

## CYPERACEAE (J. H. Kern, Leyden)

Annual or perennial, often grass-like herbs, only the monotypic African genus *Microdracoides* tree-like; the perennial *spp.* with short- or long-creeping, mostly sympodial rhizome not rarely emitting stolons. *Stems* solid, exceptionally hollow, sometimes septate, often trigonous, more rarely 2-sided or terete, or 4-, 5-, or multangular, usually nodeless below the inflorescence. *Leaves* often 3-ranked, more rarely distichous or polystichous, basal and/or cauline, usually sheathing at the base, the sheaths closed (in Mal.), very rarely open, the blades as a rule sessile, linear (grass-like) or setaceous, rarely lanceolate and petioled, rarely much reduced or even absent; sheath and blade whether or not separated by a rim of short hairs or by a membranous ligule almost completely fused to the upper surface of the blade. *Flowers* simple, inconspicuous, each subtended by a bract (*glume*), arranged in small spiciform units (*spikelets*), in *subfam. Caricoideae* strictly unisexual, in *subfam. Cyperoideae* tribe *Hypolytreae* composed of monoandrous lateral 'flowers' and a terminal ovary, in tribe *Cypereae* reduced to bisexual synanthia, a few of which may be functionally male or female by abortion of the other sex. *Spikelets* often (always?) cymose ('pseudo-spikelets'), (1-) few- to many-flowered. *Inflorescence* paniculate, anthelate, capitate, or spicate, with few to many spikelets, rarely reduced to a single spikelet, often subtended by 1-several leafy involucre bracts. *Perianth* consisting of bristles, hairs, or scales, but often absent. *Stamens* often 3, not rarely reduced to 2 or 1, very rarely more than 3 to numerous; filaments ligulate, free, only in a few *Carex spp.* connate, sometimes strongly elongating after anthesis; anthers basifixed, introrse, opening lengthwise by a slit. *Ovary* solitary, superior, usually 2- or 3-carpellate, unilocular; style not rarely thickened at the base, the thickened part whether or not articulated with the ovary; stigmas 2 or 3 (rarely more), only in a few *spp.* style unbranched; ovule solitary, erect from the base of the ovary, anatropous. *Fruit* indehiscent, a nut (often termed achene), sessile, or seated on a disk, free, or surrounded by a modified prophyll (*perigynium*, *utricle*). *Seed* erect, with thin testa not adhering to the pericarp; embryo small, at least partly surrounded by abundant mealy or fleshy endosperm.

**Distribution.** About 70–80 genera with probably some 4000 *spp.*, throughout the world.

Among the genera occurring in Malesia only *Capitularina* is endemic (in New Guinea and the Solomons) and *Paramapania* (throughout Malesia) is almost endemic, with one Mal. *sp.* extending to the West Pacific.

Malesian Cyperaceous genera show geographical relations in several directions: some have marginally westwards extending areas, for example *Oreobolus*, which genus is largely distributed in the southern half of the Pacific, reaching its most western station on the ancient high mountains of North Sumatra. Fig. 81. Another example is the very similarly distributed genus *Uncinia* of which the most western stations are found on Mt Kinabalu in North Borneo and in the Philippines.

Another type of marginal occurrence is that of *Kobresia* (incl. *Schoenoxiphium*), a genus which is distributed over Africa and the northern hemisphere and shows up with one species in the ancient high mountains of North Sumatra.

Several genera possess a worldwide range, sometimes restricted to the tropics and subtropics, e.g. *Bulbostylis*, *Fuirena*, *Hypolytrum*, *Lipocarpha*, and *Mapania*, sometimes however distributed

over the warm and temperate zones, e.g. *Carex*, *Cladium*, *Cyperus*, *Eleocharis*, *Fimbristylis*, *Machaerina*, *Rhynchospora*, *Schoenus*, *Scirpus*, and *Scleria*. Among the latter *Machaerina* and *Scleria* have only a few representatives in the extra-tropical zones; reversely *Carex* is largely extra-tropical and in the tropics almost confined to montane stations. *Cyperus* and *Fimbristylis* occur predominantly in the tropical lowlands and hills, and rapidly diminish in number towards the temperate zones.

The following genera are confined to the Old World: *Carpha*, *Costularia*, and *Tetraria*; *Lepironia* has a similar range, but its African stations are restricted to Madagascar, while *Thoracostachyum* occurs in the African region only in the Seychelles.

Finally a number of genera occur only in the Old World, but are absent from Africa, viz *Gahnia* (fig. 96), *Scirpodendron*, *Lepidosperma* (fig. 76), and *Tricostularia*, among which the latter two are properly Australian-centred, extending with a single species through Malesia to Asia.

*Distribution of species.* A fairly large number of species occurring in Malesia have (i) a worldwide or almost worldwide distribution, most of them in the warmer regions of the globe; for example:

<i>Bulbostylis barbata</i>	<i>Eleocharis geniculata</i>
<i>Carex curta</i>	<i>nigrescens</i>
<i>echinata</i>	<i>parvula</i> (not Australia)
<i>pseudocyperus</i>	<i>retroflexa</i>
<i>remota</i>	<i>Fimbristylis complanata</i>
<i>Cladium mariscus</i>	<i>cymosa</i>
<i>Cyperus brevifolius</i>	<i>dichotoma</i>
<i>compressus</i>	<i>ferruginea</i>
<i>cuspidatus</i>	<i>hispidula</i>
<i>cyperoides</i>	<i>littoralis</i>
<i>digitatus</i>	<i>squarrosa</i>
<i>halpan</i>	<i>Rhynchospora corymbosa</i>
<i>kyllingia</i>	<i>gracillima</i> (not America)
<i>odoratus</i>	<i>triflora</i> (not Australia)
<i>pedunculatus</i>	<i>Scleria lithosperma</i>
<i>polystachyos</i>	
<i>sesquiflorus</i>	
<i>unioloides</i>	

It is not unexpected that these species are almost all plants which are indifferent to soil and belong to open lowland habitats, often inhabiting places with little competition, such as beaches and waste land, and are suitable to pioneering in disturbed and cultivated places. It is striking that there are no forest dwellers among them. It is not impossible that some may have attained their large area due to man in pre-historic or post-Columbian time. They are also almost all very common species.

This is not always the case, as there are also some widely distributed species which show remarkable (ii) disjunct areas, e.g. *Eleocharis variegata* (Africa, Madagascar, Mauritius, then in North Sumatra and twice found in New Guinea), *Carex michauxiana* (NE. North America, China, Japan, and the highlands of New Guinea), *Scleria mikawana* (Africa, Ceylon, Japan, and in New Guinea), *Scleria annularis* (India to China, then New Guinea), and *Scleria parvula* (from Ceylon to Korea, then Luzon and New Guinea).

Possibly future collections will fill the gaps, as many collectors have neglected to collect sedges.

A range like that of *Scleria parvula* may show a quite natural pattern, as there are in New Guinea several plant species ranging from Japan, via Formosa and the Philippines to that island, although such cases mostly refer to mountain plants, e.g. several *Carices*.

A few seemingly rather queer ranges have appeared to be due to misidentification or to curiously mis-localized collections for which is referred to *Cyperus esculentus*, *Carex divulsa* and *Carex muricata* (= *C. pairaei*).

Besides the two categories mentioned, *worldwide* and *disjunct*, there are four others, three of which show ranges extending from the borders just into Malesia, viz from Asia, Australia, and from the Pacific, whilst the fourth category concerns the endemic species of Malesia.

Of each of these groups examples will be given, not an exhaustive enumeration.

(iii) Asian representatives (mountain plants marked by an asterisk):

- Carex* \**duriuscula* (Korea, New Guinea)  
 \**michauxiana* (northern hemisphere, New Guinea)  
*Cyperus substramineus* (Asia, Malaya)  
*Eleocharis* \**acicularis* (northern hemisphere, N. Sumatra, N. Luzon)  
 \**attenuata* (Japan, China, New Guinea)  
*Fimbristylis adenolepis* (Thailand, Indo-China, Kangean Is.)  
 \**disticha* (Burma to China, N. Sumatra)  
 \**pierotii* (Himalaya to Japan, Luzon)
- \**thomsonii* (Himalaya to Formosa, Malaya, N. Sumatra, Palawan)  
*Machaerina* \**maingayi* (Tonkin, Malaya)  
*Rhynchospora malasica* (Japan, China to W. Malesia)  
*Scirpus wallichii* (Japan to India, Malaya, Philippines)  
 \**wichurai* (Himalaya, N. Sumatra)  
*Scleria neesii* (SE. Asia, Malaya)  
*reticulata* (SE. Asia, Malaya)  
*thwaitesiana* (Ceylon to Thailand, Malaya)

(iv) Australian species just entering the borders of Malesia (mountain plants marked by an asterisk):

- Carpha* \**alpina* (New Zealand, Tasmania, Australia, New Guinea)  
*Cyperus angustatus* (Australia, New Guinea)  
*aquatilis* (ditto)  
*dietrichiae* (Australia, New Britain)  
*fulvus* (Australia, New Guinea)  
 \**lucidus* (ditto)  
*pedunculatus* (ditto)  
*Eleocharis* \**acuta* (New Zealand, Tasmania, Australia, New Guinea)  
 \**sphacelata* (ditto)  
*Fimbristylis furva* (Australia; New Guinea: Wassi Kussa, Merauke; Aru Is.)  
*recta* (Australia; S. New Guinea: Wassi Kussa)  
*schultzii* (Australia, Bali, Sumba)  
*Machaerina* \**gunnii* (Australia, New Guinea)  
 \**teretifolia* (New Zealand, Australia, W. New Guinea)
- Oreobolus* \**pumilio* (Tasmania, Australia, New Guinea)  
*Schoenus* \**melanostachys* (Australia, Mindoro, Mt Kinabalu)  
 \**nitens* (S. Chile, New Zealand, Australia, New Guinea)  
*sparteus* (Australia, New Guinea, Wetar)  
*Scirpus* \**aucklandicus* (New Zealand, Australia, New Guinea)  
 \**crassiusculus* (ditto)  
 \**inundatus* (temperate South America, New Zealand, Australia, New Guinea)  
 \**subtilissimus* (New Zealand, Australia, New Guinea, W to Luzon, Mt Kinabalu)  
*Scleria brownii* (Australia, New Caledonia, Tonga, New Guinea)  
*novae-hollandiae* (Australia, Micronesia, New Guinea, Luzon)  
*tricuspidata* (Australia, S. Moluccas: Aru Is.)

(v) The Pacific is botanically much poorer and has therefore only few species extending into East Malesia:

- Machaerina mariscoides* (Polynesia, New Guinea) *Scleria polycarpa* (Fiji, Melanesia, New Guinea, Moluccas). Fig. 110.

(vi) Of many genera endemic species occur in Malesia amongst which are many forest dwelling species of the *Mapanieae* (mountain plants marked with an asterisk):

- Capitularina involocrata* (New Guinea)  
*Carex* \**eremostachya* (New Guinea & Solomons)  
 \**gajonum* (N. Sumatra)  
 \**loheri* (Philippines)  
*malaccensis* (Malaya)  
 \**merrillii* (Philippines)  
*nodiflora* (Philippines)  
*palawanensis* (Philippines)  
 \**sarawaketensis* (New Guinea)  
*spathaceo-bracteata* (New Guinea)  
*Costularia pilisepala* (Borneo, New Guinea)
- Cyperus cinereobrunneus* (New Guinea)  
*meistostylis* (New Guinea)  
*neoguineensis* (New Guinea)  
*pachycephalus* (New Guinea)  
*subpapuanus* (New Guinea)  
*Eleocharis* \**brevicollis* (New Guinea)  
*sundaica* (Alor)  
*Fimbristylis blepharolepis* (New Guinea)  
*caesia* (Philippines, Java)  
*calpicola* (Malaya)  
*capilliculmis* (New Guinea)

- Fimbristylis celebica* (Central Celebes)  
*lineatisquama* (Philippines)  
*macassarensis* (Luzon, SW. Celebes, Madura I.)  
*malayana* (Malaya)  
*subdura* (Java)  
*sumbaensis* (Sumba I.)  
*wetarensis* (Wetar I.)  
*Hypolytrum capitulatum* (Borneo)  
*humile* (West Java)  
*Kobresia* \**kobresioidea* (N. Sumatra)  
*Machaerina aspericaulis* (Mt Kinabalu)  
 \**lamii* (New Guinea)  
*Mapania angustifolia* (Borneo)  
*debilis* (Borneo)  
*foxworthyi* (Borneo)  
*graminea* (Borneo)  
*holttumii* (Malaya)  
*latifolia* (Borneo)  
*longiflora* (Borneo, Malaya)  
*lorea* (W. Malesia)  
*maschalina* (Borneo)  
*micropandanus* (Malaya)  
*monostachya* (Borneo)  
*sessilis* (W. Malesia)  
*spadicea* (Borneo)  
*squamata* (W. Malesia)  
*wallichii* (W. Malesia)  
*Oreobolus* \**kükenthali* (N. Sumatra, Malaya)  
*Paramapania flaccida* (New Guinea)  
*gracillima* (Philippines)  
*longirostris* (New Guinea)  
*radicans* (Borneo)  
*rostrata* (Philippines)  
*simplex* (New Guinea)  
*Schoenus* \**curvulus* (New Guinea to Mt Kinabalu)  
*delicatulus* (Palawan, Mt Kinabalu)  
 \**longibracteatus* (New Guinea, Mt Kinabalu)  
*Scirpus* \**beccarii* (Sumatra)  
 \**junghuhni* (N. Sumatra)  
*Scleria cyathophora* (W. Malesia)  
*densispicata* (Luzon)  
*papuana* (New Guinea)  
*pygmaeopsis* (Sumba)  
*Tetraria borneensis* (Borneo)

Ecology. Sedges occur in every formation and even in any biotope (except epiphytic) and not infrequently they form a substantial part of the herbaceous plant cover in grassland and savanna. A large part of them occurs in lowland eutrophic swamps and consequently in wet rice-fields; they abound also in swinging bogs on lake shores. However, some occur under distinct oligotrophic conditions, e.g. on kèrangas, in peat swamps and high mountain marshes. Some are confined to the beach, and others to calcareous cliffs. Below an approximate survey is given of species which are characteristic of marked soil conditions or vegetation types. Going from the sea-shore inland we have then the following sequence:

**Mangrove.** Along muddy sea-shores or in drier places in the mangrove are found *Fimbristylis argentea* and *F. polytrichoides*, the latter sometimes in quantity. Also *Cyperus javanicus* is largely confined to coastal swamps in brackish water.

**Sandy beach.** The following species are characteristic: *Cyperus bulbosus*, *C. dubius*, *C. hyalinus*, *C. pedunculatus* (fig. 65), *C. radians*, *C. stoloniferus* (fig. 50), *Fimbristylis cymosa*, and *F. sericea*. Rhizomes or tubers are sometimes shielded by a tunica, for example in *Fimbristylis sericea* and *Cyperus bulbosus* respectively. All species produce runners for vegetative propagation, sometimes very long ones, as in *Cyperus pedunculatus*. Some are local or rare (*Cyperus bulbosus*, *C. dubius*, *C. hyalinus*), but others are very frequent (*Fimbristylis cymosa*) and may also occur somewhat inland behind the beach on low sandy flat coasts, as *Bulbostylis barbata* and *B. puberula*, which also may occur in abundance on the sandy beach.

**Saline habitats** ('asinans') occur here and there inland, especially in the seasonal districts. They are sometimes bound up with hot springs or mudwells. In such habitats several sedges are found which are in that district confined to such spots. Examples are *Eleocharis parvula* (E. Java, once), *E. spiralis* (often gregarious), *Fimbristylis ferruginea*, *F. semarangensis*, *F. sieberiana*, and *Scirpus litoralis*.

**Lowland swamp forests.** The following species have been cited to be characteristic of or abundant in this vegetation type: *Capitularina involucreta*, *Fimbristylis scaberrima*, *Mapania enodis* (sometimes gregarious and dominant), *M. lorea*, *M. macrocephala*, *M. palustris*, *Scirpodendron* (sometimes forming pure stands), *Scirpus ternatanus*, and *Thoracostachyum* (2 spp.).

**Peat swamp forests.** ANDERSON (Gard. Bull. Sing. 20, 1963, 216) mentioned two species, viz *Tetraria borneensis*, a tall sedge which is abundant in the centre of peat forest but also occurs in open heath forest (fig. 72), and *Thoracostachyum bancanum* which is found in all zones of the peat forest, but occurs also in mixed swamp forest.

**Lowland swamps.** No clear distinction could be made here between species of oligotroph and those of eutroph waters, nor between swamps with permanent water-level and those with fluctuating level. The first category (oligotroph waters) is rare and for example *Lepironia* belongs here; it can grow gregariously (fig. 6).

Several other species obviously of eutroph waters can grow gregariously, for example *Eleocharis dulcis* (fig. 36), *Fimbristylis dipsacea* (locally in Bawean), *F. pauciflora*, *Machaerina rubiginosa* (fig. 94), *Rhynchospora corymbosa*, *Scirpus mucronatus* (big stands even in the mountains), and *Scleria poaeformis*.

The following are characteristic, often common swamp and marsh sedges:

<i>Cladium mariscus</i> (rare)	<i>Fimbristylis acuminata</i>
<i>Cyperus babakan</i>	<i>aestivalis</i>
<i>digitatus</i>	<i>aphylla</i>
<i>distans</i>	<i>complanata</i>
<i>elatus</i>	<i>ferruginea</i>
<i>exaltatus</i> (rare, often coastal)	<i>globulosa</i>
<i>halpan</i>	<i>griffithii</i>
<i>holoschoenus</i> (rare)	<i>intonsa</i> (rare)
<i>imbricatus</i>	<i>littoralis</i>
<i>iria</i>	<i>miliacea</i>
<i>malaccensis</i>	<i>perlaxa</i> (rare)
<i>nutans</i>	<i>tenuicula</i> (rare)
<i>odoratus</i>	<i>tetragona</i>
<i>pilosus</i>	<i>thomsonii</i> (rare)
<i>platystylis</i> (rare)	<i>Fuirena</i> spp.
<i>polystachyos</i>	<i>Lipocarpha chinensis</i>
<i>procerus</i>	<i>Machaerina disticha</i>
<i>pulcherrimus</i>	<i>rubiginosa</i>
<i>pygmaeus</i> (rare)	<i>Rhynchospora triflora</i> (rare)
<i>sanguinolentus</i>	<i>Scirpus articulatus</i> (fig. 31)
<i>scariosus</i>	<i>grossus</i> (fig. 22)
<i>tenuispica</i>	<i>juncoides</i>
<i>Eleocharis retroflexa</i>	<i>lacustris</i>
<i>spp. div.</i> (fig. 35)	<i>lateriflorus</i>
	<i>Scleria rugosa</i>

**Floating waterplants** are few but characteristic, as they take part in the composition of floating islands of *kumpai* vegetation, often together with *Eichhornia*, *Hanguana*, *Pistia*, etc., and in that of swinging bogs. They are:

<i>Cyperus alopecuroides</i>	<i>imbricatus</i>
<i>cephalotes</i> (fig. 61–62)	<i>ohwii</i>
<i>elatus</i>	<i>platystylis</i>

*Scirpus confervoides* takes a separate position in being a true submerged aquatic plant (fig. 25).

**Mixed dryland forests** at lower altitudes have in primary condition almost only sedges of the *tribe* *Mapanieae* (*Hypolytrum*, *Mapania*, *Paramapania*) on the forest floor (fig. 13–14), but there are also a number of *Cyperus* spp. occupying that habitat viz *C. diffusus*, *C. multispicatus*, *C. pedunculatus* and allies (spp. 27–32), and *Machaerina sinclairii* (500–2000 m), *M. glomerata* (up to 1500 m) and *M. mariscoides* (up to 350 m).

In the lowland and hill forest there are a number of *Carices*, most of which extend also to the colline and montane levels, e.g.:

<i>Carex cryptostachys</i> (40–1500 m)	<i>rafflesiana</i> (500–2400 m)
<i>horsfieldii</i> (100–1100 m)	<i>satzumensis</i> (400–2300 m)
<i>indica</i> (up to 1000 m)	<i>speciosa</i> (10–1500 m)
<i>maubertiana</i> (400–2100 m)	

Secondary thickets replacing primary forest harbour several sedges, amongst them a number of mostly tall *Scleria* species, which may form the major constituent, e.g. *Scleria ciliaris*, *S. levis*, *S. lithosperma*, *S. oblata*, *S. purpurascens*, *S. scrobiculata*, *S. sumatrensis*, *S. terrestris*; furthermore *Fimbristylis dura* and some species of *Cyperus*, notably *C. cyperinus*, *C. cyperoides* and *C. diffusus*.

**Podsolized soils.** On k rangas soils some sedges are characteristic and confined to this oligotroph siliceous substratum, viz *Fimbristylis fuscoides*, *Schoenus calostachyus* (fig. 79), *Tetraria borneensis* (fig. 72), and *Tricostularia undulata* (fig. 78).

**Limestone hills** are scarce in Malasia and their most characteristic development is found in the northern part of Malaya and in the Langkawi Is., as a southern extension of those hills in Thailand. They are remains of a geological formation which had in Tertiary time a much larger extension. The following sedges are confined to these hills on this specialized habitat: *Carex malaccensis*, *Fimbristylis calcicola*, *F. malayana*, *F. trichophylla*, *Cyperus teneriffae* (in Timor!), while *C. hyalinus* often occurs on limestone, but is not restricted to it.

**Craters and solfatara** offer on the one hand little competition but on the other hand they are specialized habitats because of the infertility of the 'soil', the presence of acids in the soil, and sulphureous and other poisonous gases in the air. Species which can stand this environment and are often even common here are *Carex baccans*, *C. verticillata*, and *Gahnia javanica* (fig. 97). None of them is bound to this 'niche'.

On volcanic scree and landslides some *Carices* may form large clumps, notably *Carex baccans*.

**Mid-mountain forest** harbours proportionally few sedges and even here they prefer ridges or open spots near rocks and waterfalls. In such places one can find *Carex turrita*, *C. verticillata* (2000–3750 m), and *Gahnia baniensis* (sometimes gregarious, 900–2100 m).

The sedges of the mountain forest mostly belong to *Carex*, e.g.:

<i>Carex anemocarya</i> (1000–1200 m)	<i>lateralis</i> (1400–2200 m)
<i>breviscapa</i> (1000–1200 m)	<i>loheri</i> (1300–2400 m)
<i>brunnea</i> (1400–2100 m)	<i>longipes</i> (1500–2200 m)
<i>commixta</i> (800–1500 m)	<i>ramosii</i> (medium altitude)
<i>dolichostachya</i> (1200–1600 m)	<i>rhynchachaenium</i> (800–2100 m)
<i>helferi</i> (1100 m)	<i>satzumensis</i> (400–2300 m)
<i>lamprochlamys</i> (800–2700 m)	<i>Machaerina aspericaulis</i> (1500–1600 m)

**Subalpine forest** is again a vegetation type in which *Cyperaceae* are mainly represented by *Carices*:

<i>Carex brachyathera</i> (3000–4000 m)	<i>perciliata</i> (2400–4200 m)
<i>breviculmis</i> (2200–3900 m)	<i>phacelostachys</i> (2200–3500 m)
<i>celebica</i> (2400–3700 m)	<i>sarawaketensis</i> (2700–3950 m)
<i>filicina</i> (1400–3680 m)	<i>spathaceo-bracteata</i> (3000–4000 m)
<i>finitima</i> (2400–3900 m)	<i>verticillata</i> (2000–3750 m)
<i>graeffiana</i> (800–3800 m)	<i>Machaerina falcata</i> (1900–3300 m)
<i>maculata</i> (1800–3500 m)	<i>Uncinia riparia</i> (2300–3680 m)
<i>mysurus</i> (1700–3300 m)	<i>rup�stris</i> (2900–3300 m)

In Phillippine pine forest is found *Fimbristylis pierotii* (1550 m).

**Waterplants in the mountain streams** are three species of *Scirpus*, viz *S. beccarii* (Sumatra, 2750–3300 m; fig. 24), *S. crassiusculus* (New Guinea, 1800–3900 m), and *S. fluitans* (Java, 1600–3200 m).

A characteristic river bank sedge is *Carex teinogyna* (Sumatra, 700–1150 m).

**Mountain swamps, bogs, marshes, and stream fringes** abound with sedges, some of which may occur gregariously. The following have been selected:

<i>Bulbostylis densa</i> (1000–3000 m)	<i>gajonum</i> (3100–3300 m)
<i>Carex brownii</i> (1500–2500 m)	<i>gaudichaudiana</i> (1900–3700 m)
<i>capillacea</i> (2000–4000 m)	<i>graeffiana</i> (gregarious, 800–3800 m)
<i>celebica</i> (2400–3700 m)	<i>jackiana</i> (1350–2550 m)
<i>echinata</i> (2400–3600 m)	<i>maculata</i> (1800–3500 m)
<i>finitima</i> (2400–3900 m)	<i>michauxiana</i> (2250–2650 m)

- montivaga* (3200–3500 m)  
*nubigena* (1600–3000 m)  
*oedorrhapha* (1200–2400 m)  
*phacota* (gregarious, 1500–2700 m)  
*pruinosa* (1560–2500 m)  
*pseudocyperus* (1750–3225 m)  
*teres* (2100–3500 m)  
*Cyperus lucidus* (gregarious, 2500 m)  
*melanospermus* (500–3000 m)  
*sanguinolentus ssp. melanocephalus* (gregarious, 1000–3125 m)  
*Eleocharis attenuata* (1650–2800 m)  
*congesta* (50–2800 m)  
*tetraquetra* (650–2700 m)  
*Fimbristylis consanguinea* (1600–2300 m)  
*disticha* (1200–1400 m)
- salbundia* (900–2200 m)  
*Kobresia kobresioidea* (gregarious, 2900–3400 m)  
*Machaerina articulata* (gregarious, 1900–2500 m)  
*falcata* (1900–3300 m). Fig. 90  
*gunnii* (2250–3000 m)  
*lamii* (3250–3520 m)  
*maingayi* (900–2100 m)  
*rubiginosa* (gregarious, 100–3225 m)  
*teretifolia* (2100 m)  
*Rhynchospora rugosa* (often gregarious, 0–2800 m)  
*Scirpus inundatus* (1750–2700 m)  
*subcapitatus* (1200–4000 m). Fig. 27–28  
*subtilissimus* (1600–3700 m)

**Mat-formation, stubs, and fairy rings.** Many *Cyperaceae* show a tufted habit when rhizome internodes are short, and finally big tufts may be formed, e.g. in several *Carex*, *Cyperus* and *Gahnia* species, and *Rhynchospora rugosa* (fig. 102).

By the small species of the subalpine and alpine turf and heathland circular, low tufts are formed. Because of the rhizomes growing out in a centrifugal way such tufts may become fairly large clumps even leading to *mats* (fig. 84). In the central part of such roundish 'Polster' the oldest parts may die and decay, so that *fairy rings* are formed; this is a common feature observed in *Oreobolus*, similar to that found in tufts of *Isachne pangerangensis*, *Centrolepis*, etc. (fig. 83, 87). Though it is self-evident that through the growth mode an empty space is formed in the centre of the tuft, it is peculiar that this empty centre is not occupied by new young plants, it looks as if it were poisoned. It is not yet clarified whether the centre is exhausted of certain trace elements or that self-poisoning must be assumed. The latter assumption is not likely, because also other plant species do not occupy the bare centre of the fairy ring.

In swamps liable to a seasonally oscillating water-level stubs can be formed which may attain quite some size, up to knee-high, as was observed on Tegal Pangonan, on Mt Diëng (Central Java) in *Carex phacota*. Such stubs are invaded by other marsh plants, but also by dryland herbs, in a sort of vertical succession.

**Subalpine heathland and meadows** are generally dry, but in slight depressions and through seepage boggy places may be formed, so that this category is hardly distinct from the former. Moreover, such bogyness may be only temporary, so that the list below forms rather an addition than a class apart:

- Carex vesiculosa* (1200–3500 m)  
*Carpha alpina* (3000–4200 m)  
*Eleocharis sphacelata* (2200–2900 m)  
*Gahnia javanica* (1200–3560 m)  
*Lepidosperma chinense* (1500–3000 m). Fig. 77  
*Machaerina gunnii* (2250–3000 m)  
*Oreobolus ambiguus* (2500–4000 m). Fig. 87  
*kükenthalii* (1600–3460 m). Fig. 82–84  
*pumilio* (2600–3800 m)
- Schoenus curvulus* (1500–4000 m)  
*longibracteatus* (1500–3500 m)  
*maschalinus* (1800–3600 m)  
*melanostachys* (1650–2400 m)  
*nitens* (3400 m)  
*setiformis* (2700–3750 m)  
*Scirpus aucklandicus* (3300 m)  
*junghuhnii* (2200–3400 m)

In **seasonal regions**, with a long, distinct, annual period of drought, a large number of sedges occur in grasslands which may be swampy during the rainy season, usually in the period from November till March. In April and May sedges flower together with the grasses. This vegetation type is often subject to fire. It extends in West Java along the north coast east of Djakarta — Indramayu Residency has proved a very rich site — and then further eastwards through Central and East Java and the Lesser Sunda Islands to the southern border of New Guinea (Merauke to Wassi Kussa), along the Fly R. delta to Moresby and onwards to the east. Also parts of Celebes (mostly in the southern peninsula), spots in the Moluccas (in Buru and Ceram), and the west sides of most Philippine Islands have

this type of climate. Some species are more common in the swampy places, others in permanently dry parts. The following are characteristic, some being rare or rarely collected:

<i>Carex stramentitia</i>	<i>lanceolata</i>
<i>tricephala</i>	<i>macassarensis</i>
<i>Cyperus alopecuroides</i>	<i>microcarya</i>
<i>angustatus</i>	<i>recta</i>
<i>bulbosus</i>	<i>schultzei</i>
<i>holoschoenus</i>	<i>semarangensis</i>
<i>nervulosus</i>	<i>sieberiana</i>
<i>paniceus</i>	<i>subalata</i>
<i>squarrosus</i>	<i>subdura</i>
<i>Fimbristylis adenolepis</i>	<i>sumbaensis</i>
<i>anisoclada</i>	<i>wetarensis</i>
<i>bisumbellata</i>	<i>Gahnia aspera</i>
<i>blepharolepis</i>	<i>Lipocarpha microcephala</i>
<i>dictyocolea</i>	<i>Rhynchospora hookeri</i>
<i>fimbristyloides</i>	<i>Schoenus sparteus</i>
<i>furva</i>	<i>Scleria junghuhniana</i>
<i>insignis</i>	<i>psilorrhiza</i>

**Savanna** is of course hardly separable from the grassland category mentioned above, as these two vegetation types grade and are both liable to a dry season and annual burning. But savannas are generally dryland; the following sedges are characteristic:

<i>Fimbristylis cinnamometorum</i>	<i>signata</i>
<i>eragrostis</i>	<i>wetarensis</i>
<i>falcata</i>	<i>Rhynchospora heterochaeta</i> . Fig. 98
<i>furva</i>	<i>longisetis</i>
<i>fusca</i>	<i>rubra</i> . Fig. 99
<i>insignis</i>	<i>subtenuifolia</i>
<i>lanceolata</i>	<i>wightiana</i>
<i>ovata</i>	<i>Schoenus falcatus</i>
<i>recta</i>	<i>punctatus</i>

**Dispersal.** Local extension by vegetative growth and even propagation is a very common feature in *Cyperaceae*, on account of the frequent occurrence of rhizomes, runners and more rarely bulbs. This leads frequently to local almost pure stands (colonies), so characteristic of many swamp and highland species, and also to their rapid extension on waste land. It is characteristic in most sedges of the sandy beach, e.g. in *Cyperus bulbosus*, *C. pedunculatus* (fig. 65), *C. stoloniferus* (fig. 50), etc. It is of course equally common among inland species, e.g. in *Cyperus rotundus* (fig. 49), *C. brevifolius* (fig. 70), and other species of *Cyperus sect. Kyllingia*. This is one of the reasons that some sedges are difficult to eradicate, notably *Cyperus rotundus*, as parts of rhizomes or bulbs are in this way dispersed and act as vegetative diaspores.

As in most large families there is quite an array of dispersal devices of the fruits.

Unfortunately the number of actual observations in Malesia is very small and examples are largely derived from the northern hemisphere. They have also to be judged from the structure of the nuts and the habitat of the plants. Experiments in this field are also badly needed, as it is of course insufficient to find stomachs full of sedge nuts without checking latent germination power in those found in dung or droppings.

Fruits (nuts) of *Cyperaceae* are generally small to minute, except those of *Scirpodendron*, a marsh plant, in which they measure 1–1½ by 1 cm (fig. 3). Mostly they have no device adapted to a specialized kind of dispersal, but some have, for dispersal by water, by animals, by the sea, and a few by wind. Also vegetative dispersal can take place, by rhizomes or tubers. Vegetative dispersal by stolons is for example almost predominant in the very common *Cyperus rotundus* which very seldom sets fruit.

Most data in this paragraph are taken from RIDLEY's informative compilation (Dispersal of Plants, 1930).

*Sea-water.* Some sedges which are characteristic of the sandy beach are certainly seaborne. These are *Cyperus bulbosus*, *C. dubius*, *C. hyalinus*, *C. pedunculatus* (*Remirea*) (fig. 65), *C. radians*, *C. stoloniferus* (fig. 50) and furthermore *Fimbristylis cymosa* and *F. sericea*. One might conclude that they would all be common species, like *C. pedunculatus*. They occupy indeed generally wide ranges, but although beaches abound in the archipelago, they are far from common, e.g. *Cyperus bulbosus*. For their scarcity one can assume either that some are selective for beach microniches or that there is some deficiency with their dispersal capacity. Such questions ask for experimental evidence. The most widespread is *Cyperus pedunculatus* and this has a specialized floating mechanism, a swollen corky rachilla internode enveloping the nut.

*Aquatic dispersal.* As so many sedges inhabit marshy soil or swamps, stream- and river-banks, and man-made rice-fields, where they often occur in great quantity, fresh water must be a most important vector. Some of these marsh plants possess certain devices. Of some *Carex* species it is known that they derive buoyancy power by means of the inflated utricule enveloping the nut; *Cyperus odoratus* has swollen corky rachilla internodes remaining attached to the nut as in *Cyperus pedunculatus*; *Cyperus cephalotes* (fig. 61–62) has a corky pericarp for buoyancy; nuts of *Cyperus platystylis* with narrow corky edges also float as found by CLARKE (J. Linn. Soc. 21, 1884, 28); *Scirpodendron* (fig. 3) has large fruits with a stony endocarp surrounded by a thick corky layer keeping them afloat for a long time; in *Cladium mariscus* the pericarp contains air-cells with thin walls and wide intercellular spaces and has been observed to float for 15 months; also *Scirpus maritimus* owes floating power to the pericarp structure.

However, calculated in percentages the number of species possessing floating power are in distinct minority: normally nuts of *Cyperus*, *Eleocharis*, *Scirpus*, etc. sink in water. It is remarkable how few species have buoyant nuts, yet to observe how widespread and common, sometimes dominant, they occur in swampy places, even though the local dominance is not seldom due to vegetative reproduction, e.g. by stolons in the perennial species.

This discrepancy can in part be explained by arguing that even sinking seeds are of course dispersed by running water and floods and furthermore that whole plants or their debris are found in river drift. *Cyperus cephalotes* (fig. 62) is even a characteristic drifting plant, as described by COERT (Trop. Natuur 23, 1934, 13, fig. 8), as is *Cyperus platystylis*. Also vast numbers of non-buoyant nuts are found in drift and 'sudd', some having a means of attaching themselves, by their perianth bristles; even tubers of a *Cyperus* species have been found in such drift. Also in rice-fields nuts may be dispersed from one terrace to an other by irrigation methods.

Though this accidental dispersal must be very common, it cannot well serve to explain dispersal of the majority of species and specimens found in swamps, permanent or temporary, which are not connected by streams or rivers. For this it is assumed that the major vector is the birds.

*Dispersal by birds.* Examination of stomach contents of birds has revealed that especially ducks can really feed on sedge nuts. In one stomach 30.000 nuts were found of a *Cyperus*, in another 64.000 of an *Eleocharis*, and in stomachs and crops also nuts were found of *Carex*, *Cladium*, *Fimbristylis*, *Rhynchospora*, *Scirpus*, *Scleria*, etc. Although, as remarked before, it has insufficiently been checked how far this food is digested, it can be assumed that some nuts will retain germination power and are dispersed with the excreta, a sort of accidental endozoic dispersal.

In very few cases the nuts are attractive to birds by a display of contrasting colours, e.g. in *Gahnia*, where the nuts are yellow, or scarlet, and contrast vividly with the dark-brown to black inflorescences out of which they dangle from the filaments. In Sumatra this has been observed by JACOBSON with *Pycnonotus bimaculatus*. The nuts are very hard and whether they are digested is not clear.

*Carex baccans* has fleshy red-coloured utricles which are equally attractive to birds.

Epizoic dispersal by birds is assumed to be more important, as many sedges have very small seed which may adhere, with mud, to feet, beak and feathers of wading birds. In Europe this has been observed (KERNER) or supposed for species of *Carex*, *Cyperus*, *Eleocharis*, *Rhynchospora*, *Scirpus*, and *Cladium mariscus*.

It may well be that bristles of certain species of *Scirpus* are favourable for epizoic dispersal. A specialized organ which certainly serves for this purpose is found in *Uncinia*, in which the rachilla protrudes from the utricule and is provided at the apex with a remarkable hook by which the utricles are adhesive to fur or feathers.

To which distances dispersal is effected by epizoid dispersal can of course not be observed, but in Europe it is assumed to cover several dozens of miles in *e.g.* *Scirpus maritimus*, in order to explain isolated localities in inland saline habitats through dispersal by wild-fowl. In East Java several halophilous sedges are found near salt (mud)wells which may be accounted for in this way. However, it remains quite uncertain whether accidental epizoid dispersal may also lead to effective long-distance dispersal, for example, to explain the total range of *Scirpus maritimus*, which occurs on the northern hemisphere and in Australia, but is extremely rare in Malesia, being a few times collected only in Luzon (in the mountains, but also at low altitude) and in New Guinea (in the high mountains). For, if long-distance transtropical dispersal is assumed to explain these huge disjunctions, short-distance dispersal in the same area must occur infinitely more frequently and this species should then not be so extremely rare in Malesia; this reasoning throws a grave doubt on the assumption of long-distance dispersal.

Though in *Uncinia* effective epizoid dispersal can not be doubted, here also is doubt about its being effective over long distances (1000 km or more). Though on the one hand the range of *Uncinia* is, not reckoned oceanic disjunctions, fairly coherent and 'natural', it matches on the other hand that of many other plants which have quite different ways of dispersal or none (like *Nothofagus*). So a word of warning is in place against too hasty explanations based on the effectiveness of the specialized function of hooked fruits.

*Cattle* is also assumed to contribute to dispersal of seed of sedges as has been observed in Europe (*Carex*, *Scirpus*). Nuts of *Fimbristylis globulosa* and *F. littoralis* do not yield to digestion of water buffaloes. This serves only for short distances and anyway such nuts are also dispersed in rice-field areas by water.

*Ants* play a minor role in short-distance dispersal of sedges; ant dispersal has been observed in *Carex* in Europe where in some species the base of the utricule is provided with a sort of appendage with an oily body (SERNANDER).

The role of man is certainly large but difficult to evaluate in extent and illustrate by examples. Traffic, transport, road-building, *etc.* must have contributed to dispersal of nuts and rhizomes, also sometimes overseas as for example *Cyperus sphacelatus* and *C. aromaticus*. In northern Italy several tropical and subtropical aquatic and marsh plant species are found in rice-fields of which the seed is assumed to have been carried as contamination of the rice seed supply.

In Italy there is also the remarkable unique locality of *Cyperus polystachyos* in the isle of Ischia near Naples near the solfatara and hotwells as reported already by G. VON MARTENS (Flora 40, 1857, 346), where it can maintain itself by the grace of local, permanent higher temperature. This occurrence can only be accounted for by accidental dispersal by man from Asia Minor or Egypt, maybe dating back to surviving Crusaders who on return took to this famous holiday resort.

A similar occurrence of *Cyperaceae* outside their natural area was observed by VAN STEENIS, who found *Cyperus halpan*, a common rice-field plant ascending to some 1650 m, on the summit of Mt Agung (Bali) at c. 3000 m near fumaroles together with a dozen other lowland or hill species. It is assumed that the diaspores of these plants were accidentally dispersed by man during the annual pilgrimage to the summit of this mountain where they can grow and maintain themselves in the subalpine permanent 'open air hothouses' near the fumaroles. Likewise R. VAN DER VEEN collected *Cyperus cyperinus* near hotwells in Lombok on Mt Rindjani at 2000 m, a species ascending normally to c. 1300 m.

*Wind* plays a minor role in dispersal of seeds in the tropics, but it is assumed for the Australasian highland *Cyperus alpina* in the Papuan Alps which possesses a plumose, persistent perianth of some 9 mm length. Here again long-distance dispersal is merely an assumption, because it immediately induces the question why then the genus *Eriophorum* which is so widely distributed over the northern hemisphere and occurs also in continental tropical-montane SE. Asia has not been capable to invade the West Malesian highlands.

Wind has also incidentally been mentioned for *Scirpus* in which it has been observed that the glume may occasionally remain attached to the nut, acting as a wing. A similar mechanism has been mentioned for certain *Gahnia* species where the lengthening stamens tear the nut loose and remain sometimes entangled around it, but the nuts in *Gahnia* are heavy and are readily detached. For the various interesting mechanisms loosening the nut in this genus I refer to the discussion under the genus.

**Morphology.** For a long time taxonomists have tried in *Cyperaceae* to derive the unisexual

flower from the bisexual one, viz that of *Caricoideae* from that of *Cyperoideae*, but there remained always an unbridgeable gap between these two types, as in the unisexual flowers there is never a vestige of a perianth nor of the other sex.

If the opposite course is pursued, however, and we start our reasoning from the unisexual flower this gap can well be bridged. This idea was developed by MATTFELD (Proc. VI. Intern. Bot. Congr. 1936, 330–332) and independently by HOLTUM (Bot. Review 14, 1948, 525–541). It was further developed by me (Adv. Science 19, 1962, 141–148).

Like in many other families the primitive structures are found in the tropical representatives. Instead of assessing insight in structure starting from a temperate species of *Scirpus*, we take *Scirpodendron*, a very coarse tropical sedge, with broad cutting leaves, large dense inflorescences, and drupaceous fruits attaining a centimetre in size. From the ground-plan of its spikelets with unisexual flowers the other types can easily be derived by (sometimes excessive) reduction, as is illustrated here by a number of diagrams in fig. 1. Starting from the primitive type of *Scirpodendron*, the other types

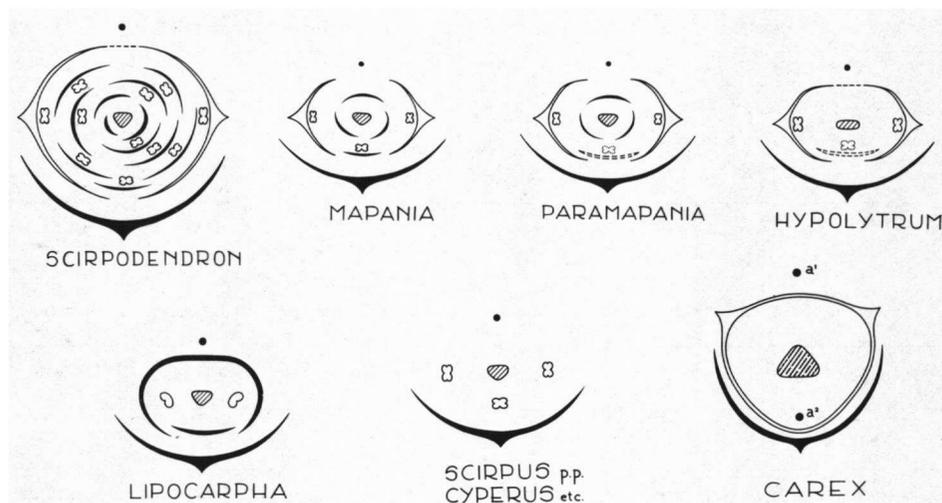


Fig. 1. Floral diagrams in several genera of *Cyperaceae*, with axis, glume and scales all in black, the transverse keeled scales (blank) representing the prophyll (after KERN, 1962).

(*Mapania*, *Paramapania*, etc.) can easily be derived, until we arrive at *Hypolytrum*, in which in the partial inflorescence (spikelet) there are no scales between stamens and ovary, the spikelet thus becoming indistinguishable from the diagram of the 'flowers' of some *Scirpus* species. This leads to the view that the 'flower' of *Cyperoideae*, which was so neatly supposed by CLARKE and others to represent a characteristic pentacyclic diagram as is usual in many Monocotyledonous families, though with reductions in the whorls, is really a pseudanthium or synanthium.

An other most important feature is the interpretation of the structure of the spikelet and the role of the prophyll. In *Cyperaceae* as a rule the first leaf of every lateral branch is a 2-keeled prophyll, backing the axis from which the branch arises.

KUNTH (in Wiegman's Arch. Naturgeschichte 1, 2, 1835, 349–353, t. vi) definitely showed that the utricle in *Carex*, up till then generally taken for a perianth, is homologous with the prophyll, the margins of which are connate up to the top and so has become a bottle-shaped organ enclosing a female flower (later the nut). In *Kobresia*, as well as in the European genus *Elyna* and in the African genus *Schoenoxiphium* — which I all regard as congeneric (see my discussion in Acta Bot. Neerl. 7, 1958, 786–795) — the situation is more primitive than it is in *Carex*. The prophyll in these genera is either open or more or less connate at the margins, whereas the axis (rachilla) on which it is seated often bears some male flowers. In *Carex* these male flowers have disappeared and only in a few

species a reduced rachilla is still present. In *Uncinia* the vestige of the rachilla is at its apex transformed into a peculiar recurved hook which can be accepted to be homologous with an empty bract or reduced male flower; this hook is designated as a specialisation for epizoid dispersal. The idea of NELMES (Reinwardtia 1, 1951, 222–225; Kew Bull. 1951, 427–436) that the unispicate *Carices* from Europe and North America with a vestigial rachilla belong to the genealogy of *Uncinia* is untenable.

According to the interpretation given above the morphological derivation of the structure of the spikelet and the essential role in it by the prophyll leads to the assumption that the most primitive state, with unisexual flowers, is still represented in the *Mapanieae*. Starting from the situation in *Scirpodendron* one can observe that in this tribe the prophyll (consisting of two transverse scales, which may be connate, in *Hypolytrum* sometimes even on both sides and thereby becoming more or less utriculiform) and flowers can be arranged in a series of successive reduction (vestigial to completely absent), leading finally in *Cyperoideae* to excessive reduction and the origin of pseudanthia. Another line of excessive reduction has led to the structure as is found in *Caricoideae* in which, however, the unisexuality of the flowers has been conserved.

Types	CAREX	SCHOENUS	FIMBRISTYLIS	BULBOSTYLIS	CYPERUS	SCIRPUS
Shape	top-shaped	top-shaped	top-shaped	broadly top-shaped	ellipsoid	mushroom-shaped
Coleoptyle	lateral	sublateral	basal	basal	basal	basal
Root-cap	basal	sublateral	lateral	basal	lateral	lateral
First leaf						

Fig. 2. Embryo types in *Cyperaceae*. In the picture of *Cyperus* the various parts have been named in detail:  $col^1$  is upper lip of coleoptyle,  $col^2$  lower lip of the same,  $cot$  is cotyledon,  $p^1$  is primordium of first leaf,  $p^2$  is primordium of second leaf,  $p$  is germination pore,  $r.c.$  is primordium of root-cap (simplified after VAN DER VEKEN).

PAX (in E. & P. Nat. Pfl. Fam. 2, 1887, 105) suggested that there would be a basic difference in *Cyperaceae*, advancing that the structure of the spikelets in *Cyperoideae* is monopodial and in tribe *Rhynchosporeae* sympodial. On this account ASCHERSON & GRAEBNER (Synopsis 2, 2, 1904, 339) raised the latter tribe to subfamily rank. This is, however, fallacious: the structure of the spikelets is in all *Cyperaceae* probably sympodial (KERN, 1962, *l.c.*).

In passing it may be remarked that some genera were assigned to *Rhynchosporeae* by erroneous interpretation, e.g. *Remirea* which is simply a *Cyperus* in which a rachilla internode is transformed into a corky organ serving buoyancy (see the fuller account under the species). On the other hand *Oreobolus* is distinctly allied to *Rhynchosporeae* and must be placed in the Schoenoid affinity.

Embryography. Interesting data on the embryography were published by P. VAN DER VEKEN (Bijdrage tot de systematische embryologie der *Cyperaceae-Cyperoideae*. Thesis, Leuven, 1964, pp. 230, illustr., in Dutch; Bull. Jard. Bot. Brux. 35, 1965, 285–354), who examined the embryo in 342 spp. of *Cyperoideae*. He found 6 main types which he named the *Cyperus*, *Carex*, *Schoenus*, *Fimbristylis*, *Bulbostylis*, and *Scirpus* types. Some of these are depicted in fig. 2.

It has appeared that in homogeneous taxa, e.g. in *Cyperus sens. lat.*, always the same embryo type is found. This is also true for e.g. *Schoenus*, *Bulbostylis*, *Eleocharis*, and *Fuirena*, on the generic level. In our opinion a type may also be characteristic on infra-generic level, e.g. in *Fimbristylis*, where

*sect. Abildgaardia* and *Actinoschoenus* have embryotypes which differ from that in *Fimbristylis*. In *Scirpus* there are not less than 7 different embryo types. Conversely, one embryo type may occur in more than one genus, e.g. *Lipocarpha* has the *Cyperus* type of embryo. Whereas the homogeneity of *Cyperus* is supported by embryography, one may conclude that *Scirpus* is distinctly heterogeneous. This might be an argument for systematic heterogeneity involving a possibly polyphyletic assemblage; each of the natural sections in *Scirpus* possesses namely according to VAN DER VEKEN (1964, p. 140) only one embryo type.

Though *Scirpus confervoides* (*Websteria*) has its own embryo type, similar to that of *Eleocharis* but somewhat more differentiated, I have kept it in *Scirpus* for flower-morphological reasons. As to *Actinoschoenus*, which has the *Carex* type of embryo combined with a Eucyperoid leaf-anatomy I have kept this in *Fimbristylis*, though VAN DER VEKEN (1964, p. 166) suggests it to belong to *Rhynchosporaeae* (see p. 591 under *Fimbristylis thouarsii*).

Vegetative anatomy. BAAS, Notes Jodrell Lab. 6 (1969) 1–20 (*Hypolytraeae*); DUVAL-JOUBE, Bull. Soc. Bot. Fr. 20(1873)91–95; GOVINDARAJALU, J. Linn. Soc. Bot. 59(1966)289–304 (*Bulbostylis*), *ibid.* 62 (1969) 27–40 (*Fuirena*), and *ibid.* 62 (1969) 41–58 (*Cyperus*); GREGORY & METCALFE, Notes Jodrell Lab. 5 (1967) 1–17 (bibliography); KAPPAHN, Beih. Bot. Centralbl. 18 (1904–05) 233–272 (silica); KOYAMA, Mem. N.Y. Bot. Gard. 15 (1966) 136–159 (*Mapanieae* = *Hypolytraeae*) and *ibid.* 16 (1967) 46–70 (*Sclerieae*); KUKKONEN, Ann. Bot. 31 (1967) 523–544 (*Uncinia*); METCALFE, Am. J. Bot. 56 (1969) 782–790 (relationships and anatomy) and Anatomy of the Monocotyledons V. Cyperaceae. Oxford (1971) 597 pp.; METCALFE & GREGORY, Notes Jodrell Lab. 1 (1964) 1–11 (descriptive terms); PFEIFFER, Beih. Bot. Centralbl. 44 (1927) 90–176 (leaf anatomy of many genera) and Ber. Deut. Bot. Ges. 47 (1929) 78–82 (silica); RIKLI, Jahrb. Wiss. Bot. 27 (1895) 485–580 (leaf anatomy, bundle sheaths); SCHUYLER, Mitt. Bot. Staatssamml. München 10(1971)577–585 (*Scirpeae*); SHARMA, Curr. Sci. 41 (1972) 494–497 (*Scirpus squarrosus*); SHARMA & MEHRA, Res. Bull. Punjab Univ. n.s. 21 (1970) 119–128 (*Kobresia*) and Bot. Gaz. 133 (1972) 87–95 (*Fimbristylis*).

METCALFE (1971, *l.c.*) provided a comprehensive survey of anatomical structures occurring within the family. His reference book also contains a very full bibliography and summaries by GREGORY of anatomical data collected in the past. Most of the following is taken from this book.

Anatomical characters to be used for diagnostic purposes or for discussions of affinities are the following.

Shape of lamina in transverse section taken midway the apex and the sheathing base. In the generally occurring dorsiventral leaf type the lamina may be V-shaped (with flanged, medianly grooved and thick subtypes), corrugate, crescentiform (thin or thick), inversely W-shaped or triangular. The shapes of isobilateral leaves (*Lepidosperma*, *Machaerina*) range from subcruciform, winged fusiform, tetragonal, elliptical to constricted elliptical in transverse section. The pseudodorsiventral leaf type (restricted to *Cladium*) is V-shaped. Cylindrical leaves with a circular to subcircular shape of the transverse section occur in some species of *Lipocarpha* and *Machaerina*. METCALFE (1969, 1971) has suggested a derivation of the cylindrical, isobilateral and pseudodorsiventral leaf types from the dorsiventral 'basic' type.

Prickle hairs are very common in the family and of little taxonomic interest. Other hair types are more infrequent and have some diagnostic value. They include adpressed hairs with tips directed towards the leaf apex (some *spp.* of *Costularia*, *Scirpus* and *Scleria*), unicellular flexible hairs (some *spp.* of *Carex*, *Fimbristylis*, *Fuirena*, *Rhynchospora*, *Schoenus* and *Scleria*), unicellular long and stiff hairs (some *spp.* of *Carex*, *Fuirena*, *Rhynchospora* and *Schoenus*), unicellular short and stiff hairs (some *spp.* of *Carex*, *Fuirena*, *Gahnia*, *Lipocarpha*, *Oreobolus* and *Scleria*) and finally lobed hairs in *Schoenus* (*S. apogon*). Papillae are present in a number of genera. In some species of *Carex*, *Cladium*, *Fimbristylis*, *Lepidosperma*, *Lepironia*, *Machaerina* and *Scleria* the papillae are restricted to the cells around the stomata and overarch the latter.

*Epidermis*. Stomata are generally paracytic but tend to be tetracytic in some genera. Silica bodies are of almost universal occurrence in the leaf epidermis of *Cyperaceae* and have proved to be of great taxonomic importance. They are absent or very doubtfully present in an unusual form in *Hypolytrum* and *Lepironia*, finely particulate silica has been noted in some species of *Costularia*, *Fuirena*, *Oreobolus*, *Paramapania* and *Scleria*. The bodies may be dome-shaped with their bases resting in the sinuations of anticlinal walls in *Oreobolus* or be present as solitary cones at the apices of sinuations of anticlinal walls (some *spp.* of *Costularia* and *Scleria*); cubical bodies associated with other types of silica bodies

occur in *Paramania* and *Rhynchospora*; warty spherical to hemispherical bodies in *Capitularina* and *Scleria*; bridge-shaped bodies in *Mapania* and *Thoracostachyum*; wedge-shaped in *Scirpodendron* and *Thoracostachyum*. The most common type is the conical type with its base resting on the inner periclinal wall. This type intergrades with the nodular one. These types occur in the majority of genera and may be present in different numbers per cell, the number and arrangement of the bodies being of diagnostic value. The epidermis may include bulliform cells.

In a number of *Cyperaceae* a parenchymatous or partly or wholly sclerenchymatous hypodermis is present. The presence or absence of bulliform cells and of a hypodermis is of restricted taxonomic value. Variations have been recorded below the species level. The distribution of sclerenchyma, mainly accompanying the vascular bundles shows an enormous range of variation within the family and the shapes of sclerenchyma girders, caps or strands may be of considerable diagnostic value at the species level.

The mesophyll of the leaves may be virtually homogeneous, differentiated in palisade and spongy chlorenchyma or may contain radiate chlorenchyma (that is radiating from the vascular bundles). The latter type is conspicuously represented in most or all species of *Bulbostylis*, *Cyperus*, *Fimbristylis* and *Lipocarpha*, some or all species of *Fimbristylis*, *Fuirena*, *Hypolytrum* and *Rhynchospora* show this feature less markedly. Air cavities or areas with translucent cells, which give rise to such cavities occur in a great number of genera.

The vascular bundles of the leaf are collateral and in most genera arranged in a single row as seen in transverse section. In cylindrical, isobilateral, pseudodorsiventral and a few dorsiventral leaves the arrangement differs. In cylindrical and isobilateral leaves they are arranged along the whole periphery of the transverse section. In the isobilateral leaves of *Lepidosperma* and *Machaerina* and the pseudodorsiventral leaves of *Cladium* they occur in opposite pairs with the xylem poles facing each other. This situation should not be confused with the arrangement of vascular bundles in two ranks in some dorsiventral leaves, each vascular bundle having a normal xylem and phloem arrangement. This occurs in species of *Costularia*, *Cyperus*, *Lipocarpha*, *Mapania*, *Rhynchospora*, *Scirpodendron* and *Thoracostachyum*. The vascular bundles are usually surrounded by a two-layered bundle sheath, with or without adaxial and/or abaxial merging with the accompanying sclerenchyma. Three basic types occur in *Cyperaceae*: 1) inner sheath sclerenchymatous, outer sheath parenchymatous (most common), 2) inner sheath parenchymatous, outer sheath sclerenchymatous (some species of *Cyperus*, *Lipocarpha*), and 3) bundle sheath three-layered, outer and inner sheath parenchymatous, middle layer sclerenchymatous (*spp.* of *Bulbostylis*, *Carpha*, *Fimbristylis* and *Mapania*). Some species show intermediate types of bundle sheaths.

Culm anatomy also provides useful diagnostic features. These also include outline in transverse section (triangular, circular, hemicircular, quadrangular, pentagonal, hexagonal, polygonal, trapezoid, winged fusiform, scutiform crescentiform and irregular), presence or absence and distribution of air cavities, arrangement of vascular bundles, and sclerenchyma.

Roots and rhizomes are less well known anatomically, and the characters thought to be of diagnostic value need further testing.

*Relationships with other families.* *Gramineae* are different from *Cyperaceae* mainly in epidermal structure. In *Gramineae* the silica bodies are morphologically entirely different and the epidermal cells are clearly differentiated in short and long cells. The latter feature, however, tends to be present in a few *Cyperaceae* as well. METCALFE (1971) has suggested that any phylogenetic relationship between the two families must be very remote. *Restionaceae* differ from most *Cyperaceae* in their culm anatomy. In *Restionaceae* there is a characteristic sequence of tissues: epidermis, chlorenchyma, parenchyma sheath, sclerenchyma sheath (enclosing peripheral vascular bundles) and medullary vascular bundles embedded in central parenchymatous ground tissue. In *Cyperaceae* some genera also possess a sclerenchyma ring in the culm, but the very regular zonation of tissues as in *Restionaceae* is always absent so that the resemblance of those *Cyperaceae* to *Restionaceae* remains superficial. Silica deposits occurring in some *Restionaceae* are either spheroidal nodular or are present as silica sand. Conical bodies, so characteristic of the majority of *Cyperaceae* are absent. Nodular bodies occur in a number of *Cyperaceae* genera but intergrade here with the conical type. According to METCALFE (1971) *Cyperaceae* are anatomically more similar to *Juncaceae* than to any other plant group. *Juncaceae* do not possess silica bodies, but this is also true for several genera of *Cyperaceae*. It may be noted in passing that most of the *Cyperaceae* lacking silica are amongst the genera belonging to the tribe

*Hypolytreae*. This tribe is generally regarded as primitive within the family. It seems therefore justified to suggest that the plant group ancestral to *Cyperaceae* and *Juncaceae* also lacked silica bodies. The affinities of *Cyperaceae* with *Juncaceae* are also supported from other sources of evidence (cf. METCALFE, 1971, pp. 42 & 43).

*Anatomical affinities within the family*. It is impossible to define the tribes and subfamilies anatomically. All tribes contain such a range of anatomical variation and the overlap with other tribes is so extensive that only vague suggestions can be made. The tribe *Hypolytreae* exhibits a great range of variation. The unusual bridge- and wedge-shaped silica bodies of some genera only occur outside this tribe in a few genera of the *Rhynchosporae*. The absence of distinct silica bodies is moreover more or less confined to genera belonging to *Hypolytreae*. Several genera, notably *Chrysithrix* and *Chorizandra*, show many resemblances with members of *Rhynchosporae* (cf. BAAS, *l.c.*, and METCALFE, 1971, *l.c.*). All other tribes typically contain some sort of conical silica bodies, and *Capitularina* of the *Hypolytreae* has also been recorded to contain this type. In my opinion this genus is rather remote from the other *Hypolytreae* on other anatomical grounds as well (BAAS, *l.c.*). The tribe *Cypereae* does not exhibit any striking anatomical features which make them stand out within *Cyperaceae*. Anatomically there are no objections against including genera usually treated in the separate tribe *Scirpeae* in *Cypereae*. *Rhynchosporae* vary considerably in their anatomy. Yet *Oreobolus* is rather isolated anatomically. Some genera resemble *Hypolytreae* (see above). The tendency in some non-Malesian genera to have wedge-shaped silica bodies also points to an affinity between the two tribes. *Sclerieae* usually possess silica bodies of deviating types in addition to the common conical ones. This seems to be the only outstanding anatomical character within the tribe. *Cariceae* are quite homogeneous anatomically. Most of the characters shared by the genera constituting this tribe are, however, also of widespread occurrence throughout the other tribes. Vegetative anatomy does not provide supporting evidence to distinguish two subfamilies *Cyperoideae* and *Caricoideae*. — P. BAAS.

*Palynology*. The pollen grains in *Cyperaceae* are, as far as investigated, degraded tetrads, in which the wall of the pollen mother cell develops into an exine, while three of the four nuclei resulting from the tetrad division degenerate. SELLING (B. P. Bish. Mus. Spec. Bull. 38, 1947, 350–352) has created the term 'pseudomonads' for such grains (see the survey by CRANWELL, Bull. Auckl. Inst. Mus. 3, 1953, 42–47). ERDTMAN (Pollen Morph. & Pl. Taxon. 1952, 141–142), however, suspects that the pollen of *Mapania* may not belong to this category, although KOYAMA (cited in Cronquist, Evol. Class. Fl. Pl. 1968, 341–342) affirms its pseudomonad nature. Evidently careful studies are still necessary to solve such problems. Exine stratification is stated by ERDTMAN, *l.c.*, to be similar to that found in other Angiospermous pollen grains. Size varies between 16–66  $\mu$ , shape may be spherical, pear-shaped or flattened triangular. Apertures are as a rule indistinct, variable in number (0–4) and in position, although one aperture may dominate. Due to lack of detailed studies, it is difficult to discuss the taxonomic significance of pollen characters in *Cyperaceae*. In *Carex* pollen morphology is known to be rather uniform and its pear-shaped, multiaperturate pollen type is also known from *Bulbostylis*, *Costularia*, *Cyperus*, *Fimbristylis*, *Fuirena*, *Gahnia*, *Oreobolus*, *Scirpus*, *Scleria*, *Tetraria*, and *Uncinia*. The pollen of the genera *Mapania* and *Thoracostachyum* is clearly monoporate and also differs in shape and, possibly, in wall structure from the *Carex* type.

The formation of pseudomonads is unique for *Cyperaceae*. An analogous mode of pollen development occurs, however, in *Juncaceae*. Here all four nuclei develop normally, resulting in a tetrad in which the outer exine is also formed by the pollen mother cell wall, while the inner walls are thinner. This is generally taken to suggest that *Cyperaceae* are closely related to *Juncaceae* and may in fact have been derived from the latter family (cf. TAKHTAJAN, Evol. Angiosp. 1959, 272). CRONQUIST, *l.c.*, however, points to the resemblance between the distinctly monoporate *Mapania* pollen grains and those of *Gramineae* and *Restionaceae* and considers it unlikely that *Cyperaceae* inherited their pseudomonads from some earlier group. — J. MULLER.

*Chemotaxonomy*. The chemical characters of this huge family were summarized 10 years ago (HEGNAUER, Chemotaxonomie der Pflanzen 2, 1963, 124–133). Accumulation of silicic acid, which is deposited in highly characteristic, anatomically easily demonstrable (spodograms) patterns, usual absence of oxalate of lime, the relatively frequent occurrence of flavonoid (*i.e.* condensed) tannins probably derived from leucoanthocyanins or protoanthocyanidins and preponderance of starch as a carbohydrate reserve seem to be typical of *Cyperaceous* plants. Some taxa produce essential oils

which are deposited in more or less elongated oil cells. Cyanogenic compounds, alkaloids and saponins seem to occur exceptionally only in this family. The scantiness of known chemical facts was stressed in 1963. In the meantime phytochemical research has not totally neglected *Cyperaceae*. Much new information about alkaloids, flavonoids, quinones and phenolic ketones of roots and rhizomes, and about the chemical composition of essential oils of several species of *Cyperus* became available in recent time. The alkaloids of *Carex brevicollis*, harman, brevicollin and brevicarin, were shown by Russian authors to be all  $\beta$ -carboline-type bases. Alkaloids were reported for several other *Cyperaceae*; their structures, however, have still to be established. The essential oils of rootstocks of *Cyperus articulatus*, *C. rotundus* and *C. scariosus* were studied intensively by several groups of workers; sesquiterpenes and sesquiterpenic alcohols and ketones are their main constituents. The taxonomically probably most interesting developments, however, concern polyphenolic compounds. E. C. BATE-SMITH published his survey of leaf phenolics of monocotyledonous plants (J. Linn. Soc. Bot. 60, 1968, 325). He noted a strong resemblance between *Gramineae* and *Caricoideae* and a tendency for *Cyeroideae* (*Scirpoideae*) to be "much more regular or 'primitive' in their phenolic pattern"; his sampling, however, was very poor with regard to *Cyperaceae*. H. T. CLIFFORD and J. B. HARBORNE (Phytochemistry 8, 1969, 123) studied the flavonoid pigments of inflorescences of sedges and arrived at the conclusions that grasses and sedges are radically different and that in wind-pollinated plants the correlation between flavonoid chemistry and taxonomy breaks down. The common anthocyanidins, flavonols and flavones seemed to be lacking in sedges; 3-deoxyanthocyanidins (carexidins), aurones (aureusidins), chalcones (okanin) and leuco-anthocyanidins were shown to occur in *Cyperaceae*, but to be erratically distributed in the family. Later HARBORNE (Phytochemistry 10, 1971, 1569) studied leaf pigments of 62 species representing 11 genera. This time a rather close resemblance between grasses and sedges and additionally palms was noted. Glycoflavones and the flavones luteolin and tricrin are widespread in leaves of sedges and flavonols including rutin were found only in *Eriophorum latifolium*, *Fuirena pubescens* and in 7 of the 44 species of *Carex* investigated. The predominant occurrence of flavonols in *Carex flava* and related species suggests, according to HARBORNE, that these are the more primitive taxa within the genus. Evidently much more facts about the chemistry and distribution of phenolic compounds are needed before sound taxonomic conclusions become possible.

Investigations aiming at extension of our knowledge were started by I. KUKKONEN (Mitt. Bot. Staatssamml. München 10, 1971, 622); many phenolics were demonstrated by him to occur in sedges; before a true evaluation of facts becomes possible, identification of these compounds is necessary.

However, for the study of species aggregates chromatographic comparisons of leaf phenolics may be valuable without identification of the compounds concerned (R. I. EDIGER, Trans. Kansas Acad. Sc. 69, 1966, 152: *Carex aggregata* complex). Totally new compounds were detected in rootstocks of Australian *Cyperaceae* by R. J. ALLAN *et al.* (Tetrahedron Letters 1969, p. 4669 & 4673; *ibid.* 1970, p. 3945). These are the cyperaquinones and phenolic ketones, both probably derived from isoprenylated and acylated phloroglucinols. The cyperaquinones were found to occur in species of *Cyperus*, *Fimbristylis*, and in *Cyperus pedunculatus* (R. BR.) KERN (*Remireia maritima* L.). Only the last mentioned species was investigated accurately for phenolic ketones; remirol, remiridiol, preemirol and isoevodionol occur in its rootstocks. These phloroglucinol-derived new constituents of sedges seem to be promising for the study of infra- and intergeneric relationships, but less so for the study of relationships between families.

Summarizing it may be stated that even to-day our phytochemical knowledge of *Cyperaceae* is scanty. The facts available at present indicate that grasses and sedges share several striking features. Therefore the phytochemical data do not contradict the hypothesis postulating a common origin for these two large families of wind-pollinated Monocotyledons. — R. HEGNAUER.

**Taxonomical affinities.** There is no unanimity of opinion about the affinities of *Cyperaceae*. As will be observed from the introductory chapters, the vegetative anatomy and palynology would suggest a remote tie with *Juncaceae*, chemotaxonomical evidence would point to *Gramineae*, while morphological structure would according to HOLTUM point to ancient relationship with *Pandanales*, suiting the habit and drupaceous fruit of the primitive tropical members and the theory of the simple, unisexual primitive flower.

*Taxonomy and subdivision of the family.* In spite of the much diversified structure of spikelets and flowers, *Cyperaceae* present in the customary circumscription, also adopted here, a natural unit. To GILLY (Iowa State Coll. J. Sc. 26, 1952, 210) the tribe *Cariceae*, comprising the large genus *Carex* and some closely allied smaller genera, is as nearly related to *Gramineae* as to *Cyperaceae* in the restricted sense, but his proposal to raise the tribe *Cariceae* to family rank as *Kobresiaceae* has found little support. According to BULLOCK (Taxon 7, 1958, 11), NELMES intended to raise some African genera to family rank as *Coleochloaceae* (*Coleochloa*, *Trilepis*, and *Microdracoides*) but he did not publish on this. These genera possess indeed some characters not found in other *Cyperaceae*, amongst others open sheaths of the cauline leaves, but they seem to me insufficient to warrant the distinction of a separate family.

More important than the attempts to split *Cyperaceae* into smaller families is the tracing of the interrelationships within the family. Here the main problem is whether there is indeed an unbridgeable gap yawning between the monoclinous and diclinous members.

The subdivision into subfamilies and tribes adopted below, and the arrangement of the Malesian genera of *Cyperaceae*, are mainly based on the ideas about relationships in this family as developed by MATTFELD (Proc. 6th Int. Bot. Congr. A'dam 1, 1936, 330–332), HOLTUM (Bot. Review 14, 1948, 525–541) and myself (Brit. Ass. Adv. of Sci. 19 (n. 78), 1962, 141–148) as explained in the chapter on morphology. Apart from some unimportant deviations they therefore agree with the system followed by SCHULTZE-MOTEL in the 18th edition of ENGLER's Syllabus (1964).

Diametrically opposed to it was the opinion prevalent among earlier cyperologists such as BOECKLER, CLARKE, PAX, and KÜENTHAL, and the system recently elaborated by the Japanese cyperologist T. KOYAMA (J. Fac. Sc. Univ. Tokyo III, 8, 1961, 37–64). However different from each other their systems may be, they all start from the supposition that the strictly unisexual flowers in *Caricoideae* (*Carex*, *Scleria*, and closely allied smaller genera) are reductions of the more primitive bisexual flowers in *Cyperoideae* (*Scirpus* etc.), which in their turn can be derived from the pentacyclic ground-plan of the monocotyledonous flower. According to this theory *Cyperaceae* with bisexual flowers must come first in the system, and *Hypolytrae* (*Scirpodendron*, *Mapania*, etc.) last, because their flowers are reduced to such an extent that they merely consist either of a single stamen or of an ovary. The structure in the axils of the glumes in *Hypolytrae* is considered a strongly reduced partial inflorescence. A serious objection to this theory is that it cannot bridge the gap between *Cyperaceae* with strictly unisexual flowers and those with bisexual ones, especially not because there has never been found a vestige of the other sex nor of hypogynous bristles or scales in the flowers of *Caricoideae*.

As early as 1877 BENTHAM (J. Linn. Soc. Lond. 15, p. 506–512) defended the thesis that the so-called partial inflorescence in *Hypolytrae* is homologous with the bisexual Cyperaceous flower. In agreement with this view both MATTFELD and HOLTUM take the flowers in *Cyperoideae* for synanthia, i.e. partial inflorescences ultimately reduced to functionally 'bisexual flowers'. Several more or less advanced stages of reduction are found in *Hypolytrae*, which tribe therefore should be placed at the beginning of *Cyperoideae*, not at the end of *Caricoideae*. In the spikelets of the tropical *Hypolytrae* the glumes subtend a bisexual structure consisting of a terminal female flower and two or more lateral monandrous male ones, the latter seated in the axil of a scale. Two outer practically opposite scales are characterized by their being navicular and ciliate on the keel. They may be connate on the adaxial side (e.g. in several species of *Hypolytrum*) and the resulting 2-keeled bidentate scale cannot be distinguished from the monocotyledonous prophyllum. Usually there is a varying number of flat glabrous scales between the ovary and the navicular scales, more or less distinctly arranged in one or two whorls and at least partly not subtending a stamen. Starting from the complex condition in *Scirpodendron*, in which there is a large but varying number of scales with stamens, the gradual reduction can be followed through *Lepironia*, *Chorizandra* (Australian), *Mapania*, and *Paramapania* to the structures in *Diplazia* (South American), and *Hypolytrum*, where the scales surround the stamens which are arranged round the ovary, this being in effect the condition in several *Cyperoideae*. Such functionally bisexual 'flowers' are thus assumed to be synanthia, being derived from reduced partial inflorescences of unisexual flowers, as I have illustrated in 1962 (Adv. Sci. 19, July 1962, 141–148, 24 fig.). Compare fig. 1. In this way the gap apparently yawning between the unisexual flowers in *Caricoideae* and the bisexual ones (synanthia) in *Cyperoideae* can be bridged.

The system here adopted is, as far as Malesian genera are concerned, as follows:

**A. SUBFAMILY CYPEROIDEAE**

**I. Tribe Hypolytreae:**

- |                         |                           |                       |
|-------------------------|---------------------------|-----------------------|
| 1. <i>Scirpodendron</i> | 4. <i>Thoracostachyum</i> | 6. <i>Paramapania</i> |
| 2. <i>Capitularina</i>  | 5. <i>Mapania</i>         | 7. <i>Hypolytrum</i>  |
| 3. <i>Lepironia</i>     |                           |                       |

**II. Tribe Cyperae:**

- |                      |                        |                         |
|----------------------|------------------------|-------------------------|
| 8. <i>Scirpus</i>    | 11. <i>Eleocharis</i>  | 13. <i>Fimbristylis</i> |
| 9. <i>Fuirena</i>    | 12. <i>Bulbostylis</i> | 14. <i>Cyperus</i>      |
| 10. <i>Lipocarpa</i> |                        |                         |

**III. Tribe Rhynchosporeae:**

- |                         |                          |                         |
|-------------------------|--------------------------|-------------------------|
| 15. <i>Tetraria</i>     | 19. <i>Tricostularia</i> | 23. <i>Machaerina</i>   |
| 16. <i>Costularia</i>   | 20. <i>Schoenus</i>      | 24. <i>Gahnia</i>       |
| 17. <i>Carpha</i>       | 21. <i>Oreobolus</i>     | 25. <i>Rhynchospora</i> |
| 18. <i>Lepidosperma</i> | 22. <i>Cladium</i>       |                         |

**B. SUBFAMILY CARICOIDEAE**

**IV. Tribe Sclerieae:**

26. *Scleria*

**V. Tribe Cariceae:**

- |                     |                  |                    |
|---------------------|------------------|--------------------|
| 27. <i>Kobresia</i> | 28. <i>Carex</i> | 29. <i>Uncinia</i> |
|---------------------|------------------|--------------------|

**SYNOPTICAL KEY TO THE MALESIAN GENERA**  
(Reflecting the adopted system, not intended as a practical key)

1. Bisexual flowers (synanthia) present (by abortion of androecium or gynoecium part of the flowers maybe unisexual) . . . . . **A. SUBFAM. CYPEROIDEAE**
2. Outer 2 hypogynous scales (in *Hypolytrum* the only ones present) folded, transverse and sharply keeled, ciliate or spinulose on the keel, free, or sometimes connate on the adaxial side . . . **I. Tribe Hypolytreae**
3. Hypogynous scales numerous, indefinite in number.
4. Nut deeply grooved, 1-1½ cm long . . . . . **1. Scirpodendron**
4. Nut not grooved, much smaller.
5. Stems 5-angular. Inflorescence terminal, capitate . . . . . **2. Capitularina**
5. Stems terete. Inflorescence a single, pseudolateral spikelet . . . . . **3. Lepironia**
3. Hypogynous scales definite in number, up to 6.
6. Hypogynous scales 5 or 6.
7. Hypogynous scales 6. Stamens 3(-4). Outer scales ciliate on the keel.
8. Inflorescence paniculate. Exocarp thin, hard. . . . . **4. Thoracostachyum**
8. Inflorescence capitate or consisting of a single spikelet. Exocarp corky or fleshy . . . **5. Mapania**
7. Hypogynous scales usually 5. Stamens 2(-3). Outer scales coarsely brown-spinulose on the keel. . . . . **6. Paramapania**
6. Hypogynous scales 2 . . . . . **7. Hypolytrum**
2. Hypogynous scales, when present, otherwise, or perianth consisting of bristles.
9. Spikelets as a rule several- to many-flowered; only 1 or 2 lower glumes empty. . . **II. Tribe Cyperae**
10. Perianth represented by hypogynous bristles or scales.
11. Flowering stems leafy, at least at the base. Style continuous with the ovary.
12. Perianth consisting of bristles, exceptionally of 4 scales . . . . . **8. Scirpus**
12. Perianth consisting of 2 or 3 scales.
13. Hypogynous scales 3, often with intervening bristles. . . . . **9. Fuirena**
13. Hypogynous scales 2, median, hyaline . . . . . **10. Lipocarpa**
11. Stems leafless. Style articulated with the ovary, its base persistent on the nut . . . **11. Eleocharis**
10. Perianth absent.
14. Nut crowned by the persistent style-base . . . . . **12. Bulbostylis**
14. Nut not crowned by the persistent style-base.
15. Style articulated with the ovary . . . . . **13. Fimbristylis**
15. Style continuous with the ovary.
16. Glumes distichous . . . . . **14. Cyperus**
16. Glumes spiral; see 8. *Scirpus*.
9. Spikelets as a rule very few-flowered (mostly 1-2-flowered); usually several lower glumes empty. . . . . **III. Tribe Rhynchosporeae**
17. Style continuous with the ovary.
18. Stamens 6. Appendage of the connective nearly as long as the anther-cells; lower flower male. . . . . **15. Tetraria**

18. Stamens fewer (exceptionally 6 in some species of 24. *Gahnia*).  
 19. Perianth consisting of bristles, long-plumose throughout.  
 20. Style hispidulous. Inflorescence large, paniculate . . . . . 16. *Costularia*  
 20. Style glabrous. Inflorescence small, almost capitate . . . . . 17. *Cyperus*  
 19. Hypogynous scales or bristles, when present, not long-plumose.  
 21. Hypogynous scales incrassate after anthesis . . . . . 18. *Lepidosperma*  
 21. Hypogynous scales or bristles not incrassate after anthesis, or perianth absent.  
 22. Hypogynous scales densely white-hairy . . . . . 19. *Tricostularia*  
 22. Hypogynous scales not densely white-hairy, or perianth absent.  
 23. Internodes of the rachilla very short between the lower (empty) glumes, elongate and prominently zigzag between the upper (flower-bearing) glumes. Glumes distichous . . . . . 20. *Schoenus*  
 23. Internodes of the rachilla not so markedly different in length.  
 24. Perianth consisting of 6 hypogynous scales . . . . . 21. *Oreobolus*  
 24. Perianth otherwise, or absent.  
 25. Nut drupe-like, borne on a disk not falling off with the nut proper. Stems hollow 22. *Cladium*  
 25. Nut not borne on a disk. Stems pithy.  
 26. Glumes distichous . . . . . 23. *Machaerina*  
 26. Glumes spiral . . . . . 24. *Gahnia*  
 17. Style articulated with the ovary, its base persistent on the nut . . . . . 25. *Rhynchospora*  
 I. All flowers strictly unisexual . . . . . B. SUBFAM. CARICOIDEAE  
 27. Female flowers not enclosed by a sac-like organ (a modified prophyll).  
 IV. Tribe *Sclerieae*. 26. *Scleria*  
 27. Female flowers enclosed by a sac-like modified prophyll . . . . . V. Tribe *Cariceae*  
 28. Modified prophyll more or less open on the abaxial side . . . . . 27. *Kobresia*  
 28. Modified prophyll closed throughout its length (utricle).  
 29. No needle-like hooked rachilla inside the utricle . . . . . 28. *Carex*  
 29. A needle-like rachilla hooked at the top inside the utricle present. Inflorescence always a single spikelet.  
 29. *Uncinia*

Useful & noxious plants. The following data are very concise and mostly taken from HEYNE (Nutt. Pl. 1927). See for more details in the text under the species.

Various sedges are used for plaiting mats and thatching, the most commonly used being *Cyperus malaccensis*, *Eleocharis dulcis*, *Lepironia*, *Scirpodendron*, *Scirpus grossus*, *S. lacustris*, *S. litoralis*, *S. mucronatus*, and *Thoracostachyum sumatranum*. The stems of *Eleocharis sphacelatus* are in New Guinea used to make rush skirts for women.

A peculiar use is made by fishermen of *Cyperus malaccensis* in Java (see p. 616 and fig. 53).

The tubers of *Eleocharis dulcis* are edible and this species is sometimes cultivated for this purpose; possibly Malays brought it to the Northern Territory together with Egyptian *Lotus*.

The apex of the stem and the leaf-bases of the sprouts of *Gahnia javanica* have a most agreeable sweet taste of nuts, but serve only as a titbit to the wandering naturalist. In Papua the rhizomes of *Machaerina articulata* are eaten. In north Central Java (near Pemalang) stem-pieces of *Cyperus malaccensis* are thickly inserted in ropes which are used to catch fry of the bandèng fish (VAN STEENIS, Trop. Natuur 29, 1940, 20, fig.).

Noxious weeds are *Cyperus rotundus* etc. which by their subterranean tubers or rhizomes are difficult to eradicate.

Several *Cyperaceae* occurring in great quantity in marshes and swamps invade the wet rice-fields. Most common paddy field sedges are *Cyperus difformis*, *C. halpan*, *C. iria*, *Fimbristylis littoralis* and *Scirpus juncooides*. They are of course weeded out, but when the rice is harvested there are still many which escaped weeding and are abundantly fruiting.

As in many places the rice harvest is alternated with a dry farming crop, the seed (nuts) of the *Cyperaceae* must remain dormant in the soil because during the dry farming a quite different weed flora comes up.

Such areas have hence a 'double weed flora', and consequently the seed or fruit of the dryland farming weeds must also be dormant during the wet period of the growing of rice.

This is an interesting feature not yet fully disclosed, because we would like to know what factors are responsible for the dormancy of both categories, the secret of the factors inhibiting their germination.

Note. This revision will be published in two instalments due to the fact that the treatment of *Carex* and *Uncinia* is not yet finished.

Acknowledgement. Since 1971 my failing eyesight prohibited actual research work and I

greatly appreciate the essential assistance of the general editor for composing the preliminary version of the introductory chapters, especially those on the ecology, dispersal, and plant geography, for my approval.

## KEY TO THE GENERA

1. Bisexual flowers always present (part of the flowers may be male or female by abortion of the other sex).
2. Flowers (the organs in the axils of the glumes of the spikelet) naked, *i.e.* not surrounded by a perianth consisting of hypogynous bristles and/or scales.
3. Nut crowned by the persistent style-base which is articulated with the nut proper.
4. Leaves reduced to bladeless sheaths. Inflorescence consisting of a single terminal spikelet.
  5. Nut  $1\frac{1}{2}$ –2 mm long, seated on a conspicuous,  $\frac{1}{2}$ –1 mm long gynophore. Spikelet 6–15 by 4–6 mm, glumes 4–5 mm long. . . . . 13. *Fimbristylis* (*tetragona*)
  5. Nut smaller, without gynophore. Spikelet and glumes smaller . . . . . 11. *Eleocharis* *spp.*
4. Leaf-blades well-developed.
6. Persistent style-base forming a minute dark button much narrower than the trigonous nut. Leaf-sheaths (if not too old) bearded in the throat with long white hairs. Stigmas 3. Annuals with capillary leaves. . . . . 12. *Bulbostylis*
6. Persistent style-base not button-like. Leaf-sheaths not bearded.
7. Persistent style-base saddle-shaped, as broad as the biconvex nut. Stigmas 2.
  7. Persistent style-base not saddle-shaped. Stigmas 3 . . . . . 25. *Rhynchospora* (*gracillima*)
  3. Nut not crowned by the persistent style-base; when the nut is beaked then the beak continuous with the nut. . . . . 13. *Fimbristylis* (*thomsonii*)
8. Style dilated at the base, articulated with the ovary, often fimbriate. Glumes spirally arranged, or more rarely distichous. Stigmas 2 or 3; nut 2- or 3-sided. . . . . 13. *Fimbristylis* *spp.*
8. Style continuous with the ovary.
9. Internodes of the rachilla very short between the lower (empty) glumes, elongate and prominently zigzag between the upper (flower-bearing) glumes; flowers (or fruits) in the hollows of the rachilla. Glumes distichous, frequently dark-coloured . . . . . 20. *Schoenus* *spp.*
9. Internodes of the rachilla not so markedly different in length.
10. Spikelets several- to many-flowered; as a rule only 1–2 lower glumes empty.
  11. Glumes distichously arranged . . . . . 14. *Cyperus* *spp.*
  11. Glumes spirally arranged . . . . . 8. *Scirpus* *spp.*
10. Spikelets very few- (mostly 1–2)-flowered; 2 or usually more lower glumes empty.
12. Mature spikelets falling off as a whole because their rachilla disarticulates at the base. Glumes distichously arranged . . . . . 14. *Cyperus* *spp.*
12. Ripe nuts and glumes falling separately from the persistent rachilla.
13. Stems hollow, up to 2 m tall. Nut drupe-like, borne on a disk not falling off with the nut proper. Leaves 3-ranked, with horizontally flattened blades cutting by the serrate-scabrous margins. . . . . 22. *Cladium* (*mariscus*)
13. Stems solid, pithy, or transversely septate. Nut not drupe-like, without disk.
14. Stems terete, pithy. Upper flower of the spikelets bisexual, nut-bearing, lower one when present sterile or male. Flower-bearing glumes smaller than the empty ones. Style-base not swollen. Leaves spirally arranged, horizontally flattened, narrowed into a long subulate scabrous tail. . . . . 24. *Gahnia*
14. Stems ancipitous or biconvex, rarely terete, pithy or sometimes transversely septate. Lower flower bisexual, nut-bearing, upper one reduced. Flower-bearing glume(s) larger than the empty ones. Style-base conspicuously incrassate. Leaves distichously arranged, vertically flattened or terete, smooth or almost so, the blades sometimes much reduced . . . . . 23. *Machaerina* *spp.*
2. Flowers with a perianth consisting of hypogynous bristles and/or scales.
15. Outer 2 hypogynous scales (in *Hypolytrum* the only ones present!) folded, transverse (*i.e.* placed right and left), sharply keeled (boat-shaped), ciliate or brown-spinulose on the keel, free, or sometimes connate on the adaxial side.
16. Hypogynous scales numerous, indefinite in number.
17. Stems terete, transversely septate. Inflorescence a single spikelet pseudolateral because of the erect bract similar to and continuing the stem. Nut strongly compressed. Leaves reduced to bladeless sheaths. . . . . 3. *Lepironia* (*articulata*)
17. Stems angular. Inflorescence terminal. Nut not compressed.
18. Stems triquetrous, not septate. Inflorescence paniculate. Nut 1– $1\frac{1}{2}$  cm long, deeply grooved.
  18. Stems 5-angular, hollow with some transverse septa (not visible from the outside!). Inflorescence capitate. Nut much smaller, not grooved. . . . . 2. *Capitularina* (*involucrata*)
16. Hypogynous scales definite in number, up to 6.
19. Hypogynous scales 2, transversal, either of them with a stamen in its axil. Stigmas 2. Inflorescence paniculate, sometimes contracted into a capituliform cluster . . . . . 7. *Hypolytrum*

19. Hypogynous scales 5 or 6. Stigmas 3, exceptionally 2 or 4.
20. Hypogynous scales usually 5. Stamens 2, in the axils of the outermost scales, which are coarsely brown-spinulose on the keel; occasionally there may be a 3rd less developed stamen. Exocarp hard. Flowering stems (scapes) leafless, arising laterally . . . . . 6. *Paramapania*
20. Hypogynous scales always 6. Stamens 3-4. Outermost scales soft-ciliate on the keel.
21. Inflorescence capitate or consisting of a single spikelet. Flowering stems central or lateral. Exocarp thick, corky or fleshy . . . . . 5. *Mapania*
21. Inflorescence paniculate. Stems central. Exocarp thin, hard . . . . . 4. *Thoracostachyum*
15. Perianth consisting of bristles, or hypogynous scales not folded and sharply keeled.
22. Perianth consisting of filiform or setaceous bristles only; no hypogynous scales present.
23. Style articulated with the ovary. Nut beaked by the persistent style-base separated from the nut proper by a distinct constriction.
24. Leaves reduced to bladeless sheaths. Inflorescence a single terminal spikelet not subtended by a leafy bract. Spikelet usually several- to many-flowered, with only the lower 1-3 glumes empty. . . . . 11. *Eleocharis* spp.
24. Leaf-blades well developed. Inflorescence paniculate or capitate, with leafy bracts. Spikelets few- (mostly 1-2-)flowered, with several empty basal glumes . . . . . 25. *Rhynchospora* spp.
23. Style continuous with the ovary. Beak of the nut when present confluent with the nut, and a part of it not separated by a constriction.
25. Hypogynous bristles plumose at least at the base. Glumes distichous.
26. Bristles plumose only at the base. Internodes of the rachilla very short between the lower (empty) glumes, elongate and zigzag between the upper (flower-bearing) glumes . . . . . 20. *Schoenus* (nitens)
26. Bristles plumose throughout.
27. Style hispidulous. Inflorescence large, paniculate. Nut obovate. Stems 120-150 cm tall. . . . . 16. *Costularia* (*pilisepala*)
27. Style glabrous. Inflorescence small, almost capitate. Nut oblong. Stems 5-25 cm tall. . . . . 17. *Carpha* (*alpina*)
25. Hypogynous bristles scabrous or smooth, not plumose.
28. Stamens 6, on finally 5-6 mm long glabrous filaments; anthers linear, 2 mm long, their appendage 1½ mm long . . . . . 15. *Tetraria* (*borneensis*)
28. Stamens at most 3.
29. Dwarf cushion-forming mountain plants with conspicuously distichous, equitant leaves. Spikelets 1-flowered. Hypogynous bristles 6. Glumes 3 . . . . . 21. *Oreobolus* (*ambiguus*)
29. Not this combination of characters.
30. Glumes several, distichous, frequently dark-coloured. Internodes of the rachilla very short between the lower (empty) glumes, elongate and zigzag between the upper (flower-bearing) glumes; flowers (or fruits) in the hollows of the rachilla . . . . . 20. *Schoenus* spp.
30. Glumes spiral or only 2. Internodes of the rachilla not so markedly different in length.
31. Leaves equitant, ensiform, vertically flattened . . . . . 23. *Machaerina* spp.
31. Leaves not equitant, not ensiform, not vertically flattened . . . . . 8. *Scirpus* spp.
22. Hypogynous scales present.
32. Hypogynous scales 2, thinly hyaline (therefore readily overlooked!), placed fore and aft (median), parallel with the subtending glume. Inflorescence capitate . . . . . 10. *Lipocarpha*
32. Hypogynous scales more than 2, not hyaline.
33. Dwarf, cushion-forming mountain plants with distichous leaves. Spikelets 1-flowered. Hypogynous scales 6, persistent on the rachilla when the nut has fallen off . . . . . 21. *Oreobolus* spp.
33. Taller plants, not cushion-forming. Leaves not distichous. Hypogynous scales remaining attached to the nut.
34. Inflorescence pseudolateral because of the erect bract similar to and continuous with the stem. Hypogynous scales usually 4 (3-5), spatulate, plumosely fringed at the top . . . . . 8. *Scirpus* (*litoralis*)
34. Inflorescence terminal. Hypogynous scales not plumosely fringed.
35. Hypogynous scales 3, stipitate, often alternating with 3 (sometimes very short) bristles. Inflorescence paniculate. Spikelets usually greyish or lead-coloured . . . . . 9. *Fuirena*
35. Hypogynous scales more than 3, not stipitate. Filiform or setaceous bristles always absent.
36. Hypogynous scales incrassate after anthesis, glabrous. Leaves almost terete, with a shallow, inconspicuous groove. Nut without pale ribs . . . . . 18. *Lepidosperma* (*chinense*)
36. Hypogynous scales not incrassate after anthesis, densely white-hairy. Leaves flat, deeply channelled because of the involute margins. Nut with 3 pale ribs . . . . . 19. *Tricostularia* (*undulata*)
1. All flowers strictly unisexual (male flowers without rudimentary ovary, female ones without staminodes). No hypogynous bristles or scales present (the straight or hooked needle inside the utricle in *Uncinia* and in a few *Carex* spp. is the axis of a reduced spikelet!).
37. Female flower not enclosed by a sac-like organ. Nut terete or obtusely trigonous, with crustaceous or bony pericarp, often white, more rarely bluish or discoloured, borne on a more or less trilobate (not rarely much reduced or obsolete) disk . . . . . 26. *Scleria*
37. Female flower enclosed by a sac-like organ (a modified prophyll). Nut otherwise, without disk.
38. Modified prophyll (perigynium) more or less open on the abaxial side . . . . . 27. *Kobresia* (*kobresiodae*)
38. Perigynium closed throughout its length (a utricle).

39. Besides the ovary (or nut) the utricle contains a needle-like rachilla produced beyond the orifice of the utricle and strongly hooked at the top. Inflorescence always a single terminal spikelet. 29. *Uncinia*  
 39. Usually no rachilla inside the utricle; when there is a rachilla, it is not hooked at the top. Inflorescence paniculate, spicate, or a single spikelet . . . . . 28. *Carex*

### 1. SCIRPODENDRON

ZIPP. *ex* KURZ, J. As. Soc. Beng. 38, ii (1869) 84. — *Ptychocarya* R. BR. *ex* WALL. Cat. (1831) n. 3538, *nom. nud. in synon.*; LINDL. Veg. Kingd. (1846) 119, *nom. nud.*; VON POST & O.K. Lexic. Gen. Phan. (1904) 470, *nom. nud.* (*Ptychocaryum*); H. PFEIFF. in Fedde, Rep. 21 (1925) 240. — Fig. 3.

Stout perennial herbs, with woody, obliquely erect rhizome, in habit strongly resembling a small *Pandanus*. Stems relatively short, erect, triquetrous, leafy at the base only. Leaves 3-ranked, with short, open sheaths and very long linear blades. Inflorescence terminal, paniculate, branched in the lower half, the lowest branches ternate, sometimes branched again. Lowest 3 bracts pseudo-whorled, very long, leaf-like, the higher ones much smaller, the uppermost scale-like. Spikelets terete or more or less trigonous, many-flowered. Glumes subcoriaceous, spirally imbricate. Flowers hermaphrodite; terminal flower of each spikelet with a terminal ovary and several flat fascicled (probably spiral) scales each bearing a single stamen in its axil; lateral flowers strongly dorsiventrally compressed, also with a terminal ovary, but with the 2 outer scales transversal, opposite, boat-shaped, sharply keeled, ciliate on the keel, usually connate on the adaxial side, the other scales variable in number (up to c. 10 in the lower flowers, often very reduced in the upper ones), flat, linear-lanceolate, acute, each with a single stamen in its axil (or uppermost scales sterile); arrangement in the lower fertile glumes of the spikelets usually more complex: two outer scales winged on the back, enclosing a normal central flower and two lateral more or less reduced ones. Style continuous with the ovary, not or hardly thickened at the base; stigmas 2 or 3 (in the same spikelet). Fruit drupaceous, coarsely ribbed; exocarp succulent, corky when dry; endocarp bony, black.

Distr. Monotypic genus, extending from Ceylon to Australia and Polynesia.

1. *Scirpodendron ghaeri* (GAERTN.) MERR. Philip. J. Sc. 9 (1914) Bot. 268; Int. Rumph. (1917) 106; BROWN, Min. Prod. Philip. For. 1 (1920) 352; En. Born. (1921) 64; En. Philip. 1 (1923) 131; HEYNE, Nutt. Pl. (1927) 313; S. T. BLAKE, Proc. R. Soc. Queensl. 54 (1943) 73; RAYM. Nat. Canad. 91 (1964) 131; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 454. — *Chionanthus ghaeri* GAERTN. Fruct. 1 (1788) 190, t. 39, f. 6a–e; BOERL. J. Linn. Soc. Bot. 31 (1895) 246. — *Pandanus pumilus* MOON, Cat. (1824) 67. — *Pandanus caricoides* [RUMPH. Herb. Amb. 4 (1743) 154] SPRENG. Syst. 3 (1826) 897; MIQ. Fl. Ind. Bat. 3 (1855) 163, *non* KURZ, 1867. — *Scleria macrocarpa* WALL. Cat. (1831) n. 3538, *nom. nud.* — *Ptychocarya macrocarpa* STEUD. Nomencl. 3 (1841) 416, *nom. nud.* — *Hypolytrum costatum* THW. En. Pl. Zeyl. (1864) 346. — *S. costatum* KURZ, J. As. Soc. Beng. 38, ii (1869) 85; *ibid.* 39, ii (1870) 85; SCHEFF. Nat. Tijd. N. I. 34 (1874) 91; BENTH. Fl. Austr. 7 (1878) 341; GOEBEL, Ann. Jard. Bot. Btzg 7

(1888) 122, t. 14, f. 1–11; CLARKE, Fl. Br. Ind. 6 (1894) 684; HOOK. f. in Trimen, Handb. Fl. Ceylon 5 (1900) 92, t. 97; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 227; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 106; MERR. Philip. J. Sc. 2 (1907) Bot. 422; CLARKE, Ill. Cyp. (1909) t. 116, f. 7–12; RIDL. & WINKL. Bot. Jahrb. 44 (1910) 202; C. B. ROB. Philip. J. Sc. 6 (1911) Bot. 195; KOORD. Exk. Fl. Java 1 (1911) 202; Atlas (1922) f. 266; RIDL. Fl. Mal. Pen. 5 (1925) 175. — *S. pandaniforme* ZIPP. *ex* KURZ, J. As. Soc. Beng. 38, ii (1869) 85, *in syn.* — *Pandanophyllum costatum* KURZ *l.c. in syn.* — *S. sulcatum* MIQ. Illustr. (1870) 65, t. 28, *err. calam.* — *Pandanus acaulis* MARTELLI, Webbia 4 (1913) 5. — *Mapania macrocephala* (*non* K. SCHUM.) MERR. En. Philip. 1 (1923) 132 *p.p.* (*quoad* ELMER 11978). — *Ptychocaryum ghaeri* H. PFEIFF. in Fedde, Rep. 21 (1925) 240; Bot. Arch. 12 (1925) 446; in Fedde, Rep. 28 (1930) 20; UUITIEN in Back. Bekn. Fl. Java. (em. ed.) 10 (1949) fam. 246, p. 53. — Fig. 3.

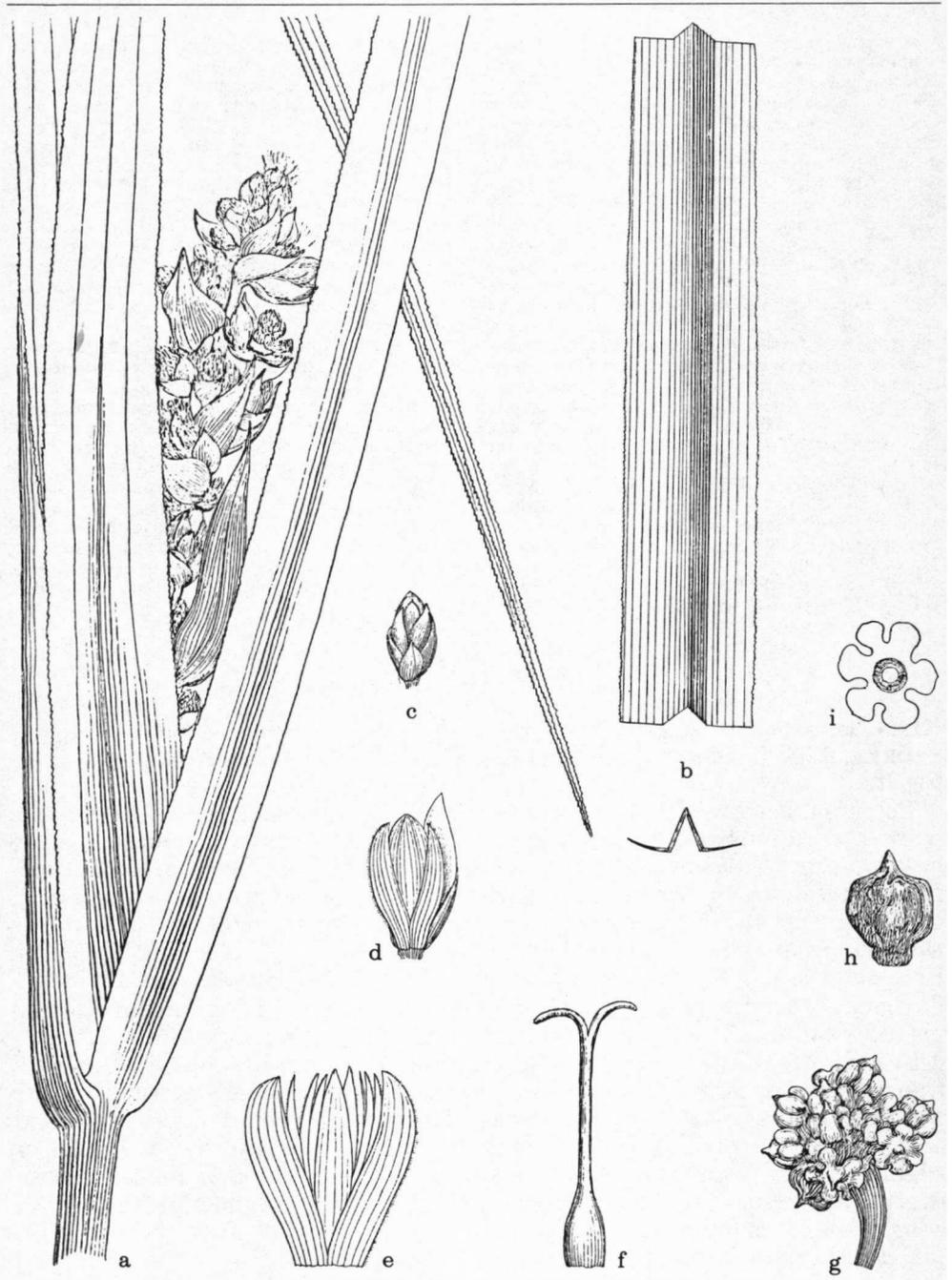


Fig. 3. *Scirpodendron ghaeri* (GAERTN.) MERR. *a.* Inflorescence, *b.* part of leaf and its section,  $\times \frac{2}{3}$ , *c.* spikelet, showing the glumes, *d.* flower, sustained by the glume,  $\times 2$ , *e.* flower, with the two transversal scales,  $\times 3$ , *f.* pistil, *g.* partial infructescence, *h.* nut, *i.* ditto in CS, nat. size (after MIQUEL).

Rhizome thick, forming large dense clumps, clothed with acute, imbricating scales and their fibrous remains. *Stems* smooth, 30–60 cm by 5–10 mm. *Leaves* numerous, coriaceous, drooping in the upper part, plicate, with 3 prominent nerves, aculeate-scabrous on the margins and the midrib beneath in the upper part, rather gradually narrowed into a filiform, triquetrous, scabrous, 15–25 cm long tail, 1–4 m by 2–5 cm; lower sheaths brown to dark castaneous. *Panicle* dense, oblong-ovoid, (5–)10–20 by up to 7 cm when in fruit; branches short, thick, obliquely spreading. Lower bracts (30–)60–150 cm long, the upper ones broadly ovate with filiform scabrous tip. *Spikelets* in sessile or almost sessile clusters, ovoid. *Glumes* ovate, obtuse, many-nerved, stramineous or greenish, c. 1 cm long. *Flowers* slightly shorter than the glumes. *Anthers* linear, 3–4 mm long. *Fruit* conical-ellipsoid, acute, usually with c. 6 more or less tuberculate longitudinal ribs, dusky brown, 1–1½ by c. 1 cm; ribs sometimes up to 10 and then often confluent at the top.

Distr. Ceylon, Peninsular Thailand, North Queensland (Cook Distr., very rare), New Hebrides, Polynesia (Fiji, Samoa); in *Malesia*: Sumatra (and the adjacent islands Simalur, Mentawai, Banka), Malay Peninsula (also in P. Penang), West and Central Java (rare), Borneo (Sarawak, N. & E. Borneo), Philippines (Palawan, Luzon, Polillo, Leyte,

Biliran, Mindanao), SE. Celebes (Kandari), Moluccas (Halmahera, Ternate, Sulu Is., Buru, Ceram, Amboina), New Guinea (Sorong).

Ecol. Freshwater tidal areas on clayish soil, tidal swamp forests, transition forests behind the mangrove, along rivermouths, especially in places where during high tide or heavy rainfall the water is waist deep. Because of the cutting, pandan-like leaves often forming almost impenetrable pure stands, which on aerial photographs can easily be recognised amidst the small-crown swamp forests.

According to RIDLEY, *Disp.* (1930) 240, 329, the large fruits readily float away when the water rises, and they are largely carried off by rats, which eat the corky exterior.

Uses. In Sumatra, Leyte, and the Moluccas (also in Ceylon) the dried leaves are used for making mats and hats, in Fiji for thatching. In S. Sumatra (Djambi, Palembang) the species is sometimes cultivated for this purpose. The material is apparently of inferior quality. In Samoa the fruits are eaten by the natives; this use is not reported from Malesia.

Vern. *Harashas*, S. piès, *rumbai latah*, Lamp., *garingging*, Simalur, *rumbai*, *sèding ayèr*, Banka, *sèlingsing*, Mal. Pen., *pandan ayèr*, Mol., *lasial*, *lasiatat*, Alf. Amb., *sèwès*, S. Halm. (Weda), *sasarèwèn*, *sosarèwu*, N. Halm. (Gal.), *hèhèwèhè*, Tob., *sèa-sèa*, Ternate; Philip.: *bilis*, Sub., *gáas*, Bik., *baróngis*, Bag.

## 2. CAPITULARINA

KERN, *nom. nov.* — *Capitularia* VALCK. SUR. Nova Guinea 8 (1912) 711, non FLÖRKE, 1807 (*quae est Cladonia*), non RABENH. 1851 (*quae est Uromyces*). — Fig. 4.

Perennial herbs with a woody, shortly creeping rhizome covered with ovate, many-nerved, fuscous to castaneous sheaths. *Stems* erect, quinquangular, hollow, inside with some indistinct septa not or hardly visible from the outside. *Leaves* basal, few, subcoriaceous, linear, folded lengthwise (at least when dry), complicate at the base, with 3 prominent nerves, or reduced to bladeless sheaths. *Inflorescence* terminal, capitate, consisting of 1–several spikelets. Involucral bracts several, long, leafy, pseudo-whorled. *Spikelets* terete, many-flowered. Rachilla persistent. *Glumes* numerous, spirally imbricate, cartilagineous, caducous, some lower ones empty. *Flowers* hermaphrodite, strongly dorsiventrally compressed; floral scales numerous, membranous, the lowest 2 transversal, opposite, free cucullate, with a narrow, minutely serrulate-ciliate wing on the acute keel, empty, the next 2 also empty, concave, posticous and anticous, the posticous one embracing the other; upper scales c. 8–15, flat or slightly concave, acute, each with a single stamen in its axil. *Anthers* linear, shortly apiculate. *Style* continuous with the ovary; stigmas 2, short. *Nut* conical-ovoid, many-ribbed, seated on a large, somewhat turgid, hollow stipe, therefore seemingly consisting of a fertile apical part and a sterile basal part; exocarp thin, not fleshy.

Distr. *Malesia*: New Guinea and Solomon Is., probably monotypic.

Note. RIDLEY (*Trans. Linn. Soc. II, Bot.* 9, 1916, 244) united *Capitularia* with the Australian genus *Chorizandra* R.BR. However, UITTEN (*Rec. Trav. Bot. Néerl.* 33, 1936, 291) pointed out that *Capitularia* is well characterized by the quinquangular stems, not found in the related genera and very unusual in *Cyperaceae*,

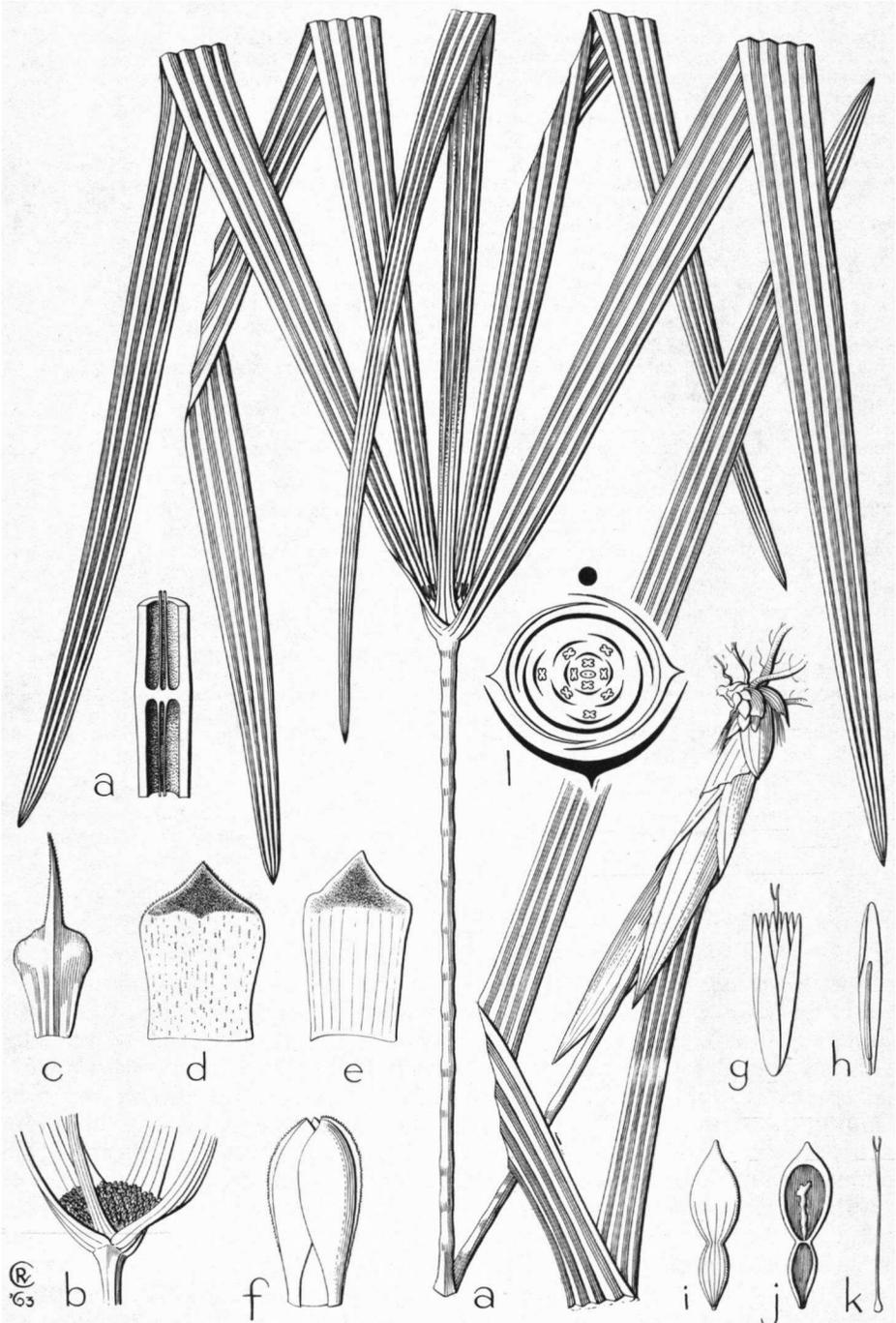


Fig. 4. *Capitularina involucrata* (VALCK. SUR.) KERN. *a*. Habit,  $\times \frac{1}{2}$ , *a'*. stem node in LS,  $\times 3$ , *b*. inflorescence,  $\times \frac{1}{2}$ , *c*. glume, *d*. transversal ciliate scale, *e*. inner scale, all  $\times 2\frac{1}{2}$ , *f*. flower, *g*. ditto, transversal scales removed, both  $\times 5$ , *h*. stamen with scale, *i*. nut on stipe, *j*. ditto, in LS showing hollow stipe, all  $\times 2\frac{1}{2}$ , *k*. pistil,  $\times 5$ , *l*. floral diagram (*a-c*, *f-g*, *k* GJELLERUP 754, *d*, *i-j* BRASS 7064, *e*, *h* BRASS 7003).

the terminal, capitate inflorescence subtended by several long leafy bracts, the four outer empty scales of the flower, the fertile inner ones, and the short stigmas. In *Chorizandra* the stems are terete, the inflorescence is pseudolateral because of the terete erect involucrel bract as though continuing the stem, the outer scales are fertile, the inner ones empty, and the stigmas long. The peculiar nuts of *Capitularina* seated on a large sterile part are entirely different from those of *Chorizandra*.

**1. *Capitularina involucreta* (VALCK. SUR.) KERN, comb. nov.** — *Capitularia involucreta* VALCK. SUR. Nova Guinea 8 (1912) 711, t. 118. — *Chorizandra involucreta* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 244. — *Capitularia foliata* var. *archboldii* UITTEN, J. Arn. Arb. 20 (1939) 214. — Fig. 4.

*Stems* borne single on the rhizome, acutely 5-angled (according to RIDLEY also 4-angled), smooth or slightly scaberulous just below the inflorescence, 35–65 cm by 2–4 mm, the base covered with bladeless, coriaceous, castaneous sheaths; upper sheaths scariosus, lanceolate, 10–20 cm long. *Leaf-blades* 0–5, gradually narrowed into a very acute to almost filiform scabrous point, scaberulous on the margins and the nerves on the under side at least in the upper part, glaucescent, 60–125 by 1–2 cm. Involucrel bracts 5–8, similar to the leaves, erect, rigid, plicate, castaneous at the base, unequal, the lowest 20–75 by 1–2 cm. *Spikelets* half hidden in the bases of the involucrel bracts, obovoid or obconical, 1–2 cm long and wide. Outer *glumes* obovate-cuneate, abruptly cuspidate, minutely serrulate-ciliate at the upper margin, pale at the base, castaneous at the apex, with a scabrous, up to 5 mm long awn, 7–11 by 5–7 mm; upper *glumes* gradually becoming lanceolate, pale, tipped with reddish brown. *Flowers* 5–11 mm long; outermost scales subspathulate, the wing on the keel up to 1 mm wide; posticous and anticous scales spathulate, obtuse, ciliolate at the top; fertile scales narrowly lanceolate, acute. *Anthers* linear, up to 6 mm long. *Style* purplish, 5–10 mm long. *Nut* terete or slightly angular, very acute and acuminate or subacuminate, longitudinally striate-sulcate, stramineous with fuscous base, 5–6 by 3–4 mm, the stipe (sterile basal part) fuscous, stri-

olate, 3–4 by 2–3 mm.

*Distr. Malesia:* New Guinea (W. New Guinea: Steenkool (Tembuni), Mt Carstensz (Canu Camp), Noord River near Alkmaar, Tor River, Utakwa River; Papua: Palmer River, W. Distr. in Kuinga Subdistr.).

*Ecol.* In swampy parts of primary forests, at low altitude (up to 200 m?).

*Notes.* *Capitularia foliata* UITTEN (Rec. Trav. Bot. Néerl. 33, 1936, 289) was based on BRASS 3045 from the Solomon Islands, which collection I have not seen. According to UITTEN, *C. foliata* is quite similar to *C. involucreta* in stem, leaves, and spikelets, but more robust in all its parts, the stem provided with very long leaves at the base, the inflorescence consisting of several spikelets, the bracts much larger and awned. In 1939 UITTEN described *C. foliata* var. *archboldii* from PAPUA, differing from the typical form by the single spikelet and the shorter-awned glumes; *C. foliata* was then said to differ from *C. involucreta* by the leafy stem-bases. In my opinion it is impossible to distinguish between *C. involucreta* and *C. foliata* solely by the absence or presence of basal foliage-leaves, and I doubt whether *C. foliata* can be maintained as a species. In GJELLERUP 754 (L) from Tor River, the base of one of the two specimens bears scariosus bladeless leaf-sheaths only, but in the other a well developed leaf is present. Both specimens certainly belong to *C. involucreta*; they were determined as such also by UITTEN.

In my opinion the few collections known from New Guinea belong to a single species which is very variable in the size of all its parts, even of its floral parts. A similar variability is found in several other members of the *Mapaniaceae*.

### 3. LEPIRONIA

L. C. RICH. in Pers. Syn 1 (1805) 70. — *Chondrachne* R. BR. Prod. (1810) 220. — *Choricarpha* BOECK. Flora 41 (1858) 19. — Fig. 5–6.

Perennial herbs with rush-like habit. Rhizome woody, horizontally creeping. *Stems* erect, terete, transversely septate within. *Leaves* reduced to bladeless sheaths open in front, the margins overlapping. *Inflorescence* consisting of a single spikelet, apparently lateral owing to the single erect involucrel bract continuing the stem. *Spikelet* terete, many-flowered. Rachilla thick, spongy, conical, persistent. *Glumes* chartaceous, spirally arranged, very densely imbricate, caducous with the nut, some lower ones empty. *Flowers* strongly dorsiventrally compressed. Hypogynous scales numerous, (up to c. 15?), the lowest 2 transversal, opposite, free, boat-shaped, ciliolate on the keel, the remaining ones fasciated (probably spiral), linear-lanceolate, acute, flat or nearly so. *Stamens* several (up to c. 10?), one in the axil of each of the keeled scales, the others solitary in the axils of the outer flat scales; anthers linear, shortly apiculate. *Ovary* terminal; style continuous with the ovary, slightly incrassate at the base, the base persistent on the nut as a short beak; stigmas 2, long. *Nut* strongly dorsiventrally compressed, plano-convex, acutely keeled on the margins.

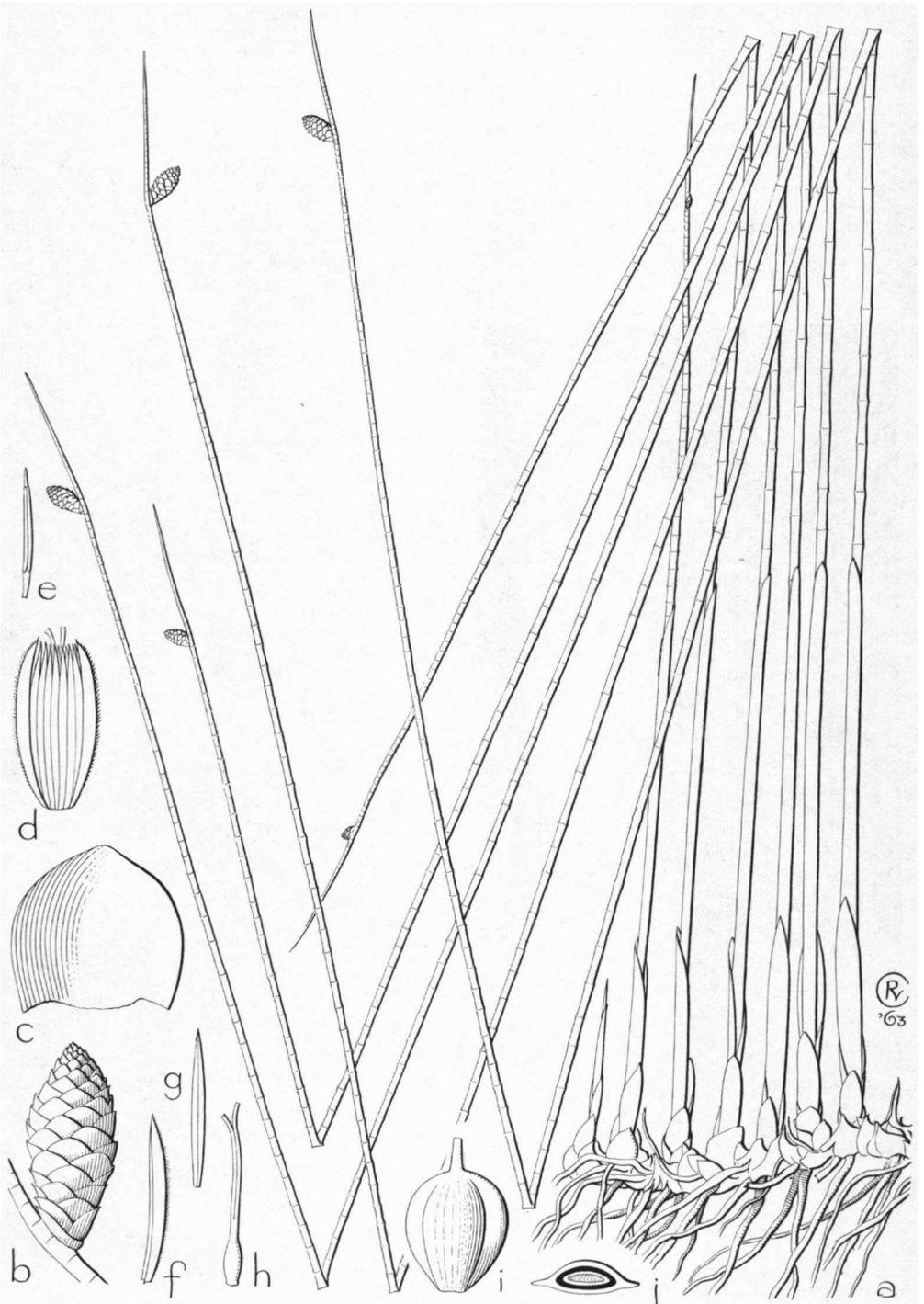


Fig. 5. *Lepironia articulata* (RETZ.) DOMIN. a. Habit,  $\times \frac{1}{2}$ , b. spikelet,  $\times 2$ , c. glume, d. flower with two transversal ciliate scales, enclosing inner scales and pistil, e. stamen, f. transversal scale, g. one inner scale, h. pistil, i. nut, j. ditto in CS; all  $\times 5$  (a-j KALKMAN 4021).

Distr. Usually considered a monotypic genus extending from Madagascar to Australia and Oceania. However, it is very likely that ENDLICHER (Gen. Pl. 1836, p. 116) was right in uniting *Lepironia* with *Chorizandra* R.Br. The latter genus comprises 4 Australian *spp.* in habit very similar to *Lepironia* and with essentially the same flower-structure. The nut in *Chorizandra* possesses c. 8 very prominent longitudinal ribs.

The species referred to *Lepironia* by MIQUEL belong to *Mapania* and *Thoracostachyum*.

1. *Lepironia articulata* (RETZ.) DOMIN, Bibl. Bot. Heft 85 (1915) 486; PFEIFF. Bot. Arch. 12 (1925) 451, f. 25 & 46; FISCHER, Kew Bull. (1932) 70; BURK. Dict. 2 (1935) 1331; S. T. BLAKE, J. Proc. R. Soc. Queensl. 54 (1943) 71; J. Arn. Arb. 28 (1947) 213. — *Restio articulatus* RETZ. Obs. 4 (1786) 14. — *Scirpus coniferus* POIR. in Lamk, Enc. 6 (1804) 756; Suppl. 5 (1817) 90. — *L. mucronata* L. C. RICH. in Pers. Syn. 1 (1805) 70; KUNTH, En. 2 (1837) 366; STEUD.

Syn. 2 (1855) 181; MIQ. Fl. Ind. Bat. 3 (1856) 346; Sum. (1861) 262, 602; KURZ, Nat. Tijds. N. I. 27 (1864) 224, J. As. Soc. Beng. 38, ii (1869) 77; Flora 52 (1869) 438; MIQ. Illustr. (1870) 60, t. 20; BOECK. Linnaea 37 (1871) 140; SCHEFF. Nat. Tijds. N. I. 34 (1874) 89; BENTH. Fl. Austr. 7 (1878) 342; GOEBEL, Ann. Jard. Bot. Botz 7 (1888) 126, t. 14, f. 12, 13; CLARKE, Fl. Br. Ind. 6 (1894) 684; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 227; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 107; CLARKE, Ill. Cyp. (1909) t. 118, f. 8–16; KOORD. Exk. Fl. Java 1 (1911) 202; Atl. (1922) f. 267 *err. 'mucronulata'*; CAMUS, Fl. Gén. I.-C. 7 (1912) 179, f. 25; MERR. En. Born. (1921) 64; KÜK. Bot. Jahrb. 50 (1924) 58; RIDL. Fl. Mal. Pen. 5 (1925) 175; HEYNE, Nutt. Pl. (1927) 313; CHERMEZ. Fl. Madag., fam. 29 (1937) 244, t. 23, f. 5–8. — *Chondrachne articulata* R. BR. Prod. (1810) 220. — *Choricarpha aphylla* BOECK. Flora 41 (1858) 20. — *L. conifera* DRUCE, Rep. Bot. Exch. Club Br. Isl. 1916 (1917) 631. — Fig. 5–6.

Rhizome covered with ovate, acute, striate, ferruginous scales. Stems approximate, uniseriate on the rhizome, slender, rigid, smooth, grey-green or glaucous, very variable in size, 40–150(–200) cm by 2–5(–8) mm, the septa close together (only visible from outside after drying). Leaf-sheaths stramineous to brownish, the upper one much longer than the lower, 10–30 cm long. Involucral bract terete, very acute, 2–5 cm long. Spikelet ovoid to oblong-ellipsoid, obliquely erect, acute, 1–2(–4) cm by 5–10(–15) mm. Glumes very broadly obovate or suborbicular, very obtuse, often lacerate at the apex, not or hardly hyaline-margined, not keeled, nerveless, shining brown to dark castaneous, 4–6 mm long and about as wide. Flowers as long as or slightly shorter than the glumes. Anthers 2–3 mm long, with dark c. ½ mm long appendage. Nut obovate to suborbicular, longitudinally striate, smooth except for the margins scaberulous at the top, brown, 3–4 by 2½–3 mm.

Distr. Madagascar, Ceylon, Thailand, Indo-China, S. China, coastal districts of N. and E. Australia, Carolines, New Caledonia, Fiji, in *Malesia*: Sumatra (Tapanuli, Palembang, Lampongs), Banka, Lingga Arch., Malay Peninsula (Dindings, Pahang, Malacca, Johore, Singapore), Borneo, Central Celebes (Towuti Lake), Moluccas (Sula Is.: Taliabu; Buru), New Guinea.

Ecol. In open swampy places, open marshes, swamps in savannah-forests, along quiet streams, often near the coast, in Sumatra up to 1000 m, in Trengganu (G. Padang) at 1200 m, in New Guinea (Wissel Lake Region) up to 1750 m. Often forming extensive communities.

Vern. *Tëkor, tikër, tikuk*, Lamp., *purum, putjet*, Banka, Mal. Pen., *këredjut*, Lingga Arch., *purum danau*, Mal. Pen., Borneo.

Uses. In S. Sumatra and Borneo mats for packing tobacco, rubber, and kapok, are made of the dried stems. The species is sometimes cultivated for this purpose.

In New Guinea (Sepik Distr.) it is used by the natives for basket-making.



Fig. 6. Stand of *Lepironia articulata* (RETZ.) DOMIN on sandy soil with peaty water in the Tasek Bera swamp valley in Malaya; ground cover with *Sphagnum* (photogr. SOEPADMO).



Fig. 7. *Thoracostachyum sumatranum* (MIQ.) KURZ. a. Habit with inflorescence,  $\times \frac{2}{3}$ , b. floral diagram, c. spikelet,  $\times \frac{2}{3}$ , d. glume, e. flower with 2 outer transverse ciliate scales, both  $\times 3$ , f. pistil, g. submature nut with style remains (after MIQUEL).

## 4. THORACOSTACHYUM

KURZ, J. As. Soc. Beng. 38, ii (1869) 75; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 133. — *Mapania* sect. *Thoracostachyum* (KURZ) KOYAMA, Mem. N.Y. Bot. Gard. 17 (1967) 50, in footnote. — Fig. 7–8.

Perennial herbs, (in the Mal. spp.) with long-creeping stolons hardening into woody, creeping rhizomes covered with lanceolate acute scales. *Stems* arising from the centre of a basal tuft of normal leaves, erect, triquetrous. *Leaves* 3-ranked, equitant, subcoriaceous, linear, flat or somewhat folded lengthwise, very gradually narrowed into a very acute to filiform scabrous point, conduplicate at the base (in 2 Indochinese spp. narrowed into a petiole); midrib (and often 2 of the lateral nerves) prominent underneath. *Inflorescence* terminal, paniculate, with divaricate rigid branches and several to many spikelets; lower bracts long, leaf-like, the upper ones much smaller. *Spikelets* broadly ovoid to oblong-ovoid, terete, solitary or more or less aggregated in twos or threes at the top of the ultimate branchlets, few- to many-flowered. *Rachilla* persistent. *Glumes* spirally imbricate, subcoriaceous, indistinctly 1–3-nerved, some lower ones empty. *Flowers* hermaphrodite, strongly dorsiventrally compressed, their structure as in *Mapania*: hypogynous scales 6, the lowest 2 transversal, opposite, free, boat-shaped, ciliate on the acute keel, each with a stamen in its axil, the upper 4 concave to almost flat, the third (anticous) one with a stamen in its axil, the remaining 3 empty (see note). *Style* continuous with the ovary; stigmas 3 (rarely in some flowers 2). *Nut* angular, hard, shining; endocarp stony, exocarp not spongy or fleshy; beak confluent with the nut proper.

Distr. Small genus of about 7 closely related spp.; 1 in the Seychelles, 2 in Indo-China, 1 in the Carolines, 1 in the Fiji Islands, in *Malesia* 2 spp. I am not certain that they all deserve specific rank.

Ecol. Usually in swampy forests, but also in open wet places, at low altitudes.

Uses. *T. sumatranum* is sometimes used for making mats.

Notes. The structure of the flowers is not as constant as it is usually assumed. Sometimes the lowest 4 (instead of 3) of the hypogynous scales bear stamens in their axils. UITTEN (Bull. Bish. Mus. n. 141, 1936, p. 16) even observed 6 stamens in some of the flowers of *T. vitiense* UITTEN all scales then being fertile. *T. pacificum* HOSOKAWA is described as having 4 or 5 stamens.

*Thoracostachyum* combines the habit of *Hypolytrum* with the flower-structure of *Mapania*. From *Hypolytrum* the genus is sufficiently distinguished by the different number of hypogynous scales and the 3 stigmas. It is very closely related to *Mapania*, the only differences with *Mapania* sect. *Cephaloscirpus* lying in the paniculate (not capitate) inflorescence, and the hard, non-drupaceous fruit.

## KEY TO THE SPECIES

1. Stems smooth even at the top. Glumes ovate, 3–3¼ mm long. Flowers 3–3½ mm long. Nut broadly obovoid, abruptly acuminate at the apex . . . . . 1. *T. sumatranum*
1. Stems more or less scabrous at the top. Glumes broadly ovate, 2–2¼ mm long. Flowers 1¾–2 mm long. Nut ellipsoid, slightly acuminate, with 3 longitudinal grooves in the conical beak . . . . . 2. *T. bancanum*

1. *Thoracostachyum sumatranum* (MIQ.) KURZ, J. As. Soc. Beng. 38, ii (1869) 75; SCHEFF. Nat. Tijd. N. I. 34 (1874) 89; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 136, f. 1b & 2b; KERN in BACK. & BAKH. f. Fl. Java 3 (1968) 455. — *Lepironia sumatrana* MIQ. Sum. (1861) 263, 604; Illustr. (1870) 62, t. 24. — *Hypolytrum pandanophyllum* F.v.M. Fragm. 9 (1875) 16. — *Pandanophyllum hypolytroides* F.v.M. l.c., in nota. — *Mapania sumatrana* BENTH. Fl. Austr. 7 (1878) 341. — *Mapania hypolytroides* F.v.M. ex BENTH. Fl. Austr. 7 (1878) 341. — *Mapania pandanophylla* K. SCH. in K. SCH. & HOLLR. Fl. Kais. Wilh.

Land (1889) 25; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 189; KOYAMA, Micronesica 1 (1964) 64. — *T. hypolytroides* CLARKE, Fl. Br. Ind. 6 (1894) 680; J. Linn. Soc. Bot. 34 (1898) 94; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 102; CLARKE, Ill. Cyp. (1909) t. 108, f. 7–10; VALCK. SUR. Nova Guinea 8 (1912) 710; KÜK. Bot. Jahrb. 59 (1924) 54; RIDL. Fl. Mal. Pen. 5 (1925) 171. — *T. dichromenoides* RIDL. Bot. Jahrb. 44 (1910) 525; MERR. EN. BORN. (1921) 66. — *T. pandanophyllum* DOMIN, Bibl. Bot. Heft 85 (1915) 484; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 138, f. 1c & 2c; S. T. BLAKE, J. Arn. Arb. 28 (1947) 208;



Fig. 8. *Thoracostachyum sumatranum* (MIQ.) KURZ. New Guinea, Cape Vogel Peninsula (Photogr. HOOGLAND; HOOGLAND 4646).

UITTEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 51. — *Mapania heyneana* BACK. Bull. Jard. Bot. Btzg III, 2 (1920) 328. — *T. heyneanum* UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 200; *ibid.* 33 (1936) 139, f. 1d. — Fig. 7-8.

Stems usually stout, smooth even at the top, (25-)60-150 cm by (2-)5-10 mm. Leaves green or pale green, distinctly reticulate when dry, up to 2 m long, (1-)2-3½ cm wide; margins scabrous at least in the upper half; lowest sheaths bladeless, fuscous to blackish. Inflorescence globose or ovoid, often dense, (3-)10-20 cm in diam., with 10 to some hundred (according to CLARKE up to 800!) spikelets; lowest bract up to more than 1 m long, pale at the base; branches smooth or scabrous. Spikelets ovoid or oblong-ovoid, often nearly globular when in fruit, straw-coloured, many-flowered, 5-10 by 3-5 mm, up to 7 mm wide when in fruit. Glumes ovate, obtuse, pale, with scarious margins, 3-3¾ by 2-2¾ mm. Flowers 3-3½ mm long. Anthers linear, 1½-1¾ mm long. Nut broadly obovoid, obtusely 3-5-angled, narrowed towards the base, abruptly acuminate at the apex, brown to castaneous, c. 3 by 2 mm (the c. 1 mm long beak included).

Distr. Australia (N.E. Queensland), Palau Islands (?), in Malasia: S. Sumatra (Palembang, Lampongs), Malay Peninsula (Malacca, Johore), W. Java (Danu

swamp), Borneo, SE. Celebes, and New Guinea. Ecol. In swamps, marshy forests, ponds, on riverbanks, on floating islands, locally often abundant; at low altitudes.

Uses. In Sumatra (Palembang) and the Malay Peninsula the leaves are used for making mats. In Sumatra it is sometimes cultivated for this purpose in swamps and inundated fields. The mats are less durable than those made of the leaves of *Pandanus* spp.

Vern. M: *umbai*, *rumpun pandan biru*, Mal. Pen., *rumbai lilin*, *r. idju*, Palemb., *selingsing*, Lamp., *tigesangi*, New Guinea (Trapi lang.).

Notes. The inflorescence is very variable in size and density. UITTEN treated *T. sumatranum* and *T. pandanophyllum* as specifically distinct on account of the large decomposed inflorescence of the latter, and *T. heyneanum* on account of the less dense inflorescence and the longer spikelets. It is evident that it is impossible to trace dividing lines only with the aid of these characters. The details of flowers and fruits are the same in all three.

In the herbaria *T. sumatranum* is often confused with *Hypolytrum nemorum*. It may be distinguished by the creeping stolons covered with long stramineous scales, the much firmer glumes, the 3 stigmas, and the nut abruptly narrowed into the beak.

2. *Thoracostachyum bancanum* (MIQ.) KURZ, J. As. Soc. Beng. 38, ii (1869) 76; SCHEFF. Nat. Tijd. N. I. 34 (1874) 89; CLARKE, Fl. Br. Ind. 6 (1894) 680, *incl. var. lonaispica*; J. Linn. Soc. Bot. 34 (1898) 94; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 226; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 102; CLARKE, Ill. Cyp. (1909) t. 107, f. 12-20; CAMUS, Fl. Gén. I.-C. 7 (1912) 174; MERR. En. Born. (1921) 65; RIDL. Fl. Mal. Pen. 5 (1925) 171; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 136, f. 1a, 1f, 2a; OHWI, Bot. Mag. Tokyo 56 (1942) 210; S. T. BLAKE, J. Arn. Arb. 28 (1947) 208. — *Lepironia bancana* MIQ. Sum. (1861) 263, 604; Illustr. (1870) 63. — *Thoracostachys bancana* KURZ, Nat. Tijd. N. I. 27 (1864) 224; Bot. Zeit. 23 (1865) 204, *nom. nud.* — *Hypolytrum borneense* KURZ, J. As. Soc. Beng. 38, ii (1869) 74; MIQ. Illustr. (1870) 59; SCHEFF. Nat. Tijd. N. I. 34 (1874) 88. — *Mapania bancana* B. & H. ex JACKS. Ind. Kew. 2 (1895) 163. — *T. ridleyi* CLARKE in Ridl. J. Str. Br. R. As. Soc. n. 46 (1906) 226; Kew Bull. add. ser. 8 (1908) 53; MERR. En. Born. (1925) 66. — *T. subcapitatum* VALCK. SUR. Nova Guinea 8 (1912) 710, t. 117.

Stems slender, more or less scabrous at the top, 15-80 cm by 1-3 mm. Leaves longer than the stems, usually glaucous, indistinctly reticulate when dry, scabrous on the margins, 4-20 mm wide. Inflorescence loose, with scabrous branches, 2-7 cm in diam., with 5-60 spikelets; lower bracts usually not pale at the base, 15-40 cm long. Spikelets globular or ellipsoid, usually reddish at the top, few-flowered, 4-6 by 2-3 mm (c. 5 mm wide when in fruit). Glumes broadly ovate, obtuse, 1¾-2¼ by 1½-2 mm. Flowers 1¾-2 mm long. Anthers oblong to linear-oblong, ¾-1 mm long. Nut ellipsoid, slightly acuminate, with 3 longitudinal grooves in the conical beak, blackish brown at the base, olive-green at the top, 2½-3 by 1¼-1½(-2) mm (beak included).

Distr. Tonkin; in *Malesia*: Sumatra (also Mentawai Is., Banka, and Riouw Arch.), Malay Peninsula (Perak, Pahang, Malacca, Johore, Singapore), Borneo, Moluccas (Buru), and New Guinea.

Ecol. In swampy places in forests, in swamp forests and peat forests, often plentiful as a ground cover, also in wet open places, at low altitudes (in Buru at 1075 m).

Vern. *Mingsing*, *rumbai bajan*, *M*, *sendang ajër*, *rumput sèding*, Banka, *rumput senayan batu*, *r*.

*sëndërayan*, *sëndayan*, *sëratiit*, Mal. Pen., *bëlingi*, *rumput grinsing*, *r*, *rembog*, W. Borneo.

Notes. *T. subcapitatum* VALCK. SUR. is a form with elongated spikelets apparently due to the attacks of an *Ustilago*. This abnormality was also described as *T. bancanum* var. *longispica* CLARKE. It occurs with the normal form.

A specimen from "E. Java, Tosari", leg. RIDLEY in the Kew Herbarium was obviously mislabelled (cf. Fl. Mal. I, 1, 1950, p. xxixa).

## 5. MAPANIA

AUBLET, Hist. Pl. Gui. Franç. 1 (1775) 47; BOECK, Linnaea 37 (1871) 136; CLARKE, Fl. Br. Ind. 6 (1894) 680; Kew Bull. add. ser. 8 (1908) 130; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 145; *l.c.* 277. — *Pandanophyllum* HASSK. Tijd. Nat. Gesch. Phys. 10 (1843) 118, *p.p. typ.*; STEUD. Syn. 2 (1855) 134, *p.p.* — Fig. 9–16.

Perennial, usually coarse herbs. *Rhizome* woody, erect, obliquely erect, or horizontal (sometimes up to 2 m long); long-creeping stolons covered with lanceolate, acute scales rarely present; roots usually thick, greyish brown to blackish, sometimes functioning as stilt roots. Flowering *stems* either central (arising from the centre of a basal tuft of leaves), erect, triquetrous, usually with 1–2 cauline leaves, or lateral (scapes), arising from the axils of the lower (rarely also higher) leaves or from below the leaves, trigonous or terete, the base clothed with some bladeless scale-like sheaths. *Leaves* 3-ranked, subcoriaceous to thickly coriaceous, linear, broadly linear, or lorate, slightly narrowed towards the conduplicate base, or rather abruptly narrowed into a petiole, the top (in almost all Mal. *spp.*) very gradually to abruptly narrowed into a filiform, triquetrous, scabrous tail; margins and midrib (rarely also 2 lateral nerves) aculeate-scabrous; midrib prominent beneath, 2 (rarely more) lateral nerves often prominent above. *Inflorescence* either consisting of a single spikelet or capitate (*i.e.* consisting of few to numerous sessile spikelets), in the latter case surrounded by some glume-like or foliaceous involucre bracts. *Glumes* spirally imbricate, coriaceous, chartaceous, or membranous, lower ones empty, upper ones flower-bearing. *Flowers* hermaphrodite, linear, strongly dorsiventrally compressed. *Hypogynous scales* (in the Mal. *spp.*) 6, thinly membranous, the lowest 2 transverse, opposite, free, rarely connate on the adaxial side, boat-shaped, ciliate on the acute or narrowly winged keel, each with a stamen in its axil, the third (anticous one) concave or 2-keeled, also with a stamen in its axil, the remaining 3 concave or flat, empty; in extra-Malesian *spp.* the number of scales and stamens less constant. *Anthers* linear; connective only shortly produced. *Style* continuous with the ovary, not or hardly incrassate at the base; stigmas 3, more rarely 2. *Nut* terete or slightly angular, beaked, stipitate; exocarp thick, corky or fleshy; endocarp stony, black.

Distr. About 50 *spp.* in the tropical regions of South America and Africa (not in Madagascar!), and from Ceylon, Assam, Sylhet, Thailand and Indo-China to the W. Pacific and N. Queensland, in *Malesia* 25 *spp.* The centre of development in *Malesia* is Borneo, from where 19 *spp.* are known (10 endemic). In the Malay Peninsula 11 *spp.* (2 endemic), in Sumatra 7 *spp.*, in W. Java only 3 *spp.* Fig. 10.

The genus is not represented in E. Java and the Lesser Sunda Is. which have largely a seasonal climate, and but poorly in Celebes and the Moluccas. *Mapania macrocephala*, *M. moseleyi*, and *M. baccifera* are restricted to the eastern part of the Archipelago, *M. macrocephala* extending to N. Queensland, Samoa, the Solomons, and the Carolines. Only *M. palustris* and *M. cuspidata* are widely distributed.

Ecol. All Malesian species occur in everwet primary rain-forests, preferably on moist, deep, muddy,

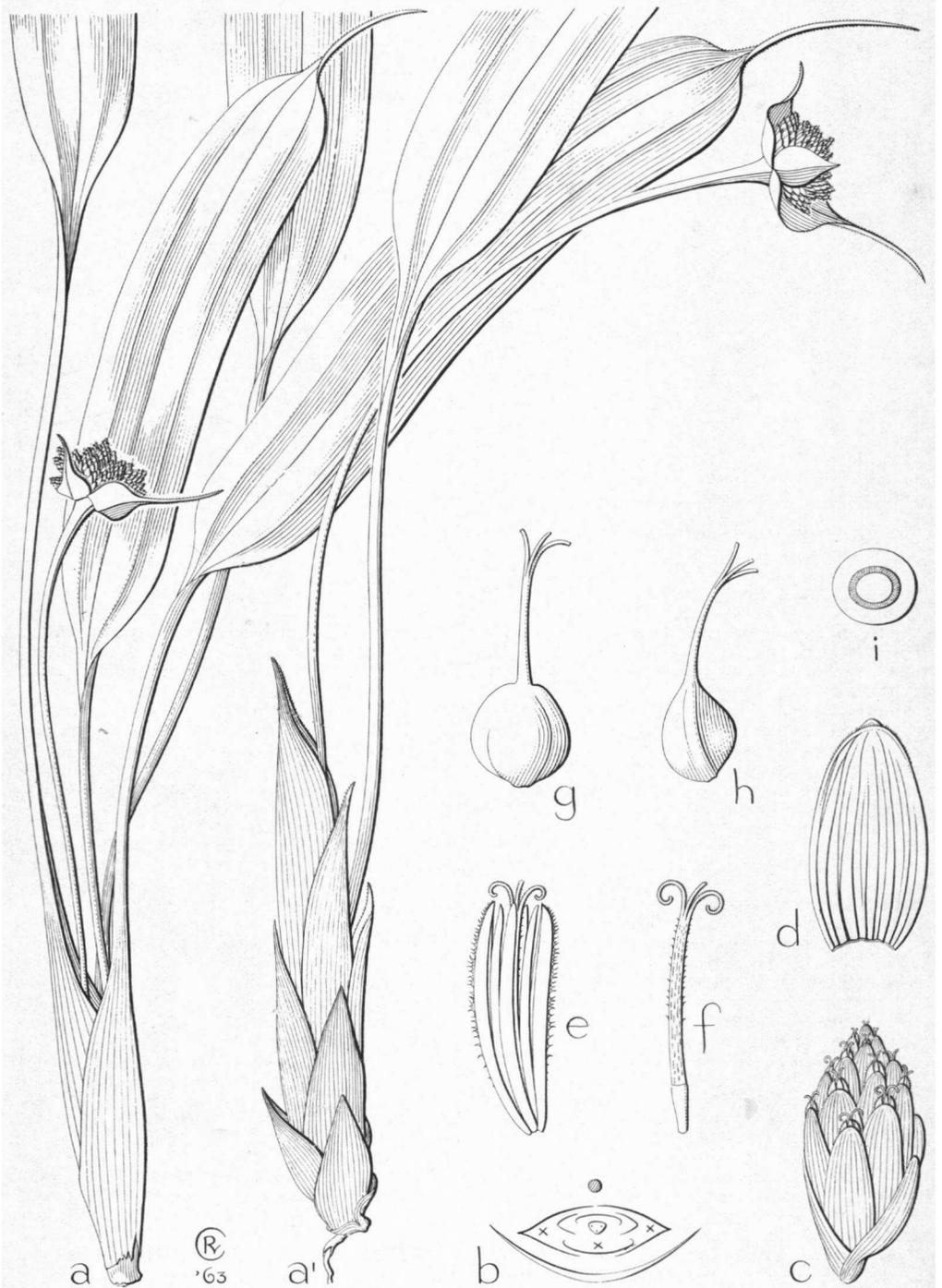


Fig. 9. *Mapania latifolia* UITTEN. a-a'. Habit,  $\times \frac{1}{2}$ , b. floral diagram, c. spikelet,  $\times 3$ , d. glume, e. flower, with two transverse scales, inner scales and stigmas, f. pistil, g-h. nut with style, i. nut in CS, all  $\times 5$  (a, g-i CLEMENS 27573, a'-f CLEMENS 30065).

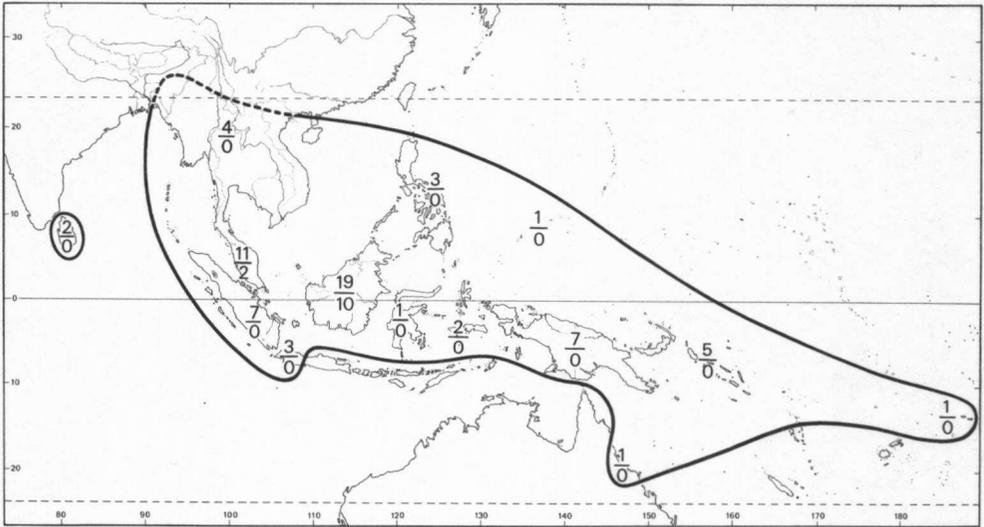


Fig. 10. Range of the genus *Mapania* AUBLET; above the hyphen the total number of species for each island or district, below it the number of endemic species.

humous or peaty soils, often on stream-banks or in shallow pools at low and medium altitudes; in New Guinea *M. macrocephala* ascends to 2000 m.

**Taxon. Subdivision of the genus.** The type species of *Mapania* is the South American *M. sylvatica* AUBL. Hist. Pl. Gui. Franç. 1 (1775) 47, t. 17. In sect. *Mapania* the leaves are as a rule all reduced to bladeless sheaths, and the inflorescence is sustained by an involucre of 3 large, oblong bracts. This section is not represented in Malesia.

The Malesian species are generally classified into 3 sections, but I greatly doubt whether these sections can be upheld, the distinction between them not being sharp, especially that between sect. *Pandanophyllum* and sect. *Macrolepironia*. Some botanists have gone so far as to raise some sections to subgeneric or even generic rank, but in my opinion there is too much reticulate affinity to warrant that procedure. There are certainly groups of allied species in Malesia, but they cannot be rigidly classified into infrageneric taxa. Therefore I have decided to refrain from recognizing sections and I have arranged the species according to their supposed affinity.

Moreover, there is a regrettable confusion as to the nomenclature. It has been overlooked that as early as 1870 MIQUEL used *Pandanophyllum* as a sectional name (in *Lepironia*) to cover the species with a capitate inflorescence. The type of this section is *Pandanophyllum palustre* HASSK. ex STEUD. Unfortunately CLARKE applied the name *Pandanophyllum* to the section with normally a single spikelet to the inflorescence, for which section MIQUEL coined the name *Macrolepironia*. This name must be reinstated.

To those who want to recognize sections, the names to be used are as follows:

**Sect. 1. Cephaloscirpus** (KURZ) B. & H. Gen. Pl. 3 (1883) 1056. — *Cephaloscirpus* KURZ, J. As. Soc. Beng. 38, ii (1869) 83 (T: *Hypaelyptum macrocephalum* GAUDICH.). — *Mapania* subg. *Cephaloscirpus* CLARKE, Kew Bull. add. ser. 8 (1908) 131; UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 185.

Flowering stems central. Involucral bracts foliaceous. Inflorescence capitate.

Embraces the E. Malesian *M. macrocephala* and *M. moseleyi*. UITTEN referred also *M. latifolia* to this section, but this species shows strong relations to *M. cuspidata* and *M. holtiumii*.

**Sect. 2. Pandanophyllum** (HASSK.) B. & H. Gen. Pl. 3 (1883) 1056. — *Pandanophyllum* HASSK. Tijds. Nat. Gesch. Phys. 10 (1843) 118, p.p. (T: *Pandanophyllum palustre* HASSK. ex STEUD.). — *Lepironia* sect. *Pandanophyllum* MIQ. Illustr. (1870) 60. — *Mapania* sect. *Halostemma* CLARKE, Fl. Br. Ind. 6 (1894) 681; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 284 (T: *Mapania silhetensis* CLARKE). — *Mapania* subg. *Halostemma* CLARKE, Kew Bull. add. ser. 8 (1908) 130; UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 185.

Flowering stems lateral. Involucral bracts glume-like. Inflorescence always capitate.

**Sect. 3. Macrolepironia** (MIQ.) KERN, Blumea 12 (1963) 25. — *Lepironia* sect. *Macrolepironia* MIQ. Illustr. (1870) 60 (Lectotype: *Lepironia enodis* MIQ.). — *Mapania* sect. *Pandanophyllum* (non B. & H.) CLARKE, Fl. Br. Ind. 6 (1894) 682; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 145. — *Mapania* subg. *Pandanophyllum* CLARKE, Kew Bull. add. ser. 8 (1908) 130; UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 185. — *Mapania* subg. *Pandanoscirpus* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 278 (T: *Mapania petiolata* CLARKE).

Flowering stems lateral. Inflorescence normally consisting of a single spikelet.

UITTEN referred *M. richardsii* and *M. longiflora* to this section. However, their inflorescence is composed of several spikelets, exactly as in *M. debilis*, which he placed in the preceding section. In future the three might be treated as a separate section.

In *M. cuspidata*, *M. squamata*, *M. spadicea*, and *M. graminea* there are not rarely some secondary spikelets branching from the axils of the lower ('empty') glumes; usually there is no distinct involucre, but sometimes the lower glumes assume the aspect of involucre bracts.

Notes. *Specific delimitation* has proved to be difficult, this in contrast with the African species in which the structure of the fruit offers good characters. The flowers in many Malesian species vary considerably in size (partly due to age). Therefore differential characters have largely been based on vegetative characters and are less tangible than desirable.

Herbarium material is often inadequate for critical study. *Mapanias* should be collected as whole plants, if possible both in flower and fruit.

## KEY TO THE SPECIES

*Texture and colour of the leaves are those of herbarium specimens!*

1. Leaves distinctly petioled.
2. Flowering stems central (arising from the centre of the shoot on which the normal leaves are borne), triquetrous, rough-hairy especially on the angles. Inflorescence capitate, with 8-50 spikelets, the lower 1-2 involucre bracts more or less foliaceous, tailed, overtopping the inflorescence . . . . . 3. *M. latifolia*
2. Flowering stems (scapes) lateral (developing from shoots in the axils of the leaves or below the leaves), terete or trigonous, the base clothed with bladeless, scale-like sheaths. Inflorescence either a single spikelet or capitate, in the latter case involucre bracts not foliaceous, glume-like, not overtopping the inflorescence.
3. Inflorescence normally a single terminal spikelet, sometimes with 1-2(-4) sessile or peduncled spikelets in the axils of the lower glumes. Scapes glabrous and smooth, ( $\frac{1}{2}$ -)1-2 mm thick. Leaves ( $\frac{1}{2}$ -)3-7 cm wide . . . . . 5. *M. cuspidata*
3. Inflorescence always capitate, with 8-16 spikelets. Scapes rough-hairy (ultimately glabrescent), (2-)-3-6 mm thick. Leaves 6-12 cm wide . . . . . 4. *M. holttumii*
1. Leaves not petioled.
4. Flowering stems central (arising from the centre of the shoot on which the normal leaves are borne), triquetrous, nearly always with 1-2 cauline leaves. Inflorescence capitate, with several to numerous spikelets, surrounded by foliaceous involucre bracts at least one of which much overtops the inflorescence.
5. Flowering stems stout to very stout, 4-8 mm thick. Leaves (2-)-4-6 cm wide. Inflorescence with many to numerous spikelets. Spikelets  $1\frac{1}{2}$ -3(-4) cm long, flowers 10-15 mm . . . . . 1. *M. macrocephala*
5. Flowering stems rather slender,  $1\frac{1}{2}$ -2 mm thick. Leaves 0.6-1.1 cm wide. Inflorescence with 5-10 spikelets. Spikelets 1- $1\frac{1}{2}$  cm long, flowers 5-7 mm . . . . . 2. *M. moseleyi*
4. Flowering stems (scapes) lateral (developing from shoots in the axils of the leaves or below the leaves), terete or trigonous, the base clothed with bladeless scale-like sheaths; scapes sometimes very short to almost lacking. Inflorescence either a single spikelet or capitate, in the latter case involucre bracts not foliaceous, glume-like, not overtopping the inflorescence.
6. Apex of the leaves acute, but not caudate. Leaves with 3 prominent nerves, the latter all very scabrid on their raised surface almost from the base to the apex of the leaves . . . . . 22. *M. micropandanus*
6. Apex of the leaves ending in a tail-like, triquetrous, scabrid acumen. Leaves with 1-several prominent nerves, but mostly only the midnerve distinctly scabrid on its raised surface.
7. Stem elongate, densely leafy, up to 50 cm long, producing in the leaf-axils solitary, subsessile spikelets. . . . . 23. *M. maschalina*
7. Stem short, not carrying a number of solitary, subsessile spikelets in successive leaf-axils.
8. Fruit with fleshy exocarp, berry-like, distinctly shrivelled when dried, yellow or orange (New Guinea). . . . . 25. *M. baccifera*
8. Fruit with dry exocarp, smooth to slightly rugulose, brown to blackish.
9. Inflorescence composed of several very densely packed spikelets at first sight hardly distinct from one another, and surrounded by some erect involucre bracts much firmer in texture than the pellucid, indistinctly nerved flower-bearing glumes, the whole simulating a single spikelet.
10. Inflorescence (2-) $2\frac{1}{2}$ - $4\frac{1}{2}$  cm long. Flowers c. 20 mm long . . . . . 7. *M. longiflora*
10. Inflorescence c. 1- $1\frac{1}{2}$  cm long. Flowers 5-8 mm long.
11. Leaves broadly linear,  $2\frac{1}{2}$ - $4\frac{1}{2}$  cm wide, abruptly contracted into the tail. Involucre bracts suborbicular . . . . . 6. *M. richardsii*
11. Leaves linear,  $\frac{1}{2}$ -1 cm wide, very gradually narrowed towards the apex. Involucre bracts elliptic or ovate . . . . . 8. *M. debilis*
9. Inflorescence either a single spikelet or composed of several to numerous distinct spikelets, in the latter case involucre bracts not strikingly different in texture from the coriaceous or chartaceous, distinctly nerved glumes.
12. Inflorescence always capitate, consisting of several to numerous distinct spikelets.
13. Bases of the leaves castaneous.
14. Leaves 1-3 cm wide. Involucre bracts 1-2 cm long. Glumes 9-12 mm long. Style usually bifid. Nut c. 5 by 3 mm . . . . . 10. *M. foxworthyi*
14. Leaves 7-9 mm wide. Involucre bracts very short, 2-4 mm long. Glumes  $3\frac{1}{2}$ -4 mm long. Style trifid. Nut 3- $3\frac{1}{2}$  by  $1\frac{1}{2}$  mm . . . . . 12. *M. angustifolia*
13. Bases of the leaves stramineous to light brown.

15. Glumes reddish brown, strongly nerved, almost ribbed when dry. Outermost flower-scales winged on the keel. Leaves with only the midnerve prominent . . . . . 11. *M. kurzii*
15. Glumes stramineous, much less conspicuously nerved. Outermost flower-scales not winged. Leaves with 3 more or less prominent nerves . . . . . 9. *M. palustris*
12. Inflorescence normally consisting of a single terminal spikelet, sometimes (on the same plant) some of them with 1-4 lateral sessile or peduncled spikelets added.
16. Bases of the leaves castaneous to blackish.
17. All spikelets sessile, triquetrous. Outer glumes sharply keeled. Flowers 15-30 mm long. Nut c. 10 mm long, the 3-4 mm long conical beak included . . . . . 20. *M. sessilis*
17. Spikelets at least partly peduncled. Outer glumes concave.
18. Leaves somewhat plicate lengthwise along several distinct lateral nerves . . . . . 19. *M. tenuiscapa*
18. Leaves with 1 or 3 prominent nerves.
19. Leaves very shining above, smooth, very densely crowded, strikingly 3-ranked, the rows very prominent and fan-like at the base; midnerve prominent beneath, 2 whitish lateral nerves somewhat prominent above. Scapes scabrous, or (at length?) glabrescent . . . . . 18. *M. spadicea*
19. Leaves when dry finely transversely wrinkled by numerous cross-nerves, not strikingly 3-ranked; midnerve prominent beneath, no prominent whitish lateral nerves. Scapes smooth. . . . . 17. *M. lorea*
16. Bases of the leaves stramineous or light brown, in *M. graminea* with castaneous margins.
20. Spikelets 6-10 mm long. Nut  $2\frac{1}{4}$ - $2\frac{1}{2}$  mm long. Leaves 2-4 mm wide . . . . . 24. *M. monostachya*
20. Spikelets and nuts much longer. Leaves at least 5 mm wide, usually much wider.
21. Nut lageniform (subglobose in the centre, distinctly beaked, constricted in the lower part and then conspicuously widened into the truncate base). Leaves remotely scabrous on the margins. Scapes usually long, (10-45-90 cm . . . . . 16. *M. enodis*
21. Nut ellipsoid, obovoid, or pyriform. Leaves with densely serrate-scabrous margins (except in *M. borneensis*). Scapes often shorter.
22. Leaves conspicuously tessellate or with numerous prominent cross-nerves.
23. Leaves subcoriaceous, with 3 prominent nerves, conspicuously narrowed towards base and apex. Margins of the leaves scabrid only in the upper part . . . . . 15. *M. borneensis*
23. Leaves mostly thickly coriaceous, with only the midnerve prominent, hardly narrowed towards the base, gradually narrowed upwards. Margins of the leaves serrate-scabrous throughout . . . . . 17. *M. lorea*
22. Leaves not tessellate.
24. Leaves very densely crowded, strikingly 3-ranked, very prominently equitant and fan-like at the base. Upper surface of the leaves scabrous just below the tail. Spikelets trigonous when young . . . . . 21. *M. graminea*
24. Leaves not strikingly 3-ranked, not scabrous on the upper surface. Spikelets terete.
25. Leaves somewhat plicate lengthwise along several distinct lateral nerves. . . . . 19. *M. tenuiscapa*
25. Leaves with 1 or 3 prominent nerves.
26. Leaves dark green, 1-2 cm wide. Scapes (2-)10-40 cm long. Inflorescence always a single spikelet. Outermost flower-scales not winged . . . . . 14. *M. wallichii*
26. Leaves pale glaucous, (2-)3 $\frac{1}{2}$ -5 cm wide. Scapes 2-4(-10) cm long. Inflorescence not rarely with 2-5 spikelets. Outermost flower-scales winged on the keel. . . . . 13. *M. squamata*

**I. *Mapania macrocephala* (GAUDICH.) K. SCH.** in Warb. Bot. Jahrb. 13 (1891) 265; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 189; MERR. Philip. J. Sc. 2 (1907) Bot. 422; VALCK. SUR. Nova Guinea 8 (1912) 711; MERR. Int. Rumph. (1917) 107; En. Philip. 1 (1923) 132 p.p. (excl. ELMER 11978); KÜK. Bot. Jahrb. 59 (1924) 56; REHD. J. Arn. Arb. 14 (1933) 65; OHWI, Bot. Mag. Tokyo 56 (1942) 211; S. T. BLAKE, J. Arn. Arb. 28 (1947) 212; Proc. R. Soc. Queensl. 58 (1947) 48; KOYAMA, Micronesica 1 (1964) 66; KERN, Pac. Pl. Areas 2 (1966) map. 32. — *Carex laevis major* RUMPH. Herb. Amb. 6 (1750) 21. — *Hypaelyptum macrocephalum* GAUDICH. in Freycin. Voyage, Bot. (1829) 415. — *Hypolytrum macrocephalum* KUNTH, En. 2 (1837) 273; STEUD. Syn. 2 (1855) 133; MIQ. Fl. Ind. Bat. 3 (1856) 334 (err. 'macrophyllum'). — *Cephaloscirpus macrocephalus* KURZ, J. As. Soc. Beng. 38, ii (1869) 84; SCHEFF. Nat. Tijds. N. I. 34 (1874) 91. — *Lepironia macrocephala* MIQ. Illustr. (1870) 64, t. 27. — *Pandanophyllum macrocephalum* BOECK. Flora 58 (1875) 116 (not based on

*Hypaelyptum macrocephalum* GAUDICH.). — *Pandanophyllum longifolium* BOECK. l.c. 112. — *M. longifolia* CLARKE, Kew Bull. add. ser. 8 (1908) 54; Ill. Cyp. (1909) t. 115, f. 1-7; PFEIFF. Bot. Arch. 12 (1925) 450, f. 14, 39. — *M. pandanacea* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 246; ? KÜK. Bot. Jahrb. 59 (1924) 57. — *M. lactea* KÜK. l.c. 56, ex descr. — *M. moseleyi* f. *latifolia* UITT. J. Arn. Arb. 20 (1939) 213. — *M. geelvinkensis* OHWI, Bot. Mag. Tokyo 56 (1942) 210, ex descr. — *M. margaritae* OHWI, l.c. 211, ex descr. — *M. palauensis* HOSOKAWA, Trans. Nat. Hist. Soc. Form. 32 (1942) 7, ex descr. — *M. yapensis* HOSOKAWA, l.c. 8, ex descr.

Usually stout to very stout, resembling a small *Pandanus*, forming dense clumps. Stems central, triquetrous, smooth or somewhat scabrous at the top, much shorter than the leaves, 30-120 cm by 4-8 mm (up to c. 10 mm at the incrassate top), with 1-2 well developed leaves about the middle, very rarely cauline leaves absent. Leaves coriaceous, broadly linear, with 3 prominent nerves, obscurely

septate-nodulose, with serrulate-scabrous margins and the keel serrulate especially towards the apex, narrowed towards the conduplicate base (but not petioled), rather abruptly long-caudate, bright green or more or less glaucous, 1-3(-4½) m by (2-4-6 cm; lower sheaths bladeless, stramineous; cauline leaves with a 5-10 cm long sheath somewhat widened above. *Inflorescence* capitate, very dense, ovoid or globose, (3-)5-7½(-9) cm in diam., with many to numerous spikelets. Bracts several, the lower 1-3 very long (up to 1½ m), finally deflexed, similar to the leaves, the upper ones much shorter, ovate, caudate. *Spikelets* oblong, 1½-3(-4) cm by c. 1 cm. *Glumes* chartaceous, oblong-lanceolate, obtuse, 3-nerved, 9-12 by c. 3 mm, the lower ones empty, several-nerved. *Flowers* linear, longer than the glumes, 10-15 mm. *Anthers* up to 4 mm long. *Style* 3-fid. *Nut* obovoid or pyriform, 5-7 by 3-5 mm, at the base narrowed into a slender 2-4 mm long stipe, greyish or purplish brown, the slender 2-3 mm long beak finally caducous.

Distr. N. Queensland (the only *Mapania* here known), Samoa Is., Solomons, W. Carolines; in *Malesia* only in the eastern part: Philippines (Bohol, Balut), Moluccas (Talaud Is., Morotai, Halmahera, Batjan, Ceram, Ambon), throughout New Guinea (also in the Admiralty Is., Bismarck Arch., Louisiades, P. Rawak near Waigeu, and Aru Is.). Fig. 11.

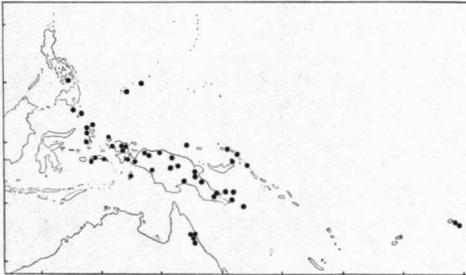


Fig. 11. Localities of *Mapania macrocephala* (GAUDICH.) K.SCH.

Ecol. In dense swampy rain-forests, sago swamps, on shady banks of streams, usually 0-1000 m, but in the Arfak Mts (Kofu Anggi) at 2000 m.

Vern. *Sosarëwu ma dorou*, Halm., *gërre, kiki kella*, New Guinea.

Notes. RIDLEY mistook a specimen of *M. palustris* for *M. macrocephala*, and described a specimen of the latter species as *M. pandanacea*.

I have not seen the type-collections of *M. lactea* KÜK., *M. geelvinkensis* OHWI, *M. margaritae* OHWI, *M. palauensis* HOSOKAWA, and *M. yapensis* HOSOKAWA. To judge from the descriptions all fall under the circumscription of *M. macrocephala* as adopted above; see also KOYAMA, l.c. Like several other *Mapaniae*, *M. macrocephala* is extremely variable as to size, width of leaves, and dimensions of inflorescences. The fruits remain on the decaying inflorescence for a long time; when finally the greyish brown exocarp has rotted away the whitish outside of the endocarp becomes visible. In all probability *M. lactea* and *M. margaritae* were based on specimens with such old fruits.

CLARKE based *M. longifolia* on *Pandanophyllum longifolium* BOECK., but the specimen in the Kew Herbarium he took for *M. longifolia* (and figures as such in Ill. Cyp. t. 115) is undoubtedly syntype of *Pandanophyllum macrocephalum* BOECK. ("spiculis . . . magnis conicis acutiusculis"). For the rest, to me BOECKELER's *Pandanophyllum longifolium* and *P. macrocephalum* are not specifically distinct.

According to a field-note the flowers are fragrant.

2. *Mapania moseleyi* CLARKE, Kew Bull. add. ser. 8 (1908) 55; VALCK. SUR. Nova Guinea 8 (1912) 711; S. T. BLAKE, J. Arn. Arb. 28 (1947) 212. — *M. ledermannii* KÜK. Bot. Jahrb. 59 (1924) 57; OHWI, Bot. Mag. Tokyo 56 (1942) 212.

*Stems* central, slender but rigid, triquetrous, with scabrous angles at the top, much shorter than the leaves, 25-50 (-90) cm by 1½-2 mm (up to 3 mm at the somewhat incrassate top), with 1 or 2 well developed cauline leaves. *Leaves* numerous, coriaceous, linear, not petioled, with the midnerve prominent on the underside and several much less prominent lateral nerves, conduplicate at the base, with slightly revolute, spinulose-scabrous margins and the keel on the underside scabrous especially towards the apex, gradually tapering to a very long and very scabrous acumen, obscurely septate-nodulose, pale green, 6-11 mm wide, the lower sheaths bladeless or shortly laminate, pungent, stramineous to brownish. *Inflorescence* capitate, globose, with 5-6(-10) spikelets, 1½ (finally 2½-3) cm across. Bracts 3-5, the lower 1-2 very long, finally deflexed, similar to the leaves, the upper ones shorter, sub-erect. *Spikelets* ellipsoid, 1-1½ cm by 4-6 mm. *Glumes* chartaceous, ovate, rounded at the apex, with hyaline margins especially towards the apex, 3-5-nerved, brown or stramineous, c. 6 by 4 mm; lower sterile glumes 5-7-nerved. *Flowers* 5-7 mm long; outermost scales with narrowly winged keel; wings c. ½ mm wide, densely ciliate. *Anthers* 2-2½ mm long. *Style* 3-fid. *Nut* ellipsoid or obovoid, brown, 5-7 by 2½-3 mm (beak included), the base narrowed into a broad c. 1 mm long stipe, the apex rostrate by the short conical style.

Distr. Solomons (Bougainville), New Britain, Admiralty Is.; in *Malesia*: New Guinea (W. New Guinea: Japen-Biak, Nabire, Rouffaer R., Idenburg R., Cycloop Mts; NE. New Guinea: Sepik Distr.; Papua: Mt Musgrave, Mt Knutsford, Ferguson I., Normanby I.). Fig. 12.

Ecol. In rain-forests, 200-1500 m.

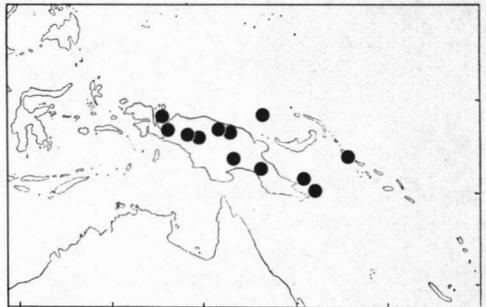


Fig. 12. Localities of *Mapania moseleyi* CLARKE.

3. *Mapania latifolia* UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 199; *ibid.* 33 (1936) 143. — *M. montana* RIDL. J. Str. Br. R. As. Soc. n. 44 (1905) 206; MERR. J. Str. Br. R. As. Soc. n. 76 (1917) 79; En. Born. (1921) 65; *non* LAUT. & K. SCH. 1900, *nec* UITTEN, 1925. — Fig. 9.

Stolons up to 15 cm long, covered with lanceolate, acute, many-nerved scales; brownish sheaths often present. *Leaves* subcoriaceous, lorate, with prominent midnerve and 2 of the lateral nerves more or less prominent, scabrous on margins and keel only at the very top, dark green above, paler beneath, 15–75 by 3–7 cm, the apex somewhat notched or suddenly contracted into a stiff, triquetrous, aculeate, 1–6 cm long tail, the base contracted into a conduplicate ribbed petiole 15–50 cm long and 3–5 mm wide; leaf-sheaths broad, purplish, the lower ones bladeless. *Scapes* terminal, triquetrous, gradually thickened towards the top, setulose-scabrous especially on the angles, rusty when dry, 15–50 cm long, 2–3 mm thick at the base, 5–7 mm at the top, the base destitute of scales. *Inflorescence* capitate, with 8–50 densely crowded spikelets, (2–)3–5 cm across. Bracts c. 3, the outer 1–2 more or less leafy and overtopping the inflorescence, abruptly narrowed into a 3–7½ cm long tail, the lowest sometimes slightly distant, similar to the leaves, shortly sheathing, up to 45 by 7 cm. *Spikelets* oblong, acute or obtusish, 1–2 cm by 5–6 mm. *Glumes* oblong-ovate to oblong, obtuse, somewhat cucullate, prominently many-nerved, 7–9 mm long. *Flowers* about as long as

the glumes. *Anthers* linear, 3–4 mm. *Style* (2–)3-cleft. *Nut* ellipsoid or subpyriform, brown, 4 by 2–2½ mm.

*Distr. Malesia:* Borneo (Sarawak: Gat, Mt Dulit; N. Borneo: Mt Kinabalu, Kinabatangan, Mt Nunkok; E. Borneo: W. Kutei).

*Ecol.* In primary forests, along streams, at low and medium altitudes, on Mt Kinabalu up to 1650 m.

*Note.* In some spikelets I found several bifid styles among the trifid ones.

4. *Mapania holttumii* KERN, Blumea 9 (1958) 215. — *M. insignis* HOLT. Gard. Bull. Sing. 11 (1947) 293, *non* SANDW. 1933. — Fig. 13.

Very stout. *Leaves* subcoriaceous, lorate, drooping (the tip pointing downwards), with 3 more or less prominent nerves, scabrous on margins and keel only at the very top, dark green above, paler beneath, (30–)50–70 by 6–12 cm, the apex rather gradually narrowed into an up to 15 cm long aculeate tail, the base contracted into a conduplicate, ribbed petiole up to 60 cm long and 6–10 mm wide; leaf-sheaths broad, purplish, up to 20 cm long, the lower ones bladeless. *Scapes* lateral, solitary in the lower leaf-axils or below the leaves, robust, obtusely trigonous, hardly incrassate at the top, very shortly and densely rough-hairy throughout, ultimately glabrescent, rusty when dried, 10–35 cm by (2–)3–6 mm, the base clothed with some stiff, acute, up to 8 cm long, striate scales. *Inflorescence* capitate, consisting of



Fig. 13. *Mapania holttumii* KERN in Trengganu primary forest (photogr. CORNER, 1935; SF 30544).

8–16 sessile spikelets, 3–6 cm across. Bracts ovate to lanceolate, acute, stiff, up to 3 cm long. *Spikelets* oblong, acute, 2–3 by 1 cm. *Glumes* narrowly oblong, with rounded apex, many-nerved, 9–11 mm long. *Flowers* about as long as the glumes; outermost scales ciliate on the keel near the apex only. *Anthers* linear, 3–5 mm. *Style* 3-cleft. *Nut* unknown.

*Distr. Malesia:* Malay Peninsula (Trengganu: G. Padang; Pahang: G. Tahan, Karak For. Res.; Kemaman: Sungai Nipa).

*Ecol.* In forests at low and medium altitudes, up to 1200 m.

*Note.* Closely related to *M. cuspidata*, with the same vegetative habit, but much stouter. The very large leaves are scabrous at the very top only, the scapes thick and short-hairy (but finally glabrescent). The capitate inflorescence with several to many spikelets furnishes an easy character for discrimination, but as *M. cuspidata* may sometimes have a few secondary spikelets in the axils of the basal glumes, the distinction between the two species on this ground is not sharp. According to a field-note of CORNER the tufts are not stilted, unlike those of *M. cuspidata*.

**5. *Mapania cuspidata* (MIQ.) UITTEN**, J. Arn. Arb. 20 (1939) 213; S. T. BLAKE, J. Arn. Arb. 28 (1947) 211; HOLTT. Gard. Bull. Sing. 11 (1947) 293; UITTEN

in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 49; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 454. — *Lepironia cuspidata* MIQ. Sum. (1861) 263, 603. — *Pandanophyllum zippelianum* KURZ, Nat. Tijd. N. I. 27 (1864) 224, *nom. nud.* — *Pandanophyllum humile* (non STEUD.) OUDEM. Bot. Zeit. 23 (1865) 193; KURZ, J. As. Soc. Beng. 38, ii (1869) 82; SCHEFF. Nat. Tijd. N. I. 34 (1874) 90. — *Lepistachya praemorsa* ZIPP. ex KURZ, J. As. Soc. Beng. 38, ii (1869) 82, in *syn.* — *Lepironia humilis* MIQ. Illustr. (1870) 61, t. 23, *quoad specim., haud Pandanophyllum humile* STEUD. — *M. humilis* F.-VILL. Nov. App. (1882) 309, *quoad specim., haud Pandanophyllum humile* STEUD.; RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 14; CLARKE, Fl. Br. Ind. 6 (1894) 683; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 227; CLARKE, Philip. J. Sc. 2 (1907) Bot. 109; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 105; KOORD. Exk. Fl. Java 1 (1911) 203; Atlas (1922) f. 268; VALCK. SUR. Nova Guinea 8 (1912) 711; MERR. En. Born. (1921) 64; En. Philip. 1 (1923) 132; KÜK. Bot. Jahrb. 59 (1924) 56; RIDL. Fl. Mal. Pen. 5 (1925) 174; H. PFEIFF. Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 174. — *Pandanophyllum wendlandi* HORT. ex Gard. Chron. 21 (1884) 711. — *M. lucida* N. E. BROWN, Ill. Hort. 32 (1885) 77, t. 557. — *M. triquetra* RIDL. J. Str. Br. R. As. Soc. n. 41 (1904) 51; *ibid.* n. 46 (1906) 227; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 106; RIDL. & WINKL. Bot. Jahrb. 44 (1910) 525; MERR.



Fig. 14. *Mapania cuspidata* (MIQ.) UITTEN in Tawao F. R. (photogr. W. MEIJER, 1960; SAN 19434).

En. Born. (1921) 65; RIDL. Fl. Mal. Pen. 5 (1925) 174. — *M. petiolata* CLARKE, Kew Bull. add. ser. 8 (1908) 54; MERR. En. Born. (1921) 65; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 280; KÜK. Bot. Jahrb. 69 (1938) 261. — *M. platyphylla* MERR. Philip. J. Sc. 11 (1916) Bot. 54; En. Born. (1921) 65. — *M. caudata* KÜK. in Fedde, Rep. 29 (1931) 201. — *M. inopinata* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 151, f. 3. — *M. stolonifera* UITTEN, l.c. 279. — Fig. 14.

Leaves subcoriaceous, the lower ones reduced to bladeless sheaths, the upper ones very variable in shape and size, lorate to broadly linear, usually with 3 prominent nerves, scabrous on margins and keel beneath towards the apex, dark green above, paler beneath, pink to purplish when young, (3-)10-90 by  $(\frac{1}{2})$ - $\frac{3}{2}$ -7 cm, the apex not rarely notched and suddenly to rather gradually narrowed into an up to 10 cm long acuminate tail, the base contracted into a conduplicate ribbed petiole dilated into a scariously margined inflated sheath in the lower part. Scapes solitary in the leaf-axils or below the leaves, usually rather robust, obtusely trigonous or almost terete upwards, slightly incrassate at the top, smooth, (2-)5-35 cm by  $(\frac{1}{2})$ -1-2 mm, the base clothed with some hard, ovate-lanceolate, acute, striate scales scarious on the margins. Inflorescence normally consisting of a single terminal spikelet, sometimes with 1-2(-4) digitately arranged sessile or peduncled lateral spikelets in the axils of the lower glumes. Spikelet oblong when young, ovoid when mature, acute, (7-)15-40 by (7-)10-20 mm. Lower 4-7 glumes empty, firm, ovate or oblong-ovate, obtuse, many-nerved, with scarious margins, fuscous, (6-)8-9 by  $(3\frac{1}{2})$ -5-6 mm, upper ones gradually smaller and less firm, fertile. Flowers about as long as the glumes. Anthers linear, white,  $3\frac{1}{2}$ -5 mm. Stigmas 3. Nut ellipsoid or narrowly ellipsoid, rounded at the base, shortly stipitate or almost sessile, acuminate, greyish brown to dusky black, (4-)5-7 by (2-)3 mm.

Distr. Thailand, Solomons (Bougainville), almost throughout Malesia, in Java only in the western part, lacking in the Lesser Sunda Is.

Ecol. In damp localities in primary forests, on shady banks of streams, at low altitudes (up to 1500 m).

Use. In the Malay Peninsula the leaves are used as a remedy against fever.

Vern. Sëlisingan, pandan bangkuang, duhut bakkuang, bangkuang laju, simarbakkuang, M (Sum.), sohlenat, kigëmbang, harassas, gëbang, S, siak-siak rimba, pandan hutan, Mal. Pen., nanasaka, Talaud Is., hëhëwëhé mabëka, Morotai, kihadiö, Ceram; Philip.: babakal, Sub., lubigan, P.Bis., maribari, S.L.Bis., malalubigan, Tag.

Notes. In old stout specimens the old part of the stem has died off and the rosettes of leaves stand on thick stiff stilt roots. The flowers open late in the morning; the anthers hang on long filaments and fade rapidly.

OUDEMANS (1865), who described a specimen cultivated in the Amsterdam Botanical Garden, was the first who applied HASSKARL's *nomen nudum* *Pandanophyllum humile* to the species described above. Herein he was followed by most subsequent authors, but STEUDEL (1855) had given a quite different interpretation (see under *Hypolytrum humile*

p. 494). STEUDEL's interpretation has to be followed.

The species is very variable, not only with regard to the shape and size of the leaf-blades, but also in the length and stoutness of the petioles and scapes, the size and number of spikelets, and even in the size of flowers and fruits. UITTEN distinguished *M. inopinata* by the inflorescence consisting of (1-)3-5 spikelets, and referred it on this ground to *sect. Halostemma*. However, scapes bearing 2 or more spikelets (one or more in the axils of the lower normally empty glumes) are not rarely found in *M. cuspidata*, as was already observed by KURZ (1869), MIQUEL (1870), GOEBEL (Ann. Jard. Bot. Btzg 7, 1888, 129), and CLARKE (1908). *M. stolonifera* UITTEN is said to differ from *M. cuspidata* by the horizontal stolons, but a creeping, often branched rhizome is always present in completely collected old specimens of *M. cuspidata*.

The varieties UITTEN distinguished were mainly based on the shape of the leaf-blades. They are connected by many intermediates. The intermediate form (*var. petiolata*) occurs throughout the area of the species, broad-leaved plants (*var. cuspidata*) have only been found in the western part, and narrow-leaved specimens (*var. angustifolia*) prevail in the Philippines and the Moluccas. Possibly they are only ecological forms.

#### KEY TO THE VARIETIES

1. Leaf-blades small, 3-8(-12) by  $(\frac{1}{2})$ -1-2 cm, usually only the midnerve prominent. Scapes very slender, almost filiform, c.  $\frac{1}{2}$  mm thick. Spikelets small, 7-10 mm long. Nut small, c. 4 by 2 mm  
*var. pumila*
1. Leaf-blades larger, always with 3 prominent nerves. Scapes 1-2 mm thick. Spikelets  $(1\frac{1}{2})$ -2-3 $\frac{1}{2}$  cm long. Nut larger.
2. Leaf-blades 3-5 times as long as broad, up to 7 cm broad, abruptly narrowed into the  $1\frac{1}{2}$ -3 mm thick petiole, the apex truncate to retuse; leaf-sheaths broadly ovate.  
*var. cuspidata*
2. Leaf-blades more than 5 times as long as broad. Petiole usually thicker. Leaf-sheaths narrower.
3. Leaf-blades  $3\frac{1}{2}$ -6 cm broad, up to 90 cm long, abruptly narrowed into the tail.  
*var. petiolata*
3. Leaf-blades (1-)2-3 cm broad, shorter than in *var. petiolata*, rather gradually passing in the tail . . . . . *var. angustifolia*

*var. cuspidata*. — *Pandoanophyllum wendlundi* HORT. — *M. lucida* N. E. BROWN. — *M. triquetra* RIDL. — *M. platyphylla* MERR. — *M. inopinata* UITTEN. — *M. petiolata var. cuspidata* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 282.

Distr. Malesia: Malay Peninsula, Sumatra, W. Java, Borneo.

*var. petiolata* (CLARKE) UITTEN, J. Arn. Arb. 20 (1939) 213; OHWI, Bot. Mag. Tokyo 56 (1942) 212; UITTEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 49. — *M. petiolata* CLARKE. — *M. humilis var. petiolata* RIDL. Fl. Mal. Pen. 5 (1925) 174; H. PFEIFF. Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 174.

Distr. As the species.

*var. angustifolia* (UITTIEN) UITTIEN, J. Arn. Arb. 20 (1939) 214. — *M. petiolata var. angustifolia* UITTIEN, Rec. Trav. Bot. Néerl. 33 (1936) 282.

Distr. Bougainville; *Malesia*: Philippines, Molucas, New Guinea.

*var. pumila* (UITTIEN) UITTIEN, J. Arn. Arb. 20 (1939) 214. — *M. petiolata var. pumila* UITTIEN, Rec. Trav. Bot. Néerl. 33 (1936) 283. — *M. caudata* KÜK. in Fedde, Rep. 29 (1931) 201. — Probably a form of oligotrophic soil. — Fig. 15.

Distr. *Malesia*: Malay Peninsula (Trengganu), Borneo, a few times collected.

6. *Mapania richardsii* UITTIEN, Rec. Trav. Bot. Néerl. 32 (1935) 195.

*Leaves* subcoriaceous, broadly linear, with the midnerve prominent beneath and 2 of the lateral nerves prominent above, septate-nodulose by numerous cross-nervules, scabrous on the margins towards base and apex and on the midnerve near the top, gradually narrowed towards the conduplicate base but not petioled, abruptly contracted at the apex into a triquetrous, aculeate-scabrous, 1–8 cm long tail, 65–120 by  $2\frac{1}{2}$ – $4\frac{1}{2}$  cm. *Scapes* lateral, slender, subterete, striate, smooth, slightly incrassate at the top, 13–17 cm by 1 mm, the lower 4–6 cm clothed with some loose, brownish, striate scales. *Inflorescence* capitate, consisting of c. 6 very densely packed spikelets, simulating a single spikelet, broadly ellipsoid to globose, 9–11 mm long and wide. Bracts 3, coriaceous, erect, suborbicular, concave, many-ribbed, with scarios margins lacerate at the top. *Spikelets* strongly compressed, 7 mm long. *Glumes* thinly membranous, pellucid, narrowly oblong, obtuse, 1-nerved or indistinctly 3-nerved, purplish punctulate at the top, c. 7 by 2 mm. *Flowers* 6 mm long; outermost scales ciliate in the upper half. *Anthers* 3 mm long. *Style* 3-cleft. *Nut* unknown.

Distr. *Malesia*: Borneo (Sarawak: Dulit trail; Belaga, Kapit Distr.).

Ecol. In large tussocks in primary forests, all c. 800 m.

Note. UITTIEN placed this species next to *M. cuspidata* and *M. borneensis*, but in his system it should be referred to *subg. Halostemma* next to *M. debilis* and *M. longiflora*, which have the same type of inflorescence.

7. *Mapania longiflora* CLARKE, Kew Bull. add. ser. 8 (1908) 54; Ill. Cyp. (1909) t. 110, f. 7–13; MERR. En. Born. (1921) 64; UITTIEN, Rec. Trav. Bot. Néerl. 33 (1936) 146, excl. *var. sessilis* UITTIEN.

*Leaves* coriaceous, linear, only slightly narrowed below, gradually narrowed upwards to the very slender, triquetrous, very scabrous tip, with 3 prominent nerves (the midnerve prominent beneath, scabrous, the lateral nerves prominent above), with aculeate-scabrous margins throughout their length, pale green or glaucous, 60–120 by  $1\frac{1}{2}$ – $2\frac{1}{2}$  cm; sheaths dull stramineous to light brown. *Scapes* lateral, solitary in the leaf-axils or below the leaves, rather robust, trigonous upwards, slightly incrassate at the top, 15–30 cm by 2–4 mm, smooth, the base clothed with some hard, keeled, many-nerved scales up to 8 cm long. *Inflorescence* capitate, seemingly consisting of a single spikelet because of the large, erect involucre bracts hiding the few to several densely packed spikelets inside, ellipsoid, obtuse,

terete,  $(2-2\frac{1}{2}-4\frac{1}{2})$  by  $(1-1\frac{1}{2}-2)$  cm. Bracts 6–10, the lower ones slightly shorter than, the upper ones about as long as the inflorescence, coriaceous, concave or somewhat keeled, ovate, obtusish, many-striate, greenish, later on fuscous, 2–3 cm long. *Spikelets* at first sight hardly distinct from one another, scarcely extending beyond the upper bracts, lanceolate, terete, many-flowered, stramineous, c. 2 by  $\frac{1}{2}$  cm. *Glumes* thinly membranous, pellucid, soon disintegrating into fibers, oblong-lanceolate, indistinctly 1–3-nerved,  $1\frac{1}{2}$ –2 cm long. *Flowers* as long as the glumes, the lower ones often sterile or male, only the upper ones fructiferous; outermost scales not winged. *Anthers* linear, 5–6 mm. *Style* 3-cleft. *Nut* ellipsoid or subpyriform, smooth, greyish brown, stipitate (stipe 2–4 mm), acuminate, 5–6 by  $3-3\frac{1}{2}$  mm (the 1–2 mm long beak included).

Distr. *Malesia*: Malay Peninsula (Singapore: Bukit Timah), E. Borneo (Nunukan; E. Kutei: Sungei Susuk region; Banjarmasin, Batulitjin).

Ecol. In damp primary forests, along streams, at low altitudes.

Vern. *Selingsing*, SE. Borneo.

Note. UITTIEN placed *M. longiflora* next to *M. enodis*, *M. squamata*, etc. These are certainly not its nearest allies because of the quite different structure of the inflorescence.

8. *Mapania debilis* CLARKE in Ridl. J. Str. Br. R. As. Soc. n. 46 (1906) 227; Kew Bull. add. ser. 8 (1908) 53; MERR. En. Born. (1921) 64. — *M. zeylanica var. RIDL.* J. Str. Br. R. As. Soc. n. 46 (1906) 227. — *M. gracilipes* MERR. J. Str. Br. R. As. Soc. n. 85 (1922) 158. — *M. flagellaris* UITTIEN, Rec. Trav. Bot. Néerl. 32 (1935) 198, f. 3.

Short stolons covered with lanceolate, brown, striate scales sometimes present. *Leaves* subcoriaceous or coriaceous, linear, slightly narrowed towards the conduplicate base, very gradually narrowed upwards to the very slender, triquetrous, aculeate-scabrous tip, with the midnerve prominent beneath and some lateral nerves somewhat prominent above, with aculeate-scabrous margins throughout their length, glaucous, up to 90 cm by 5–10 mm; sheaths stramineous to brownish. *Scapes* lateral, from the caudex below the leaves, very slender, obtusely trigonous to terete, striate-sulcate, smooth, up to 20 cm by 1–2 mm, the base clothed with some loose, striate scales up to 5 cm long. *Inflorescence* capitate, when in flower seemingly consisting of a single spikelet, ovoid to subglobose, containing 3–5 very densely packed spikelets, 10–13 mm long. Bracts few, coriaceous, concave, ovate or elliptic, acutish, many-nerved, with broad, scarios, brownish punctulate-lineolate margins, 9–13 mm long. *Spikelets* at first sight hardly distinct from one another, somewhat extending beyond the bracts, ellipsoid, stramineous, 5–10 by 2–4 mm. *Glumes* thinly membranous, pellucid, oblong, obtuse, indistinctly 1-nerved, brownish punctulate-lineolate at the top, 5–8 mm long. *Flowers* as long as the glumes; keel of the outermost scales minutely ciliate at the top. *Anthers* c. 4 mm. *Style* 3-cleft. *Nut* obovoid-pyriform, slightly rugulose, greyish brown, shortly stipitate (stipe  $\frac{1}{2}$  mm), acuminate, shortly beaked, c. 3 by  $1\frac{1}{2}$ –2 mm.

Distr. *Malesia*: Borneo (Sarawak: Mt Poi, Mt Matang, Mt Dulit; N. Borneo: near Sandakan;

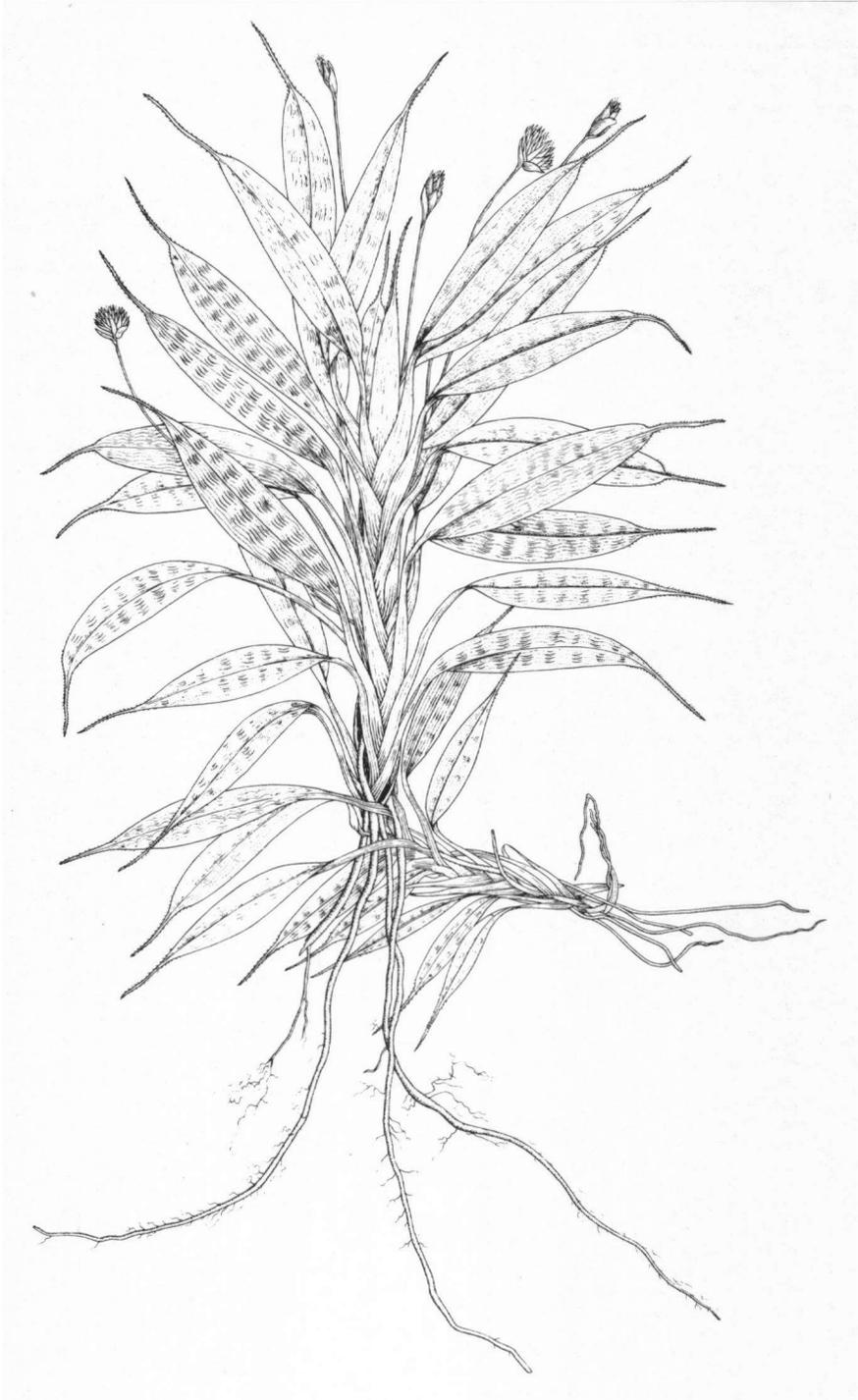


Fig. 15. *Mapania cuspidata* (MIQ.) UITTEN var. *pumila* (UITTEN) UITTEN. Habit,  $\times \frac{1}{2}$  (ENDERT 3557).

E. Borneo: W. Kutei; also collected by TEYSMANN in W. Borneo, without definite locality).

Ecol. In damp primary forests at low altitudes, up to 1200 m.

Note. Both *M. debilis* and *M. gracilipes* are known from a single, rather poor collection only. *M. flagellaris* was separated from them on account of the coriaceous leaves with much longer acumen. As the length of the acumen in the specimens with thicker leaves is variable, and the leaves of *M. gracilipes* are intermediate in texture between those of *M. debilis* and *M. flagellaris*, I think the three should be united, at least provisionally, until more material will be available.

9. *Mapania palustris* (HASSK. ex STEUD.) F.-VILL. Nov. App. (1882) 309; CLARKE, Fl. Br. Ind. 6 (1894) 681; J. Linn. Soc. Bot. 34 (1894) 95; Ill. Cyp. (1909) t. 109; RIDL, J. Str. Br. R. As. Soc. n. 23 (1891) 15; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 103; KOORD. Exk. Fl. Java 1 (1911) 203; Atlas (1922) f. 269; MERR. Philip. J. Sc. 9 (1914) Bot. 267; En. Philip. 1 (1923) 132; PFEIFF. Bot. Arch. 12 (1925) 449, f. 7, 34, 51; RIDL, Fl. Mal. Pen. 5 (1925) 172; UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 194; *ibid.* 33 (1936) 285; in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 49; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 455. — *Pandanophyllum palustre* [?] HASSK. Tijds. Nat. Gesch. Phys. 10 (1843) 119; Cat. Hort. Bog. (1844) 297; MOR. Syst. Verz. (1846) 99; ZOLL. Syst. Verz. 1 (1854) 61, *nom. nud.*] ex STEUD. Syn. 2 (1855) 134; MIQ. Fl. Ind. Bat. 3 (1856) 334; KURZ, J. As. Soc. Beng. 38, ii (1869) 78, *incl. var. malesica* KURZ & *var. silhetana* KURZ, *excl. WALLICH 3541*; BOECK. Linnaea 37 (1871) 138; SCHEFF. Nat. Tijds. N. I. 34 (1874) 89. — *Pandanophyllum zeylanicum* (*non* THWAITES) KURZ, J. As. Soc. Beng. 38, ii (1869) 80, *p.p., quoad specim. andam.* — *Lepironia palustris* MIQ. Illustr. (1870) 63, t. 25. — *M. andamanica* CLARKE, Fl. Br. Ind. 6 (1894) 681; J. Linn. Soc. Bot. 34 (1898) 95; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 288. — *M. silhetensis* CLARKE, Fl. Br. Ind. 6 (1894) 681; J. Linn. Soc. Bot. 34 (1898) 94. — *M. kurzii* (*non* CLARKE) MERR. Philip. J. Sc. 2 (1907) Bot. 422; C. B. ROB. *ibid.* 6 (1911) Bot. 194; MERR. En. Philip. 1 (1923) 132; ELM. Leaflet. Philip. Bot. 10 (1938) 3537. — *M. albescens* CLARKE, Kew Bull. add. ser. 8 (1908) 54; RIDL, Fl. Mal. Pen. 5 (1925) 172; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 288. — *M. banahaensis* ELM. Leaflet. Philip. Bot. 2 (1909) 574; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 288. — *M. macrocephala* (*non* K. SCH.) RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 245. — *M. affinis* MERR. J. Str. Br. R. As. Soc. n. 85 (1922) 157; En. Philip. 1 (1923) 131; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 287. — *M. grandiceps* KÜK. Bot. Jahrb. 59 (1924) 55, *ex descr.*; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 287; *non* OHWI, Bot. Mag. Tokyo 56 (1942) 211. — *M. longiflora* (*non* CLARKE) PFEIFF. Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 173. — *M. javana* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 287; in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 50.

Leaves coriaceous, linear to broadly linear, with the midnerve prominent beneath and 2 of the lateral nerves more or less prominent above, slightly narrowed towards the conduplicate base, gradually to rather abruptly narrowed to the up

to 10 cm long, aculeate-scarbrous, triquetrous tail, aculeate-scarbrous on the margins and on the keel beneath, up to  $2\frac{1}{2}$  m by (2-)3-6 cm; sheaths brownish. Scapes lateral, trigonous to almost terete, densely furfuraceous to almost smooth, (10-)30-70 cm by (2-)3-6 mm, up to 15 mm thick at the incrassate top, sheathed at the base with some loose, ovate to lanceolate, striate, up to 15 cm long scales. Inflorescence capitate, semiglobose to globose, with few to numerous spikelets, ( $1\frac{1}{2}$ -)4-6(-8) cm across. Bracts 4-8, coriaceous, ovate to lanceolate, somewhat shorter than to about as long as the inflorescence, many-ribbed. Spikelets usually 10-50, sometimes only 3-5, not rarely up to 100, very densely packed, ellipsoid,  $1\frac{1}{4}$ -2 by 5-10 mm. Glumes subcoriaceous, oblong or lanceolate, often lacerate at the top. Flowers about as long as the glumes, (7-)10-15 mm long. Outermost flower-scales ciliate on the keel, the third (anterior) scale ciliate on both keels. Stamens 4-8 mm long. Style 3-cleft. Nut obovoid, shortly stipitate, with small recurved beak, greyish brown, c. 4 by 2-2 $\frac{1}{2}$  mm.

Distr. SE. Asia (from Assam to Indo-China and S. China); in *Malesia*: Sumatra, Riouw Arch., Malay Peninsula, W. Java, Borneo, Natuna Is., Philippines, New Guinea.

Ecol. In wet or muddy places in damp primary forests, along streams, on wet rocks, from few m altitude up to 1500 m.

Use. In the Malay Peninsula the leaves are used for making mats and baskets.

Vern. *Harashas*, *bangkonoh*, *S*, *měnkvang tědong*, *měnkvang lobo*, Mal. Pen. (from its resemblance to the mēngkuan, *Pandanus furcatus* ROXB.), *assingsing*, Sum. E. C.; Philip.: *kulibang*, *bias*, Sub.

Notes. The most variable species of the *Malesian Mapaniae*. However different in appearance the extremes may be, it seems impossible to treat them as separate species. The characters used by UITTEN (Rec. Trav. Bot. Néerl. 33, 1936, 285, *spp.* 4-10) are unfit for practical use, as all the 'species' are connected by numerous intermediates. *M. andamanica* CLARKE and *M. banahaensis* ELM. are more slender and have smaller — often much smaller — spikelets and flowers than typical *M. palustris*. As was already stated by UITTEN, *M. albescens* CLARKE differs from *M. andamanica* only by the pale colour of the dried specimens.

*M. affinis* MERR. was separated on account of the larger inflorescences and the shorter glabrous scapes. However, still larger inflorescences and glabrous scapes are often found in *M. palustris*. *M. grandiceps* KÜK. is also a stout form, but with scabrid scapes.

I fail to see any difference whatever between *M. silhetensis* CLARKE and *M. javana* UITTEN. Both have inflorescences with few large spikelets. This form may have some taxonomical value; KURZ treated it as a variety. MIQUEL (1870) very properly remarked that the size of the spikelets diminishes when their number increases. CLARKE, who saw but a few specimens of typical *M. palustris*, thought *M. silhetensis* were also characterized by the smooth scapes in contrast to the scabrous scapes of *M. palustris*, and UITTEN characterized *M. javana* also by the leaf-bases rounded on the back. These characters do not hold good.

In CLARKE's flower diagram (1909; also in PFEIFFER, *l.c.*, whose diagrams are obviously copied

from those of CLARKE's) the outermost flower scales are figured as being connate. I always find them completely free.

The specimen from "East Java, PLOEM" cited by UITTEN (1936, p. 287) was collected in W. Java. No *Mapania* is known to occur in E. Java.

Stout specimens of *M. palustris* are often confused in the herbaria with *M. macrocephala*, but the latter is readily recognizable by the central flowering stems and the very long leaf-like bracts of the inflorescence.

**10. *Mapania foxworthyi* MERR.** Philip. J. Sc. 11 (1916) Bot. 53; En. Born. (1921) 64; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 286.

*Leaves* coriaceous, linear, with only the midnerve prominent, hardly narrowed towards the conduplicate base, gradually attenuate towards the very slender, triquetrous, aculeate-scabrous tip, densely aculeate-scabrous throughout the margins and on the upper part of the midnerve on the lower side, dark green, up to 170 by 1–3 cm; sheaths castaneous. *Scapes* lateral, trigonous, slightly thickened at the apex, smooth, 30–80 cm by 3–4 mm (up to 6 mm at the top), the base clothed with some lanceolate acute sheaths scabrous at the top and up to 15 cm long. *Inflorescence* capitate, globose or semi-globose, composed of c. 20 densely crowded spikelets, 3–4 cm across. Bracts ovate to lanceolate, many-ribbed, with scarios margins, scabrid at the top, 1–2 cm long. *Spikelets* ovoid to ellipsoid, 1½–2 cm by 8–10 mm. *Glumes* coriaceous, oblong, obtuse, strongly many-nerved, reddish brown, 9–12 by 5–6 mm, the flower-bearing ones much less firm, 3-nerved. *Flowers* about as long as the glumes, 9–14 mm long; outermost scales ciliate in the upper half, not or hardly winged. *Anthers* linear, 4–5 mm. *Style* bifid, rarely some trifid. *Nut* obovoid, brown, c. 5 by 3 mm, the very short beak included.

*Distr.* *Malesia*: Borneo (Sarawak: Lundu, Mt Poi).

*Ecol.* In forests, up to 1700 m.

*Note.* Very near to *M. kurzii*, but apparently satisfactorily characterized by the castaneous leaf-sheaths, the larger flowers and anthers, the oblong glumes, and the usually bifid style. It was collected in the type locality (Mt Poi) as early as 1866 by BECCARI (PB2401).

**11. *Mapania kurzii* CLARKE**, Fl. Br. Ind. 6 (1894) 681; J. Linn. Soc. Bot. 34 (1898) 95; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 104; Fl. Mal. Pen. 5 (1925) 172; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 288. — *M. multispicata* CLARKE [ex RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 15, *nom. nud.*] Fl. Br. Ind. 6 (1894) 682, *p.p.*; J. Linn. Soc. Bot. 34 (1898) 95, *p.p.*, *excl. specim. jav.* — *M. longispica* RIDL. J. Str. Br. R. As. Soc. n. 44 (1905) 205; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 104; Fl. Mal. Pen. 5 (1925) 172. — *M. valida* RIDL. J. Str. Br. R. As. Soc. n. 44 (1905) 205, *excl.* RIDLEY 1714; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 104; Fl. Mal. Pen. 5 (1925) 172.

*Leaves* coriaceous, linear, with only the midnerve prominent beneath, and several very indistinct lateral nerves, hardly narrowed towards the conduplicate base, gradually attenuate to the very slender, triquetrous, aculeate-scabrous tip, densely aculeate-scabrous throughout the margins and on the upper part of the keel on the lower side, glaucous, up to 120 by (1–)2(–3) cm; sheaths stramineous to

light brown. *Scapes* lateral, trigonous, slightly thickened at the apex, smooth, 10–40 cm by 1–3 mm, the base clothed with some lanceolate, acute sheaths up to 15 cm long. *Inflorescence* capitate, with 5–15 spikelets, 2–5 cm long and wide. *Bracts* ovate to lanceolate, many-ribbed, with scarios margins, 1–2 cm long. *Spikelets* ovoid or ellipsoid to cylindrical, 1–5 cm by 6–8 mm. *Glumes* coriaceous, ovate, obtuse, strongly many-nerved, almost ribbed when dry, reddish brown, 7–9 by 5–6 mm, the upper ones less firm, 3–5-nerved. *Flowers* about as long as the glumes or slightly longer; outermost scales with a narrow, membranous, ciliate wing on the keel. *Anthers* linear, 2–3 mm. *Style* 3-fid. *Nut* ellipsoid or pyriform, shortly stipitate, brown, 4½–5 by 2–2½ mm, the 1–1½ mm long, recurved beak included.

*Distr.* Thailand; in *Malesia*: Central Sumatra (W. Indragiri; Taluk region), widely distributed in the Malay Peninsula (Perak, Selangor, Negri Sembilan, Malacca, P. Penang, Singapore).

*Ecol.* In primary forests, at low altitudes, up to 950 m.

*Notes.* Closely allied to *M. palustris*, but well characterized by the 1-nerved leaves, brown inflorescence, the ribbed bracts and glumes, and the narrow wings of the outermost flower scales. Very variable in width of the leaves, thickness and length of the scapes, and number and length of the spikelets. On the whole Perak specimens have long cylindrical spikelets, but some have them short. Penang specimens have mostly very slender scapes and few, rather short spikelets. The specimens with long cylindrical spikelets were separated as *M. longispica* RIDL., but there is no other difference with typical *M. kurzii*.

The name *M. multispicata* was intended by CLARKE as a new name for *Pandanophyllum humile* HASSK. ex STEUD., but published with a description drawn up from a specimen of *M. kurzii* (see *Hypolytrum humile*, p. 494).

**12. *Mapania angustifolia* UITTEN**, Rec. Trav. Bot. Néerl. 32 (1935) 197, f. 2.

*Leaves* coriaceous, linear, with prominent midnerve beneath and 2 of the lateral nerves more or less prominent above, hardly narrowed at the conduplicate base, gradually narrowed at the top into a long aculeate-scabrous acumen, serrulate-scabrous throughout the margins and on the midnerve in the upper part, glaucous, up to 80 cm by 7–9 mm; sheaths shining castaneous. *Scapes* lateral, obtus-angular, striate-sulcate, scaberulous especially towards the top, 18–30 cm by 1 mm, the base clothed with some membranous, brown, acute, striate sheaths up to 5 cm long. *Inflorescence* capitate, consisting of 3–5 spikelets, c. 1 by 1½–2½ cm. *Involutral bracts* c. 3, very small, ovate or triangular, 2–4 mm long. *Spikelets* narrowly ellipsoid or lanceolate, acute, 7–13 by 3–4 mm. *Glumes* coriaceous, ovate to oblong, rounded at the apex, indistinctly 3-nerved, fuscous, with scarios margins, 3½–4 by c. 2 mm. *Flowers* as long as the glumes; outermost scales minutely ciliate on the keel. *Style* 3-fid. *Nut* ovoid-ellipsoid, acuminate at both ends, stipitate (stipe c. ¾ mm), rugulose, brown or greyish brown, 3–3½ by 1½ mm, the short, conical, recurved beak included.

Distr. *Malesia*: Borneo (Sarawak: Mt Dulit).

Ecol. In tussocks on steep stony slope in primary forest, under 300 m.

**13. *Mapania squamata* (KURZ) CLARKE**, Kew Bull. add. ser. 8 (1908) 53; PFEIFF. Bot. Arch. 12 (1925) 449, f. 9; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 149; in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 50; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 455. — *Pandanophyllum squamatum* KURZ, J. As. Soc. Beng. 38, ii (1869) 80; SCHEFF. Nat. Tijd. N. I. 34 (1874) 90. — *Lepironia squamata* MIQ. Illustr. (1870) 64, t. 26. — *M. wallichii* (non CLARKE) RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 105, p.p., *quoad* RIDLEY 11475; Fl. Mal. Pen. 5 (1925) 173, p.p. — *M. heterocephala* MERR. J. Str. Br. R. As. Soc. n. 85 (1922) 158.

*Leaves* subcoriaceous, broadly linear, with the midnerve prominent beneath and 2 of the lateral nerves prominent above, densely serrulate-scabrous throughout the margins and on the upper part of the midnerve on the lower surface, pale glaucous, slightly narrowed towards the conduplicate base, rather suddenly narrowed upwards into a 7–14 cm long, triquetrous, very scabrous tail, 50–150(–180) by (2–)3½–5 cm; sheaths stramineous to light brown. *Scapes* lateral, from the caudex below the leaves, obtusely trigonous to almost terete, smooth, usually very short (2–4 cm), rarely up to 10 cm, 2–3 mm thick, clothed with ovate-oblong, acute, concave, striate scales usually almost to the top. *Inflorescence* consisting of a single spikelet or composed of 2–5 fasciculate arranged spikelets (both types often occurring on the same plant). *Spikelets* ovate or lanceolate in outline, terete, acute, 2–3 by 1–2½ cm. Lower sterile *glumes* coriaceous, oblong-elliptic, obtuse or lacerate at the top, many-nerved, brown with scarious margins, c. 1½ cm long, the upper fertile ones chartaceous, less nerved. *Flowers* (11–)15(–17) mm long; keel of the outermost scales distinctly winged, the wing c. ½ mm wide, brown, ciliate at the top. *Anthers* linear, c. 6 mm. *Style* 3-cleft. *Nut* ovoid, indistinctly 3-ribbed, slightly rugulose, greyish brown, shortly stipitate (stipe c. 1 mm), 6–7 by 2½–3½ mm (the recurved beak included).

Distr. *Malesia*: Malay Peninsula (Selangor: Batu Tiga; Johore: Gunong Pantii; Singapore: Bukit Timah), W. Java (very rare), Borneo (Sarawak: Matang; N. Borneo: Sandakan, Mt Kinabalu; E. Borneo: Nunukan, W. Kutei).

Ecol. In damp primary forests, along streams, at low and medium altitudes, up to 1500 m.

Note. Not known from Sumatra and Central Java; the records "Palembang" and "Sumatra" (UITTEN, l.c.) refer to leaves of *Pandanaceae*; WALLICH 3541, also cited under *M. squamata*, is the type collection of *M. wallichii*.

**14. *Mapania wallichii* CLARKE**, Fl. Br. Ind. 6 (1894) 682; J. Linn. Soc. Bot. 34 (1898) 95; Ill. Cyp. (1909) t. 110, f. 1–6; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 105, p.p., *excl.* RIDLEY 11475; CLARKE, Kew Bull. add. ser. 8 (1908) 130 ('*wallichiana*'); MERR. En. Born. (1921) 65; RIDL. Fl. Mal. Pen. 5 (1925) 173, f. 220, p.p.; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 148. — *Pandanophyllum palustre* non HASSK. *ex* STEUD. KURZ, J. As. Soc. Beng. 38, ii (1869) 79, p.p., *quoad* WALLICH 3541.

*Leaves* coriaceous, linear, with only the midnerve prominent beneath and sometimes 2 of the lateral nerves somewhat prominent above, densely serrulate-scabrous throughout the margins and on the upper part of the midnerve on the lower surface, dark green, slightly narrowed towards the conduplicate base, very gradually narrowed into a long, aculeate-scabrous, triquetrous acumen, shining above, dull beneath, up to 150 by 1–2 cm; sheaths stramineous to light brown. *Scapes* lateral, from the caudex below the leaves, obtusely trigonous to terete, smooth, striate, very variable in length, usually much longer than in *M. squamata*, (2–)10–40 cm by 2–3 mm, hardly incassate at the top, the base clothed with some ovate to oblong, striate scales up to 4 cm long. *Inflorescence* always a single spikelet, ovoid-conical, terete, acute, 2–4 by 1½–2 cm. Sterile *glumes* numerous (up to 50), the lower ones coriaceous, broadly ovate or ovate, obtuse, the upper ones oblong, chartaceous; fertile *glumes* 15–20 mm long, less nerved. *Flowers* about as long as the *glumes*. *Anthers* linear, c. 8 mm. *Style* 3-cleft. Keel of the outermost scales ciliate in the upper half or narrowly winged and ciliate. *Nut* (immature) ellipsoid or obovoid, shortly beaked, greyish brown to blackish, c. 5 by 3 mm; stipe 1 mm.

Distr. *Malesia*: P. Musala (W. of Sumatra), Banka, P. Lingga, Malay Peninsula (Singapore, P. Batam), Borneo.

Ecol. In primary forests, marshy coastal forests, along streams, at low altitudes (up to 500 m).

Vern. *Sëding babi*, Banka.

Note. *M. wallichii* is so near to *M. squamata* that I very much doubt whether the two are specifically distinct. As their distribution is practically the same, they cannot represent geographical races. In general *M. wallichii* is characterized by the stiff, narrow, dark green leaves, the inflorescence always consisting of a single spikelet, the usually much longer scapes, and the quite or almost wingless outermost flower-scales, but throughout the genus these characters are not very satisfactory. The question should be studied in the field, e.g. on Bukit Timah (Singapore), where both occur.

**15. *Mapania borneensis* MERR.** J. Str. Br. R. As. Soc. n. 76 (1917) 78; En. Born. (1921) 64. — *M. dictyophlebia* S. T. BLAKE, J. Arn. Arb. 28 (1947) 211, t. 2. — *Cf. M. alpina* ELM., p. 484.

*Leaves* subcoriaceous, broadly linear, with 3 prominent nerves, septate-nodulose by numerous cross-nervules, conspicuously narrowed towards the conduplicate base (but not petioled), rather gradually to abruptly contracted into a long, triquetrous, aculeate-scabrous acumen, spinulose-scabrous on the margins in the upper part, 30–65 cm by (10–)15–25 mm. *Scapes* lateral, from the caudex below the leaves, slender, terete or subtrigonous, striate, smooth, 6–20 cm by c. 1 mm, the base clothed with some pale brown, striate, loose scales up to 5 cm long. *Inflorescence* consisting of a single spikelet, ovoid or oblong-ovoid, acutish, terete, finally 1½–2 by 1½ cm. *Glumes* subcoriaceous, ovate-oblong, obtuse, many-nerved, with scarious margins, 8–10 mm long. *Flowers* about as long as the *glumes*; outermost scales ciliate on the keel in the upper half. *Style* 3-cleft. *Nut* obovoid-pyriform, terete, slightly rugulose, brown, purplish spotted, shortly

stipitate (stipe  $\frac{1}{2}$ – $\frac{2}{3}$  mm), c. 4 by 2– $2\frac{1}{2}$  mm, the short recurved beak included.

Distr. Solomons (Bougainville); in *Malesia*: N. Borneo (Mt Kinabalu, Mt Nungkok), W. New Guinea (Idenburg R.).

Ecol. In damp primary forests, along streams, on forested hillsides, 850–1400 m altitude.

Note. In habit very similar to *M. cuspidata*, but the leaves not contracted into a petiole and without broad sheaths at the base.

**16. *Mapania enodis* (MIQ.) CLARKE**, Kew Bull. add. ser. 8 (1908) 53; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 149. — *Lepironia enodis* MIQ. Sum. (1861) 263, 603; Illustr. (1870) 60, t. 21; BOECK. Linnaea 37 (1871) 141. — *Lepironia foliosa* MIQ. Sum. (1861) 263, 603. — *Pandanophyllum miquelianum* KURZ, J. As. Soc. Beng. 38, ii (1869) 81; SCHEFF. Nat. Tijd. N. I. 34 (1874) 90. — *M. longa* [RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 14, nom. nud.] ex CLARKE, Fl. Br. Ind. 6 (1894) 683, p.p.; J. Linn. Soc. Bot. 34 (1898) 95, p.p., quoad specim. Singap.; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 105; Fl. Mal. Pen. 5 (1925) 173; non CAMUS, Fl. Gén. I.-C. 7 (1912) 178 (quae est *Carex vietnamica* RAYM.). — *Pandanophyllum angustifolium* KURZ ex CLARKE, Fl. Br. Ind. 6 (1894) 683, nom. nud., in syn. — *M. zeylanica* (non CLARKE) RIDL. & WINKL. Bot. Jahrb. 44 (1910) 525; MERR. En. Born. (1921) 65, p.p., quoad WINKLER 2585, fide UITTEN. — *M. tumida* UITTEN, Gard. Bull. S. S. 10 (1939) 182.

*Leaves* coriaceous, linear, with the midnerve prominent beneath and 2 of the lateral nerves prominent above, rather gradually attenuate towards the slender, triquetrous, aculeate-scabrous tip, remotely aculeate-scabrous on the margins and the upper part of the midnerve on the lower side, hardly narrowed towards the conduplicate base, septate-nodulose by numerous cross-nerves, glaucous, paler beneath, (45 cm) 1– $1\frac{1}{2}$  m by 1– $2\frac{1}{2}$  cm; sheaths stramineous. *Scapes* lateral, rather robust, much shorter than the leaves, obtusely trigonous, thickened at the apex, smooth, glaucous, (10–)45–90 cm by  $1\frac{1}{2}$ –2 mm (up to 4 mm at the top), the base clothed with some lanceolate, acute, striate sheaths, the upper sheaths widened upwards, with scarios brown margins, up to 15 cm. *Inflorescence* consisting of a single spikelet (very rarely 1 or 2 lateral spikelets in the axils of the lower glumes), conical, acute, 2– $3\frac{1}{2}$ (–4) by 1  $\frac{1}{2}$ (–2) cm. *Glumes* coriaceous, oblong-lanceolate, obtuse, greenish with narrow scarios brown margins, the lower empty ones many-nerved, 8–10 by 4–5 mm, the fertile upper ones less firm, oblong, less nerved, 8–9 by  $2\frac{1}{2}$ –3 mm. *Flowers* about as long as the glumes; outermost scales ciliate on the keel in the upper half. *Anthers* not seen. *Style* 3-cleft, sometimes some of them 2-cleft. *Nut* lageniform, subglobose in the centre, distinctly beaked, constricted towards the base and then conspicuously widened, truncate at the very base, shortly stipitate, with 3 longitudinal ribs, brown, 5–7 by  $2\frac{1}{2}$ –3 mm.

Distr. Peninsular Thailand; in *Malesia*: Sumatra (Djambi, Palembang), Malay Peninsula (Johore, Singapore), W. Borneo.

Ecol. In swampy forests, along streams, at low altitudes, sometimes dominant.

Vern. *Rumput sëlingsing*, *M. tērissi*, Borneo.

Notes. The type collection of *Lepironia enodis*

MIQ. consists of fruiting scapes only. MIQUEL placed this species next to *Lepironia articulata* (RETZ.) DOMIN (= *L. mucronata* L. C. RICH.) as he supposed it to be leafless. Immature complete specimens from the same locality were described as *Lepironia foliosa* MIQ. In 1870, when aware of his mistake, MIQUEL united the two under the binomial *Lepironia enodis*, which choice must be followed.

*M. longa* CLARKE was based on two collections, RIDLEY 169 from Singapore and MOTLEY 1190 from Borneo (see J. Linn. Soc. Bot. 34, 1898, 95 and Ill. Cyp. 1909, t. 110). In the Flora of British India CLARKE placed the species in his section *Pandanophyllum*, remarking that perhaps it might better be referred to sect. *Halostemma*. This remark is due to the fact that RIDLEY's specimen is *M. enodis* (belonging in CLARKE's sect. *Pandanophyllum*), whereas MOTLEY's collection, from which the description was drawn up, belongs in his sect. *Halostemma*.

**17. *Mapania lorea* UITTEN**, Rec. Trav. Bot. Néerl. 33 (1936) 150. — *M. valida* RIDL. J. Str. Br. R. As. Soc. n. 44 (1905) 205, p.p., quoad RIDLEY 1714; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 104, p.p.; Fl. Mal. Pen. 5 (1925) 172, p.p. — *M. tenuiscapa* (non CLARKE) RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 105, p.p., quoad RIDLEY 11501; Fl. Mal. Pen. 5 (1925) 173, p.p. — *M. zeylanica* (non CLARKE) MERR. En. Born. (1921) 65, p.p., quoad NAT. Coll. 350.

*Leaves* thickly coriaceous, linear, with the midnerve prominent beneath, and several indistinct lateral nerves, finely transversely wrinkled by very numerous cross-nerves connecting the nerves, slightly narrowed towards the conduplicate base, gradually attenuate to the very slender, triquetrous, aculeate-scabrous tip, densely serrate-scabrous throughout the margins and on the upper half of the keel on the lower side, also aculeate-scabrous on the upper surface in the upper part, glaucous, up to 1 m by 1–2 cm; sheathing base dark castaneous, more rarely shining light brown. *Scapes* lateral, from the axils of the lower leaves or below the leaves, terete or compressed, slightly thickened at the apex, smooth, 5–30 cm by 1–2 mm, the base clothed with some light brown scales up to 5 cm. *Inflorescence* always a single spikelet, subglobose to cylindrical, terete, very obtuse when in fruit, 1–4 by 1– $1\frac{1}{2}$  cm. *Glumes* coriaceous, ovate, obtuse, strongly many-nerved, pale brown, with scarios margins, densely purplish punctulate in the upper half, 7–9 mm long, the upper ones less firm, oblong, several-nerved. *Flowers* about as long as the glumes; keel of outermost scales sparingly ciliate. *Anthers* c. 4 mm. *Style* 3-cleft. *Nut* ellipsoid or pyriform, shortly stipitate, fulvous, 5–6 by  $2\frac{1}{2}$ – $3\frac{1}{2}$  mm, the short recurved beak included.

Distr. *Malesia*: Sumatra (Siak R. region and P. Rupa), Enggano, Malay Peninsula (Perak, Johore, Singapore), Borneo (Sarawak, once collected; E. Borneo: Long Tubus; N. Borneo: Kilagan).

Ecol. In swamps and swampy forests at low altitudes, in P. Enggano characteristic of the open forest on tertiary red soil.

Vern. *Sëlingsing*, *sëlîng sëlîngan*, *prupò*, *M.*

Notes. Distinguishable from *M. tenuiscapa* by the much thicker, leathery, transversely wrinkled leaves with only one distinct nerve, the more robust scapes, and the leaves scabrous also on the upper side just

below the tail. In appearance it is similar to *M. kurzii*, but this species has always a capitate inflorescence, with several dark reddish spikelets, almost ribbed glumes, smooth upper side of the leaves, and distinctly winged outermost flower-scales.

The base of the leaf is usually dark brown to almost black, but in the Enggano specimens of a much lighter colour.

**18. *Mapania spadicea* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 147.**

*Leaves* very densely crowded, strikingly 3-ranked, the rows prominent and fan-like at the base (almost as in *M. graminea*), coriaceous, linear, with the midnerve prominent beneath and 2 whitish lateral nerves somewhat prominent above, slightly narrowed towards the conduplicate base, gradually narrowed into a long, flagelliform, triquetrous, very scabrous acumen, densely serrate-scabrous throughout the margins and on the midnerve beneath in the upper part, glaucous, very shining above, dull beneath, up to 170 by 9–14 mm; sheathing bases shining dark brown to blackish. *Scapes* lateral, from the caudex below the leaves, stout, subterete or compressed, scabrous or (at length?) almost smooth, (2–)10–30 cm by 3–4 mm, the base clothed with stiff, acute, dark brown scales. *Inflorescence* usually a single spikelet, sometimes consisting of 2–3 fasciculate arranged spikelets (both types occurring on the same plant). *Spikelets* lanceolate or narrowly lanceolate in outline, terete, acute, 2½–5 cm by 10–15 mm. Lower *glumes* coriaceous, lanceolate, acutish, castaneous, with scarious margins, many-nerved, flower-bearing glumes lanceolate, thinner and less nerved, 12–15 mm long. *Flowers* about as long as the glumes; keel of outermost scales ciliate in the upper part. *Anthers* c. 8 mm. *Style* 3-cleft. *Nut* ellipsoid, subtrigonus, acuminate, shortly stipitate (stipe c. 1 mm), brown, 4–5 by 2½ mm.

*Distr. Malesia:* Borneo (W. Borneo: Sanggau; E. Borneo: W. Kutei).

*Ecol.* In primary forests, along streams, at low altitudes.

*Vern. Mërsing, W. Kutei.*

**19. *Mapania tenuiscapa* CLARKE, Fl. Br. Ind. 6 (1894) 683; J. Linn. Soc. Bot. 34 (1898) 95; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 105, p.p.; Fl. Mal. Pen. 5 (1925) 173, p.p.; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 150. — *M. versicolor* BECC. For. Born. (1902) 517, nom. nud.; MERR. En. Born. (1921) 65. — *M. archboldii* UITTEN, J. Arn. Arb. 20 (1939) 214; S. T. BLAKE, *ibid.* 28 (1947) 211.**

*Leaves* densely crowded, subcoriaceous, linear, with the midnerve prominent beneath, somewhat plicate lengthwise along several distinct lateral nerves, slightly narrowed towards the conduplicate base, very gradually narrowed into a long, flagelliform, triquetrous, aculeate-scabrous acumen, densely aculeate-scabrous throughout the margins and on the midnerve beneath, pale or bright green, up to 1 m by 7–10 mm; sheaths ferruginous to brown. *Scapes* lateral, from the caudex below the leaves, very slender, much shorter than the leaves, striate, 7–30 cm by ½–1 mm, up to 2 mm thick at the somewhat incrassate apex, the base clothed with some stramineous or brown, loose scales up to 5 cm long. *Inflorescence* consisting of a single spikelet, ovoid

when in fruit, terete, acute, 10–15 by 5–6 (–10 when in fruit) mm. *Glumes* subcoriaceous, with scarious margins, ovate-lanceolate, many-nerved, 8–10 mm long, the upper ones less firm, oblong, obtuse or lacerate, brown-punctulate at the top, 5–7-nerved. *Flowers* about as long as the glumes; outermost scales ciliate on the hardly or narrowly winged keel. *Style* 3-cleft. *Nut* fusiform or pyriform, terete, shortly stipitate (stipe ½–1 mm), greyish or blackish brown, 4–7 by 2–3 mm, the short recurved beak included.

*Distr.* Thailand, Indo-China; in *Malesia*: Malay Peninsula (Kedah, Perak, Pahang, Malacca, Johore, P. Langkawi), Borneo (Sarawak), New Guinea (W. New Guinea: Japen-Biak; Papua: Palmer River).

*Ecol.* In primary forests, on river banks, locally abundant, at low altitudes.

*Vern. Sendayan, Mal. Pen.*

*Notes.* CLARKE says that the spikelets are "more or less compound (*i.e.* basal partial spikes containing more than one spikelet)". I always find them simple.

In the New Guinea specimens (*M. archboldii* UITTEN) the fruits are 6–7 mm long, in the other specimens examined 4–6 mm. Otherwise *M. archboldii* agrees in details with *M. tenuiscapa*.

**20. *Mapania sessilis* MERR. J. Str. Br. R. As. Soc. n. 85 (1922) 156. — *M. longiflora* var. *sessilis* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 146.**

*Leaves* coriaceous, linear, slightly narrowed below, gradually narrowed upward to the very slender, triquetrous, aculeate-scabrous tip, with the midnerve prominent beneath and 2 lateral nerves somewhat prominent above, the margins serrulate-scabrous throughout except near the base, and the keel scabrous on the lower surface in the upper part, glaucous, up to 1½ m by 1–1½ cm; sheathing bases shining castaneous. *Scapes* lateral, along the caudex below the leaves, very short and inflorescences therefore practically sessile. *Inflorescence* always a single spikelet, lanceolate in outline, acute, triquetrous, up to 3–4 by 1–1½ cm. Sterile *glumes* coriaceous, ovate to oblong-ovate, acute, sharply keeled at least in the upper half, shining castaneous, 2–3 by 1–1½ cm; fertile *glumes* membranous, oblong, white, 3–5-nerved. *Flowers* 15–30 mm long; outermost scales with a distinct, pellucid, white wing ½–⅔ mm wide, sparsely and minutely ciliate at the top. *Anthers* 7–15 mm. *Nut* oblong-ellipsoid, terete or slightly compressed, stipitate (stipe 1–2 mm), brown, c. 10 by 3½ mm (the long, straight, conical, 3–4 mm long beak included).

*Distr. Malesia:* Sumatra (E. Coast Res.), Banka, N. Borneo (near Sandakan).

*Ecol.* In damp forests, along small streams, at low altitudes.

*Vern. Sëding rimba, Banka.*

*Notes.* The number of stigmas is unknown.

Only a few times collected, probably owing to the fact that the spikelets, all sessile at the very base of the plant, are easily overlooked.

UITTEN reduced this species to a variety of *M. longiflora* scarcely deserving recognition. However, it differs from the latter species not only by the lack of a scape, but also by the different structure of the inflorescence, the castaneous base of the leaves, the keeled outer glumes, the winged outermost flower-scales, and the larger nuts.

21. *Mapania graminea* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 147, incl. *var. stipitata* UITTEN.

Rhizome woody, erect or ascending, 1-1½ cm thick. *Leaves* very densely crowded, strikingly 3-ranked (the rows very prominent and fan-like at the base, the base of the foliage in cross-section therefore Y-shaped), coriaceous, linear, with the midnerve prominent beneath, slightly narrowed towards the conduplicate base, very gradually narrowed into a long, flagelliform, triquetrous, aculeate-scabrous acumen, densely serrate-scabrous throughout the margins and on the midnerve beneath in the upper part, also aculeate-scabrous on the upper surface in the upper part, glaucous, up to 1½ m by 5-20 mm; margins of the sheaths dark brown or purplish. *Scapes* lateral, from the caudex below the leaves, very variable in length, subtrigonus or compressed, striate, smooth, 1-15 cm by 1-2½ mm, the base (when very short wholly) covered by some ovate to lanceolate, pale brown sheaths up to 4 cm long. *Inflorescence* consisting of a single spikelet, rarely of 2-3 fasciculate arranged spikelets. *Spikelet* ellipsoid or lanceolate in outline, trigonus when young, acute, 2-3 by 1-1½ cm. Lower (sterile) *glumes* coriaceous, with scarios margins, lanceolate, acutish, many-nerved, fertile ones thinner, oblong, less nerved, 11-14 mm long. *Flowers* about as long as the glumes; outermost scales ciliate on the keel in the upper half. *Anthers* 6-6½ mm. *Style* 3-cleft. *Nut* obovoid-pyriform, subtrigonus, shortly beaked, shortly stipitate (stipe ½-⅔ mm), brown or greyish brown, 4-5 by 2½ mm.

Distr. *Malesia*: Borneo (Sungei magne, Bukit Kasian, Nunukan; E. Borneo: W. Kutei, Mt Palimasan; N. Borneo).

Ecol. In primary forests at low altitudes.

Note. Almost sessile and distinctly pedunculate spikelets sometimes occur on the same plant; it seems superfluous to distinguish specimens with elongated scapes as *var. stipitata*.

22. *Mapania micropandanus* HOLTZ. Gard. Bull. Sing. 11 (1947) 294.

Rhizome ½-1 cm thick, woody, erect or finally becoming almost horizontal, the older part dying off and then the leafy end standing upon long, greyish brown stilt roots 15-30 cm above the ground. *Leaves* herbaceous, linear, pale green, with denticulate-aculeate margins throughout their length, 20-40 cm by 8-13 mm, the apex rather abruptly narrowed into the acute tip, not caudate, the base slightly narrowed, conduplicate, the midrib prominent on the underside and 2 of the lateral nerves prominent on the upper side, all 3 main nerves scabrous on their raised surface almost from base to apex of the leaf. *Scapes* lateral, hidden in the leaf-axils, very short, the solitary spikelet almost sessile. *Spikelet* lanceolate in outline, trigonus, acute, 15-20 by 5-6 mm. *Glumes* lanceolate, many-nerved, almost ribbed when dry, acute, pale, with scarios margins, c. 15 mm long, the lower sterile ones shorter and broader, ovate to broadly ovate, firmer, c. 10 mm long. *Flowers* as long as the subtending glume (c. 15 mm), linear; outermost scales narrowly winged on the keel, sparsely ciliate at the top only. *Stamens* 3; anthers linear, c. 8 mm. *Style* 3-fid. *Nut* unknown.

Distr. *Malesia*: Malay Peninsula (SE. Johore: Sungai Sedili basin; Pulau Tioman).

Ecol. In dry *Dryobalanops* forests and in the drier parts of freshwater swampy forests, at low altitudes.

Note. This remarkable species, like a miniature *Pandanus*, is distinct from all other species by the non-caudate leaves toothed on the margins and throughout the three main veins. Its nearest ally may be *M. graminea* UITTEN from Borneo, in which the spikelets are often also subsessile and trigonus, the texture and nervation of the glumes very similar, and the outermost flower scales also winged.

23. *Mapania maschalina* KERN, Blumea 12 (1963) 23, f. 1. — Fig. 16.

Rhizome woody, ascendent. *Stems* elongated, erect, sustained by 2-3 mm thick terete roots, densely leafy, c. 50 cm tall. *Leaves* coriaceous, narrowly linear, rigid, dull green, glaucescent, stramineous towards the conduplicate base, gradually narrowed into a triquetrous, very scabrous tail, up to 50 cm long, 5-7 mm wide, the upper part densely serrulate-scabrous on the margins and the prominent midnerve beneath, the lateral nerves scarcely distinct. *Scapes* lateral, very short, hidden in the axils of the cauline leaves, each with a solitary spikelet. *Spikelets* subsessile, ovoid, acute, c. 15 by 7-10 mm. Sterile *glumes* coriaceous, ovate, acute, many-nerved, fuscous, with scarios margins, 8-9 mm long; fertile glumes lanceolate, less firm, 9-10 mm long. *Flowers* linear, 8-10 mm long; scales membranous, the transversal 2 ciliate on the keel. *Anthers* linear, 5-6 mm long. *Style* 3-fid. *Nut* subpyriform, narrowed into a short, slightly curved beak, shortly stipitate (stipe ½ mm), rugulose, greyish brown, 6 by 3 mm (beak included).

Distr. *Malesia*: N. Borneo (Distr. Sandakan: Malubok Kinabatangan). Only a single collection known of this remarkable species.

Ecol. In swamp forest.

24. *Mapania monostachya* UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 194, f. 1; RICHARDS, J. Ecol. 24 (1936) 15.

*Leaves* subcoriaceous, linear, with the midnerve very prominent on the underside and 2 of the lateral nerves more or less prominent above, serrulate-scabrous on margins and midnerve at least in the upper part, the apex gradually narrowed into a filiform, triquetrous, aculeate-scabrous acumen, hardly narrowed at the conduplicate base, brilliant metallic blue-green, 20-40 cm by 2-4 mm; sheaths stramineous. *Scapes* lateral, somewhat angular, very slender, much shorter than the leaves, (4-8-15 cm by ⅓-⅔ mm), the base clothed with some greenish or stramineous, striate, up to 15 mm long scales. *Inflorescence* consisting of a single spikelet, 6-10 by 2-3 mm. Bracts 2-3, oblong-lanceolate, obtusish, many-nerved, densely fuscous-punctulate, 5-7 mm long, the lowest 1-3 mm distant. *Glumes* hardly differing from the bracts but somewhat narrower, with less conspicuous and less numerous nerves. *Flowers* 4-6 mm long; outermost scales sparsely ciliate on the keel in the upper part. *Stamens* 3; anthers linear, white, 2-3 mm. *Style* 2- or 3-fid. *Nut* pyriform, terete, narrowed at the base, acuminate at the apex, dusky brown, darker spotted, slightly rugulose, 2¼-2½ by 1¼-1⅓ mm.

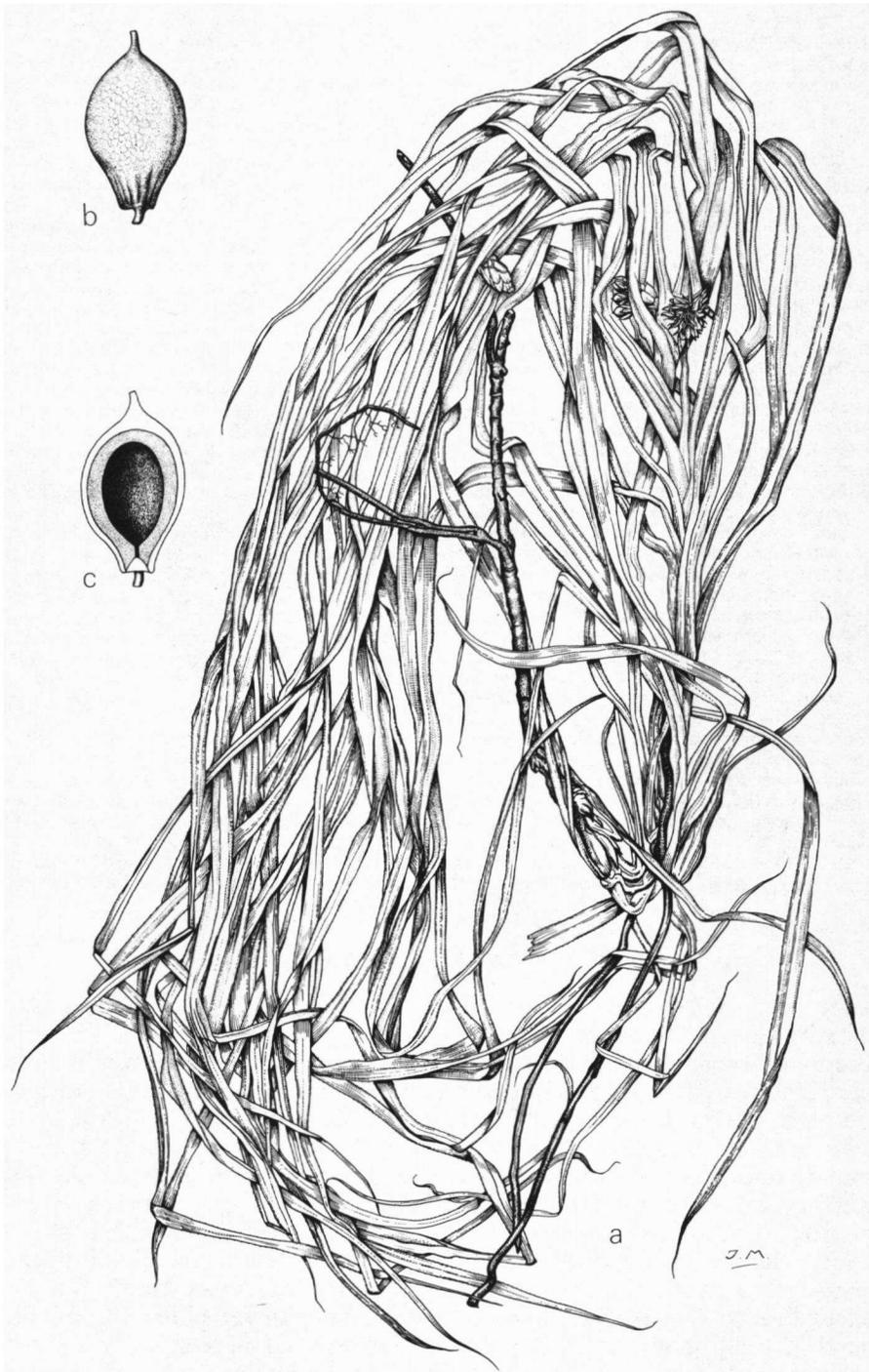


Fig. 16. *Mapania maschalina* KERN. a. Habit,  $\times \frac{1}{2}$ , b. nut, c. ditto in LS, both  $\times 4\frac{1}{2}$  (a-b MEIJER SAN 23592).

Distr. *Malesia*: Borneo (Sarawak: Upper Rejang R., Mt Dulit; N. Borneo: Distr. Temburong, Kuala Belalong; W. Borneo: Sungei Simun and Sanggau).

Ecol. In primary forests, along streams, from low altitudes up to 1100 m.

Note. The smallest species of the genus, very similar in habit to *Paramapania gracillima* from the Philippines (see p. 488). Readily distinguishable from this by the longer flowers and glumes, the number of stamens, the linear much longer anthers, the flower-scales not spinulose on the keel, and the different shape of the nut.

25. *Mapania baccifera* CLARKE, Kew Bull. add. ser. 8 (1908) 53; Ill. Cyp. (1909) t. 115, f. 8-9; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 278, 279; S. T. BLAKE, J. Arn. Arb. 28 (1947) 211. — *M. radulosa* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 245. — *M. papuana* RIDL. L.c. 246; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 146, 151, 278, 279; S. T. BLAKE, J. Arn. Arb. 28 (1947) 210. — *M. grandiceps* (non KÜK.) OHWI, Bot. Mag. Tokyo 56 (1942) 211.

*Leaves* coriaceous, linear, slightly narrowed towards the conduplicate base, gradually to rather suddenly narrowed upward to the slender, triquetrous, aculeate-scabrous tip, with the midnerve prominent beneath and several rather prominent lateral nerves, the margins finely scabrous to almost smooth and the midnerve scabrous on the lower surface in the upper part, glaucous, up to  $1\frac{1}{2}$  m by c.  $1\frac{1}{2}$ -4 cm; sheathing bases stramineous. *Scapes* lateral, from the axils of the lower leaves or below the leaves, trigonous to almost terete, incrassate at the top, scabrous by very short, stiff hairs, at length glabrescent, up to 60(-90?) cm by  $1\frac{1}{2}$ -3 mm. *Inflorescence* either consisting of a single spikelet or capitate, with up to 4 spikelets surrounded by a few coriaceous, lanceolate, acute, many-nerved, up to 3 cm long bracts. *Spikelets* oblong-ovoid, acute, terete, 2-4 cm long. Lower *glumes* coriaceous, ovate-lanceolate, acute, many-nerved, with scarious margins, 10-15 mm long; flower-bearing glumes thinner, oblong, several-nerved. *Flowers* 10-15 mm

long; outermost scales ciliate on the keel. *Style* 3-cleft. *Nut* obovoid-pyriform, terete, berry-like by the succulent exocarp, stipitate (stipe 1-2 mm), shortly beaked, strongly wrinkled when dry, yellow or orange, 6-7 by  $3\frac{1}{2}$ -4 mm (beak included).

Distr. Solomons; in *Malesia*: ?Moluccas (Morotai); W. New Guinea (Bume R. near Nabire, Mt Carstenz, Idenburg R.), Japen, Biak.

Ecol. In dense rain-forest, in mossy forest undergrowth, at low altitudes, up to 900 m.

Note. Very insufficiently known. Provisionally I have united all Malesian *Mapaniae* with succulent yellowish fruits, for the material available at the present is inadequate for critical study. The type collections of *M. baccifera*, *M. papuana*, and *M. radulosa* consist of leaf fragments and a single inflorescence or a few detached ones. In the type of *M. baccifera* from the Solomons the inflorescence contains 4 overmature spikelets surrounded by some involucre bracts, in the specimens collected in those islands by BRASS and referred to *M. baccifera* by both UITTEN and BLAKE the inflorescence is a single spikelet. The type of *M. papuana* is still more fragmentary than that of *M. baccifera*. The leaves are c. 2 cm wide, the inflorescence a very young spikelet. In the specimens UITTEN referred to *M. papuana* the leaves are much wider and in BRASS 13079 (referred to *M. papuana* by BLAKE) the inflorescence is apparently compound. The latter collection is very similar to the type of *M. radulosa*, the original description of which is inaccurate: the leaves are 2 (not  $1\frac{1}{2}$ ) cm wide and the involucre bracts 3 (not 8) cm long.

#### Doubtful

*Mapania alpina* ELM. Leaf. Philip. Bot. 10 (1938) 3535. — Based on ELMER 14864 from Irosin (Mt Bulusan), Luzon, in the woods at 3500 ft altitude. — I have not seen this collection; judging from the description it might belong to *M. borneensis* MERR. — MERRILL, En. Philip. 1 (1923) 132, referred it to *M. cuspidata* (MIQ.) UITTEN ('*M. humilis*'), but ELMER properly observes that it is distinct from this species.

## 6. PARAMAPANIA

UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 186; *ibid.* 33 (1936) 141; KERN, Blumea 9 (1958) 215. — Fig. 17.

Perennial herbs with short, woody, obliquely erect rhizome covered with the fibrous remains of decayed leaf-sheaths. *Leaves* 3-ranked, equitant, conduplicate at the base, subcoriaceous, either linear, gradually narrowed into a tail-like, aculeate-scabrous acumen, or, more rarely, narrowly oblong, petiolate, abruptly acuminate and caudate; midnerve prominent on the under side; ligule absent. Flowering *scapes* slender, usually much shorter than the leaves, arising laterally, either from the axils of the lower leaves, or below the leaves, with some basal bladeless sheaths, not rarely also with 1-3 bladeless sheaths higher up. *Inflorescence* terminal, corymbose, capituliform, or consisting of a single spikelet; bracts very short. *Spikelets* small, (narrowly) ellipsoid, ovoid, or obovoid, terete, many-flowered, usually brown. *Glumes* spirally imbricate, subcoriaceous, brown, with paler midnerve, nerveless sides, and hyaline margins, some lower ones empty. *Flowers* compressed, bisexual; hypogynous scales

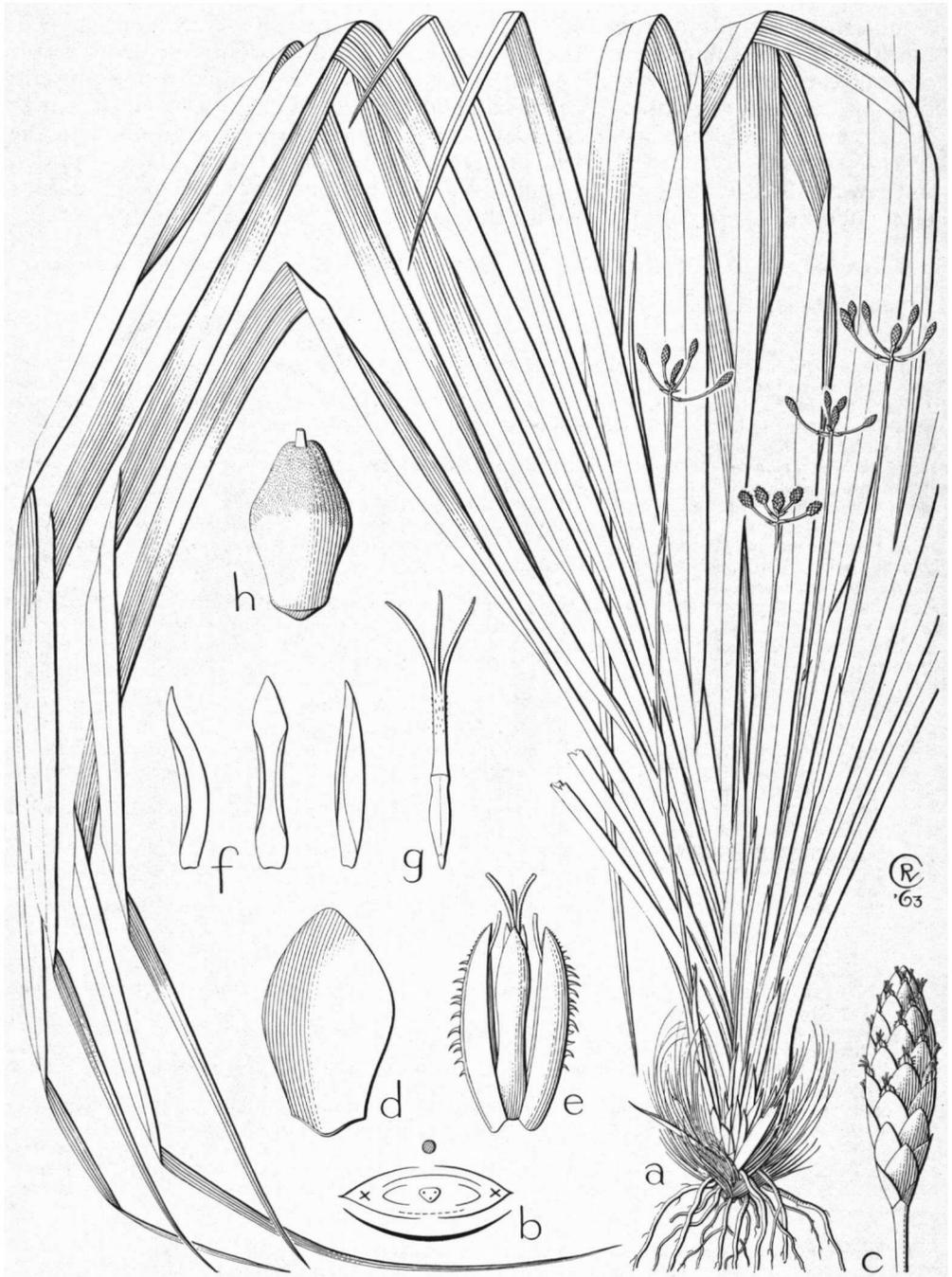


Fig. 17. *Paramapania parvibractea* (CLARKE) UITTEN. a. Habit,  $\times \frac{1}{2}$ , b. floral diagram, c. spikelet,  $\times 5$ , d. glume, e. flower with two transverse ciliate scales, inner scales each with apex of filament, and stigmas, f. three inner scales, g. pistil, h. mature nut, all  $\times 15$  (a-h SULIT 6308).

(*squamellae*) usually 5, the lowest 2 transversal, opposite, free, boat-shaped, coarsely brown-spinulose on the acute keel, the 3rd (anticous) scale as a rule absent, the upper 3 concave, empty; rarely scales 6, the anticous one present, but smaller than the upper 3. *Stamens* 2, very rarely 3, in the axils of the lower scales; anthers oblong-linear, scarcely appendaged. *Style* continuous with the ovary; stigmas 3, rarely 4. *Nut* subterete or angular, turgid in the middle, narrowed towards the base, the apex with a cupuliform, conical-pyramidal, or elongated beak often confluent with the nut proper; exocarp hard, thin.

Distr. Small genus (7 spp.), almost entirely confined to *Malesia*; *P. parvibractea* extending to the western Pacific.

Ecol. All the species inhabit very damp rain-forests at low or medium altitudes.

Notes. The species of *Paramapania* are mutually closely related, and form a natural group. Nevertheless it is difficult to characterize the genus in a satisfactory way. In structure the flowers are very similar to those of *Mapania* and *Thoracostachyum*, but generally more reduced, as the third hypogynous scale is usually lacking and the number of stamens is reduced to 2. When the third scale is present it is smaller than the upper ones, and as a rule empty. Occasionally there may be a stamen in its axil, but if so that stamen is less developed than the other two. The relatively coarse, brown spinules on the keel of the two lowest (lateral) scales are characteristic of *Paramapania*; the corresponding scales in *Mapania* and *Thoracostachyum* are softly ciliate on the back. *Paramapania* can readily be distinguished from *Mapania* sect. *Cephaloscirpus* and *Thoracostachyum* by the lateral, leafless scapes. It is, however, difficult or practically impossible to distinguish between *Paramapania* and the scapigerous species of *Mapania* and *Hypolytrum* by their habit alone. Especially some African *Hypolytrum* spp. (e.g. *H. nudicaule* from Madagascar) bear a close resemblance to *P. parvibractea*, but in them the number of scales is reduced to 2. As a rule the spikelets and flowers in *Mapania* are much larger than those in *Paramapania*, and the fruits drupaceous by the thick, fleshy or spongy exocarp. Corymbose inflorescences are not found in *Mapania*.

Specific delimitation is difficult as the greater part of the species (*P. gracillima*, *P. flaccida*, *P. rostrata*, *P. longirostris*, and *P. simplex*) are only known from a few collections, and the more widely distributed species are highly variable. Several of the characters used by UITTEN are apparently taxonomically less important than he supposed them to be.

#### KEY TO THE SPECIES

1. Flowering scapes strongly compressed, ancipitous. Leaves abruptly acuminate, shortly caudate, the margins scabrous only at the very top . . . . . 4. *P. flaccida*
1. Flowering scapes terete or trigonous.
  2. Stigmas 4, or in a few flowers 3. Inflorescence consisting of a single spikelet . . . . . 3. *P. gracillima*
  2. Stigmas 3, or in a few flowers 4.
    3. Nut lageniform, with a hexagonal, conical, obtuse, densely verruculose beak, 2 mm long. Glumes distinctly spinulose-ciliolate on the upper margin. Inflorescence dense, head-like, or reduced to a single spikelet . . . . . 2. *P. radians*
    3. Nut with a triquetrous, acute, smooth beak, or beak indistinct. Glumes not or scarcely (not spinulose) ciliolate.
      4. Nut indistinctly beaked,  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm long. Inflorescence usually corymbose, with well-developed rays and many to numerous spikelets . . . . . 1. *P. parvibractea*
      4. Nut with a distinct, triquetrous,  $1\frac{1}{4}$ -3 mm long beak. Inflorescence either consisting of a single spikelet or head-like, with up to 5 spikelets.
        5. Leaves abruptly acuminate, caudate, 8-12 mm wide, their margins scabrous only at the very top, the base narrowed into a 1-5 cm long petiole . . . . . 7. *P. simplex*
        5. Leaves very gradually narrowed into a long point, 4-8 mm wide, scabrous on the margins at least in the upper half, conduplicate at the base, but not distinctly petioled.
          6. Nuts stellately spreading, their upper part dark brown, suddenly narrowed into the pale, obconical lower part. Beak of the nut firm, straight or but slightly curved, hence spikelets echinate. . . . . 5. *P. rostrata*
          6. Nuts obliquely erect, brown, their body ellipsoid, rather gradually attenuate at both ends. Beak of the nut slender, curved; spikelets not echinate . . . . . 6. *P. longirostris*

1. *Paramapania parvibractea* (CLARKE) UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 143; S. T. BLAKE, J. Arn. Arb. 28 (1947) 209; KERN, Blumea 9 (1958) 217, excl. pl. Philip. — *Hypolytrum parvibractea* CLARKE, Kew Bull. (1899) 114. — *Mapania montana* LAUT. & K. SCH. in K. Sch. & Laut. Fl. Schutzgeb. (1900) 189. — *Hypolytrum parvibractea* CLARKE, Kew

Bull. add. ser. 8 (1908) 51; VALCK. SUR. Nova Guinea 8 (1912) 709; RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 243. — *Mapania lucbanensis* ELMER, Leaf. Philip. Bot. 2 (1909) 573. — *Hypolytrum parvibractea* var. *quadrilumatum* VALCK. SUR. Nova Guinea 8 (1912) 709, t. 116, nom. inval. — *Hypolytrum quadrilumatum* VALCK. SUR. l.c., nom.

*inval.* — *Thoracostachyum montanum* VALCK. SUR. l.c. 710; KÜK. Bot. Jahrb. 59 (1924) 54; OHWI, Bot. Mag. Tokyo 56 (1942) 209. — *Thoracostachyum lucbanense* KÜK. ex MERR. Philip. J. Sc. 11 (1916) Bot. 258; EN. Philip. 1 (1923) 132, p.p. — *Thoracostachyum longistylum* KÜK. Bot. Jahrb. 58 (1924) 54, incl. *f. parvum* KÜK. — *Hypolytrum radians* RIDL. Fl. Mal. Pen. 5 (1925) 170, p.p. (*quoad specim. Johor.*), non *Mapania radians* CLARKE. — *P. lucbanensis* UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 190, *quoad basion.* — *P. johorensis* UITTEN, l.c. 191; *ibid.* 33 (1936) 141. — *P. amboinensis* UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 191, f. 4. — *P. montana* UITTEN, l.c. 200, *nom. provis.* — *P. longistyla* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 141. — *Thoracostachyum parvibractea* KÜK. Bot. Jahrb. 69 (1938) 261. — ? *Thoracostachyum macilentulum* OHWI, Bot. Mag. Tokyo 56 (1942) 210, *e descr.* — *Mapania parvibractea* Koyama, Micronesica 1 (1964) 66. — Fig. 17.

Forming compact, 3-angled clumps. *Leaves* linear, flat or somewhat folded lengthwise, very gradually or (in broad-leaved specimens) rather suddenly narrowed into a subfiliform, scabrous point, antrorsely aculeate-scabrous on the margins and on the midnerve beneath in the upper part, up to 70(-100) by  $\frac{3}{4}$ - $1\frac{1}{2}$ (-2) cm, the base strongly conduplicate, with reddish brown or purplish, scarious margins. *Scapes* trigonous, smooth, usually reddish brown, up to 45 cm by 1-2 mm, in or about the middle with 1-2 tubular, 3-5 cm long sheaths split up at the top, the base clothed with some loose, lanceolate, fuscous sheaths. *Inflorescence* corymbiform, simple or compound, with few to many spikelets, rarely in some of the scapes reduced to a single spikelet, up to  $3\frac{1}{2}$  by 7 cm, the lower branches divaricate, up to 3 cm long, the upper ones suberect, very short. *Fruiting spikelets* subglobose, ellipsoid, or oblong-ovoid, 3-(6-10) by 3-4 mm. *Glumes* ovate, obtuse, minutely ciliolate on the upper margin, 2-3 by  $1\frac{1}{2}$ -2 mm. *Flowers*  $1\frac{3}{4}$ -2(-3) mm long; hypogynous scales 5(-6), the upper 3(-4) lanceolate or narrowly ovate. *Stamens* 2, very rarely 3; anthers oblong-linear,  $\frac{1}{2}$ -1 mm. *Style* triquetrous, more or less scabrid; stigmas 3, or in a few flowers 4. *Nut* obliquely erect, fusiform or subpyriform, subterete or slightly compressed, acuminate at both ends, shortly stipitate, rounded at the apex, brown or greyish black, with 3 longitudinal pale stripes,  $1\frac{1}{2}$ - $2\frac{1}{2}$  by  $\frac{3}{4}$ - $1\frac{1}{4}$  mm; beak indistinct, confluent with the nut proper.

Distr. W. Carolines, Solomons, Samoa, Fiji; in *Malesia*: W. Sumatra, Lingga Archipelago, Malay Peninsula (Kelantan, Johore), Borneo (Distr. Sandakan), Philippines (Luzon, Samar, Mindanao), Celebes (E. Peninsula), Moluccas (Talaud Is., Morotai, Amboina, Ceram, P. Gebe), New Guinea and adjacent islands.

Ecol. In rain-forests, along forest-trails, on seepages, in the lowlands and on the lower mountain slopes, up to 1200 m.

Vern. Philip.: *payong-payong*, *tingol*, Sub. (these names may refer also to *P. rostrata*); New Guinea: *masibu*, Kutubu lang.

Notes. The type collection (GIULIANETTI s.n., K) is said to be collected on Mt Scratchley at 12,200 ft, i.e. in the subalpine zone. See, however, VAN STEENIS, Fl. Mal. I, 1 (1950) xxi.

The type collection of *P. lucbanensis* (ELM.)

UITTEN is ELMER 9116 from Lucban, prov. of Tayabas, Luzon (E). It belongs undoubtedly to *P. parvibractea*. UITTEN, who did not see the type, took RAMOS 23642, distributed as *Thoracostachyum lucbanense*, but which belongs to *P. rostrata*, for *P. lucbanensis*. See also under *P. rostrata*.

Originally UITTEN distinguished between *P. johorensis* from the Malay Peninsula and *P. parvibractea* (= *P. amboinensis* UITT.) by the number of flower-scales (6 in *P. johorensis*, 5 in *P. parvibractea*), and the smaller number of spikelets to the inflorescence in the former. Later on he referred specimens from P. Lingga, with 5 scales and inflorescences bearing up to 20 spikelets, also to *P. johorensis* on account of the globose, stipitate nut. As I fail to see any essential difference in the nuts, and the number of scales is variable also in the eastern part of the area, I refer *P. johorensis* to the synonymy of *P. parvibractea*.

More deviating from typical *P. parvibractea* is *P. longistyla* (KÜK.) UITTEN, only known from two New Guinea collections: LEDERMANN 19586 (L, P!) and 19728 (*f. parva* KÜK., not seen). The leaves are up to 2 cm wide, rather suddenly acuminate, the flowers about 3 mm long, with 6 scales and 3 stamens, the style is distinctly scabrid on the angles, and the nut somewhat larger. In *P. parvibractea*, however, the width of the leaves is very variable, 3 mm long flowers with 6 scales and 3 stamens are also found in narrow-leaved specimens, and the style is more or less scabrid. Provisionally I consider *P. longistyla* a local race of *P. parvibractea*, the polymorphism of which needs further study.

2. *Paramapania radians* (CLARKE) UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 188, f. 1; 200; KERN, Blumea 9 (1958) 217, p.p. (*quoad pl. Born.*). — *Mapania radians* CLARKE in Ridl. J. Str. Br. R. As. Soc. n. 46 (1906) 226; Kew Bull. add. ser. 8 (1908) 53; MERR. En. Born. (1921) 65. — *Hypolytrum radians* RIDL. Fl. Mal. Pen. 5 (1925) 170, *excl. specim. Malacc.*

Near to the preceding species. *Leaves* linear, flat or somewhat folded lengthwise, very gradually narrowed into a subfiliform, aculeate-scabrous point, antrorsely scabrous on the margins and on the midnerve beneath in the upper part, pale green or glaucous, up to 80 cm by 3-8 mm; sheaths conduplicate, fuscescent, with reddish brown, scarious margins. *Scapes* trigonous or subterete, smooth, often dark-punctulate, 4-16 cm by  $\frac{1}{2}$ -1 mm, the base clothed with a few lanceolate, fuscous sheaths, otherwise without sheaths, nodeless. *Inflorescence* simple, very dense, head-like, subglobose, with 2-10 spikelets, up to  $1\frac{1}{2}$  cm across, not rarely in some of the scapes reduced to a single spikelet. *Fruiting spikelets* ovoid-ellipsoid, brown, 7-10 by 4-5 mm. *Glumes* ovate, obtuse, spinulose-ciliolate on the upper margin, 2 by  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm. *Flowers*  $1\frac{1}{2}$ - $1\frac{3}{4}$  mm long; hypogynous scales 5, the upper 3 lanceolate or narrowly ovate. *Stamens* 2; anthers  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. *Stigmas* 3, rarely in a few flowers 4. *Nuts* obliquely erect, lageniform, terete or obscurely trigonous, with 6 longitudinal ribs, smooth, shining, dark brown, 2 by  $\frac{3}{4}$ -1 mm (beak included); beak clearly distinct from the nut proper, pyramidal-conical, obtuse, hexagonal by 6 ribs, densely verruculose, c.  $\frac{3}{4}$  mm long.

Distr. *Malesia*: Borneo (Sarawak; Brunei; Sabah; NE. Borneo: Nunukan near Tarakan; E. Borneo: W. Kutei).

Ecol. In primary Dipterocarpaceous and *Agathis* forests, up to 600 m.

**3. *Paramapania gracillima*** (KÜK. & MERR.) UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 190, f. 3. — *Mapania gracillima* KÜK. & MERR. Philip. J. Sc. 9 (1914) Bot. 267; MERR. En. Philip. 1 (1932) 132.

*Leaves* linear, flat, gradually attenuate at both ends, glaucescent, aculeate-scabrous on the margins and especially at the filiform, triquetrous top, up to 30 cm by (2-)4-5 mm. *Scapes* very slender, filiform, terete or obtusangular, slightly asperous-furfuraceous, 5-10 cm by  $\frac{1}{3}$ - $\frac{1}{2}$  mm, in the middle often with a single, tubular,  $\frac{1}{2}$ -2 cm long sheath split up at the top, the base clothed with some lanceolate, fuscous, bladeless sheaths. *Inflorescence* consisting of a single spikelet. *Spikelet* small, at first linear-ellipsoid, when in fruit obovoid or ellipsoid, 4-7 by 3-4 mm. *Glumes* ovate, obtuse, 2 by  $1\frac{1}{2}$  mm. *Flowers* c.  $1\frac{1}{4}$  mm long; hypogynous scales (5-6), the anticous one present in the majority of flowers, but smaller than the upper scales. *Stamens* 2; anthers elliptic-oblong,  $\frac{1}{3}$ - $\frac{2}{5}$  mm long. *Stigmas* 4 (or in a few flowers 3). *Nut* fusiform-sublageniform, narrowed at both ends, subterete, slightly angular by 4 longitudinal ribs, shortly stipitate, with short, obtuse beak scarcely distinct from the nut proper, smooth, stramineous to brown, 2 by 1 mm.

Distr. *Malesia*: Philippines (Luzon: Prov. of Tayabas, Mt Dingalan; Mindanao, Distr. Zamboanga).

Ecol. On forested ridges, at about 1100 m.

**4. *Paramapania flaccida*** UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 142.

*Leaves* linear, flat, rather abruptly acuminate, shortly caudate (the aculeate-scabrous tail 1-2 cm long), gradually narrowed towards the strongly conduplicate base, scabrous, on the margins only at the very top, pale green, fuscous at the base, 10-20 cm by 7-14 mm. *Scapes* strongly compressed, acipitous, scabrid on the edges only at the top, 5-18 cm by 1 mm, the base clothed with some lanceolate, fuscous sheaths. *Inflorescence* consisting of 1(-3) spikelets; branches when present short,  $\frac{1}{2}$ -1 cm long. *Spikelets* oblong-obovoid, narrowed at the base, brown, 7-10 by 4-6 mm when in fruit. *Glumes* oblong, obtuse, brown, 3- $3\frac{1}{2}$  by  $1\frac{1}{2}$  mm. *Flowers* oblong, c. 3 mm long; hypogynous scales 6, the anticous one small, 2 mm long, the upper ones 3 mm. *Stamens* 2. *Style* triquetrous, smooth; stigmas 3. *Nut* ellipsoid-fusiform, obtusely trigonous, slightly dorsiventrally compressed, acuminate at both ends, dark brown,  $2\frac{3}{4}$ -3 by  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm, with obtuse beak almost confluent with the nut proper.

Distr. *Malesia*: W. New Guinea (along Rouffaer River).

Ecol. In lowland rain-forest, 250 m.

Notes. Only known from the type collection, DOCTERS VAN LEEUWEN 10413.

In appearance very similar to *P. simplex*, but distinguishable by the acipitous scapes and the almost eorostrate nuts.

The irrelevant specific epithet was obviously intended to refer to the compressed (Dutch 'vlakke'), but not flaccid scapes.

**5. *Paramapania rostrata*** UITTEN, Rec. Trav. Bot. Néerl. 32 (1936) 189. — *Mapania rostrata* ELM., nomen in sched. ad Phil. Isl. Pl. 16150. — *P. longirostris* UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 142, p.p. (quoad specim. Philip.). — *Thoracostachyum lucbanense* MERR. En. Philip. 1 (1923) 132, p.p., non *Mapania lucbanensis* ELM. — *P. lucbanensis* UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 190, quoad specim. cit., non *Mapania lucbanensis* ELM. — *P. radians* (non UITTEN) KERN, Blumea 9 (1958) 216, 217, p.p. (quoad pl. Philip.).

*Leaves* linear, flat or with revolute margins, very gradually narrowed into a flagelliform, aculeate-scabrous point, also aculeate-scabrous on the margins and the midnerve beneath, glaucescent, up to 65 cm by 5-8 mm, the base strongly conduplicate, pinkish or purplish. *Scapes* filiform, minutely scabrid, 3-20 cm by  $\frac{1}{4}$ - $\frac{1}{2}$  mm, the base clothed with a few, brown, bladeless or short-bladed sheaths, the longer ones also with a sheath about the middle. *Inflorescence* simple, often consisting of a single spikelet, not rarely head-like with up to 5 spikelets; branches when present up to 5 mm. *Spikelets* at first ellipsoid or oblong-ellipsoid, dark brown, 6-14 by 2 mm, finally subglobose, echinate, up to 8 mm thick. *Glumes* ovate, brown with scarios margins, 2- $2\frac{1}{4}$  mm long. *Flowers*  $1\frac{1}{2}$ - $2\frac{1}{4}$  mm long; hypogynous scales 5, oblong-elliptic. *Stamens* 2. *Style* triquetrous; stigmas 3. *Nuts* stellately spreading, stipitate, distinctly rostrate, in cross-section hexagonal by 6 ribs, 3- $5\frac{1}{2}$  by  $1\frac{1}{4}$  mm (beak included), the brown upper part of the body abruptly narrowed into the pale, obconical, narrowly winged lower part, rather gradually narrowed into the firm, triquetrous, straight or but slightly curved, smooth, pale,  $1\frac{1}{4}$ -3 mm long beak.

Distr. *Malesia*: Philippines (Luzon: Prov. Sorogon, Mt Bulusan; Lake Polog and Sierra Madre, NNE of Dingalan; Alabat Island).

Ecol. On Mt Bulusan in loose, humus covered ground among shrubberies at 1750 m, in the Sierra Madre in primary Dipterocarpaceous forest at 300-400 m.

Notes. In Blumea, l.c., I treated *P. rostrata* as being conspecific with the Bornean *P. radians*, but after having seen recent Philippine collections with ripe fruits I am convinced that the two are well distinct.

In 1936 UITTEN referred *P. rostrata* to the synonymy of the New Guinean *P. longirostris*. The two are certainly closely related, but the shape of their fruits differs considerably, so that I prefer to keep them apart. Some additional minor differences corroborate this view.

In both *P. rostrata* and *P. longirostris* the beak of the fruit is variable in length. Though in RAMOS 23642 from Lake Polog and in JACOBS 7666 from Sierra Madre the beak is shorter than in ELMER 16150 from Mt Bulusan, the type collection of *P. rostrata*, I refer them to that species on account of the remaining characters. See also under *P. parvibractea*.

**6. *Paramapania longirostris*** (KÜK.) UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 142, p.p. (quoad specim. Nov. Guin.); KERN, Blumea 9 (1958) 216. — *Mapania longirostris* KÜK. Bot. Jahrb. 59 (1924) 55; OHWI, Bot. Mag. Tokyo 56 (1942) 211. — *P. attenuata* S. T. BLAKE, J. Arn. Arb. 28 (1947) 210, t. 1.

*Leaves* narrowly linear, flat, very gradually narrowed into a flagelliform, curved to circinnate, aculeate-scabrous point, scabrous on the margins and keel at least in the upper half, pale green or glaucescent, 30–65 cm by 4–6 mm; sheaths conduplicate, sharply keeled, purplish or fuscous. *Scapes* obscurely trigonous, smooth, (1–)3–10(–20) cm by  $\frac{1}{3}$ – $\frac{1}{2}$  mm, the base clothed with a few bladeless, lanceolate, fuscous sheaths. *Inflorescence* simple, with up to 4 spikelets, usually consisting of a single spikelet; branches when present up to  $\frac{1}{2}$  cm long. *Spikelets* at first oblong-ellipsoid, when in fruit ovoid or obovoid, brown, 5–15 by 5–6 mm. *Glumes* oblong-ovate, obtuse, 3 by  $\frac{1}{2}$ – $\frac{3}{4}$  mm. *Flowers*  $2\frac{1}{2}$ –3 mm long; hypogynous scales 5, the upper 3 lanceolate or narrowly ovate. *Stamens* 2. *Stigmas* 3. *Nut* obliquely erect, lanceolate in outline, stipitate, 6-ribbed, trigonous because 3 of the ribs are more prominent and end in the beak, smooth, shining, brown,  $3\frac{1}{2}$ –5 by 1– $\frac{1}{2}$  mm (beak included); body ellipsoid, rather gradually attenuate at both ends; beak gradually long-attenuate, triquetrous, more or less curved,  $\frac{1}{2}$ –2 mm long.

Distr. *Malesia*: New Guinea (W. New Guinea: Sorong; Idenburg R.; Dallman, Nabire; NE. New Guinea: Sepik region).

Ecol. In very damp rain-forests, on seepages, up to 1200 m.

Notes. Very similar in habit to *P. gracillima*, but readily distinguishable by the quite different shape of the nut.

*P. attenuata* S. T. BLAKE is said to differ from *P. longirostris* by the twice as long glumes, the flowers slightly shorter than the glumes, and the indistinctly 3-angled (not 6-angled) nut passing gradually (not abruptly) into the relatively shorter beak. However, "glumae . . . 1, 5 mm longae" in UITTEN's description of *P. rostrata* UITTEN (1935, l.c.) is obviously an

error for 2.5 mm. The young nuts in the type collection of *P. attenuata* (BRASS 12930) do not differ from those of *P. longirostris*.

7. *Paramapania simplex* (RIDL.) UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 190; S. T. BLAKE, J. Arn. Arb. 28 (1947) 209. — *Thoracostachyum simplex* RIDL Trans. Linn. Soc. II, Bot. 9 (1916) 244.

Very near to *P. longirostris*. *Leaves* broader, narrowly oblong to linear, 5–30 cm by 8–12 mm, abruptly acuminate, caudate (the tail 1–3 cm long), the base narrowed into a 1–5 cm long petiole, the margins smooth almost throughout, scabrous only at the very top just below the aculeate-scabrous tail. *Inflorescence* consisting of a single spikelet, 5–8 by 4–5 mm. *Glumes*  $2\frac{3}{4}$ – $3\frac{1}{4}$  by  $1\frac{3}{4}$ – $2\frac{1}{4}$  mm. Upper sterile scales narrower and slightly longer than in *P. longirostris*, very narrowly elliptic to oblong-linear.

Distr. *Malesia*: New Guinea (W. New Guinea: Ramoi, Vogelkop, Otakwa R., Idenburg R.; Papua: Fly R., Palmer R.).

Ecol. In rain-forests, on shaded river-banks, at low alt., up to 900 m.

Note. However different in habit tall specimens of *P. longirostris* with narrowly linear leaves very gradually narrowing towards the apex, may be from dwarf specimens of *P. simplex* with oblong, petiolate and caudate leaves, it is questionable whether they are specifically distinct. Provisionally they are kept apart because the difference in facies seems to correlate with one in the shape of the upper hypogynous scales, and there is also a marked difference in the scabridity of the leaf-margins. On the other hand I fail to find any essential difference in the nuts. Whether the characters indicated above hold true, can only be decided when the variability of both species will better be known.

## 7. HYPOLYTRUM

L. C. RICH. in Pers. Syn. 1 (1805) 70. — *Hypaelyptum* VAHL, En. 2 (1806) 283, p.p. — *Beera* LESTIB. Essai Fam. Cyp. (1819) 43. — *Tunga* ROXB. Fl. Ind. 1 (1820) 187, p.p. — *Albikia* PRESL, Rel. Haenk. 1 (1828) 184. — *Pandanophyllum* HASSK. Tijd. Nat. Gesch. Phys. 10 (1843) 118, p.p.; STEUD. Syn. 2 (1855) 134, p.p. — Fig. 18–20.

Perennial herbs with short, rather stout rhizomes; long-creeping stolons absent (in *Mal. spp.*). Flowering stems centrally arising from a tuft of normal leaves, erect, trigonous, usually leafy, or from the axils of the lower leaves or below the leaves and then scapiform. *Leaves* 3-ranked, basal and usually one to several higher on the stem, subcoriaceous or herbaceous, conduplicate at the base, very acute, with 3 more prominent nerves, linear to lanceolate; cauline leaves sheathing the stem, in the scapigerous species reduced to bladeless sheaths. *Inflorescence* terminal, paniculate, more or less corymbose, sometimes contracted into a single capituliform cluster. Bracts long, leaf-like, not sheathing at the base, in the scapigerous species small, almost glume-like. *Spikelets* few to very numerous, ovoid to oblong-ellipsoid, often almost globose when in fruit, terete, several- to many-flowered. *Glumes* membranous to chartaceous, spirally imbricate, glabrous, smooth, 1-nerved, muticous or with slightly excurrent midrib, some lower ones empty. *Flowers* hermaphrodite, strongly

dorsiventrally compressed. Hypogynous scales 2, hyaline, transversal, opposite, boat-shaped, ciliate on the acute keel, often (always in *Mal. spp.*?) delicately connate on the adaxial side, but readily rupturing when the fruit develops (in some extra-Mal. *spp.* also connate on the abaxial side and then forming a tube); no inner flat scales present. *Stamens* 2, in the axils of the scales (in some extra-Mal. *spp.* stamens 3). Ovary terminal. *Style* continuous with the ovary, not or hardly incrassate at the base; stigmas 2, long. *Nut* biconvex, ovate, elliptic, or almost orbicular, hard, smooth or irregularly wrinkled, with long spongy beak confluent with the nut proper.

Distr. Pantropic. In absence of a monograph the number of good species is unknown; it has usually been estimated at c. 50, but this seems much too high, judging from the numerous reductions which I felt compelled to make for the Malesian species.

Taxon. Originally *Hypolytrum* L. C. RICH. as well as *Hypaelytrum* VAHL (in all probability a mutilation of RICHARD's name) and *Tunga* ROXB. comprised species partly belonging to *Hypolytrum* partly to *Lipocarpha* in the present sense. No generic distinction was made between *Hypolytrum* and *Lipocarpha* as in both genera two hypogynous scales are found. However, the median scales in *Lipocarpha* are morphologically quite different from the transversal, sharply keeled, usually connate, ciliate scales in *Hypolytrum*, the latter in my opinion homologous with the cladophyll generally present at the base of the branches in *Cyperaceae*.

#### KEY TO THE SPECIES AND SECTIONS

1. Flowering stems solitary, arising from the centre of a tuft of normal basal leaves; usually also 1-several cauline leaves with well developed leaves present. Lower bracts of the inflorescence foliaceous, the lowest overtopping the inflorescence. 1. *Sect. Foliigera* CLARKE.
2. Inflorescence paniculate, with well developed rays.
  3. Glumes obtuse, not mucronulate,  $1\frac{1}{2}$ - $2\frac{1}{4}$  mm long. Anthers oblong,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. Nut  $1\frac{1}{2}$ -3 mm long. 1. *H. nemorum*
  3. Glumes acute, mucronulate by the slightly excurrent mid-nerve, 4-5 mm long. Anthers linear, c.  $1\frac{1}{2}$  mm long. Nut 3-4 mm long. 2. *H. compactum*
2. Inflorescence densely contracted, capituliform or capitate.
  4. Stems rather robust, 2-3 mm  $\phi$ . Glumes chartaceous, acutish, with narrow scarious margins, 4-5 mm long. Anthers c.  $1\frac{1}{2}$  mm long. Nut with a narrow acute beak. 2. *H. compactum*
  4. Stems very slender, 1- $1\frac{1}{2}$  mm  $\phi$ . Glumes thinly membranous, obtusish, 3- $3\frac{1}{2}$  mm long. Anthers  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. Nut with a broad obtusish beak. 3. *H. capitulatum*
1. Flowering stems several, scapiform, arising from the axils of the lower leaves or below the leaves; cauline leaves when present reduced to sheaths. Bracts of the inflorescence small, not foliaceous, none of them overtopping the inflorescence. 2. *Sect. Scaposa* CLARKE. 4. *H. humile*

#### 1. Section Foliigera

CLARKE, Fl. Trop. Afr. 8 (1902) 486. — *Sect. Latifolia* CHERMEZ. Fl. Madag. fam. 29 (1937) 242.

The Malesian species of this section are all very closely related.

1. *Hypolytrum nemorum* (VAHL) SPRENG. Syst. 1 (1825) 233; KERN, Blumea 9 (1958) 218; in Back. & Bakh. f. Fl. Java 3 (1968) 456. — *Carex laevis minor* RUMPH. Herb. Amb. 6 (1750) 21. — *Scirpus anomalus* RETZ. Obs. 5 (1789) 15, non *H. anomalus* STEUD. (1855). — *Schoenus nemorum* VAHL, Symb. Bot. 3 (1794) 8; En. 2 (1806) 227. — *Hypaelytrum nemorum* BEAUV. Fl. Owar. 2 (1810) 13. — *H. latifolium* L. C. RICH. in Pers. Syn. 1 (1805) 70; KUNTH, En. 2 (1837) 271; STEUD. Syn. 2 (1855) 132; MIQ. Fl. Ind. Bat. 3 (1856) 333; KURZ, J. As. Soc. Beng. 38, ii (1869) 72; MIQ. Illustr. (1870) 58; SCHEFF. Nat. Tijd. N. I. 34 (1874) 87; HOOK. f. Bot. Mag. 103 (1877) t. 6282; BENTH. Fl. Austr. 7 (1878) 339; F.-VILL. Nov. App. (1882) 309; F.V.M. Descr. Not. 7 (1886) 34; CLARKE, Fl. Br. Ind. 6 (1894) 678; J. Linn. Soc. Bot. 34 (1898) 93; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 191; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 225; CLARKE, Philip. J. Sc. 2 (1907) 108; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 100; CLARKE, Ill. Cyp. (1909) t. 106, f. 1-12; KOORD. Exk. Fl. Java 1 (1911) 184; Atlas (1922) f. 192; VALCK. SUR. Nova Guinea 8 (1912) 709; CAMUS, Fl. Gén. I.-C. 7 (1912) 171, f. 22, 2-8; MERR. Int. Rumph. (1917) 106; En. Born. (1921) 54; En. Philip. 1 (1923) 103; KÜCK. Bot. Jahrb. 59 (1924) 53; *ibid.* 69 (1938) 260; RIDL. Fl. Mal. Pen. 5 (1925) 170, *incl. var. penangense*; OHWI, Bot. Mag. Tokyo 56 (1942) 209, *incl. var. depauperatum*; S. T. BLAKE, Proc. R. Soc. Queensl. 54 (1943) 71; J. Arn. Arb. 28 (1947) 207; UITTEN, in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 52. — *Tunga diandra* ROXB. Fl. Ind. 1 (1820) 188. — *Albikia schoenoides* PRESL, Rel. Haenk. 1 (1828) 185, t. 34. — *Albikia scirpoides* PRESL, l.c., t. 35. — *H. diandrum* DIETR. Sp. Pl. 2 (1833) 365. — *H. giganteum* WALL. ex NEES in Wight, Contr. Bot. Ind. (1834) 93; BOECK. Linnaea 37 (1871) 131. — *H. schoenoides* NEES, Linnaea 9 (1934) 288;

MOR. Syst. Verz. (1846) 97; ZOLL. Syst. Verz. 1 (1854) 61. — *H. trinervium* KUNTH, En. 2 (1837) 272; STEUD. Syn. 2 (1855) 132; MIQ. Fl. Ind. Bat. 3 (1856) 332; Illustr. (1870) 59; F.-VILL. Nov. App. (1882) 308; CLARKE, Fl. Br. Ind. 6 (1894) 679; CAMUS, Fl. Gén. I.-C. 7 (1912) 173. — *H. myrianthum* MIQ. Fl. Ind. Bat. 3 (1856) 333. — *H. giganteum*  $\alpha$  *normale* O.K. Rev. Gen. Pl. 2 (1891) 751. — *H. penangense* CLARKE, Fl. Br. Ind. 6 (1894) 679; J. Linn. Soc. Bot. 34 (1898) 94; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 101. — *H. costatonux* CLARKE in Ridl. J. Str. Br. R. As. Soc. n. 46 (1906) 225; Kew Bull. add. ser. 8 (1908) 52; MERR. En. Born. (1921) 53. — *H. viridinux* CLARKE, Philip. J. Sc. 2 (1907) Bot. 109; RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 244; MERR. En. Born. (1921) 54. — *H. philippense* CLARKE, Philip. J. Sc. 2 (1907) Bot. 109; KÜK. Bot. Jahrb. 59 (1924) 53; *ibid.* 69 (1938) 261. — *H. amplexens* VALCK. SUR. Nova Guinea 8 (1912) 708. — *H. anomalum* DOMIN, Bibl. Bot. 85 (1915) 484; H. PFEIFF. Bot. Arch. 12 (1925) 450, f. 21–22; non STEUD. 1855. — *H. scirpoides* MERR. En. Philip. 1 (1923) 103; ELMER, Leaf. Philip. Bot. 10 (1938) 3534. — *H. scabrum* UITTEN, J. Arn. Arb. 20 (1939) 215; S. T. BLAKE, J. Arn. Arb. 28 (1947) 207. — *H. microcarpum* S. T. BLAKE, J. Arn. Arb. 35 (1954) 235. — Fig. 18–19.

## KEY TO THE VARIETIES

1. Spikelets brown. Glumes not or hardly scarios-margined, not lacerate. Usually stout plants.  
     *var. nemorum*
1. Spikelets whitish. Glumes with broad white scarios margins, soon lacerate. Usually small slender plants . . . . . *var. proliferum*

*var. nemorum.*

Stems usually stout (but slender specimens often occur), rigid, triquetrous upwards, smooth or scaberulous at the top, with 1–2 well developed leaves above the base, 60–120 cm by (2)–3–6 mm. Leaves longer than the stems, subcoriaceous or chartaceous, flat, more or less scabrous on the margins and midnerve beneath, 1–3½ cm wide; basal sheaths bladeless, keeled, ferruginous or brownish. Inflorescence paniculate, open to very dense, more or less corymbose, compound or decomposed, with few to very numerous spikelets, 5–15 cm across; branches rigid, divaricate, smooth or more or less scaberulous. Bracts 2–4, the lowest similar to the leaves, much overtopping the inflorescence. Spikelets oblong-ovoid or ellipsoid when in flower, 2–6 by 1–2 mm, ovoid to subglobose and 3–6 mm wide when in fruit, brown. Glumes membranous, ovate to almost orbicular, concave, obtuse, not or hardly scarios-margined, entire, mucicous, 1½–2¼ by 1¼–1½ mm. Flowers slightly shorter than the glumes. Anthers oblong, ½–¾ mm. Nut compressed-ovoid to subglobose, rugulose, sometimes almost smooth, brown or chestnut, 1½–3 by 1–2 mm (the conical paler beak included).

Distr. From India to Formosa, NE. Queensland and Polynesia, widely distributed in *Malesia*, not yet collected in the Lesser Sunda Is.

BENTHAM *l.c.* says that it is common in tropical Asia and Africa, and closely allied to if not identical with an American species. KÜKENTHAL (1924, *l.c.*) also gives the distribution as pantropical. It may be



Fig. 18. *Hypolytrum nemorum* (VAHL) SPRENG. In flower, Sanggau, W. Borneo, Sept. 1961 (photogr. Father E. ELSENER).

better indeed to consider the very closely related African and American 'species' as at most racially distinct.

Ecol. In swampy places in forests and clearings, at low and medium altitudes, up to 1200 m.

Vern. *Harassa lalaki*, *papajungan*, *S. ielat*, *M. giring-giring*, *rumpu sèndèreian*, *r. supiding*, *r. susat bèlukar*, *sèlinsing*, *M* (Mal. Pen.), *sèpèdjam*, Palembang, *pandan sinhit*, Djambi, *pandan oweng*, Simalur; Philippines: *baliis*, Tag., *bèlas*, *bubugo*, *salagsalag*, Sub., *marakikkib*, root, Neg., *paraibiau*, Sul., *alisàhis*, Buk.; New Guinea: *kikisa*, Orne lang.

Notes. VAHL's description of *Schoenus nemorum* applies very well to the variety described above, to which the two specimens in the Copenhagen Herbarium marked '*Schoenus nemorum*' by VAHL certainly belong. CLARKE and others referred the name to an African *Hypolytrum*, but it is based on an Indian plant. NELMES (Kew Bull. 1955, 71) wrongly referred it to *H. wightianum* BOECK. (Linnaea 37, 1871, 130; CLARKE, Fl. Br. Ind. 6, 1894, 678; J. Linn. Soc. Bot. 34, 1898, 93; Ill. Cyp. 1909, t. 106, f. 13–14), according to CLARKE endemic in Malabar and the Nicobars, with pale, usually glandular-punctate nut. In my opinion *H. wightianum* cannot be separated specifically from *H. nemorum*.

In *H. nemorum* in the sense here accepted certainly several races are involved. Its polymorphism has led to the segregation of numerous so-called species, which I fail to distinguish after having studied a rich material. Specimens with slenderer stems more or less scabrous at the top, and also the axis and branches of the inflorescence scabrid, with copious panicle, small few-flowered spikelets, and small (1½–2 mm long) nuts have been described as



Fig. 19. *Hypolytrum nemorum* (VAHL) SPRENG. In fruit, same place as fig. 18 (photogr. Father E. ELSENER).

*Albikia scirpoides* PRESL, *H. costatonux* CLARKE, *H. viridinux* CLARKE, *H. philippense* CLARKE, *H. amplexens* VALCK. SUR., *H. scabrum* UITT., and *H. microcarpum* S. T. BLAKE. However different the specimens from the Philippines and New Guinea may be from typical *H. nemorum*, none of the characters indicated are reliable, and there are too many intermediates to consider them even as a well-marked subspecies. *H. myrianthum* MIQ. with copious panicle and small nuts was already withdrawn by MIQUEL himself. In the type of *H. costatonux* CLARKE the flowering stem arises from the centre of the tuft of normal leaves, not laterally as was indicated by CLARKE; longitudinally ribbed fruits often occur in mature specimens of *H. nemorum*. *H. amplexens* VALCK. SUR. is said to differ also by the hypogynous scales connate on one side. These scales are always connate on the adaxial side in *H. nemorum* during anthesis (see also Note under *H. capitulatum*). According to UITTEN *H. scabrum* is amongst others characterized by the leaves beautifully spotted with reddish brown. The same mottling I observed in otherwise typical specimens of *H. nemorum*, in the related African *H. purpurascens* CHERMEZ., and in the American *H. sylvaticum* POEPP. & KUNTH (see CHERMEZON, Bull. Soc. Bot. Fr. 80, 1933, 508; NELMES, Kew Bull. 1955, 69).

*H. penangense* CLARKE differs from normal *H. nemorum* only by the longer, cylindrical spikelets. Already RIDLEY (1907) supposed it to be abnormal *H. latifolium*. Obviously the abnormal shape of the spikelets is due to the attack of a fungus, like in *Thoracostachyum bancanum* 'var.' *longispica* CLARKE.

Remarkable specimens of *H. nemorum* were collected by FORSTEN in 1841 in the Moluccas and by WINKLER (n. 2107) in Borneo. Besides the central stem they possess lateral leafless scapes with very short bracts.

**var. proliferum** (BOECK.) KERN, *stat. nov.* — *H. proliferum* BOECK. Linnaea 37 (1871) 126; CLARKE, Fl. Br. Ind. 6 (1894) 679; J. Linn. Soc. Bot. 34 (1898) 94; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 225; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 101; CLARKE, Ill. Cyp. (1909) t. 104, f. 1–5; CAMUS, Fl. Gén. I.-C. 7 (1912) 173; MERR. En. Born. (1921) 54; RIDL. Fl. Mal. Pen. 5 (1925) 170; H. PFEIFF. Bot. Arch. 12 (1925) 451, f. 19.

Stems usually slender, (20–)30–60(–90) cm by 1–2(–4) mm. Leaves herbaceous or subcoriaceous, (3–)6–8(–20) mm wide. Inflorescence very variable in size, with few (rarely numerous) spikelets. Spikelets glistening white; upper margin of the glumes conspicuously white-scarious, pellucid, soon lacerate. Beak of the nut more acute than in the typical variety.

Distr. Tonkin (CAMUS, l.c.); in *Malesia*: Banka, Riouw & Lingga Arch., Malay Peninsula (P. Penang, Pahang, Johore, Singapore, Karimon Is.), Borneo.

Ecol. In damp woods, on margins of lakes and along streams, up to 800 m.

Note. In its typical form readily recognizable by its slender weak habit, narrow leaves, small inflorescence, and the white margins of the glumes almost completely covering the brown bases. Some stout specimens I have referred to this variety on account of the white spikelets. As there is nothing proliferous in the plant, BOECKELER's epithet is inappropriate.

**2. Hypolytrum compactum** NEES & MEY. [Linnaea 9 (1834/5) 288, *nom. nud.*] ex KUNTH, En. 2 (1837) 271; NEES, Nov. Act. Ac. Caes. Leop.-Car. 16, suppl. 2 (= 19, suppl. 1) (1843) 73; STEUD. Syn. 2 (1855) 132; MIQ. Fl. Ind. Bat. 3 (1856) 333; KURZ, J. As. Soc. Beng. 38, ii (1869) 75; BOECK. Linnaea 37 (1871) 127; F.-VILL. Nov. App. (1882) 309; MERR. Philip. J. Sc. 1 (1906) Suppl. 29; CLARKE, Philip. J. Sc. 2 (1907) Bot. 109; WINKL. Bot. Jahrb. 44 (1910) 523?; MERR. En. Philip. 1 (1923) 102; KÜK. Bot. Jahrb. 59 (1924) 53; *ibid.* 69 (1938) 261; MERR. En. Born. (1921) 53?; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 155; OHWI, Bot. Mag. Tokyo 56 (1942) 209; S. T. BLAKE, J. Arn. Arb. 28 (1947) 207. — *H. xerocarpum* CLARKE, Kew Bull. add. ser. 8 (1908) 52; VALCK. SUR. Nova Guinea 8 (1912) 709. — *Mapania thoreliana* CAMUS, Not. Syst. 1 (1910) 250; Fl. Gén. I.-C. 7 (1912) 178.

Stems rather stout, rigid, subtriquetrous, smooth, sometimes slightly scaberulous just below the inflorescence, with a well-developed leaf in or above the middle, 30–60 cm by 2–3 mm. Leaves about as long as or longer than the stem, subcoriaceous, flat, more or less scabrous on the margins in the upper part, pale green, 7–14 mm wide, two lateral nerves very

prominent beneath; basal sheaths bladeless, acute, keeled, ferruginous or brownish. *Inflorescence* compound, with several to many spikelets, contracted into a very dense, ovoid to globose mass, 2-5 by  $1\frac{1}{2}$ -4 cm, the lowest cluster often somewhat remote, rarely the whole inflorescence somewhat open. Bracts 4-7, the lowest similar to the leaves, up to 60 cm long. *Spikelets* oblong to linear-oblong, ovoid when in fruit, many-flowered, ferruginous-brown, 7-9 by  $1\frac{1}{2}$ -3 mm, 5-6 mm wide when in fruit. *Glumes* chartaceous, narrowly ovate to lanceolate, acutish, minutely mucronulate by the slightly excurrent midnerve, with narrow scarious margins, 4-5 by  $1\frac{3}{4}$ -2 mm. *Flowers* slightly shorter than the glumes, narrowly elliptic; scales ciliate-setulose on the keels, the setulae more or less confluent. *Anthers* linear c.  $1\frac{1}{2}$  mm. *Nut* compressed, ovate, with keeled margins, irregularly rugulose, acuminate into the acute pale beak, 3-4 by  $1\frac{1}{4}$ -2 mm.

*Distr.* Andamans (CLARKE, *l.c.*), Indo-China, Queensland (Cape York Peninsula); in *Malesia*: Borneo, Philippines (Palawan, Mindoro, Luzon), Celebes (Kendari), Moluccas (Ceram), New Guinea (*incl.* Japen, Waigeo, and Aru Is.).

*Ecol.* In rain-forests at low altitude, up to 750 m. *Vern.* *Nomahagino*, Sorong, *gafaat*, Waigeo; *Philip.*: *tuhog-dalag*, Tag.

**3. *Hypolytrum capitulatum* VALCK. SUR. ex CLARKE,** Kew Bull. add. ser. 8 (1908) 51; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 155. — Fig. 20.

*Stems* very slender, subtriquetrous, smooth, (10-)40-60 cm by  $1-1\frac{1}{2}$  mm, with 1-2 well developed leaves in or above the middle, rarely in small specimens cauline leaves absent. *Leaves* about as long as the stems, herbaceous, flat, 5-8 mm wide, two lateral nerves rather prominent, margins scaberulous towards the top; basal sheaths bladeless, keeled, ferruginous or brownish. *Inflorescence* simple, densely contracted, capitate or almost so, with 3-6 spikelets, 1-2 cm across. Bracts 2-3, the lowest similar to the leaves, 5-15 cm long, the upper ones much shorter. *Spikelets* ovoid, many-flowered, rufescent, (5-)8-10 by 5-7 mm when in fruit. *Glumes* thinly membranous, ovate-elliptic, obtusish, with rather broad pellucid margins, purplish lineolate,  $3-3\frac{1}{2}$  by  $1\frac{1}{2}-1\frac{3}{4}$  mm, the inconspicuous midnerve ending somewhat below the apex. *Flowers* slightly shorter than the glumes, narrowly elliptic,  $2\frac{1}{2}-3$  by 1 mm; scales minutely ciliate on the keel. *Anthers* linear,  $\frac{1}{2}-\frac{3}{4}$  mm. *Nut* compressed, elliptic, longitudinally rugose, rufous or brown, 3-4 by  $1\frac{1}{2}-2$  mm (beak included), the beak obtusish, slightly longer than the nut proper.

*Distr.* *Malesia*: W. Borneo (Bukit Singkadjang, Sendabai Lakes), only 3 collections.

*Ecol.* Margins of lakes, clearings, at low altitude.

*Note.* Closely allied to *H. compactum*; differing from it in the much slenderer habit, the thinly membranous obtusish glumes with pellucid margins, the smaller anthers, the different shape of the beak of the nut, and the minutely ciliate scales. Glumes with pellucid margins are also found in *H. nemorum* var. *proliferum*, but here the inflorescence is not capitate, the spikelets are smaller, and the glumes and nuts much smaller.

CLARKE, *l.c.*, calls the hypogynous scales connate only at the base. However, they are fused on the

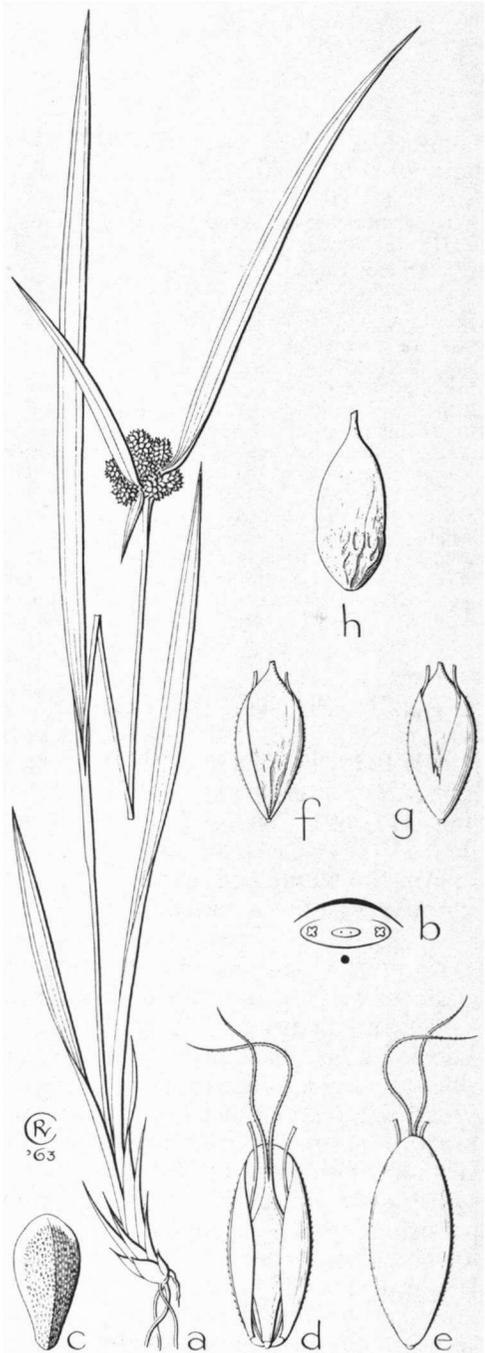


Fig. 20. *Hypolytrum capitulatum* VALCK. SUR. ex CLARKE. a. Habit,  $\times\frac{1}{2}$ , b. floral diagram, c. glume,  $\times 6$ , d-e. flower,  $\times 10$ , f-g. nut enveloped by scale, frontal and dorsal views, h. ditto, scale removed, both  $\times 6$ .

adaxial side almost to the top, which is probably the case in all Malesian *spp.* They are torn up quite or almost to the base by the ripening nut, which is enclosed by the persistent scales.

## 2. Section Scaposa

CLARKE, Fl. Trop. Afr. 8 (1902) 487. — *Sect. Africana* CHERMEZ. Fl. Madag. fam. 29 (1937) 240.

4. *Hypolytrum humile* (STEUD.) BOECK. Linnaea 37 (1871) 128; SCHEFF. Nat. Tijd. N. I. 34 (1874) 58; UITTEN, Rec. Trav. Bot. Néerl. 33 (1936) 153; in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 52; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 456. — *Pandanophyllum humile* HASSK. [ex MOR. Syst. Verz. (1846) 98; ZOLL. Syst. Verz. 1 (1854) 61, nom. nud.] ex STEUD. Syn. 2 (1855) 134; MIQ. Fl. Ind. Bat. 3 (1856) 334. — *Mapania multispicata* (non RIDL. J. Str. Br. R. As. Soc. n. 23, 1891, 15) CLARKE, Fl. Br. Ind. 6 (1894) 682 p.p., *quoad specim. jav. et. synon.*; J. Linn. Soc. Bot. 34 (1898) 95, p.p. (*quoad specim. jav.*); KOORD. Ekk. Fl. Java 1 (1911) 203; H. PFEIFF. Bot. Arch. 12 (1925) 449.

*Scapes* lateral, obtusely trigonous to almost terete, leafless, smooth, 10–35 cm by 1–2 mm, at the base with a few acute ferruginous sheaths up to 4 cm long, often also a bladeless sheath in or about the middle. *Leaves* subcoriaceous, linear, acute, up to

more than 1 m by 10–20 mm, margins and midnerve scabrous at the top. *Inflorescence* globose, obovoid, or ellipsoid, consisting of 10–60 densely congested spikelets,  $1\frac{1}{2}$ – $2\frac{1}{2}$  cm long. Bracts 3–4, similar to the basal sheaths of the scape, subspathaceous, shorter than to as long as the inflorescence, the lowest often somewhat remote. *Spikelets* (when in flower) oblong, acute, many-flowered, 5–8 by c. 2 mm. *Glumes* ovate to oblong-ovate, obtuse, with membranous-pellucid apex and margins,  $2\frac{1}{2}$ –3 by  $1\frac{3}{4}$ –2 mm. *Flowers* about as long as the glumes. *Anthers* linear, 1– $1\frac{1}{2}$  mm long. *Nut* slightly flattened, ellipsoid or obovoid, acuminate at both ends, apiculate, longitudinally and subreticulately rugose,  $2\frac{1}{2}$ –3 by  $1\frac{3}{4}$ –2 mm, fuscous.

Distr. *Malesia*: West Java.

Ecol. In damp forests, 400–1000 m.

Vern. *Irateun hahajaman*, S.

## 8. SCIRPUS

LINNÉ, Sp. Pl. 1 (1753) 47; Gen. Pl. ed. 5 (1754) 26; KUNTH, En. 2 (1837) 157; STEUD. Syn. 2 (1855) 83; BOECK. Linnaea 36 (1869–70) 475; B. & H. Gen. Pl. 3 (1883) 1049; PAX in E. & P. Nat. Pfl. Fam. 2, 2 (1887) 111; CLARKE, Kew Bull. add. ser. 8 (1908) 111; BEETLE, Am. J. Bot. 27 (1940) 63–64; *ibid.* 28 (1941) 469–476, 691–700; *ibid.* 29 (1942) 82–88, 653–656; *ibid.* 30 (1943) 395–401; *ibid.* 31 (1944) 261–265; *ibid.* 33 (1946) 660–666. — Fig. 21–31.

For the numerous generic names here referred to *Scirpus*, see under the synonymy of the sections.

Annual or perennial herbs of very various habit, stoloniferous or caespitose, glabrous or only minutely hairy in the inflorescence. *Stems* erect or procumbent, sometimes floating or submerged, terete to acutely angled, usually smooth. *Leaves* either with more or less developed blades, or reduced to bladeless sheaths; ligule membranous or wanting. *Inflorescence* terminal, but often pseudolateral, capitate or anthelate, or consisting of a single spikelet. Involucral bracts 1–several, in pseudolateral inflorescences seemingly a continuation of the stem, in 1-spiculate inflorescences usually reduced and glume-like. *Spikelets* solitary or clustered, terete or angular, usually many-flowered. Rachilla persistent, not winged. *Glumes* spirally arranged, acropetally caducous, the lower 1–3 often empty. *Flowers* hermaphrodite, the upper ones often tabescent. Perianth consisting of 1–6(–11) setaceous (rarely flattened, scale-like) bristles, not rarely absent. *Stamens* 1–3; anthers linear or oblong, with shortly produced, smooth or bristly connective. *Style* caducous, continuous with the ovary (neither separated by a constriction nor different in texture, but passing insensibly into the top of the ovary), glabrous or very rarely sparsely fimbriate, hardly or not dilated at the base; stigmas 2–3. *Nut* 2- or 3-sided, obovate or elliptic to oblong



Fig. 21. *Scirpus junghuhnii* MIQ. a. Habit,  $\times \frac{1}{2}$ , b. spikelet,  $\times 4$ , c. glume, d. flower, e. nut, all  $\times 8$  (a-b, d VAN STEENIS 8484, c, e JÜNGHUHN 477).

in outline, often apiculate, smooth or rugulose; epidermal cells hexangular or vertically oblong to linear.

Distr. A large genus (possibly 200 spp.) of worldwide distribution, in *Malesia* 21 spp. Several Malesian species are mountain plants with disjunct areas. *Scirpus beccarii* and *S. junghuhnii* are apparently endemics of Sumatra.

Ecol. Most species prefer open, wet localities: swamps, pools, ditches, wet rice-fields, lake-shores, and stream banks; *S. confervoides* grows always, *S. fluitans* often submerged. In Malesia prolificating inflorescences have been observed in *S. mucronatus*, *S. inundatus*, and *S. subtilissimus*.

Uses. Only a few species have some economic importance. The stems of *S. grossus* and *S. mucronatus* are often used for making cheap but durable mats and bags; *S. juncooides* is sometimes used as a green food for cattle.

Notes. The genus is in comparison with other genera of the family heterogeneous. It comprises all the species of subfamily *Cyperoideae* left after the more or less homogeneous genera have been taken out. The only characteristics of *Scirpus* are the spirally arranged glumes and the style not articulated with the ovary.

Several attempts have been made to split it up into smaller genera, or to divide it into subgenera. These efforts have failed in my opinion, as the resulting genera or subgenera are just as well heterogeneous, and often agglomerates of very dissimilar species. The only way out is obviously to distinguish a number of sections each comprising a set of probably allied species, a procedure also employed by CHERMEZON in the Fl. Madag. The Malesian species are tentatively arranged in such sections, to which a separate key has been added.

Specific delimitation offers several difficulties, as many species appear to be racially differentiated, especially when isolated populations have been formed in mountainous country. A good example of this is the *S. subcapitatus* complex. It is remarkable that certain characters, generally accepted as important in *Cyperaceae*, as for example the structure of the perianth bristles, are less constant in such complexes, which are doubtless genetically coherent.

In some cases specific limits turn out to be less distinct than was assumed formerly; for instance *S. mucronatus* spp. *clemensii* from New Guinea distinctly diminishes the demarcation between *S. mucronatus* and *S. juncooides*.

#### KEY TO THE SECTIONS REPRESENTED IN MALESIA

1. Spikelets not squarrose. Perennials, or annuals with nuts longer than  $\frac{1}{2}$  mm.
2. Involucral bracts several, foliaceous, flat.
3. Hypogynous bristles inconspicuous, shorter than the glumes, or absent.
  4. Stems nodeless. Leaves basal. Sp. 1 . . . . . 1. Sect. *Actinoscirpus*
  4. Stems noded, leafy.
    5. Spikelets usually not numerous, large. Glumes 5–7 mm long. Spp. 2–3 . . . . . 2. Sect. *Maritimi*
    5. Spikelets very numerous in a decomposed umbelliform inflorescence, small. Glumes much smaller. Sp. 4 . . . . . 3. Sect. *Scirpus*
3. Hypogynous bristles strongly elongating after anthesis, at maturity greatly exceeding the glumes, strongly curled and entangled. Sp. 5 . . . . . 4. Sect. *Trichophorum*
2. Involucral bract non-foliaceous, single, either looking like a continuation of the stem, or glume-like, or absent.
  6. Stems branched, procumbent, floating, or submerged.
    7. Hypogynous bristles absent. Spikelet several-flowered. Spp. 6–8 . . . . . 5. Sect. *Eleogiton*
    7. Hypogynous bristles present. Spikelet 1(–2)-flowered. Sp. 9 . . . . . 6. Sect. *Confervoides*
  6. Stems not branched, erect.
    8. Inflorescence terminal, subtended by the outer caducous, often mucronate glume. Sp. 10.
      7. Sect. *Baeothryon*
    8. Inflorescence pseudolateral, subtended by a persistent bract looking like a continuation of the stem.
      9. Stems tall, usually stout. Bristles usually present. Nut (1–)  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm long, smooth or transversely ridged. Spp. 11–17 . . . . . 8. Sect. *Schoenoplectus*
      9. Stems low, setaceous. Bristles absent. Nut smooth,  $\frac{3}{4}$ – $1\frac{1}{2}$  mm long. Spp. 18–20 . . . . . 9. Sect. *Isolepis*
1. Spikelets squarrose by the recurved mucros of the glumes. Small tufted annuals with nuts c.  $\frac{1}{2}$  mm long. Sp. 21 . . . . . 10. Sect. *Micranthi*

#### KEY TO THE SPECIES

1. Spikelets strongly squarrose by the recurved mucros of the glumes. Small tufted annual with nuts c.  $\frac{1}{2}$  mm long . . . . . 21. *S. squarrosus*
1. Spikelets not squarrose. Perennials, or annuals with nuts longer than  $\frac{1}{2}$  mm.
  2. Bracts several, flat, leaf-like, not continuous with the stem. Stout perennials with well developed leaf-blades.
    3. Leaves all basal. Stem nodeless. Stigmas 3. Nut trigonous . . . . . 1. *S. grossus*
  3. Stems noded, leafy.
    4. Glumes  $1\frac{1}{4}$ – $2\frac{1}{2}$  mm long. Nut  $\frac{3}{4}$ – $1\frac{1}{4}$  mm long.
      5. Perianth-bristles strongly elongating after anthesis, finally greatly exceeding the glumes, curled and entangled. Stigmas 3. Nut trigonous . . . . . 5. *S. wichural*
      5. Perianth-bristles inconspicuous, shorter than the glumes, straight, or absent. Stigmas 2 (rarely in some flowers 3). Nut planoconvex or unequally biconvex . . . . . 4. *S. ternatanus*
    4. Glumes 4–7 mm long. Nut larger.
      6. Inflorescence terminal, umbelliform. Glumes pubescent outside. Bristles straight, retrorsely scabrous. . . . . 2. *S. maritimus*

6. Inflorescence consisting of up to 4 distant corymbiform partial inflorescences. Glumes papillose or hispidulous at the top. Bristles flexuous, antrorsely scabrous. . . . . 3. *S. junghuhnii*
2. Inflorescence subtended by a single bract similar to and continuous with the stem (sometimes a very small patent second bract present), or bracts absent or glume-like.
7. Inflorescence pseudolateral because of the bract looking like a continuation of the stem.
8. Glumes 5-7 mm long, pubescent on the back . . . . . 2. *S. maritimus*
8. Glumes at most 4 mm long, glabrous (but sometimes with ciliate margins).
9. Stem and bract transversely septate, the bract longer than the stem proper (hence inflorescence seemingly inserted in the lower half of the stem) . . . . . 16. *S. articulatus*
9. Stem and bract not septate, the bract shorter than the stem (hence inflorescence seemingly inserted in the upper half of the stem).
10. Perianth absent.
11. Nut conspicuously transversely wavy-ridged, black when mature. Inflorescence sometimes capitate, but usually with one of the rays 1(-4) cm long. . . . . 17. *S. lateriflorus*
11. Nut smooth, stramineous to light brown when mature. Inflorescence capitate or consisting of a single spikelet, sometimes proliferous.
12. Stems branched. Style 2-cleft, incompletely 3-cleft, and 3-cleft on the same specimen. Nuts planoconvex and triquetrous on the same specimen,  $1\frac{3}{4}$ -2 mm long. . . . . 7. *S. beccarii*
12. Stems unbranched. Style 3-cleft, very rarely in some flowers 2-cleft. Nuts triquetrous, usually c. 1 mm long, rarely up to  $1\frac{1}{2}$  mm.
13. Stamens 3. Anthers  $\frac{3}{4}$ -1 mm long, with distinctly produced connective. Inflorescence partly hidden by the dilated base of the bract . . . . . 18. *S. aucklandicus*
13. Stamens 1-2(-3). Anthers  $\frac{1}{2}$  mm long, with hardly produced connective. Inflorescence not hidden by the base of the bract.
14. Rhizome filiform, shortly creeping, forming mats. Stems filiform, terete,  $\frac{1}{5}$ - $\frac{1}{3}$  mm thick. Leaf-blades well developed. Spikelets solitary or in clusters of 2-3 . . . . . 19. *S. subtilissimus*
14. Without definite rhizome. Stems tufted, strongly compressed,  $\frac{1}{2}$ -1 mm wide. Leaves usually all reduced to their sheaths, only the upper one often with a very short, rarely  $\pm$  elongated blade. Spikelets (except in depauperate specimens) in clusters of 3-12 . . . . . 20. *S. inundatus*
10. Perianth present, consisting of setaceous bristles or ligulate-spatulate scales.
15. Inflorescence anthelate, open. Glumes often notched at the apex, mucronate. Connective of the anthers with a fimbriate appendage.
16. Hypogynous bristles 5-6, setaceous, retrorsely scabrous. Glumes distinctly ciliate.
11. *S. lacustris*
16. Hypogynous scales usually 4 (3-5), ligulate-spatulate, plumosely fringed with antrorse hairs. Glumes only microscopically ciliate . . . . . 12. *S. litoralis*
15. Inflorescence capitate. Glumes not emarginate, apiculate. Connective of the anthers with smooth appendage.
17. Stems sharply triquetrous, usually rather stout (up to 8 mm thick) . . . . . 13. *S. mucronatus*
17. Stems terete or more or less 4-5-angular, but not sharply triquetrous, usually slender.
18. Involucral bract very short (1-2 cm), hardly overtopping the inflorescence. Glumes distinctly many-nerved (especially when dry). Stems usually rather coarse.
13. *S. mucronatus ssp. clemensii*
18. Involucral bract slender, 5-15 cm long, much overtopping the inflorescence. Glumes faintly nerved (only the midnerve distinct). Stems slender.
19. Bristles shorter to slightly longer than the nut, the longest 2-2 $\frac{1}{2}$  mm. Nut biconvex (only low-convex on the ventral side). Anthers 1-1 $\frac{1}{2}$  mm long. . . . . 14. *S. juncoideis*
19. Bristles all distinctly longer than the nut. Nut planoconvex (the ventral side flat). Anthers  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. . . . . 15. *S. wallichii*
7. Inflorescence terminal, or stems and branches terminated by a single spikelet.
20. Spikelets 1(-2)-flowered. Submerged very delicate aquatic, the stem-nodes with numerous thread-like sterile stems not to be confused with leaves . . . . . 9. *S. confervoides*
20. Spikelets more-flowered. Habit quite different, if an aquatic each node with one true leaf.
21. Leaf-blades well developed. Perianth-bristles absent. Stigmas 2; nut planoconvex or biconvex. Stems procumbent or floating, branched, the branches bearing a single terminal spikelet.
22. Nut planoconvex, sharply angled,  $1\frac{1}{4}$ -1 $\frac{1}{2}$  by c. 1 mm. Spikelets 3-6 by 2-3 mm . . . . . 6. *S. fluitans*
22. Nut slightly biconvex in the centre, thinner towards the margins and there thickened into an obtuse edge,  $1\frac{1}{4}$ -2 by c. 1 mm. Spikelets 5-8 by 3-4 mm . . . . . 8. *S. crassiusculus*
21. Leaf-blades reduced to an up to 2 cm long (usually much shorter) mucro. Perianth-bristles 6. Stigmas 3; nut trigonous. Stems erect, not branched. Inflorescence consisting of 1-5 spikelets.
10. *S. subcapitatus*

### 1. Section Actinoscirpus

OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 98. — *Hymenochaeta* BEAUV. ex LESTIB. Ess. Fam. Cyp. (1819) 43?; *emend.* NEES, Edinb. New Phil. J. 17, n. 34 (1834) 264; Linnaea 9 (1834) 293; in Wight, Contr. Bot. Ind. (1834)

110. — *Sect. Hymenochaeta* BEETLE, *Am. J. Bot.* 33 (1946) 661.

Type species: *S. grossus* L. f.

**1.** *Scirpus grossus* LINNÉ f. *Suppl.* (1781) 104; PRESL, *Rel. Haenk.* 1 (1828) 195; STEUD. *Syn.* 2 (1855) 87; MIQ. *Fl. Ind. Bat.* 3 (1856) 307 (*f. minor*); BOECK. *Linnaea* 36 (1870) 723; CLARKE, *Fl. Br. Ind.* 6 (1893) 659; Ill. *Cyp.* (1909) t. 49, f. 12; VALCK. *SUR. Nova Guinea* 8 (1912) 705; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 136; MERR. *En. Philip.* 1 (1923) 117; RIDL. *Fl. Mal. Pen.* 5 (1925) 162; BACK. *Onkr. Suiker.* (1928) 151, t. 153; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18 (1944) 122; BEETLE, *Am. J. Bot.* 33 (1946) 661; BACK. *Bekn. Fl. Java (em. ed.)* 10 (1949) fam. 246, p. 10; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 205; RAYMOND, *Nat. Canad.* 84 (1957) 117; KERN in BACK. & Bakh. *f. Fl. Java* 3 (1968) 458. — *S. kysoor* (non ROXB.) LLANOS, *Fragm. Pl. Filip.* (1851) 20 (*'kisoor'*); F.-VILL. & NAVES in Blanco, *Fl. Filip.* ed. 3, 4<sup>1</sup> (1880) 14 (*'kisoor'*). — *Cyperus difformis* (non L.) BLANCO, *Fl. Filip.* (1837) 32; ed. 2 (1845) 22; ed. 3, 1 (1877) 41. — *S. aemulans* STEUD. [in *Zoll. Syst. Verz.* 1 (1854) 62, *nom. nud.*] *Syn.* 2 (1855) 87. — *S. maritimus* var. *aemulans* MIQ. *Fl. Ind. Bat.* 3 (1856) 306. — *S. grossus* var. *kysoor* (non CLARKE, *Fl. Br. Ind.* 6, 1893, 660) CLARKE, *Philip. J. Sc.* 2 (1907) Bot. 100. — *Schoenoplectus grossus* PALLA, *Allg. Bot. Zeitschr.* 17 (1941) Beil. 3. — Fig. 22.

Stout perennial, with rather long stolons ending in small tubers. *Stems* erect, sharply triquetrous with concave sides, septate-nodulose, smooth, or slightly scaberulous at the top, 80–200 cm tall, up to 2½ (at the top ½–1) cm thick. *Leaves* basal, 50–180 by up to 3 cm, in the lower half keeled, triquetrous, in the upper half almost flat, acute, very gradually acuminate, strongly septate-nodulose, with more or less scabrous margins; sheaths spongy, stramineous. *Inflorescence* terminal, large, corymbiform, decomposed to supradecomposed. Involucral bracts several, patent, flat, at least 2 of them far overtopping the inflorescence, 15–70 mm. Primary rays several, unequal, spreading, scaberulous. *Spikelets* numerous, solitary, sessile and peduncled, ovoid to oblong-ovoid, acutish, densely many-flowered, 4–10 by 3½–4 mm. *Glumes* membranous, appressed, concave, ovate to broadly ovate, obtuse, mucicous or very shortly mucronulate, with strong green midnerve and ferruginous to reddish brown nerveless sides, more or less puberulous, glabrescent, minutely ciliolate, 2½–3 by 1¾–2 mm. *Bristles* 4–6, retrorsely scabrous, incurved at the top, as long as to somewhat longer than the nut. *Stamens* 3; anthers linear, 1¼–1½ mm. *Style* glabrous; stigmas 3. *Nut* trigonous,



Fig. 22. *Scirpus grossus* L. f. in Rawa Tembaga, a lowland swamp near Bekasi (E of Djakarta) with *Nymphoides indica* (L.) O.K. (photogr. VAN STEENIS, 1941).

obovate, apiculate, smooth, brown,  $1\frac{1}{4}$ – $1\frac{3}{4}$  by c. 1 mm.

Distr. Throughout India (except the NW), SE. Asia. S. China, Bonin Is., tropical Australia (N. Territory, N. Queensland), probably throughout *Malesia*, but not yet collected in the Lesser Sunda Is. and the Moluccas.

Ecol. In swampy or inundated localities, pools, ditches, rice-fields, often abundant. 0–850 m.

Uses. Often used for making sleeping mats, bags, and baskets; the stems are dried after removal of the ribs, then flattened, and bleached in the sun.

Vern. *Mëndarong*, *mënsiang* (*mansiang*, *mësiang*, *musiang*, *masiang*), *mënurong*, *murong*, *M*, *beba-wangan*, *walingi*, *S*, *lingi*, *wlingèn*, *wlingi*, *wlingian*, *J*, *balingeh*, *Md*, *basiang*, *Bat.*, *mansiro daun*, *Menangk.*, *rèduk*, *Palembang*, *bundung*, *W*. Borneo, *kaingas*,

*kawasar*, *tinorong*, *Alf*. Minah.; Philip.: *agás*, *bang-kúang*, *ragiudiu*, *Bik.*, *bagads*, *báki-báki*, *balángót*, *P*. Bis., *balakbák*, *Pang.*, *tikug*, *Mbo*, *tikiu*, *titiu*, *Tag*.

Note. In *var. kysoor* (ROXB.) CLARKE, *Fl. Br. Ind.* 6 (1893) 660 (*S. kysoor* ROXB. Hort. Beng. 1814, 6; *Fl. Ind.* 1, 1820, 235. — *S. grossus f. kysoor* BEETLE, *Am. J. Bot.* 33, 1946, 661) from India the glumes are more distinctly mucronate, the weaker bristles villous to almost plumose by longer weaker hairs, and the stems usually scabrous at the top. According to CLARKE the hairs of the bristles are multicellular (see also *Ill. Cyp.* t. 49, f. 11), which is incorrect. CLARKE (1907) recorded this variety from the Philippines and "many examples from the Malayan Peninsula and Archipelago", but I have not seen any Malasian specimen. It is obviously restricted to India.

## 2. Section Maritimi

CHERM. *Fl. Madag. fam.* 29 (1937) 155, *descr. gall.* — *Scirpus b. Euscirpus a. Phyllanteli* BEURL. *Pl. vasc. Scand.* (1859) 55. — *Sect. Euscirpus* B. & H. *Gen. Pl.* 3 (1883) 1051, *p.p.* — *Bolboschoenus* PALLA in Koch, *Syn. Deut. u. Schw. Fl. ed.* 3, 3 (1904) 2531. — *Sect. Bolboschoenus* BEETLE, *Am. J. Bot.* 29 (1942) 82.

Type species: *S. maritimus* L.

2. *Scirpus maritimus* LINNÉ, *Sp. Pl.* 1 (1753) 51; KUNTH, *En.* 2 (1837) 167; BOECK. *Linnaea* 36 (1870) 722; BENTH. *Fl. Austr.* 7 (1878) 335; CLARKE, *Fl. Br. Ind.* 6 (1893) 658.

Perennial, with horizontally creeping rhizome forming hard, ovoid tubers at the nodes. *Stems* erect, approximate or solitary from a tuberous base, slender to stout, triquetrous, striate, smooth, or scaberulous just below the inflorescence, 15–180 cm tall and 1–15 mm thick towards the base. *Leaves* cauline, stiff, flat, with revolute margins when dry, scabrid on the margins, very gradually narrowed into the long, triquetrous tip, (1–)2–12 mm wide, the upper ones overlapping the inflorescence; ligule absent; sheaths tight, smooth, with slightly emarginate, truncate or somewhat produced mouth, the basal ones greyish brown. *Inflorescence* very variable in development, umbelliform with several unequal, smooth, up to 10 cm long primary rays and short secondary rays, to capitate, sometimes even reduced to a single spikelet. Bracts 1–several, foliaceous, dilated at the base, not sheathing, overtopping the inflorescence, the longest usually erect, the remainder oblique. *Spikelets* solitary or in clusters of 3–10, ovoid to oblong-ovoid, terete, densely many-flowered, acutish, ferruginous to castaneous, 1–2(–4) cm long. *Glumes* membranous, appressed, not keeled, ovate or elliptic, emarginate or lacerate at the top, pubescent outside, 4–7 mm long, 1(–3)-nerved, the strong midnerve produced into an antorsely scabrid awn. *Bristles* (0–)3–6, retrorsely scabrous, caducous. *Stamens* 3; anthers linear, 2–5 mm long, with bristly appendage of the connective. *Style* long, glabrous; stigma: 2 or 3 (the number often differing in flowers of the same spikelet). *Nut* two-sided or trigonous, obovate, brown to blackish,  $2\frac{1}{2}$ –4 mm long.

Distr. *Scirpus maritimus* in the wide sense here accepted is widely distributed over the tropical and temperate regions of the whole world; from *Malesia*

only 4 collections are known: Philippines (Luzon: Laguna), New Guinea (NE. New Guinea: Western Highlands and Mt Sarawaket); Papua: Lower Fly River).

Ecol. In lowland rice-field (Laguna), in tall reed swamp (Western Highlands, c. 2500 m), on loose sand on open foreshores (Lower Fly R.), in moist localities at c. 1150 m (Mt Sarawaket).

Notes. Extremely polymorphous. The type is from Europe. In European specimens the style is trifid as a rule, but usually there are bifid styles in some basal flowers of each spikelet. Specimens in which digynous flowers prevail are very rare in Europe (*var. digynus* GODR. *Fl. Lorr.* 3, 1844, 91). The Malasian plants are strictly or predominantly digynous.

*S. maritimus var. fluviatilis* TORR. *Ann. Lyc. Nat. Hist. N.Y.* 3 (1836) 325, mainly characterized by its constantly trigonous nuts and 6 persistent hypogynous bristles, may be a good species [*S. fluviatilis* (TORR.) A. GRAY, *Man. Bot. ed.* 1 (1848) 527; KOYAMA, *J. Fac. Sc. Un. Tokyo III*, 7 (1958) 334]. It is widely distributed (N. America, Japan, Korea, Manchuria, China, and Indo-China), but not known from *Malesia*.

The specimens from the Western Highlands in New Guinea are stout, c. 180 cm tall, with pale green leaves up to 12 mm wide, a compound inflorescence with c. 8 unequal, up to 10 cm long rays, solitary, 10–15 mm long spikelets, c. 4 mm long glumes, 3–5 caducous bristles, 3–3½ mm long anthers, and 2 or 3 stigmas in flowers of the same spikelet. They may come nearest to a taxon described from New Zealand as *S. medianus* COOK, *Trans. Proc. R. Soc. New Zeal.* 76 (1947) 569, also with bifid and trifid styles in the same spikelet, but with a simple inflorescence and probably a different nut.

The Philippine plants may belong to the E. Asian form known as *S. planiculmis* FR.SCHM., *Reisen*

Amurl. (1868) 190; KOYAMA, J. Fac. Sc. Un. Tokyo III, 7 (1958) 330. The stems are up to 55 cm tall, 2–3 mm thick, the capitate inflorescence consists of 3–4 spikelets, the glumes are c. 6 mm long, the anthers 4 mm, and there are c. 4 caducous bristles; no fruits present; style 2-fid.

The Lower Fly River collection consists of very slender, narrow-leaved specimens (stems 30–60 cm by 1–1½ mm; leaves 1–1½ mm wide; inflorescence a single, pseudolateral spikelet; glumes 5–7 mm; bristles 2–3; nut lenticular, strongly compressed, slightly concave on the inner side, 3¾–4 mm long). I take them for a somewhat depauperated form of *S. planiculmis*. S. T. BLAKE, J. Arn. Arb. 35 (1954) 204, referred them with some doubt to *S. affinis* ROTH in R. & S. Syst. Veg. 2 (1817) 140 [*S. strobilinus*

ROXB. Fl. Ind. 1 (1820) 222] from Central, S. and SE. Asia, which has large, straw-coloured spikelets, and smaller nuts.

In my opinion neither *S. planiculmis* nor *S. affinis* can be separated specifically from *S. maritimus*.

3. *Scirpus junghuhnii* MIQ. Fl. Ind. Bat. 3 (1856) 307; Suppl. 1 (1861) 261; KÜK. Bull. Jard. Bot. Btzig 16 (1940) 301, incl. var. *minor* KÜK.; in Fedde, Rep. 53 (1944) 102. — Fig. 21, 23.

Perennial with very short rhizome. Stems erect, usually stout, trigonous, smooth, up to 150 by 1 cm. Leaves basal and cauline, coriaceous, flat, gradually tapering into a long scabrous tip, 10–25 mm wide; margins scabrous in the upper part; lower sheaths shining fuscous; ligule a dark, minutely ciliolate rim.



Fig. 23. *Scirpus junghuhnii* MIQ. in a mountain heath (*blang*) on Mt Goh Lembuh (Gajo Lands, N. Sumatra), at c. 3000 m (photogr. VAN STEENIS).

*Inflorescence* large, decompound, up to 70 by 20 cm, consisting of (1-)2-4 distant corymbiform partial inflorescences with hispidulous rachis; peduncles erect, rigid, trigonous, smooth, subtended by long leafy bracts, the lowest up to 25 cm; secondary branches divaricate, up to 3 cm, tertiary ones slender, up to 2 cm, with 3-7 spikelets. *Spikelets* approximate, at right angles to the rachis, easily caducous, shortly peduncled, often curved upwards, oblong-lanceolate, somewhat angular, acute, loosely 8-10-flowered, 10-15 by  $2\frac{1}{2}$ -3 mm. *Glumes* rather firm, slightly keeled, oblong to narrowly lanceolate, acute, shortly mucronate (mucro c.  $\frac{1}{2}$  mm), with strong midnerve, papillose or hispidulous at the top, auricled at the base, rufous to dark brown, 5-6 by  $2\frac{1}{2}$ -3 mm, the margins more or less inrolled when dry. *Bristles* (4-)6, delicate, flexuous, antrorsely scabrous, 5-6 mm. *Stamens* 3; filaments strongly elongated after

anthesis; anthers linear,  $2\frac{1}{2}$ - $3\frac{1}{2}$  mm. *Style* c. 5 mm long, fimbriate at the top, slightly dilated at the base; stigmas 2 and 3 in the same spikelet, somewhat shorter than to almost as long as the style. *Nut* biconvex or trigonous, elliptic, shortly annulate at the top, densely punctulate, brown,  $1\frac{3}{4}$ -2 by 1 mm.

*Distr.* *Malesia*: N. & Central Sumatra (Atjeh: Gajo Lands; Lubuk Raja, Mt Malintang, Mt Kerintji).

*Ecol.* In brushwood, on river banks, on open heaths, at high altitudes (2200-3400 m), often gregarious.

*Notes.* KÜKENTHAL's *var. minor* is merely a less robust form of very high altitudes, without systematic value.

KÜKENTHAL placed this remarkable species in the affinity of *S. maritimus*; however, it probably represents a separate section.

### 3. Section Scirpus

*Seidlia* OPIZ, Beitr. Naturgesch. 11 (1826) 349. — *Sect. Euscirpus* B. & H. Gen. Pl. 3 (1883) 1051, p.p. — *Sect. Phylloscirpus* PAX in E. & P. Nat. Pfl. Fam. 2, 2 (1887) 112. — *Sect. Sylvatici* CLARKE, Fl. Br. Ind. 6 (1893) 661, p.p. — *Sect. Seidlia* CLARKE, Kew Bull. add. ser. 8 (1908) 113, p.p. — *Sect. Taphrogeton* RCHB. Fl. Germ. Excurs. 1 (1830) 79; BEETLE, N. Am. Fl. 18 (1947) 486.

*Type species*: *S. sylvaticus* L.

4. *Scirpus ternatanus* REINW. ex MIQ. Fl. Ind. Bat. 3 (1856) 307; in De Vriese, Pl. Ind. Bat. Or. (1857) 140 ('*ternatensis*'); CLARKE, J. Linn. Soc. 34 (1898) 83; Philip. J. Sc. 2 (1907) Bot. 100; Ill. Cyp. (1909) t. 52, f. 1-4 ('*ternatensis*'); MERR. En. Philip. 1 (1923) 118; KÜK. Bot. Jahrb. 69 (1938) 259; Bull. Jard. Bot. Btzg III, 16 (1940) 301; OHWI, Bot. Mag. Tokyo 56 (1942) 204; Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 108; KÜK. in Fedde, Rep. 53 (1944) 101; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 10; S. T. BLAKE, J. Arn. Arb. 35 (1954) 203; RAYMOND, Nat. Canad. 84 (1957) 115; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 458. — *S. chinensis* MUNRO in Seem. Bot. Voy. Herald (1857) 423; CLARKE, Fl. Br. Ind. 6 (1893) 662; VALCK. SUR. Nova Guinea 8 (1912) 705; RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 242, non OSBECK, 1757. — *Hypolytrum minus* RIDL. l.c. 244, p.p.

Perennial. *Stems* erect, rather stout to stout, trigonous, triquetrous just below the inflorescence, leafy, smooth, several-noded, 50-200 cm by 4-8 mm. *Leaves* rigid, flat, gradually acuminate, the cauline ones often overtopping the stem,  $\frac{3}{4}$ - $2\frac{1}{2}$  cm wide; margins scaberulous; ligule a membranous rim, or absent in the upper leaves; lower sheaths shining fuscous to castaneous. *Inflorescence* terminal, umbelliform, copiously branched, compound to supra-decompound, usually dense, 10-25 cm across. *Involucral bracts* 3-5, leaf-like, overtopping the inflorescence, the lowest up to 50 cm. *Primary rays* several, divaricate, very unequal, smooth, up to 10 cm. *Spikelets* in clusters of 4-10, ovoid to oblong-

ovoid, terete, obtuse, rarely acutish, very densely many-flowered, brown,  $2\frac{1}{2}$ -6 by 2-3 mm. *Glumes* membranous, tightly appressed, hardly keeled, ovate to almost orbicular, obtuse, submucronulate, 1-nerved,  $1\frac{1}{4}$ - $2\frac{1}{4}$  by  $1-1\frac{1}{2}$  mm. *Bristles* 0-3(-6), delicate, sparsely antrorsely scaberulous in the upper half. *Stamens* 2-3; anthers oblong-linear,  $\frac{3}{2}$ -1 mm. *Style* glabrous; stigmas 2, rarely in some flowers 3. *Nut* plano-convex or unequally biconvex, strongly dorsiventrally compressed, obovate, minutely apiculate, smooth, pale brown,  $\frac{3}{4}$ -1 by  $\frac{1}{2}$ - $\frac{3}{4}$  mm.

*Distr.* From the NW. Himalaya through S. Asia to S. China, Formosa, the Ryu Kyu Is. and Bonin Is.; in *Malesia*: throughout Sumatra, W. Java (Mt Gedeh-Pangerango; near Talun between Mt Papan-dajan and Mt Kantjana), Philippines (Luzon, Mindanao), Borneo (Mt Kinabalu; Sabah: Mt Trusmadi), Celebes, Moluccas (Ternate), New Guinea.

*Ecol.* In open wet places, in thickets and forests, on banks of streams, often in large clumps, chiefly between 800 and 2000 m; in New Guinea up to 2650 m, but also collected at 30 m (PULLE 152).

*Vern.* *Riat sèla*, Minahasa; Philip.: *daatan*, Tag., *sagari*, Bag., *sāngānga*, Klg., *siilak*, Ig.

*Note.* Very variable as to size of spikelets and glumes, and number of bristles. According to CLARKE the plants are often stoloniferous when growing in swamps, and their leaf-sheaths occasionally perforated by descending aerial stolons (like in *S. radicans* SCHK.).

4. Section *Trichophorum*

(PERS.) A. GRAY, *Man. Bot.* ed. 5 (1867) 565. — *Trichophorum* PERS. *Syn.* 1 (1805) 69; NEES, *Linnaea* 9 (1834) 293. — *Sect. Sylvatici* CLARKE, *Fl. Br. Ind.* 6 (1893) 661, *p.p.* — *Sect. Seidlia* CLARKE, *Kew Bull. add. ser.* 8 (1908) 113, *p.p.*

Type species: *S. cyperinus* (L.) KUNTH.

5. *Scirpus wichurai* BOECK. *Linnaea* 36 (1870) 729; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18 (1944) 107; RAYMOND, *Nat. Canad.* 84 (1957) 115. — *S. eriophorum* (non MICHX) CLARKE, *Fl. Br. Ind.* 6 (1893) 661. — *S. asiaticus* BEETLE, *Am. J. Bot.* 33 (1946) 662.

Perennial; rhizome short, without stolons. *Stems* erect, rather stout to stout, rigid, obtusely trigonous to subterete, leafy, smooth, 5–9-noded with brownish nodes, 100–150 cm by 5–8 mm. *Leaves* shorter than the stems, basal and cauline, rather rigid, flat, gradually acuminate, scabrous on the margins, 5–20 mm wide; ligule a membranous rim; lower sheaths brownish. *Inflorescence* consisting of 1–4 anthelas, the terminal one large, decompound or supradecomponent, up to 25 by 20 cm, the lateral ones when present axillary, much smaller. Involucral bracts 2–3, similar to the leaves, often overtopping the inflorescence. Primary rays scaberulous at the top, up to 15 cm, secondary ones and peduncles of the spikelets very scabrous. *Spikelets* very numerous, solitary or partly in clusters of 2–4, ellipsoid to oblong-ellipsoid, terete, obtuse, rather densely many-flowered, 3–6 by 2–3 mm. *Glumes* membranous, appressed, not keeled, ovate, rufous, acute or minutely mucronulate, 1-nerved,  $1\frac{1}{2}$ –2 by  $1\frac{1}{2}$  mm. *Bristles* 6, delicate, strongly elongated, curled and entangled after anthesis, smooth below, antorsely scaberulous near the top. *Stamens* 1–2; anthers linear, c. 1 mm. *Style* glabrous, c.  $\frac{3}{4}$  mm; stigmas 3, papillose.

*Nut* compressed-trigonous, elliptic or slightly obovate, with a distinct c.  $\frac{1}{4}$  mm long beak, smooth, stramineous to pale brown,  $1\frac{1}{4}$  (beak included) by 0.6 mm.

*Distr.* India (E. Himalaya, Khasia, Assam), Annam, S. China, Korea, Japan, in *Malesia* only in Sumatra: Atjeh (Peuet Sago, Bur ni Gêrêdong), West Coast Res. (Mt Kerintji).

*Ecol.* Swampy places in forests, on river banks, 1700–2200 m.

*Note.* The Malesian specimens perfectly agree with the type collection and additional materials from India. *Scirpus wichurai* belongs to an intricate group of mutually closely related taxa, which has another centre of development in North America. It comes near to the American *S. cyperinus* (L.) KUNTH and *S. rubricosus* FERN. (= *S. eriophorum* MICHX, *nom. illeg.*). It differs by the ovate (not oblong-ovate) glumes, the shorter, somewhat firmer bristles scabrid in the upper part, and the larger nuts. Possibly these differences are too trifling to warrant specific distinctness, the more so as some Japanese specimens show a clear approach to the American taxa in having narrower glumes, and bristles only denticulate at the very top. Also OHWI refers the Japanese plants to *S. wichurai*. The question whether all the species distinguished can be upheld, or should be considered racial differentiations of one linneont can only be solved by comparative study of extensive materials from the whole area of the group.

5. Section *Eleogiton*

(LINK) PAX in E. & P. *Nat. Pfl. Fam.* 2, 2 (1887) 111. — *Eleogiton* LINK, *Hort. Berol.* 1 (1827) 284. — *Sect. Monostachyi* \**Fluitantes* CLARKE, *Kew Bull. add. ser.* 8 (1908) 111. — *Sect. Fluitantes* CHERM. *Fl. Madag. fam.* 29 (1937) 142, *descr. gall.*

Type species: *S. fluitans* L.

6. *Scirpus fluitans* LINNÉ, *Sp. Pl.* 1 (1753) 48; BOECK. *Linnaea* 36 (1870) 485; BENTH. *Fl. Austr.* 7 (1878) 325; CLARKE, *Fl. Br. Ind.* 6 (1893) 653; BACK. *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 9; KERN in BACK. & BAKH. *f. Fl. Java* 3 (1968) 458; STEEN. *Mt Fl. Java* (1972) t. 14:16. — *Isolepis fluitans* R. BR. *Prod.* (1810) 221. — *Eleogiton fluitans* LINK, *Hort. Berol.* 1 (1827) 284. — *Eleogiton curvulus* NEES in WIGHT, *Contr. Bot. Ind.* (1834) 110. — *Isolepis curvula* KUNTH, *En.* 2 (1837) 189; ZOLL. *Syst. Verz.* 1 (1854) 62 ('*curvata*' *err. typ.*). — *Eleogiton fluitans* var. *fasciculata* MIQ. *Fl. Ind. Bat.* 3 (1856) 313, *incl. f. curvula et f. tenerior.*

Perennial. *Stems* weak, filiform, fascicled,  $\frac{3}{4}$ –1 mm thick, sympodially branched (each superposed branch terminated by a spikelet), floating and then

up to 40 cm long, or in terrestrial forms much shorter, creeping or procumbent, and often forming dense cushion-like tufts. *Leaves* narrowly linear, almost setaceous, 3–4-nerved, rather acute, 1–7 cm by  $\frac{1}{2}$ –1 mm. Peduncles pseudolateral, up to 12 cm long, each bearing a single, terminal, ebracteate, ovoid to oblong, 5–10-flowered, 3–6 mm long, 2–3 mm wide *spikelet*. *Glumes* membranous, appressed, concave, ovate to broadly ovate, obtusish, mucous, faintly many-nerved,  $2\frac{1}{2}$ – $\frac{3}{2}$  by  $1\frac{1}{2}$  mm; margins hyaline; sides often purplish. *Bristles* none. *Stamens* 2–3; anthers oblong,  $\frac{1}{2}$ –1 mm. *Stigmas* 2. *Nut* planoconvex, elliptic or slightly obovate, sharply angled, smooth, pale brown, shortly apiculate,  $\frac{1}{4}$ – $1\frac{1}{2}$  by 0.9–1 mm.

*Distr.* Widely distributed throughout the Old

World, from Europe to Australia, in *Malesia*: W. Java (Mts Gedeh-Pangerango and Papandajan), Central Java (Dieng plateau), E. Java (Mts Lawu, Argopuro, Tengger, and Smeru, Jang plateau).

Ecol. In swampy localities, along streams, or submerged in shallows, often abundant, 1600–3200 m.

Vern. *Reubeu*, Md.

Note. In the Javan plants the number of stamens is usually 2, only some flowers are triandrous. The European plants are constantly triandrous; they have usually still narrower, 3-nerved leaves, with less distinct cross-nerves.

7. *Scirpus beccarii* BOECK. Bot. Jahrb. 7 (1886) 275; KERN, *Blumea* 8 (1955) 161. — Fig. 24.

Very near to *S. fluitans*. Spikelets solitary or 2 together, 6–7 by 3 mm, subtended by an erect bract as though continuing the peduncle, as long as or somewhat longer than the spikelet(s), up to 1½ cm, auricled at the base. Stamens 3. Style 2-cleft, incompletely 3-cleft, or 3-cleft (on the same specimen). Nut planoconvex, or with a raised dorsal angle, or sharply triquetrous, slightly larger than in *S. fluitans* (1¾–2 by 1–1¼ mm), and longer-beaked.

Distr. *Malesia*: Sumatra (Atjeh: Mt Losir, Mt Kemiri; Ophir Distr.: Mt Talamau; Mt Singgalang).

Ecol. In tufts along the shore of lakes, in and along brooklets, 2750–3300 m.

Note. BOECKELER placed the species in the affinity of *S. varians* BOECK. (according to Ind. Kew. = *S. inundatus* POIR.) and *S. supinus* L., presumably on account of the pseudolateral inflorescence. Its true relationship, however, is clearly with *S. fluitans* L. In Sumatra *S. fluitans* is apparently absent and replaced by *S. beccarii*.

8. *Scirpus crassiusculus* (HOOK. f.) BENTH. Fl. Austr. 7 (1878) 326; KÜK. Bot. Jahrb. 69 (1938) 258; S. T.

BLAKE, J. Arn. Arb. 35 (1954) 205. — *Isolepis crassiuscula* HOOK. f. Fl. Tasm. 2 (1860) 86, t. 143. — *S. fluitans* (non L.) CLARKE, Kew Bull. (1899) 113?; VALCK. SUR. Nova Guinea 8 (1912) 704?; HOOGL. *Blumea*, Suppl. 4 (1958) 235. — *S. pseudo-fluitans* MAKINO, Bot. Mag. Tokyo 19 (1905) 28; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 100. — *S. fluitans* L. ssp. *pseudo-fluitans* KOYAMA, J. Fac. Sc. Un. Tokyo III, 7 (1958) 326.

Perennial. Stems tufted, erect, or creeping and rooting at the nodes, or submerged and elongated, much coarser than in the closely related *S. fluitans*. Flowering branches 5–15 cm long. Leaves linear, longer and usually broader (1–2 mm) than in *S. fluitans*. Spikelet ovoid, terete, acute, c. 15-flowered, 5–8 by 3–4 mm. Glumes membranous, appressed, with somewhat prominent keel, oblong-ovate to oblong, obtusish, mucous, many-nerved, with purplish margins, 3½–4 by 1½–2 mm. Bristles none. Stamens 3; anthers linear, c. 1 mm; connective shortly produced, smooth. Style c. 1½ mm; stigmas 2, about as long as the style. Nut strongly compressed, slightly biconvex in the centre, thinner towards the margin and there thickened into an obtuse edge, elliptic, distinctly apiculate, brown, 1¾–2 by c. 1 mm.

Distr. SE. Australia, Tasmania, New Zealand; also known from a single locality in Japan (Honshu: Iwaki, Kanayama); in *Malesia*: New Guinea (W. New Guinea: Lake Habbema, Mt Wilhelmina; NE. New Guinea: Morobe Distr., Mt Sarawaket; Papua: Central Div., Mt Albert Edward; Eastern Highlands: Mt Wilhelm; Milne Bay Distr.: Duri; Mt Giluwe, Sugarloaf complex).

Ecol. On sand bars or submerged in slow-moving streams, in shallows of alpine tarns, on wet peaty soil, in dense patches, 1800–3900 m.

Vern. *Iwarud*, *kasump*, Minda lang.

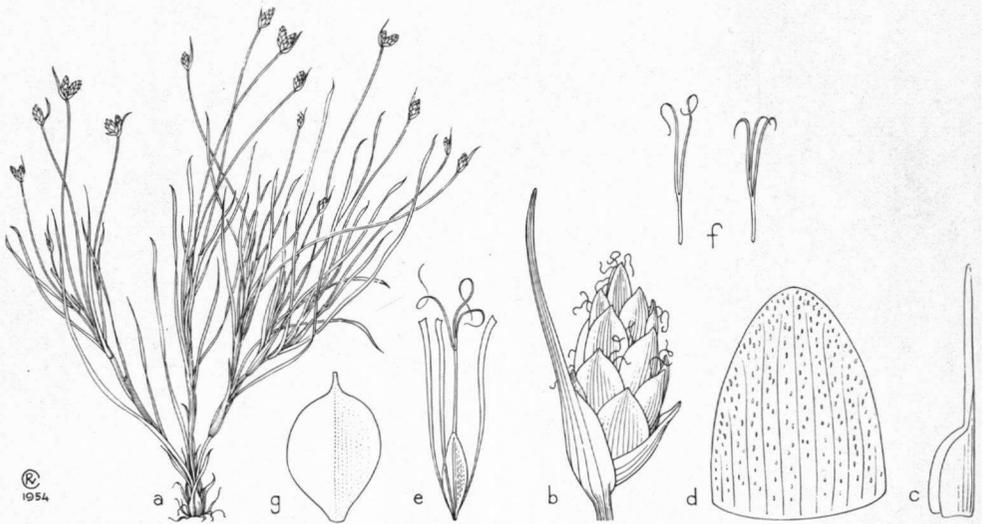


Fig. 24. *Scirpus beccarii* BOECK. a. Habit,  $\times \frac{1}{2}$ , b. spikelet, c. bract, both  $\times 5$ , d. glume, e. flower, f. style, g. nut, all  $\times 10$  (a–g DOCTERS VAN LEEUWEN 3977).

6. Section *Confervoides*

CHERM. Fl. Madag. fam. 29 (1937) 143. — *Websteria* S. H. WRIGHT, Bull. Torr. Bot. Club 14 (1887) 135.

Type species: *S. confervoides* POIR.



Fig. 25. *Scirpus confervoides* POIR. a. Habit,  $\times \frac{4}{3}$ , b. spikelet, c. glume, d. deflorate flower, all  $\times 5$  (after STONE).

9. *Scirpus confervoides* POIR. in Lamk, Encycl. 6 (1804) 755; KUNTH, En. 2 (1837) 173, *p.p.*; BOECK. *Linnaea* 36 (1870) 487; CHERM. Fl. Madag. fam. 29 (1937) 143; BEETLE, N. Am. Fl. 18 (1947) 496; STONE, Mal. Nat. J. 24 (1971) 91, f. 1. — *Baeothryon confervoides* A. DIETR. Sp. Pl. 2 (1833) 94. — *Schoenus confervoides* WILLD. ex KUNTH, En. 2 (1837) 173, in *syn.* — *Eleocharis? confervoides* MIQ. Fl. Ind. Bat. 3 (1856) 303, *quoad basion.* — *S. ruppioides* THW. ex SAUV. Fl. Cub. (1871) 80, in *obs.* — *S. submersus* SAUV. Anal. Acad. Ci. Habana 8 (1871) 79; Fl. Cub. (1873) 175; CLARKE, Fl. Br. Ind. 6 (1893) 653; in Dur. & Schinz, Consp. Fl. Afr. 5 (1895) 631; in Urban, Symb. Antill. 2 (1900) 91. — *Rhynchospora ruppioides* BENTH. in Hook. Ic. Pl. 14 (1881) 31, t. 1344. — *Websteria limnophila* S. H. WRIGHT, Bull. Torr. Bot. Club 14 (1887) 135; TRIMEN in Hook. f. Handb. Fl. Ceylon 5 (1900) 78. — *Websteria submersa* BRITTEN, Bull. Torr. Bot. Club 15 (1888) 99; SUESSENG. Bot. Jahrb. 73 (1943) 122; LEON, Fl. Cuba 1 (1946) 204; EITEN, Phytologia 20 (1970) 276. — Fig. 25.

Submerged aquatic rooting in the mud, flaccid, tassel-like when lifted out of the water, with filiform branched stems bearing at the nodes pseudo-whorled fascicles of numerous sterile, leaf-like side-stems. Stems terete, smooth, less than  $\frac{1}{2}$  mm thick; lower internodes elongate, upper shorter; side-stems ultra-

capillary,  $2\frac{1}{2}$ –10 cm long, with a tubular, short, hyaline sheath at the base. *Spikelets* solitary, on filiform peduncles from amongst the sterile stems, oblong-lanceolate, 1(–2)-flowered, 6–12 mm long; peduncles emergent from the water, smooth, 4-fistular,  $1\frac{1}{2}$ –30 cm long, the base often rooting and enclosed in a hyaline sheath. *Glumes* 2, membranous, erect, narrowly lanceolate, acute, green with hyaline margins, 7–10 mm long, the lower one 3-nerved, empty, the upper one longer, 1-nerved, with a bisexual flower. *Bristles* 6–11, very delicate, retrorsely barbed, yellow. *Stamens* 3; anthers linear, with shortly produced connective. *Style* very slender, halfway bifid, the stigmas filiform. *Nut* biconvex, broadly obovate, smooth, long-beaked, 3–3 $\frac{1}{2}$  mm long (beak included), pale brown.

Distr. Subtropical and tropical America (Florida, Guatamala, Cuba, Guyana, Paraguay), tropical Africa, Madagascar, Ceylon; in *Malesia*: Malay Peninsula (Trengganu: Kp. Jambu Bongkok; Pahang: Tasek Bera); generally local and rare.

Not known from Java; the records for Java and Surinam refer respectively to *Eleocharis retroflexa* (see p. 534) and *Eleocharis flaccida* URB. (*cf.* UTTIEN in Fl. Surinam 1, 1934, 111).

Ecol. Oligotroph lakes in lowland swamps, in Malaya associated with *Pandanus helicopus* and *Lepironia articulata*.

### 7. Section Baeothryon

(A. DIETR.) B. & H. Gen. Pl. 3 (1883) 1050. — *Baeothryon* A. DIETR. Sp. Pl. 2 (1833) 89. — *Sect. Monostachyi* \*\**Caespitosi* CLARKE, Kew Bull. add. ser. 8 (1908) 111, *p.p.* — *Sect. Anthelophorum* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 95. — *Sect. Paucispicati* BEETLE, Am. J. Bot. 33 (1946) 664.

Type species: *S. caespitosus* L.

10. *Scirpus subcapitatus* THWAITES, En. Pl. Zeyl. (1864) 351; BOECK. *Linnaea* 36 (1870) 704; CLARKE, Fl. Br. Ind. 6 (1893) 661; Ill. Cyp. (1909) t. 51, f. 1–2; KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 301, *incl. f. rigidus* KÜK. et *var. triangularis* KÜK.; in Fedde, Rep. 53 (1944) 101; BEETLE, Am. J. Bot. 33 (1946) 665; KERN, Reinwardtia 4 (1956) 89; RAYMOND, Nat. Canad. 84 (1957) 142. — *S. caespitosus* (*non* L.) F.v.M. Trans. R. Soc. Vict. 1 (1889) 35. — *S. clarkei* STAFF, Trans. Linn. Soc. Bot. 4 (1894) 244; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 224; J. Fed. Mal. St. Mus. 6 (1915) 192; STAFF in Gibbs, J. Linn. Soc. Bot. 42 (1914) 174; BEETLE, Am. J. Bot. 33 (1946) 664; S. T. BLAKE, J. Arn. Arb. 35 (1954) 206. — *S. pakapakensis* STAFF in Gibbs, J. Linn. Soc. Bot. 42 (1914) 174. — *S. clarkei* var. *pakapakensis* BEETLE, Am. J. Bot. 33 (1946) 665. — Fig. 26–28.

Perennial; glabrous. Rhizome woody, very shortly creeping. Stems slender, erect, rigid, densely to very densely tufted, terete to more or less distinctly triangular, grooved, smooth, or obscurely scaberrulous just below the inflorescence, 10–75 cm by  $\frac{1}{2}$ –1 $\frac{1}{4}$  mm, the base clothed with tight brown sheaths bearing an up to 2 cm long (usually much shorter) smooth or scabrid mucro; orifice of the sheaths obliquely truncate, with a hyaline border. *Inflorescence* terminal, consisting of 1–5 spikelets, when 1-spiculate often ebracteate, otherwise the

first spikelet sessile, the others on short smooth peduncles, and with an involucreal bract sheathing the stem, 5–10 mm long, with a smooth or scabrid, up to 4 mm long mucro. *Spikelets* oblong-lanceolate, terete, acute, 5–10-flowered, 5–15 by c. 2 mm. *Glumes* membranous, oblong-lanceolate, slightly keeled, the outermost obtusish, the inner more acuminate, ferruginous-brown, ( $2\frac{1}{2}$ –)3 $\frac{1}{2}$ –5 by  $1\frac{1}{2}$ –2 $\frac{1}{2}$  mm, with 3 yellowish nerves and hyaline margins. *Bristles* 6, very slender, flexuous, scabrid near the top, much longer than the nut, (3)–5–7 mm. *Stamens* 3; anthers 1–3 mm long, apiculate. *Style* glabrous; stigmas 3, papillose. *Nut* compressed-trigonal, elliptic to oblong, apiculate, smooth, fuscous,  $1\frac{3}{4}$ –2 $\frac{1}{4}$  by 0.6–1 mm; epidermal cells minute, rounded to hexagonal.

Distr. India, Thailand, Ceylon, Annam, S. China, Formosa, in *Malesia*: N. and Central Sumatra, Malay Peninsula (Trengganu: Padang; Pahang: Mt Tahan), N. Borneo (Mt Kinabalu), New Guinea (Papua: Mt Albert Edward, Owen Stanley Range, Mt Wilhelm, Mt Knutsford; Sugarloaf complex: HOOGLAND & SCHODDE 7108); two subspecies in Luzon and Celebes.

Ecol. In open boggy, sandy or rocky places (grassland slopes, forest glades, banks of streams, mountain heaths), often dominant, 1200–4000 m. Fig. 27–28.

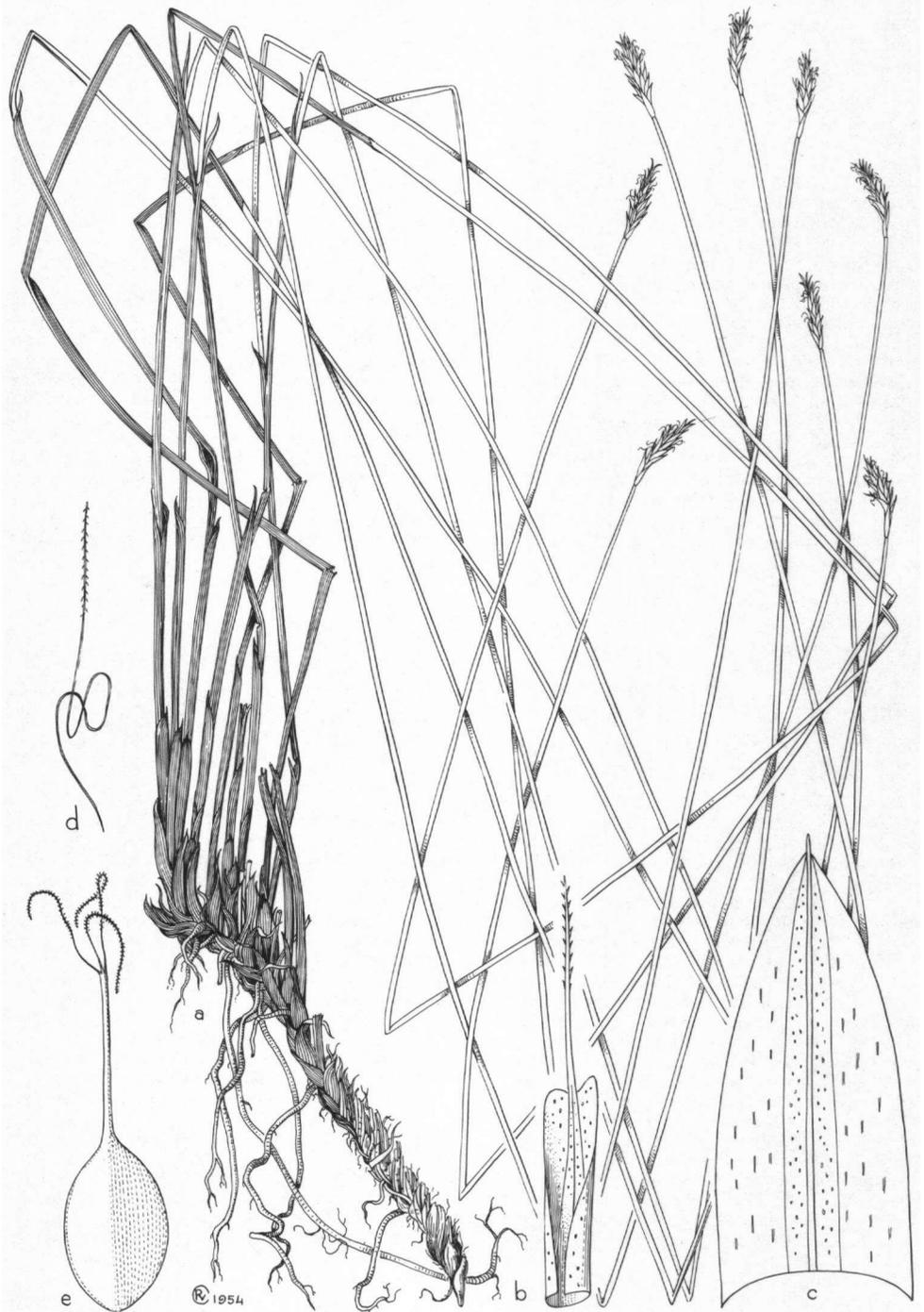


Fig. 26. *Scirpus subcapitatus* THW. a. Habit,  $\times \frac{2}{3}$ , b. involucre, c. glume, d. perianth bristle, e. immature nut with style and stigmas (a-e BÜNNEMEIJER 2908).



Fig. 27. *Scirpus subcapitatus* tufts (dark) in mountain heaths (*blang*) on Mt Kemiri at c. 3300 m (Gajo Lands, N. Sumatra) (photogr. VAN STEENIS, 1937).

Notes. I fail to trace dividing lines between *S. subcapitatus* s. str., *S. clarkei* (said to differ by the very slender habit, the more advanced development of the lamina of the leaves, the solitary spikelets, and the more distinctly barbellate perianth-bristles), and *S. pakapakensis* (differing from *S. subcapitatus* by the loose inflorescence and the more distinctly barbellate bristles).

More distinct geographical races are:

*ssp. pulogensis* (MERR.) KERN, Reinwardtia 4 (1956) 90. — *S. pulogensis* MERR. Philip. J. Sc. 5 (1910) Bot. 333; En. Philip. 1 (1923) 118.

Stems very slender, 1-spiculate. Perianth-bristles smooth, about as long as the nut.

Distr. *Malesia*: Philippines: Luzon (Benguet, Mt Pulog).

Ecol. In very damp ravines and on open grassy slopes, 2400–2700 m.

*ssp. celebicus* KERN, Reinwardtia 4 (1956) 90, f. 1. — Fig. 29.

Stems very slender, 1-spiculate. Spikelet very small, 3–5 by 1–2 mm. Glumes ovate or broadly ovate,  $1\frac{3}{4}$ –2 by  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm. Perianth-bristles distinctly papillose, 2–3 mm long, unequal, the outer ones flat, straight or slightly flexuous, the inner ones filiform, strongly flexuous. Nut  $1\frac{1}{4}$ – $1\frac{1}{2}$  by 0.75–0.9 mm.

Distr. *Malesia*: SW. Celebes, Subdiv. Enrekang (Latimodjong Mts; B. Rante Mario, Masimbollong, Pokapindjang).

Ecol. Open moist localities, 2700–3000 m.

## 8. Section Schoenoplectus

RCHB. Ic. Fl. Germ. 8 (1846) 40 *ex B. & H. Gen. Pl.* 3 (1883) 1051. — *Pterolepis* SCHRAD. Gött. Gel. Anz. (1821) 2071. — *Schoenoplectus* PALLA, Sitz. Ber. Zool. Bot. Ges. Wien 37 (1888) 49; Bot. Jahrb. 10 (1888) 298. — *Sect. Scirpus (proper)* CLARKE, Fl. Br. Ind. 6 (1893) 655, *p.p.* — *Sect. Euscirpus* CLARKE, Kew Bull. add. ser. 8 (1908) 112, *p.p.* — *Sect. Littorales* CHERM. Fl. Madag. fam. 29 (1937) 155, *descr. gall.* — *Sect. Mucronati* CHERM. *l.c.* 151, *descr. gall.* — *Sect. Lacustres* BEETLE, Am. J. Bot. 28 (1941) 691. — *Sect. Pterolepis* BEETLE, N. Am. Fl. 18 (1947) 502. — *Sect. Actaeogeton* RCHB. Fl. Germ. Excurs. 1 (1830) 78; BEETLE, N. Am. Fl. 18 (1947) 498.

Type species: *S. lacustris* L.



Fig. 28. Tuft of *Centrolepis fascicularis* LABILL. invaded by *Scirpus subcapitatus* THW. and *Gentiana* sp. (one flower) on Mt Losir (Gajo Lands, N. Sumatra), c. 3250 m (photogr. VAN STEENIS, 1937).

11. *Scirpus lacustris* LINNÉ, Sp. Pl. 1 (1753) 48.

In *Malesia* only:

*ssp. validus* (VAHL) KOYAMA, Can. J. Bot. 40 (1962) 927. — *S. validus* VAHL, En. 2 (1806) 268; BEETLE, Am. J. Bot. 28 (1941) 693 (*quoad specim. philipp. p.p. min.*; MERRILL 1792); S. T. BLAKE, Trans. R. Soc. S. Austr. 67 (1943) 54; J. Arn. Arb. 35 (1954) 205. — *S. triquetus* var. *segregatus* CLARKE, Fl. Br. Ind. 6 (1893) 658, *saltem quoad specim. nov.-guin.*; VALCK. SUR. Nova Guinea 8 (1912) 704. — *S. litoralis* (non SCHRAD.) K. SCH. & LAUT. Fl. Schutzgeb. (1901) 195, *p.p.* — *S. lacustris* (non L.) MERR. Philip. J. Sc. 5 (1910) Bot. 172; En. Philip. 1 (1923) 117, *p.p.* — *S. tabernaemontani* (non GMEL.) KÜK. Bot. Jahrb. 59 (1924) 51; OHWI, Bot. Mag. Tokyo 56 (1942) 203; RAYMOND, Nat. Canad. 84 (1957) 139. — *S. lacustris* var. *validus* KÜK. in Fedde, Rep. 23 (1926) 200.

Perennial. Rhizome stout, horizontally creeping, scaly. Stems rather approximate, stout, erect, terete or nearly so, soft and easily compressed, smooth,  $\frac{1}{2}$ –2 m by  $\frac{1}{2}$ –2 cm at the base. Leaves reduced to the sheathing bases, rarely the uppermost with an up to 10 cm long blade. Inflorescence pseudolateral, compound or subdecompound, consisting of many spikelets, 5–10(–15) cm long. Involucral bract erect, shorter than the inflorescence, 2–5 cm. Primary rays rather stiff, scabrous on the edges, in the upper part up to 5 cm; secondary rays scabrous, up to 2 cm. Spikelets solitary or partly in clusters of 2–3, ovoid to oblong-ovoid, rather acute, densely many-flowered, fulvous to deep brown, 5–10 by 4–5 mm. Glumes scarious, appressed, ovate to oblong-ovate, with prominent midrib excurrent into a short mucro, more or less notched at the top, more or less ciliate on the margins, 3–4 by 2–2½ mm. Bristles 5–6, slightly longer than the nut, retrorsely scabrous. Stamens 3; anthers linear, 1½–2 mm, the connective produced into a triangular-ovate bearded appendage. Style bifid. Nut planoconvex (with low rounded back), obovate, apiculate, smooth, greyish black, c. 2 by ¼–1½ mm.

Distr. Widely distributed in the countries bordering the Pacific Ocean, in *Malesia*: Philippines (Luzon: Cagayan, Zambales, Benguet), New Guinea.

Ecol. In open marshes, open sandy foreshores, freshwater swamps, 0–1900 m.

Uses. In N. Luzon used for weaving mats.

Vern. Philip.: *tikér*, Ilk.

Note. *Scirpus lacustris* in the wider sense is a highly polymorphous cosmopolitan species. The

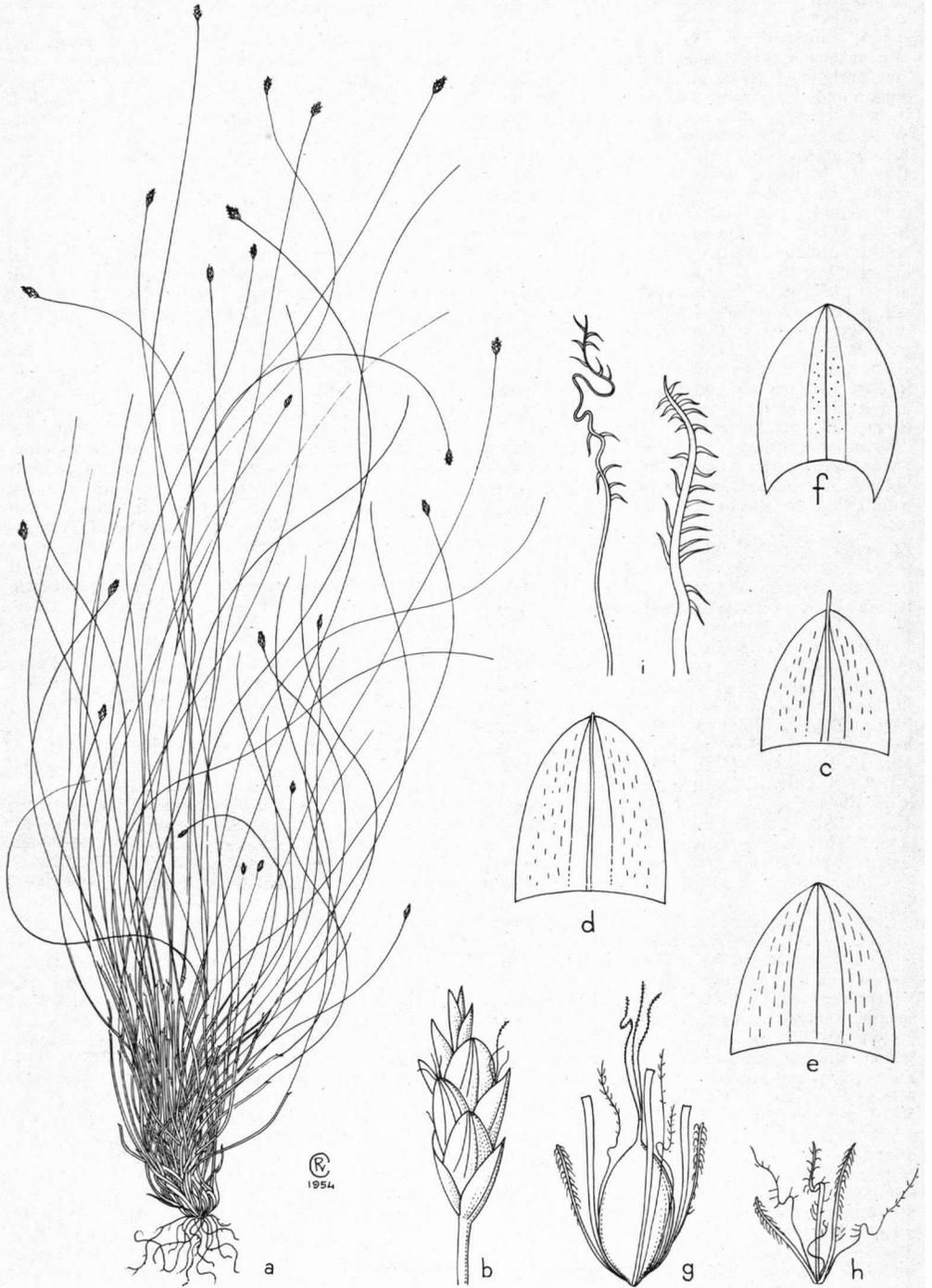


Fig. 29. *Scirpus subcapitatus* THW. ssp. *celebicus* KERN. a. Habit,  $\times \frac{1}{2}$ , b. spikelet,  $\times 6$ , c-e. lower empty glumes, f. fertile glume, g. deflorate flower, h. perianth bristles, all  $\times 12$ , i. perianth bristles, enlarged (a-i EYMA 981).

typical subspecies is restricted to Europe. The circum-Pacific *ssp. validus* differs from it by the constantly bifid styles (trifid in *ssp. lacustris*) and some minor very inconstant characters. Because of its bifid styles *ssp. validus* approaches the European-W. Asian *ssp. glaucus* (SMITH) HARTM. (= *S. tabernaemontani* GMEL.), to which KÜENTHAL and OHWI refer the Mallesian plants. Typical *ssp. glaucus* has smaller stems (but very stout specimens occur!) and densely gland-dotted glumes. According to BLAKE (1943) the rays of the inflorescence in *ssp. validus* are more distinctly scabrous than in *ssp. glaucus*, but this is incorrect. On account of the many intergrading specimens BEETLE (1941) treated *ssp. glaucus* as a variety of *S. lacustris*, viz *S. lacustris* var. *tabernaemontani* (GMEL.) DOELL, whereas in his opinion *S. validus* is a clearly distinct species. In this connection it may be remarked that in Europe *ssp. lacustris* and *ssp. glaucus* frequently occur together and hybrids of the two are formed, whereas *ssp. validus* inhabits an entirely separated area. The differentiating characters between *ssp. lacustris* and *ssp. validus* are not more important than those between *ssp. lacustris* and *ssp. glaucus*. They are too trifling to justify specific distinction.

12. *Scirpus litoralis* SCHRAD. Fl. Germ. 1 (1806) 142, t. 5, f. 7; KUNTH, En. 2 (1837) 166; STEUD. Syn. 2 (1855) 86; BENTH. Fl. Austr. 7 (1878) 334; K. SCH. & HOLLR. Fl. Kais. Wilhelm Land (1889) 25; CLARKE, Fl. Br. Ind. 6 (1893) 659; Ill. Cyp. (1909) t. 50; VALCK. SUR. Nova Guinea 8 (1912) 705; BACK. Onkr. Suiker. (1928) 150, t. 152; STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 289, f. 73; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 10; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 459. — *S. subulatus* VAHL, En. 2 (1806) 268; KUNTH, En. 2 (1837) 165; MIQ. Fl. Ind. Bat. 3 (1856) 306; BOECK. Linnaea 36 (1870) 715; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 122. — *S. thermalis* TRAB. in Batt. & Trab. Fl. Alg. (Monoc.) ed. 2 (1895) 99. — *S. lacustris* (non L.) MERR. En. Phil. 1 (1923) 117, p.p. — *S. validus* (non VAHL) BEETLE, Am. J. Bot. 28 (1941) 693, p.p. (quoad CURRAN 17290 & MCGREGOR 41439).

Perennial. Rhizome short; sometimes slender stolons present. Stems rather stout to stout, erect, terete but obtusely trigonous just below the inflorescence (see note), glaucous, 60–150 cm by 3–10 mm. Leaves reduced to bladeless or shortly laminate sheaths. Inflorescence pseudolateral, simple or compound, few- to many-spiculate, 2–8 cm long; rays slender, smooth, or scaberulous at the top. Involucral bract erect, continuous with the stem, rigid, channelled along the inner side to triquetrous, 2–5 (–10) cm. Spikelets solitary, ovoid to oblong-ovoid, terete, acutish, densely many-flowered, rusty or brown, 8–15 by 3–4 mm. Glumes scarious, appressed, elliptic to oblong, obtuse or slightly notched, minutely ciliate at the apex, otherwise glabrous,  $3\frac{1}{2}$ –4 by c. 2 mm; midrib prominent, excurrent into a short but distinct  $\frac{1}{3}$ – $\frac{1}{2}$  mm long mucro; sides nerveless. Hypogynous scales usually 4 (3–5), ligulate-spatulate, plumosely fringed in the upper part with antrorse moniliform hairs, ferruginous, about as long as the nut. Stamens (2–)3; anthers  $1\frac{1}{2}$ –2 mm, the connective with a fimbriate appendage. Style deeply bifid. Nut unequally biconvex, strongly

dorsiventrally compressed, elliptic to obovate, apiculate, smooth, castaneous to blackish, c. 2 by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm.

Distr. From the Mediterranean region through S. Asia to Australia, Africa, in *Malaysia* very rare: Java (here and there near the sea, in W. Java also inland near Garut), Madura, Kangean, Lesser Sunda Is. (Bali: Batur Lake), Philippines (Luzon: Pangasinan Province, MCGREGOR BS 41439, CLEMENS 18104), NE. New Guinea.

Ecol. In brackish swampy places, saline pools near the sea, sometimes abundant; at Tarogong (Mt Guntur) at 800 m in water originating from hot springs, along Batur Lake (Bali) at 1000 m.

Uses. In W. Java (Indramaju) used for making mats.

Vern. *Endong*, *pëndjalinan*, J.

Notes. In appearance very similar to *S. lacustris*, but usually with looser, less compound inflorescence, and easily recognized by the flat, plumose hypogynous scales.

In the Mediterranean plants and also in those from the Middle East, China and Mongolia (*S. litoralis* s.s.) the stems are sharply triangular throughout; however, in *Scirpus* this character does not warrant specific separation. *S. subulatus* was based on specimens from the Nicobars identical with the Mallesian ones, to which the above description only refers. It may be distinguished as *S. litoralis* var. *subulatus* (VAHL) CHIOV. (Distr.: Tropical Africa, S. Africa, Madagascar, India, *Malaysia*, Micronesia). See also TOWNSEND, Kew Bull. 15 (1961) 415–417. Also the African *S. pterolepis* KUNTH with more copiously branched inflorescence and longer, oblong spikelets is possibly not specifically distinct from *S. litoralis*.

13. *Scirpus mucronatus* LINNÉ, Sp. Pl. 1 (1753) 50; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 361; Descr. Herb. Timor. (1835) 33, excl. var.  $\alpha$ ; KUNTH, En. 2 (1837) 161; MIQ. Fl. Ind. Bat. 3 (1856) 304; BOECK. Linnaea 36 (1870) 703; BENTH. Fl. Austr. 7 (1878) 332; F.-VILL. Nov. App. (1882) 308; CLARKE, Fl. Br. Ind. 6 (1893) 657; Philip. J. Sc. 2 (1907) Bot. 100; RIDL. Mat. Fl. Mal. Pen. 3 (1907) 79; CAMUS, Fl. Gén. I.-C. 7 (1912) 134; VALCK. SUR. Nova Guinea 8 (1912) 704; MERR. En. Philip. 1 (1923) 118; KÜK. Bot. Jahrb. 59 (1924) 51; *ibid.* 69 (1938) 259; RIDL. Fl. Mal. Pen. 5 (1925) 161; BACK. Onkr. Suiker. (1928) 149, t. 151; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 10; S. T. BLAKE, J. Arn. Arb. 35 (1954) 204; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 59, incl. var. *planoconvexus* KOYAMA; RAYMOND, Nat. Canad. 84 (1957) 129; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 459; STEEN. Mt Fl. Java (1972) t. 14:17. — *S. triangulatus* ROXB. Fl. Ind. 1 (1820) 219; ed. Carey 1 (1832) 217; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 60. — *S. acutus* PRESL, Rel. Haenk. 1 (1828) 192, non MÜHL. — *S. preslii* DIETR. Sp. Pl. 2 (1833) 175 ('*presslii*'); KUNTH, En. 2 (1837) 161; MIQ. Fl. Ind. Bat. 3 (1856) 305; F.-VILL. Nov. App. (1882) 308 ('*preslei*'). — *S. javanus* NEES in Wight, Contr. Bot. Ind. (1834) 112; KUNTH, En. 2 (1837) 161; MOR. Syst. Verz. (1846) 97; MIQ. Fl. Ind. Bat. 3 (1856) 305. — *S. sundanus* MIQ. Fl. Ind. Bat. 3 (1856) 304; in De Vriese, Pl. Ind. Bat. Or. (1857) 140. — Fig. 30.

Perennial. Rhizome very short. Stems rather stout, stiff, erect, tufted, triquetrous with more or less

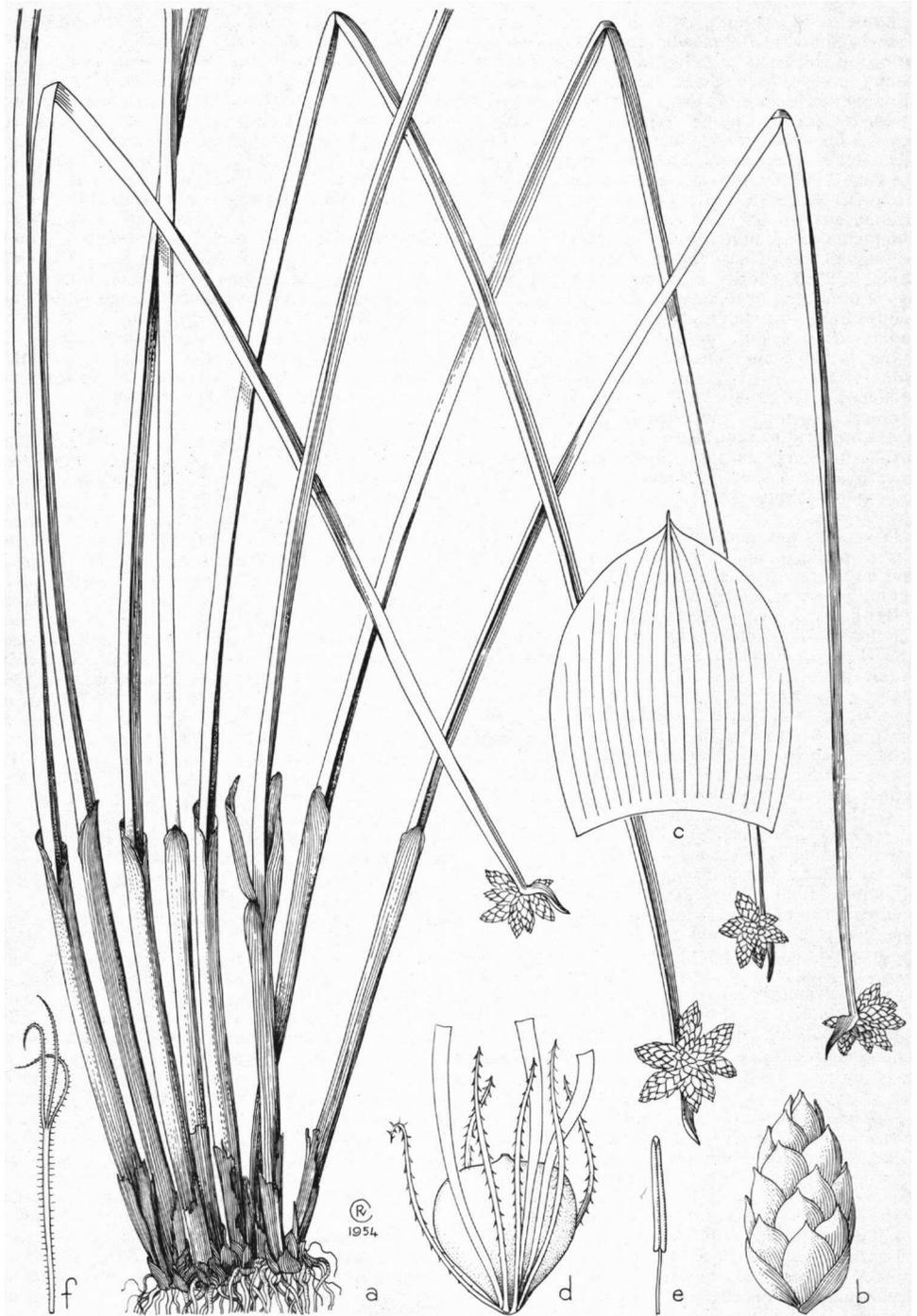


Fig. 30. *Scirpus mucronatus* L. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 3$ , c. glume, d. deflorate flower, e. young stamen, f. style, all  $\times 13$  (a-f LÖRZING 6723).

concave sides, smooth,  $\frac{1}{2}$ –1 mm by (2–)3–8 mm. *Leaves* reduced to 1–2 membranous, stramineous to brownish, bladeless sheaths. *Inflorescence* pseudolateral, capitate (sometimes proliferous, with some slender branches bearing one or more spikelets), with (2–)4–25 spikelets, up to 4 cm across. Involucral bract at first erect, looking like a continuation of the stem, finally often patent to reflexed, triquetrous like the stem, 1–10 cm. *Spikelets* sessile, ovoid to oblong-ovoid, terete, rather acute, densely many-flowered, stramineous to brownish at maturity, 10–20 by 4–6 mm. *Glumes* firm, tightly appressed, concave, but slightly keeled near the apex, ovate or broadly ovate, acutish, shortly mucronate,  $3\frac{1}{2}$ –4 by c.  $2\frac{1}{2}$  mm; midrib prominent, sides many-nerved, yellowish brown, margins minutely ciliate at the top. *Bristles* 5–6, stout, unequal, slightly to distinctly longer than the nut, retrorsely scabrid. *Stamens* 3; anthers linear, 1– $1\frac{3}{4}$  mm; connective distinctly produced. *Style* 2– $2\frac{1}{2}$  mm, sparsely fimbriate or papillose; stigmas 3, but often in some flowers 2. *Nut* strongly dorsiventrally compressed, planoconvex, or trigonous but the dorsal angle indistinct, broadly obovate, shortly apiculate, scarcely rugulose to smooth, shining black at maturity,  $1\frac{3}{4}$ – $2\frac{1}{4}$  by  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm.

*Distr.* Warmer parts of the Old World, from S. Europe to Japan, and through S. Asia to Australia, rare in tropical Africa; probably throughout *Malesia*, but not yet seen from the Moluccas.

*Ecol.* In open wet places, swamps, ditches, pools, margins of lakes, often dominant, or codominant with *Leersia hexandra*, sometimes in inundated rice-fields, 0–c. 2100 m.

*Uses.* The dried and flattened stems are often used for making cheap but durable mats and bags, and for strings. In the Padang Uplands (Sumatra West Coast) the species is cultivated for this purpose.

*Vern.* *Djadjaruman*, walini, S, *mëndongan*, J, *rumpit kumbah*, M, *baion login*, *login djau*, Sum. E. C., *buku ajër*, *kèrtjut*, *kumbuh*, *mansiang agam*, Sum. W. C., *abulbugul*, Sibil, *kumbuèn*, *mansiro hitam*, Minangk., *ma'siang*, Simalur, *bubundelan*, Banten, *andung*, Borneo (Mal.), *maufles*, *ututu*, Timor, *pusu*, Alf. Minah., *bimpolu*, SW. Celebes; Philip.: *bibiran*, *kanubsuban*, Tag., *parapipit*, Ilk., *pulutapit*, *pupuegan*, Bon.; New Guinea: *ticomba*, Orne lang.

*Note.* The above description refers only to the Malesian plants; *S. mucronatus*, with its wide range, is very polymorphous. In the European form the style and anthers are shorter and the nuts distinctly rugulose, but the Malesian specimens cannot be separated specifically from them. Very remarkable is:

*ssp. clemensii* KÜK. Bot. Jahrb. 69 (1938) 259. — *S. clemensii* OHWI, Bot. Mag. Tokyo 56 (1942) 203; KÜK. Mitt. Thür. Bot. Ver., N.F. 50 (1943) 13 ('*clemensiae*'); S. T. BLAKE, J. Arn. Arb. 35 (1954) 204.

Stems terete or very obtusely trigonous. Glumes fuscous to purplish.

*Distr. Malesia:* New Guinea (W. New Guinea: Arfak Mts, Wissel Lake region, Lake Habbema; NE. New Guinea: Morobe Distr., Mt Sarawaket; Mt Sugarloaf; Mt Giluwe).

According to KOYAMA (Willdenowia 5, 1969, 493) *S. johaiensis* TANG & WANG (Fl. Reip. Pop. Sinic.

11, 1961, 23, 222, t. 10, f. 6–10) from Yunnan should belong to the same taxon.

*Ecol.* In open swamps, sandy marginal shallows of lakes, tarns, locally often abundant, 1750–3225 m.

*Note.* As additional characters distinguishing this taxon from *S. mucronatus* s. str., KÜKENTHAL (1943) indicated the creeping rhizome, the non-triquetrous bracts, and the obovate nut. I fail to see differences in the rhizome and in the nut; the involucral bract is obtusely trigonous to almost terete like the stem (in *S. mucronatus* s. str. both are triquetrous). The colour of the glumes is very variable in *S. mucronatus* s. str. For these reasons I prefer to maintain the original subspecific rank. Both KÜKENTHAL and OHWI indicate 3 stigmas, but just as in *S. mucronatus* s. str. digynous flowers often occur with trigynous ones, even in one spikelet.

Slender specimens of this subspecies strongly resemble *S. juncooides*. They may be distinguished by the characters given in the key on p. 497.

14. *Scirpus juncooides* ROXB. Fl. Ind. 1 (1820) 218; ed. Carey 1 (1832) 216; KUNTH, En. 2 (1837) 160; ZOLL. Syst. Verz. 2 (1854) 62; MIQ. Fl. Ind. Bat. 3 (1856) 303; CHERM. Fl. Madag. fam. 29 (1937) 152; S. T. BLAKE, Proc. R. Soc. Queensl. 62 (1952) 88; RAYMOND, Nat. Canad. 84 (1957) 134; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 57; J. Fac. Sc. Un. Tokyo III, 7 (1958) 310, incl. var. *ohwianus* (KOYAMA) KOYAMA, l.c. 311; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 459. — *S. luzonensis* PRESL, Rel. Haenk. 1 (1828) 193; NEES in Wight, Contr. Bot. Ind. (1834) 112; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 361; Descr. Herb. Timor. (1835) 33; MIQ. Fl. Ind. Bat. 3 (1856) 304. — *S. juncoformis* NEES in Wight, Contr. Bot. Ind. (1834) 112. — *S. mucronatus* var. *a* DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 361; Descr. Herb. Timor. (1835) 33. — *S. timorensis* KUNTH, En. 2 (1837) 162; MIQ. Fl. Ind. Bat. 3 (1856) 305 ('*timoriensis*'). — *S. supinus* var. *elatiior* BOECK. Linnaea 36 (1870) 700. — *S. erectus* (non POIR.) CLARKE, Fl. Br. Ind. 6 (1893) 656; Philip. J. Sc. 2 (1907) Bot. 99; RIDL. Mat. Fl. Mal. Pen. 3 (1907) 79; CLARKE, III. Cyp. (1909) t. 48, f. 11–12; CAMUS, Fl. Gén. I.-C. 7 (1912) 136; MERR. En. Philip. 1 (1923) 117; RIDL. Fl. Mal. Pen. 5 (1925) 161; BACK. Onkr. Suiker. (1928) 148, t. 149; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 11. — *S. ohwianus* KOYAMA, Bot. Mag. Tokyo 69 (1956) 212, f. 4.

Annual. Stems rather slender, erect, tufted, usually subterete, not rarely more or less angular, ribbed, smooth, 15–75(–120) cm by 1–2(–3) mm. *Leaves* reduced to 2–3 membranous sheaths obliquely truncate at the top, often with a very small rudimentary blade. *Inflorescence* pseudolateral, capitate, consisting of (1–)2–7 spikelets. Involucral bract erect, looking like a continuation of the stem, grooved on the inner side, with a callous tip, always much shorter than the stem, 5–15 cm. *Spikelets* sessile, ovoid to oblong-ovoid, terete, obtusish, densely many-flowered, stramineous to brownish at maturity, 7–18 (sometimes lengthening to 30) by 5–6 mm. *Glumes* firm, tightly appressed, concave but slightly keeled near the apex, broadly ovate, obtuse, shortly mucronulate, with strong midrib, faintly many-nerved purplish lineolate sides, and margins minutely ciliate at the top,  $3\frac{1}{2}$ –4 by 3– $3\frac{1}{2}$  mm. *Bristles*

5-6, stout, unequal, shorter than or the longer ones slightly exceeding the nut, retrorsely scabrid, up to  $2(-2\frac{1}{2})$  mm. *Stamens* (2-3); anthers linear,  $1-1\frac{1}{2}$  mm. *Style* glabrous, 2 mm; stigmas 2, sometimes a short third stigma present. *Nut* strongly dorsiventrally compressed, unequally biconvex (only low-convex on the ventral side), broadly obovate, shortly apiculate, more or less pitted, shining black, c. 2 by  $1\frac{1}{2}-1\frac{3}{4}$  mm.

*Distr.* Madagascar; from India, China, and Japan to Hawaii and tropical Australia; the North American *S. purshianus* FERN. (= *S. debilis* PURSH, non LAMK), curiously omitted by BEETLE in Fl. N. Am., is hardly different and in all probability not specifically distinct; in *Malesia*: Sumatra, Malay Peninsula, Java, Lesser Sunda Is. (Lombok, Timor), Borneo, Philippines (Mindoro, Luzon, Polillo, Leyte, Biliran, Mindanao), Celebes, W. New Guinea (Biak Res.: Arupa). Rather common in the western part of the region, much rarer in the eastern part, not yet collected in the Moluccas.

*Ecol.* In open wet localities: swamps, river banks, and particularly in inundated rice-fields, only in fresh water, both in regions with a strong and a feeble dry monsoon, 0-1200 m, rarely up to 2000 m.

*Uses.* Sometimes used as a green-food for cattle; feeding-value rather high.

*Vern.* *Kambo-mantjik*, M, *bawang kladi*, *njon-joran*, J, *babawangan*, *kutjaja*, *wawalingian*, S, *paroparo*, Minangk., *luluwang*, Alas, *siwuntuh*, Sum. W. C., *rumpit prut tikus*, Mal. Pen., *adas-adasan*, Banten: Philip.: *bitubituinan*, *gumi*, Tag., *paratupit*, Ilk.; New Guinea: *nunu*, Kapauku.

*Note.* *S. ohwianus* KOYAMA according to KOYAMA occurring from W. Japan to S. China and Luzon. I fail to see a demarcation between *S. juncooides* and *S. ohwianus*.

*var. triangulatus* (HONDA) OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 115. — *S. erectus var. triangulatus* HONDA, Bot. Mag. Tokyo 45 (1931) 45.

Stems distinctly (3-)-5-angled.

*Distr.* Japan, in *Malesia*: West Java.

*Note.* I have not seen the type of this variety. OHWI described it as more robust in all its parts, with anthers 1.7-2 mm long, and suspected hybrid origin (*S. juncooides* × *preslii*?). The Javan specimens are rather robust, distinctly 5-angled, with anthers c.  $1\frac{1}{2}$  mm long. In herbarium specimens it is often difficult to decide whether *in vivo* the stems were terete or angular.

15. *Scirpus wallichii* NEES in Wight, Contr. Bot. Ind (1834) 112; KUNTH, En. 2 (1837) 160; STEUD. Syn. 2 (1855) 84; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 113; KERN, Reinwardtia 4 (1956) 90; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 60; RAYMOND, Nat. Canad. 84 (1957) 136. — *S. erectus var. wallichii* BEETLE, Am. J. Bot. 29 (1942) 654.

Closely related to *S. juncooides*. *Stems* very slender, 4-5-angular, 10-40 cm. by  $\frac{3}{4}$ -1 mm. *Inflorescence* with 1-2(-3) spikelets. *Spikelets* oblong-ovoid, acute, greenish, 3-4 mm wide. *Glumes* membranous, ovate to elliptic, acute, shortly mucronate, finally greyish green,  $3\frac{1}{2}$ -4 by c.  $2\frac{1}{2}$  mm. *Bristles* 4-5, distinctly longer than the nut, the outer ones somewhat shorter than the inner ones, the latter c. 3 mm. *Anthers* oblong-linear,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. *Style* always bifid.

*Nut* planoconvex (the ventral side flat), somewhat smaller than in *S. juncooides*, c.  $1\frac{3}{4}$  by  $1\frac{1}{2}$  mm.

*Distr.* India, Annam, Tonkin, Mergui Arch., Japan, Korea, Formosa, in *Malesia* apparently very rare: Malay Peninsula (Kedah: Kepala Batas; Malacca: Batu Berendam, Sawar); Philippines (Luzon: Prov. of Bulacan, Manila, Rio Tansa).

*Ecol.* Insufficiently known; the habitats are probably similar to those of *S. juncooides* as it was often collected together with that species (open wet localities, especially wet rice-fields).

16. *Scirpus articulatus* LINNÉ, Sp. Pl. 1 (1753) 47; BOECK, Linnaea 36 (1870) 702; BENTH. Fl. Austr. 7 (1878) 331; CLARKE, Fl. Br. Ind. 6 (1893) 656; Philip. J. Sc. 2 (1907) Bot. 99; Ill. Cyp. (1909) t. 49, f. 1-2; CAMUS, Fl. Gén. I.-C. 7 (1912) 133; MERR. En. Philip. 1 (1923) 116; BACK, Onkr. Suiker. (1928) 149, t. 150; Bkn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 11; RAYMOND, Nat. Canad. 84 (1957) 132; KERN in Back & Bakh. f. Fl. Java 3 (1968) 458. — *S. incurvatus* ROXB. Fl. Ind. 1 (1820) 217; LLANOS ex F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4<sup>1</sup> (1880) 105. — *Isolepis prolongata* NEES in Wight, Contr. Bot. Ind. (1834) 108; KUNTH, En. 2 (1837) 199. — *Carex glomerata* (non THUNB.) BLANCO, Fl. Filip. ed. 2 (1845) 24; ed. 3, 1 (1877) 45. — Fig. 31.



Fig. 31. *Scirpus articulatus* L. on swampy ground amidst matted *Marsilea crenata* in Papua, Central Distr., Kairuku Subdistr., c. 5 miles NW of Hisiu village (DARBYSHIRE 826).

Annual or perennial. *Stems* erect, densely tufted, terete, fistulose, more or less distinctly transversely septate, smooth, (4–)10–35 cm by 3–6 mm. *Leaves* reduced to 1–2 bladeless, scarious, obliquely truncate, stramineous to brownish sheaths. *Inflorescence* pseudolateral, capitate, globose, consisting of numerous (up to 30) spikelets, 1–3 cm across. *Involucral bract* erect, similar to and continuous with the stem, terete, transversely septate, somewhat to much longer than the stem proper, up to 60 cm. *Spikelets* sessile, ovoid to oblong-ovoid, terete, acutish, densely many-flowered, 8–17 by 4–5 mm. *Glumes* firm, appressed, concave, with scarcely prominent keel, broadly ovate to suborbicular, rather acute, apiculate, many-nerved, rufous-testaceous,  $3\frac{1}{2}$ –5 mm long and wide. *Bristles* none. *Stamens* 3; anthers oblong,  $\frac{1}{2}$ –1 mm. *Style*  $1\frac{1}{2}$ –2 mm; stigmas 3, shorter than the style. *Nut* triquetrous with slightly concave sides, obovate, narrowed towards the base, shortly apiculate, conspicuously to obsoletely transversely wavy-ridged, black, c.  $1\frac{1}{2}$  by 1 mm.

*Distr.* From the Mediterranean through Africa and S. Asia to Australia (N. Australia, Queensland), in *Malesia*: scattered through Java, Bawean I., Lesser Sunda Is. (Bali, Lombok, Timor), Philippines (Luzon, Cebu, Mindoro), SW. Celebes; once collected in New Guinea (Papua, Central Distr., Kairuku Subdistr.; fig. 31).

*Ecol.* In regions with a pronounced dry season, in open swampy or inundated places, shallow pools, rice-fields, locally sometimes abundant, at low altitude, in Java below 50 m, in Bawean I. at 200 m, in Timor at 450 m.

*Vern.* *Mëndong*, J, *bawang-bawang*, *pakitan*, Bawean; Philip.: *apúrau*, Pang.

*Note.* The above description refers only to the Malesian specimens of this widely distributed polymorphous species. NEES distinguished between *Isolepis prolongata* (POIR.) NEES (*S. prolongatus* POIR. Enc. 6, 1804, 764), with an involucral bract 3–4 times as long as the obsoletely articulated stem, broadly ovate glumes, and transversely rugulose nuts, and *I. articulata* (L.) NEES, with an involucral bract twice as long as the distinctly articulated stem, ovate glumes, and smooth nuts. Apparently only the former occurs in Malesia. The Indian *S. articulatus sensu* NEES (*S. articulatus var. major* BOECK. Linnaea 36, 1870, 702) has often stouter stems and larger nuts (c.  $1\frac{3}{4}$  by  $1\frac{1}{4}$  mm), but very stout specimens are not rare in Malesia. African plants with slender stems only 2–3 mm thick, obtuse small spikelets (3 by 4 mm), small glumes (3 by 2 mm), and somewhat smaller ( $1\frac{1}{4}$  by 1 mm), transversely wavy-ridged nuts represent *Isolepis senegalensis* HOCHST. ex STEUD. Syn. 2 (1855) 96. I think these three taxa do not deserve specific rank.

17. *Scirpus lateriflorus* GMEL. Syst. Veg. 1 (1791) 127; S. T. BLAKE, Proc. R. Soc. Queensl. 62 (1952) 87; Koyama, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 59; KERN, Blumea, Suppl. 4 (1958) 164; in Back. & Bakh. f. Fl. Java 3 (1968) 459. — *S. lateralis* RETZ. Obs. 4 (1786) 12; *ibid.* 5 (1789) 16; RAYMOND, Nat. Canad. 84 (1957) 132; non FORSK. 1775. — *Eleocharis tristachyos* MOR. Syst. Verz. (1846) 97, non *Scirpus tristachyos* ROTTB. — *Isolepis ambigua* STEUD. in Zoll. Syst. Verz. 2 (1854) 62, *nom. nud.*, non STEUD. Syn. 2 (1855) 91. — *Isolepis orysetorum*

(*err. typ. orysetorum*) STEUD. Syn. 2 (1855) 96. — *S. tristachyos* ZOLL. ex STEUD. l.c., *in syn.*, non ROTTB. — *Isolepis uninodis* (non DELILE) MIQ. Fl. Ind. Bat. 3 (1856) 308. — *Isolepis? juncoides* MIQ. Fl. Ind. Bat. 3 (1856) 312. — *S. supinus* (non L.) F.–VILL. Nov. App. (1882) 308; CLARKE, Philip. J. Sc. 2 (1907) Bot. 99; RIDL. Mat. Fl. Mal. Pen. 3 (1907) 79; CAMUS, Fl. Gén. I.-C. 7 (1912) 135, *an f.* 17, 6?; MERR. En. Philip. 1 (1923) 118; RIDL. Fl. Mal. Pen. 5 (1925) 161; BACK. Onkr. Suiker. (1928) 148, t. 148; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 12. — *S. supinus var. uninodis* CLARKE, Fl. Br. Ind. 6 (1893) 656; Philip. J. Sc. 2 (1907) Bot. 99, non *Isolepis uninodis* DELILE. — *S. orysetorum* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 112.

Annual. *Stems* slender, weak, densely tufted, obtusangular to subterete, smooth, with a node a short distance above the base, 10–35 cm by  $\frac{1}{2}$ –1 mm. *Leaves* reduced to 2–3 sheaths slightly widened upwards, obliquely truncate at the apex, often with a small rudimentary, rarely  $\pm$  elongate blade. Axils of the basal sheaths often with a solitary female flower with very long, exerted, trifid style. Terminal *inflorescence* pseudolateral, with 4–10(–15) spikelets, sometimes capitate, usually with one of the rays developed 1(–4) cm long. *Involucral bracts* 1–2, the lower erect, similar to and continuous with the stem, always distinctly shorter than the latter, up to 15 cm, the second when present patent, much shorter, up to 5 cm. *Spikelets* oblong-ovoid, angular, acutish, densely many-flowered, 5–10(–15) by c.  $2\frac{1}{2}$  mm. *Glumes* membranous, appressed, distinctly keeled nearly throughout, ovate, stramineous to ferruginous, often reddish variegated, 2–2 $\frac{1}{2}$  by  $1\frac{3}{4}$ –2 mm; midnerve prominent, sides nerveless, margins hyaline, microscopically ciliolate at the apex. *Bristles* none. *Stamens* 3; anthers oblong, 0.4–0.6 mm; connective produced, papillose-bristly at the top. *Style* stigmas 3, about as long as the style. *Nut* compressed-trigonous, obovate, shortly apiculate, conspicuously transversely wavy-ridged, black, 1–1.2 by 0.9–1 mm.

*Distr.* SE. Asia (from India to S. China and Formosa), Australia, in *Malesia*: Malay Peninsula (Kedah, Wellesley, Kelantan, Trengganu, P. Langkawi), W.-E. Java, Kangean Arch., Madura, P. Bawean, Lesser Sunda Is. (Bali, Lombok), Philippines (Luzon, Panay).

*Ecol.* In open wet places, edges of swamps, rice-fields, only in fresh water, sometimes abundant, at low altitude (0–300 m, rarely up to 1300 m).

*Vern.* *Domdoman*, *sriwit*, *weko*, J.

*Notes.* *S. lateriflorus* belongs to a group of closely related species which is greatly in need of revision. The type of *S. lateralis* RETZ. is from Ceylon (leg. KÖNIG), RETZIUS erroneously ascribed a bifid style to it. The species was renamed by GMELIN because RETZIUS's name is a later homonym of *S. lateralis* FORSK., a *nomen confusum* of which the type got lost ("In herbario Forskälæi non aderat" VAHL 1806).

S. T. BLAKE (1952) considered *S. erectus* POIR. = *Isolepis uninodis* DELILE synonymous with *S. lateriflorus*. However, *S. erectus* is a clearly distinct African species, with larger glumes, more distinctly bristly connective of the anthers, bifid styles, and larger biconvex nuts (see CHERMEZON, Arch. Bot. 4, Mém. 7, 1931, 26). BLAKE wrongly placed *Isolepis?*

*juncoides* MIQ. in the synonymy of *S. juncoides* ROXB. It was not based on the latter binomial; MIQUEL's description and the type-specimen in the Leyden Herbarium prove that it belongs to *S. lateriflorus*. The latter is often united with the Eurasian *S. supinus* L., which can be distinguished

by its less slender habit, the nodeless stems, the absence of basal flowers, the always solitary involucre bract, the always capitate inflorescence, the many-striate glumes, and the smooth appendage of the connective.

### 9. Section *Isolepis*

(R.BR.) GRISEB. Spicil. Fl. Rumel. Bith. 2 (1844) 417; K.SCH. in Engler, Pfl. Welt Ost-Afrikas C (1895) 125. — *Isolepis* R.BR. Prod. (1810) 221; LINK, Hort. Berol. 1 (1827) 285. — *Sect. Cernui* CHERM. Fl. Madag. fam. 29 (1937) 145, *descr. gall.* — *Sect. Setacei* CHERM. l.c. 144.

Type species: *S. setaceus* L.

**18. *Scirpus aucklandicus* (HOOK. f.) BOECK.** Linnaea 36 (1870) 491; S. T. BLAKE, Proc. R. Soc. Queensl. 58 (1947) 39; Contr. Queensl. Herb. 8 (1969) 18. — *Isolepis aucklandica* HOOK. f. Fl. Antarct. 1 (1844) 88, t. 50; STEUD. Syn. 2 (1855) 92; HOOK. f. Handb. New Zeal. Fl. (1867) 302.

Perennial; forming loose mats. Rhizome very slender, creeping, branched. *Stems* slender, erect, setaceous, ribbed, smooth, 5–15 cm by  $\frac{1}{5}$ – $\frac{1}{2}$  mm. *Leaves* narrowly linear, from somewhat shorter than to often overtopping the stems, semiterete, often somewhat canaliculate by the inrolled margins, 3-nerved, obtuse, smooth, c.  $\frac{1}{2}$  mm wide; lower sheaths bladeless, transversely truncate, ferruginous. *Inflorescence* pseudolateral, consisting of 1(–2) sessile spikelets. Involucral bract similar to the leaves, erect, continuous with the stem, strongly dilated at the base, 1–1½ cm. *Spikelet* ovoid, terete, obtusish, several-flowered, c. 3 by 2 mm, partly hidden by the base of the bract. *Glumes* membranous, ovate, keeled, obtuse, mucicous, ferruginous, the lowermost often ± bract-like but fertile, cullulate at the top, c. 3 mm long, the remaining ones  $\frac{1}{5}$ –2 mm long; midnerve distinct, green; sides finely nerved. *Bristles* none. *Stamens* 3; anthers oblong-linear,  $\frac{3}{4}$ –1 mm; connective distinctly produced. *Style*  $\frac{1}{3}$ – $\frac{1}{2}$  mm; stigmas 3, much longer than the style. *Nut* triquetrous with somewhat concave sides and rib-like angles, elliptic-ovate, slightly dorsiventrally compressed, apiculate, smooth, stramineous, 1–1½ by  $\frac{3}{5}$ – $\frac{9}{10}$  mm.

Distr. SE. Australia (New South Wales, Victoria, Tasmania), New Zealand and its outlying islands, Amsterdam I., in *Malesia*: NE. New Guinea (Western Highlands: Mt Hagen; Eastern Highlands: Mt Wilhelm).

Ecol. In tussock grassland at the edge of an alpine swamp, c. 3300 m.

**19. *Scirpus subtilissimus* (BOECK.) S. T. BLAKE,** Contr. Queensl. Herb. 8 (1969) 20. — *Isolepis subtilissima* BOECK. Flora 41 (1858) 416. — *S. inundatus* (non POIR.) STAPP, Trans. Linn. Soc. Bot. 4 (1894) 244; RIDL. J. Str. Br. As. Soc. n. 46 (1906) 224; CLARKE, Philip. J. Sc. 2 (1907) Bot. 99. — *Cyperus tenellus* (non L. f.) CLARKE, l.c. 81. — *Schoenoplectus merrillii* PALLA in Kneucker, Cyp. et Junc. exsicc. 8 (1911) n. 223; Allg. Bot. Zeitschr. 17 (1912) Beil. 3. — *S. merrillii* KÜK. ex MERR. En. Philip. 1 (1923)

117; S. T. BLAKE, Proc. R. Soc. Queensl. 58 (1947) 38; J. Arn. Arb. 35 (1954) 206.

Perennial; forming loose mats. Rhizome filiform, creeping, branched, forming small, irregular, 2–6 mm long tubers. *Stems* very slender, erect, filiform, terete, smooth, 2–10 cm by  $\frac{1}{5}$ – $\frac{1}{2}$  mm. *Leaves* filiform, from somewhat shorter than to often overtopping the stems, flat or more or less canaliculate, 3-nerved (lateral nerves submarginal), with rounded apex, smooth,  $\frac{1}{4}$ – $\frac{1}{2}$  mm wide; lower sheaths bladeless, transversely truncate, ferruginous. *Inflorescence* pseudolateral, capitate, consisting of 1–2(–3) sessile spikelets, not rarely proliferous. Involucral bract similar to the leaves, erect, continuous with the stem,  $\frac{1}{2}$ –1½ cm, at the base with scarious purplish auricles. *Spikelets* ovoid, terete, acutish, several-flowered,  $\frac{1}{2}$ –3 by 1–1½ mm. *Glumes* membranous, concave, very broadly ovate, obtuse or slightly notched, mucicous or scarcely apiculate, 1–1¼ by  $\frac{3}{4}$ –1 mm; midnerve distinct, green; sides finely nerved, often purplish; keel curved. *Bristles* none. *Stamens* 1(–2); anthers oblong,  $\frac{1}{5}$ – $\frac{1}{2}$  mm; connective hardly produced. *Style*  $\frac{3}{4}$ –1 mm (the 3 stigmas included; stigmas exceptionally in some of the flowers 2). *Nut* triquetrous with rib-like angles, elliptic, apiculate, nearly as long as the subtending glume, smooth, yellowish to brownish, 0.8–1 by 0.6–0.75 mm.

Distr. New Zealand, Australia (Tasmania, Victoria, New South Wales, Queensland), in *Malesia*: N. Borneo (Mt Kinabalu), Philippines (Luzon, Negros, Mindanao), SW. Celebes, New Guinea.

Ecol. In marshes, shallow swamps, tussock grassland, on wet banks of alpine streams, on open seepages, associated with mosses, *Haloragis micrantha* R.BR. and *Isachne clementis* MERR. var. *vulcanica* (MERR.) JANSEN, 1600–3700 m.

Vern. Philip.: *salaisoi*, Bag.; New Guinea: *noma*, Mendi lang.

**20. *Scirpus inundatus* (R.BR.) POIR.** Enc. Suppl. 5 (1817) 103; SPRENG. Syst. 1 (1825) 207; BENTH. Fl. Austr. 7 (1878) 329; ?KÜK. Bot. Jahrb. 69 (1938) 258; OHWI, Bot. Mag. Tokyo 56 (1942) 203. — *Isolepis inundata* R. BR. Prod. (1810) 222. — *S. setaceus* (non L.) RENDLE in Gibbs, Arfak (1917) 90; an K.SCH. & LAUT. Fl. Schutzgeb. (1901) 195?

Perennial; rhizome not creeping, not forming

mats. *Stems* usually coarser than in *S. subtilissimus*, tufted, slender, erect, strongly compressed, striate, smooth, 5–30 cm by  $\frac{1}{2}$ –1 mm wide. *Leaves* usually all reduced to their sheaths, the upper one often with a very short, rarely  $\pm$  elongated blade; lower sheaths purplish. *Inflorescence* pseudolateral, capitate, consisting of 3–12 (in depauperate specimens sometimes 1 or 2) spikelets, frequently proliferous. Involucral bract at first erect, finally pushed aside by the mature inflorescence, obtuse, at the base with whitish or more or less purplish hyaline auricles, very short, as long as or slightly longer than the inflorescence, 4–10 mm. *Spikelets* ovoid to oblong-ovoid, somewhat angled, acute, (2–)4–6 mm long. *Glumes* membranous, ovate or broadly ovate, concave, somewhat keeled, obtuse or minutely mucronulate, not emarginate,  $1\frac{1}{2}$ – $1\frac{3}{4}$  by 1– $1\frac{1}{2}$  mm; midnerve distinct, green, sides finely 3–4-nerved, striate with purplish

streaks, rarely pale throughout. *Bristles* none. *Stamens* 1–2; anthers oblong, c.  $\frac{1}{2}$  mm; connective shortly produced. *Style* very short; stigmas 3, much longer than the style. *Nut* triquetrous with narrowly ribbed angles, elliptic-ovate, slightly dorsiventrally compressed, apiculate, smooth, stramineous,  $\frac{1}{2}$ –1 by  $\frac{1}{2}$ – $\frac{3}{4}$  mm.

*Distr.* Widely distributed in the eastern Australian States, Tasmania, New Zealand, also in temperate South America, in *Malesia*: New Guinea (W. New Guinea: Arfak Mts, Wissel Lake region; NE. New Guinea: Western Highlands, Hagen Distr.; Mt Sarawaket, according to KÜENTHAL, *l.c.*, not seen; Papua: Southern Highlands: Mt Giluwe; Eastern Highlands: Mt Wilhelm, BRASS 30421.

*Ecol.* In open marshes and peat swamps, 1750–2700 m.

*Vern.* New Guinea: *tambugo*, Mendi lang.

### 10. Section *Micranthi*

C. B. CLARKE, Fl. Br. Ind. 6 (1893) 663. — *Sect. Microstyli* CLARKE, Kew Bull. add. ser. 8 (1908) 113. — *Sect. Squarrosi* CHERM. Fl. Madag. fam. 29 (1937) 141, *descr. gall.*

Type species: *S. squarrosus* L.

21. *Scirpus squarrosus* LINNÉ, Mant. 2 (1771) 181; ROTTB. Descr. & Ic. (1773) 49, t. 17, f. 5; VAHL, En. 2 (1806) 259; BOECK. Linnaea 36 (1870) 734, *quoad specim. asiat.*; CLARKE, Fl. Br. Ind. 6 (1893) 663; Ill. Cyp. (1909) t. 52, f. 11–13; CAMUS, Fl. Gén. I.-C. 7 (1912) 134; KERN, Reinwardtia 4 (1956) 93. — *Isolepis squarrosa* R. & S. Syst. 2 (1817) 111; NEES in Wight, Contr. Bot. Ind. (1837) 106. — *Ascolepis tenuior* STEUD. Syn. 2 (1855) 105. — *S. chinensis* (non OSB.) RAYMOND, Nat. Canad. 84 (1957) 123.

Annual; glabrous. *Stems* erect, tufted, setaceous, obtusangular, smooth, 5–20 cm by  $\frac{1}{4}$ – $\frac{1}{2}$  mm. *Leaves* shorter than the stems, filiform, smooth or slightly antrorsely scaberulous at the top, c. 1 mm wide; ligule absent; lower sheaths ferruginous, purplish striate, bladeless. *Inflorescence* capitate, usually pseudolateral, consisting of (1–)2–4 spikelets. Involucral bracts 1–3, similar to the leaves, dilated at the base, the lowest usually erect, continuous with the stem, 1–6 cm, the others when present much shorter, patent to reflexed. *Spikelets* sessile (at length, when the lower glumes and nuts have fallen off, seemingly peduncled by the naked base of the rachilla), ovoid to subcylindrical, terete, obtuse, very densely many-flowered, greenish or brownish, 3–7 by c. 3 mm. *Glumes* thinly membranous, squarrose, easily caducous, obovate-rhomboid, 3–5-nerved (midnerve prominent, side-nerves delicate), suddenly narrowed into a c.  $\frac{1}{2}$  mm long recurved mucro,  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm (mucro included) by c.  $\frac{1}{2}$  mm. *Bristles* none. *Stamens* 1(–2); anther oblong, c.  $\frac{1}{4}$  mm. *Style*

hardly any; stigmas 3, short, much recurved. *Nut* trigonous, obovate or oblong-obovate, not or hardly apiculate, smooth, ultimately castaneous to black, 0.5–0.6 by 0.3–0.35 mm; epidermal cells hexangular.

*Distr.* S. Asia, in *Malesia* very rare: Malay Peninsula (P. Penang, Johore, Singapore). In Fl. Br. Ind. 6 (1893) 663 also recorded for Java.

*Ecol.* In cultivated land (P. Penang), sandy open places, grassy fields, at low altitude.

Note. *S. squarrosus* is often confused with *Lipocarpha microcephala* (R.Br.) KUNTH, which it deceptively resembles in habit. The latter species is easily recognized by the narrow c. 1 mm long nut enveloped by 2 thinly membranous hypogynous scales, and by the widely patent or reflexed involucral bracts.

### Excluded or Doubtful

*Scirpus borneensis* H. PFEIFF. Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 172. — West Borneo, lower course of Serawai R., HANS WINKLER 258, 1258.

The type collection got lost during the war. From the description it seems doubtful whether it actually belonged to *Scirpus*. It is incomprehensible why PFEIFFER supposed "*S. macrothyrsus* MIQ." in De Clercq, Nieuw Plantk. Woordenb. Ned. Ind. (1907) might belong here, for this name is an error for *Carex macrothyrsa* MIQ.

### 9. FUIRENA

ROTTB. Descr. & Ic. (1773) 70; KUNTH, En. 2 (1837) 180; BOECK. Linnaea 37 (1871) 98; B. & H. Gen. Pl. 3 (1883) 1053; CLARKE, Kew Bull. add. ser. 8 (1908) 115. — Fig. 32.

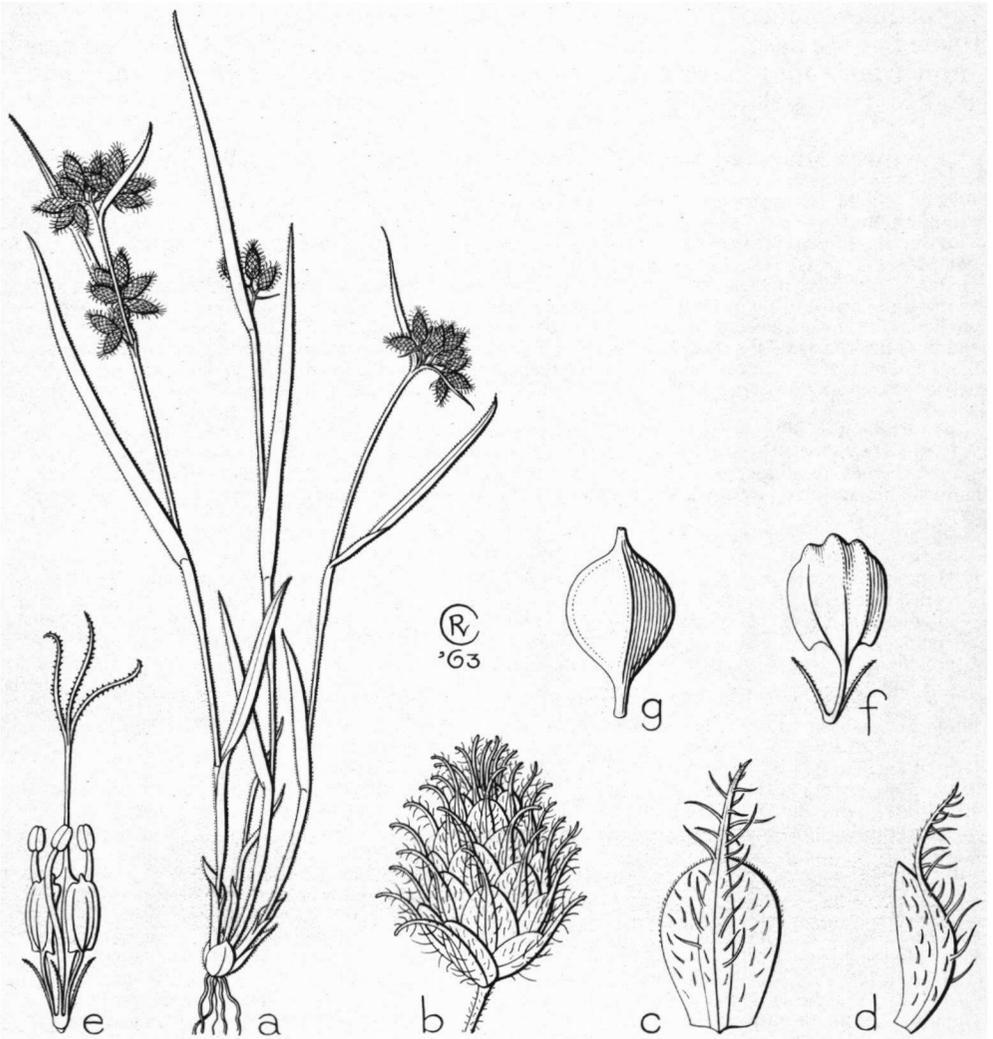


Fig. 32. *Fuirena ciliaris* (L.) Roxb. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 6$ , c-d. glume, dorsal and lateral views,  $\times 12$ , e. deflorate flower, f. scaly perianth segment and two bristle-like ones, g. nut, all  $\times 24$  (a-g COERT 51).

Annual or perennial herbs. *Stems* erect, noded, leafy throughout their length. *Leaves* usually with elongate, linear or lanceolate blades and closed sheaths. Ligule membranous. *Inflorescence* paniculate, elongate, consisting of a terminal partial inflorescence and 1-several axillary ones, but often much reduced. *Spikelets* clustered, terete, usually greyish green or lead-coloured. Rachilla persistent, not winged, with lozenge-shaped scars. *Glumes* spirally imbricate, acropetally caducous, not keeled, nearly always aristate, 3-nerved, hairy on the back at least in the upper half, the lower 1-2 empty. *Flowers* hermaphrodite, the upper ones tabescent. Perianth (in sect. *Fuirena*) consisting of 3 outer bristles opposite the angles of the nut (sometimes reduced or wanting), and 3 inner scales opposite the faces of the nut, or (in extra-Malesian sections) of 2 series of 3

(sometimes reduced or wanting) bristles. *Stamens* (2–)3. *Style* not or hardly dilated at the base, continuous with the ovary, glabrous; stigmas 3. *Nut* small, triquetrous, obovate or ovate, more or less stipitate, smooth or trabeculate, beaked, falling off enclosed by the hypogynous scales.

Distr. About 30 *spp.* in the warm regions of the globe, most of them in tropical Africa and tropical America; in *Malesia* only 2 *spp.*

Ecol. The Malesian *spp.* grow in open wet localities at low and medium altitudes.

Notes. Both Malesian *spp.* belong to *sect. Fuirena* (*sect. Fuirena* 'proper' CLARKE, Fl. Br. Ind. 6, 1893, 666; *sect. Eu-Fuirena* CLARKE, Fl. Trop. Afr. 8, 1902, 463; *sect. Genuinae* CLARKE, Kew Bull. add. ser. 8, 1908, 116.—Type species: *F. umbellata* ROTTB.).

This section is characterized by the 3 broad, petal-shaped hypogynous scales often alternating with 3 hypogynous bristles. The most acceptable interpretation of these bristles and scales is that they represent the perianth. This was already accepted by LESTIBOUDOIS (*Essai sur la famille des Cypéracées*, 1819, 13, 34), and since BENTHAM (J. Linn. Soc. Bot. 15, 1877, 510) advocated it, by most modern authors. NEES (*Linnaea* 9, 1834, 5, 278, t. 4, f. 2–3), assuming that the stamens were inserted below bristles and scales, took the latter two for staminodes, whereas BOECKELER, *l.c.*, was of the opinion that only the scales should be interpreted as such.

The delimitation of the genus against *Scirpus* is very difficult, as in several extra-Malesian *spp.* the perianth-segments are either all bristly or lacking, like in *Scirpus*; on the other hand they are flat and petal-like in *Scirpus litoralis*, recalling the scales of *Fuirena* *sect. Fuirena*. The noded, leafy stems and the dark, aristate, hairy glumes, in some way also characteristic of *Fuirena*, are likewise found in some species of *Scirpus*.

#### KEY TO THE SPECIES

1. Hypogynous scales hardly clawed, almost sessile, obovate, narrowed at the base, usually with a minute curled mucro at the truncate apex; bristles usually wanting. Mostly rather stout perennial; leaves glabrous or ciliate only at the base, very rarely pubescent, (5–)8–15(–25) mm wide . . . . . 1. *F. umbellata*
1. Hypogynous scales distinctly clawed, subquadrate, cordate at the base, tridentate at the apex; bristles present (though usually short). Slender annual; leaves pubescent or at least ciliate throughout the margins, 3–8 mm wide . . . . . 2. *F. ciliaris*

**I. *Fuirena umbellata* ROTTB.** Descr. & Ic. (1773) 70, t. 19 (*i.e.* t. 18 *altera*), f. 3; VAHL, En. 2 (1806) 383; KUNTH, En. 2 (1837) 185; MOR. Syst. Verz. (1846) 97; ZOLL. Syst. Verz. 2 (1854) 61; STEUD. Syn. 2 (1855) 126; MIQ. Fl. Ind. Bat. 3 (1856) 328; BOECK. *Linnaea* 37 (1871) 110, *incl. var. pentagona*; BENTH. Fl. Austr. 7 (1878) 337; F.-VILL. Nov. App. (1882) 308; VIDAL, Phan. Cuming. (1885) 156; Rev. Pl. Vasc. Filip. (1886) 284; CLARKE, Fl. Br. Ind. 6 (1893) 666; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 194; RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 224; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 80; CLARKE, Philip. J. Sc. 2 (1907) Bot. 101; Ill. Cyp. (1909) t. 59, f. 9; CAMUS, Fl. Gén. I.-C. 7 (1912) 141, f. 18, 6; VALCK. SUR. Nova Guinea 8 (1912) 706; MERR. En. Borneo (1912) 58; En. Philip. 1 (1923) 116; KÜK. Bot. Jahrb. 59 (1924) 52; RIDL. Fl. Mal. Pen. 5 (1925) 162; BACK. Onkr. Suiker. (1928) 146, t. 147; S. T. BLAKE, J. Arn. Arb. 28 (1947) 228; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 16; KERN in BACK. & BAKH. f. Fl. Java 3 (1968) 457. — *Scirpoides paradoxus* ROTTB. Progr. (1772) 27, *nom. provis.* — *F. pentagona*<sup>1</sup> W. & A. ex NEES in WIGHT, Contr. Bot. Ind. (1834) 93; in Hook. J. Bot. Kew Misc. 6 (1854) 28; MIQ. Fl. Ind. Bat. 3 (1856) 329; KURZ, Nat. Tijd. N. I. 27 (1864) 224, *non* SCHUM. 1827. — *F. quinqueangularis* HASSK. Tijds. Nat. Gesch. Phys. 9 (1842) 128; Flora 25 (1842) Beibl. 3; Pl. Jav. Rar. (1848) 58; STEUD. Syn. 2 (1855) 127. — *F. uncinata* (*non* KUNTH) CAMUS, Fl. Gén. I.-C. 7 (1912) 141. — *F. philippinensis* GAND. Bull. Soc. Bot. Fr. 66 (1920) 297.

Perennial with short thick rhizome. *Stems* tufted, erect, slender to rather stout, acutely 4–5-angular, pubescent in the inflorescence or very rarely throughout, 30–110 cm by up to 8 mm at the base, the lowest internode not rarely bulbously thickened. *Leaves* much shorter than the stems, rather rigid, flat, acute, glabrous or ciliate at the base, very rarely pubescent, with 5 prominent nerves, (5–)8–15(–25) mm wide, the lower ones very short; sheaths shorter than the internodes, usually glabrous. *Inflorescence* usually with a terminal partial inflorescence and several axillary ones, the latter single or binate, on pubescent peduncles. Lower bracts similar to the leaves, as long as or slightly overtopping the inflorescence, obliquely erect to patent, sheathing at the base; upper ones much shorter, not or hardly sheathing. *Spikelets* in very dense clusters, ovoid to oblong-ovoid, acute, finally more or less squarrose, brownish or greyish to blackish green, 4–10 by 2½–3 mm. *Glumes* membranous, ovate or obovate, rounded at the apex, short-hairy, pilose at the apex, 2–2½ by 1¼–1½ mm, somewhat below the apex with a recurved, often pilose, ¾–1½ mm long awn. *Perianth* usually uniseriate; bristles usually absent, very rarely present, but always much shorter than the nut; scales about as long as the nut, subsessile (with a very short curved claw), obovate, narrowed at the base, truncate at the somewhat thickened top, the midnerve usually excurrent into a short curled mucro, minutely ciliolate at the apex, 3-nerved, brown. *Stamens* (2–)3; anthers linear-oblong, ½–¾

<sup>1</sup> Illegitimate name, antedated by *F. pentagona* SCHUM. Guin. Pl. (1827) 42, which is conspecific with *F. pentagona* NEES, but based on a different type. All belong to the same species.

mm long. Nut elliptic to obovate, triquetrous, narrowed into a stipe and beak, smooth, shining stramineous to fuscous,  $1-1\frac{1}{4}$  by  $0.6-0.7$  mm.

Distr. Widely distributed in the tropical and subtropical, not too dry regions of the whole world, presumably common throughout *Malesia*, but not yet collected in the Lesser Sunda Is. and the Moluccas; according to BACKER (1928, *l.c.*) in Java less common than *F. ciliaris*.

Ecol. In open wet lands: swamps, pools, ditches, marshy shores of lakes, swampy grasslands, rice-fields, sometimes in secondary forests, at low and medium altitudes, up to 1800 m.

Vern. *Djukut, wawalingian, pèpèntul, S, kasabon, J, rumput buku buloh, r. lidah mènkarong, r. kèlulut, M (Mal. Pen.), blidang ajèr, M (Palembang), rumput paro-paro, M (Djambi), tihè galbus, Asahan, anggalbur, Toba, tikang bèlangkas, S. & E. Borneo, rumput ragi, r. kuluwing, Minahassa, hèhè, W. New Guinea, sinbora, Orokaiva lang., Papua.*

Note. Usually stouter and more glabrous than *F. ciliaris*, with broader leaves and much more compound inflorescence, but these characters are all highly variable. Specimens with strongly pilose stems, leaf-blades and sheaths are very rare. The two *spp.* can always be distinguished with certainty by the quite different shape of the hypogynous scales.

2. *Fuirena ciliaris* (L.) ROXB. [Hort. Beng. (1814) 81] Fl. Ind. 1 (1820) 184; MERR. Fl. Manila (1912) 119; En. Philip. 1 (1923) 116; BACK. Onkr. Suiker. (1928) 146, t. 146; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 16. — *Scirpus ciliaris* LINNÉ, Mant. 2 (1771) 182; ROTTB. Descr. & Ic. (1773) 55, t. 17, f. 1. cf. CLARKE, J. Linn. Soc. Bot. 30 (1894) 314. — *F. glomerata* LAMK, Tabl. Enc. Méth. Bot. 1 (1791) 150; VAHL, En. 2 (1806) 386; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 360; Descr. Herb. Timor. (1835) 32; KUNTH, En. 2 (1837) 184; STEUD. Syn. 2 (1855) 127; MIQ. Fl. Ind. Bat. 3 (1856) 328; BOECK. Linnaea 37 (1871) 107; BENTH. Fl. Austr. 7 (1878) 338; F.-VILL. Nov. App. (1882) 309; CLARKE, Fl. Br. Ind. 6 (1893) 666; Philip. J. Sc. 2 (1907) Bot. 101; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 81; CLARKE, Ill. Cyp. (1909) t. 59, f. 6; CAMUS, Fl. Gén. I.-C. 7 (1912) 140; RIDL. Fl. Mal. Pen. 5 (1925) 163. — *F. rotboellii* NEES in Wight, Contr. Bot. Ind. (1834) 94; ZOLL. Syst. Verz. 2 (1854) 61; MIQ. Fl. Ind. Bat. 3 (1856) 329. — *F. striata* LLANOS, Fragm. Pl. Filip. (1851) 21; repr. by F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4<sup>1</sup> (1880) 14. — *F. wallichiana*

(*non* KUNTH) CAMUS, Fl. Gén. I.-C. 7 (1912) 141. — Fig. 32.

Annual. Stems slender, obtusangular, striate-sulcate, pubescent at the top or sometimes throughout, (5-)10-40 cm by 1-2 mm, not incrassate at the base. Leaves rather weak, more or less pubescent or at least ciliate on the margins, with 3-5 more prominent nerves, light green, 3-8 mm wide; sheaths pubescent. Inflorescence sometimes a single terminal cluster, but usually also with 1-2 clusters on short pubescent peduncles in the upper axils. Glumes obovate to oblong-obovate, short-hairy almost throughout the back, pilose in the centre,  $1\frac{1}{2}-1\frac{3}{4}$  by  $c. 1\frac{1}{4}$  mm (the  $c. 1$  mm long awn excluded). Perianth biseriata: bristles scaberulous or almost smooth, sometimes as long as the nut, usually much shorter; scales distinctly clawed, subquadrate, cordate or hastate at the base, with 3 minute teeth at the distinctly thickened top (central tooth largest), glabrous or minutely hairy at the apex. Anthers oblong,  $c. \frac{1}{4}$  mm long. Nut slightly smaller than in *F. umbellata*,  $\frac{3}{4}-1$  by  $0.5-0.6$  mm. Otherwise as *F. umbellata*.

Distr. In the tropics of the Old World: tropical Africa, throughout SE. Asia (extending to S. China, Japan, and to tropical Australia), in *Malesia*: N. Sumatra (Atjeh), Central Sumatra, Malay Peninsula (Kedah, Wellesley, Perak, Kelantan, P. Langkawi, P. Penang), throughout Java, Borneo (Sarawak), Lesser Sunda Islands (Sumbawa, Timor), throughout the Philippines, S. Celebes, W. New Guinea (WICHMANN M14 in L).

Ecol. In open wet lands: in swampy grassland, on riverbanks, and especially in wet rice-fields, at low altitudes (in Java up to 800 m, in Atjeh collected at 1180 m), usually scattered but sometimes abundant.

Vern. *Kapohan, J, rumput halia, Mal. Pen., rëbu osap, Sumbawa; Philip.: pugapak, Tag.*

#### Excluded

*Fuirena glabra* ECKL. ex KUNTH, En. 2 (1837) 182; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 17. — Only known from S. Africa. A specimen of this species in the Herbarium of the Amsterdam University is labelled "Lamongan, Java, Nov. 1904, P. MOLHUYSEN". As MOLHUYSEN's collections include several plants from Africa, which are certainly not native to Java, this record is apparently based on an erroneously localized specimen. See Fl. Mal. I, 1 (1950) 366.

### 10. LIPOCARPHA

R.BR. in Tuckey, Narr. Exped. Congo, App. (1818) 459, *nom. cons.*; KUNTH, En. 2 (1837) 266; STEUD. Syn. 2 (1855) 129; BOECK. Linnaea 37 (1871) 114; CLARKE, Kew Bull. add. ser. 8 (1908) 116. — *Hypaelyptum* VAHL, En. 2 (1806) 283; R.BR. Prod. (1810) 219, *p.p.*; K.SCH. in Engl. Pflanzenw. Ost. Afr. C (1895) 126. — *Tunga* ROXB. Fl. Ind. 1 (1820) 187, *p.p.* — Fig. 33.

Annual or perennial glabrous herbs. Stems tufted, erect, smooth, leafy only at the base. Leaves elongate, linear; sheaths of the basal ones open, of the cauline ones closed at the base. Ligule absent. Inflorescence terminal, capitate, with (1-)2-8 spikelets, subtended by some involucre bracts similar to the leaves.

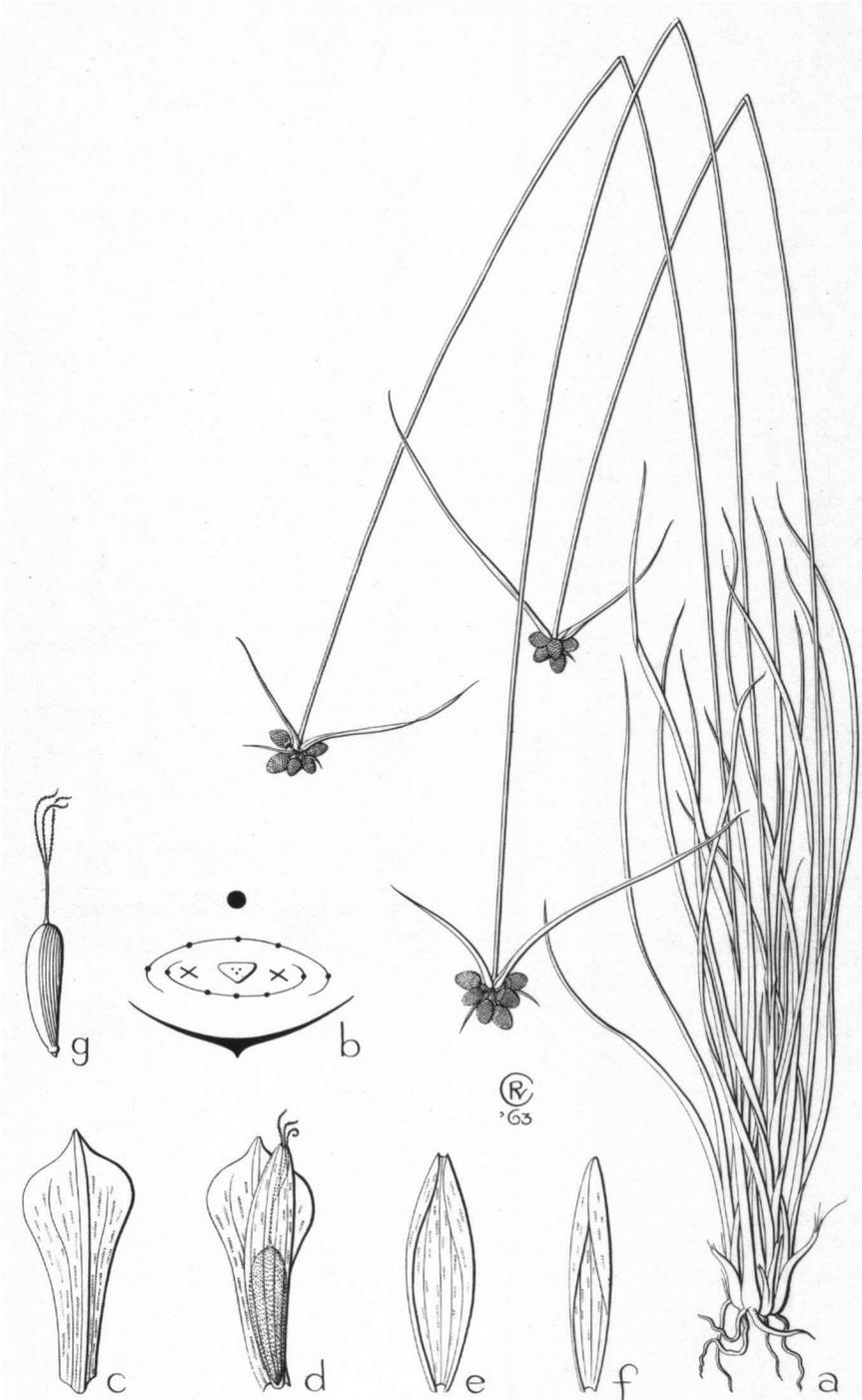


Fig. 33. *Lipocarpa chinensis* (OSB.) KERN. a. Habit,  $\times \frac{2}{3}$ , b. floral diagram, c. glume, d. glume with flower, e-f. the two transparent inner scales, g. nut with style, all  $\times 18$  (a-g RAHMAT Sİ BOEËA 4999).

*Spikelets* small, sessile (finally seemingly peduncled by the rachilla naked at the base because of the caducous glumes), terete, very densely many-flowered. Rachilla persistent, not winged, marked by lozenge-shaped scars. *Glumes* spirally imbricate, acropetally caducous, not keeled, the lower 1-2 empty. *Flowers* hermaphrodite, the upper ones tabescent. Perianth consisting of 2 (readily overlooked!) hyaline, nerved scales placed in the median plane (*i.e.* fore and aft, parallel with the subtending glume, the posticous scale embracing the anticous one). *Stamens* 1-2; anthers small, oblong to linear, with shortly produced smooth connective. *Style* small, not dilated at the base, continuous with the ovary, glabrous; stigmas 2-3. *Nut* small, dorsiventrally compressed, trigonous or planoconvex, oblong-obovate to narrowly oblong, smooth, reticulate, often slightly curved, enclosed by the hypogynous scales; epidermal cells isodiametric.

Distr. About 15 *spp.*, in tropical America, tropical and South Africa, and from continental S. and SE. Asia through Malasia to Australia, apparently absent from the Pacific islands; most of the species in Africa; in Malasia only 2 *spp.*

Ecol. The Malasian species inhabit open (permanently or temporarily) marshy localities at low and medium altitudes; *L. chinensis* was once found in N<sup>w</sup> Guinea at 2800 m. *L. microcephala* is almost restricted to regions with a pronounced dry monsoon.

Notes. The most important character of the genus lies in the two median hypogynous scales, which are difficult to discern as they are very thin and closely adhere to the nut. They are interpreted in various ways (see CLARKE, Fl. Trop. Afr. 8, 1902, 468). The most acceptable interpretation to me is that they represent the perianth, a view already advanced by BENTHAM (J. Linn. Soc. Bot. 15, 1877, 509, 510, 518), and followed by HOLTUM (Bot. Rev. 14, 1948, 525-541). They take the scales for homologous with the bristles in *Scirpus* and *Eleocharis*. Then the genus has to be placed next to *Scirpus* sect. *Micranthi*, to which it shows affinities in several respects.

According to VON GOEBEL (1887) each stamen of *L. chinensis* has two thecae, but each theca has only one pollen chamber (checked by Dr. W. VAN HEEL, 1972).

CHERMEZON divided the genus into 2 sections:

Sect. *Acutae*: spikelets squarrose by the mucronate glumes.

Sect. *Obtusae* (correct name at present sect. *Lipocarpha*): spikelets not squarrose; glumes not mucronate.

Of the Malasian species *L. chinensis* belongs to sect. *Lipocarpha*, *L. microcephala* to sect. *Acutae*.

#### KEY TO THE SPECIES

1. Spikelets not squarrose, whitish, 4-5 mm wide; glumes not mucronate, but with a short erect or slightly incurved triangular tip. Hypogynous scales distinctly longer than the nut, c. 2 mm. Anthers linear,  $\frac{3}{4}$ -1 mm long. Nut  $\frac{1}{5}$ - $\frac{1}{2}$  mm wide. Rather firm plant with leaves 2-4 mm wide . . . . . 1. *L. chinensis*
1. Spikelets squarrose by the distinct, finally recurved mucros of the glumes, greenish, 2-3 mm wide. Hypogynous scales but slightly longer than the nut, c. 1 mm. Anthers oblong,  $\frac{1}{4}$ - $\frac{2}{5}$  mm long. Nut  $\frac{1}{5}$ - $\frac{1}{4}$  mm wide. Very slender, weak plant with leaves 1-2 mm wide . . . . . 2. *L. microcephala*

**1. *Lipocarpha chinensis* (OSB.) KERN**, Blumea Suppl. 4 (1958) 167; in Back. & Bakh. f. Fl. Java 3 (1968) 457. — *Scirpus chinensis* OSB. Dagb. Ostind. Resa (1875) 220. — *Scirpus senegalensis* LAMK, Tabl. Enc. Méth. Bot. 1 (1791) 140. — *Hypolytrum senegalense* RICH. in Pers. Syn. 1 (1805) 70, non CLARKE, 1902. — *Hypaelytrum argenteum* VAHL, En. 2 (1806) 283. — *Hypolytrum argenteum* KUNTH in H.B.K. Nova Gen. & Sp. Pl. 2 (1816) 218, *quoad basion*. — *Tunga laevigata* ROXB. Fl. Ind. 1 (1820) 188. — *L. laevigata* NEES ex WIGHT, Cat. Pl. (1834) 110; in Wight, Contr. Bot. Ind. (1834) 92; in Hook. J. Bot. Kew Misc. 6 (1854) 28. — *L. argentea* R.BR. ex NEES, Linnæa 9 (1835) 287; KUNTH, En. 2 (1837) 266, *p.p.* (*excl. pl. am.*); STEUD. Syn. 2 (1855) 129; MIQ. Fl. Ind. Bat. 3 (1856) 331; BOECK. Linnæa 37 (1871) 114, *p.p.*; BENTH. Fl. Austr. 7 (1878) 336; F.-VILL. Nov. App. (1882) 308; CLARKE, Fl. Br. Ind. 6 (1893) 667; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 197; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 81; CLARKE,

Philip. J. Sc. 2 (1907) Bot. 109; III. Cyp. (1909) t. 60, f. 4-7; KOORD. Exk. Fl. Java 1 (1911) 183; Atlas f. 191; CAMUS, Fl. Gén. I.-C. 7 (1912) 143, t. 1, f. A, 1, 2; VALCK. Sur. Nova Guinea 8 (1912) 706; MERR. En. Born. (1921) 53; En. Philip. 1 (1923) 102; KÜK. Bot. Jahrb. 59 (1924) 51; *ibid.* 69 (1938) 259; RIDL. Fl. Mal. Pen. 5 (1925) 163; BACK. Onkr. Suiker. (1928) 124, t. 118. — *Kytingia albescens* STEUD. Syn. 2 (1855) 68; MIQ. Fl. Ind. Bat. 3 (1856) 294; F.-VILL. Nov. App. (1882) 300. — *L. senegalensis* TH. & HÉL. DURAND, Syll. Fl. Congol. (1909) 619; DANDY, J. Bot. 70 (1932) 331; OHWI, Bot. Mag. Tokyo 56 (1942) 204; Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1943) 166; S. T. BLAKE, J. Arn. Arb. 28 (1947) 229; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 28. — *L. triceps* (non NEES) CAMUS, Fl. Gén. I.-C. 7 (1912) 144. — *L. debilis* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 243; cf. KERN, Reinw. 4 (1956) 96. — *Cyperus lipocarpha* KOYAMA, Bot. Mag. Tokyo 73 (1960) 438. — Fig. 33.

Annual or perennial. Rhizome hardly any. *Stems* tufted, erect, rather stiff, obtusely trigonous, striate-sulcate, smooth, (10-)20-50(-70) cm by 1-2 mm. *Leaves* usually much shorter than the stems, rather rigid, flat or involute, gradually attenuate, obtusish, practically smooth (only minutely scaberulous at the very top), 2-4 mm wide. *Inflorescence* 1-1½(-2) cm across. Involucral bracts 2-3(-5), much overtopping the inflorescence, finally horizontally spreading to reflexed, dilated at the base, the longest up to 10(-15) cm. *Spikelets* 3-6(-10), ovoid to oblong-ovoid, terete, obtuse, whitish, 5-8 by 4-5 mm. *Glumes* membranous, spatulate to oblong-obovate, sub-truncate at the apex with obtuse triangular tip, concave, with strong midnerve and faintly 1-2-nerved sides, often purplish lineolate, 1¼-2¾ by 1-1¼ mm. *Hypogynous scales* oblong, 5-7-nerved, much longer than the nut, 1¾-2 mm long. *Stamens* 1(-2); anthers linear, ¾-1 mm. Style (2-)3-fid. *Nut* oblong-obovate to oblong, straight or slightly curved, minutely apiculate, stramineous to fuscous, 1-1¼ by ½-½ mm.

Distr. Tropical and S. Africa, Madagascar, Mascarene Is., S. and SE. Asia (to Formosa and the Ryu Kyu Is.), tropical Australia, in *Malesia*: throughout Sumatra, Banka, Lingga Arch., Malay Peninsula (common all over the peninsula), Central Java (only once collected in the Rawah Pening near Ambarawa, 1941), Madura, Borneo, Anambas & Natuna Is., Philippines (Luzon, Mindanao), Celebes, Moluccas, and New Guinea. In view of the wide distribution in the Malesian region it is very remarkable that there is only a single record for Java, and none for the Lesser Sunda Is.

Ecol. In open marshy places; swamps, marshes, along lakes and pools, on riverbanks, in moist grassfields, wet rice-fields, clearings in forests, locally often abundant, at low and medium altitudes (usually between 0 and 1800 m, in W. New Guinea once at 2800 m: BRASS 10741).

Vern. *Rumpul lida angsa*, *r. rotan*, Mal. Pen., *imbulu tano*, *tihe-tihe*, Sum. E. C., *pohun*, Lingga Arch.; Philip.: *balabak*, Buk.; New Guinea: *kurumb*, *Mendi lang*.

2. *Lipocarpa microcephala* (R.Br.) KUNTH, En. 2 (1837) 268; STEUD. Syn. 2 (1855) 130; MIQ. Fl. Ind. Bat. 3 (1856) 331; BOECK. Linnaea 37 (1871) 118; BENTH. Fl. Austr. 7 (1878) 337; F.v.M. Pap. Pl. 7 (1886) 34; CLARKE, Fl. Br. Ind. 6 (1893) 668; KOORD. Minah. (1898) 285; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 82, *p.p.*; CLARKE, Philip. J. Sc. 2 (1907) Bot. 110; KOORD. Exk. Fl. Java 1 (1911) 183; CAMUS, Fl. Gén. I.-C. 7 (1912) 144; MERR. En. Philip. 1 (1923) 102; KÜK. Bot. Jahrb. 59 (1924) 51; RIDL. Fl. Mal. Pen. 5 (1925) 163, *p.p.*; OHWI, Bot. Mag.

Tokyo 56 (1942) 204; Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 167; S. T. BLAKE, J. Arn. Arb. 28 (1947) 228; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 27; KERN in BACK. & BAKH. f. Fl. Java 3 (1968) 457. — *Hypaelyptum microcephalum* R.Br. Prod. (1810) 220. — *Ascolepis kyllingoides* STEUD. [in Zoll. Syst. Verz. 2 (1854) 63, *nom. nud.*] Syn. 2 (1855) 105; MIQ. Fl. Ind. Bat. 3 (1856) 313; KOORD. Exk. Fl. Java 1 (1911) 184. — *Kyllingia squarrosa* STEUD. Syn. 2 (1855) 68; MIQ. Fl. Ind. Bat. 3 (1856) 294. — *L. zollingeriana* BOECK. Flora 42 (1859) 100. — *Scirpus squarrosus* (non L.) K.SCH. & LAUT. Fl. Schutzgeb. (1900) 195; VALCK. SUR. Nova Guinea 8 (1912) 705. — *Cyperus zollingerianus* KOYAMA, Bot. Mag. Tokyo 73 (1960) 438.

Annual. *Stems* tufted, erect, very slender, often filiform, obtusely trigonous, striate-sulcate, smooth, 5-30(-40) cm by ½-1 mm. *Leaves* usually much shorter than the stems, weak, flat or involute, gradually acuminate, acute, smooth, or minutely scaberulous at the very top, 1-2 mm wide. *Inflorescence* ½-1 cm across. Involucral bracts 2-3, much overtopping the inflorescence, finally horizontally spreading to reflexed, dilated at the base, the longest up to 10 cm. *Spikelets* (1-)3(-4), globose-ovoid to oblong-ovoid, terete, squarrose, obtuse, greenish, 3-5 (finally to 8) by 2-3 mm. *Glumes* thinly membranous, oblong-obovate, concave, with strong midnerve and nerveless sides, often purplish lineolate, without the mucro 1-1½, by ⅔-⅔ mm; mucro finally recurved, smooth, ½-¾ mm. *Hypogynous scales* linear, 3-5-nerved, slightly longer than the nut, 1-1¼ mm long. *Stamens* 1(-2); anthers oblong, ¼-⅔ mm long. Style 2(-3)-fid. *Nut* oblong-linear, slightly curved, minutely apiculate, stramineous to fuscous, 0.9-1 by ½-¼ mm.

Distr. SE. and E. Asia (Indo-China, S. China, Japan, Korea, Ryu Kyu Is., Formosa), all mainland Australian States, in *Malesia*: Malay Peninsula (Kelantan: Kota Bharu; P. Penang, *n.v.*; Singapore), Java (W. Java: Indramaju, Cheribon; Central Java: Kedu, Borobudur; E. Java: Kediri), Madura, Philippines (Luzon: Apayao, Ifugao, Bulacan, Rizal), Celebes (Minahassa, Makassar), Moluccas (Talaud Is., Buru, Ceram, Ambon), New Guinea (also on P. Japen and Daru I.), New Britain.

Ecol. In open wet localities (wet grassfields, rice- and sugar-cane-fields, on damp soil of savannah-forests) at low altitude, very local and absent over large tracts of Malesia, apparently largely bound to areas subject to a dry season.

Vern. *Kukus imbola*, Minahassa; New Guinea: *famdi*, Wapi lang.

Note. Very similar in habit to *Scirpus squarrosus* L. and often confused with it; for the differences see p. 516.

## 11. ELEOCHARIS

R. BR. Prod. (1810) 224; KUNTH, En. 2 (1837) 139; STEUD. Syn. 2 (1855) 75; BOECK. Linnaea 36 (1869-70) 418; CLARKE, Kew Bull add. ser. 8 (1908) 105; SVENS. Rhodora 31 (1929) 121-135; 152-163; 167-191; 199-219; 224-242; *ibid.* 34 (1932) 193-203; 215-227; *ibid.* 36 (1934) 377-389; *ibid.* 39 (1937) 210-231; 236-272; *ibid.* 41 (1939) 1-19; 43-77; 90-110; S. T. BLAKE, Proc. R. Soc. Queensl.

50 (1939) 88–132; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 84–99. — *Heleocharis* LESTIB. Ess. Fam. Cyp. (1819) 41. — *Chaetocyperus* NEES, Linnaea 9 (1835) 289. — *Chlorocharis* RIKLI, Jahrb. Wiss. Bot. 27 (1895) 564. — Fig. 34–36.

Annual or perennial herbs, in the latter case often stoloniferous. *Stems* usually tufted, erect or arcuate, terete to acutely angled. *Leaves* reduced to bladeless tubular sheaths often bearing a short erect micro (vestige of the blade) at the apex. *Inflorescence* a terminal, ebracteate, single spikelet, sometimes proliferous. *Spikelet* terete or angular, rarely compressed, few- to many-flowered. Rachilla persistent. *Glumes* spirally imbricate, sometimes subdistichous, caducous, the lowest 1–2 usually empty and more persistent than the fertile ones (in *ser. Aciculares* all glumes fertile). *Flowers* hermaphrodite. Perianth normally consisting of 6–10 bristles, not rarely reduced, very rarely wanting. Stamens 1–3; anthers ovate to linear, the connective produced into a small, rarely subulate appendage. Style usually glabrous, articulated with the nut, the dilated base persistent on the nut, in *ser. Pauciflorae* not sharply differentiated; stigmas 2–3. *Nut* 3- or 2-sided, obovate, orbicular, or pyriform, crowned by the enlarged style-base; epidermal cells hexagonal, transversely oblong to linear, or vertically oblong.

*Distr.* According to SVENSON c. 150  *spp.*, from the tropics to the polar regions of both hemispheres with the greatest concentration in the New World, in *Malesia* 19  *spp.*

*Ecol.* Semi-aquatic and marsh plants inhabiting wet muddy places along streams, or swamps and shallow waters of lakes and ponds. Nearly all Malesian  *spp.* are lowland plants ascending to medium altitudes; *E. attenuata* ascends to 2800 m, the northern *E. acicularis* was found at 900–1450 m; *E. tetraquetra* is almost restricted to altitudes above 1000 m.

*Uses.* Only a few species are of economic value. Some are used for matting (*E. ochrostachys*, *E. dulcis*). The tubers of *E. dulcis* are edible and the species is therefore cultivated.

*Notes.* *Eleocharis* is a natural genus nearest to *Scirpus*, *Fimbristylis*, and *Bulbostylis*; it is mainly characterized by the dilated style-base articulated with the ovary and persistent on the fruit, and the bladeless leaf-sheaths. The embryo, a variant of the *Fimbristylis*-type, is characterized by the first leaf more or less protruding from the germination-pore (VAN DER VEKEN, Bull. Jard. Bot. Brux. 35, 1965, 330). Only the members of *ser. Pauciflorae* (represented in *Malesia* by *E. parvula*) cause some difficulty as to the delimitation of the genus. Many authors consider them to belong to *Scirpus*. Their style-base, though confluent with the nut, is clearly different in texture and colour; therefore their natural place is obviously in *Eleocharis*; the type species of the series (see p. 537) has a typical *Eleocharis* embryo. RIKLI, Jahrb. Wiss. Bot. 27 (1895) 564, 574, divided the genus into *Eleocharis s.s.* with eucyberoid anatomical structure, and *Chlorocharis* with chlorocyperoid anatomy.

Both *Scirpus* and *Fimbristylis* lack the persistent style-base of *Eleocharis* and *Bulbostylis*. The leaf-sheaths of *Eleocharis* are at most mucronate, but in *Scirpus* a comparatively well developed blade is usually present. In *Fimbristylis* and *Bulbostylis* the perianth is always lacking; in the former the style, falling off as a whole, leaves no button on the nut.

The etymologically more correct spelling '*Heleocharis*' of LESTIBOUDOIS was followed by many authors. In the present revision the two spellings have not been considered as different in citing synonymy.

In general SVENSON's arrangement, somewhat modified by S. T. BLAKE, has been followed; however, the circumscription of several species has been broadened.

KEY TO THE SERIES AND SUBSERIES  
represented in *Malesia*

1. Style-base sharply differentiated from and articulated with the nut proper (see *E. spiralis*).
2. Glumes indurated, cartilaginous on the back, with a distinct midnerve and finely many-nerved sides, not keeled or only obscurely so. Mostly coarse perennials with the stem as wide or almost as wide as the spikelet. Style 2-fid or 3-fid. Nut lenticular, stramineous or brown, 1½–2 mm long. *Spp.* 1–8.
  1. *ser. Mutatae*
2. Glumes membranous, with a distinct midnerve and nerveless sides, often keeled. Stem much narrower than the spikelet.
3. Style 3-fid.
  4. Nut triquetrous, trigonous, or lenticular, smooth or variously sculptured (finely reticulate, or cancellate *i.e.* with deep honeycomb reticulation), but not trabeculate, the epidermal cells inconspicuous, mostly shortly vertically oblong.
  5. Coarse or rather coarse perennials (excepts for small annual forms of *E. congesta*). Nut obtusely trigonous, not costate on the rounded angles, usually 1 mm or more long. Uppermost leaf-sheath distinctly mucronate at the mouth (mucous or almost so in *E. congesta*).

6. Nut trigonous. *Sp.* 9–11 . . . . . 2. *ser. Multicaules*  
 6. Nut lenticular. *Sp.* 12 . . . . . 3. *ser. Acutae*  
 5. Dwarf, tufted annuals with capillary stems. Nut (in *Mal. spp.*) sharply triquetrous with costate angles, small, rarely up to 1 mm long. Uppermost leaf-sheath not mucronate. *Sp.* 13–14. 4. *ser. Tenuissimae*  
 7. Nut smooth or only finely reticulate under high magnification. *Sp.* 13. 4a. *subser. Leiocarpeae*  
 7. Nut coarsely cancellate. *Sp.* 14 . . . . . 4b. *subser. Chaetariae*  
 4. Nut obscurely trigonous or subterete, trabeculate (*i.e.* with some longitudinal ribs connected by numerous cross-ridges), the epidermal cells transversely linear or oblong. Lowest glume flower-bearing. *Sp.* 15 . . . . . 5. *ser. Aciculares*  
 3. Style 2-fid. Nut biconvex, smooth.  
 8. Rather coarse, usually stoloniferous perennials. Style-base spongy. Nut more than 1 mm long, yellow or brown. *Sp.* 16 . . . . . 6. *ser. Palustriformes subser. Palustres*  
 8. Small annuals, without stolons. Style-base not spongy. Nut less than 1 mm long, purplish or black. *Sp.* 17–18 . . . . . 7. *ser. Maculosae subser. Rigidae*  
 1. Style-base confluent with the apex of the nut, not constricted at the base. Nut trigonous, usually reticulate under high magnification. Style 3-fid. *Sp.* 19 . . . . . 8. *ser. Pauciflorae*

## KEY TO THE SPECIES

*The length of the nut is given without the persistent style-base crowning the nut*

1. Stems transversely septate, *i.e.* with a single large central cavity divided into several chambers by distinct transverse septa visible (at least when dry) from the outside.  
 2. Stems tufted on a short rhizome with elongated stolons sometimes bearing subglobose tubers. Spikelets 3–6 mm wide. Glumes greyish, 4–6½ mm long. Bristles 6–8. Nut 1½–2 mm long . . . . . 7. *E. dulcis*  
 2. Stems in a close linear series on a very stout, shortly creeping rhizome never producing tubers. Spikelets 8–9 mm wide. Glumes light brown, 7½–9 mm long. Bristles 8–10. Nut 2½–2½ mm long. . . . . 8. *E. sphacelata*
1. Stems not transversely septate.  
 3. Glumes cartilaginous, not or hardly keeled, finely many-nerved, usually with prominent midnerve. Nut lenticular, stramineous to brown, 1½–2½ mm long. Style 2-fid or 3-fid. Spikelets hardly (if at all) wider than the stem (*E. ochrostachys* often excepted).  
 4. Nut constricted below the apex into a short but definite neck, the apex expanded. Stems acutangular.  
 5. Epidermal cells of the nut for the greater part transversely oblong to linear, shallowly pitted. Glumes appressed, not in 4 rows. Spikelet terete. Stems triquetrous, usually 3–4 mm wide. . . . . 1. *E. acutangula*  
 5. Epidermal cells of the nut for the greater part isodiametric, hexagonal, deeply pitted. Glumes finally subsquarrose, almost in 4 rows. Spikelet angular. Stems acutely 4–5-angled, c. 2 mm wide. . . . . 2. *E. philippinensis*
4. Nut not constricted below the apex, without neck.  
 6. Glumes very obtuse to truncate, very densely imbricate (the exposed part broader than long, only ½–1 mm long).  
 7. Stems triquetrous at least in the upper part. Style-base c. ⅓ as long and ½ as wide as the nut. Epidermal cells of the nut transversely oblong-linear to linear, in c. 20 vertical series on either face . . . . . 3. *E. spiralis*  
 7. Stems terete. Style-base c. ¾ as long and almost as wide as the nut. Epidermal cells of the nut transversely oblong, in c. 30 vertical series on either face. . . . . 4. *E. sundaica*
6. Glumes obtuse, not particularly densely imbricate (the exposed part longer than broad, 2–3 mm long).  
 8. Epidermal cells of the nut small, not inflated, transversely oblong, in 15–20 vertical rows on either face. Nut with prominent longitudinal ridges . . . . . 5. *E. ochrostachys*  
 8. Epidermal cells of the nut large, strongly inflated, isodiametric or slightly transversely elongated, in c. 12(–15) vertical rows on either face. Nut not longitudinally ridged. . . . . 6. *E. variegata*
3. Glumes thinly membranous, often keeled, with distinct midnerve but nerveless sides. Nut triquetrous, trigonous, or lenticular. Spikelet much wider than the stem.  
 9. Style 3-fid.  
 10. Nut lenticular, plano-convex or biconvex. Uppermost leaf-sheath prominently mucronate. . . . . 12. *E. acuta*
10. Nut trigonous, subterete or triquetrous.  
 11. Nut trabeculate (with some longitudinal ribs connected by numerous cross-ridges) or cancellate (with deep, regular honey-comb reticulation). Stems capillary.  
 12. Nut obovoid, sharply triquetrous, almost truncate at the apex, cancellate. Style-base about as wide as the nut, 3-lobed, the lobes decurrent on the angles of the nut. . . . . 14. *E. retroflexa*

12. Nut obovoid-oblong, obscurely trigonous or subterete, trabeculate. Style-base minute, at most  $\frac{1}{2}$  as wide as the nut, not decurrent 15. *E. acicularis*
11. Nut smooth, neither trabeculate nor cancellate, only finely reticulate under high magnification.
13. Style-base not constricted at the base, confluent with the apex of the nut and seemingly a continuation of it, but of different colour and texture. Dwarfish (stems 1-7 cm by  $\frac{1}{4}$ - $\frac{1}{3}$  mm), often with filiform stolons ending in small fusiform tubers. 19. *E. parvula*
13. Style-base constricted at the base, sharply differentiated from and articulated with the nut.
14. Nut triquetrous with costulate angles, very small (c.  $\frac{1}{2}$  mm long). Bristles absent (in Malesian specimens) 13. *E. nigrescens*
14. Nut trigonous, not costulate,  $\frac{4}{5}$ - $1\frac{1}{2}$  mm long. Bristles 6, as long as or longer than the nut.
15. Stems acutely quadrangular. Bristles densely scabrous to barbellate-subplumose. Nut  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm long, crowned by a large, cap-like style-base. 9. *E. tetraquetra*
15. Stems terete, more or less angular-ribbed but not quadrangular. Bristles more or less scabrous, not subplumose. Nut  $\frac{1}{5}$ - $1\frac{1}{3}$  mm long with short-pyramidal style-base.
16. Style-base  $\frac{3}{5}$  to almost as wide as the nut. Glumes 2- $2\frac{1}{2}$ (-3) mm long. Uppermost leaf-sheath truncate or slightly oblique, distinctly mucronate. Nut 1- $1\frac{1}{5}$  mm long 10. *E. attenuata*
16. Style-base  $\frac{1}{3}$ - $\frac{1}{2}$  as wide as the nut. Glumes  $1\frac{1}{2}$ -2 mm long. Uppermost leaf-sheath usually oblique, not or but minutely mucronate. Nut  $\frac{1}{2}$ -1 mm long 11. *E. congesta*
9. Style 2-fid. Nut lenticular.
17. Rather coarse, stoloniferous perennial. Nut  $1\frac{1}{2}$ - $1\frac{2}{3}$  mm long, yellowish or pale brown. Glumes c.  $4\frac{1}{2}$  mm long. 16. *E. brevicollis*
17. Small annuals without stolons. Nut less than 1 mm long, blackish when ripe. Glumes at most 2 mm long.
18. Spikelets c. 3 mm thick. Glumes scarcely keeled,  $1\frac{3}{4}$ -2 mm long. Bristles 6-8, slightly longer than the nut, ferruginous to brown. Nut  $\frac{3}{4}$ - $\frac{9}{10}$  mm long 17. *E. geniculata*
18. Spikelets  $1\frac{1}{2}$ -2 mm thick. Glumes keeled, up to  $1\frac{1}{2}$  mm long. Bristles 3-4(-6), shorter than to as long as the nut, whitish, translucent, sometimes absent. Nut  $\frac{1}{2}$ - $\frac{2}{3}$  mm long. 18. *E. atropurpurea*

## 1. Series Mutatae

SVENS. *Rhodora* 31 (1929) 127. — *Limnochloa* NEES in Wight, Contr. Bot. Ind. (1834) 71; *Linnaea* 9 (1834) 294, non BEAUV. ex LESTIB. Ess. Fam. Cyp. (1819) 41? — *Subg. Limnochloa* C. B. CLARKE, Kew Bull. add. ser. 8 (1908) 105. — Type species: *E. mutata* (L.) R. & S.

1. *Eleocharis acutangula* (ROXB.) SCHULT. in R. & S. Mant. 2 (1824) 91; TROUPIN, Fl. Sperm. Parc Nat. Garamba (1956) 108; ANDREWS, Flow. Pl. Sudan 3 (1956) 359; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 461. — *Scirpus fistulosus* POIR. Enc. 6 (1804) 749, non FORSK. 1775. — *Scirpus acutangulus* ROXB. Fl. Ind. 1 (1820) 216. — *E. fistulosa* SCHULT. in R. & S. Mant. 2 (1824) 89; KUNTH, En. 2 (1837) 155; MOR. Syst. Verz. (1846) 97; STEUD. Syn. 2 (1855) 80; MIQ. Fl. Ind. Bat. 3 (1856) 302; BOECK. *Linnaea* 36 (1870) 472; NAVES, Nov. App. (1882) 306; CLARKE, Fl. Br. Ind. 6 (1893) 626; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 76; CLARKE, Ill. Cyp. (1909) t. 35, f. 1-4; KOORD. Exk. Fl. Java 1 (1911) 197; CAMUS, Fl. Gén. I.-C. 7 (1912) 84, f. 13, 3 & 4; MERR. En. Philip. 1 (1923) 120; RIDL. Fl. Mal. Pen. 5 (1925) 151; FERN. *Rhodora* 27 (1925) 39, t. 149, f. 5-10; SVENS. *Rhodora* 31 (1929) 152, t. 188, f. 3; *ibid.* 41 (1939) 4; S. T. BLAKE,

*Proc. R. Soc. Queensl.* 50 (1939) 97, t. 7, f. 1-3; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 31; S. T. BLAKE, J. Arn. Arb. 28 (1947) 226; BACK. *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 15, p.p.; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 36; J. Fac. Sc. Un. Tokyo III, 8 (1961) 98. — *E. planiculmis* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 80<sup>1</sup>; NAVES, Nov. App. (1882) 306; MIQ. Fl. Ind. Bat. 3 (1856) 301. — *E. variegata* (nec PRESL, nec KUNTH) BOECK. *Linnaea* 36 (1870) 470, p.p.; BACK. *Onkr. Suiker.* (1928) 153, p.p.

Perennial, with short rhizome and long stolons. Stems erect, tufted, rather stout, somewhat spongy, triquetrous, smooth, not transversely septate, 30-70 cm by (1-) $3\frac{1}{2}$ -4 mm. Sheaths membranous, rather loose, with oblique mouth, pointed at the summit, often rubescent. Spikelets cylindrical, scarcely if at all broader than the stem, terete, acute, many-flowered, dusky green, 2- $3\frac{1}{2}$  cm by 3-4 mm. Glumes firm, rather loosely imbricate, closely appressed, ovate or oblong-ovate, obtuse, not keeled, many-nerved with prominent midnerve, dirty stramineous, with rather broad scarious margins,  $4\frac{1}{4}$ - $4\frac{1}{2}$ (-5) by  $2\frac{1}{4}$ - $3\frac{1}{4}$  mm. Bristles 6-7, rather stout, one very short, one about as long as the nut, the others subequal, usually as long as or slightly surpassing the style-base, rusty brown. Stamens 2-3; anthers linear,

<sup>1</sup> The type is erroneously cited as ZOLLINGER 284; should be 281.

shortly apiculate,  $1\frac{1}{2}$ –2 mm. *Style* 3-fid. *Nut* turgidly and unequally biconvex, with scarcely ribbed margins, obovate, distinctly constricted below the apex into a short neck c.  $\frac{2}{3}$  as wide, the expanded apex c.  $\frac{1}{2}$  as wide as the body of the nut, glistening stramineous,  $1\frac{1}{2}$ –2 by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm; epidermal cells conspicuous, transversely oblong, in c. 15 vertical rows on either face, shallowly pitted. *Style-base* ovate-deltoid, flat, dark brown, c.  $\frac{1}{3}$  as long and  $\frac{1}{2}$  as wide as the nut.

*Distr.* Widely distributed but apparently uncommon species in the tropics both of the Old and the New World: West Indies, tropical S. America, tropical Africa, Madagascar, S. and E. Asia (to Formosa and Japan), tropical Australia (Queensland), in *Malesia*: Sumatra, Malay Peninsula (Kedah, Perak, Malacca, P. Langkawi, Singapore), W. and Central Java (also in Kangean, Madura), Lesser Sunda Islands (Timor, Alor, Wetar), N. Borneo, Philippines (Luzon, Mindanao), Celebes, New Guinea (Papua, NE. New Guinea). Distribution map in *Rhodora* 41 (1939) 10, f. 28.

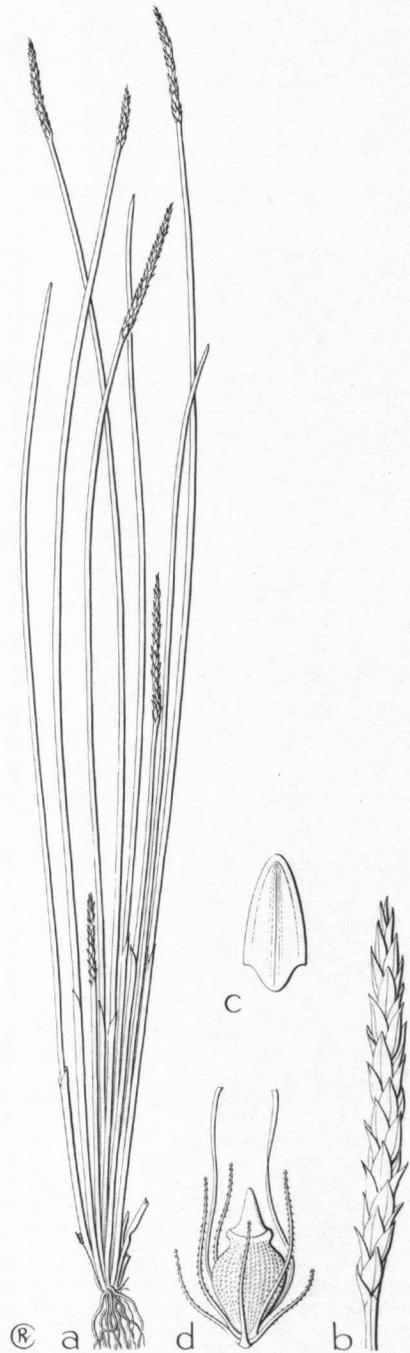
*Écol.* In open wet places (swamps, rice-fields) at low alt., up to 800 m.

*Vern.* *Bhan-talobhānan*, Md., *komlak*, Alor.

*Note.* After TROUPIN, l.c., had pointed out that the correct name of this species is *E. acutangula*, not *E. fistulosa*, KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 98, accepted again the latter combination in ascribing it to LINK, *Jahrb. Gewächsk.* 3 (1820) 78. However, the combination was not definitely made there ("*Scirpus fistulosus* . . . ist ebenfalls eine *Eleocharis*").

**2. *Eleocharis philippinensis* SVENS.** *Rhodora* 31 (1929) 155, f. 9; S. T. BLAKE, *Proc. R. Soc. Queensl.* 50 (1939) 98, t. 7, f. 7–10; KERN, *Reinw.* 4 (1956) 94; in Back. & Bakh. *f. Fl. Java* 3 (1968) 462. — *E. fistulosa* (non SCHULT.) BENTH. *Fl. Austr.* 7 (1878) 293. — *E. variegata* var. *laxiflora* (non CLARKE, *Fl. Br. Ind.* 6, 1893, 626) CLARKE, *Philipp. J. Sc.* 2 (1907) Bot. 90; MERR. *Fl. Manila* (1912) 114; *En. Philip.* 1 (1923) 121, p.p. — *E. nuda* (non CLARKE) SVENS. *Rhodora* 41 (1939) 8, p.p. — **Fig. 34.**

Perennial, with short rhizome and long, slender stolons. *Stems* erect, tufted, slender, sharply and unequally 4–5-angled, smooth, not transversely septate, (10–)30–50 cm by c. 2 mm. *Sheaths* thin, rather loose at the apex, purple at the base. *Spikelet* linear, scarcely if at all broader than the stem, angular, acute, many-flowered, dusky green, 2–6 cm by 2–3 mm. *Glumes* firm, almost in 4 rows, rather loosely imbricate, subsquarrose, more or less convolute when dry, oblong-ovate, obtuse, rather prominently keeled, many-nerved, more or less distinctly brown-zonate within the narrow scarious margins, 4–5 by 2–2 $\frac{1}{2}$  mm. *Bristles* 6–7, rather coarse, unequal (the inner ones distinctly longer than the outer ones), from less than half as long as the nut proper to slightly longer than the nut together with the style-base, retrorsely scabrous, brown. *Stamens* 3; anthers linear, 1–1 $\frac{1}{2}$  mm. *Stigmas* 2–3. *Nut* turgidly biconvex with slightly ribbed margins, obovate, somewhat pyriform, slightly narrowed into a distinct neck which is upwards outwardly curved into a prominent annulus, stramineous to fuscous,  $1\frac{1}{2}$ – $1\frac{3}{4}$  by c.  $1\frac{1}{4}$  mm; epidermal cells in 15–20 regular vertical series on either face, hexagonal, deeply pitted. *Style-base* deltoid, flattened, c.  $\frac{1}{2}$ – $\frac{2}{3}$  as long and  $\frac{2}{4}$ – $\frac{3}{2}$  as wide as the nut.



**Fig. 34.** *Eleocharis philippinensis* SVENS. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times \frac{1}{2}$ , c. glume,  $\times 4$ , d. defflorate flower,  $\times 8$  (a–d RAMOS 1461).

Distr. Tropical Australia, New Caledonia, Thailand (Bangkok, KERR 11105), Indo-China (Bien Hoa), in *Malesia*: Malay Peninsula (Kedah), W. Java (near Djakarta), Madura, Lesser Sunda Is. (Sumba: Waik-abubak; Tainimbar Is.: P. Jamdena), Philippines (Luzon), New Guinea (tributaries of Goragatabu Creek 17 miles NE. of Port Moresby).

Ecol. On open marshy ground, in wet rice-fields, in P. Jamdena in *Melaleuca*-forest surrounded by primary forest; at low altitude, up to 400 m.

Vern. The local name *rebbhā lob-tolohān*, Md, is reported from Madura. It may also refer to other *Eleocharis* species (cf. *E. acutangula*).

Notes. In 1939 referred by SVENSON to *E. nuda* C. B. CLARKE, Kew Bull. add. ser. 8 (1908) 21. I have followed BLAKE, who keeps the two apart, distinguishing *E. nuda* from *E. philippinensis* by the terete or trigonous stems, the relatively broader appressed glumes, the distinctly pyriform nut with shallower pitting, the strongly upcurved annulus and the caducous bristles. The specimens of *E. nuda* in the Kew Herbarium show that *E. nuda* is clearly distinct.

*E. philippinensis* is also related to *E. plicarhachis* (GRISEB.) SVENS. of the West Indies and South America, from which it differs in the slender, elongate spikelet with somewhat spreading glumes, and the larger nuts with more deeply pitted, almost isodiametric epidermal cells and a wider annulus.

*E. ochrostachys* differs in the terete or obscurely angular stems, the short spikelet with appressed glumes, the different shape and the transversely linear marking of the nut. As BLAKE pointed out, the outer cells of the nut in *E. philippinensis* occasionally show a tendency to lengthen transversely, but not to such an extent as to alter the typical character of the nut.

In HEYLIGERS 1316 (CANB), the only collection known from New Guinea, the bristles are very short. This form is also known from Queensland; see S. T. BLAKE, *l.c.* The plants from the other parts of *Malesia* and those from continental Asia have long bristles.

3. *Eleocharis spiralis* (ROTTB.) R. & S. Syst. Veg. 2 (1817) 155; KUNTH, En. 2 (1837) 155; STEUD. Syn. 2 (1855) 81; BOECK. Linnaea 36 (1870) 473; BENTH. Fl. Austr. 7 (1878) 292, *p.p.*; CLARKE, Fl. Br. Ind. 6 (1893) 627; Ill. Cyp. (1909) t. 35, f. 5-7; CAMUS, Fl. Gén. I.-C. 7 (1912) 85, f. 11, 6-7; MERR. En. Philip. 1 (1923) 121; BACK. Onkr. Suiker. (1928) 153, t. 155; SVENS. Rhodora 31 (1929) 135, t. 188, f. 12; *ibid.* 41 (1939) 9; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 97, t. 7, f. 4-6; J. Arn. Arb. 28 (1947) 227; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 15; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 461. — *Scirpus spiralis* ROTTB. Descr. & Ic. (1773) 45, t. 15, f. 1. — *E. variegata* (non PRESL, nec KUNTH) MERR. En. Borneo (1921) 60, *p.p.*

Perennial, with short rhizome and creeping stolons. Stems erect, tufted, rather robust, triquetrous at least in the upper part, smooth (somewhat rugulose when dry), not transversely septate, glaucous, 25-60 cm by 2-4 mm. Sheaths thin, rather loose at the apex, pale green to brownish, more or less tinged with purple, obliquely truncate, with a setaceous, up to 4 mm long point at the apex. Spikelet cylindrical, somewhat broader than the stem, terete, obtuse, very densely many-flowered, yellowish,  $1\frac{1}{2}$ - $3\frac{1}{2}$  cm by

3-5 mm. Glumes rather firm, strikingly spirally arranged, very closely packed, (the exposed portion broader than long), tightly appressed, broadly cuneate-obovate to almost quadrate, subtruncate at the apex, faintly many-nerved (the midnerve not very prominent), stramineous to light brown, more or less distinctly brown-zonate within the narrow scarious margins,  $2\frac{3}{4}$ - $3\frac{3}{4}$  mm long and about as wide. Bristles 4-6, delicate, from much shorter than to about as long as the nut, with weak both antrorse and retrorse teeth, ferrugineous. Stamens 3; anthers linear, shortly apiculate,  $1\frac{1}{4}$ -2 mm. Style 2-3-fid. Nut turbidly biconvex (the margins not ribbed), obovate, without neck and apical annulus (or latter indistinct), shining, at first stramineous, finally deep brown,  $1\frac{1}{2}$ - $1\frac{3}{4}$  by c.  $1\frac{1}{4}$  mm; epidermal cells transversely oblong-linear to linear, in c. 20 vertical series on either face, not pitted. Style-base triangular, almost confluent with the nut, c.  $\frac{1}{2}$  as long and  $\frac{1}{2}$  as wide as the nut.

Distr. Tropical Africa, Madagascar (here perhaps introduced), Mauritius, Ceylon, S. India, S. China, N. Australia, Queensland, New Caledonia, in *Malesia* apparently very rare: Malay Peninsula (Singapore), W.-E. Java, in a few localities; Madura; N. Borneo; Philippines (Luzon, Rizal); New Guinea (Papua, Central Distr., Kairuka Subdistr.). Distribution map in Rhodora 41 (1939) 5, f. 17.

Ecol. In open wet places, pools, swamps, often on clayish soil, at low altitudes (up to 100 m?); almost restricted to brackish or salt localities, sometimes forming extensive, practically pure stands; far inland along salt mudwell near Kesongo (Java, res. Rembang).

Uses. In Indramaju (W. Java) used for making mats.

Vern. *Boroslanang* (endong), J (Indramaju).

Note. *Eleocharis spiralis* is very near to *E. mutata* (L.) R. & S. (*Scirpus mutatus* LINNÉ, Moen. Ac. 5, 1759, 391) from America and tropical Africa, and might perhaps better be treated as a subspecies of a pantropic species. The two were united by BOECKLER, Linnaea 36 (1870) 473.

*E. spiralis* differs from *E. mutata* by the firmer and more sharply truncate glumes, the shorter and thicker spikelets, the smoother nuts with finer markings, and the more irregularly toothed, slenderer bristles.

4. *Eleocharis sundaica* KERN, Blumea 9 (1958) 220, f. 1.

Perennial, with short rhizome and long-creeping stolons ending (always?) in tubers. Stems erect, tufted, rather robust, terete, smooth (rugulose when dry), not transversely septate, 65-85 cm by 3-6 mm. Sheaths loose, membranous, pale green to stramineous, often darker at the base, obliquely truncate, mucous. Spikelet cylindrical, terete, subacute, very densely many-flowered,  $1\frac{1}{2}$ -2 cm by 4-6 mm. Glumes rather firm, very closely packed (the exposed portion broader than long), broadly ovate or suborbicular, rounded at the apex, not keeled, faintly many-nerved, stramineous, brown-zonate within the broad scarious margin, c. 4 by (3-4) mm, the lowermost empty, embracing the stem. Bristles 5-6, firm, retrorsely scabrous, 2-3 reaching the top of the persistent style-base, other ones slightly shorter to slightly longer than the nut. Stamens 3. Style 2-fid

(always?). *Nut* biconvex, broadly elliptic or broadly obovate, subtruncate, with slightly ribbed angles, slightly reticulate, shining, castaneous when ripe, c. 2 by  $1\frac{2}{3}$ – $1\frac{3}{4}$  mm; epidermal cells transversely oblong, in c. 30 vertical series on either face. *Style-base* triangular, flattened, spongy,  $\frac{3}{4}$  as long and almost as wide as the nut.

Distr. *Malesia*: Lesser Sunda Is. (Alor, near Naumang).

Ecol. Abundant along a lake, at 450 m.

Vern. *Móluta*.

Note. Closely related to *E. spiralis*, from which it differs by the terete stems, the larger, not almost truncate glumes, the larger nut with the external cells oblong, the much stouter style-base, and the longer and firmer bristles. Apparently also close to *E. brassii* S. T. BLAKE, Proc. R. Soc. Queensl. 49 (1938) 154; *ibid.* 50 (1939) 100, t. 7, f. 16–19, from N. Australia and Queensland. Not seen; according to description and figure mainly differing by the much narrower, ovate glumes, the length of the bristles (4 about as long as the nut, 2 very small or absent), and the hexagonal epidermal cells of the nut in c. 20 vertical rows on either face.

5. *Eleocharis ochrostachys* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, *nom. nud.*] Syn. 2 (1855) 80; MIQ. Fl. Ind. Bat. 3 (1856) 301; BOECK. Linnaea 36 (1870) 452; CLARKE, Fl. Br. Ind. 6 (1893) 626; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 76; Fl. Mal. Pen. 5 (1925) 151; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 32; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 461. — *Scirpus laxiflorus* THW. En. Pl. Zeyl. (1864) 435. — *E. variegata* (POIR.) PRESL var. *laxiflora* CLARKE, Fl. Br. Ind. 6 (1893) 626; MERR. En. Philip. 1 (1923) 121, *p.p.*; KÜK. Bot. Jahrb. 59 (1924) 47; *ibid.* 69 (1938) 257; SVENS. Rhodora 31 (1929) 156, f. 10. — *E. subulata* BOECK. Flora 41 (1858) 412; KOORD. Exk. Fl. Java 1 (1911) 197. — *Scirpus ochrostachys* O.K. Rev. Gen. Pl. 2 (1891) 758. — *E. laxiflora* H. PFEIFF. Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 169; SVENS. Rhodora 41 (1939) 8, t. 537, f. 3; S. T. BLAKE, J. Arn. Arb. 28 (1947) 227. — *E. variegata* (non PRESL, nec KUNTH) BOECK. Linnaea 36 (1870) 470, *p.p.* (*excl. syn.*); KOORD. Exk. Fl. Java 1 (1911) 196; BACK. Onkr. Suiker. (1928) 153, *p.p.* — *E. fistulosa* (non LINK) BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 15, *p.p.* — Fig. 35.

Perennial, with short rhizome and long stolons. Stems erect, tufted, slender, rigid, terete or obscurely angular, smooth, not transversely septate, 35–60 cm by ( $\frac{3}{4}$ )–12–3(–5) mm. *Sheaths* membranous, closely appressed, purplish at the base, obliquely truncate, acute or rounded at the apex. *Spikelet* cylindrical, as broad as to distinctly broader than the stem, somewhat angular, acute, few- to several-flowered, pale green, (5–)10–20 by 3–4 mm. *Glumes* firm, loosely imbricate, appressed, oblong-ovate, obtuse, somewhat convolute when dry, many-nerved with prominent midnerve, usually brown-zonate within the broad scarious margins, 4–5 by 2–3½ mm. *Bristles* 5–7, coarse, up to 2–3 times as long as the nut, retrorsely scarious in the upper half, yellowish or light brown. *Stamens* 2–3; anthers linear, 1–1½ mm, shortly apiculate. *Style* 2–3-fid. *Nut* turgidly and unequally biconvex, ribbed on the margins, obovate to broadly obovate, not constricted but with an annular prominence c.  $\frac{1}{2}$ – $\frac{3}{4}$  as wide as the nut at

the apex, shining stramineous to greyish,  $1\frac{1}{2}$ –2 by  $1$ – $1\frac{1}{2}$  mm; epidermal cells small, transversely oblong, in 15–20 vertical series on either face, not pitted, the longitudinal ridges prominent. *Style-base* deltoid, flat, dark brown,  $\frac{1}{2}$ – $\frac{3}{4}$  mm high.

Distr. From India and Ceylon to Thailand, Indo-China, Formosa and the Ryu Kyu Islands, Micronesia (Carolines) and Melanesia (Solomon Is., Fiji), almost throughout *Malesia*, but often very local; in Java only in the western part, in the Philippines only known from Luzon and Mindanao, in the Moluccas only from Halmahera; not yet collected in the Lesser Sunda Is. Distribution map in Rhodora 41 (1939) 5, f. 15.

Ecol. In open wet places, swamps, on margins of lakes, floating islands etc., at low and medium altitudes (up to 1400 m), sometimes dominant.

Uses. Sometimes used for making bags (Sumatra E.C., W. Borneo).

Vern. *Purun*, *purun tikus*, *purun dama*, *rumpit sikat*, *M*, *ngunu boba* (Halmahera); these names may partly refer to *E. acutangula*.

Note. Except for some minor points the collection KALKMAN 4003 from W. New Guinea, Sibil valley, very well answers the description of *E. difformis* S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 99, of which I have not seen the type. Similar slender specimens with stems not fully 1 mm wide I have seen from the Malay Peninsula and Borneo. In my opinion they are not specifically distinct from *E. ochrostachys*, and I doubt whether *E. difformis* can be upheld.

6. *Eleocharis variegata* (POIR.) PRESL in Oken, Isis 21 (1828) 269; KUNTH, En. 2 (1837) 153; BOECK. Linnaea 36 (1870) 470, *p.p.*; SVENS. Rhodora 41 (1939) 8, t. 537, f. 4; KERN, Reinw. 4 (1956) 95. — *Scirpus variegatus* POIR. Enc. 6 (1804) 749.

Closely related to *E. ochrostachys* and agreeing with this species in almost every detail, except for the quite different marking of the nut. *Glumes* often reddish-zonate within the broad, lacerate, scarious margins. *Nut* glossy, stramineous to orange, without prominent longitudinal ridges, the epidermal cells large, strongly inflated, isodiametric or somewhat horizontally elongated, in 12–15 vertical series on either face.

Distr. Tropical Africa, Madagascar, Mauritius, Seychelles, in *Malesia* only a few times collected: N. Sumatra (S. foot of Mt Piso-piso, NW. of Toba Lake, LÖRZING 9374) and NE. New Guinea (Western Highlands). Distribution map in Rhodora 41 (1937) 5, f. 11.

Ecol. In swamps, 1400–1500 m.

Note. Though in habit very similar to *E. ochrostachys* readily recognized by the large inflated outer cells of the nut, according to SVENSON approached nowhere else in the genus except in the Caribbean *E. cellulosa* TORR. In the Malesian specimens the stems are more or less quadrangular (with one of the sides narrower than the other ones), especially in the upper part. Therefore they agree very well with the description of *E. calocarpa* CHERM. (Arch. Bot. Caen 4, Mém. 7, 1931, 41) from tropical Africa, of which I have not seen the type. In SVENSON'S opinion *E. variegata* and *E. calocarpa* are very closely related, the chief distinction lying in the 4-angled stems of *E. calocarpa* as compared with the cylindrical stems of *E. variegata*, which are sometimes trigonous below



Fig. 35. *Eleocharis ochrostachys* STEUD. in foreground gregarious in front of drifting mats of *Leersia hexandra* and *Isachne miliacea* and behind open water with *Nymphoides indica*. Rawa Tembaga near Bekassi (E of Djakarta) (photogr. VAN STEENIS, 1941).

the inflorescence. It is somewhat surprising that one of the collections cited by SVENSON under *E. calocarpa* is annotated 'culms terete'. As in my opinion angular stems alone are an unsatisfactory character for specific separation, I referred the Malesian specimens to *E. variegata*.

7. *Eleocharis dulcis* (BURM. f.) HENSCHEL, Vita Rumph. (1833) 186; MERR. Int. Rumph. (1917) 104; Sp. Blanc. (1918) 82; BROWN, Min. Prod. Philip. For. 2 (1921) 250, t. 8; En. Philip. 1 (1923) 119; BACK. Onkr. Suiker. (1928) 152, t. 154; SVENS. Rhodora 31 (1929) 158, t. 188, f. 16; *ibid.* 41 (1939) 11; STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 285, f. 15, 36, 53; OCHSE, Veg. Dutch E. Ind. (1931) 219, f. 132; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 103, t. 8, f. 6-9; J. Arn. Arb. 28 (1947) 227; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 12; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 35; J. Fac. Sc. Un. Tokyo III, 8 (1961) 97; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 460. — *Cyperus dulcis* RUMPH. Herb. Amb. 6 (1750) 7, t. 3, f. 1; cf. TRIN. Clav. Agr. (1822) 120. — *Andropogon dulce* BURM. f. Fl. Ind. (1768) 219. — *Scirpus plantaginoides* ROTTB. Descr. & Ic. (1773) 45, t. 15, f. 2. — *Scirpus plantagineus* RETZ. Obs. 5 (1789) 14. — *Hippuris indica* LOUR. Fl. Cochinch. (1790) 16. — *E. plantaginea* R. & S. Syst. 2 (1817) 150; MIQ. Fl. Ind. Bat. 3 (1856) 302; NAVES, Nov. App. (1882) 306; BOECK. Linnaea 36 (1870) 474, p.p.; CLARKE, Fl. Br. Ind. 6 (1893) 625; Ill. Cyp. (1909) t. 33, f. 1-5; t. 34, f. 7; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 75; KOORD. Exk. Fl. Java 1 (1911) 196; *ibid.* 4 (1922) f. 243; CAMUS, Fl. Gén. I.-C. 7 (1912) 82; RIDL. Fl. Mal. Pen. 5 (1925) 150. — *Scirpus tuberosus* ROXB. Fl. Ind. 1 (1820) 213. — *Scirpus tumidus* ROXB. Fl. Ind. 1 (1820) 215. — *E. tuberosa* R. & S. Mant. 2 (1824) 86; MIQ. Fl. Ind. Bat. 3 (1856) 302; NAVES, Nov. App. (1882) 306. — *E. tumida* R. & S. Mant. 2 (1824) 86; NAVES, Nov. App. (1882) 306. — *E. equisetina* PRESL, Rel. Haenk. 1 (1828) 195; STEUD. Syn. 2 (1855) 82; MIQ. Fl. Ind. Bat. 3 (1856) 302;

NAVES, Nov. App. (1882) 306; CLARKE, Fl. Br. Ind. 6 (1893) 626; Philip. J. Sc. 2 (1907) Bot. 89; RIDL, Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 75; MERR. Fl. Manila (1912) 114; CAMUS, Fl. Gén. I.-C. 7 (1912) 83; MERR. En. Philip. 1 (1923) 120; RIDL, Fl. Mal. Pen. 5 (1925) 150; SVENS. Rhodora 31 (1929) 161, t. 188, f. 14; KÜK. Bot. Jahrb. 69 (1938) 257; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 104, t. 8, f. 10-13. — *Carex tuberosa* (non DEGL.) BLANCO, Fl. Filip. (1837) 35; ed. 2 (1845) 24; ed. 3, 1 (1877) 45, t. 15. — *E. sphacelata* (non R.Br.) BENTH. Fl. Austr. 7 (1878) 292, p.p. — *E. plantaginoidea* W. F. WIGHT, Contr. U.S. Nat. Herb. 9 (1905) 267. — *E. plantaginoides* DOMIN, Bibl. Bot., Heft 85 (1915) 445. — *E. indica* DRUCE, Rep. Bot. Exch. Club Br. Isl. 4 (1917) 621. — Fig. 36.

Perennial; rhizome short with elongated stolons sometimes bearing subglobose, brownish to blackish, zoned tubers c. 1 cm ø (up to 4 cm in cultivated races). Stems erect, tufted, slender, terete, finely longitudinally striate, conspicuously transversely septate, smooth, greyish to shining dark green, 40-200 cm by (1-3)-10 mm. Sheaths membranous, oblique at the apex, purplish. Spikelet cylindrical, as broad as or somewhat broader than the stem, terete, rather obtuse to acute, many-flowered, 1½-6 cm by 3-6 mm. Glumes numerous, firm, rather densely imbricate, appressed, oblong-obovate to oblong, obtuse to truncate, finely many-nerved with distinct mid-nerve, greyish green or stramineous, with a narrow scarious margin at the apex and a faint brown zone within it, 4-6½ by 2-3 mm. Bristles 6-8, from about as long to twice as long as the nut, retrorsely

scabrous, light brown. Stamens 3; anthers linear, 2-3 mm, the connective with a distinct appendage. Style 2-3-fid. Nut biconvex, obovate to broadly obovate, not costate on the margins, hardly constricted at the summit but with an inconspicuous annular thickening about ½ as wide as the nut, usually with a shallow longitudinal furrow on the anticous side, shining brown, 1½-2 by 1¼-1½ mm; epidermal cells very small, hexagonal to oblong-hexagonal. Style-base triangular, flat, dark brown, c. 2/3 as wide and ½ as long as the nut, the remainder of the long style often persistent.

Distr. Tropical West Africa, Madagascar, SE. Asia (from India to S. China, Formosa, the Ryu Kyu Is. and Japan), Australia (N. Australia, Queensland), Micronesia (Marianas, Carolines), Melanesia (New Caledonia, Fiji, Samoa), in *Malaysia*: Sumatra, Banka, Riouw Arch., Malay Peninsula, Java, Kangean, Lesser Sunda Is. (Bali, Sawu, Alor, Timor), Philippines (Luzon, Negros, Mindanao), Celebes, Moluccas (Key & Aru Is.), and New Guinea (W. New Guinea, Papua).

Ecol. In open wet places, both in salt or brackish and in fresh water swamps, in pools, ponds, rice-fields; often forming pure stands surrounding the open water; 0-1350 m; on Mt Diëng (Central Java) at 2000 m (not flowering); in most parts of the area of local occurrence.

Uses. The boiled tubers of the wild form are sold in large quantities at the Djakarta and Manila markets in the months of August to December (*kulub*, S). They are usually made into chips, *kripik* (*ëmping tiki*). See OCHSE, *l.c.* In the warmer parts of China the species has long been cultivated and developed into a strain yielding tubers which are superior in size and sweetness to those produced by the wild plants and esteemed as a nutritious delicacy in Chinese cookery. They are also extensively eaten raw as a substitute for fresh fruits because of the crisp apple-like flesh. The much larger tubers of this cultivated form (*matat*' = horse's hoof; *E. tuberosa* R. & S. s.s.) are imported in Indonesia. Recently there is vivid interest in the establishment of this species as a new crop in the United States of America (see HODGE in Econ. Bot. 10, 1956, 49-65, with bibliography).

In Sumatra (Padang Highlands) and N. Celebes the species is also cultivated; here the stems are used for making sleeping mats (this use is also reported from Halmahera). By some Papuan tribes they are used for making skirts for the women.

Vern. *Chinese waterchestnut*, E; M; *begau*, *biga*, Sum. W. C., *mansiro buluk*, *m. bolong*, *m. kuning*, Menangk., *putjut*, Banka, *pépèrètan*, Djakarta; *babawangan beureum*, *lembang*, S; *bélanè pèrèt*, *titimbihen*, Minah., *tingkal*, Halmahera, *lorio*, Biagi, Papua; Philippines: *cabezas de negro*, Sp., *apúlad*, Tag., Bik., *kalañgub*, C. Bis., *potok*, Tag.; special names for the tuberiferous form (according to HEYNE): M: *tiké*, Djakarta, *tjikai*, Palemb.; *dékèng*, *tèki-tiké*, J, *pangoké*, *tékéré*, Mak., *goro*, *pagoro*, *pèru-pèru lénrong*, Bug.

Notes. Originally SVENSON (1929) distinguished between *E. dulcis* s.s. and *E. equisetina* PRESL, the latter characterized by the punctulate (not reticulate) nuts; however, he considered them conspecific in 1939. BLAKE (1939, 1947) distinguished *E. equisetina* by stolons never tuberiferous, harder stems usually



Fig. 36. *Eleocharis dulcis* (BURM. f.) HENSCHEL grown in a muddy pool near Wapanamanda (Papua), used for women's skirts (photogr. HOOGLAND).

less flattened in herbarium specimens, broader, shorter, subtruncate glumes somewhat incurved when dry, long-apiculate anthers, bright brown nut with acutely costulate margins and more evenly arranged external cells, weaker, usually much shorter hypogynous bristles which are quite free from another (not conspicuously connate at the base), and non-prominent receptacle.

Apart from the difficulties encountered in naming the numerous incomplete collections (without rhizomes, or in flower only), I fail to divide satisfactorily the Malesian materials into two groups, on account of the many intermediates. Undoubtedly several races are involved in this widely distributed and extensively cultivated, extremely polymorphic species; possibly additional collections of whole plants with ripe fruits will enable to distinguish between them. The stems of the cultivated form are much more robust than those of the wild plants; cytological study must show whether polyploidy is involved. *E. kuroguwai* OHWI, J. Jap. Bot. 12 (1936) 654, from Japan, characterized by the narrowly oblong glumes and the linear appendage of the connective, apparently also belongs here; according to KOYAMA (1961, *l.c.*) it is a good species, characterized by the less imbricate, rounded glumes, the conspicuously annulate nuts with narrower style-base, and the spikelets gradually narrowed towards the apex.

8. *Eleocharis sphacelata* R. Br. Prod. (1810) 224; BOECK. Linnaea 36 (1870) 475; BENTH. Fl. Austr. 7 (1878) 292, *p.p.*; CLARKE, Ill. Cyp. (1909) t. 34, f. 1-6; SVENS. Rhodora 31 (1929) 160, t. 188, f. 15; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 102, t. 8, f. 1-5.

Very closely allied to *E. dulcis*. Rhizome woody, very stout, shortly creeping, up to 1 cm thick, never producing tubers. Stems in a close linear series, up to 2 m tall and 12 mm thick. Spikelet acute, 8-9 mm wide. Glumes densely packed, light brown, mm long. Bristles 8-10, at least partly reaching the top of the style-base or overtopping it. Anthers  $3\frac{1}{2}$ -4 mm long. Nut broadly obovate to orbicular, with somewhat costulate margins and a definite longitudinal furrow on the anticost side, light yellowish to tawny or pale brown,  $2\frac{1}{3}$ - $2\frac{1}{2}$  by  $1\frac{1}{3}$ - $2\frac{1}{4}$  mm. Style-base from  $\frac{1}{2}$  to fully as long as the nut.

Distr. Australia (not in the Western part), Tasmania, New Zealand, in Malesia: NE. New Guinea, Western Highlands District (Sirunke, Wabag area, Kandep valley and northern slopes of Sugarloaf complex).

Ecol. In swamps, c. 2200-2900 m.

Uses. Used by native women for making rush skirts.

Vern. Kur, Enga language.

Notes. Distinguishable from *E. dulcis* by its stout horizontal rhizome without tuber-bearing stolons, broader spikelets, longer glumes, and slightly larger nuts. The stems are always stout, but equally stout stems occasionally occur in *E. dulcis*.

As only two Malesian collections are known, I have followed BLAKE's monograph of the Australian

*Eleocharis* species in treating it as a separate species extending from the Australian mainland to Tasmania, New Zealand, and New Guinea, though it probably may better be treated as a subspecies of *E. dulcis*.

## 2. Series Multicaules

SVENS. Rhodora 41 (1939) 4, *descr. angl.*; ex KERN<sup>1</sup>. — Sect. *Leiocarpeae* C. B. CLARKE, Kew Bull. add. ser. 8 (1908) 106, *p.p.* — Ser. *Tuberculosae* & ser. *Intermediae* SVENS. Rhodora 31 (1929) 129, *p.p.* — Type species: *E. multicaulis* (Sm.) Sm.

9. *Eleocharis tetraquetra* NEES in Wight, Contr. Bot. Ind. (1834) 113; KUNTH, En. 2 (1837) 150; BOECK. Linnaea 36 (1870) 447; BENTH. Fl. Austr. 7 (1878) 294; NAVES, Nov. App. (1882) 307; CLARKE, Fl. Br. Ind. 6 (1893) 630; Ill. Cyp. (1909) t. 37, f. 17-20; KOORD. Exk. Fl. Java 1 (1911) 197; *ibid.* 4 (1922) f. 247; MERR. En Philip. 1 (1923) 121; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 111, t. 9, f. 12-15; SVENS. Rhodora 41 (1939) 99; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 13; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 36; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 38; J. Fac. Sc. Un. Tokyo III, 8 (1961) 91; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 461; STEEN. Mt Fl. Java (1972) t. 14: 13. — *E. erythrochlamys* MIQ. Fl. Ind. Bat. 3 (1856) 300. — *Scirpus tetraquetra* THWAITES, En. Pl. Zeyl. (1864) 434; O.K. Rev. Gen. Pl. 2 (1891) 757 ('*tetraquetrus*'). — *E. tetraquetra* var. *micranthera* OHWI, Bot. Mag. Tokyo 56 (1942) 201.

Perennial, with short rhizome; long slender stolons sometimes present. Stems erect, tufted, slender, rigid, acutely 4-angled, with usually prominently ribbed angles and finely longitudinally striate or rather prominently ribbed sides, smooth, (15-)30-70 cm by 1-1½ mm. Sheaths herbaceous, closely appressed, purplish below, the upper one slightly thickened and brownish at the mouth, truncate or somewhat oblique, shortly mucronate just below the apex. Spikelet ovoid to oblong-ellipsoid, broader than the stem, often somewhat inclined, terete, acute, densely many-flowered, ferruginous to brown, 10-20 by 3-5 mm. Glumes rather firm, rather densely imbricate, closely appressed when young, somewhat spreading with age, elliptic to oblong-elliptic or lanceolate, obtuse, not or only faintly keeled, 1-nerved, ferruginous with paler keel and narrow scarious margins, 3-4 by c. 2 mm. Bristles 6, coarse, flat, about as long as or slightly exceeding the nut including the style-base, very densely retrorsely scabrous or subplumose, rufous. Style 3-fid. Stamens 2-3; anthers linear, minutely apiculate, 1-1½ mm. Nut obtusely trigonous, compressed, obovoid, not constricted below the apex, shining, yellowish or olivaceous to brown, obsolete reticulate by the small, vertically oblong epidermal cells,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by  $\frac{9}{10}$ - $1\frac{1}{5}$  mm. Style-base large, deltoid to subtrifidiform, compressed above, somewhat pyramidal below, spongy, fuscous, c.  $\frac{1}{2}$ - $\frac{3}{4}$  as long and  $\frac{1}{2}$ - $\frac{4}{5}$  as wide as the nut.

Distr. From Ceylon, India, China, Formosa, the Ryu Kyu Is. and Japan to Australia (Queensland,

<sup>1</sup> *Culmi vulgo subvalidi. Vagina summa ore truncata vel oblique secta, saepe mucronata. Stylus trifidus. Nux obtuse trigona, angulis ecostatis.*

N. S. Wales, in *Malesia*: Sumatra, Java, Lesser Sunda Is. (Flores), Philippines (Luzon, Mindanao), SW. Celebes, New Guinea. Distribution map in *Rhodora* 41 (1939) 75, f. 46.

**Ecol.** Open swampy places, at medium and high altitudes (in Java between 1000 and 2200 m, in the Philippines between 650 and 1800 m, in Sumatra Eastcoast Res. descending to 450 m), rarely ascending to 2700 m (W. and NE. New Guinea).

**Vern.** *Djukut djarum*, *S. tihe-tihe*, *tihe alk*, *si gonde langet*, *si martihe-tihe*, Sum. E.C.; New Guinea: *Kuli*, Enga lang., *patso*, Mendi lang.

**Note.** In VAN STEENIS 4058 (in BO), mentioned by BACKER (1949, *l.c.*) as being similar in habit to *E. tetraquetra* but differing from it by the distinctly reticulate nuts, I fail to see any difference with the other specimens of Javan. *E. tetraquetra*.

**10. *Eleocharis attenuata*** (FRANCH. & SAV.) PALLA, *Monde d. Pl.* 12 (1910) 40; HARA, *J. Jap. Bot.* 19 (1943) 153; *ibid.* 20 (1944) 333; KOYAMA, *J. Fac. Sc. Un. Tokyo III*, 8 (1961) 91; TANG & WANG, *Fl. Reip. Pop. Sinic.* 11 (1961) 58. — *Scirpus attenuatus* FRANCH. & SAV. *En. Pl. Jap.* 2 (1877) 110; (1879) 543. — *E. major* HARA, *J. Jap. Bot.* 11 (1935) 820, f. 24. — *E. laeviseta* NAKAI *var. major* HARA, *J. Jap. Bot.* 14 (1938) 521; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un. B* 18 (1944) 42. — *E. pellucida* PRESL *f. attenuata* OHWI, *l.c.* 40, *quoad basion*. — *E. pellucida* (non PRESL) S. T. BLAKE, *J. Arn. Arb.* 28 (1947) 227.

**Perennial** (always?). Rhizome short, without stolons. *Stems* densely tufted, erect or obliquely erect, slender, terete, longitudinally striate-costate, smooth, 20–60 cm by  $\frac{1}{2}$ –1 mm. Lower *sheaths* obliquely truncate, reddish brown, uppermost truncate or somewhat oblique, distinctly mucronate. *Spikelet* ovoid or narrowly ovoid, obtusish, terete, densely many-flowered, 5–10 by 3–5 mm. *Glumes* membranous, appressed, obovate, obtuse with rounded apex, convex (scarcely keeled), 1-nerved, greenish white often tinged with purple, with pale or green midnerve and scarious margins, 2–2 $\frac{1}{2}$ (–3) mm long. *Bristles* 6, slender, distinctly to obscurely retrorsely scabrous [smooth in *f. laeviseta* (NAKAI) HARA (*E. laeviseta* NAKAI in Fedde, *Rep.* 13 (1914) 246), not known from Malesia], as long as or slightly longer than the nut, but not overtopping the style-base. *Stamens* 2–3; anthers short-linear, *c.*  $\frac{3}{4}$  mm, shortly apiculate. *Style* 3-fid. *Nut* obtusely trigonous, obovoid, rounded at the apex, somewhat attenuate towards the base, smooth, shining olivaceous to brown, 1–1 $\frac{1}{5}$  by  $\frac{3}{5}$ – $\frac{4}{5}$  mm. *Style-base* depressed-deltoid-pyramidal,  $\frac{2}{3}$  to almost as wide as the nut.

**Distr.** Japan, Ryu Kyu Is., S. Korea, Quelpaert, E. and NW. China, in *Malesia*: New Guinea (W. New Guinea: Lake Habbema; Territory of N.G.: W. and E. Highlands).

**Ecol.** In swampy ground: along pools, swampy places in forests and grassy fields, on creek-banks, 1650–2800 m.

**Note.** Very closely related to *E. congesta* and possibly only a geographical (E. Asian) race of it.

**11. *Eleocharis congesta*** D. DON, *Prod. Fl. Nepal.* (1825) 41; KUNTH, *En. 2* (1837) 152; CLARKE, *Fl. Br. Ind.* 6 (1893) 630; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 88; SVENS. *Rhodora* 41 (1939) 102, t. 546 f. 2; KOYAMA,

*Contr. Inst. Bot. Un. Montréal n.* 70 (1957) 37; *J. Fac. Sc. Un. Tokyo III*, 8 (1961) 89; KERN in BACK. & BAKH. *f. Fl. Java* 3 (1968) 461. — *E. pellucida* PRESL, *Rel. Haenk.* 1 (1828) 196; *MIQ. Fl. Ind. Bat.* 3 (1856) 301; NAVES, *Nov. App.* (1882) 307; SVENS. *Rhodora* 41 (1939) 101; KOYAMA, *Contr. Inst. Bot. Un. Montréal n.* 70 (1957) 37. — *E. afflata* STEUD. [*in Zoll. Syst. Verz.* 1 (1854) 62, *nom. nud.*] *Syn.* 2 (1855) 76; *MIQ. Fl. Ind. Bat.* 3 (1856) 299; NAVES, *Nov. App.* (1882) 307; CLARKE, *Fl. Br. Ind.* 6 (1893) 629; Philip. *J. Sc.* 2 (1907) Bot. 90; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 87, f. 13; 5; MERR. *En. Philip.* 1 (1923) 119; BACK. *Onkr. Suiker.* (1928) 154, t. 157; *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 14. — *E. subprolifera* STEUD. [*in Zoll. Syst. Verz.* 1 (1854) 62, *nom. nud.*] *Syn.* 2 (1855) 80; *MIQ. Fl. Ind. Bat.* 3 (1856) 300; BOECK. *Linnaea* 36 (1870) 426; KOORD. *Exk. Fl. Java* 1 (1911) 197; *Atlas* (1922) f. 246. — 5. *subvivipara* BOECK. *Linnaea* 36 (1870) 424; CLARKE, *Fl. Br. Ind.* 6 (1893) 629; *Ill. Cyp.* (1909) t. 37, f. 13–16. — *Scirpus afflatus* BENTH. *Fl. Hongk.* (1861) 394; O.K. *Rev. Gen. Pl.* 2 (1891) 757. — *E. japonica* *MIQ. Ann. Mus. Bot. Lugd.-Bat.* 2 (1865) 142. — *Scirpus zollingeri* O.K. *Rev. Gen. Pl.* 2 (1891) 758. — *Scirpus subviviparus* O.K. *l.c.*

**Annual** of perennial, without stolons. *Stems* tufted, erect or oblique, slender, often capillary, striate or somewhat angular-ribbed, smooth, bright green, 5–40 cm by  $\frac{1}{2}$ –1 mm. *Sheaths* appressed, often purplish at the base, mucinous or with a minute mucro at the oblique or very oblique mouth. *Spikelet* ovoid or lanceolate, acutish, terete, densely several-to many-flowered, 3–9 by 1 $\frac{1}{2}$ –3 mm, often proliferous at the base. *Glumes* membranous, appressed, oblong-ovate to lanceolate, obtuse, scarcely keeled, 1-nerved, pale ferruginous, often tinged with red, with green midnerve and whitish, scarious margins, 1 $\frac{1}{2}$ –2 mm long. *Bristles* 6, slender, retrorsely scabrous, slightly to distinctly longer than the nut, at first whitish, finally ferruginous. *Stamens* 2(–3); anthers linear, shortly apiculate,  $\frac{3}{10}$ – $\frac{1}{2}$  mm long. *Style* 3-fid. *Nut* trigonous, obovoid, smooth or obsolete longitudinally striolate, shining, yellowish green to olivaceous,  $\frac{1}{5}$ –1 by  $\frac{1}{4}$ – $\frac{3}{5}$  mm; epidermal cells longitudinally oblong. *Style-base* shortly pyramidal, triangular, as long as or slightly longer than wide,  $\frac{1}{3}$ – $\frac{1}{2}$  as broad as the nut.

**Distr.** SE. and E. Asia (from India to China and Japan), in *Malesia*: N. and Central Sumatra, Malay Peninsula (P. Penang; Selangor: Kuala Lumpur, here introduced?), Java (in Central and E. Java less common than in W.), Lesser Sunda Is. (Flores), N. Borneo (according to MERRILL, *En. Born.* p. 59; not seen), Philippines (Luzon, Babuyan Is.), SW. and Central Celebes.

**Ecol.** In shallow water, swampy places, ditches, wet rice-fields, 50–2800 m.

**Vern.** *Bulu mata munding*, *S. dongdoman*, *J*; Philippines: *hallopnat*, *If*.

**Notes.** *E. congesta* and *E. pellucida* are treated as specifically distinct by SVENSON, but distinguished only by the thicker, rigid stems of the former. KOYAMA, *J. Fac. Sc. Un. Tokyo III*, 8 (1961) 89, assigns varietal rank to *E. pellucida* [*E. congesta var. japonica* (MIQ.) KOYAMA], distinguishing it from *E. congesta var. congesta* by the capillary stems, the small spikelets up to 7 mm by 1 $\frac{1}{5}$  mm, and the small, less than 1 $\frac{1}{5}$  mm long glumes.

However different in habit the small, annual plants of the wet rice-fields in the lowlands (*E. pellucida*) are from the much coarser, apparently perennial ones occurring in more natural habitats at medium and high altitudes (*E. congesta* s.s.). I fail to trace a dividing line between them. CLARKE's suggestion, *E. congesta* might be a western variety of *E. afflata* (= *E. pellucida*), cannot be maintained, as *E. congesta* s.s. is widely distributed in Malasia, although of much rarer occurrence than *E. pellucida*.

The group of spp. 9-11 is a very difficult one. *E. attenuata* is not always easily distinguishable from *E. congesta*. Also *E. tetraquetra* is sometimes identifiable only with difficulty, as the quadrangular nature of its stems is not always clearly pronounced, and the hypogynous bristles vary from densely subplumose to scabrous. The length of the nut may serve as an auxiliary character.

### 3. Series Acutae

S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 114, descr. angl.; ex KERN<sup>1</sup>. — Type species: *E. acuta* R. BR.

12. *Eleocharis acuta* R. BR. Prod. (1810) 224; STEUD. Syn. 2 (1855) 82; BENTH. Fl. Austr. 7 (1878) 294, excl. var.; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 114, t. 10 f. 1-7; SVENS. Rhodora 41 (1939) 102, t. 538 f. 2. — *E. mucronulata* NEES, Ann. Nat. Hist. I, 6 (1841) 46; STEUD. Syn. 2 (1855) 82; BOECK. Linnaea 36 (1870) 466.

Perennial, with slender, creeping stolons. Stems erect, in distant tufts, rigid, terete, longitudinally striate-sulcate, not transversely septate, up to 90 cm by 1-2(-3) mm. Sheaths herbaceous or rigidly membranous, appressed, more or less purplish at the base, the uppermost truncate, somewhat thickened at the often dark brown mouth, prominently mucronate. Spikelet oblong-ovoid to linear, broader than the stem, terete, acute, rather densely many-flowered, dark brown or variegated with brown, 15-30 by 3-7 mm. Glumes membranous, rather densely imbricate, closely appressed when young, somewhat spreading with age, ovate-lanceolate or oblong-ovate, subobtusate to very acute, faintly keeled, 1-nerved, deep brown or reddish brown with greenish back and whitish, scarios margins,  $3\frac{1}{2}$ - $5\frac{1}{2}$  mm long, the two lowermost firmer, shorter, rounded, empty. Bristles 6-7(-9), rather slender, somewhat unequal, about as long as or slightly exceeding the style-base, strongly retrorsely scabrous, occasionally ill-developed. Stamens 3; anthers linear,  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm incl. the long, prominent appendage of the connective. Style 3-fid. Nut (not present in the only Malasian collection) plano-convex or biconvex, broadly obovate, not costate on the margins, shining yellowish to brown,  $1\frac{1}{2}$ - $1\frac{3}{4}$  by  $1-1\frac{1}{2}$  mm, the epidermal cells minute, shortly vertically oblong. Style-base ovate or triangular, compressed, cellular, whitish or finally discoloured,  $\frac{3}{4}$ - $\frac{5}{8}$  by  $\frac{1}{2}$ - $\frac{3}{4}$  mm.

Distr. Australia, Tasmania, New Zealand, Norfolk Island, in Malasia: New Guinea (Territory of New Guinea, Western Highlands, Yobobos grassland area, source of Lagaip R., Lagaia Subdistr.).

Ecol. On sandy bank along river, c. 2500 m.

Vern. Guli, Enga language, Kepilam.

Note. The determination remains somewhat doubtful as long as no fruits of the New Guinean plants are known. According to S. T. BLAKE, l.c., the most variable of the Australasian species. The Malasian plants differ from the few Australian ones I have seen in the slightly longer glumes and the c.  $\frac{1}{3}$  mm long, more or less bristly appendage of the connective. In the Australian specimens the glumes are up to  $4\frac{1}{2}$  mm long and the c.  $\frac{1}{3}$  mm long appendage of the connective is smooth or almost so.

### 4. Series Tenuissimae

(CLARKE) SVENS. Rhodora 31 (1929) 129. — Sect. *Leiocarpeae* a. *Tenuissimae* C. B. CLARKE, Kew Bull. add. ser. 8 (1908) 106. — Type species: *E. tenuissima* CLARKE — Distribution map in Rhodora 39 (1937) 211.

#### 4a. Subseries *Leiocarpeae*

(CLARKE) SVENS. l.c. — Sect. *Leiocarpeae* C. B. CLARKE, Kew Bull. add. ser. 8 (1908) 106. — Type species: *E. nigrescens* (NEES) STEUD.

13. *Eleocharis nigrescens* (NEES) STEUD. Syn. 2 (1855) 77; CLARKE, Ill. Cyp. (1909) t. 38, f. 1-4; SVENS. Rhodora 39 (1937) 223, t. 462, f. 5-7; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 108, t. 9 f. 1-4. — *Scirpidium nigrescens* NEES [Linnaea 9 (1834) 293, nom. nud.] in Mart. Fl. Bras. 2, 1 (1842) 97. — ? *E. schweinfurthiana* BOECK. Flora 62 (1879) 562; SVENS. Rhodora 39 (1937) 252 t. 461, f. 13, saltem quoad specim. philipp. — *E. microcarpa* (non TORR.) CLARKE, Philip. J. Sc. 2 (1907) Bot. 91. — ? *E. perrieri* CHERM. Bull. Soc. Bot. Fr. 73 (1926) 554; Fl. Madag. fam. 29 (1937) 213, t. 19, f. 10-12; SVENS. Rhodora 39 (1937) t. 461, f. 14, in syn.

Annual (or perennial?). Stems erect or obliquely erect, tufted, filiform, obscurely quadrangular, sulcate, punctate, 3-10(-20) cm by c.  $\frac{1}{2}$  mm. Sheaths thinly herbaceous, appressed, obliquely truncate, readily disintegrating, stramineous or reddish. Spikelet ovoid, obtusish, densely many-flowered, 2-3(-5) by  $1-1\frac{1}{2}$  mm. Glumes thinly membranous, spreading in fruit, ovate-elliptic, obtuse to slightly emarginate, keeled (the keel curved in profile), 1-nerved, yellowish, purplish punctulate (or brownish),  $\frac{3}{4}$ -1 by  $\frac{1}{2}$  mm. Bristles wanting (or half as long as to nearly equalling the nut, light brown, obscurely toothed). Stamens 1(-2); anther oblong,  $\frac{1}{3}$ (- $\frac{1}{2}$ ) mm long. Style 3-fid. Nut triquetrous with costulate angles, obovoid, smooth, obscurely reticulate, shining, stramineous to light brown,  $\frac{1}{2}$ - $\frac{7}{10}$  by  $\frac{1}{3}$ - $\frac{2}{5}$  mm. Style-base very short, pyramidal or depressed, apiculate, somewhat narrower than the nut.

Distr. Southern United States to Mexico and Brazil, tropical Africa and Madagascar, Australia (N. Australia, Queensland, S. Australia); in Malasia: Philippines (Central Luzon, about 1900, LOHER 5193). Map in Rhodora 39 (1937) 224.

Notes. Originally the LOHER specimens in the Kew Herbarium were determined by CLARKE as *E. microcarpa* TORR.; the name *E. schweinfurthiana* BOECK. was given in synonymy. The N. American *E. microcarpa*, though closely related, seems to be

<sup>1</sup> *Culmi rigidi, subvalidi. Vagina summa ore truncata, distincte mucronata. Stylus trifidus. Nux lenticularis, angulis ecostatis, cellulis extimis minutis oblongis.*

clearly distinct by the non-costulate nuts. CLARKE's remark (1907, *l.c.*) "No 5193 LOHER may be taken to be a depauperated state of the common *Eleocharis afflata* STEUD." [= *E. congesta* D. DON] is certainly wrong.

In 1932 SVENSON annotated the specimens as follows: "Identical with PERRIER DE LA BÂTHIE 17947 and 17282 from Madagascar. It is very close to *E. nigrescens* KUNTH, from which it differs in stouter growth and in having an achene which is smooth or at most with traces of black striolation. *E. nigrescens* has a clearly marked reticulation on the achene."

In *Rhodora* 39 (1937) 224 SVENSON referred *E. perrieri* with a question mark to *E. nigrescens* (PERRIER DE LA BÂTHIE 17947), on p. 252 it is cited as a synonym of *E. schweinfurthiana* (same collector 17282) and LOHER's specimens considered identical in outward aspect and in minute details of the nut with the type collection of *E. schweinfurthiana*. However, in SCHWEINFURTH 1949 (type collection of *E. schweinfurthiana*) the bristles are about half as long as the nut, in LOHER 5193 they are absent. In SVENSON's key (*l.c.* 214) absence of bristles leads to *E. nigrescens*. In the Australian plants bristles are also wanting (S. T. BLAKE, *l.c.*).

According to SVENSON *E. schweinfurthiana* stands between *E. nigrescens* and *E. anceps* RIDL., the latter characterized by the somewhat broader stems ( $\frac{1}{2}$ – $1\frac{1}{2}$  mm wide) and the slightly larger nuts ( $\frac{1}{2}$  mm long), whereas *E. helenae* BUSC. & MUSCHL. is intermediate between *E. schweinfurthiana* and *E. anceps*.

NELMES (*in litt.*) saw specimens of an *Eleocharis* from N. Rhodesia agreeing with *E. schweinfurthiana* in every way, except that they had no bristles in some flowers, but up to 3 short white bristles in other flowers. Therefore he took the Philippine collection for *E. schweinfurthiana*.

As I fail to see the distinguishing characters between all these 'species', I provisionally refer the Philippine plants to *E. nigrescens*, of which I have not seen the type.

In the above description the data between brackets refer to extra-Malesian specimens.

#### 4b. Subseries *Chaetarieae*

(CLARKE) SVENS. *Rhodora* 31 (1929) 129. — *Chaetocyperus* NEES in WIGHT, *Contr. Bot. Ind.* (1834) 95; LINNAEA 9 (1834) 289, *p.p.* — *Sect. Chaetarieae* C. B. CLARKE, *Kew Bull. add. ser.* 8 (1908) 106, *p.p.* — Type species: *E. chaetaria* R. & S.

14. *Eleocharis retroflexa* (POIR.) URB. *Symb. Ant.* 2 (1900) 165; MERR. *En. Philip.* 1 (1923) 120; BACK. *Onkr. Suiker.* (1928) 155, t. 160; BEKN. *Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 14; SVENS. *Rhodora* 39 (1937) 236, t. 461, f. 11; KERN in BACK. & BAKH. *f. Fl. Java* 3 (1968) 460. — *Cyperus setaceus* RETZ. *Obs.* 5 (1789) 10; VAHL, *En.* 2 (1806) 305, *non E. setacea* R. BR. *Prod.* (1810) 225. — *Scirpus pygmaeus* LAMK, *Ill.* 1 (1791) 139, *non E. pygmaea* TORR. (1836). — *Scirpus retroflexus* POIR. in LAMK, *Enc.* 6 (1804) 753. — *E. chaetaria* R. & S. *Syst. Veg.* 2 (1817) 154;

KUNTH, *En.* 2 (1837) 140; MOR. *Syst. Verz.* (1846) 96 (*var. subbiflora*); ZOLL. *Syst. Verz.* 1 (1854) 62; BOECK. *Linnaea* 36 (1870) 428, *p.p.*; NAVES, *Nov. App.* (1882) 307; CLARKE, *Fl. Br. Ind.* 6 (1893) 629; PHILIP. *J. Sc.* 2 (1907) Bot. 90; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 77; KOORD. *Exk. Fl. Java* (1911) 197; Atlas (1922) f. 245; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 87, f. 12, 7–8; RIDL. *Fl. Mal. Pen.* 5 (1925) 151; SVENS. *Rhodora* 39 (1937) 250, t. 461, f. 10; S. T. BLAKE, *Proc. R. Soc. Queensl.* 58 (1947) 42; Koyama, *Contr. Inst. Bot. Un. Montréal n.* 70 (1957) 37; J. Fac. Sc. Un. Tokyo III, 8 (1961) 88. — *Chaetocyperus setaceus* NEES, *Linnaea* 9 (1834) 289; MIQ. *Fl. Ind. Bat.* 3 (1856) 298; *non* KURZ, *Nat. Tijd. N. I.* 27 (1864) 223. — *Chaetocyperus limnocharis* NEES in WIGHT, *Contr. Bot. Ind.* (1834) 96. — *Chaetocyperus arenicola* STEUD. *Syn.* 2 (1855) 73. — *E.? confervoides* MIQ. *Fl. Ind. Bat.* 3 (1856) 303, *quoad specim. jav., non* STEUD. *Syn.* 2 (1855) 32, *nec Scirpus confervoides* POIR. (*basionym*). — *E. setacea* [non R. BR. *Prod.* (1810) 225] MERR. *En. Born.* (1921) 59.<sup>1</sup>

Annual. Stems very slender, tufted, often curved, angular, 4–5-ribbed, punctulate, light green, 5–20 cm by  $\frac{1}{5}$ – $\frac{1}{3}$  mm. Sheaths reddish at the base, whitish-scarious at the apex. Spikelet ovoid, obtuse, more or less compressed, loosely few-(3–10)-flowered, 2–5 by  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm. Glumes membranous, spreading in fruit, ovate, obtuse, keeled, with distinct greenish midnerve, purplish sides, and scarious margins,  $2\frac{1}{4}$ – $3\frac{1}{4}$  by  $1\frac{1}{2}$ –2 mm, the lower ones almost distichous. Bristles 6, rather delicate, unequal, the longest usually longer than the nut, retrorsely scabrous, whitish to yellowish, occasionally reduced to obsolete. Stamens 3; anthers linear, minutely apiculate,  $\frac{1}{2}$ – $\frac{3}{4}$  mm. Style 3-fid. Nut equilaterally triquetrous, urceolate, truncate or slightly convex at the apex, conspicuously cancellate, costulate on the angles, dull stramineous to fumose,  $\frac{9}{10}$ –1 by  $\frac{7}{10}$ – $\frac{9}{10}$  mm; epidermal cells conspicuous, deeply pitted, hexagonal or roundish, in 6–10 vertical series on each face. Style-base pyramidal, in the Malesian specimens usually much depressed and blunt at the apex, c.  $\frac{1}{2}$  as high as and equal in width to the nut, 3-lobed, the lobes decurrent on the angles of the nut.

Distr. Probably pantropic: tropical America, Asia, and Australia (Queensland); common throughout *Malesia*.

The records for tropical Africa (CLARKE, *Fl. Trop. Afr.* 8, 1902, 408) SVENSON partly refers to *E. brainii* SVENS. *Rhodora* 39 (1937) 251, remarking that it is questionable whether *E. chaetaria* actually occurs in tropical Africa. Map of *E. retroflexa* s.s. in *Rhodora* 39 (1937) 237.

Ecol. In wet muddy places: along streams, along humid road-sides, in shallow pools, in rice-fields, 0–1600 m.

Vern. *Rumput kakamatan*, *M. djadjaruman*, *djukut bulu mata*, *S. duhut tilam*, *Asahan*, *lumut*, Borneo, Minahassa, *djukut kambang*, *bulu babi*, *bulu idung*, E. Borneo, *tamomo oë*, Celebes.

Notes. In running water with hairlike stems and proliferous spikelets (*E. confervoides* of MIQUEL). In shallow, stagnant water often propagating by recurring or decumbent stems developing young plants in the axils of the glumes.

<sup>1</sup> MERRILL *l.c.* cited "(RETZ.) R. BR. *Prodr.* (1810) 224". Here BROWN did not make a combination based on *Cyperus setaceus* RETZ.; *E. setacea* R. BR. *Prod.* (1810) 225 is a quite different species.

SVENSON thinks *E. retroflexa* of the New World and *E. chaetaria* of the Old World are clearly distinct, *E. chaetaria* having a much lower and blunter style-base, and larger and deeper markings on the nut. Apart from the question whether these trifling characters are sufficient to justify specific separation, it may be remarked that in the Malesian specimens the style-base is variable in shape and sometimes much approaches that of American ones. Apparently this is also the case in the Australian specimens (see S. T. BLAKE, *l.c.*). Already KUNTH (1837) remarked that *E. retroflexa* differs from *E. chaetaria* only in the longer, more acute style-base, and in its native country. Agreeing with his '*species vix servanda*' I think it desirable to unite the two.

### 5. Series Aciculares

(CLARKE) SVENS. *Rhodora* 31 (1929) 128. — *Sect. Aciculares* C. B. CLARKE, *Kew Bull.* add. ser. 8 (1908) 105. — Type species: *E. acicularis* (L.) R. & S. — Distribution map in *Rhodora* 41 (1939) 2.

15. *Eleocharis acicularis* (L.) R. & S. *Syst. Veg.* 2 (1817) 154; KUNTH, *En.* 2 (1837) 141; BOECK. *Linnaea* 36 (1870) 431; MERR. *Philip. J. Sc.* 9 (1914) Bot. 264; *En. Philip.* 1 (1923) 119; STEEN. *Arch. Hydrobiol. Suppl.* 11 (1932) 284; SVENS. *Rhodora* 31 (1929) 184; *ibid.* 41 (1939) 18, t. 59, f. 1, 9 b; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18 (1944) 35; KOYAMA, *Contr. Inst. Bot. Un. Montréal n.* 70 (1957) 36; J. *Fac. Sc. Un. Tokyo III*, 8 (1961) 87. — *Scirpus acicularis* LINNÉ, *Sp. Pl.* 1 (1753) 48.

Perennial, with capillary stolons usually forming dense mats. *Stems* erect, capillary, angular-sulcate (usually 4-angled), smooth, 3–10(–30) cm by  $\frac{1}{6}$ – $\frac{1}{4}$ (– $\frac{1}{2}$ ) mm, often much elongated in deep or running water. *Sheaths* thinly membranous, loose, oblique at the mouth, often reddish at the base, the apex scarious and often somewhat inflated. *Spikelet* ovate to lanceolate, more or less flattened, acute, (3–)5–8(–15)-flowered, 2–4(–7) by 1–1½ mm. *Glumes* thinly membranous, suberect, oblong-ovate, obtusish, 1-nerved, pale green with scarious margins and often reddish brown sides, 1½–2 by 1–1½ mm, the lower ones subdistichous. *Bristles* up to 4, very slender, equalling or exceeding the nut, often reduced or absent (see note). *Stamens* 2–3; anthers linear,  $\frac{3}{5}$ –1 mm; connective shortly produced. *Style* 3-fid. *Nut* very obtusely trigonous, almost terete, obovate-oblong, on each face with 2–4 distinct longitudinal ribs connected by numerous transverse cross-ridges, whitish to light brown,  $\frac{3}{4}$ –1 by  $\frac{2}{5}$ – $\frac{1}{2}$  mm; epidermal cells transversely linear. *Style-base* minute, depressed pyramidal,  $\frac{1}{3}$ – $\frac{1}{2}$  as wide as the nut.

*Distr.* Widely distributed in North America, throughout Europe and northern Asia, Japan, Korea, extending southward to the Ryu Kyu Is., Yunnan, Annam, and Formosa, in *Malesia*: N. Sumatra (Toba Lake), Philippines (N. Luzon; Benguet Subprov., Baguio). A distinct northern element in the Malesian flora.

*Ecol.* In open damp places; around Toba Lake rather common on very wet sandy soil at c. 900 m; in Luzon on seepage slopes about rice paddies at c. 1450 m.

*Notes.* The Malesian plants (and with a few exceptions all East Asiatic ones) belong to:

*var. longiseta* SVENS. *Rhodora* 31 (1929) 189; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18 (1944) 36. — *Scirpus yokoscensis* FRANCH. & SAV. *En. Pl. Jap.* 2 (1879) 109, 543. — *E. svensonii* ZINSERL. *Fl. U.R.S.S.* 3 (1935) 71, 580. — *E. yokoscensis* TANG & WANG, *Fl. Reip. Pop. Sinic.* 11 (1961) 54, t. 20 f. 10–13. — Bristles 3–4, conspicuously longer than the nut. The chromosome number (2n = 20) differs from that of typical *E. acicularis* (2n = 30–58; 50–70).

In the majority of the European plants the bristles are lacking or greatly reduced, very rarely equalling the nut, in the North American specimens they are either very slender and equalling the nut, or absent.

The South American *E. costulata* NEES & MEY. ex KUNTH (*En.* 2, 1837, 142), mainly differing by the pale green glumes and the  $\frac{1}{2}$  mm long, distinctly apiculate anthers, is very near to *E. acicularis*, and is probably only racially distinct. Also *E. pusilla* R. BR. *Prod* (1810) 225; S. T. BLAKE, *Proc. R. Soc. Queensl.* 50 (1939) 106, t. 8 f. 14–19; SVENS. *Rhodora* 41 (1939) 19, t. 539 f. 2, widely spread in extra-tropical eastern Australia and New Zealand, is obviously very near to *E. acicularis*. For the trifling differences see S. T. BLAKE, *l.c.* 107. According to SVENSON, *l.c.* 95, *in nota*, *E. acicularis* has been introduced into Australia, and between it and *E. pusilla* all intermediate stages are found.

### 6. Series Palustriformes

SVENS. *Rhodora* 31 (1929) 128. — Type species: *E. palustris* (L.) R. & S.

#### 6a. Subseries Palustres

(CLARKE) SVENS. *Rhodora* 31 (1929) 128. — *Subg. Eleogetus* c. *Palustres* C. B. CLARKE, *Kew Bull.* add. ser. 8 (1908) 105. — Type species: *E. palustris* (L.) R. & S.

16. *Eleocharis brevicollis* KERN, *Blumea* 13 (1965) 117, f. 1.

Perennial, with woody, creeping rhizome 2–3 mm thick. *Stems* erect, in tufts, slender, subterete, longitudinally ribbed, smooth, pale green, (30–)60–90 cm by 1–2 mm. *Sheaths* herbaceous, shining, dark purplish at the base, the uppermost scarious at the very oblique, not mucronate mouth. *Spikelet* erect, cylindrical, obtuse, densely many-flowered, pale to dark brown, 12–18 by c. 3 mm. *Glumes* thinly membranous, appressed, concave (not keeled), oblong-ovate, acutish, 1-nerved, with narrow, green, median streak, otherwise brown, purplish zonate within the broad, whitish, scarious margins, c. 4½ mm long, the lowest firmer, obtuse, embracing the spikelet, sterile. *Bristles* (3–)4, firm, retrorsely scarious, reaching as high as the style-base or slightly overtopping it, pale. *Stamens* (2–)3; anthers linear, c. 2 mm long, with ovate appendage of the connective. *Style* 2-fid, occasionally 3-fid. *Nut* biconvex, turgid, elliptic, constricted at the top into a short, but distinct neck, not costate on the angles, shining, yellow or pale brown, 1½–1¾ by 1½ mm, obsoletely reticulate by the subsodiametric epidermal cells. *Style-base* triangular, flattened, cellular-spongy, c.  $\frac{3}{5}$  as wide as the nut.

Distr. *Malesia*: Territory of New Guinea, Western Highlands (Sirunki and Lake Inim), Southern Highlands (Tari Gap).

Ecol. In swampy, mixed *Acorus* and sedge sward, rooting in fine detritus clay, at Lake Inim forming ring round edge of marsh, c. 2500 m.

Note. The only Malesian member of *subser. Palustres*, a very difficult group of chiefly Holarctic distribution.

### 7. Series Maculosae

SVENS. *Rhodora* 31 (1929) 128. — Type species: *E. maculosa* (VAHL) R. & S.

### 7a. Subseries Rigidae

SVENS. *l.c.* — Type species: *E. atropurpurea* (RETZ.) PRESL.

17. *Eleocharis geniculata* (L.) R. & S. Syst. Veg. 2 (1817) 150; FURTADO, Gard. Bull. S. S. 9 (1937) 293, 298; SVENS. *Rhodora* 41 (1939) 50; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 124, t. 10, f. 29–31; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 93; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 461. — *Scirpus geniculatus* LINNÉ, Sp. Pl. 1 (1753) 48. — *Scirpus caribaeus* ROTTB. Descr. Pl. Rar. Progr. (1772) 24; Descr. & Ic. (1773) 46, t. 15, f. 3. — *E. capitata* R. BR. Prod. (1810) 225; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 361; Herb. Timor. Descr. (1835) 33; KUNTH, En. 2 (1837) 150; MIQ. Fl. Ind. Bat. 3 (1856) 299; BOECK. *Linnaea* 36 (1870) 461; BENTH. Fl. Austr. 7 (1878) 296; NAVES, Nov. App. (1882) 307; CLARKE, Fl. Br. Ind. 6 (1893) 627; Philip. J. Sc. 2 (1907) Bot. 90; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 77; KOORD. Exk. Fl. Java 1 (1911) 197; Atlas (1922) f. 248; MERR. Fl. Manila (1912) 114; CAMUS, Fl. Gén. I.-C. 7 (1912) 85; MERR. En. Borneo (1921) 59; RIDL. Fl. Mal. Pen. 5 (1925) 151, non *Scirpus capitatus* L. — *E. atropurpurea* PRESL, Rel. Haenk. 1 (1828) 196, *quoad specim. cit.*, *excl. syn.* — *Scirpus retroflexus* (NON POIR.) LLANOS, Fragm. Pl. Filip. (1851) 19; F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4<sup>1</sup> (1880) 13. — *E. caribaea* S. F. BLAKE, *Rhodora* 20 (1918) 24; MERR. Sp. Blanc. (1918) 83; En. Philip. 1 (1923) 119; BACK. Onkr. Suiker. (1928) 155, t. 159; SVENS. *Rhodora* 31 (1929) 225, f. 48; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 13.

Annual. *Stems* tufted, slender but rather rigid, erect or oblique, angular-striate, smooth, 5–40 cm by  $\frac{1}{2}$ –1 mm. *Sheaths* appressed, purplish at the base, the uppermost with an oblique and more or less attenuate mouth. *Spikelets* globose to oblong-ovoid, very obtuse, terete, densely many-flowered, 4–8 by 3–3 $\frac{1}{2}$  mm. *Glumes* membranous, appressed or obliquely ascending, broadly elliptic, broadly ovate or suborbicular, very obtuse, scarcely keeled, 1-nerved, ferruginous with greenish keel and sides more or less tinged with purple, 1 $\frac{3}{4}$ –2 by 1 $\frac{1}{4}$ –1 $\frac{1}{2}$  mm. *Bristles* 6–8, rather coarse, ferruginous to brown, somewhat longer than the nut. *Stamens* 2–3; anthers linear-oblong, minutely apiculate, c.  $\frac{1}{2}$  mm. *Style* 2-fid. *Nut* biconvex, obovate, smooth, shining black,

$\frac{3}{4}$ – $\frac{9}{10}$  by  $\frac{3}{5}$ – $\frac{4}{5}$  mm; epidermal cells very inconspicuous, subquadrate. *Style-base* conical, usually much depressed, about  $\frac{1}{2}$  as wide as the nut.

Distr. The most widely distributed *Eleocharis*, throughout the warmer parts of both the Old and the New World, in *Malesia* rather rare, but locally sometimes abundant: N. and Central Sumatra, Malay Peninsula (Perak, Trengganu, Pahang, Johore, Singapore), W.-E. Java, Bawean, Madura, Lesser Sunda Is. (Timor), N. Borneo (not seen), Philippines (Luzon, Bohol, Cebu), Celebes.

Ecol. In open wet lands (swamps, swampy grasslands, wet rice-fields, sometimes on brackish clay), from sea-level up to 900 m.

Vern. *Djangga tembe*, S, *sriwit*, *sudjinan*, *djëmbut*, J.

18. *Eleocharis atropurpurea* (RETZ.) PRESL, Rel. Haenk. 1 (1828) 196, *excl. specim. cit.*; KUNTH, En. 2 (1837) 151; GAY, *Flora* 25 (1842) 641; BOECK. *Linnaea* 36 (1870) 458, *excl. varr.  $\beta$  &  $\gamma$* ; BENTH. Fl. Austr. 7 (1878) 296, *p.p.*; CLARKE, Fl. Br. Ind. 6 (1893) 627; Philip. J. Sc. 2 (1907) Bot. 90; III. Cyp. (1909) t. 36, f. 6–9; MERR. En. Philip. 1 (1923) 119; BACK. Onkr. Suiker. (1928) 154, t. 158; SVENS. *Rhodora* 31 (1929) 227, t. 191, f. 49; S. T. BLAKE, Proc. R. Soc. Queensl. 50 (1939) 125, t. 10, f. 32–33; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 13; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 94; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 461. — *Scirpus atropurpureus* RETZ. Obs. 5 (1789) 14. — *E. ochreatea* (non NEES, nec STEUD.) CLARKE, Philip. J. Sc. 2 (1907) Bot. 90, *non al.*; MERR. En. Philip. 1 (1923) 120.

Dwarf annual. *Stems* tufted, erect or curved, capillary, angular-sulcate, smooth, 4–15 cm by  $\frac{1}{4}$ – $\frac{1}{2}$  mm. *Sheaths* appressed, purplish or brownish at the base, the apex of the uppermost oblique, often attenuate. *Spikelet* oblong-ovoid, obtusish, somewhat angular, densely many-flowered, 2–4 (finally lengthening to 8) by 1 $\frac{1}{2}$ –2 mm. *Glumes* membranous, at length more or less spreading, elliptic, obtuse, keeled, 1-nerved, with green keel and pale or more or less purplish sides,  $\frac{2}{10}$ – $1\frac{1}{2}$  by  $\frac{1}{2}$ – $\frac{1}{10}$  mm. *Bristles* 3–4(–6), slender, minutely retrorsely scabrous to almost smooth, shorter than to about as long as the nut, whitish, translucent, not rarely vestigial or absent. *Stamens* 1–2; anthers linear or oblong-linear, minutely apiculate,  $\frac{1}{4}$ – $\frac{1}{2}$  mm long. *Style* 2-fid. *Nut* biconvex, obovate, smooth, shining, black,  $\frac{1}{2}$ – $\frac{2}{3}$  by  $\frac{1}{2}$ – $\frac{2}{3}$  mm; epidermal cells very inconspicuous. *Style-base* minute, flattened, strongly depressed, disciform or depressed-conical,  $\frac{1}{4}$ – $\frac{1}{3}$  as wide as the nut.

Distr. Scattered through the tropics of both the Old and New World, also in the U.S.A., and in Europe in Italy and Switzerland; in S. and E. Asia to China, Formosa, and Japan, in Australia in W. and N. Australia, and Queensland, in *Malesia* very rare: Central Sumatra, W. Java, Madura, Philippines (Luzon), New Guinea (near Port Moresby). The record 'Central Java' in Backer, 1949 *l.c.*, is based on a young specimen of *E. geniculata*.

Ecol. In wet rice-fields, wet grassy places, 90–250 m.

Note. Usually readily distinguishable from the more common *E. geniculata* by its smaller size. From small specimens of the latter it may be distinguished

by the smaller nuts, the much more delicate bristles which are glistening white and translucent, and by the more prominently keeled glumes giving the spikelet an angular appearance.

### 8. Series Pauciflorae

SVENS. *Rhodora* 31 (1929) 127. — Type species: *E. pauciflora* (LIGHTF.) LINK [correct name: *E. quinqueflora* (HARTM.) SCHWARZ].

19. *Eleocharis parvula* (R. & S.) LINK ex BLUFF, NEES & SCHAUER in Bluff & Fingerh. Comp. Fl. Germ. ed. 2, 1<sup>1</sup> (1836) 93; SVENS. *Rhodora* 31 (1929) 168, t. 189, f. 18; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 34; KERN, Reinw. 4 (1956) 94; Blumea 10 (1960) 643; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 87; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 460. — *Scirpus pusillus* VAHL, En. 2 (1806) 246, non *E. pusilla* R. BR. (1810). — *Scirpus nanus* (non POIR.) SPRENG. Pugill. 1 (1813) 4. — *Scirpus parvulus* R. & S. Syst. Veg. 2 (1817) 124; BOECK. Linnaea 36 (1869–70) 477.

Dwarf perennial, densely tufted, forming mats, and propagating by small, fusiform, brown or purplish, 3–6 mm long tubers at the end of filiform stolons. Stems erect, weak, capillary, terete, striate when dry, smooth, pale green, 1–7 cm by  $\frac{1}{4}$ – $\frac{1}{5}$  mm. Sheaths membranous. Spikelet ovoid, obtuse, compressed, few-(2–9)-flowered, 2–4 by  $1\frac{1}{2}$ –2 mm. Glumes subdistichous, membranous, obliquely spreading in fruit, ovate, obtuse, scarcely keeled, with distinct green midnerve and pale green or stramineous, sometimes dull brown sides,  $1\frac{1}{2}$ – $1\frac{3}{4}$  by c. 1 mm. Bristles 4–6, delicate, retrorsely scabrous, yellowish, unequal, somewhat shorter to slightly longer than the nut, sometimes reduced. Stamens 3; anthers linear, c. 1 mm long, the connective with a distinct reddish appendage. Style 3-fid. Nut equilaterally trigonous, with prominent angles, obovate, smooth, shining stramineous, c. 1 by  $\frac{3}{5}$  mm; epidermal cells inconspicuous, oblong. Style-base minute, pyramidal, confluent with the apex of the nut and seemingly a continuation of it, but of different texture, greenish.

Distr. Along the Atlantic coast of North America from New Foundland to the West Indies and the Pacific coast from N. California to British Columbia, rarely inland; in South America in Brazil; Mediter-

ranean coast of Europe and N. Africa, Atlantic coast of Europe north to Norway, rarely inland; Japan (Kiushiu); Cochinchina, once collected; in Malesia: E. Java (Bangil, S of Surabaya).

Ecol. Salt marshes and brackish mud along the seacoast, sometimes inland in salt lakes, at Bangil near the salt iodine-wells not far from the coast.

Note. Often treated as a species of *Scirpus*. As the style-base, though small and confluent with the nut, clearly differs in texture from the latter, it stands more naturally in *Eleocharis* (see p. 523). According to SVENSON, it may perhaps be considered the most primitive member of ser. *Pauciflorae*.

### Doubtful

*Eleocharis alta* BOECK. Cyp. Nov. 1 (1888) 17. — “Java, Vulcan Gede, alt. 2400 m”. No collector mentioned.

The description is insufficient. The plant is stated to be very close to *E. variegata* KUNTH. It was placed in the synonymy of *E. tetraquetra* NEES by CLARKE, Fl. Br. Ind. 6 (1893) 630.

*Eleocharis obtusa* (WILLD.) SCHULT. Mant. 2 (1824) 89; SVENS. *Rhodora* 31 (1929) 214; *ibid.* 55 (1953) 1. — *Scirpus obtusus* WILLD. En Hort. Berol. 1 (1809) 76. — The specimens in the Kew Herbarium, cited as “*E. ovata* R. BR.” by CLARKE in J. Bot. 25 (1887) 269 from ‘Java, ZOLLINGER’ and in J. Linn. Soc. Bot. 34 (1898) 50 from ‘Java’ (see also SVENS. *Rhodora* 31, 1929, 213) are in fact *E. obtusa*. Originally they belonged to the HOOKER herbarium; they are provided only with the small printed part of a ZOLLINGER-label “*Plantae javanicae cl. ZOLLINGERO lectae*”. This supposed ZOLLINGER collection is not represented in any of the other *Eleocharis* collections I could study, therefore it is very unlikely that the plants were actually collected in Java. *E. obtusa* is known from the eastern United States, the Pacific region from northern California to British Columbia, and the Hawaiian Islands.

By its annual, cespitose habit, the bifid style, and the biconvex nut *E. obtusa* is similar to *E. geniculata* and *E. atropurpurea*. It belongs in ser. *Ovatae* characterized by the flat lamelliform style-base, which is here nearly or quite as broad as the nut. In the closely related, and possibly not specifically distinct *E. soloniensis* (DUBOIS) HARA = *E. ovata* (ROTH) R. & S. the style-base is much narrower than the nut.

### 12. BULBOSTYLIS

KUNTH, En. 2 (1837) 205, *nom. cons.*, nec STEV. 1813, nec DC. 1836. — *Stenophyllus* RAF. Neog. (1825) 4. — *Oncostylis* NEES in Mart. Fl. Bras. 2, 1 (1842) 80. — *Scirpus sect. Oncostylis* BOECK. Linnaea 36 (1870) 736. — *Fimbristylis sect. Oncostylis* BENTH. & HOOK. Gen. Pl. 3 (1883) 1049. — Fig. 37.

Perennial or (in Mal.) annual herbs. Stems tufted, erect, very slender, angular, striate or sulcate, leafy only at the base. Leaves very narrow, nearly always capillary; sheaths generally bearded in the throat with long white hairs sometimes disappearing with age. Inflorescence terminal, subtended by foliaceous involucre bracts, capitate or anthelate, sometimes reduced to a

single spikelet. *Spikelets* usually not compressed, angular, several- to many-flowered. Rachilla persistent, narrowly winged. *Glumes* spiral, acropetally caducous, with strong midnerve; lower 1–2 empty. Flowers achlamydeous (hypogynous bristles or scales absent), bisexual, the uppermost often male or barren. *Stamens* 1–3; anthers oblong or linear, with shortly produced connective. *Style* articulate with the ovary, slender, glabrous; stigmas 3, very rarely 2 (not in Mal.); style-base incrassate, bulbiform, persistent on the apex of the nut as a minute, darker coloured button. *Nut* trigonous or triquetrous, very rarely biconvex (not in Mal.), obovate, obtuse, scarcely stipitate.

Distr. Probably c. 100 spp. in the tropical and subtropical regions of the world; centres of development are tropical Africa and America; in *Malesia* only 3 spp., none of them common.

Ecol. *B. barbata* and *B. puberula* prefer rather dry sandy localities at low altitudes, *B. densa* occurs in wet or swampy localities at medium and high altitudes.

Notes. The Malesian spp. are easily recognized by the capillary leaves with needle-like white hairs at the orifice of the sheaths, as well as by the peculiar button crowning the nut (like in *Eleocharis*, which is to *Scirpus* as *Bulbostylis* is to the closely related genus *Fimbristylis*).

SVENSON (N. Am. Fl. 18, 1957, 540) attaches much value to the shape of the epidermal cells of the nut as a generic character (longitudinally elongated in *Bulbostylis*, isodiametric to horizontally elongated in *Fimbristylis*). This would, however, place the closely related *B. barbata* and *B. puberula* in different genera and *Fimbristylis hispida* (p. 560, lacking the button on the nut!) in *Bulbostylis*, with which I do not agree.

It is somewhat doubtful whether the name *Bulbostylis* was validly published by KUNTH, who proceeded to describe the members of the genus as species of *Isolepis*, though he proposed *Bulbostylis* as a separate genus intermediate between *Isolepis* and *Fimbristylis*.

#### KEY TO THE SPECIES

1. Glumes muticous, acute. Inflorescence anthelate, open, rarely reduced to a single spikelet. Nut minutely granular, absoletely transversely wrinkled . . . . . 1. *B. densa*
1. Glumes mucronulate, the mucro finally excurved. Inflorescence capitate or, if anthelate, congested. Nut either smooth or distinctly transversely wrinkled.
  2. Nut smooth, minutely reticulate by the isodiametric epidermal cells,  $\frac{1}{2}$ – $\frac{3}{4}$  mm long. Glumes glabrous, or but slightly pubescent . . . . . 2. *B. barbata*
  2. Nut distinctly transversely wrinkled, with longitudinally oblong-linear epidermal cells,  $\frac{3}{4}$ –1 mm long. Glumes rather densely pubescent . . . . . 3. *B. puberula*

1. *Bulbostylis densa* (WALL. in ROXB.) HAND.-MAZZ. in Karsten & Schenk, Vegetationsb. 20, 7 (1930) 16; HARA, J. Jap. Bot. 18 (1942) 467; OHWI, Mem. Coll. Sc. Kyoto B 18 (1944) 50; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 468. — *Scirpus densus* WALL. in ROXB. Fl. Ind. 1 (1820) 231. — *Isolepis trifida* NEES in Wight, Contr. Bot. Ind. (1834) 108. — *Isolepis capillaris, formae indicae* KUNTH, En. 2 (1837) 212; MIQ. Fl. Ind. Bat. 3 (1856) 312. — *Isolepis trichocolea* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 96 ('*trichokolea*'); MIQ. Fl. Ind. Bat. 3 (1856) 308. — *Fimbristylis capillacea* HOCHST. ex STEUD. [in Zoll. Syst. Verz. 1 (1854) 61, nom. nud.] Syn. 2 (1855) 111; MIQ. Fl. Ind. Bat. 3 (1856) 320. — *Scirpus capillaris* (non L.) BOECK. Linnaea 36 (1870) 759, p. p. — *B. capillaris* var. *trifida* CLARKE, Fl. Br. Ind. 6 (1893) 652; Philip. J. Sc. 2 (1907) Bot. 98. — *Stenophyllus capillaris* var. *trifidus* DOMIN, Bibl. Bot. 20, Heft, 85 (1915) 464. — *B. capillaris* (non CLARKE) CAMUS, Fl. Gén. I.-C. 7 (1912) 127. — *Stenophyllus capillaris* *B. trifidus* PFEIFF. Bot. Arch. 6 (1924) 188. — *B. trichokolea* BEETLE, Leaf. West. Bot. 4 (1944) 45. — *Stenophyllus capillaris* (non BRITT.) BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 26. — *B. trifida* NELMES, Kew Bull. (1950) 209. — *Fimbristylis densa* KOYAMA & CHUANG, Quat. J. Taiwan Mus. 13 (1960) 229.

Stems setaceous, glabrous and smooth, (1)–5–40

cm by  $\frac{1}{4}$ – $\frac{1}{3}$  mm. Leaves much shorter than the stems, capillary, glabrous (except for the long white hairs at the orifice of the sheaths), slightly scabrous at the top,  $\frac{1}{4}$ – $\frac{1}{2}$  mm wide. Inflorescence very variable, simple or subcompound, with 1–many spikelets, in Mal. usually very loose, up to 5 cm long. Involucral bracts usually very short, glume-like, or the lower 1–2 setaceous with dilated scarious base, sometimes up to 7 cm. Rays 0–7, filiform, glabrous, smooth, up to 4 cm. Spikelets solitary, oblong-ovate to oblong, acute, rather densely flowered, 3–6 by  $1\frac{3}{4}$ –2 mm. Glumes membranous, ovate to broadly ovate, acute, muticous, strongly keeled, with nerveless sides and ciliate margins, brownish to castaneous,  $1\frac{1}{4}$ –2 mm long. Stamens 2; anthers oblong,  $\frac{1}{4}$ – $\frac{1}{3}$  mm. Style  $\frac{3}{4}$ –1 mm; stigmas 3, shorter than the style. Nut triquetrous, obovate to broadly obovate, densely granular-punctulate, stramineous to fumose, 0.7–0.9 by 0.5–0.8 mm; epidermal cells minute, isodiametric to oblong.

Distr. Widely distributed in the Old World tropics and subtropics: S. and E. Asia to China and Japan, tropical Africa and Australia, in *Malesia*: N. Sumatra (Atjeh, E. Coast Res.), Central and E. Java, Lesser Sunda Islands (Bali, Lombok, Wetar, Alor), Philippines (Luzon: Cagayan, Pampanga, Lepanto, Bontoc, Benguet), SW. Celebes, and New Guinea.

Ecol. In open wet places, locally often abundant,

at medium and high altitudes, usually 1000–3000 m; ELBERT 4551 from Wetar was collected between 425 and 500 m.

Vern. *Nomai, poudan*, New Guinea (Enga lang.).

Notes. *B. densa* is very near to the American *B. capillaris* (L.) CLARKE, differing by the more acute, glabrous or only slightly pubescent glumes, and the granular, not or hardly transversely rugulose nuts.

Remarkable specimens of this species were collected on Mt Pulog in Luzon (FB 16143; MERRILL Philip. Pl. 541): the inflorescence is reduced to 1–3 spikelets, the latter are larger than usual, c. 3 mm wide; the glumes c. 3 mm long; the nuts broadly obovate to turbinate, 1.1 by 0.95 mm; the anthers somewhat longer than usual, c.  $\frac{1}{2}$  mm. The cited collections may represent a local race of this extremely variable species.

*Isolepis trichocolea* STEUD. was based on ZOLLINGER 613. The sheet in STEUDEL's herbarium (P) contains two specimens, one of which is *B. densa*, the other *B. barbata*. Hence STEUDEL's description partly refers to the former species, partly to the latter. In accordance with CLARKE (Fl. Br. Ind. 6, 1893, 652), the specimen of *B. densa* is selected as the type.

2. *Bulbostylis barbata* (ROTTB.) CLARKE, Fl. Br. Ind. 6 (1893) 651; Philip. J. Sc. 2 (1907) Bot. 98; RIDL. Mat. Fl. Mal. Pen. 3 (1907) 77; CAMUS, Fl. Gén. I.-C. 7 (1912) 126; MERR. En. Philip. 1 (1923) 127; RIDL. Fl. Mal. Pen. 5 (1925) 160; KÜK. Bot. Jahrb. 70 (1940) 463, incl. f. *paupercula* KÜK.; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 468. — *Scirpus barbatus* ROTTB. Progr. (1772) 27; Descr. & Ic. (1773) 52, t. 17 f. 4; BOECK. Linnaea 36 (1870) 751, excl. var.  $\beta$ ; VIDAL, Phan. Cuming. Philip. (1885) 156; Rev. Pl. Vasc. Filip. (1886) 284. — *Isolepis barbata* R. BR. Prod. (1810) 222; PRESL, Rel. Haenk. 1 (1828) 187; KUNTH, En. 2 (1837) 208; DECNE, Herb. Tim. Descr. (1835) 32; MIQ. Fl. Ind. Bat. 3 (1856) 310. — *Oncostylis barbata* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 29. — *Isolepis involucellata* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 101; MIQ. Fl. Ind. Bat. 3 (1856) 311. — *Isolepis cumingii* STEUD. Syn. 2 (1855) 101; MIQ. Fl. Ind. Bat. 3 (1856) 310. — *Isolepis armerioides* MIQ. Fl. Ind. Bat. 3 (1856) 310, incl. var.  $\beta$ ; KURZ, Nat. Tijds. N. I. 27 (1864) 223. — *Fimbristylis barbata* BENTH. Fl. Austr. 7 (1878) 321; F.-VILL. Nov. App. (1882) 308; MERR. Fl. Manila (1912) 116; BACK. Onkr. Suiker. (1928) 157, t. 161. — *Fimbristylis cumingii* F.-VILL. Nov. App. (1882) 308. — *Iriha barbata* O.K. Rev. Gen. Pl. 2 (1891) 753. — *Stenophyllus barbarus* COOKE, Fl. Bombay 2 (1908) 887; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 27. — *Fimbristylis actinoschoenus* (non CLARKE) CAMUS, Fl. Gén. I.-C. 7 (1912) 124, excl. descr. et fig. — *Fimbristylis armerioides* BEETLE, Leaf. West. Bot. 4 (1944) 45. — *Scirpus mindorensis* BEETLE, l.c. 46.

Stems setaceous, glabrous and smooth, 5–30 cm by  $\frac{1}{4}$ – $\frac{1}{3}$  mm. Leaves much shorter than the stems, capillary, glabrous (except for the long white hairs at the orifice of the sheaths), smooth or slightly scaberulous at the top,  $\frac{1}{4}$ – $\frac{1}{3}$  mm wide. Inflorescence capitate, hemispherical, with (1)–3–20 spikelets, 5–15 mm across. Involucral bracts 1–3, somewhat shorter to much longer than the inflorescence, filiform, with dilated scarious base, 5–20 mm.

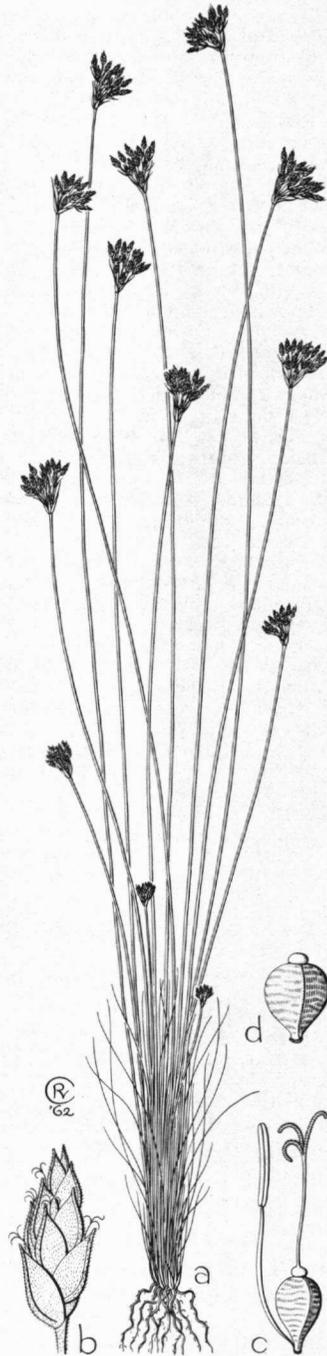


Fig. 37. *Bulbostylis puberula* (POIR.) CLARKE. a. Habit,  $\times \frac{1}{2}$ , b. spikelet,  $\times 5$ , c. deflorate flower, d. nut, both  $\times 15$  (a–d BÜNNEMEIJER 6002).

*Spikelets* sessile, ovate to oblong, acute, 3–8 by 1–1½ mm. *Glumes* membranous, ovate, mucronulate (mucro finally excurved), strongly keeled, with nerveless sides and minutely ciliolate margins, otherwise glabrous or but slightly puberulous, rusty brown with green keel, 1½–2¼ by 1¼–1½ mm. *Stamen* 1; anther oblong-linear, c. ½ mm. *Style* 1 mm; stigmas 3, shorter than the style. *Nut* triquetrous, broadly obovate, smooth, finely reticulate by the minute isodiametric epidermal cells, whitish to stramineous, 0.5–0.75 by 0.4–0.6 mm.

*Distr.* Widely distributed over the warm parts of the Old World, also in the southern U.S.A. (see SVENSON, N. Am. Fl. 18, 1957, 544), throughout *Malesia*, but nowhere common.

*Ecol.* In open dry sandy places, locally sometimes abundant, often near the sea: dunes, fields, savannahs, sometimes on rocks, usually at low altitudes (e.g. in Java up to 250 m, in Flores at 1000 m, in Papua up to 450 m); according to MERRILL in the Philippines ascending to 1500 m; a specimen from Luzon (Benguet Subprov., MEARN'S BS 4257) was collected at 2100 m.

*Vern.* *Mapu*, Sumba, *papoa*, Sula Is., *bese baroho*, *korompau nguas*, Tanimbar; Philip.: *humot*, Iv., *kulilis*, Tag., *tirtiris*, Ilk.

*Note.* A variable species. A form known from Ceylon and India, with larger glumes, 3 stamens with larger anthers, and slightly larger nuts is sometimes treated as a separate species.

3. *Bulbostylis puberula* (POIR.) CLARKE, Fl. Br. Ind. 6 (1893) 652; RIDL, Mat. Fl. Mal. Pen. 3 (1907) 78; CAMUS, Fl. Gén. I.-C. 7 (1912) 128, f. 17, 1–2'; RIDL, Fl. Mal. Pen. 5 (1925) 160; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 468. — *Scirpus puberulus* POIR. in Lamk, Enc. 6 (1804) 767; BOECK, Linnaea 36 (1870) 767, *excl. syn.* *Isolepis armerioides*. — *Isolepis puberula* KUNTH, En. 2 (1837) 213; STEUD. Syn. 2 (1855) 103. — *Scirpus setaceus* (non L.) CAMUS, Fl. Gén. I.-C. 7 (1912) 132. — *Stenophyllus puberulus* KILLIP, J. Siam Soc. Nat. Hist. Suppl. 7 (1927) 57;

BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 27. — *Fimbristylis puberula* BACK. ex STEEN. Arch. Hydrobiol. 3, Suppl. Band 11 (1932) 236. — Fig. 37.

*Stems* setaceous, glabrous or pubescent, sometimes hispid just below the inflorescence, 5–40 cm by ¼–¾ mm. *Leaves* much shorter than the stems, capillary, short-pubescent, ⅓–½ mm wide; sheaths stramineous to brownish, pubescent. *Inflorescence* simple or subcompound, anthelate with up to 5 short rays c. ½ cm long, often congested to almost capitate, sometimes reduced to a single spikelet, up to 1½ cm long and wide. *Involucral bracts* 2–4, filiform, scarious at the dilated base, the lowest erect, often as though continuing the stem, usually longer than the inflorescence, up to 4 cm. *Spikelets* solitary, stalked (except in very small plants), but often closely packed, ovate to oblong, acute, 4–8 by c. 1½ mm. *Glumes* membranous, broadly ovate, mucronulate (mucro finally excurved), strongly keeled with nerveless sides, rather densely pubescent, greenish to brown, 1¾–2¼ by 1½–2 mm. *Stamen* 1; anther oblong-linear, ½–¾ mm. *Style* ¾–1 mm; stigmas 3, shorter than the style. *Nut* triquetrous, obovate to broadly obovate, transversely wavy-wrinkled, whitish to stramineous, 0.75–1 by 0.6–0.75 mm; epidermal cells longitudinally oblong-linear.

*Distr.* Tropical Africa and Asia, in *Malesia*: Sumatra, Riouw Arch., Malay Peninsula, W.-E. Java, Madura, W. & N. Borneo, Anambas & Natuna Is.; everywhere rare.

*Ecol.* In sandy localities at low altitudes, often near the sea, locally sometimes abundant.

*Uses.* According to a label in SING the plant is (was?) cultivated by the Chinese in Singapore and exported to China, where it is used as a diuretic.

*Vern.* *Rumput bulu hidung*, M (Mal. Pen.).

*Note.* The habit is much like that of *B. barbata*, but the texture of the pericarp is quite different. The nut character is the most distinctive; sessile or stalked spikelets is also a good distinction, except in very small plants. The hairiness of the stem is variable.

### 13. FIMBRISTYLIS

VAHL, En. 2 (1806) 285, *nom. cons.*; KUNTH, En. 2 (1837) 220; STEUD. Syn. 2 (1855) 106; MIQ. Fl. Ind. Bat. 3 (1856) 314; BOECK, Linnaea 37 (1871) 2; *ibid.* 38 (1874) 384; B. & H. Gen. Pl. 3 (1883) 1048, *excl. sect.* *Oncostylis*; PAX in E. & P. Pfl. Fam. 2, 2 (1887) 113; CLARKE, Kew Bull. add. ser. 8 (1908) 107; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 52; KERN, Blumea 8 (1955) 10; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 99, *excl. subg.* *Bulbostylis*. — *Cyperus subg. Iria* L. C. RICH. ex PERS. Syn. 1 (1805) 65. — *Iria* HEDW. Gen. Pl. (1806) 360. — *Gussonea* PRESL, Rel. Haenk. 1 (1828) 183. — *Iriha* O.K. Rev. Gen. Pl. 2 (1891) 751. — *Trachystylis* S. T. BLAKE, Proc. R. Soc. Queensl. 48 (1937) 89. — *Tylocarya* NELMES, Kew Bull. (1949) 139. — Fig. 38–48.

For the other generic names referred to *Fimbristylis* in the present treatment see under the synonymy of the sections.

Annuals, or perennial herbs with short, rarely creeping rhizome. *Stems* usually tufted, erect or obliquely erect, rarely decumbent, solid, more or less angular or subterete, striate or sulcate. *Leaves* linear, all basal, or also a few in the lower part of the stems, often cellular-reticulate above, those of the



Fig. 38. *Fimbristylis subdura* OHW1. a. Habit,  $\times \frac{1}{2}$ , a'. leaf tip, b. spikelet, both  $\times 5$ , c. glume, d. anther, e. deflorate flower, f. nut, all  $\times 10$  (a-f BACKER 6525).

flowering stems not rarely reduced to bladeless or short-bladed sheaths; ligule a fringe of short hairs or a membranous projection between sheath and blade, or absent. *Inflorescence* terminal (very rarely pseudolateral because of the erect lowest bract seemingly continuing the stem), often anthelate (terminal spikelet or cluster overtopped by the lateral ones), simple or more or less compound, not rarely subcapitate or capitate by suppression of the rays, or consisting of a single spikelet. Rays subtended by foliaceous but often much reduced bracts, the base enclosed in a tubular prophyll (*cladoprophyll*). *Spikelets* solitary or in clusters, terete, angular (because of the acutely keeled glumes), or strongly laterally compressed, few- to many-flowered; axis (rachilla) as a rule persistent after the glumes and fruits have fallen off, often winged by the persistent basal part of the glumes, exceptionally spikelets falling off as a whole. *Glumes* usually spirally arranged, more rarely subdistichous or distichous, acropetally deciduous, only in a few *spp.* persistent on the rachilla, some (up to 6) lower ones empty. *Flowers* bisexual (the uppermost of the spikelet often tabescent), naked (hypogynous bristles or scales absent). *Stamens* 1–3; anthers usually with shortly produced connective, rarely the latter produced in a conspicuous, smooth or bristly appendage. *Style* articulated with the ovary, deciduous with its dilated base, leaving no button on the nut (in a few *spp.* style-base subpersistent), ciliate or glabrous, triquetrous or flat; stigmas 2 or 3 (number sometimes varying in the same specimen). *Nut* trigonous or lenticular, from orbicular or broadly obovate to oblong-linear, smooth, verrucose, or tuberculate, reticulate by the hexagonal or roundish epidermal cells, or lineolate when those cells are linear, or trabeculate (with longitudinal ribs connected by cross-bars), or cancel-late (latticed).

*Distr.* Large genus with some hundreds of species, chiefly in the tropics of both hemispheres, but with some species extending to the warmer parts of the temperate regions. In *Malesia* 78 *spp.*; unlike in *Cyperus* only a small number of them (8) is pantropical. The number of endemic *spp.* is relatively high (17), but their distribution is usually inadequately known. The vast majority of the Malesian *spp.* is widely distributed in S. and SE. Asia, several extending to tropical Australia. Australian elements extending to E. Malesia are *F. schultzii*, *F. recta*, *F. furva*, *F. lanceolata*, *F. signata*, and *F. acicularis*.

Very disjunct areas are shown by *F. dictyocolea* (Thailand and Indo-China – New Guinea), *F. adenolepis* (Thailand and Indo-China – Kangean), *F. intonsa* (Bengal – N. Sumatra – New Guinea), and *F. semarangensis* (Indo-China – Java). Future collections may fill some of these gaps.

*Ecol.* Most *spp.* prefer wet localities: swamps, wet rice-fields, margins of lakes, river-banks. Relatively few occur in forests, savannahs, or savannah forests, or are characteristic of the sandy or muddy sea-shore. Three *spp.* (*F. trichophylla*, *F. calcicola*, and *F. malayana*) are restricted to open, dry places on the limestone hills of the Malay Peninsula.

*F. dichotoma* and *F. littoralis* are sometimes troublesome weeds.

Nearly all the Malesian *spp.* are lowland plants ascending to medium altitudes. Only *F. aestivalis*, *F. aphylla*, *F. consanguinea*, *F. fusca*, *F. pierotii*, and *F. salbundia* occur above 1500 m, *F. consanguinea* ascending to 2300 m.

*Uses.* The genus has but little economic value. Some species are used for matting; *F. globulosa* is sometimes cultivated for that purpose. The foliage of *F. dichotoma* and *F. littoralis* furnishes a rather good cattle-fodder.

*Notes.* VAHL, the founder of the genus, segregated from *Scirpus* only those species with spirally arranged glumes, and flat, ciliate, distigmatic, deciduous style with enlarged base. For the species with the same flower-structure but distichous glumes he created the genus *Abildgaardia*; the tristigmatic species were left in *Scirpus*. Already ROBERT BROWN recognised the deciduous style articulated with the nut as the essential character of the genus, and added several tristigmatic Australian species. This extension of the genus was carried through by KUNTH for the extra-Australian species. NEES tried to revive LESTIBOUDOIS' genus *Trichelostylis* comprising the tristigmatic species, but he was never followed.

ASA GRAY, BENTHAM, and recently KOYAMA, merged *Bulbostylis* into *Fimbristylis*. To me *Bulbostylis* is morphologically as well circumscribed as many other Cyperaceous genera. VAN DER VEKEN, Bull. Jard. Bot. Brux. 35 (1965) 323–328 and 333–336, who investigated the embryos of 45 *Fimbristylis spp.* and 19 *Bulbostylis spp.*, found that, with a few exceptions in *Fimbristylis*, the embryos of the two genera are of a different type, another reason for keeping *Bulbostylis* apart. In a few *Fimbristylis spp.* the embryo is a variant of the *Bulbostylis* type, and of those species the systematic place is indeed disputable also on other grounds (see *F. hispidula*). The embryo of *F. thuarsii* differs essentially from both the *Fimbristylis* and *Bulbostylis* types. As also the eucyperoid anatomical structure and the articulated rachilla are not found elsewhere in the genus, it may be

better to reinstate the genus *Actinoschoenus*, probably also comprising *F. yunnanensis*, of which anatomical structure and embryo-type are as yet unknown.

The species with a single terminal spikelet, and especially *F. tetragona* with greatly reduced leaves, are often taken for *Eleocharis* spp. The genus *Eleocharis* differs from *Fimbristylis* by the presence of hypogynous bristles and by the persistent style-base forming a button on the nut.

The spikelets of *Fimbristylis* spp. with distichous glumes strongly resemble those of *Cyperus*. In the latter genus the style is not articulated with the ovary.

Probably due to the attack of a parasite the spikelets of *F. dura*, *F. globulosa*, and *F. dichotoma* are sometimes comose by the strongly elongated, sterile upper glumes (see MIQUEL, Fl. Ind. Bat. 3, p. 318 under *F. efoliata*). *F. germainii* CAMUS was based on such abnormal specimens of *F. dichotoma*.

In outline the subdivision of the genus accepted below agrees with that of OHWI in J. Jap. Bot. 14 (1938) 571. A natural classification has not been attained. In some of the tristigmatic species the number of stigmas is often reduced to two (*F. cymosa*, *F. globulosa*, *F. sericea*, and to a lesser extent *F. pauciflora* and *F. schultzei*). Distigmatic *F. scaberrima* has been placed next to tristigmatic *F. dura*, to which it shows affinity in almost every respect. The arrangement of the glumes in *sect. Abildgaardia* and *sect. Fuscae* is sometimes not clearly distichous.

KEY TO THE SECTIONS  
represented in *Malesia*

1. Rachilla of the spikelets persistent. Glumes acropetally deciduous.
2. Nut obovate, oblong-obovate, orbicular, pyriform, or turbinate.
3. Stigmas 3; style triquetrous, usually glabrous. Nut trigonous or triquetrous (see *F. globulosa*, *F. scaberrima*, and *F. cymosa*!).
  4. Glumes spirally arranged.
    5. Nut smooth or verruculose.
    6. Inflorescence anthelate or capitate.
      7. Ligule a fringe of short hairs. *Spp.* 1-6. . . . . 1. *Sect. Trichelostylis*
      7. Ligule absent.
        8. Cauline leaves reduced to bladeless sheaths. *Spp.* 7-13 . . . . . 2. *Sect. Miliaceae*
        8. Cauline leaves with well developed blades.
          9. Glumes not or only microscopically ciliolate.
            10. Rather stout perennials. *Spp.* 14-20. . . . . 3. *Sect. Cymosae*
            10. Small annuals. *Spp.* 21-22. . . . . 4. *Sect. Tenerae*
          9. Glumes long-ciliate. *Spp.* 23-28 . . . . . 5. *Sect. Leptocladae*
    6. Inflorescence consisting of a single spikelet. *Spp.* 29-30 . . . . . 6. *Sect. Heleocharoides*
  5. Nut coarsely tuberculate, pyriform. Cauline leaves reduced to bladeless sheaths. Inflorescence anthelate. *Sp.* 31 . . . . . 7. *Sect. Signatae*
4. Glumes distichously arranged (see *F. eragrostis*!).
  11. Nut large, 2-3 mm long, usually coarsely tuberculate. Inflorescence usually consisting of a single spikelet. *Sp.* 32 . . . . . 8. *Sect. Abildgaardia*
  11. Nut much smaller, smooth or verruculose. Inflorescence with a few to numerous spikelets. *Spp.* 33-44. . . . . 9. *Sect. Fuscae*
3. Stigmas 2; style flat, usually ciliate. Nut biconvex or planoconvex. Glumes spirally arranged.
  12. Nut not coarsely rugulose.
    13. Glumes ovate or orbicular, less than twice as long as broad. Inflorescence usually anthelate.
      14. Ligule a fringe of short hairs, very rarely membranous.
        15. Nut smooth. *Spp.* 45-50 . . . . . 10. *Sect. Dichelostylis*
        15. Nut trabeculate. *Spp.* 51-58 . . . . . 11. *Sect. Fimbristylis*
      14. Ligule absent.
        16. Spikelets terete or subterete, 2-4 mm wide. *Spp.* 59-62 . . . . . 12. *Sect. Rigidulae*
        16. Spikelets angular, 1-1½ mm wide. *Spp.* 63-67 . . . . . 13. *Sect. Pogonostylis*
    13. Glumes oblong-ovate or oblong-lanceolate, twice or more than twice as long as broad. Inflorescence usually consisting of a single spikelet. *Spp.* 68-71 . . . . . 14. *Sect. Neodichelostylis*
  12. Nut coarsely rugulose by transverse ridges. Cauline leaves reduced to bladeless sheaths. Inflorescence consisting of a single spikelet. *Spp.* 72-74 . . . . . 15. *Sect. Nutantes*
2. Nut subcylindric, with almost parallel edges.
  17. Inflorescence consisting of a single spikelet. Cauline leaves reduced to bladeless sheaths. Nut without clavate appendages. *Sp.* 75 . . . . . 16. *Sect. Mischospora*
  17. Inflorescence anthelate. Cauline leaves with well developed blades. Nut ornamented with rows of clavate appendages. *Sp.* 76 . . . . . 17. *Sect. Dipsaceae*
1. Rachilla deciduous, spikelets falling off entire. Glumes distichous. Cauline leaves reduced to bladeless sheaths. Inflorescence capitate. *Sp.* 77 . . . . . 18. *Sect. Actinoschoenus*

KEY TO THE SPECIES  
*Ripe fruits are indispensable*

1. Glumes (at least in young spikelets) exactly distichous, the distichous arrangement in mature spikelets sometimes less pronounced by torsion of the rachilla. Spikelets strongly laterally compressed, much resembling those in *Cyperus*.

2. Stigmas 2. Nut biconvex. See *sub* 56 . . . . . 15. *F. scaberrima*
2. Stigmas 3. Nut trigonous or triquetrous.
3. Inflorescence a dense globose head of sessile, stellately spreading spikelets, the latter when mature falling off as a whole . . . . . 77. *F. thouarsii*
3. Inflorescence anthelate, with distinct rays, or consisting of a single terminal spikelet, rarely almost capitate. Glumes acropetally deciduous from the persistent rachilla.
4. Nut 2-3 by  $1\frac{1}{4}$ -2 mm, coarsely tuberculate, rarely almost smooth. Inflorescence usually consisting of a single terminal spikelet, more rarely 1 or 2 peduncled lateral spikelets added . . . . . 32. *F. ovata*
4. Nut much smaller, smooth or verruculose. Inflorescence usually with several to numerous spikelets.
5. Glumes densely reddish gland-dotted. Leaves very narrow, setaceous or almost so,  $\frac{1}{2}$ -1 mm wide. Spikelets few-flowered.
6. Nut smooth, inconspicuously reticulate by the isodiametric epidermal cells. Anthers with a subulate,  $\frac{1}{4}$  mm long appendage of the connective . . . . . 35. *F. fuscoides*
6. Nut verruculose, transversely lineolate by the linear or oblong-linear epidermal cells. Connective of the anthers but shortly produced.
7. Perennial with creeping, woody rhizome. Inflorescence compound or decompound, with many to numerous spikelets. Glumes  $2\frac{3}{4}$ -4 mm long. Stamens 3. Style shortly hairy at the base, 3- $3\frac{1}{2}$  mm long . . . . . 33. *F. cinnamometorum*
7. Delicate, tufted annual with fibrous roots. Inflorescence simple or almost so, with (1-)3-5 spikelets. Glumes  $1\frac{1}{2}$ -2 mm long. Stamen 1. Style glabrous, 1- $1\frac{1}{4}$  mm long . . . . . 34. *F. adenolepis*
5. Glumes not gland-dotted, either glabrous or hairy.
8. Outer leaf-sheaths coriaceous, shining purplish or fuscous. Leaves long-acuminate, with bristle-like, readily caducous tip . . . . . 36. *F. vanoverberghii*
8. Outer leaf-sheaths stramineous or light brown. Leaves with rounded, apiculate top.
9. Nut finely longitudinally striate and transversely lineolate by the transversely linear epidermal cells in 3-4 vertical rows on each face. . . . . 44. *F. calcicola*
9. Marking of the nut otherwise; epidermal cells isodiametric or almost so.
10. Base of the pyriform nut abruptly truncate, conspicuously broader than the short but distinct stipe . . . . . 40. *F. fimbriatoloides*
10. Nut not truncate at the base.
11. Nut perfectly smooth. Glumes long-acuminate, minutely puberulous at the top,  $3\frac{3}{4}$ -4 mm long. . . . . 42. *F. malayana*
11. Nut verruculose or tuberculate.
12. Glumes hairy.
13. Glumes very broadly ovate,  $1\frac{3}{4}$ -2 mm long. Style 1- $1\frac{1}{3}$  mm long. Anthers oblong-linear,  $\frac{1}{2}$  mm long . . . . . 41. *F. intonsa*
13. Glumes lanceolate or ovate-lanceolate, 4- $6\frac{1}{2}$  mm long. Style 4-6 mm long. Anthers linear,  $1\frac{1}{2}$ -2 mm long.
14. Leaves much shorter than the stems, often scarcely  $\frac{1}{4}$  as long, (1-)2-4 mm wide. Inflorescence compound to supradecomposed, with several to numerous spikelets. Glumes scabrid by very short, stiffish hairs, with broad, whitish hyaline, glabrous margins . . . . . 38. *F. fusca*
14. Leaves longer, up to 35 cm, 1-2 mm wide. Inflorescence simple, rarely one of the rays with a short secondary ray, with 3-7 spikelets. Glumes pubescent by soft hairs, not or scarcely hyaline-margined, ciliate in the upper part . . . . . 39. *F. fulvescens*
12. Glumes glabrous.
15. Perennial with short, woody rhizome. Leaves (2-)3-5 mm wide. Spikelets 2-4 mm wide. Glumes 3-5 mm long, distinctly mucronate, chartaceous . . . . . 37. *F. eragrostis*
15. Annual with fibrous roots. Leaves 1-2 mm wide. Spikelets  $1\frac{1}{2}$  mm wide. Glumes  $1\frac{1}{2}$ -2(- $2\frac{1}{2}$ ) mm long, minutely apiculate just below the apex, membranous . . . . . 43. *F. disticha*
1. Glumes spirally arranged. Spikelets terete or angular, not strongly compressed.
16. Nut subcylindrical, oblong-linear in outline (with almost parallel edges).
17. Inflorescence consisting of a single terminal spikelet, 6-15 by 4-6 mm. Glumes muticous, 3-5 mm long. Nut trabeculate, seated on a conspicuous, up to 1 mm long gynophore,  $1\frac{1}{2}$ -2 mm long. . . . . 75. *F. tetragona*
17. Inflorescence anthelate, with up to 15 spikelets, rarely reduced to a single one. Spikelets 3-6 by 2-3 mm. Glumes mucronate, the blade about 1 mm long. Nut sessile, ornamented on the edges with a row of clavate appendages,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long . . . . . 76. *F. dipsacea*
16. Nut obovate, oblong-obovate, orbicular, pyriform, or turbinate.
18. Stigmas 3, rarely in some of the flowers 2. Nut trigonous or triquetrous, when dorsiventrally compressed with a raised dorsal angle.
19. Glumes with long-ciliate margins.
20. Nut truncate or depressed at the top, transversely wrinkled by the prominent walls of the longitudinally elongate, linear epidermal cells . . . . . 24. *F. hispida*
20. Nut neither truncate or depressed, nor transversely wrinkled, the epidermal cells isodiametric or transversely linear.
21. Upper side of leaves asperulous by short, bulbous-based hairs. Nut trabeculate, with transversely linear epidermal cells. Ligule a dense fringe of hairs . . . . . 6. *F. blepharolepis*
21. Leaves without bulbous-based hairs. Nut not trabeculate, its epidermal cells not linear. Ligule absent.

22. Inflorescence consisting of a single terminal spikelet 5–6 mm wide. Glumes 5–7 mm long. Nut  $1\frac{3}{4}$ –2 mm long . . . . . 27. *F. recta*
22. Inflorescence usually with several spikelets. Spikelets much narrower. Glumes and nuts shorter.
23. Glumes densely gland-dotted.
24. Spikelets aggregated into small clusters. Glumes very small, at most  $1\frac{1}{2}$  mm long. Anthers with smooth connective. . . . . 23. *F. leptoclada*
24. Spikelets not clustered. Glumes larger,  $2$ – $4\frac{1}{2}$  mm long. Connective of anthers with setulose top.
25. Spikelets linear, 10–25 mm long. Glumes  $4$ – $4\frac{1}{2}$  mm long. Style  $3$ – $3\frac{3}{4}$  mm. Nut  $\frac{9}{10}$  mm long. . . . . 27. *F. lanceolata*
25. Spikelets ovoid or oblong-ovoid, 5–10 mm long. Glumes 2–3 mm long. Style 1–2 mm. Nut  $\frac{1}{2}$ – $\frac{2}{3}$  mm long . . . . . 28. *F. macassarensis*
23. Glumes not gland-dotted.
26. Inflorescence anthelate . . . . . 26. *F. furva*
26. Inflorescence a small, hemispherical or subglobose head. See under 50 . . . . . 22. *F. schultzei*
19. Glumes with glabrous or only microscopically ciliolate margins.
27. Nut truncate and quasi-tridentate at the apex. Inflorescence usually consisting of a single spikelet, pseudolateral because of the erect bract as though continuing the stem . . . . . 78. *F. fenestrata*
27. Nut neither truncate nor quasi-tridentate at the apex. Inflorescence terminal.
28. Lowest (empty) glume more than half as long as the spikelet. Inflorescence always consisting of a single spikelet.
29. Sheaths of the cauline leaves disintegrating in front into fine, reticulate fibres. Spikelet 7–9 by 3 mm. Glumes 1-nerved. Style 3–5 mm long. . . . . 29. *F. dictyocolea*
29. Leaf-sheaths not disintegrating into reticulate fibres. Spikelets 3–6 by  $1$ – $1\frac{1}{2}$  mm. Glumes several-nerved. Style  $1\frac{1}{2}$ – $2\frac{1}{4}$  mm long. . . . . 30. *F. pauciflora*
28. Lowest glume much shorter than half the spikelet. Inflorescence consisting of several to numerous spikelets, but rarely reduced to a single one.
30. Leaves ligulate (blade and sheath separated from each other by a fringe of short hairs).
31. Stems obtusely trigonous or quadrangular, only slightly compressed. Spikelets  $2$ – $2\frac{1}{2}$  mm wide. Glumes 7–9-nerved. Nut  $\frac{1}{4}$ – $1\frac{1}{2}$  mm long. Style abruptly thickened at the base. . . . . 1. *F. thomsonii*
31. Stems strongly compressed, ancipitous. Spikelets 1–2 mm wide. Glumes with 3-nerved keel. Nut usually shorter than 1 mm (in *F. consanguinea*  $1$ – $1\frac{1}{2}$  mm).
32. Spikelets very small, 1 mm wide. Glumes 1 mm long. Style  $\frac{1}{2}$  mm . . . . . 5. *F. microcarya*
32. Spikelets larger,  $1\frac{1}{2}$ – $2\frac{1}{4}$  mm wide. Glumes 2–3 mm long. Style 1–2 mm.
33. Stems and leaves very narrow,  $\frac{1}{3}$ – $\frac{1}{2}$  mm wide. Margins of the glumes scarcely hyaline. Anthers  $\frac{1}{2}$  mm long . . . . . 4. *F. capillulmis*
33. Stems 1–4 mm wide, leaves (1–)3–5 mm. Margins of the glumes whitish hyaline. Anthers  $1$ – $1\frac{1}{2}$  mm long.
34. Inflorescence subsimple, with few spikelets. Stems  $1$ – $1\frac{1}{2}$  mm wide. Glumes ( $2\frac{1}{2}$ –)3 mm long. Nut smooth,  $1$ – $1\frac{1}{2}$  mm long . . . . . 3. *F. consanguinea*
34. Inflorescence compound or decomposed, with many spikelets. Stems 2–4 mm wide. Glumes  $2$ – $2\frac{1}{2}$  mm long. Nut verruculose,  $\frac{2}{10}$ – $\frac{4}{5}$  mm long. . . . . 2. *F. complanata*
30. Leaves eligulate (sheaths on the inner side gradually passing into the blades).
35. Spikelets solitary, or only a few of them more or less clustered.
36. Cauline leaves (at least the upper one) reduced to bladeless, tubular sheaths.
37. Glumes  $3\frac{3}{4}$ –4 mm long, the midnerve excurrent in a scabrid,  $1$ – $1\frac{1}{2}$  mm long awn. Nut coarsely tuberculate, about  $1\frac{1}{4}$  mm long . . . . . 31. *F. signata*
37. Glumes much shorter, mucous or shortly apiculate. Nut smooth or verruculose, smaller.
38. Basal leaves strongly twisted to the left. Inflorescence simple or almost so, with few (rarely more than 4) spikelets . . . . . 21. *F. obtusata*
38. Basal leaves when present not arising in a left-hand spiral. Inflorescence usually compound to supradecomposed, with many or numerous spikelets.
39. Basal leaves equitant, laterally compressed, without prominent midnerve, the outer margin thin, the inner grooved . . . . . 8. *F. littoralis*
39. Basal leaves when present not equitant, dorsiventrally compressed, with prominent midnerve and thickened, rib-like margins.
40. Stems obtusangular or subterete, not deeply grooved.
41. Spikelets globose, ovoid, or ellipsoid, obtuse, 3–4 mm wide. Glumes mucous, the midnerve ending somewhat below the apex . . . . . 7. *F. globulosa*
41. Spikelets lanceolate, acute,  $1\frac{1}{4}$  mm wide. Glumes apiculate or mucronulate by the more or less excurrent midnerve . . . . . 13. *F. subdura*
40. Stems acutely 4–5-angled, deeply grooved.
42. Nut obovoid, densely verruculose, its epidermal cells transversely linear in 4–6 vertical rows on each face.
43. Annual with fibrous roots. Spikelets angular,  $1$ – $1\frac{1}{2}$  mm wide. Glumes distinctly keeled, apiculate by the shortly excurrent midnerve,  $1$ (– $1\frac{1}{2}$ ) mm long . . . . . 10. *F. miliacea*
43. Rhizomatous perennial. Spikelets terete,  $1\frac{1}{2}$ –2 mm wide. Glumes scarcely keeled, mucous,  $1\frac{1}{2}$  mm long . . . . . 9. *F. aphylla*

42. Nut broadly obovoid, smooth or very sparsely verruculose, its epidermal cells transversely elliptic or oblong in 9–13 vertical rows on each face, or nut obscurely reticulate.
44. Inflorescence 2–4 (rarely up to 7) cm long. Involucral bracts very short, up to  $1\frac{1}{2}$  cm. Spikelets 3–5 by 2 mm. Glumes 2– $2\frac{1}{4}$  mm long. Stamens (2–)3. Style 1 mm long. Nut  $\frac{3}{4}$ – $\frac{9}{10}$  mm long . . . . . 11. *F. salbundia*
44. Inflorescence 12–20 cm long, rarely shorter, much interrupted. Lowest bract 4–8 cm long. Spikelets 2–3 by  $1\frac{1}{2}$  mm. Glumes  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm long. Stamens 1–2. Style  $\frac{1}{2}$ – $\frac{3}{4}$  mm long. Nut  $\frac{3}{4}$ – $\frac{3}{4}$  mm long . . . . . 12. *F. anisoclada*
36. Cauline leaves with well developed blades, or all the leaves basal.
45. Spikelets 2–4 mm wide. Glumes  $4\frac{1}{2}$ –6 mm long. Style  $2\frac{1}{2}$ –5 mm long.
46. Glumes mucronulate. Nut obovoid-pyriform, truncate or somewhat depressed at the top. Rhizome not creeping . . . . . 17. *F. insignis*
46. Glumes muticous. Nut broadly obovoid, rounded at the top. Rhizome creeping. . . . . 16. *F. pierottii*
45. Spikelets 1–2 mm wide. Glumes  $1\frac{1}{2}$ – $2\frac{1}{4}$  mm long. Style  $\frac{1}{2}$ –1 mm long.
47. Stems strongly compressed, ancipitous in the upper half. Leaves 3–8 mm wide. Lowest bract overtopping the inflorescence . . . . . 14. *F. dura*
47. Stems not or but slightly compressed. Leaves at most 3 mm wide. Lowest bract much shorter than the inflorescence.
48. Perennial with stiff, coriaceous leaves and rigid, 1–2 mm thick stems. Leaves not twisted. . . . . 19. *F. cymosa*
48. Small annual with herbaceous, strongly falcate leaves twisted to the left, and setaceous stems. . . . . 21. *F. obtusata*
13. Spikelets in clusters, some solitary ones often added.
49. Leaves and glumes glabrous. Rhizome not creeping, or absent.
50. Small annual with setaceous, 10–25 cm tall stems and  $1\frac{1}{2}$  mm wide leaves. Inflorescence a single, hemispherical or subglobose head. Glumes mucronate from the sinus of the bilobed apex . . . . . 22. *F. schultzi*
50. Perennials with stouter stems and broader leaves. Inflorescence usually with well developed rays and several clusters of spikelets, rarely subcapitate. Glumes muticous, or mucronulate from the apex.
51. Glumes distinctly mucronulate, 3–5 mm long, irregularly subspiral. Spikelets (2–)3–4 mm wide . . . . . 37. *F. eragrostis*
51. Glumes muticous or apiculate,  $2\frac{2}{3}$ – $3\frac{1}{4}$  mm long, regularly spiral. Spikelets  $1\frac{1}{2}$ –2 mm wide.
52. Nut whitish or stramineous,  $\frac{4}{5}$ –1 mm long. Connective of the anthers distinctly produced, bristly at the top . . . . . 18. *F. falcata*
52. Nut blackish,  $\frac{2}{3}$ – $\frac{1}{2}$  mm. Connective but shortly produced, smooth . . . . . 19. *F. cymosa*
49. Leaves densely silky-pubescent beneath. Glumes pubescent. Rhizome creeping. . . . . 20. *F. sericea*
18. Stigmas 2. Nut strongly dorsiventrally compressed, biconvex or planoconvex.
53. Nut coarsely rugulose by transverse wavy ridges. Inflorescence consisting of a single terminal spikelet.
54. Spikelet more or less nodding, broadly ovoid or ovoid, 3–5 mm wide. Style strap-shaped.  $\frac{1}{2}$ – $\frac{7}{10}$  mm wide. Nut with 3–5(–6) ridges . . . . . 73. *F. nutans*
54. Spikelet erect, lanceolate or oblong-ovoid,  $1\frac{1}{2}$ – $3\frac{1}{2}$  mm wide. Style less than  $\frac{1}{2}$  mm wide. Nut with 5–8 ridges.
55. Spikelet 6–12 by  $2\frac{3}{2}$  mm. Nut broadly obovate or orbicular,  $1\frac{1}{4}$ – $1\frac{3}{4}$  mm long and wide, stramineous or brownish . . . . . 72. *F. acuminata*
55. Spikelet 4–6 by  $1\frac{1}{2}$ –(2) mm. Nut obovate,  $\frac{3}{4}$ – $\frac{9}{10}$ (–1) by  $\frac{1}{2}$ – $\frac{2}{3}$ (– $\frac{4}{5}$ ) mm, white or pale stramineous. . . . . 74. *F. acicularis*
53. Nut smooth or verruculose, but not coarsely rugulose.
56. Stems strongly flattened, ancipitous. Rachilla broadly winged . . . . . 15. *F. scaberrima*
56. Stems not ancipitous.
57. Glumes oblong-ovate or oblong-lanceolate, twice or more than twice as long as broad. Stems usually terminated by a single spikelet.
58. Flower-bearing glumes muticous. Inflorescence with 1–3 spikelets, often subtended by a short-bladed bract. Nut reticulate by the small epidermal cells in about 30 vertical rows on either face. . . . . 68. *F. polytrichoides*
58. All the glumes shortly but distinctly mucronulate. Stems always with a single spikelet.
59. Leaf-sheaths and sometimes also the blades hairy. Glumes obtuse,  $2\frac{1}{2}$  mm long. Stamen 1. Nut reticulate by the transversely oblong epidermal cells in about 15 vertical rows on either face. . . . . 69. *F. tenuicula*
59. Glabrous. Glumes acute, 3 mm long. Stamens (1–)2–3. Nut smooth . . . . . 70. *F. celebica*
57. Glumes ovate or orbicular, less than twice as long as broad.
60. Stem-base clothed with bladeless, subinflated sheaths. Spikelets when young globose. Glumes muticous. Nut verruculose, its epidermal cells in 12–15 vertical rows on either face. . . . . 7. *F. globulosa*
60. Blades of the cauline leaves well developed, rarely the upper one short, or all the leaves basal. Other characters not united.
61. Leaves ligulate (sheaths and blades separated from each other by a fringe of short hairs or a membranous projection).

62. Glumes hairy, at least in the apical part.
63. Lower sheaths coriaceous, shining brown or castaneous. Blades of the cauline leaves rather short, up to 10 cm by  $\frac{1}{2}$ - $1\frac{1}{2}$  mm. Involucral bracts usually shorter than the inflorescence. Spikelets acute. Glumes pubescent, ferrugineous . . . . . 45. *F. ferruginea*
63. Lower sheaths herbaceous, stramineous or ferrugineous. Blades of the cauline leaves long, up to 30 cm by  $1\frac{1}{2}$ -2 mm. Lowest involucral bract usually overtopping the inflorescence. Spikelets obtusish. Glumes densely tomentose, usually dark brown . . . . . 46. *F. sieberiana*
62. Glumes glabrous.
64. Nut smooth, distinctly stipitate by the conspicuous,  $\frac{1}{4}$ - $\frac{3}{4}$  mm long gynophore.
65. Apex of the nut broadly emarginate by the  $\frac{1}{2}$ - $\frac{3}{4}$  mm wide style-scar.
66. Stems tufted. Spikelets 1-3 to the stem, 3-4 mm wide. Glumes  $4\frac{1}{2}$ -5 mm long, anthers c. 1 mm, style c. 2 mm . . . . . 49. *F. caesia*
66. Stems approximate on the short-creeping rhizome. Inflorescence consisting of a single, 4-5 mm wide spikelet. Glumes 6-7 mm long, anthers  $2\frac{1}{2}$ -3 mm, style  $3\frac{1}{2}$ -4 mm . . . . . 50. *F. subalata*
65. Apex of the nut rounded or umbonulate, not emarginate.
67. Inflorescence with 1-2(-3) spikelets which are 3-4 mm wide. Glumes  $2\frac{1}{2}$ -3 mm long. Anthers  $\frac{3}{4}$  mm long . . . . . 48. *F. schoenoides*
67. Inflorescence with (1-)3-7(-11) spikelets which are (4-)5-6 mm wide. Glumes 4-6 mm long. Anthers  $1\frac{1}{2}$ -2 $\frac{1}{2}$  mm long . . . . . 47. *F. tristachya*
64. Nut trabeculate or cancellate, usually shortly stipitate, only in *F. tomentosa* seated on a conspicuous gynophore.
68. Style glabrous or with a few cilia at the top only. Spikelets  $1\frac{1}{2}$ -2 mm wide. Glumes  $1\frac{1}{3}$ -2 mm long. Epidermal cells of the nut in 5-6(-9) vertical rows on either face . . . . . 55. *F. merrillii*
68. Style ciliate at least in the upper half. Other characters not united.
69. Spikelets 1- $1\frac{1}{2}$  mm wide.
70. Spikelets angular. Glumes membranous, sharply keeled, mucronulate, with nerveless sides. Anthers  $\frac{1}{2}$  mm long, style  $\frac{3}{4}$ -1 mm. Nut  $\frac{3}{5}$ - $\frac{7}{10}$  by  $\frac{2}{5}$ - $\frac{1}{2}$  mm . . . . . 54. *F. bisumbellata*
70. Spikelets terete. Glumes chartaceous, scarcely keeled, apiculate, with finely 5-8-nerved sides. Anthers (1-)1 $\frac{1}{2}$  mm long, style  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm. Nut  $\frac{1}{10}$ - $\frac{2}{10}$  by  $\frac{1}{4}$ - $\frac{3}{5}$  mm . . . . . 56. *F. tenuinervia*
69. Spikelets 2-4 mm wide.
71. Nut oblong-obovate, the epidermal cells in 12-16 vertical rows on either face. Glumes distinctly many-nerved almost over the whole breadth . . . . . 53. *F. lineatisquama*
71. Nut obovate, broadly elliptic, or suborbicular, in *F. dichotoma* rarely almost oblong-ovate, but then the epidermal cells in 5-10 vertical rows. Sides of the glumes nerveless or only faintly nerved.
72. Epidermal cells of the nut in 5-10 (rarely some more) vertical rows on either face. Spikelets  $2\frac{1}{2}$ -3(-5) mm wide. Glumes 2-3(- $4\frac{1}{2}$ ) mm long. Style 2-4 mm long. Nut obovate or broadly obovate; gynophore small . . . . . 51. *F. dichotoma*
72. Epidermal cells of the nut in 15-24 vertical rows on either face. Other characters not united.
73. Spikelets ( $2\frac{1}{2}$ )-3-4 mm wide. Glumes  $3\frac{1}{4}$ - $3\frac{1}{2}$  mm long. Gynophore conspicuous.  $\frac{1}{2}$ - $\frac{1}{2}$  mm long. Nut with obtuse, thickened edges . . . . . 52. *F. tomentosa*
73. Spikelets 2- $2\frac{1}{2}$  mm wide. Glumes 2- $2\frac{1}{2}$  mm long. Gynophore inconspicuous. Edges of the nut not thickened.
74. Inflorescence very loose, 8-15 cm long. Spikelets light brown. Stamens 2. Nut broadly elliptic or suborbicular,  $\frac{3}{4}$ - $\frac{4}{5}$  by  $\frac{2}{3}$  mm, not verruculose . . . . . 57. *F. perlaea*
74. Inflorescence loose, 2-7 cm long. Spikelets whitish or greyish green, often brownish variegated. Stamen 1. Nut obovate, 1- $1\frac{1}{4}$  by  $\frac{3}{4}$ - $\frac{2}{10}$ , verruculose . . . . . 58. *F. albiviridis*
61. Leaves eligulate (sheaths on the inner side gradually passing into the blades).
75. Edges of the nut ornamented with a row of clavate appendages. Dwarf annual with filiform leaves, squarrose spikelets, and long-awned glumes . . . . . 76. *F. dipsacea*
75. Nut without clavate appendages.
76. Spikelets small, 1- $1\frac{1}{2}$  mm wide. Small annuals with thinly membranous glumes, 1(-2) stamens,  $\frac{1}{2}$ -1 mm long style,  $\frac{1}{2}$ - $\frac{3}{4}$  mm long nut . . . . .
77. Inflorescence capitate, globose or hemispherical,  $\frac{1}{2}$ -1 cm across. Nut broadly obovate or suborbicular, about  $\frac{1}{2}$  mm long and wide . . . . . 67. *F. argentea*
77. Inflorescence anthelate, with well developed rays, larger. Nut elliptic or obovate, usually slightly larger.
78. Base of the style fringed with a whorl of long pendent hairs covering at least the upper half of the nut . . . . . 65. *F. squarrosa*
78. Style-base glabrous, or microscopically ciliolate.
79. Glabrous. Stem-base clothed with 1-2 bladeless or very shortly laminate sheaths. Style glabrous . . . . . 64. *F. griffithii*
79. More or less hairy. Cauline leaves with a distinct blade. Style ciliate at least at the top.
80. Lowest involucral bract shorter than or but slightly overtopping the inflorescence. Rays

- of the inflorescence usually glabrous. Glumes about  $1\frac{1}{2}$  mm long, style  $\frac{1}{2}$ – $\frac{3}{4}$  mm, nut  $\frac{1}{2}$ – $\frac{2}{3}$  mm . . . . . 63. *F. aestivalis*
80. Lowest involucrel bract up to twice as long as the inflorescence. Rays of the inflorescence usually pilose. Glumes about 2 mm long, style 1– $1\frac{1}{3}$  mm, nut  $\frac{3}{4}$ – $\frac{9}{10}$  mm. . . . . 66. *F. gracilentia*
76. Spikelets larger, 2–4 mm wide. Other characters not united.
81. Stems terminated by a single spikelet up to 2 cm long and 3–4 mm wide. . . . . 71. *F. wetarensis*
81. Inflorescence with 3–numerous smaller spikelets.
82. Rhizome creeping.
83. Leaves densely silky-pubescent on the under side. Glumes pubescent. Spikelets in clusters of 3–6. . . . . 20. *F. sericea*
83. Leaves glabrous or hairy, but not silky-pubescent. Glumes glabrous, sometimes minutely ciliolate. Spikelets solitary or a few in pairs . . . . . 60. *F. rigidula*
82. Rhizome not creeping. Stems tufted.
84. Involucrel bracts very short, much shorter than the inflorescence. Nut blackish. Leaves rigid, coriaceous. . . . . 19. *F. cymosa*
84. Involucrel bracts longer, whether overtopping the inflorescence or not. Nut white, stramineous or brownish. Leaves weak, grass-like.
85. Nut oblong-obovate or suboblong. Anthers with bristly appendage of the connective. Leaves either filiform, less than 1 mm wide, or (in *var. erecta*) up to  $1\frac{1}{2}$  mm. . . . . 59. *F. trichophylla*
85. Nut obovate or broadly ovate. Connective smooth. Leaves flat, 1–2 mm wide.
86. Rays of the inflorescence scabrid-pilose. Style retrorsely hispidulous at the base. Epidermal cells of the nut transversely oblong-linear . . . . . 61. *F. sumbaensis*
86. Rays of the inflorescence glabrous and smooth. Style-base glabrous. Epidermal cells of the nut roundish or transversely elliptic.
87. Nut  $\frac{3}{4}$  mm long. Stamens (2)–3. Spikelets brown . . . . . 62. *F. semarangensis*
87. Nut  $1-1\frac{1}{4}$  mm long. Stamen 1. Spikelets whitish or greyish green, often brownish variegated. . . . . 58. *F. albovidis*

### 1. Section *Trichelostylis*

(LESTIB.) BOECK. *Linnaea* 37 (1871) 23. — *Trichelostylis* LESTIB. *Ess. Fam. Cyp.* (1819) 40. — *Isolepis sect. Trichelostylis* ENDL. *Gen. Pl.* (1836) 118. — *Fimbristylis subg. Trichelostylis* A. GRAY, *Man. Bot.*, ed. 5 (1867) 567. — *Fimbristylis ser. Autumnales* OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B18 (1944) 53.

Type species: *F. autumnalis* (L.) R. & S. (*Scirpus autumnalis* L.).

1. *Fimbristylis thomsonii* BOECK. *Linnaea* 37 (1871) 37; CLARKE, *Fl. Br. Ind.* 6 (1893) 646; J. Linn. Soc., *Bot.* 36 (1903) 246; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 117; MERR. *En. Philip.* 1 (1923) 127; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B18 (1944) 65; KERN, *Blumea* 8 (1955) 110; KOYAMA, *J. Fac. Sc. Un. Tokyo* III, 8 (1961) 105. — *Iriha thomsonii* O.K. *Rev. Gen. Pl.* 2 (1891) 753. — *F. asperrima* (non BOECK.) RIDL. *Fl. Mal. Pen.* 5 (1925) 158 *p.p.* (*quoad specim. Pulau Rawei*).

Glabrous perennial with very short woody rhizome. Stems solitary or somewhat tufted, obtusely trigonous or quadrangular, more or less compressed, smooth, many-leaved at the base, 30–80 cm by  $\frac{3}{4}$ –2 mm. Leaves shorter than to as long as the stems, flat, rather rigid, gradually narrowed to the rather abruptly acuminate tip, serrulate-scabrous on the margins in the upper part, 2–4 mm wide; ligule a dense fringe of short hairs; sheaths rounded on the back. Inflorescence compound to supradecomposed, loose, with many spikelets, 5–15 cm across. Involucrel bracts 2–4, erect, scariously margined at the base, the lowest half as long as to longer than the inflorescence. Primary rays 8–12, erecto-patent, compressed, smooth, up to 7 cm. Spikelets solitary, oblong-ovoid to oblong-lanceolate, angular, acute, 8–15-flowered, castaneous, 5–8 by 2– $2\frac{1}{2}$  mm; rachilla winged. Glumes spiral, chartaceous, ovate-lanceolate, acute, mucronulate or apiculate just

below the apex, with 7–9-nerved keel and pale membranous margins, 3–4 by 2– $2\frac{1}{2}$  mm. Stamens 3; anthers linear,  $1\frac{1}{2}$ –2 mm. Style triquetrous, glabrous, abruptly thickened at the base,  $1\frac{1}{4}$ –2 mm; style-base sometimes more or less persistent on the nut; stigmas 3, about as long as the style. Nut trigonous with slightly concave sides, obovoid, obtuse to subtruncate at the apex, shortly stipitate, umbonulate, verrucose especially near the angles, whitish or stramineous,  $1\frac{1}{4}$ – $1\frac{1}{2}$  by  $\frac{9}{10}$ – $1\frac{1}{2}$  mm; epidermal cells hexagonal to transversely elliptic.

Distr. India, Thailand, Indo-China, S. China, Ryu Kyu Is. (Okinawa), Formosa; in *Malesia*: N. and Central Sumatra, Malay Peninsula (Kedah: Rawei Island), Philippines (Palawan).

Ecol. In moist to swampy grassy localities, 800–1400 m (Sumatra), on dry open slopes bordering thickets, at low altitude (Palawan).

Note. A specimen in the Singapore Herbarium labelled "Route to Merapi, HORSFIELD" was collected either in Central Java or in S. Sumatra (Palembang Highlands). It was referred to *F. fusca* by RIDLEY, *J. Str. Br. R. As. Soc. n.* 59 (1911) 223.

2. *Fimbristylis complanata* (RETZ.) LINK, *Hort. Berol.* 1 (1827) 292; KUNTH, *En.* 2 (1837) 228; STEUD. *Syn.* 2 (1855) 112; MIQ. *Fl. Ind. Bat.* 3 (1856) 320, *incl. var. laeviculmis* MIQ.; CLARKE, *Fl. Br. Ind.* 6 (1893) 646; Philip. *J. Sc.* 2 (1907) *Bot.* 96; RIDL. *Mat. Fl. Mal.*

Pen. (Monoc.) 3 (1907) 96; KOORD. Exk. Fl. Java 1 (1911) 200; *ibid.* 4, Atlas (1922) f. 260; CAMUS, Fl. Gén. I.-C. 7 (1912) 116, f. 15, 3-4; MERR. En. Philip. 1 (1923) 122; RIDL. Fl. Mal. Pen. 5 (1925) 158; BACK. Onkr. Suiker. (1928) 163. t. 173; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 25; S. T. BLAKE, J. Arn. Arb. 35 (1954) 215; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 105; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 464. — *Scirpus complanatus* RETZ. Obs. 5 (1789) 14. — *Scirpus anceps* WILLD. Ges. Nat. Fr. Berl. Mag. 2 (1808) 287, t. 8 f. 2. — *Isolepis complanata* R. & S. Syst. 2 (1817) 119; PRESL, Rel. Haenk. 1 (1828) 189; DECNE, Nouv. Ann. Mus. Paris 3 (1834) 360; Descr. Herb. Timor. (1835) 32. — *Isolepis willdenowii* R. & S. Syst. 2 (1817) 120; PRESL, Rel. Haenk. 1 (1828) 189. — *Trichelostylis complanata* NEES in WIGHT, Contr. (1834) 103; in Hook. J. Bot. Kew Misc. 6 (1854) 29. — *F. amblyphylla* STEUD. Syn. 2 (1855) 116; MIQ. Fl. Ind. Bat. 3 (1856) 324; F.-VILL. Nov. App. (1882) 308. — *F. anceps* STEUD. Syn. 2 (1855) 112. — *F. autumnalis* (non R. & S.) VIDAL, Phan. Cuming. (1885) 156; Rev. Pl. Vasc. Filip. (1886) 284; BOECK. Linnaea 37 (1871) 38, *excl. var. gracilis* BOECK.; WARB. Bot. Jahrb. 18 (1893) 186; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 196. — *Iriha autumnalis*  $\alpha$  *normalis* O.K. Rev. Gen. Pl. 2 (1891) 752. — *F. complanata* var. *kraussiana* (non CLARKE) USTERI, Beitr. Kenntn. Philip. (1905) 131. — *F. autumnalis* var. *complanata* KÜK. Bot. Jahrb. 59 (1924) 50; BARROS, An. Mus. Argent. Cienc. Nat. 41 (1945) 334.

Glabrous perennial with short rhizome. *Stems* slender to rather robust, densely tufted, compressed-quadrangular at the base, acipitous (almost winged) in the upper part, smooth, or scabrid just below the inflorescence, 20-90 cm by 2-4 mm. *Leaves* shorter than the stems, flat, rather rigid, abruptly acuminate, 3-5 mm wide; ligule a dense fringe of short hairs; sheaths compressed, keeled on the back, the lower ones bladeless. *Inflorescence* compound or decompound, loose to dense, with many spikelets, 1-7 cm long. Involucral bracts 2-4, erect, shorter to slightly longer than the inflorescence, abruptly acuminate, the lowest 1-5 cm long. Primary rays suberect, compressed, scabrid, up to 7 cm long. *Spikelets* solitary or somewhat aggregate, lanceolate to oblong-ovoid, angular, acute, 5-12-flowered, brown, 5-8 by c. 2 mm. *Glumes* spiral, membranous, ovate or oblong-ovate, acute, apiculate or mucronulate, sharply keeled, 2-2½ mm long; keel stramineous, 3-nerved, sides nerveless, margins whitish hyaline. *Stamens* 3; anthers linear, 1-1½ mm. *Style* triquetrous, with pyramidally thickened base, glabrous, 1-1¼ mm; stigmas 3, about as long as the style. *Nut* trigonous, broadly obovoid, minutely stipitate and umbonulate, verruculose (or smooth, not in Malesia), whitish or stramineous, ¼-½ by ½-¾ mm; epidermal cells minute, transversely oblong.

Distr. Pantropic; very common in SE. Asia; throughout Malesia, but apparently rather rare in the Malay Peninsula (Pahang, Malacca, P. Penang, Singapore) and in the south-eastern part of the Archipelago.

Ecol. On the sea-shore, on muddy river-banks, in swampy grass-fields, wet rice-fields, teak-forests, 0-1300 m.

Vern. *Dodombaän*, S. *sinitih*, Siberut, *dëha*, Sumba, *tebororehu*, N. Celebes; Philip.: *baki-bäki*, P. Bis.

3. *Fimbristylis consanguinea* KUNTH, En. 2 (1837) 228; STEUD. Syn. 2 (1855) 113; BOECK. Linnaea 37 (1871) 36; KERN, Blumea 8 (1955) 110; in BACK. & Bakh. f. Fl. Java 3 (1968) 464; STEEN. Mt. Fl. Java (1972) t. 14: 11. — *F. kraussiana* HOCHST. ex KRAUSS, Flora 28 (1845) 757, *nom. inval.*; HOOK. f. in Trimen, Handb. Fl. Ceylon 5 (1900) 63; CHERM. Fl. Madag., fam. 29 (1937) 185. — *F. connectens* THWAITES, En. Pl. Zeyl. (1864) 349. — *Iriha consanguinea* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. complanata* var. *kraussiana* CLARKE, Fl. Br. Ind. 6 (1893) 646. — *F. horsfieldii* CLARKE, Kew Bull. add. ser. 8 (1908) 25. — *F. paupercula* (non BOECK.) KÜK. Candollea 6 (1936) 426. — *F. monticola* (non STEUD.) BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 25.

Differs from the closely related *F. complanata* by the following characters:

*Stems* narrower, only 1-1½ mm wide at the top. *Leaves* narrow, 1-2 mm wide, the cauline ones sometimes much reduced, ½-2 cm long; sheaths rounded on the back or but slightly keeled. *Inflorescence* less compound, subsimple, with few spikelets, 1-3 cm long and wide. *Glumes* larger, (2½-3) by c. 2 mm. *Anthers* longer, c. 1½ mm. *Style* longer, 1¼-2¼ mm. *Nut* smooth, larger, 1-1½ by ¾ mm.

Distr. Insufficiently known: S. Africa, Madagascar, Ceylon, India; in Malesia: W.-E. Java.

Ecol. Swamps, swinging bogs, swampy margins of lakes; often dominant, forming large clumps like *Carex nubigena* and *Rhynchospora rugosa*, 1600-2300 m.

Notes. None of the Malesian *Fimbristylis* spp. occurs at such high altitudes as *F. consanguinea*. Also in Ceylon it is found in the montane zone above 1200 m, in Madagascar it ascends to 1600 m. *F. complanata* is restricted to low and medium altitudes.

*F. horsfieldii* CLARKE was based on a specimen from Central Java, Mt Prahau, HORSFIELD 1073, with very short stem-leaves.

4. *Fimbristylis capilliculmis* OHWI, Blumea 8 (1955) 99, f. 4. — *F. diphylla* (non VAHL) RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 242.

Probably annual. *Stems* very slender, setaceous, densely tufted, acipitous, glabrous and smooth, finely striate, 30-40 cm by c. ½ mm. *Leaves* about as long as the stems or somewhat shorter, capillary, weak, abruptly acuminate, glabrous, scabrid at the very top, otherwise smooth, c. ½ mm wide; ligule a dense fringe of short hairs; sheaths membranous, glabrous, rounded on the back. *Inflorescence* simple or subcompound, loose, with 3-10 spikelets, 1½-2½ cm long and wide. Involucral bracts 2-3, the lowest up to twice as long as the inflorescence, 2-5 cm. Rays acipitous, smooth, sometimes with a short secondary ray, bearing 1(-3) spikelets. *Spikelets* solitary, narrowly ovoid, angular, acute, loosely few-flowered, light brown, 4-5 by 1½(-2) mm; rachilla winged. *Glumes* spiral, membranous, oblong-ovate, mucronulate, sharply keeled, glabrous, 2-2½ by 1½ mm; keel 3-nerved, sides nerveless, margins scarcely hyaline. *Stamens* 2-3; anthers linear, c. ½ mm long. *Style* triquetrous, pyramidally thickened in the lower ½, glabrous, 1½ mm long; stigmas 3, somewhat shorter than the style. *Nut* trigonous, slightly dorsiventrally compressed, broadly obovoid, with flat, smooth faces, minutely stipitate, umbonulate, shining, whitish, c. ⅔ by ¼ mm; epidermal cells transversely elliptic.

Distr. *Malesia*: New Guinea: W. New Guinea (Beaufort R.), NE. New Guinea (Morobe District).

Ecol. River-banks, on loamy soil; on open rocks; 100–450 m.

Note. Like *F. consanguinea* very near to *F. complanata*, but readily distinguishable by its capillary stems and leaves, the few-flowered spikelets, and the glumes hardly scarious on their margins.

5. *Fimbristylis microcarya* F.V.M. Fragm. 1 (1859) 200; BENTH. Fl. Austr. 7 (1878) 316; S. T. BLAKE, Proc. R. Soc. Queensl. 48 (1937) 93 (= Un. Queensl. Pap. Dep. Biol. 1, 3); KERN, Blumea 8 (1955) 111; in Back. & Bakh. f. Fl. Java 3 (1968) 464. — *Iriha microcarya* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. complanata* var. *microcarya* (errore 'microcarpa') CLARKE, Fl. Br. Ind. 6 (1893) 646; DOMIN, Bibl. Bot., Heft 85 (1915) 462. — *F. autumnalis* var. *microcarya* KÜK. Bot. Jahrb. 69 (1938) 258; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 104. — *F. taiwanica* OHWI, J. Jap. Bot. 14 (1938) 574 e descr.; Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 62. — *F. quinqueangularis* f. *abludens* BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 26.

Annual. Stems very slender, densely tufted, weak, strongly compressed, ribbed, smooth, leafy at the base, 10–30 cm by  $\frac{3}{4}$ – $1\frac{1}{4}$  mm. Leaves shorter than the stems, flat, weak, rather abruptly acuminate, glabrous, scabrid on the margins in the upper part, 1–2 mm wide; ligule a dense fringe of short hairs. Inflorescence decompound, very loose, diffuse, with many spikelets, 3–7 cm long. Involucral bracts 2–4, erect, shorter than to as long as the inflorescence, the lowest up to 4 cm. Primary rays slender, compressed-angular, smooth or scabrid at the top, up to 5 cm. Spikelets solitary, very small, ovoid to oblong-lanceolate, angular, acute, few- to several-flowered, ferruginous, 2–4 by 1 mm; rachilla winged. Glumes spiral, membranous, broadly ovate, acute, mucronulate (mucro often slightly excurved), acutely keeled, glabrous, with 3-nerved keel and nerveless sides, c. 1 by 1 mm. Stamen 1 (see Notes); anther oblong,  $\frac{1}{4}$  mm long. Style triquetrous, pyramidally thickened at the base, glabrous, c.  $\frac{1}{2}$  mm long; stigmas 3, somewhat shorter than the style. Nut trigonous with prominent angles and somewhat convex sides, obovoid, subsessile, umbonulate, finely lineolate by the transversely oblong-linear epidermal cells superposed in 4–6 vertical rows on each face, smooth or sparsely and minutely verruculose, whitish,  $\frac{1}{2}$ – $\frac{3}{5}$  by  $\frac{1}{3}$ – $\frac{2}{5}$  mm.

Distr. Widely distributed in N. Australia and Queensland, also reported from India and E. Asia (Formosa) (see Notes); in *Malesia* a few times collected in very distant localities: E. Java (near Surabaya), Lesser Sunda Is. (Alor), Philippines (Luzon, prov. of Cavite and Rizal), New Guinea (Papua: near Port Moresby).

Ecol. Open savannah land by the sea (Port Moresby), margin of lake, at 450 m (Alor).

Vern. *Mátequila*, Alor (see under 52. *F. tomentosa*).

Notes. The Malesian plants agree in details with the Australian ones. The Indian specimens I have

seen are dwarfs, with contracted inflorescence, anthers  $\frac{2}{5}$  mm long, and nuts  $\frac{3}{4}$  by c.  $\frac{1}{2}$  mm. They may represent CLARKE's '*F. complanata* var. *microcarya*', but fit also very well the description of *F. woodrowii* C. B. CLARKE (type not seen).

The description of *F. taiwanica* OHWI leaves little doubt that the Formosa plants belong to *F. microcarya*. According to OHWI the plants are diandrous.

*F. microcarya* is very near to the N. American-E. Asiatic *F. autumnalis* (L.) R. & S., but the nuts of the latter are very different (larger, triquetrous with flat faces, epidermal cells  $\pm$  isodiametric in many rows); the style is longer, and the spikelets larger. The spikelets of *F. microcarya* are the smallest in the genus.

6. *Fimbristylis blepharolepis* KERN, Blumea 12 (1963) 25, f. 2.

Tall annual, with fibrous roots. Stems erect, rigid, sharply 5-angular, grooved, glabrous, scabrid below the inflorescence, leafy at the base, 50–130 cm by 2–4 mm. Leaves shorter than the stems, flat, when dry with inrolled margins, rigid, long-acuminate, several-nerved beneath with prominent midnerve, asperulous above by short, white, bulbous-based hairs,  $2\frac{1}{2}$ –3 mm wide; ligule a dense fringe of white or ferruginous hairs; sheaths pubescent in the upper part. Inflorescence decompound, ovoid, loose, with numerous spikelets, 8–24 by 6–20 cm. Involucral bracts c. 5, the lower ones similar to the leaves, somewhat shorter to slightly longer than the inflorescence, scabrid on the margins, scarious-margined at the dilated, hairy base, 10–25 cm long, the upper ones gradually shorter. Primary rays 6–9, unequal, obliquely spreading, 5-angular, scabrid, the longest 5–12 cm; secondary rays  $2\frac{1}{2}$ –5 cm, peduncles of the spikelets  $\frac{1}{2}$ –1 cm. Spikelets solitary, ovoid, finally oblong-ovoid, subterete, acutish, densely many-flowered,  $2\frac{1}{2}$ –3 mm wide, finally 8–9 mm long; rachilla winged. Glumes spiral, membranous, appressed, broadly ovate, obtuse, mucinous or minutely apiculate, densely ciliate, ferruginous with 3-nerved green keel and white margin, c. 2 by 2 mm. Stamens 3; anthers oblong-linear, 1– $2\frac{1}{3}$  mm long. Style triquetrous, slightly thickened at the base, ciliate in the upper part,  $\frac{2}{3}$ –1 mm; stigmas 3, much longer than the style. Nut trigonous, obovoid, minutely umbonulate, broadly stipitate, trabeculate, sparsely verrucose, white,  $\frac{2}{3}$ – $\frac{3}{4}$  by  $\frac{2}{5}$ – $\frac{1}{2}$  mm; epidermal cells transversely linear, in 4–5 rows on each face.

Distr. *Malesia*: W. New Guinea: near Merauke. To be expected in Queensland.

Ecol. In wet places submerged from January until May, at low altitude.

Notes. Related to the Australian *F. trachycarya* F.V.M. (with non-ciliate glumes) and *F. phaeoleuca* S. T. BLAKE (with long-ciliate glumes and the epidermal cells of the nut isodiametric to transversely oblong in 8–10 rows on each face).

In the three related species the upper side of the leaves is asperulous by short, stiff, bulbous-based hairs (not known to occur in other *Fimbristylis* spp.). The stomatiferous under side is glabrous and smooth.

## 2. Section Miliaceae

OHWI, J. Jap. Bot. 14 (1938) 572. — *Fimbristylis* sect. *Globulosae* OHWI, l.c. — *Fimbristylis* ser. *Miliaceae* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 54.

Type species: *F. miliacea* (L.) VAHL (*Scirpus miliaceus* L.).

7. *Fimbristylis globulosa* (RETZ.) KUNTH, En. 2 (1837) 231; STEUD. Syn. 2 (1855) 114; MIQ. Fl. Ind. Bat. 3 (1856) 322, excl. var. *aphylla* MIQ.; BOECK. Linnaea 37 (1871) 45, incl. var. *foliata* BOECK.; CLARKE, Fl. Br. Ind. 6 (1893) 644, incl. var. *torresiana* CLARKE; Philip. J. Sc. 2 (1907) Bot. 96; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 95; KOORD. Exk. Fl. Java 1 (1911) 200, non *ibid.* 4, Atlas (1922) f. 259; CAMUS, Fl. Gén. I.-C. 7 (1912) 115; BROWN, Min. Prod. Philip. For. 1 (1920) 348, t. 15; MERR. En. Philip. 1 (1923) 123; RIDL. Fl. Mal. Pen. 5 (1925) 158; BACK. Onkr. Suiker. (1928) 163, t. 172; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 24; HEYNE, Nutt. Pl. ed. 3 (1950) 310; S. T. BLAKE, J. Arn. Arb. 35 (1954) 215; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 363. — *Scirpus globulosus* RETZ. Obs. 6 (1791) 19; VAHL, En. 2 (1806) 277. — *F. torresiana* GAUDICH. in Freyc. Voy. Bot. (1826) 413; KUNTH, En. 2 (1837) 231; STEUD. Syn. 2 (1855) 114; F.-VILL. Nov. App. (1882) 308. — *F. efoliata* STEUD. [in Zoll. Syst. Verz. 1 (1854) 61, nom. nud.] Syn. 2 (1855) 109; MIQ. Fl. Ind. Bat. 3 (1856) 318. — *Iriha globulosa* O.K. Rev. Gen. Pl. 2 (1891) 752. — *F. utilis* ELM. Leaf. 3 (1910) 855. — *F. subtrabeculata* (non CLARKE) CAMUS, Fl. Gén. I.-C. 7 (1912) 99.

Glabrous perennial with short rhizome. Stems erect, densely tufted, rigid, obtusangular or subterete, more or less flattened below the inflorescence, striate, smooth, 20–120 cm by 1–5 mm. Cauline leaves reduced to bladeless, tubular, obliquely truncate, cinnamomeous-margined sheaths, the uppermost up to 20 cm; leaves of the sterile shoots narrow, flat or canaliculate, c. 1½ mm wide; ligule absent. Inflorescence simple or compound, with up to 40 spikelets, up to 10 cm long, not rarely much reduced. Involucral bracts 2–3, very short, erect, lanceolate, with scarious margins, up to 1 cm. Primary rays up to 10, smooth, up to 5 cm. Spikelets solitary, globose, ovoid, or ellipsoid, terete, obtuse, densely many-flowered, 4–8 by 3–4 mm; rachilla narrowly winged. Glumes spiral, membranous, ovate, very obtuse, rounded at the apex, mucous, scarcely keeled, often with lacerate top, 3-nerved in the centre (the midnerve ending somewhat below the apex), with a longitudinal dark brown stripe on either side and broad hyaline margins, 2–2½ by 1½ mm. Stamens 2–3; anthers oblong-linear, ½ mm. Style dilated at the base, glabrous, 1 mm long, either triquetrous and trifid, or, more rarely in some or all flowers flat and bifid. Nut compressed-trigonous or biconvex, shortly stipitate, minutely umbonulate, verruculose, ¼–1 by ⅓–¾ mm; epidermal cells transversely oblong, superposed in 12–15 vertical rows on each face.

Distr. From Ceylon and India through S. Asia to China and the Ryu Kyu Is. to Micronesia and Polynesia; in *Malesia*: Sumatra, Malay Peninsula, W. and Central Java, Borneo, Philippines, Celebes, Aru Is., New Guinea.

Ecol. In wet open places: swamps, grass-fields, rice-fields, usually at low altitudes, rarely up to 1000 m. OHWII's record in Bot. Mag. Tokyo 56 (1942) 202: Arfak Mts, 1900 m, refers to *F. salbundia*.

Uses. *F. globulosa* is cultivated in the Malay Peninsula, Sumatra, Celebes, and Java. It is good for fine matting. Hats, baskets, and mats are the main products. The weaving is done as a domestic industry. A common use for the stems is as string.

Vern. *Rumpul sandang*, Mal.Pen., *siih*, Simalur,

*lai, mansiang mantjik, mansiro pandan*, Sum, W.C., *baih-baih, mansiro baih*, Menangk., *dajon tihe*, Sum. E.C., *tjut-tjut*, Alas, *purun tikus*, M., *djukut bubu-ut*, S., *kodokan, méndong*, J., *purun damar, bundusan*, Borneo, *tiu, tuju, kamun, tikogu, werat*, Celebes, *nanaiang*, Snagir, *wamu*, New Guinea, *Kutubu Philippines: anahiuan*, Mbo., Sub., Bis., *badang-badang*, Ilk., *pilokong-kabo*, Mbo., *sud-sud*, Buk., *tayok-tayok*, P. Bis., *tikog*, C. Bis., P. Bis.

Notes. The digynous plants, sometimes treated as a separate species (*F. torresiana* GAUDICH., *F. utilis* ELM.), cannot be segregated from the trigynous ones in a satisfactory way. Under culture is a stout, distigmatic race (clone?).

I have not seen *F. globulosa* var. *javanensis* H. PFEIFF. Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 170, and *Iriha globulosa* var. *robusta* O.K. Rev. Gen. Pl. 2 (1891) 752. The former name, based on HANS WINKLER 1441 from Borneo, was apparently intended to distinguish the Malesian plants from those of Ceylon and India. For this distinction I do not see any reason. As to the latter name ("foliis basilariibus numerosissimis robustis rigidis. Java: Rauwa Ungia"), it is not clear whether it really belongs to *F. globulosa*.

8. *Fimbristylis littoralis* GAUDICH. in Freyc. Voy. Bot. (1826) 413; S. T. BLAKE, J. Arn. Arb. 35 (1954) 217; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 107. — *Scirpus tetragonus* POIR. in Lamk. Encycl. 6 (1804) 767, non *F. tetragona* R. BR. 1810. — *F. miliacea* VAHL, En. 2 (1806) 287, excl. *basion*; KUNTH, En. 2 (1837) 230; HASSK. Pl. Jav. Rar. (1848) 67; STEUD. Syn. 2 (1855) 113; MIQ. Fl. Ind. Bat. 3 (1856) 321, incl. var. *validior* MIQ.; BOECK. Linnaea 37 (1871) 43; BENTH. Fl. Austr. 7 (1878) 316; CLARKE, Fl. Br. Ind. 6 (1893) 644; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 95; CLARKE, Philip. J. Sc. 2 (1907) Bot. 96; KOORD. Exk. Fl. Java 1 (1911) 200; *ibid.* 4, Atlas (1922) f. 259, non f. 258; CAMUS, Fl. Gén. I.-C. 7 (1912) 115; VALCK. SUR. Nova Guinea 8 (1912) 703, incl. f. *tenerrima* VALCK. SUR.; MERR. En. Philip. 1 (1923) 124; RIDL. Fl. Mal. Pen. 5 (1925) 158; BACK. Onkr. Suiker. (1928) 162, t. 171; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 24; HEYNE, Nutt. Pl. ed. 3 (1950) 312. — *Isolepis miliacea* PRESL, Rel. Haenk. 1 (1828) 188, excl. *basion. et var.* — *F. tetragona* A. DIETR. Sp. Pl. 2 (1833) 152, non R. BR. 1810. — *Trichelostylis miliacea* NEES in Wight, Contr. (1834) 103, excl. *basion.* — *Trichelostylis tetragona* NEES, l.c. 104. — *Scirpus niloticus* (non GMEL.) BLANCO, Fl. Filip. (1837) 33; ed. 2 (1845) 23; ed. 3, 1 (1877) 43. — *F. flaccidula* STEUD. ex. ZOLL. Syst. Verz. 1 (1854) 61, nom. nud. — *F. flaccida* STEUD. Syn. 2 (1855) 113; MIQ. Fl. Ind. Bat. 3 (1856) 321.

var. *littoralis*. Synonymy as above.

Glabrous annual or perennial. Stems erect, densely tufted, compressed acutely 4–5-angular, smooth, 10–60(–90) cm by 1–2 mm, the base clothed with laterally compressed, sharply keeled, acuminate or shortly laminate, up to 15 cm long sheaths. Leaves distichous, from much shorter than to about as long as the stems, strongly laterally flattened, equitant, striate, without prominent midnerve, slightly scabrid on the thin margins, gradually acuminate, grooved on the inner margin (see Note 1), 1½–2½ mm wide; ligule absent. Inflorescence compound or decoumpound, loose, diffuse, with many to numerous

spikelets, up to 10 cm long. Involucral bracts 2-4, much shorter than the inflorescence, erect,  $\frac{1}{2}$ -3 cm. Primary rays several, scabrid, up to 7 cm. *Spikelets* solitary, globose or ellipsoid, terete, very obtuse, densely many-flowered, ferruginous or rufous, 2-5 by  $1\frac{1}{2}$ -2 mm; rachilla wingless. *Glumes* spiral, membranous, ovate, obtuse, mucicous, scarcely keeled, 3-nerved in the centre, frequently with a brown streak on both sides, narrowly hyaline-margined, c.  $1\frac{1}{2}$  by 1 mm. *Stamens* 1-2; anthers oblong-linear,  $\frac{1}{2}$ - $\frac{3}{5}$  mm. *Style* triquetrous, slightly thickened at the base, glabrous, 1 mm; stigmas 3, about as long as the style. *Nut* trigonous, obovoid, subsessile, umbonulate, verruculose, minutely transversely lineolate by the transversely oblong-linear epidermal cells, whitish or stramineous,  $\frac{3}{5}$  by  $\frac{1}{2}$  mm.

Distr. Pantropical; common throughout *Malesia*.

Ecol. In open, very wet places; a characteristic weed of the wet rice-fields, 0-1000 m.

Use. The plants are readily eaten by cattle, but the food value is indifferent.

Vern. *Babawangan, bulu mata munding, panon munding, S, adas-adasan, das-dasan, riwit, sunduk wèlut, sriwit, tumbaran, mēndongan, kēmbangan, J, rēbha komēs, r. mungsēn, komēs-peppè, Md, tjekukoh, Alas, rumput kēladi, r. kerbau, r. kurau, r. bukit, janggut kēli, Mal. Pen., purum bundusan, tinggalung, djenggot kambing, Borneo, tijo humaluo, djaka-djaka, Celebes, rebu segar, Sumbawa, Julimbi, NE. New Guinea; Philippines: agor, taulat, ubod-ubod, Tag., gumi, Pang., sirau-sirau, Ilk., sirisi-búyas, Bik.; and many others.*

*var. macrostachya* (KERN) KERN, *comb. nov.* — *F. miliacea* *var. macrostachya* KERN, *Blumea* 8 (1955) 117.

Spikelets larger, 5-10 by 3 mm. *Glumes*  $2\frac{1}{4}$  by  $1\frac{1}{2}$  mm. *Stamens* 3.

Distr. *Malesia*: Central Java, Philippines (Luzon: Burgos).

Notes. As a rule the leaf-blades in *Fimbristylis* are dorsiventrally flattened and cellular-reticulate on the upper side. In *F. littoralis* only the groove on the inner margin is cellular-reticulate. Strictly speaking this groove is the upper side of the leaf.

*F. littoralis* is readily recognizable by those characteristic leaves. Herbarium specimens lacking the leaves may be distinguished from the allies by the wingless rachilla.

Because of the strikingly larger spikelets and *glumes var. macrostachya* has been mistaken for *F. globulosa*. It obviously belongs in *F. littoralis* on account of the equitant leaves, the narrowly hyaline-margined *glumes*, the wingless rachilla, and the size of the nuts. It is not *F. miliacea var. validior* MIQ., which is normal. *F. littoralis*.

For two centuries and in numerous publications the names *Scirpus miliaceus* L. and *F. miliacea* (L.) VAHL have been applied to this widely spread and common species. However, already CLARKE, J. Linn. Soc., Bot. 30 (1894) 312, stated that the sheet marked "miliaceus" in LINNÉ's hand, is *F. quinqueangularis* (VAHL) KUNTH. S. T. BLAKE, *l.c.*, took the nomenclatorial consequences of this fact, and accepted the name *F. littoralis* GAUDICH. as the correct one for the species described above. He was followed by KOYAMA and others. To prevent further confusion I also accept that name, though I think

that the very undesirable change of names might have been avoided. See Taxon 3 (1954) 246.

9. *Fimbristylis aphylla* STEUD. [in Zoll. Syst. Verz. 1 (1854) 61, *nom. nud.*] Syn. 2 (1855) 114; KERN, *Blumea* 8 (1955) 117; KOYAMA, *Contr. Inst. Bot. Un. Montréal* n. 70 (1957) 47; RAYMOND, *Dansk Bot. Ark.* 23 (1966) 327; KERN in *Back. & Bakh. f. Fl. Java* 3 (1968) 464. — *F. globulosa var. aphylla* MIQ. *Fl. Ind. Bat.* 3 (1856) 322. — *Iriha quinqueangularis*  $\beta$  maxima O.K. *Rev. Gen. Pl.* 2 (1891) 752. — *F. quinqueangularis var. crassa* CLARKE, *Fl. Br. Ind.* 6 (1893) 644; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 115. — *F. quinqueangularis* (non KUNTH) KOORD. *Exk. Fl. Java* 1 (1911) 200, *p.p.*; BACK, *Onkr. Suiker.* (1928) 162, *p.p.*; KÜK. *Candollea* 6 (1936) 425. — *F. salbundia* (non KUNTH) BOECK. *Linnaea* 37 (1871) 44, *quoad pl. jav.*

Glabrous, densely tufted perennial. *Stems* stiffly erect, prominently 4-5-angled, almost winged, smooth or slightly scabrid just below the inflorescence, 30-60(-125) cm by (1-2)-3 mm. *Leaves* of the flowering stems reduced to 3 or 4 rather loose, bladeless, obliquely truncate, up to 20 cm long sheaths; those of the sterile shoots well developed, rather abruptly acuminate, with prominent midrib and scabrid margins, up to 30 cm by 2-4 mm; ligule absent. *Inflorescence* compound or decomposed, open, with many spikelets, (2-4)-10 cm long and wide. Involucral bracts 2-3, much shorter than the inflorescence, 1-2 cm long. Primary rays obliquely spreading, smooth, up to 7 cm. *Spikelets* solitary, ovoid, terete, acute, densely many-flowered, on scabrid peduncles,  $2\frac{1}{2}$ - $3\frac{1}{2}$  by  $1\frac{1}{2}$ -2 mm; rachilla winged. *Glumes* spiral, membranous, ovate, obtuse, mucicous, scarcely keeled, c.  $1\frac{1}{2}$  by 1 mm. *Stamens* 1-2; anthers oblong-linear,  $\frac{1}{2}$  mm. *Style* triquetrous, slightly thickened towards the base, glabrous, or ciliate at the top,  $\frac{3}{4}$ -1 mm long; stigmas 3, about as long as the style. *Nut* obtusely trigonous, with somewhat increscitate angles, obovoid, scarcely umbonulate, shortly stipitate, densely verruculose, finely transversely lineolate by the transversely linear epidermal cells in 4-6 vertical rows on each face, whitish or stramineous,  $\frac{7}{10}$ - $\frac{3}{4}$  by  $\frac{2}{5}$ - $\frac{1}{2}$  mm.

Distr. SE. Asia, from India to Indo-China; in *Malesia*: Sumatra, Java, Philippines (Luzon: Bontoc, once collected).

Ecol. In open wet places, swamps, at medium altitudes (500-1500 m).

Vern. *Login ngair, login eme, Sum. E.C., agam mandjit, sajenji, sedjanik, Sum. W.C., panon munding, S, sunduk welut, J.*

Note. Very similar in habit to *F. salbundia*. For the differences see the note under that species (p. 553).

10. *Fimbristylis miliacea* (L.) VAHL, *En.* 2 (1806) 287, *quoad basion.*; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 216; KOYAMA *J. Fac. Sc. Un. Tokyo* III, 8 (1961) 108; KERN in *Back. & Bakh. f. Fl. Java* 3 (1968) 463. — *Scirpus miliaceus* LINNÉ, *Syst. Veg.* ed. 10 (1759) 868. — *Scirpus\* benghalensis* PERS. *Syn.* 1 (1805) 68, *p.p.* — *Scirpus quinqueangularis* VAHL, *En.* 2 (1806) 279. — *F.\* benghalensis* R. & S. *Syst.* 2 (1817) 94, *p.p.* — *Isolepis miliacea* PRESL, *Rel. Haenk.* 1 (1828) 188, *quoad basion.* — *Trichelostylis miliacea* NEES in Wight, *Contr.* (1834) 103, *quoad basion.* — *Trichelostylis quinqueangularis* NEES, *l.c.* 104 — *F.*

*quinquangularis* KUNTH, En. 2 (1837) 229; STEUD. Syn. 2 (1854) 113; MIQ. Fl. Ind. Bat. 3 (1856) 321; BOECK. Linnaea 37 (1871) 42; BENTH. Fl. Austr. 7 (1878) 317, p.p.; CLARKE, Fl. Br. Ind. 6 (1893) 644; Philip. J. Sc. 2 (1907) Bot. 96; ? Ill. Cyp. (1909) t. 43 f. 4-6; KOORD. Exk. Fl. Java 1 (1911) 200, p.p.; *ibid.* 4, Atlas (1922) f. 257 & 258; CAMUS, Fl. Gén. I.-C. 7 (1912) 114, f. 15, 2; MERR. En. Philip. 1 (1923) 125; BACK. Onkr. Suiker. (1928) 162, p.p., t. 170; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 26; KERN, Blumea 8 (1955) 118. — *Iriha quinquangularis* O.K. Rev. Gen. Pl. 2 (1891) 752. — *Iriha miliacea* O.K. l.c., *quoad basion*.

Glabrous annual with fibrous roots. *Stems* erect, densely tufted, acutely 4-5-angled, striate, smooth, up to 40(-75) cm by 1-1½ mm, the base clothed with 2-3 tubular, obliquely truncate, bladeless sheaths. *Leaves* shorter than to as long as the stems, dorsiventrally flattened, with prominent midrib, flat, scabrid on the rib-like angles in the upper part, gradually acuminate, acute, 2-3 mm wide; ligule absent (see Notes). *Inflorescence* compound or decomposed, loose, with many to numerous spikelets, 4-10 cm long. Involucral bracts +5, much shorter than the inflorescence, erect, setaceous, up to 3 cm. Primary rays several, compressed, scabrid, up to 6 cm. *Spikelets* solitary, ovoid, angular, acutish, densely many-flowered, 1½-5 by 1-1½ mm; rachilla narrowly winged. *Glumes* spiral, membranous, ovate or broadly ovate, obtuse, apiculate, keeled, with a brown streak on both sides of the 3-nerved keel and hyaline margins, 1-1¼(-1½) by 1 mm. *Stamen* 1, or in some flowers 2; anther oblong, c. ½ mm. *Style* triquetrous, pyramidally thickened at the base, glabrous or minutely ciliate in the upper half, ½ mm long; stigmas 3, about as long as the style. *Nut* very obtusely trigonous, broadly ellipsoid to subglobose, subsessile, scarcely or not umbonulate, verruculose, minutely transversely lineolate by the transversely oblong-linear epidermal cells in 4-6 vertical rows on each face, stramineous, ⅔-½(-⅔) by ⅓-⅔(-⅓) mm.

Distr. Ceylon, throughout India to S. China and Formosa, tropical Australia; in *Malesia*: Sumatra (E. Coast Res.), Java, Kangean Arch., Lesser Sunda Is., Philippines (Coron I., Luzon, Samar, Leyte, Bohol, Panay, Mindanao), Celebes, Moluccas (Amboina, Buru, Halmahera), New Guinea.

Ecol. In open or lightly shaded wet places: swampy grassland, rice-fields, damp savannah flats, teak forests, at low altitudes, 0-500 m. The record: Java, Mt Salak, 1100 m by KÜKENTHAL, Cand. 6 (1936) 425, refers to *F. aphylla*.

Vern. *Porih pae*, Sumbawa.

Notes. *F. miliacea* is everywhere much rarer than *F. littoralis*, but has certainly often been overlooked or taken for the latter species. It can easily be recognized by the leaves with prominent midrib and rib-like, not grooved margins, the apiculate, keeled glumes, and the rachilla ragged with scale-like wings after the fall of the glumes.

Like in the other *spp.* of *sect. Miliaceae* the leaves are eligulate, i.e. the blade is not separated from the sheath by a fringe of hairs. In one of the specimens of ROBINSON 1894 from Amboina, however, I found the ligule well developed.

*Scirpus\* benghalensis* PERS. ('Bengalia') was published without definite indication of rank; see CHATER & BRUMMITT, Taxon 15 (1966) 146. CLARKE

wrongly cited the name in the synonymy of *F. littoralis* (his *F. miliacea*). The type collection (L) is a mixture of *F. autumnalis* (L.) R. & S. and *F. miliacea* (*F. quinquangularis*).

11. *Fimbristylis salbundia* (NEES) KUNTH, En. 2 (1837) 230; STEUD. Syn. 2 (1855) 113; BOECK. Linnaea 37 (1871) 44 p.p., *excl. pl. jav.*; CLARKE, Fl. Br. Ind. 6 (1893) 646; S. T. BLAKE, J. Arn. Arb. 35 (1954) 216; KERN, Blumea 8 (1955) 119. — *Trichelostylis salbundia* NEES in Wight, Contr. (1834) 105. — *Iriha salbundia* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. paludosa* MERR. Philip. J. Sc. 9 (1914) Bot. 265; En. Philip. 1 (1923) 125. — *F. globulosa* (non KUNTH) OHWI, Bot. Mag. Tokyo 56 (1942) 202. — *F. haspaniformis* KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 45, t. 6 A-E.

Glabrous perennial with shortly creeping, obliquely descending rhizome covered with ovate-lanceolate scales. *Stems* uniseriate on the rhizome, close together, erect, rather stiff, prominently 4-5-angled or almost winged, smooth, 30-75 cm by 1-3 mm. *Leaves* of the flowering stems reduced to 2-4 bladeless sheaths, the lower ones ovate or oblong-ovate, fuscous, the upper ones tubular, herbaceous, with obliquely truncate, membranous upper margin, up to 15 cm long; sterile shoots unknown; ligule absent. *Inflorescence* compound or decomposed, loose or rather dense, with many spikelets, 2-4(-7) cm long and wide. Involucral bracts 2-5, very short, lanceolate, with recurved setaceous point, up to 1½ cm. Primary rays rather rigid, slightly compressed, smooth, or scabrid at the top, up to 5 cm. *Spikelets* solitary or some subaggregated, ellipsoid, ovoid, or broadly ovoid, angular, obtusish, densely many-flowered, 3-5 by c. 2 mm; rachilla narrowly winged. *Glumes* spiral, membranous, ovate, obtuse, muticous (midnerve ending somewhat below the apex), keeled, 3-nerved on the castaneous back, with nerveless, yellowish sides and broad hyaline margins in the upper half, 2-2½ by 1½ mm. *Stamens* (2-3); anthers oblong-linear, ¾-1 mm. *Style* triquetrous, with pyramidally thickened base, glabrous, 1 mm; stigmas 3, about as long as the style. *Nut* trigonous, broadly obovoid, shortly stipitate, not umbonulate, smooth or sparsely verruculose, reticulate-lineolate by the transversely elliptic or oblong epidermal cells in 9-13 vertical rows on each face, whitish or brownish, ⅔-⅑ by ⅓-⅗ mm.

Distr. India, Burma, N. Thailand, Annam; in *Malesia*: Sumatra (Karo plateau, Tapianuli, Mt Kerintji), Philippines (Luzon), N. and Central Celebes, New Guinea. CLARKE, l.c., wrongly recorded it from Australia.

Ecol. Swamps, moist grasslands, river marshes, in shallow water, 900-2200 m.

Vern. New Guinea: *pimbina*, Enga lang., *tambug'u-pimongo*, Kaugel dial.

Note. Very similar in habit to *F. aphylla*. *F. salbundia* is characterized by the darker spikelets angular by reason of the keeled glumes, the slightly longer glumes, the number of stamens and especially by the different marking of the nut.

12. *Fimbristylis anisoclada* OHWI, Blumea 8 (1955) 97, f. 2; KERN, Blumea 8 (1955) 120; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 47; KERN, Reinwardtia 6 (1961) 40; in BACK. & BAKH. f. Fl. Java 3 (1968) 463.

Glabrous, densely tufted perennial. *Stems* slender,

acutely 5-angled, almost winged, slightly scabrid just below the inflorescence, up to 1 m by c. 2 mm. *Leaves* of the flowering stems reduced to 1-3 bladeless or almost bladeless, tubular, up to 20 cm long sheaths; those of the sterile shoots much shorter than the stems, erect, rigid, abruptly acuminate, smooth or slightly scabrid on the margins near the apex, 1-2 mm wide; ligule absent. *Inflorescence* decomposed or supradecomposed, rather dense, interrupted, with numerous spikelets, up to 20 by 10 cm. Involucral bracts 4-6, the lower 1-2 erect, rather rigid, gradually acuminate, with scabrid upper surface and margins, 4-8 cm by 1-1½ mm. Primary rays very unequal, erect, rigid, 4-5-angular, smooth, up to 12 cm. *Spikelets* solitary, ovoid, angular, acute, few-flowered, 2-3 by 1-1½ mm; rachilla narrowly winged. *Glumes* spiral, chartaceous, ovate or broadly ovate, acutish, apiculate, obtusely keeled, with dark castaneous keel, yellowish brown sides, and margins hyaline in the upper ⅓, 1¼-1½ by c. 1½ mm. *Stamens* 1-2; anthers oblong-linear, ⅓-¾ mm. *Style* triquetrous, rather gradually thickened towards the base, glabrous, ½-¾ mm; stigmas 3, about as long as the style. *Nut* trigonous with somewhat convex sides, broadly obovoid, shortly stipitate, scarcely umbonulate, smooth, obscurely reticulate by the roundish or transversely elliptic epidermal cells, stramineous, ⅓-¾ by ⅓ mm.

Distr. SE. Thailand, Cochinchina, Annam; in *Malesia*: Central Java (forestry Plosokerep), Celebes (Mara).

Ecol. Open muddy ground, moist grasslands, rice-fields, at low altitudes.

13. *Fimbristylis subdura* OHWI, *Blumea* 8 (1955) 101, f. 5; KERN in *Back. & Bakh. f. Fl. Java* 3 (1968) 463. — Fig. 38.

### 3. Section *Cymosae*

OHWI, *J. Jap. Bot.* 14 (1938) 571. — *Fimbristylis ser. Cymosae* OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B18 (1944) 54.

Type species: *F. cymosa* R. Br.

14. *Fimbristylis dura* (ZOLL. & MOR.) MERR. *Philipp. J. Sc.* 11 (1916) Bot. 53; *BACK. Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246. p. 25; KERN in *Back. & Bakh. f. Fl. Java* 3 (1968) 464. — *Isolepis dura* ZOLL. & MOR. in *Mor. Syst. Verz.* (1846) 97; *STEUD. Syn.* 2 (1855) 104; *MIQ. Fl. Ind. Bat.* 3 (1856) 312. — *F. asperrima* BOECK. *Linnaea* 37 (1871) 40; CLARKE, *Fl. Br. Ind.* 6 (1893) 643; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 96; KOORD. *Exk. Fl. Java* 1 (1911) 199; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 113; RIDL. *Fl. Mal. Pen.* 5 (1925) 158 (*excl. specim. Pulau Rawet*).

Glabrous perennial with stout, short, woody rhizome. *Stems* solitary or somewhat tufted, rather robust, rigid, quadrangular and deeply sulcate at the base, angipitous with scabrid angles below the inflorescence, many-leaved at the base, 45-75(-100) cm by 2-5 mm. *Leaves* distichous, somewhat shorter than to as long as the stems, coriaceous, flat, gradually narrowed to the rather abruptly acuminate apex, with prominent midrib and serrulate-scabrous margins, glaucous or greyish green, 3-8 mm wide; ligule absent; lower sheaths bladeless or shortly laminate, shining, fuscous to castaneous. *Inflorescence* decomposed, large, loose, diffuse,

Glabrous perennial with short, woody rhizome. *Stems* densely tufted, rather rigid, obtusangular, somewhat compressed at the top, striate, smooth, 40-50 cm by 1-1½ mm, the base clothed with 1-2 tubular, bladeless or very short-bladed, obliquely truncate sheaths. Basal *leaves* somewhat shorter than the stems, rather rigid, flat, gradually narrowed towards the abruptly acuminate apex, scabrid on the margins, 2½-3 mm wide; ligule absent. *Inflorescence* decomposed or supradecomposed, large, loose, diffuse, with numerous spikelets, up to 10 cm long and wide. Involucral bracts 4-5, setaceous, erect or slightly recurved, much shorter than the inflorescence, 2-3 cm long. Primary rays 6-10, obliquely patent, compressed, smooth, 4-6 cm long. *Spikelets* solitary, lanceolate, terete, acute, several-flowered, rufous or fuscous, 3-6 by 1¼ mm; rachilla broadly winged. *Glumes* spiral, subchartaceous, broadly ovate, obtuse, apiculate or mucronulate, slightly keeled, with 3-nerved keel, nerveless sides, and narrow, hyaline margins, c. 2 by 1¾ mm. *Stamens* 3; anthers oblong-linear, ⅓ mm. *Style* triquetrous, slightly thickened at the base, glabrous, or sparsely ciliate at the top, 1¼ mm; stigmas 3, somewhat shorter than the style. *Nut* obtusely trigonous, broadly ellipsoid or slightly obovoid, broadly stipitate, not umbonulate, densely verrucose, indistinctly reticulate by the somewhat impressed, transversely elliptic epidermal cells, shining, greyish white, ⅓-7/10 by ½ mm.

Distr. *Malesia*: Central Java (Gundih N of Solo; forestry Manggar near Kedungdjati).

Ecol. Only twice collected, both times in teak-forest, 50-200 m.

Note. This remarkable species is in habit similar to *F. dura* and by OHWI and me originally placed near to it. Its natural place is rather in *sect. Miliaceae* on account of the bladeless stem-leaves, the short bracts, etc.

with numerous spikelets, up to 20 by 10 cm. Involucral bracts 3-4, erect, the lower 1-2 overtopping the inflorescence, 10-25 cm long. Primary rays numerous, erecto-patent, compressed, smooth, up to 10 cm. *Spikelets* solitary, narrowly oblong to linear, somewhat angular, acute, many-flowered, brown, 4-13 by 1-1½ mm; rachilla broadly winged. *Glumes* spiral, chartaceous, ovate to oblong-ovate, acute or apiculate, keeled, 1½-2 by 1½ mm, the upper ones not rarely abnormally elongated, up to 4 mm long; keel green, 3-nerved, sides nerveless, shining ferruginous to brown. *Stamens* 3 (or in some flowers 2); anthers oblong, ¾-1 mm long. *Style* triquetrous, pyramidally thickened at the base, glabrous or ciliate at the top, ¾-1 mm; stigmas 3, as long as to somewhat longer than the style. *Nut* obtusely trigonous with slightly convex sides, ellipsoid to oblong-obovoid, shortly stipitate, obscurely umbonulate, sparsely verruculose, finely transversely lineolate by the oblong-linear epidermal cells, stramineous to brownish, 7/10-¾ by ½-⅓ mm.

Distr. SE. Asia, from India, Thailand and Indochina to *Malesia*, here restricted to the Western

part: Sumatra, Malay Peninsula, W. Java, very rare in Central Java, Borneo.

Ecol. In open places in primary forests, often abundant in secondary forests, forest-borders, shaded grassy localities, on river-banks, rarely in rice-fields, 0–1000 m.

Use. According to BURKILL, Dict., in Pahang used as a medicine ('ubat meroyan') after child-birth. Vern. *Si marimbulu tano, si marbuliga-buliga*, Sum. E.C., *rumpu siamet, r. pulu, r. bawang, r. siamèh gunong*, Mal. Pen., *gèlunggung gunung*, Kutei.

Note. Similar to stout forms of the polymorphic *F. complanata*, but readily distinguishable by the long involucre bracts and the eligulate leaves.

**15. *Fimbristylis scaberrima* NEES in Wight, Contr. (1834) 102; KUNTH, En. 2 (1837) 229; STEUD. Syn. 2 (1855) 113; BOECK. Linnaea 37 (1871) 13, p.p.; *ibid.* 38 (1874) 408; CLARKE, Fl. Br. Ind. 6 (1893) 637; J. Linn. Soc. Bot. 34 (1898) 60; KERN, Blumea 8 (1955) 112; in Back. & Bakh. f. Fl. Java 3 (1968) 465. — *Iriha scaberrima* O.K. Rev. Gen. Pl. 2 (1891) 753. — Fig. 39.**

Glabrous perennial with short, woody rhizome. *Stems* densely tufted, rigid, ancipitous, with a median rib on either side, scabrid or scabrous in the upper part, many-leaved at the base, 50–70 cm by 1½–2 mm. *Leaves* somewhat shorter than the stems, rather rigid, flat, gradually narrowed to the abruptly acuminate apex, with scabrous, somewhat incurved margins, glaucous, 3–5 mm wide; ligule absent; lower sheaths shining, spadiceous. *Inflorescence* decomposed, rather dense, with numerous spikelets, 5–10 cm long and wide. Involucral bracts 3–5, the lowest as long as or longer than the inflorescence. Primary rays several, erecto-patent, compressed, smooth, up to 4(–7) cm. *Spikelets* all solitary or partly in clusters of 2–3, narrowly ovoid, angular, often slightly compressed, acute, many-flowered, 4–7(–12) by 2–2½ mm; rachilla broadly winged. *Glumes* spiral, sometimes subdistichous, membranous, patulous at the top, oblong-ovate, acute or apiculate, acutely keeled, 2–2¾ by 1½ mm; keel green, 3-nerved, sides ferruginous to fuscous, nerveless. *Stamens* 3; anthers linear, ¾–1 mm long. *Style* flat, dilated at the base, glabrous or sparsely papillose at the top; stigmas 2, about as long as the style. *Nut* biconvex, obovate or broadly obovate, shortly stipitate, umbonulate, smooth or sparsely verruculose, stramineous, ultimately dull greyish brown, ¾–¾ by ½–¾ mm; epidermal cells transversely elliptic to oblong.

Distr. Insufficiently known, much rarer than *F. dura*. India (Sylhet), Indo-China (Cambodia), in *Malesia*: Sumatra (Res. Djambi: near Lake Sipin), W. Java (Bantam), Borneo (W. Borneo and W. Kutei).

Ecol. Open places in swamp forests, shores of lakes, often dominant; at low altitudes.

Vern. *Purun damar*, Kutei, *èntjerip*, Dyak, *tamparai*, W. Borneo.

Notes. This species, according to CLARKE, 1898, endemic in Sylhet and probably once collected, is apparently not rare in Borneo, where it was first collected by TEYSMANN; it is much rarer in Sumatra and Java.

NEES, who restricted *Fimbristylis* to the species with bifid style and lenticular nuts, placed *F. scaber-*

*rima* in that genus, not in *Trichostylis* (with trifid style and trigonous nuts). But already CLARKE pointed to its relationship with the trigynous *F. complanata*. It is still closer to *F. dura*, so that it cannot be placed in different genera.

**16. *Fimbristylis pierotii* MIQ. Ann. Mus. Lugd. Bat. 2 (1865) 145; BOECK. Linnaea 37 (1871) 32; CLARKE, Fl. Br. Ind. 6 (1893) 642; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 65; KERN, Blumea 8 (1955) 112; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 106. — *Iriha pierotii* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. pinetorum* MERR. Philip. J. Sc. 9 (1914) Bot. 266; En. Philip. 1 (1923) 125.**

Glabrous perennial with creeping, woody rhizome clothed with lanceolate scales. *Stems* slender, solitary, compressed-triquetrous, striate-sulcate, scabrid at the top, few-leaved at the base, 20–60 cm by ½–¾ mm. *Leaves* shorter than the stems, rigid, flat or with inrolled, scabrid margins, acute, rather abruptly acuminate, often with a subulate point, dark green, 1–2 mm wide; ligule absent; lower sheaths bladeless, hardly keeled. *Inflorescence* simple or subcompound, loose, with 3–10 spikelets, 1½–4 cm long. Involucral bracts very short, lanceolate or with a setaceous point, up to 1½ cm long. Rays suberect, compressed, smooth, 1–2 cm long. *Spikelets* solitary, ovoid-lanceolate, angular, acute, rather loosely flowered, castaneous, 7–15 by 3–4 mm; rachilla broadly winged. *Glumes* spiral, subchartaceous, ovate, rather acute to obtuse, mucicous, keeled, with 3-nerved, green keel and hyaline margins, gland-dotted in the upper half, 4½–6 by c. 3½ mm. *Stamens* 3; anthers linear, 2–2½ mm long. *Style* triquetrous, pyramidally thickened at the base, glabrous, 2½–4 mm; stigmas 3, usually shorter than the style. *Nut* trigonous, broadly obovoid, shortly stipitate, umbonulate, verruculose, whitish, 1–1½ by 1 mm; epidermal cells transversely elliptic-oblong.

Distr. From India (NW. Himalaya, Simla, Kumaon) to Japan and Korea (S. part and Quelpert); in *Malesia* only in the Philippines: N. Luzon (Benguet Subprov.: Baguio).

Ecol. In Luzon scattered on slopes among various grasses in thin pine forests, at 1550 m.

**17. *Fimbristylis insignis* THWAITES, En. Pl. Zeyl. (1864) 349; CLARKE, Fl. Br. Ind. 6 (1893) 645; CAMUS, Fl. Gén. I.-C. 7 (1912) 118; S. T. BLAKE, J. Arn. Arb. 35 (1954) 215; KERN, Blumea 8 (1955) 112. — *F. thwaitesii* BOECK. Linnaea 37 (1871) 34. — *Iriha insignis* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. rigidula* (non NEES) MERR. En. Philip. 1 (1923) 125, p.p. — *F. longispica* (non STEUD.) RIDL. Fl. Mal. Pen. 5 (1925) 156, p.p. — *F. petrogena* OHWI, Bot. Mag. Tokyo 56 (1942) 201.**

Glabrous perennial with short rhizome. *Stems* solitary or somewhat tufted, rigid, obtusangular, compressed at the top, sulcate, smooth, incrassate at the leafy base, (15–)30–40(–60) cm by (½–)1(–2) mm. *Leaves* shorter than the stems, erect, rigid, flat, exactly linear, obtuse or abruptly acuminate, scabrid on the margins at least at the top, (1–)2–2½(–4) mm wide; ligule absent. *Inflorescence* simple or subcompound, loose, with (2–)4–8(–18) spikelets, 3–6(–10) cm long. Involucral bracts 2–3, very short, erect, ½–2 cm long, the margins scarious at the base. Rays 2–6, obliquely erect, compressed, smooth, 2–6 cm long. *Spikelets* solitary, oblong-lanceolate,

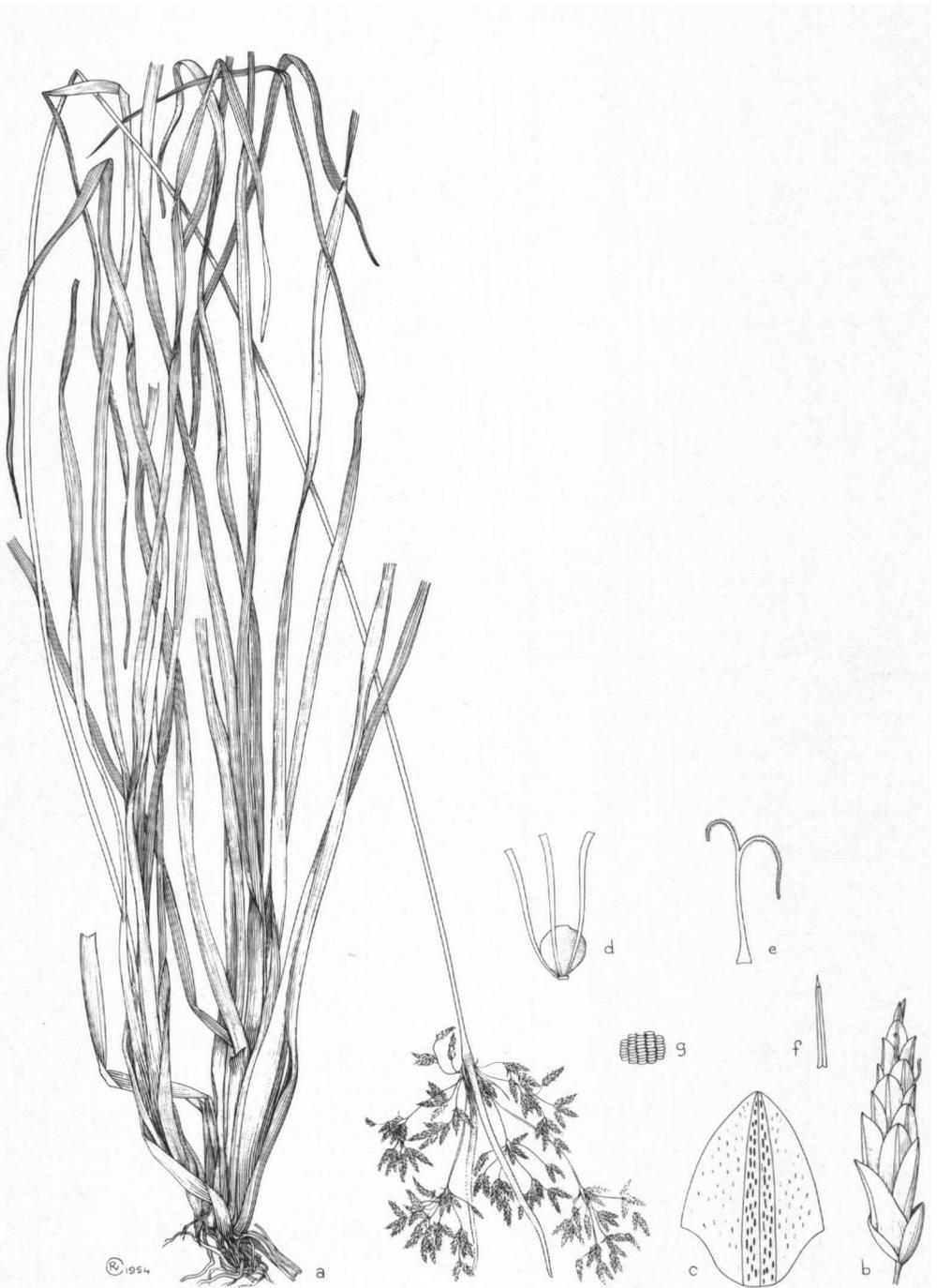


Fig. 39. *Fimbristylis scaberrima* NEES. *a.* Habit,  $\times \frac{1}{2}$ , *b.* spikelet,  $\times 5$ , *c.* glume, *d.* nut with persistent filaments, *e.* style, *f.* anther, all  $\times 10$ , *g.* external cells of nut, strongly enlarged (*a-g* VAN STEENIS 12565).

terete, acute, many-flowered, brown, 10–20 by 2–3 mm; rachilla broadly winged. *Glumes* spiral, chartaceous, ovate or oblong-ovate, rather acute, mucronulate, scarcely keeled, with strong midnerve, nerveless sides and narrow hyaline or microscopically ciliate margins, fulvous,  $(3\frac{1}{2}-4\frac{1}{2}-6$  by  $3-4\frac{1}{2}$  mm. *Stamens* 3; anthers linear,  $1\frac{1}{2}-2\frac{1}{4}$  mm long. *Style* triquetrous, flattened at the top, pyramidally thickened at the base, ciliate in the upper half or membranous-margined, rarely glabrous,  $(2\frac{1}{2}-4-5$  mm long; stigmas 3, shorter than the style. *Nut* trigonous with slightly concave sides, obovoid-pyriform, truncate or somewhat impressed at the top, shortly stipitate, umbonulate, more or less verrucose, whitish or brownish, reticulate by the roundish or hexagonal epidermal cells,  $(\frac{7}{8}-1-1\frac{1}{4}$  by  $\frac{7}{10}-1$  mm.

Distr. Ceylon, Thailand, Tonkin, Cochinchina, Laos, S. China, tropical Australia; in *Malesia* in several remote localities: Malay Peninsula (Setul, Kedah), N. Borneo, Philippines (Culion, Luzon, Panay), SE. Celebes (Rumbia, Timampu), throughout New Guinea.

Ecol. In frequently burnt savannahs, in open rocky grass-fields by the sea-shore, in the Malay Peninsula on heaths, in Celebes found in monsoon forest; at low altitudes.

Note. THWAITES described the style as glabrous. In the specimens of CP 3317 (type-collection) and in most of the other collections I have seen the style is distinctly ciliate. Sometimes it is bordered by a hyaline membrane; only in VESTERDAL 228 from Kedah I found it glabrous.

Why BOECKLER renamed this species is not clear.

18. *Fimbristylis falcata* (VAHL) KUNTH, En. 2 (1837) 239; STEUD. Syn. 2 (1855) 120; MIQ. Fl. Ind. Bat. 3 (1856) 325; BOECK. Linnaea 37 (1871) 48; F.-VILL. Nov. App. (1882) 308; KERN, Blumea 8 (1955) 113. — *Scirpus falcatus* VAHL, En. 2 (1806) 275. — *F. brevifolia* PRESL, Rel. Haenk. 1 (1828) 192, non R.Br. 1810. — *F. brachyphylla* PRESL, Rel. Haenk. 1 (1830) 351, non SCHULT. 1827. — *Trichelostylis junciformis* NEES in Wight, Contr. (1834) 106. — *F. haenkei* PRESL ex DIETR. Sp. Pl. 2 (1833) 161; Syn. Pl. 1 (1839) 201; STEUD. Syn. 2 (1855) 119. — *F. junciformis* KUNTH, En. 2 (1837) 239; STEUD. Syn. 2 (1855) 120; MIQ. Fl. Ind. Bat. 3 (1856) 327; BOECK. Linnaea 37 (1871) 49; CLARKE, Fl. Br. Ind. 6 (1893) 647; Philip. J. Sc. 2 (1907) Bot. 97; CAMUS, Fl. Gén. I.-C. 7 (1912) 119; MERR. En. Philip. 1 (1923) 123, excl. syn. Retzii; KÜK. Bot. Jahrb. 59 (1924) 50. — *Iriha junciformis* O.K. Rev. Gen. Pl. 2 (1891) 752. — *Iriha falcata* O.K. l.c. 753.

Glabrous perennial with woody, shortly creeping rhizome covered with the fibrous remains of old leaf-sheaths. *Stems* solitary or somewhat tufted, rigid, angular, slightly compressed, sulcate, smooth, or scabrid at the top, leafy at the base, 10–55 cm by *c.* 1 mm. *Leaves* shorter than the stems, rigid, flat, often with inrolled scabrid margins, often recurved, abruptly pointed,  $1\frac{1}{2}-3$  mm wide; ligule absent; lower sheaths ferruginous. *Inflorescence* compound or subdecompound, loose, 3–15 cm long. Involucral bracts 2–4, very short, erect, rigid, the lowest up to  $2\frac{1}{2}$  cm. Primary rays erecto-patent, smooth, up to 8 cm long. *Spikelets* in clusters of 2–5, or a few solitary, ovoid, angular, acute, several-flowered, brown to castaneous, 3–4 by *c.*  $1\frac{1}{2}$  mm; rachilla broadly winged. *Glumes* spiral, subchartaceous with

broad scarios margins, triangular-ovate, acute or minutely apiculate, keeled, with 3-nerved keel and nerveless sides,  $2-2\frac{3}{4}$  by  $2-2\frac{1}{2}$  mm. *Stamens* 3; anthers linear,  $\frac{3}{4}-1$  mm long; connective distinctly produced, bristly at the top. *Style* triquetrous, pyramidally thickened at the base, glabrous, or ciliate at the top, 1–2 mm long; stigmas 3, about as long as the style. *Nut* trigonous with somewhat convex sides, obovoid, minutely stipitate, umbonulate, verruculose or almost smooth, whitish or stramineous,  $\frac{4}{5}-1$  by  $\frac{7}{10}-\frac{2}{5}$  mm; epidermal cells transversely oblong.

Distr. Madagascar?, Ceylon, throughout India, Thailand, Indo-China; in *Malesia* very rare: Philippines (Luzon: Manila; Burgos, Ilocos, Norte Prov.), New Guinea (Sepik Distr., Morobe Distr.), New Britain (Gazelle Peninsula).

Ecol. In grasslands, from low altitudes up to 1800 m.

Notes. In the herbaria it is often confused with *F. cymosa*, to which it is similar in habit; characteristic of *F. falcata* are the thick, creeping rhizome, the conspicuous scarios margins of the glumes, the pale nuts, and the bristly appendage of the anthers.

According to a field-note (HENTY 161, from New Guinea), the roots are slightly aromatic, smelling of sage.

19. *Fimbristylis cymosa* R.Br. Prod. (1810) 228; DECNE, Herb. Timor. Descr. (1835) 33; KUNTH, En. 2 (1837) 244; MIQ. Fl. Ind. Bat. 3 (1856) 328; BENTH. Fl. Austr. 7 (1878) 318; CLARKE, Ill. Cyp. (1909) t. 43, f. 7–11; CAMUS, Fl. Gén. I.-C. 7 (1912) 119, f. 15, 5–6; MERR. En. Philip. 1 (1923) 127; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 467. — *F. spathacea* ROTH, Nov. Pl. Sp. (1821) 24; KUNTH, En. 2 (1837) 246; STEUD. Syn. 2 (1855) 114; CLARKE, Fl. Br. Ind. 6 (1893) 640; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 93; CLARKE, Philip. J. Sc. 2 (1907) Bot. 95; KOORD. Exk. Fl. Java 1 (1911) 199; *ibid.* 4, Atlas (1922) f. 256; CAMUS, Fl. Gén. I.-C. 7 (1912) 109; MERR. En. Philip. 1 (1923) 126; RIDL. Fl. Mal. Pen. 5 (1925) 156; BACK. Onkr. Suiker. (1928) 161, t. 169; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 22. — *Isolepis haenkei* PRESL, Rel. Haenk. 1 (1828) 187. — *F. glomerata* NEES ex KUNTH, En. 2 (1837) 246; BOECK. Linnaea 37 (1871) 47; KÜK. Candollea 6 (1936) 425. — *F. rigida* KUNTH, En. 2 (1837) 231; MOR. Syst. Verz. (1846) 97; ZOLL. Syst. Verz. 1 (1854) 61; MIQ. Fl. Ind. Bat. 3 (1856) 327; F.-VILL. Nov. App. (1882) 308. — *F. ciliolata* STEUD. Syn. 2 (1855) 109; MIQ. Fl. Ind. Bat. 3 (1856) 317. — *F. laevisissima* STEUD. Syn. 2 (1855) 117; MIQ. Fl. Ind. Bat. 3 (1856) 324. — *F. pycnocephala* HILLEBR. Fl. Haw. Isl. (1888) 473; S. T. BLAKE, J. Arn. Arb. 35 (1954) 219. — *Iriha cymosa* O.K. Rev. Gen. Pl. 2 (1891) 753. — *Iriha glomerata* O.K. l.c. — *Iriha pycnocephala* O.K. l.c. — *F. warburgii* K. Sch. in Warb. Bot. Jahrb. 13 (1891) 265. — *F. cymosa* var. *subcapitata* CLARKE, Bot. Tidsskr. 24 (1901) 90. — *F. capitulifera* MERR. Philip. J. Sc. 9 (1914) Bot. 265; En. Philip. 1 (1923) 122. — *F. atollensis* ST. JOHN, Pac. Sc. 6 (1952) 145.

Glabrous perennial with short rhizome. *Stems* densely tufted, rigid, compressed-trigonous to subterete, smooth, many-leaved at the base, 10–50 cm by 1–2 mm. *Leaves* much shorter than the stems, coriaceous, flat or canaliculate, abruptly acuminate,

scabrid on the margins, 1-2(-3) mm wide; ligule absent. *Inflorescence* compound or decompound, loose to very dense, not rarely subcapitate, with many to numerous spikelets. Involucral bracts 2-3, very short, erect, dilated at the base,  $\frac{1}{2}$ -1 cm long. Primary rays 3-8, obliquely erect to erecto-patent, very unequal, compressed, smooth, up to 4 cm long. *Spikelets* solitary or in clusters, ovoid, oblong-ovoid, ellipsoid, or cylindrical, somewhat angular, acutish, densely many-flowered, 3-6 by c. 2 mm; rachilla broadly winged. *Glumes* spiral, membranous, broadly ovate to oblong-ovate, obtuse, often notched, muticous, rarely minutely apiculate, slightly keeled, 3-5-nerved in the centre with prominent midnerve and nerveless sides, ferruginous to fuscous with pale scarious margins,  $\frac{1}{2}$ - $2\frac{1}{4}$  by  $\frac{1}{4}$ - $1\frac{3}{4}$  mm. *Stamens* 1-3; anthers linear,  $\frac{3}{4}$ -1 mm long; connective shortly produced, smooth. *Style* flat or triquetrous, dilated at the base, glabrous,  $\frac{1}{2}$ -1 mm long; stigmas 2 or 3, as long as or longer than the style. *Nut* biconvex or trigonous, obovate, shortly stipitate, minutely umbonulate, smooth or sparsely verruculose, finally chestnut-black,  $\frac{2}{3}$ - $\frac{5}{8}$  by  $\frac{1}{2}$ - $\frac{7}{10}$  mm; epidermal cells minute, quadrangular or transversely oblong.

Distr. Pantropic; throughout *Malesia*.

Ecol. In open sandy, clayish, or rocky places by the sea: sandy beaches, wet dune hollows, muddy places in the mangrove, etc.; locally often abundant; sometimes inland near hot springs. See RIDLEY, *Disp.* (1930) 329.

Vern. *Kodökan, sulang watu, tēki parang, J.*

Notes. In the wide sense accepted here extremely variable. The spikelets may be all solitary or clustered on the well developed rays, or the inflorescence may be contracted into a single head. Glumes, anthers, and style vary considerably in size. The nut may be biconvex or trigonous, smooth or verruculose. The Malesian plants are distigmatic as a rule (*F. spathacea*), but often there are a few tristigmatic flowers among the distigmatic ones. Plants with all or nearly all the flowers tristigmatic (*F. cymosa* s. str.) are very rare in Malesia (e.g. RAMOS 33444 from Luzon); they prevail in other regions.

*F. capitulifera* MERR. from the Batan and Babuyan Islands is a remarkable form with the spikelets in dense clusters on well-developed rays, the oblong glumes with shortly excurrent midnerve, a slender style and somewhat smaller nut. It is usually tristigmatic, but distigmatic flowers occur. The spikelets are not always so strikingly clustered. It comes near *F. cymosa* var. *umbellato-capitata* HILLEBR., Fl. Haw. Isl. (1888) 473 (*F. spathacea* var. *umbellato-capitata* KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 107; *F. cymosa* ssp. *umbellato-capitata* KOYAMA, *Micronesica* 1 (1964) 82).

*F. pycnocephala* HILLEBR., l.c., is according to S. T. BLAKE, J. Arn. Arb. 35 (1954) 219-220, specifically distinct from *F. cymosa*, whereas KOYAMA, 1961, refers it to the synonymy of *F. spathacea* var. *umbellato-capitata*.

The '*F. cymosa-spathacea*-complex' needs further study.

20. *Fimbristylis sericea* R.Br. *Prod.* (1810) 228; KUNTH, *En. 2* (1837) 244; STEUD. *Syn. 2* (1855) 121; BOECK. *Linnaea* 37 (1871) 22; BENTH. *Fl. Austr.* 7 (1878) 319; CLARKE. *Fl. Br. Ind.* 6 (1893) 641; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 94; KOORD. *Exk. Fl. Java* 1 (1911) 198; *ibid.* 4, *Atlas* (1922) f. 252; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 111; BACK. *Trop. Nat.* 8 (1919) 9, f. 16; RIDL. *Fl. Mal. Pen.* 5 (1925) 157; BACK. *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 21; KOYAMA, *J. Fac. Sc. Un. Tokyo III*, 8 (1961) 106; KERN in BACK. & Bakh. *f. Fl. Java* 3 (1968) 466. — *F. decora* NEES & MEY. ex NEES in Wight, *Contr.* (1834) 101; KUNTH, *En. 2* (1837) 240. — *F. dasyphylla* MIQ. *Fl. Ind. Bat.* 3 (1856) 327. — *Iriha sericea* O.K. *Rev. Gen. Pl.* 2 (1891) 753. — *F. junciformis* var. *latifolia* (non CLARKE) CAMUS, *Fl. Gén. I.-C.* (1912) 120.

Perennial with thick, woody, horizontally long-creeping or ascending, sinuous, often branched rhizome densely clothed with the remains of old leaf-sheaths. *Stems* solitary, rigid, obtusely trigonous or subterete, striate, pubescent to at length glabrous, the lower 5-15 cm surrounded by 2-3 tubular sheaths with short erect blades, 10-30(-60) cm by 1-2½ mm. *Basal leaves* much shorter than the stems, rigid, often falcate or circinnate, flat with revolute margins, abruptly acuminate, silky strigose-pubescent beneath, 2-4 mm wide; ligule absent. *Inflorescence* simple or compound, loose, 5-10 cm long. Involucral bracts 2-3, much shorter than the inflorescence, lanceolate, acuminate, silky pubescent, rarely up to 2½ cm long. Primary rays 3-6, obliquely patent, smooth, usually 3-8 cm long, sometimes very short. *Spikelets* in clusters of 3-6, oblong-ovoid, angular, acute, densely several-flowered, silvery grey to brownish, 6-10 by 2½-3 mm; rachilla broadly winged. *Glumes* spiral, membranous, broadly ovate, mucronulate, distinctly keeled, many-nerved over the whole breadth, pubescent, with broad scarious margins, 2½-4 by 2-3 mm. *Stamens* (2-3); anthers linear, c. 1½ mm long, with distinctly produced connective bristly at the top. *Style* flat, broad, slightly dilated at the base, with more or less papillose-ciliolate margins, 1½-1¾ mm long; stigmas 2, or in a few flowers 3 (see Notes), shorter than to as long as the style. *Nut* biconvex, obovate, subsessile, indistinctly umbonulate, smooth, fuscous, 1-1½ by ½-1 mm; epidermal cells minute, hexagonal.

Distr. India (rare), Thailand, Indo-China, S. China, Japan, Formosa, N. Australia; in *Malesia* restricted to the Western part: Malay Peninsula (along the east coast from Johore to Kelantan), Banka, Java (especially along the south coast), Madura (north coast), Borneo (Sarawak).

Ecol. Sandy sea-shores, dunes along the coast, locally often abundant and acting as a sand-binder.

Notes. The Australian plants are generally but not always tristigmatic (see R. BROWN, l.c., and BENTHAM, l.c.). In the Asian plants distigmatic flowers by far prevail.

The rhizome when bruised smells of varnish.

#### 4. Section *Tenerae*

KERN, *Blumea* 8 (1955) 159.

Type species: *F. tenera* SCHULT.

21. *Fimbristylis obtusata* (CLARKE) RIDL. Fl. Mal. Pen. 5 (1925) 157; KERN, Blumea 8 (1955) 116. — *F. tenera* R. & S. var. ? *obtusata* CLARKE, Fl. Br. Ind. 6 (1893) 642; RIDL, J. Str. Br. R. As. Soc. n. 46 (1906) 224; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 94; MERR. En. Born. (1921) 62. — *F. nigrobrunnea* var. *thorelii* CAMUS, Not. Syst. 1 (1910) 248; Fl. Gén. I.-C. 7 (1912) 121, p.p.<sup>1</sup>

Dwarfish, glabrous annual with fibrous roots. Stems tufted, setaceous, angular-sulcate, somewhat compressed, smooth, 5–15 cm by  $\frac{1}{4}$ – $\frac{1}{2}$  mm, the lower part surrounded by 1–2 tubular sheaths with short leaf-blades. Basal leaves in a rosette, about half as long as the stems, falcate (twisted to the left), broadly linear, flat or somewhat canaliculate, obtuse, scabrid on the margins in the upper part,  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm wide; ligule absent; sheaths stramineous or ferruginous. Inflorescence simple, rarely subcompound, loose, with few, (1)–3–4(–6) spikelets. Involutural bracts 2–3, very short, glume-like, with dilated base, mucronate, 2–3 mm long. Rays at first obliquely erect, finally widely spreading, capillary, angular, smooth, the longest  $\frac{1}{2}$ –1 cm. Spikelets solitary, lanceolate to oblong-lanceolate, angular, acute, several-flowered, 4–8 by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm; rachilla broadly winged. Glumes spiral or the lower ones sometimes subdistichous, membranous, broadly ovate, acute or minutely apiculate, keeled, c.  $1\frac{1}{2}$  mm long and wide, with 3-nerved green keel, nerveless ferruginous sides and narrow hyaline margins. Stamen 1; anther oblong, c.  $\frac{1}{2}$  mm long. Style triquetrous, pyramidally thickened at the base, glabrous,  $\frac{3}{4}$ –1 mm; stigmas 3, about as long as the style. Nut obtusely trigonous, tricostate, with convex sides, minutely stipitate, umbonulate, densely verruculose, obsolete reticulate by the isodiametric epidermal cells, whitish or stramineous,  $\frac{3}{5}$ – $\frac{3}{4}$  by  $\frac{1}{2}$ – $\frac{2}{3}$  mm.

Distr. Lower Bengal, Lower Burma, Peninsular Thailand; in Malesia: Malay Peninsula (P. Langkawi, Pahang, Malacca, Johore, P. Penang, Singapore), Borneo (Sarawak; Kuching; W. Borneo: Banjarmasin, Sanggau; N. Borneo: Jesselton, Mt Kinabalu); Celebes: Pare-Pare; specimens in the Leyden Herb. "Sumatra, leg. WAITZ" may be mislabeled.

Ecol. Grass-fields, grassy road-sides, at low altitude; on Mt Kinabalu collected at 900 m.

Note. Clearly distinct from *F. tenera* R. & S., of which CLARKE considered it a variety. Mainly characterized by the flat, relatively broad, obtuse leaves and the muticous, glabrous, glumes. By the leaves arising in a left hand spiral and the tendency to distichous arrangement of the glumes it shows affinity to the species of sect. *Fuscae* (e.g. *F. fimbriatylodes*).

22. *Fimbristylis schultzii* BOECK. Linnaea 38 (1874) 391; BENTH. Fl. Austr. 7 (1878) 320; S. T. BLAKE, Proc. R. Soc. Queensl. 58 (1947) 45; KERN, Blumea 8 (1955) 116. — *F. platystachys* BOECK. Linnaea 38 (1874) 390; DOMIN, Bibl. Bot., Heft 85 (1915) 464, incl. var. *schultzii* DOMIN. — *Iriha platystachys* O.K. Rev. Gen. Pl. 2 (1891) 753.

Glabrous annual with fibrous roots. Stems very slender, setaceous, tufted, quadrangular, smooth or

minutely scabrid at the top, leafy at the base, 10–25 cm by  $\frac{1}{2}$ – $\frac{3}{4}$  mm. Leaves radical and 1–2 somewhat higher on the stem, much shorter than the stems, subfalcate, flat or with inrolled margins, acute, scabrid on the margins in the upper part, 1– $1\frac{1}{2}$  mm wide; ligule absent. Inflorescence capitate, hemispherical or subglobose, with 5–12 spikelets, 5–10 mm across. Involutural bracts 4–6, spreading or reflexed, dilated at the base, the lower 1–2 somewhat longer than the inflorescence, 1– $1\frac{1}{2}$  cm long. Spikelets sessile, stellately spreading, oblong-ovoid, angular, acute, few- to several-flowered, 3–8 by  $1\frac{1}{2}$ –2 mm; rachilla winged. Glumes spiral, membranous, erect, ovate, keeled, with strong midrib and nerveless, stramineous to ferruginous sides, glabrous or denticulate-ciliate at the upper edge, mucronulate to strongly mucronate from the incised apex,  $1\frac{1}{2}$ –3 mm long; mucros almost straight to strongly recurved,  $\frac{1}{3}$ – $\frac{1}{4}$  mm long. Stamens 2–3; anthers oblong or linear,  $\frac{1}{2}$ – $1\frac{1}{2}$  mm. Style triquetrous, pyramidally thickened at the base, glabrous, ( $\frac{1}{4}$ –)1–2 mm long; stigmas 3 (or in a few flowers 2), about as long as the style. Nut obtusely trigonous, obovoid or obovoid-pyriform, shortly stipitate, obtuse, minutely umbonulate, smooth and subcancellate by the slightly impressed epidermal cells in c. 9 vertical rows on each face, or densely verruculose, whitish or shining dark brown,  $\frac{3}{5}$ – $\frac{3}{4}$ (–1) by  $\frac{1}{2}$ – $\frac{2}{3}$  mm.

Distr. Australia (Northern Territory, W. Australia, Queensland); in Malesia only twice collected in the Lesser Sunda Is. (W. Bali: Gilimanuk; Sumba: Waikelo).

Ecol. In Bali in grassy fields at low altitude.

Notes. BENTHAM, *l.c.*, is of opinion that BOECKELER's separation of *F. schultzii* and *F. platystachys* is apparently justified by the specimens in the Berlin herbarium, but as those of the Kew herbarium differ much less from each other, and F. MUELLER's specimens are intermediate in most respects, he finds himself unable to give tangible characters even for two distinct varieties. S. T. BLAKE also considered *F. schultzii* and *F. platystachys* as one species. I find the two SCHULTZ collections in the Kew herbarium, though young, fairly distinct, but having seen only a few collections I have provisionally followed BENTHAM and BLAKE.

The plants from Sumba (IBOET 358a in BO) agree very well with the type collection of *F. schultzii* (SCHULTZ 96, according to BOECKELER from Adelaide, but probably from Port Darwin). The glumes are  $1\frac{1}{2}$ –2 mm long with a short, but slightly spreading awnlet  $\frac{1}{2}$ – $\frac{1}{3}$  mm long, not ciliate, the anthers  $\frac{1}{4}$ – $\frac{3}{4}$  mm long, the style  $\frac{3}{4}$ –1 mm, the nut rather pyriform than obovoid, not verruculose, and brown. The Bali plants (VAN STEENIS 7586), though similar in habit and certainly closely related, differ considerably in the spikelets, which are strongly squarrose by the stout, recurved, long awns, in the denticulate-ciliate upper margins of the glumes, and in the nuts, which are obovoid, densely verruculose, and white. By these characters they come near to the type collection of *F. platystachys* (SCHULTZ 792), in which, however, the glumes are larger (c. 3 mm without the up to  $1\frac{3}{4}$  mm long awn), and the anthers c.  $1\frac{1}{2}$  mm long (in the Bali plants respectively  $1\frac{1}{2}$ –2 mm and c.  $\frac{3}{4}$  mm).

S. T. BLAKE, Proc. R. Soc. Queensl. 58 (1947) 46, described *S. stellata*, "very similar to *F. schultzii* in

<sup>1</sup> The other part belongs to *F. onchnidiocarpa* KERN.

habit, foliage, anthers, style and shape of glumes", but differing "in the broader, more squarrose spikelets, the more coarsely and obtusely keeled glumes more densely hairy at the margins and with longer stouter awnlets, and in the white (not black) simply obovoid (neither pyriform nor obcordate) somewhat larger nut which also appears to be more densely and

evenly verrucose". In a duplicate of the type collection I fail to see in what way it differs from *F. platystachys*.

I am inclined to consider *F. schulzii* and *F. platystachys* well-founded taxa, *F. stellata* synonymous with the latter, and the Bali plants a local race of it.

### 5. Section Leptocladae

OHWI, J. Jap. Bot. 14 (1938) 572. — *Fimbristylis ser. Leptocladae* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 54.

Type species: *F. leptoclada* BENTH.

23. *Fimbristylis leptoclada* BENTH. Fl. Hongk. (1861) 393, non Fl. Austr. 7 (1878) 314; CLARKE, Fl. Br. Ind. 6 (1893) 647; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 96; CAMUS, Fl. Gén. I.-C. 7 (1912) 118; MERR. En. Borneo (1921) 61; En. Philip. 1 (1923) 124; RIDL. Fl. Mal. Pen. 5 (1925) 159. — *F. retusa* THWAITES, En. Pl. Zeyl. (1864) 349; BOECK. Linnaea 37 (1871) 46. — *Iriha leptoclada* O.K. Rev. Gen. Pl. 2 (1891) 753. — *Iriha retusa* O.K. l.c. — *F. disticha* (non BOECK.) CAMUS, Fl. Gén. I.-C. 7 (1912) 125, p.p.

Annual (?), glabrous except for the glumes. *Stems* densely tufted, very slender, often setaceous, angular, smooth, or scabrid at the top, 15–65 cm by 1/2–1(–2) mm. *Leaves* basal, usually much shorter than the stems, flat but narrow, rather abruptly acuminate, with scabrid margins, 1–2 1/2 mm wide; ligule absent; lower sheaths stramineous or ferruginous. *Inflorescence* simple, sometimes head-like, consisting of 1–7 small clusters of spikelets, 1–2 cm across. Involucral bracts 1–2–3, very short, the longest 1/2–1(–2) cm. Rays erect to patent, often curved, compressed, smooth, up to 2 cm long. *Spikelets* 3–8 to each cluster, sessile, globose to ovoid or ellipsoid, slightly angular, obtuse, 10–15-flowered, dark brown, 2–3 by 1 1/2 mm; rachilla narrowly winged. *Glumes* spiral, membranous, ovate or suborbicular, very obtuse, more or less emarginate-bilobed at the apex, mucronulate from the sinus, keeled, with prominent midrib, nerveless, gland-dotted sides, and densely ciliate margins, 1 1/4–1 1/2 by 1–1 1/4 mm. *Stamens* 1(–2); anthers oblong-linear, 1/2–2/3 mm long. *Style* triquetrous, abruptly bulbously or pyramidally thickened in the lower 1/3–1/2, glabrous, 1/2–3/4 mm long; stigmas 3, about as long as the style. *Nut* very obtusely trigonous, obovoid, shortly stipitate, inconspicuously umbonulate, verruculose (see Note), whitish to stramineous, 7/10–9/10 by 1/2–7/10 mm; epidermal cells isodiametric, roundish or hexagonal.

Distr. Ceylon, Peninsular Thailand, Indo-China, S. China; in *Malesia*: Sumatra (E. Coast and W. Coast Res.), Malay Peninsula (Setul, Pahang, Malacca, P. Penang, Singapore), Lesser Sunda Is. (Flores), N. Borneo and W. Borneo, Philippines (Luzon, Culion, Palawan). The collection from the Moluccas (Amboina, ROBINSON 1901 in US) may be mislabelled as all other specimens of this number examined belong to *F. dichotoma*.

Ecol. In dry open sandy soil at low altitudes, in P. Penang on rocks dripping with water.

Vern. *Imbulu tano*, Sum. E.C.

Note. The only known New Guinean collection

differs from the typical variety (*var. leptoclada*) and may be distinguished as:

*var. etuberculata* KERN, Blumea 10 (1960) 637.

Nut smooth, not verruculose.

Distr. W. New Guinea: Tanah Merah, on aerodrome.

24. *Fimbristylis hispida* (VAHL) KUNTH, En. 2 (1837) 227; STEUD. Syn. 2 (1855) 112; BOECK. Linnaea 37 (1871) 27; KERN, Blumea 8 (1955) 120; Reinwardtia 4 (1956) 95. — *Scirpus hispidulus* VAHL, En. 2 (1806) 276. — *Isolepis exilis* KUNTH in H.B.K. Nov. Gen. 1 (1815) 224. — *F. exilis* R. & S. Syst. Veg. 2 (1817) 98. — *Abildgaardia pubescens* PRESL, Rel. Haenk. 1 (1828) 180, non *F. pubescens* LINK. — *F. prestii* KUNTH, En. 2 (1837) 228; STEUD. Syn. 2 (1855) 108; F.-VILL. Nov. App. (1882) 308; MERR. En. Philip. 1 (1923) 127. — *F. clavimix* CLARKE, Ill. Cyp. (1909) t. 41 f. 1–3. — *Bulbostylis pubescens* SVENS. N. Amer. Fl. 18 (1957) 542. — Fig. 40.

Annual (always ?). *Stems* densely tufted, setaceous, angular, smooth or hispidulous-scabrid just below the inflorescence, 5–30 cm by 1/4–1/2 mm. *Leaves* basal, much shorter than the stems, filiform, erect, hispidulous, 1/3–1/2 mm wide; ligule absent; sheaths stramineous, hairy. *Inflorescence* consisting of 1–5 (sometimes more) spikelets, the rays when present 1–1 1/2 cm long. Involucral bracts 1–2, glume-like, mucronate, or filiform and up to 2 cm long. *Spikelets* solitary, erect, lanceolate, subterete, acute, 4–12-flowered, 4–10 by 2–2 1/2(–3) mm wide; rachilla winged. *Glumes* spiral, membranous, ovate-lanceolate, acute, mucicous or minutely mucronulate, densely short-pubescent, with strong midnerve on both sides bordered by a yellowish stripe, ferruginous or brownish often sanguineous-variegated sides and densely ciliate margins, 3–4 mm long. *Stamens* 1–3; anthers linear, 1–2 mm long. *Style* triquetrous, pyramidally thickened at the base, glabrous, or sparsely spinulose-ciliolate at the top, 1 3/4–2 1/2 mm long; stigmas 3, about as long as the style. *Nut* trigonous with prominent angles, turbinate, usually slightly depressed at the apex, minutely stipitate, umbonulate in the apical depression, not tubercled, with up to 10 prominent transverse wrinkles on each side, brownish or fumose, 1–1 1/4 mm long and wide; epidermal cells linear, longitudinally elongate.

Distr. Very common in tropical Africa, rare in tropical America (Mexico, Columbia); very rare in *Malesia*: E. Java (near Situbondo), Lesser Sunda Is.

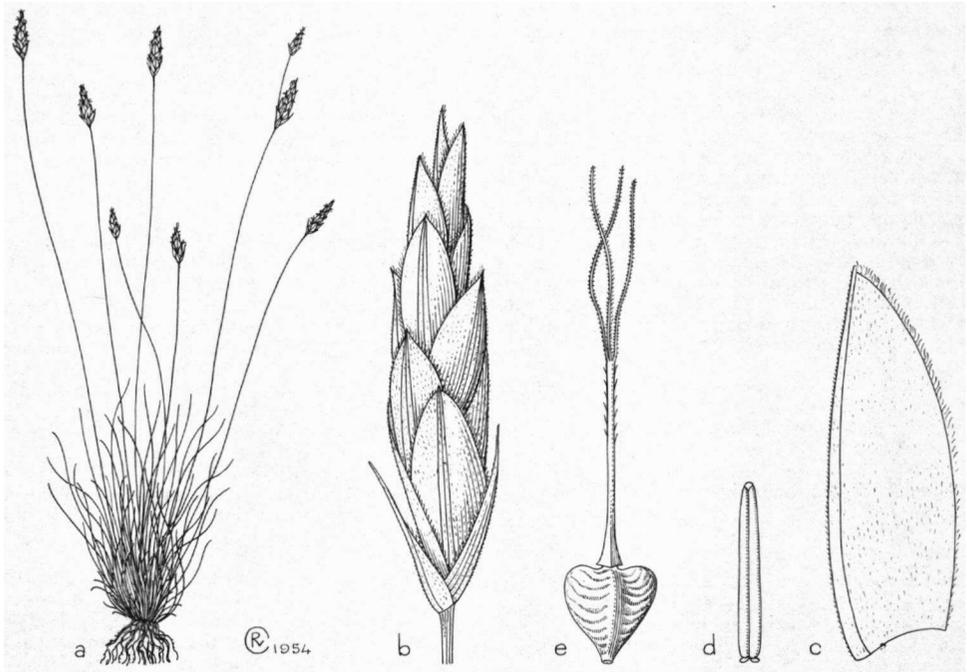


Fig. 40. *Fimbristylis hispidula* (VAHL) KUNTH. *a.* Habit,  $\times \frac{2}{3}$ , *b.* spikelet,  $\times 6$ , *c.* glume, *d.* anther, *e.* nut with style and stigmas, all  $\times 13$  (*a-e* RAMOS BS 32797).

(Wetar, Flores), Philippines (Luzon: Burgos, Ilocos Norte Prov.).

**Ecol.** In Java in grassy fields, in Wetar in *Eucalyptus* forest and swampy places, 425–500 m.

**Notes.** *Abildgaardia pubescens* PRESL was based on specimens collected by HAENKE "in Mexico et in Luzon". MERRILL, *l.c.*, thought it was probably not Philippine. However, in July 1918 specimens were collected near Burgos in Luzon which undoubtedly represent PRESL's species. They cannot be separated specifically from the widely distributed and polymorphous *F. hispidula*. The inflorescence usually consists of a single terminal spikelet, sometimes with 1–2 lateral ones added, the glumes are 4 mm long, the style is sparsely ciliate and c. 2 mm long.

The very slender specimens from Java, Flores and Wetar perfectly agree with some of the African specimens I have seen. The inflorescence is anthelate consisting of 1–5 spikelets and subtended by small setaceous bracts, the glumes are 3 mm long, the style is glabrous and c.  $1\frac{1}{4}$  mm long.

Nuts with longitudinally elongate epidermal cells are very rare in *Fimbristylis*, whereas they frequently occur in the closely related genus *Bulbostylis*, to which *F. hispidula* shows affinity also in other respects. VAN DER VEKEN, *Bull. Jard. Bot. Brux.* 35 (1965) 327, found that its embryo is of the *Bulbostylis* type. According to SVENSON, *N. Amer. Fl.* 18 (1957) 540 & 550, the cells are always longitudinally elongate in *Bulbostylis*, but never so in *Fimbristylis*. Consequently he transferred *Abildgaardia pubescens* PRESL to *Bulbostylis*. However, in *B. capillaris* and *B. barbata*,

also to him true *Bulbostylis* species, the epidermal cells are isodiametric.

Nowadays for *F. hispidula* mostly the name *F. exilis* (KUNTH) R. & S., based on *Isolepis exilis* KUNTH, is accepted. KUNTH deliberately rejected his epithet *exilis* in favour of *hispidula*, but he did not cite *Scirpus hispidulus* in synonymy. In VAHL's *Enumeratio* 94 spp. of *Scirpus* are enumerated, two of them without specific epithet. Of the remaining 92 species 91 are meticulously accounted for in KUNTH's *Enumeratio*, only *Scirpus hispidulus* VAHL is missing. There is, therefore, ample circumstantial evidence that KUNTH based his name on that of VAHL, the more so as VAHL's type locality (Guinea) is cited.

**25. *Fimbristylis recta*** F. M. BAILEY, 3rd Suppl. Syn. Queensl. Fl. (1890) 80; Queensl. Fl. 6 (1902) 1762; S. T. BLAKE, *Proc. R. Soc. Queensl.* 58 (1947) 44; J. Arn. Arb. 35 (1954) 211; KERN, *Blumea* 8 (1955) 120. — *F. xyridis* R.Br. var. *rigidula* BENTH. Fl. Austr. 7 (1878) 307. — *F. macgillivrayi* CLARKE, *Kew Bull. add. ser.* 8 (1908) 24. — *F. stricticulmis* DOMIN, *Bibl. Bot.*, Heft 85 (1915) 452.

Perennial with short rhizome. **Stems** densely tufted, rigid, angular-sulcate, somewhat incrassate just below the inflorescence, antrorsely scabrous, 30–80 cm by c. 1 mm. **Leaves** basal, shorter than the stems, up to 30 cm long, erect, flat, rigid, with obtuse or rounded apex, glabrous, with scabrous margins, greyish green or glaucous, 2–3 mm wide; ligule absent; sheaths white-scarious in front. **Inflorescence**

consisting of a single terminal spikelet. *Spikelet* erect, ellipsoid or slightly obovoid, terete, acute, densely many-flowered, 8–20 by 5–6 mm; rachilla narrowly winged. *Glumes* spiral, membranous, oblong-ovate, very obtuse, minutely apiculate, not keeled, with strong midnerve, nerveless sides, and densely ciliate upper margin, reddish brown in the apical half, much paler in the basal half, 5–7 by  $3\frac{1}{2}$ –4 mm; lower empty glumes much smaller, manifestly mucronate. *Stamens* 3; anthers linear, 3–4 mm long. *Style* triquetrous, pyramidally thickened at the base, glabrous, 4–5 mm long; stigmas 3, somewhat shorter than the style. *Nut* trigonous with convex faces, tricostate, pyriform, shortly stipitate, verrucose in the upper part, pale brown,  $1\frac{3}{5}$ –2 by  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm; epidermal cells isodiametric hexagonal to roundish.

Distr. Tropical Australia (Northern Territory, Queensland, Hammond I. in Torres Strait); in *Malesia*: New Guinea (Papua, Western Div.: Tarara, Wassi Kussa River).

Ecol. In the only known Malesian locality in savannah forests, common in grass on ridges, at low altitude.

26. *Fimbristylis furva* R.BR. Prod. (1810) 228; BENTH. Fl. Austr. 7 (1878) 318; BAILEY, Queensl. Fl. 6 (1902) 1766; DOMIN, Bibl. Bot., Heft 85 (1915) 460; S. T. BLAKE, J. Arn. Arb. 35 (1954) 219; KERN, Blumea 8 (1955) 121. — *Iriha furva* O.K. Rev. Gen. Pl. 2 (1891) 753.

Perennial (always?). *Stems* erect, tufted, obtus-angular, slightly compressed, glabrous and smooth, 10–30(–50) cm by  $\frac{1}{2}$ –1 mm, the base clothed with 2–3 bladeless or very short-bladed, obliquely truncate sheaths ferruginous-membranous at the mouth. *Leaves* shorter than the stems, flaccid, flat, obtuse or abruptly acuminate, glabrous, scabrid on the margins in the upper part, ( $1\frac{1}{2}$ –)2–4 mm wide; ligule absent. *Inflorescence* simple or compound, relatively small, dense to rather loose, with 4–25 spikelets, 1–5 cm long and wide. Involucral bracts small, glume-like, or the lower 1–2 produced into a short point. Primary rays 4–6, obliquely erect but outer ones widely spreading, compressed, smooth, up to 3 cm; secondary rays very short, widely spreading. *Spikelets* solitary, ovoid or oblong-ovoid, terete, acute, brown, 4–8 by c. 2 mm; rachilla winged. *Glumes* spiral, membranous, appressed, ovate or broadly ovate, obtuse, mucronulate, slightly keeled, with prominent midnerve, glabrous, nerveless sides, and scarious, ciliate margins,  $2\frac{1}{4}$ –3 by c. 2 mm. *Stamens* 2–3; anthers oblong-linear, 1– $1\frac{1}{2}$  mm; connective distinctly produced, setulose at the top. *Style* triquetrous, pyramidally thickened at the base, sparsely ciliate, hispidulous at the base,  $1\frac{1}{4}$ – $1\frac{3}{4}$  mm; stigmas 3, about as long as or longer than the style. *Nut* obtusely trigonous, obovoid, shortly stipitate, umbonulate, smooth or scaly-verruculose, purplish black,  $\frac{3}{5}$ – $\frac{7}{10}$  by  $\frac{2}{5}$ – $\frac{3}{5}$  mm; epidermal cells longitudinally oblong to almost isodiametric.

Distr. Australia (N. Territory, Queensland inclusive of the islands in Torres Strait); in *Malesia*: New Guinea (W. New Guinea: near Merauke; Papua: W. Div., Wassi Kussa R., Mai Kussa R.), Aru Is. (P. Trangan).

Ecol. In damp grassland, marshy grounds,

*Melaleuca* swamps, at low altitudes; locally often abundant.

Note. The New Guinea plants are perennial. Some of the Australian collections I have seen (e.g. S. T. BLAKE 17548) are apparently annuals, which differ moreover from the perennials by the smaller glumes ( $1\frac{1}{2}$  mm), anthers ( $\frac{2}{3}$  mm), style (1 mm), and nuts ( $\frac{1}{2}$  mm).

27. *Fimbristylis lanceolata* CLARKE, Kew Bull. add. ser. 8 (1908) 25; DOMIN, Bibl. Bot., Heft 85 (1915) 460; KERN, Blumea 8 (1955) 121.

Perennial with short rhizome. *Stems* densely tufted, strongly compressed (almost ancipitous), glabrous, or pilose especially towards the apex, smooth, (10–)20–40 cm by  $\frac{3}{4}$ – $1\frac{1}{4}$  mm, the base clothed with 1–2 tubular, bladeless, 5–8 cm long sheaths. *Basal leaves* shorter than the stems, erect, flat, rather rigid, obtuse or abruptly acuminate, glabrous, scabrid on the margins in the upper part,  $1\frac{1}{2}$ –2 mm wide; ligule absent; lower sheaths bladeless, with membranous margins, ferruginous or brown. *Inflorescence* simple or subcompound, rather dense, with 2–9 spikelets,  $1\frac{1}{2}$ –5 cm long, 2–7 cm wide. Involucral bracts 2–3, very short, glume-like, cuspidate, 1–5 mm. Primary rays 1–5, finally patent to arcuately reflexed, compressed, smooth,  $\frac{1}{2}$ –2 cm; secondary rays when present very short, c.  $\frac{1}{2}$  cm. *Spikelets* solitary, linear, terete, subacute, loosely many-flowered, 10–25 by 2 mm; rachilla winged. *Glumes* spiral, thinly membranous, oblong-ovate, very obtuse and notched, mucronulate just below the apex, scarcely keeled, densely reddish gland-dotted in the apical half, 3–5-nerved (midnerve prominent, lateral nerves obscure), fulvous or fuscous, 4– $4\frac{1}{2}$  by  $2\frac{1}{2}$ – $2\frac{3}{4}$  mm, the margins long-ciliate in the upper  $\frac{1}{2}$ – $\frac{3}{4}$ . *Stamens* 3; anthers linear, 2– $2\frac{1}{2}$  mm; connective distinctly produced, the appendage oblong-ovate, crested by conspicuous bristles. *Style* triquetrous, pyramidally thickened at the base, glabrous except for the hispidulous base, 3– $3\frac{3}{4}$  mm; stigmas 3, shorter than the style. *Nut* very obtusely trigonous, broadly obovoid, shortly stipitate, hardly or not umbonulate, densely verruculose, at first whitish, ultimately blackish,  $\frac{9}{10}$  by  $\frac{7}{10}$ – $\frac{4}{5}$  mm; epidermal cells obscure, longitudinally elliptic or oblong.

Distr. North coast of Australia (Raffles Bay); in *Malesia*: SE. Celebes (Rumbia Distr.), S. Moluccas (Aru Is.: P. Trangan).

Ecol. In monsoon-forests and savannahs, at low altitude.

28. *Fimbristylis macassarensis* STEUD. Syn. 2 (1855) 109; MIQ. Fl. Ind. Bat. 3 (1855) 318; KERN, Blumea 8 (1955) 122; in Back. & Bakh. f. Fl. Java 3 (1968) 462. — *F. tenera* (non SCHULT.) CLARKE, Philip. J. Sc. 2 (1907) Bot. 95; MERR. En. Philip. 1 (1923) 126. — *F. corniculata* MERR. Philip. J. Sc. 7 (1912) Bot. 231; Fl. Manila (1912) 116; En. Philip. 1 (1923) 122. — Fig. 41.

Annual. *Stems* densely tufted, compressed, obtus-angular, glabrous and smooth, 10–20 cm by  $\frac{1}{2}$ –1 mm, the base clothed with 1–2 tubular, bladeless, up to 3 cm long sheaths. *Basal leaves* half as long as the stems, flat, rather firm, acute, glabrous,  $\frac{3}{4}$ – $1\frac{1}{2}$  mm wide, the margins scabrid in the upper part;

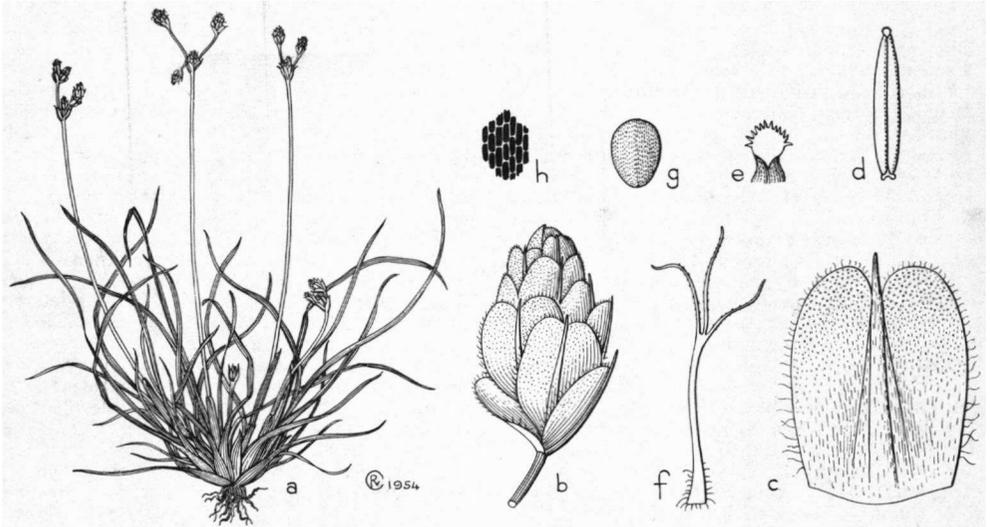


Fig. 41. *Fimbristylis macassarensis* STEUD. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 6$ , c. glume, d. anther, both  $\times 13$ , e tip of anther,  $\times 50$ , f. style, g. nut, both  $\times 13$ , h. outer cells of nut, strongly enlarged (a-h BÜNNEMEIER 10837).

ligule absent. *Inflorescence* simple, rarely subcompound, with 2–10 spikelets, 1–3 cm across. Involucral bracts 1–2, membranous, ovate, with retuse, cuspidate apex, 2–5 mm long. Primary rays 1–4, finally patent to arcuately reflexed, compressed, smooth, up to 15 mm; secondary rays when present very short, up to 5 m. *Spikelets* solitary, ovoid or oblong-ovoid, terete, obtuse, several-flowered, dull fuscous, 5–10 by 2–3 mm. *Glumes* spiral, thinly membranous, ovate, mucronulate, scarcely keeled, densely glandular-punctulate in the upper half, with strong green midnerve, nerveless sides, and margins long-ciliate in the upper  $\frac{1}{2}$ – $\frac{3}{4}$ , rounded, retuse or notched at the apex, 2–3 by  $1\frac{1}{2}$ –2 mm. *Stamens* (2–)3; anthers linear,  $\frac{2}{5}$ – $1\frac{1}{2}$  mm; connective distinctly produced, bristly at the top. *Style* triquetrous, slightly dilated at the base, hispidulous at the base, otherwise glabrous or sparsely ciliate, 1–2 mm long; stigmas 3, somewhat shorter than to

as long as the style. *Nut* obtusely trigonous with convex sides, obovoid, sessile, not or hardly umbonulate, verruculose or smooth, black,  $\frac{1}{5}$ – $\frac{2}{3}$  by  $\frac{2}{5}$ – $\frac{1}{2}$  mm; epidermal cells longitudinally elliptic or oblong.

*Distr. Malesia*: Philippines (Central Luzon); SW. Celebes (Macassar; Mt Galesang near Malino), Madura (near Pamekasan).

*Ecol.* Open grasslands, roadsides, at low altitudes.

*Notes.* Only known from a few rather poor collections. The nuts are usually verruculose, smooth only in the specimens from Mt Galesang. In the Luzon plants the anthers are very small ( $\frac{2}{5}$  mm).

*F. macassarensis* has nothing to do with *F. tenera* SCHULT., to which species the oldest Philippine collection was referred by CLARKE. It is very near to *F. lanceolata* CLARKE, from which it differs rather by quantitative than qualitative characters.

## 6. Sect. Heleocharoides

BENTH. Fl. Austr. 7 (1878) 301. — *Fimbristylis ser. Heleocharoides* KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 100.

Type species: *F. pauciflora* R.Br.

29. *Fimbristylis dictyocolea* S. T. BLAKE, J. Arn. Arb. 35 (1954) 209, f. 1; RAYM. Dansk Bot. Ark. 23 (1966) 328. — *F. cardiocarpa* (non F.v.M.) KÜK. Mitt. Thür. Bot. Ver. N.F. 50 (1943) 9.

Glabrous perennial with short rhizome. *Stems* tufted, erect, setaceous, obtusely 5-angular, striate, smooth or scabrid just below the inflorescence, 20–40 cm by  $\frac{1}{2}$ –1 mm, the base clothed with 2–3 obliquely truncate, bladeless sheaths in front disintegrating into fine, herringbone-shaped fibres.

Basal leaves few, shorter than to about as long as the stems, filiform, triquetrous, laterally compressed, smooth,  $\frac{1}{2}$ –1 mm wide; ligule absent. *Inflorescence* consisting of a single spikelet. *Spikelet* erect, oblong or ellipsoid, terete, acute, densely many-flowered, pale green, 7–9 by c. 3 mm; rachilla not winged. *Glumes* spiral, membranous, oblong, obtuse, muticous, scarcely keeled, 1-nerved, hyaline-margined, 4–6 by  $1\frac{1}{2}$ –2 mm; lower 1–3 glumes larger, empty. *Stamens* 3; anthers linear; 2– $2\frac{1}{2}$  mm long. *Style*

slender, compressed-triquetrous, incrassate at the base, minutely ciliate, 3–5 mm long; stigmas 3, much shorter than the style. *Nut* trigonous with convex sides, obovoid, sessile, umbonulate, verruculose, shining, stramineous, c. 1 by  $\frac{3}{4}$  mm; epidermal cells minute, hexagonal.

Distr. Thailand (Chantaburi), Cambodia; in *Malesia*: New Guinea (W. New Guinea: Kurik near Merauke; Papua, W. Division: Tarara, Wassi Kussa R.; Mabuduan).

Ecol. In open wet grasslands, in shallow pools, in savannah-forests, at low altitudes.

Note. Allied to *F. pauciflora*, from which it can easily be distinguished by the coarser habit, the leaf-sheaths disintegrating into fine reticulate fibres, the larger spikelet, and the more oblong, obtuse, single-nerved glumes.

30. *Fimbristylis pauciflora* R.Br. Prod. (1810) 225; BENTH. Fl. Austr. 7 (1878) 303; CLARKE, Fl. Br. Ind. 6 (1893) 633; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 90; KOORD. Exk. Fl. Java 1 (1911) 198; *ibid.* 4, Atlas (1922) f. 249; CAMUS, Fl. Gén. I.-C. 7 (1912) 98, f. 13, 10; RIDL. Fl. Mal. Pen. 5 (1925) 154; KÜK. Mitt. Thür. Bot. Ver. N.F. 50 (1943) 9; S. T. BLAKE, J. Arn. Arb. 35 (1954) 210. — *Trichelostylis filiformis* NEES in Wight, Contr. (1834) 102. — *F. filiformis* KUNTH, En. 2 (1837) 221; STEUD. Syn. 2 (1855) 106; MIQ. Fl. Ind. Bat. 3 (1856) 314; BOECK. Linnæa 37 (1871) 23. — *F. pumila* BENTH. in Hook. Lond. J. Bot. 2 (1843) 239 (*p.p.* ?); STEUD. Syn. 2 (1855) 106; MIQ. Fl. Ind. Bat. 3 (1856) 315. — *F. malaccana* BOECK. Flora 41 (1858) 597. — *Chaetocyperus setaceus* (non NEES) KURZ, Nat. Tijd. N. I. 27 (1864) 223. — *Iriha pauciflora* O.K. Rev. Gen. Pl. 2 (1891) 752.

Perennial (always ?), glabrous. *Stems* densely tufted, finally forming large clumps some dm in diam., erect or finally prostrate, setaceous, striate-sulcate, smooth, greyish green, (5–)10–30 cm by  $\frac{1}{4}$ – $\frac{1}{2}$  mm. *Leaves* all reduced to membranous, obliquely truncate, ferruginous sheaths not disintegrating into reticulate fibres, or 1–2 with a short

filiform blade sometimes up to 6 cm long; ligule absent. *Inflorescence* consisting of a single terminal spikelet. *Spikelet* erect, oblanceolate or narrowly oblong, terete, acute, 4–9-flowered, 3–6 by 1– $1\frac{1}{2}$  mm; rachilla winged. *Glumes* spiral, cartilaginous, erect, lanceolate, acute, mucicous, scarcely keeled, pale,  $2\frac{1}{2}$ –3 by c.  $1\frac{1}{2}$  mm; keel green, indistinctly 3–5(–7)-nerved, sides nerveless; lower (1–)2 empty glumes larger, almost as long as the spikelet, several-nerved, 3–4 by  $1\frac{3}{4}$  mm. *Stamens* 1–2(–3); anthers linear,  $1\frac{1}{4}$ –2 mm long. *Style* triquetrous, slightly thickened at the base, sparsely and minutely ciliate,  $1\frac{1}{2}$ – $2\frac{1}{4}$  mm; stigmas 3, or in some flowers 2, much shorter than the style. *Nut* obtusely trigonous with convex faces, usually dorsiventrally compressed, sometimes biconvex (in the digynous flowers), obovoid, shortly stipitate, not or hardly umbonulate, whitish verruculose, stramineous to brown,  $\frac{3}{4}$ – $\frac{9}{10}$  by  $\frac{1}{2}$ – $\frac{3}{5}$  mm; epidermal cells irregular, isodiametric or elliptic.

Distr. Mergui, Thailand, Indo-China, Ryu Kyu Is., Carolines, N. Australia and Queensland; in *Malesia*: Sumatra (incl. Riouw Arch., Lingga Arch., Banka and Billiton), Malay Peninsula, Borneo, Anambas and Natuna Is., Moluccas (Ternate, Amboina, Ceram), New Guinea. A collection said to be from Java (HORSFIELD 89, BM) was probably mislabelled.

Ecol. In damp sandy and clayish localities both shaded and sunny, swamp margins, savannahs, often completely covering jungle-paths, at low altitudes, up to 800 m.

Uses. In some parts of the Malay Peninsula, as in Penang, it makes a fair proportion of the weeds in the rice-fallows which are ploughed in for green manure (BURKILL).

Vern. *Rumput djënggol kambing*, *r. sapi*, *r. jambak*, *r. lumut*, *r. sarang puyoh*, *r. girah*, *M*, *r. djani*, Riouw, *kaju mênkirei*, Banka.

Note. BENTHAM's description of *F. pumila*, which does not well accord with *F. pauciflora*, may partly refer to *F. acicularis*. The type collection (Amboina, leg. BARCLAY) is a mixture of the two species.

## 7. Section Signatae

KERN, *Blumea* 8 (1955) 160.

Type species: *F. signata* S. T. BLAKE.

31. *Fimbristylis signata* S. T. BLAKE, J. Arn. Arb. 35 (1954) 214; KERN, Reinwardtia 4 (1956) 96. — *F. debilis* F.v.M. Fragm. 1 (1859) 198; BENTH. Fl. Austr. 7 (1878) 315, non STEUD. 1855. — *Iriha debilis* O.K. Rev. Gen. Pl. 2 (1891) 753.

Annual. *Stems* very slender, densely tufted, compressed, smooth, (10–)25–50 cm by  $\frac{1}{2}$ –1 mm. *Leaves* reduced to 2–3 sheaths clothing the base of the stem, rather loose, acuminate, scarious-margined, glabrous, pale green or stramineous, sometimes produced into short, erect blades; ligule absent. *Inflorescence* simple or subcompound, small, with (1–)3–5(–9) spikelets, 1– $2\frac{1}{2}$  by 1– $3\frac{1}{2}$  cm. Involucral bracts 3–4, much shorter than the inflorescence, dilated at the base, up to 1 cm long. Rays up to 5, obliquely erect to horizontally spreading, compressed, smooth or slightly scabrid,  $\frac{1}{2}$ – $1\frac{1}{2}$  cm long. *Spikelets* solitary, oblong to linear-lanceolate, angular, acute, loosely several-flowered, 6–10 by c. 2 mm.

Rachilla broadly winged. *Glumes* spiral, membranous, appressed, ovate-lanceolate, acute, mucronate, sharply keeled, with prominent, ciliate midnerve, nerveless sides, and margins microscopically ciliate at the top, stramineous or pale brown,  $3\frac{3}{4}$ –4 by  $2\frac{1}{2}$ –3 mm (mucro excluded), the midnerve excurrent in a scabrid, ultimately spreading, 1– $1\frac{1}{2}$  mm long awn. *Stamens* 2; anthers oblong-linear, 1– $1\frac{1}{2}$  mm long. *Style* triquetrous, pyramidally thickened at the base, sparsely short-ciliate, 2– $2\frac{1}{2}$  mm; stigmas 3, much shorter than the style. *Nut* obtusely trigonous, pyriform, abruptly narrowed towards the base, subglose in the upper part, shortly stipitate, umbonulate, coarsely tuberculate, dark brown, c.  $1\frac{1}{4}$  by 1 mm; epidermal cells obscure, almost isodiametric.

Distr. Northern Australia; in *Malesia*: Philippines (Mindanao), New Guinea (Papua, W. Div.: Daru I.).

Ecol. On river-side (Mindanao); frequent on damp soil in savannah-forest (Daru I.).

8. Section *Abildgaardia*

(VAHL) BENTH. Fl. Austr. 7 (1878) 299. — *Abildgaardia* VAHL, En. 2 (1806) 296. — *Cyperus* sect. *Abildgaardia* ENDL. Gen. Pl. (1836) 119. — *Fimbristylis* ser. *Monostachyae* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 53.

Type species: *F. monostachyos* (L.) HASSK. (*Cyperus monostachyos* L. = *F. ovata* (BURM. f.) KERN).

32. *Fimbristylis ovata* (BURM. f.) KERN, Blumea 15 (1967) 126; in Back. & Bakh. f. Fl. Java 3 (1968) 467. — *Carex ovata* BURM. f. Fl. Ind. (1768) 194; KÜK. Pfl. R. Heft 38 (1909) 103. — *Cyperus monostachyos* LINNÉ, Mant. 2 (1771) 180; ROTTB. Descr. et Ic. (1773) 18, t. 13 f. 3. — *Cyperus caribaeus* RICH. ex PERS. Syn. 1 (1805) 65, nom. illeg. — *Cyperus indicus* RICH. ex PERS. l.c. — *Abildgaardia monostachya* VAHL, En. 2 (1806) 296; KUNTH, En. 2 (1837) 247; STEUD. Syn. 2 (1855) 72; MIQ. Fl. Ind. Bat. 3 (1856) 296, incl. var. *rigidior* STEUD. ex MIQ.; BOECK. Linnaea 37 (1871) 53. — *Abildgaardia compressa* PRESL, Rel. Haenk. 1 (1828) 179; NEES, Nov. Act. Ac. Caes. Leop.-Car. 19, Suppl. 1 (1843) 74; STEUD. Syn. 2 (1855) 72; MIQ. Fl. Ind. Bat. 3 (1856) 297. — *Abildgaardia javana* NEES, Linnaea 9 (1834) 289, fide Ind. Kew. — *F. monostachyos* HASSK. Pl. Jav. Rar. (1848) 61 ('*monostachya*'); STEUD. Syn. 2 (1855) 107; BENTH. Fl. Austr. 7 (1878) 308; CLARKE, Fl. Br. Ind. 6 (1893) 649; Philip. J. Sc. 2 (1907) Bot. 97; KOORD. Exk. Fl. Java 1 (1911) 200; *ibid.* 4, Atlas (1922) f. 261; CAMUS, Fl. Gén. I.-C. 7 (1912) 122; MERR. En. Philip. 1 (1923) 124; RIDL. Fl. Mal. Pen. 5 (1925) 159; BACK. Onkr. Suiker. (1928) 164, non t. 174; Bkn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 18. — *F. compressa* F.-VILL. Nov. App. (1882) 307, non R. & S. 1817, nec BOECK. 1874. — *Iriha monostachya* O.K. Rev. Gen. Pl. 2 (1891) 751.

Glabrous perennial with short rhizome. Stems densely tufted, compressed-trigonous, smooth, or scabrid at the top, somewhat incrassate at the base, (5-)15-40(-60) cm by  $\frac{1}{2}$ -1 mm. Leaves basal, shorter than the stems, very narrow, rather abruptly

acuminate, smooth, or slightly scabrid at the top,  $\frac{2}{3}$ -1 mm wide; ligule absent. Inflorescence usually consisting of a single terminal spikelet, more rarely 1(-2) peduncled lateral spikelets added. Spikelets ovate or ovate-lanceolate, strongly compressed, ultimately often twisted, acute, shining stramineous or yellowish, 8-15(-30) by 4-6 mm; rachilla broadly winged. Glumes distichous, but at length often appearing subspiral by torsion of the rachilla, subcoriaceous, broadly ovate, acute, mucronate, with prominent 3-nerved keel and nerveless sides,  $4\frac{1}{2}$ -5 by 4-4 $\frac{1}{2}$  mm; lowest 1-2 empty glumes awned, the awn usually not exceeding the spikelet, or the lowest with a short,  $\frac{1}{2}$ -1 $\frac{1}{2}$  cm long blade. Stamens 2-3; anthers linear,  $1\frac{1}{2}$ -3 mm long. Style triquetrous, pyramidally thickened at the base, hyaline-fimbriate almost to the base, 2-4 mm long; stigmas 3, much shorter than the style. Nut obtusely trigonous, pyriform, sessile, umbonate, coarsely tuberculate or almost muricate except for the smooth base, very rarely quite smooth (not in Malesia), stramineous to greyish brown, 2-3 by  $1\frac{1}{4}$ -2 mm; epidermal cells minute, isodiametric.

Distr. Pantropical; throughout Malesia, but apparently very rare in the Malay Peninsula (Perlis: Kanga; Kedah: P. Langkawi; Singapore).

Ecol. Sunny or partly shaded grasslands, sandy heaths, roadsides, teak-forests, at low altitudes, 0-900 m, rarely (in W. Java on Mt Gedeh and in New Guinea) collected at 1200 m.

Vern. *Babawangan*, *kukutjaian*, S, *sèkètan*, J, *tè lèntéjan*, Md.

9. Section *Fuscae*

OHWI, J. Jap. Bot. 14 (1938) 571.

Type species: *F. fusca* (NEES) C. B. CLARKE (*Abildgaardia fusca* NEES).

33. *Fimbristylis cinnamometorum* (VAHL) KUNTH, En. 2 (1837) 229; STEUD. Syn. 2 (1855) 113; BOECK. Linnaea 37 (1871) 35; KÜK. Mitt. Thür. Bot. Ver. N.F. 50 (1943) 9; S. T. BLAKE, J. Arn. Arb. 35 (1954) 220; KERN, Blumea 8 (1955) 123; *ibid.* 15 (1967) 433. — *Scirpus cinnamometorum* VAHL, En. 2 (1806) 278. — *F. cyperoides* R.Br. Prod. (1810) 228; KUNTH, En. 2 (1837) 244; CLARKE, Fl. Br. Ind. 6 (1893) 650, incl. var. *cinnamometorum* CLARKE; Ill. Cyp. (1909) t. 44 f. 1-4; BENTH. Fl. Austr. 7 (1878) 317. — *F. biflora* BOECK. Linnaea 38 (1874) 393. — *F. kamp-hoeveneri* BOECK. Bot. Jahrb. 5 (1884) 505. — *Iriha cinnamometorum* O.K. Rev. Gen. Pl. 2 (1891) 753.

Perennial with creeping, woody, 1-1 $\frac{1}{2}$  mm thick rhizome. Stems solitary, approximate or somewhat remote, very slender, compressed-angular, smooth,

25-50 cm by  $\frac{1}{2}$ -1 mm. Leaves at least half as long as the stem, erect, setaceous, often complicate, rigid, acute, antrorsely scabrid at the top,  $\frac{1}{3}$ - $\frac{1}{2}$  mm wide; ligule absent; lower sheaths horny. Inflorescence compound or decompound, loose, with many to numerous spikelets, 3-6 cm long. Involucral bracts 1-2, erect, much shorter to slightly longer than the inflorescence, the lowest up to 4 cm. Primary rays 5-8, filiform, erect or obliquely erect, smooth. Spikelets solitary, oblong or oblong-linear, strongly compressed, acute, few-flowered, 4-5 by 1 mm; rachilla winged. Glumes distichous, thinly membranous, erect, ovate-lanceolate, acute, mucronate or apiculate, sharply keeled, with 3-nerved keel and nerveless, densely reddish gland-dotted sides,  $2\frac{3}{4}$ -4 by  $1\frac{1}{2}$ -2 mm. Stamens 3; anthers linear, (1-) $1\frac{1}{2}$ -2 mm. Style slender, glabrous

except for the pyramidal, shortly hairy base, 3-3½ mm; stigmas 3, much shorter than the style. *Nut* trigonous with somewhat convex sides, obovoid or oblong-obovoid, shortly stipitate, umbonulate, verruculose, stramineous to brownish, finely transversely lineolate by the oblong-linear epidermal cells, ¾-¾/10 by ¼-¼/10 mm.

Distr. From SE. Asia (Ceylon, India, Thailand, Indo-China) to S. China and tropical Australia; in *Malesia*: N. Sumatra (E. Coast Res.), Philippines (Luzon: Burgos), New Guinea (W. New Guinea: Cycloop Mts; NE. New Guinea: Sepik Distr.; Papua: Wassi Kussa R., Fly R., Mt Lawes near Port Moresby).

Ecol. In swamps, savannah forests, on wet flats, at low altitudes, locally often abundant.

Notes. It was already pointed out by S. T. BLAKE, *l.c.*, that the Australian *F. cyperoides* R. BR. and the Asian *F. cinnamometorum* are not specifically distinct.

From the type collection (KAMPHOEVENER 2485 from Teressa I. in KIEL) and BOECKELER's accurate description it is evident that CLARKE wrongly referred *F. kamphoeveneri* BOECK. to the synonymy of *F. fusca* (NEES) CLARKE.

**34. *Fimbristylis adenolepis* KERN, Blumea 8 (1955) 123, f. 3; *ibid.* 15 (1967) 433; in Back. & Bakh. *f.* Fl. Java 3 (1968) 468.**

Delicate, glabrous annual with fibrous roots. *Stems* tufted, setaceous, angular, smooth, 5-12 cm by ¼-½ mm. *Leaves* much shorter than the stems, filiform, weak, flat, rather obtuse, abruptly acuminate, smooth, ½ mm wide; ligule absent. *Inflorescence* simple or almost so, loose, with (1)-3-5 spikelets, up to 2 cm long and wide. *Involutral bracts* 2-3, shorter than the inflorescence, erect, the lowest ½-1 cm. *Rays* 1-3, erecto-patent, compressed, smooth, up to 12 mm. *Spikelets* solitary, lanceolate, strongly compressed, acute, few-flowered, 3-5 by 1 mm; rachilla narrowly winged. *Glumes* distichous, thinly membranous, erect, elliptic-ovate, muticous, densely reddish gland-dotted, 1½-2 by 1 mm. *Stamen* 1; anther oblong, c. ½ mm. *Style* triquetrous, pyramidally thickened at the base, glabrous, 1 ¼ mm; stigmas 3, about half as long as the style. *Nut* trigonous, oblong-obovoid, subsessile, minutely umbonulate, verruculose, stramineous, transversely lineolate by the oblong-linear epidermal cells, ¾-¾/4 by ¼-¼/2 mm.

Distr. SE. and Peninsular Thailand, Indo-China (Cochinchina, Tonkin, Annam); in *Malesia*: Kangean I. (near Ardjasa).

Ecol. In Kangean I. in a moist grass-field, abundant, at 25 m altitude.

**35. *Fimbristylis fuscoides* CLARKE in Ostenf. Bull. Herb. Boiss. II, 5 (1905) 719; Kew Bull. add. ser. 8 (1908) 25; CAMUS, Fl. Gén. I.-C. 7 (1912) 124 *p.p.* (*specim. siam.*); RIDL. Fl. Mal. Pen. 5 (1925) 160; KERN, Blumea 8 (1955) 125; *ibid.* 15 (1967) 433. — *F. angustifolia* RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 223. — *F. erythradenia* CAMUS, Not. Syst. 1 (1910) 247; Fl. Gén. I.-C. 7 (1912) 113.**

Perennial. *Stems* densely tufted, setaceous, smooth, 10-20 cm by ¼-½ mm. *Leaves* ½-¾ as long as the stems, erect, rigid, very narrow, flat, acute, glabrous, scabrid at the top, greyish or

glaucescous, ½-¾ mm wide; ligule absent. *Inflorescence* simple or compound, loose, with 4-18 spikelets, 2-4 cm long. *Involutral bracts* 2-3, very short, erect, dilated at the base, up to 1 cm. *Primary rays* 2-4, filiform, compressed, smooth, 1-2 cm. *Spikelets* solitary, lanceolate, strongly compressed, acute, few-flowered, 4-6 by 1-1½ mm. *Glumes* distichous, membranous, erect, lanceolate, acutish, keeled, fuscous, densely reddish gland-dotted, with 3-nerved keel and nerveless sides, 3-3¾ by c. 1½ mm; rachilla winged. *Stamens* 3; anthers linear, the anther-cells 1-1¼ mm, the connective produced into a subulate, smooth, ¼ mm long appendage. *Style* triquetrous, glabrous except for the hairy, pyramidally thickened base, 2½-3½ mm; stigmas 3, much shorter than the style. *Nut* trigonous with somewhat convex sides, obovoid, shortly stipitate, obtuse, not umbonate, smooth, whitish, ¾-¾/4 by ¾-¾/2 mm; epidermal cells minute, isodiametric.

Distr. Thailand, Cochinchina, Cambodia; in *Malesia* only in the Western part: Malay Peninsula (Setul; Perlis: Bukit Ketri heath), Billiton, N. Borneo (Distr. Papar, Kimanis F.R.; Labuan).

Ecol. Sandy fields, sandy places in heaths, at low altitudes.

Vern. *Rumpu djani*, Billiton.

**36. *Fimbristylis vanoverberghii* KÜK. Pfl. R., Heft 101 (1936) 631; KERN, Blumea 8 (1955) 127, f. 4; *ibid.* 15 (1967) 434. — *Cladium cyperoides* MERR. Philip. J. Sc. 7 (1912) Bot. 74, non *F. cyperoides* R. BR. 1810. — *Mariscus fallax* FERNALD, Rhodora 25 (1923) 53, non CHERMEZ. 1919. — *F. fusca* (non CLARKE) MERR. En. Philip. 1 (1923) 123 *p.p.* — *F. nigrobrunnea* (non THWAITES) KÜK. in Fedde, Rep. 51 (1942) 192. — *F. fusca* var. *hispidissima* KÜK. Mitt. Thür. Bot. Ver. N.F. 50 (1943) 11. — *Machaerina cyperoides* KOYAMA, Bot. Mag. Tokyo 69 (1956) 63.**

Perennial with woody, shortly creeping-ascending rhizome covered with ovate, striate, fuscous sheaths. *Stems* solitary or somewhat tufted, obtusely trigonous, slightly compressed, glabrous or pilose, smooth, leafy at the base, 20-30 cm by ½-¾ mm. *Leaves* much shorter than the stems, erect or slightly curved, flat or with inrolled margins, long-acuminate, with bristle-like, readily caducous tip, more or less hispid especially beneath, or glabrescent, ½-1 mm wide; ligule absent; outer sheaths coriaceous, shining fuscous or purplish, glabrous or pilose. *Inflorescence* simple or subcompound, obtriangular, rather dense, with (1)-5-15 spikelets, up to 4 cm long. *Involutral bracts* 3-4, erect, dilated at the base, hispid at least at the base, the lowest up to 2½ cm. *Rays* up to 4, obliquely patent, compressed, glabrous and smooth, 1-2 cm. *Spikelets* solitary or partly 2-3 together, oblong-ovate, strongly compressed, acute, 6-9-flowered, fuscous, 5-8 by 2-2½ mm; rachilla broadly winged. *Glumes* distichous, chartaceous, obliquely erect, triangular-ovate, acuminate, apiculate, sharply keeled, 1-nerved, scabrid with short white hairs but finally glabrescent, whitish hyaline-margined, dull fuscous, 3-4 by 2-3 mm. *Stamens* 3; anthers linear, 1½-2 mm. *Style* triquetrous, slightly incrassate at the base, glabrous, 2-3 mm; stigmas 3, about ½ as long as the style. *Nut* obtusely trigonous, obovoid, shortly stipitate, minutely umbonulate, sparsely verruculose, whitish or stramineous, 1-1½ by ¾-¾/4 mm; epidermal cells minute, isodiametric.

Distr. *Malesia*: N. Sumatra (between Sibosar and Parsoburan; W. Batuhuda; between Mt Piso-Piso and Toba Lake); Borneo (Brunei: Temburong R.); Philippines (Luzon: Bontoc Subprov., Bauco); New Guinea (W. New Guinea: Kobar; NE. New Guinea: Morobe Distr., Sattelberg).

Ecol. In moist grasslands, on hill-sides, river-banks, 540–1320 m.

37. *Fimbristylis eragrostis* (NEES) HANCE, J. Linn. Soc. Bot. 13 (1873) 132<sup>1</sup>; KÜK. Mitt. Thür. Bot. Ver. N.F. 50 (1943) 9; S. T. BLAKE, J. Arn. Arb. 35 (1954) 215; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 117; KERN, Blumea 15 (1967) 434. — *Abildgaardia eragrostis* NEES & MEY. ex NEES in Wight, Contr. (1834) 95; KUNTH, En. 2 (1837) 249; STEUD. Syn. 2 (1855) 72; BOECK. Linnaea 37 (1871) 55. — *F. nigrobrunnea* THWAITES, En. Pl. Zeyl. (1864) 434; CLARKE, Fl. Br. India 6 (1893) 648; J. Linn. Soc. Bot. 34 (1898) 70; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 97; CAMUS, Fl. Gén. I.-C. 7 (1912) 120; RIDL. Fl. Mal. Pen. 5 (1925) 159. — *F. subtetrastachya* BOECK. Linnaea 37 (1871) 50. — *F. pycnostachya* HANCE, J. Bot. Lond. 15 (1877) 338. — *Iriha eragrostis* O.K. Rev. Gen. Pl. 2 (1891) 753. — *Iriha subtetrastachya* O.K. l.c. — *F. lepidota* CAMUS, Not. Syst. 1 (1910) 247; Fl. Gén. I.-C. 7 (1912) 121, f. 14, 3–6. — *F. tortispica* TURR. Kew Bull. 1911 (1911) 348. — *F. schlechteri* KÜK. Bot. Jahrb. 59 (1924) 50.

Glabrous perennial with short woody rhizome in old specimens clothed with the remains of decayed leaf-sheaths. *Stems* solitary or somewhat tufted, rigid, acutely 4–5-angled, sulcate, smooth, or scabrid at the top, 30–70 cm by 1–2(–3) mm, the base clothed with 2–3 tubular, 4–5(–15) cm long sheaths with short erect blades. Basal leaves numerous, much shorter than the stems, subfalcate, firm, flat, exactly linear, with obtuse, rounded, apiculate top, spinulose-scabrid on the margins in the upper part, (2–)3–5 mm wide; ligule absent. *Inflorescence* compound or decoumpound, with several to numerous spikelets, 3–6 cm long, sometimes subcapitate. Involucral bracts 2–4, very short, erect, dilated at the base, the lowest up to 1½ cm. Primary rays (0–)3–6, erecto-patent to recurved, compressed, smooth, up to 4 cm. *Spikelets* solitary or partly clustered, lanceolate, compressed or subterete, often contorted, acute, 8–16-flowered, stramineous to dark brown, 6–10(–15) by 2–4 mm. Rachilla winged. *Glumes* distichous or subspiral, chartaceous, shining, glabrous, broadly ovate to oblong-ovate, rather obtuse, distinctly mucronulate, keeled, 3–5 by 2½–3 mm. *Stamens* 3; anthers linear, 1½–2 mm. *Style* triquetrous, pyramidally thickened at the base, glabrous or sparsely ciliate at the top, 2–3 mm; stigmas 3, about as long as the style. *Nut* trigonous, obovoid or broadly obovoid, shortly stipitate, umbonulate, verruculose, whitish or stramineous, ¼–1 by ⅓–1 mm; epidermal cells minute, isodiametric.

Distr. S. Asia, from Ceylon and India eastwards to S. China, Hainan and Formosa, southwards to tropical Australia (Queensland); in *Malesia*: Malay Peninsula (Kedah, Trengganu), Lesser Sunda Is.

<sup>1</sup> HANCE wrongly ascribes the authority of the basionym *Abildgaardia eragrostis* to VAHL.

(Port. Timor), Aru Is. (P. Trangan), New Guinea (NE. New Guinea, Papua).

Ecol. In savannahs and savannah-forests, forest-clearings, at low altitudes.

Notes. In the wide sense here accepted a most polymorphous species. *F. eragrostis* s. str., *F. nigrobrunnea* and *F. pycnostachya* (= *F. lepidota*) look very different, but I am unable to trace dividing lines, as they are connected by numerous inter-mediate.

Typical *F. nigrobrunnea* (= *F. subtetrastachya*) is characterized by the often clustered spikelets and the dark, imperfectly spirally arranged glumes. In its typical form unknown from *Malesia*.

*F. pycnostachya* still more deviates from typical *F. eragrostis* by its thick rhizomes, robust stems, castaneous leaf-sheaths, coriaceous leaves, subcapitate inflorescences, and subspiral dark glumes. In *Malesia* it is only known from Kedah (Kedah Peak).

*F. tortispica* from N. Thailand and *F. schlechteri* from NE. New Guinea are in my opinion typical *F. eragrostis*, with solitary, light coloured spikelets and distichous glumes.

38. *Fimbristylis fusca* (NEES) CLARKE, Fl. Br. Ind. 6 (1893) 649; Philip. J. Sc. 2 (1907) Bot. 98; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 97 p.p.; KOORD. Exk. Fl. Java 1 (1911) 200; *ibid.* 4, Atlas (1922) f. 262; CAMUS, Fl. Gén. I.-C. 7 (1912) 123; MERR. En. Philip. 1 (1923) 123 p.p. (excl. syn. *Cladium cyperoides* MERR.); RIDL. Fl. Mal. Pen. 5 (1925) 160 p.p.; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 18; S. T. BLAKE, J. Arn. Arb. 35 (1954) 211; KERN, Blumea 8 (1955) 125; *ibid.* 15 (1967) 435; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 118; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 468. — *Gussonea cyperoides* PRESL, Rel. Haenk. 1 (1828) 183, t. 33, non *F. cyperoides* R.BR. 1810. — *Gussonea pauciflora* BRONGN. in DUPERT. Voy. Bot. 2 (1829) 171, t. 34B, non *F. pauciflora* R.BR. 1810. — *Abildgaardia fusca* NEES in Wight, Contr. (1834) 95; KUNTH, En. 2 (1837) 249; STEUD. Syn. 2 (1855) 72; BOECK. Linnaea 37 (1871) 54, excl. var. *longifolia* BOECK. — *Abildgaardia cyperoides* NEES in Wight, Contr. (1834) 95; KUNTH, En. 2 (1837) 249; STEUD. Syn. 2 (1855) 72. — *Abildgaardia pauciflora* KUNTH, En. 2 (1837) 249; STEUD. Syn. 2 (1855) 73; MIQ. Fl. Ind. Bat. 3 (1856) 298. — *Rhynchospora ? anomala* STEUD. [in Zoll. Syst. Verz. 1 (1854) 61, non nud.] Syn. 2 (1855) 149; MIQ. Fl. Ind. Bat. 3 (1856) 337. — *Iriha fusca* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. subfusca* CAMUS, Not. Syst. 1 (1910) 248; Fl. Gén. I.-C. 7 (1912) 123. — *F. rigidifolia* RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 223; Fl. Mal. Pen. 5 (1925) 159. — *F. stenochlaena* KÜK. Mitt. Thür. Bot. Ver. N.F. 50 (1943) 11; S. T. BLAKE, J. Arn. Arb. 35 (1954) 220. — Fig. 42.

Perennial with short, woody rhizome clothed with the remains of decayed leaf-sheaths. *Stems* tufted, rigid, angular-sulcate, often scabrid-pilose just below the inflorescence, otherwise glabrous and smooth, 20–50 cm by ½–1 mm. *Leaves* much shorter than the stems (often scarcely ¼ as long), basal except for one somewhat higher on the stem, rather stiff, flat, exactly linear, abruptly pointed, glabrous, or pubescent especially beneath, scabrid at the top, (1–)2–4 mm wide; ligule absent. *Inflorescence* compound to



Fig. 42. *Fimbristylis fusca* (NEES) CLARKE. a. Habit,  $\times \frac{1}{2}$ , a'. leaf tip,  $\times 7$ , b. spikelet,  $\times 5$ , c. glume, d. anther, e. nut with style and stigmas,  $\times 10$  (a-e BEUMÉE A597).

supradecomponent, loose, with several to very numerous spikelets, up to 10 cm long. Involucral bracts 3–5, very short, glabrous or pilose, dilated at the base, the lowest rarely up to 3 cm. Primary rays suberect, rigid, glabrous or pilose, up to 7 cm. *Spikelets* solitary, lanceolate, strongly compressed, acute, 3–10-flowered, 5–10 by 2–2½ mm; rachilla broadly winged. *Glumes* distichous, subchartaceous, obliquely erect, lanceolate, gradually acuminate, prominently keeled, 1-nerved, scabrid by very short, stiff hairs, fulvous, with broad, glabrous, whitish hyaline margins, 4–6½ by 2–2½ mm. *Stamens* 3; anthers linear, 1½–2 mm. *Style* very slender, triquetrous, pyramidally thickened at the base, glabrous, 4–6 mm; stigmas 3, much shorter than the style. *Nut* trigonous with convex sides, obovoid, cuneate at the base, shortly stipitate, umbonulate, densely verruculose, whitish to brownish, ⅓–1 by ⅓–⅓ mm; epidermal cells isodiametric.

*Distr.* From Nepal and India through Thailand and Indo-China to S. China and Japan (Shikoku, Kyushu); in *Malesia*: Sumatra, Malay Peninsula (Setul, Kelantan, Singapore), W. Java, Borneo, Philippines (Palawan, Luzon) Celebes, Moluccas (Ambon), and New Guinea.

*Ecol.* In open, rather dry to wet grasslands, in Celebes collected on dry gravel-hills; in Java only known from low altitudes (40–100 m), in N. Sumatra and the Philippines ascending to 1300 m, in New Guinea to 1600 m.

*Notes.* *F. stenochlaena* KÜK. was based on BRASS 7840 from Papua, Lake Daviumbu. The specimens of this collection are stout and in habit similar to *F. eragrostis*, from which species they can readily be distinguished by the hairy, mucous, acute glumes, the much longer style, etc. According to KÜENTHAL *F. stenochlaena* differs from *F. fusca* by the broader leaves (2 mm) with light-coloured sheaths, the twice as long spikelets, the regularly distichous, long-acuminate, narrower glumes, and the many-flowered spikelets with all the flowers bisexual. S. T. BLAKE *l.c.*, p. 223 gives the following key characters:

*F. fusca*: glumes more than half as wide as long, 3–4 mm long; style about 3 mm long; culms 5-ribbed; leaves 2 mm wide; spikelets 1½–2 mm wide.

*F. stenochlaena*: glumes about half as wide as long, 4–5 mm long; style 4 mm long; culms many-ribbed; leaves 1½–4 mm wide; spikelets 2–3 mm wide.

Like in most *Fimbristylis spp.* the width of the leaves and the number of flowers in the spikelets varies considerably. In the type-collection of *F. fusca* (WALLICH 3530) the glumes are 4½–5¼ mm long, the style c. 5 mm. The flowers of *F. stenochlaena* are triandrous (like in *F. fusca*), not diandrous as KÜENTHAL wrongly indicates.

In my opinion *F. stenochlaena* cannot be treated as a distinct species.

Also in *F. subfusca* CAMUS and *F. rigidifolia* RIDL. the floral characters are those of *F. fusca*, so I take them for broad-leaved forms of this species.

**39. *Fimbristylis fulvescens* (THWAITES) THWAITES**, En. Pl. Zeyl. (1864) 434; CLARKE, Fl. Br. Ind. 6 (1893) 650; J. Linn. Soc. Bot. 34 (1898) 72; HOOK. *f.* in Trimen, Handb. Fl. Ceylon 5 (1900) 62; KERN, Blumea 8 (1955) 127, *ibid.* 15 (1967) 435. — *Abildgaardia fulvescens* THWAITES, En. Pl. Zeyl. (1864)

347. — *Abildgaardia fusca* var. *longifolia* BOECK. Linnaea 37 (1871) 55. — Fig. 43.

Perennial (always?). *Stems* densely tufted, very slender, sharply 4–5-angled, ribbed, smooth, (20–)50–60 cm by c. ½ mm, the base clothed with 2–3, up to 7 cm long sheaths usually with very short blades. *Basal leaves* erect, flat, acute, glabrous, scabrid on the margins at the top, up to 35 cm long, 1–2 mm wide; ligule absent. *Inflorescence* simple (very rarely one of the rays with a short secondary ray), loose, with 3–7 spikelets, 1½–3 cm long, 2–4 cm wide. Involucral bracts 3–5, erect or somewhat excurved, setaceous, dilated at the base, the lowest ½–1 cm. Rays 2–5, slender, obliquely patent to horizontally spreading, compressed, smooth, 5–15 mm. *Spikelets* solitary, lanceolate or oblong-lanceolate, strongly compressed, acute, 6–10-flowered, 5–10 by 2–4 mm; rachilla broadly winged. *Glumes* exactly distichous, subchartaceous, obliquely erect, ovate-lanceolate, acute, 1-nerved, sharply keeled, pubescent by soft hairs, not or hardly hyaline-margined, ciliate in the upper part, ⅓–⅓ by 2½–3 mm. *Stamens* 3; anthers linear, 1½ mm. *Style* very slender, triquetrous, pyramidally thickened at the base, glabrous, 4 mm; stigmas 3, much shorter than the style. *Nut* trigonous, oblong-obovoid, shortly stipitate, umbonulate, sparsely verruculose, light brown, 1¼–1⅓ by ⅓ mm; epidermal cells isodiametric.

*Distr.* Insufficiently known. Ceylon; in *Malesia*: Malay Peninsula (Government Hill on P. Penang). *Ecol.* At 750 m altitude.

*Note.* Closely related to *F. fusca*, from which it is possibly not specifically distinct. In *Malesia* only collected by KÜNSTLER in 1881 and CURTIS in 1889.

**40. *Fimbristylis fimbristylisoides* (F.V.M.) DRUCE**, Rep. Bot. Exch. Cl. Br. Isl. 1916 (1917) 623; S. T. BLAKE, J. Arn. Arb. 35 (1954) 221; KERN, Blumea 8 (1955) 129; *ibid.* 15 (1967) 437; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 117; KERN in Back. & Bakh. *f.* Fl. Java 3 (1968) 468. — *Abildgaardia fimbristylisoides* F.V.M. Fragm. 8 (1874) 273. — *F. dallachyi* F.V.M. ex BENTH. Fl. Austr. 7 (1878) 309; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 18. — *Iriha fimbristylisoides* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. lacei* TURR. Kew Bull. 1911 (1911) 348. — *F. disticha* var. *dallachyi* CLARKE ex DOMIN, Bibl. Bot., Heft 85 (1915) 454. — *F. disticha* (non BOECK.) KÜK. Bot. Jahrb. 59 (1925) 50. — *F. straminea* (non TURR.) OHWI, J. Jap. Bot. 14 (1938) 574; Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 60. — *F. nanofusca* TANG & WANG, Fl. Reip. Pop. Sinic. 11 (1961) 229.

Dwarf annual with fibrous roots. *Stems* tufted, ribbed, antrorsely scabrid-hispid at least at the top, leafy at the base, 7–12 cm by ½–½ mm. *Leaves* much shorter than the stems, strongly falcate in the same direction (to the right or to the left), flat, abruptly acuminate, apiculate, antrorsely spinulose-scabrid on the margins, (1–)2 mm wide; ligule absent. *Inflorescence* simple or subcompound, loose, with 3–10 spikelets, up to 4 cm long. Involucral bracts 2–3, obliquely erect, much shorter than the inflorescence, up to 15(–25) mm. Primary rays 3–5, obliquely erect, scabrid-pilose, up to 3 cm; secondary rays when present very short. *Spikelets* solitary, lanceolate, strongly compressed, acute, 6–12-flowered, pale to dark brown, 4–10 by (1–)1½–2 mm;

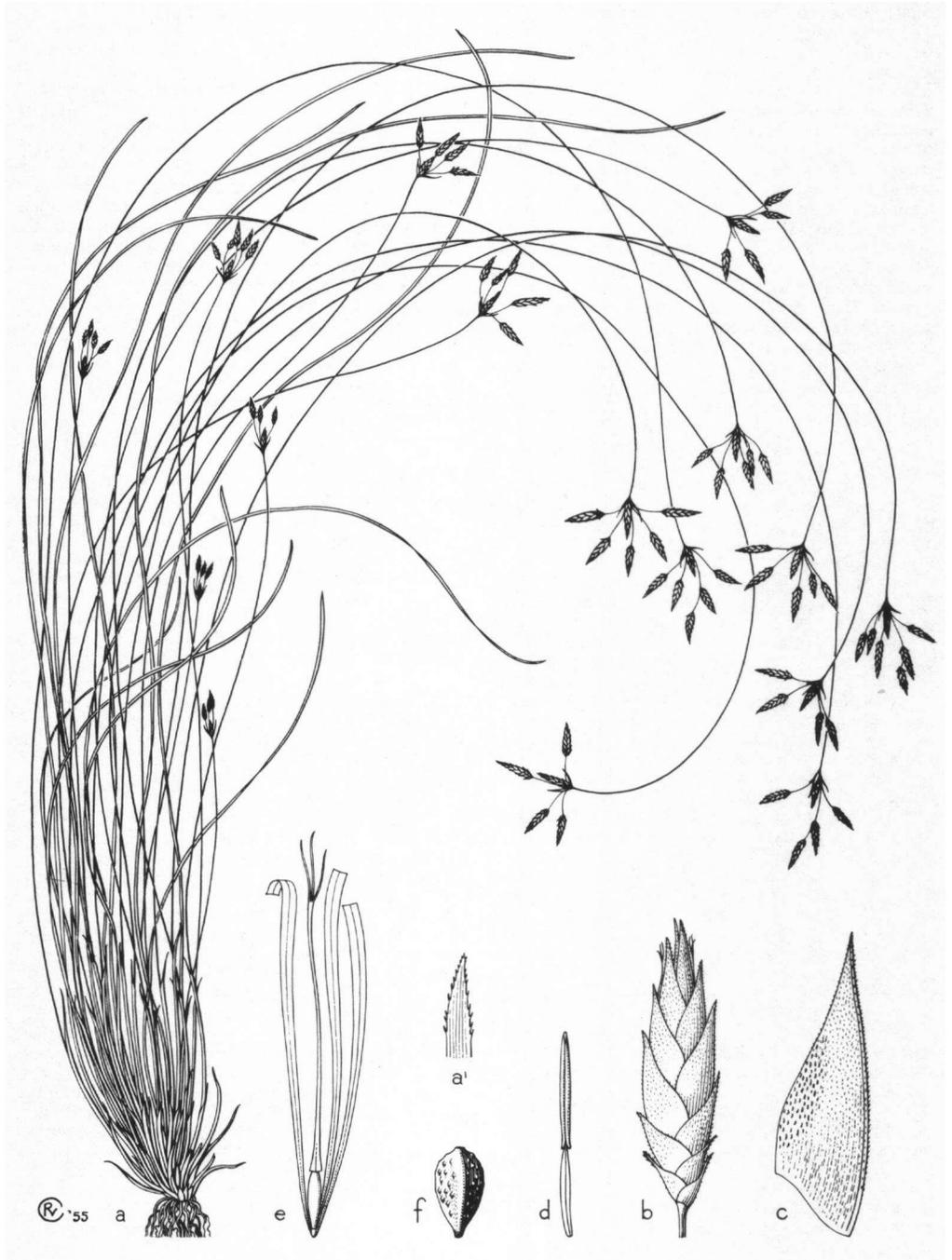


Fig. 43. *Fimbristylis fulvescens* (THW.) THW. a. Habit,  $\times \frac{1}{2}$ , a'. leaf tip, b. spikelet, both  $\times 5$ , c. glume, d. stamen, e. deflorate flower, f. nut, all  $\times 10$  (a-f CURTIS 2175).

rachilla winged. *Glumes* distichous, membranous, scabrid by minute hairs, ovate-lanceolate, acute, often mucronulate, prominently keeled, with ciliolate midnerve, nerveless sides, and broad hyaline margins, (2-) $2\frac{1}{2}$ -3 by c.  $1\frac{3}{4}$  mm. *Stamens* (1-) $2(-3)$ ; anthers oblong,  $\frac{1}{5}$ - $\frac{1}{2}$  mm. *Style* triquetrous, pyramidally thickened at the base, glabrous, (1-) $1\frac{1}{2}$ - $1\frac{3}{4}$  mm; stigmas 3, much shorter than the style. *Nut* trigonous with convex sides, pyriform, umbonulate, abruptly truncate at the base which is conspicuously broader than the short but distinct stipe, smooth or verruculose, whitish,  $\frac{2}{5}$ - $\frac{3}{6}$  by  $\frac{1}{2}$ - $\frac{2}{3}$  mm; epidermal cells isodiametric.

Distr. Burma, E. Thailand, S. China, Ryu Kyu Is., S. Korea, tropical Australia (Queensland); in *Malesia*: N. Sumatra, W. and Central Java, Madura, Kangean Arch., Lesser Sunda Is. (Flores), N. Borneo, Celebes, New Guinea.

Ecol. In open wet grassy places, *Imperata*-fields, on hill-sides and in valleys, 25-825 m.

41. *Fimbristylis intonsa* S. T. BLAKE, J. Arn. Arb. 35 (1954) 221, f. 2; KERN, *Blumea* 8 (1955) 130; *ibid.* 15 (1967) 438. — *F. disticha* var. *kurzii* CLARKE, Fl. Br. Ind. 6 (1893) 651.

Annual with fibrous roots. *Stems* tufted, setaceous, acutely 5-ribbed, scabrid at the top, 5-15(-25) cm by c.  $\frac{1}{2}$  mm, the base clothed with 1-2 tubular, short-bladed sheaths. *Leaves* much shorter than the stems, rather firm, falcate, flat, obtuse, apiculate, antrorsely spinulose-scabrid on the margins in the upper part,  $1\frac{1}{2}$ -2 mm wide; ligule absent. *Inflorescence* simple or subcompound, loose, with (1-) $3(-8(-15))$  spikelets, 1-5 cm long. Involucral bracts 2-3, erect, spinulose-scabrid, the lowest often subfoliaceous, up to 12 mm. Primary rays 3-7, scabrid, up to 3 cm, the longer ones sometimes with  $\frac{1}{2}$ -1 cm long secondary rays. *Spikelets* solitary, ovate-oblong, strongly compressed, sometimes contorted, acute, densely many-flowered, brown, (3-) $5(-10)$  by  $1\frac{1}{2}$ - $1\frac{3}{4}$  mm; rachilla winged. *Glumes* distichous, very small, subchartaceous, obliquely erect, very broadly ovate, obtuse, apiculate or minutely mucronulate, 1-nerved, with sharp keel and ciliolate margins, densely pubescent by very short hairs almost all over,  $1\frac{3}{4}$ -2 by  $1\frac{1}{2}$ - $1\frac{3}{4}$  mm. *Stamens* 3; anthers oblong-linear, c.  $\frac{1}{2}$  mm. *Style* triquetrous, pyramidally thickened at the base, glabrous,  $1-1\frac{1}{3}$  mm; stigmas 3, much shorter than the style. *Nut* obtusely trigonous, with convex sides, obovoid or oblong-obovoid, shortly stipitate, umbonulate, densely verruculose, shining white,  $\frac{2}{5}$ - $\frac{4}{5}$  by  $\frac{2}{5}$ - $\frac{1}{2}$  mm; epidermal cells isodiametric.

Distr. Bengal; in *Malesia*: Sumatra (E. Coast Res., Tapanuli), New Guinea (W. New Guinea: Kebar Valley; Papua: W. Div., Lake Daviumbu, Middle Fly R.).

Ecol. On wet grassy plains, scattered among tall grasses, at low and medium altitudes; in Sumatra up to 1000 m.

42. *Fimbristylis malayana* OHWI, *Blumea* 8 (1955) 96, f. 1; KERN, *Blumea* 15 (1967) 438. — *F. fuscoides* (non CLARKE) HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 86.

Perennial, glabrous except for the glumes, light green. *Stems* densely tufted, rigid, obtusely 3-4-angled or subterete, slightly compressed, smooth, 20-40 cm by  $\frac{1}{2}$ -1 mm, the base clothed with 1-2

bladeless or short-bladed, 1-2 cm long sheaths. *Leaves*  $\frac{1}{3}$ - $\frac{1}{2}$  as long as the stems, falcate, flat, obtuse, apiculate, scabrid on the margins in the upper part,  $1\frac{1}{2}$ -2 mm wide; ligule absent. *Inflorescence* simple or subcompound, narrow, rather dense, with 2-7 spikelets, 3-4 cm long. Involucral bracts very short, often glume-like, mucronate, scarious-margined at the dilated base, the lower 1-2 sometimes with a short blade up to  $1\frac{1}{2}$  cm. Rays 2-4, suberect, rigid, slightly compressed, smooth, 1- $2(-3)$  cm. *Spikelets* solitary, lanceolate or linear-lanceolate, strongly compressed, acute, often contorted, 8-10 by 2- $2\frac{1}{2}$  mm; rachilla broadly winged. *Glumes* distichous, chartaceous, suberect, oblong-ovate, long-acuminate, sharply keeled, with nerveless sides and whitish hyaline margins, minutely puberulous at the top, dull brown,  $3\frac{1}{4}$ -4 by 2 mm. *Stamens* 3; anthers linear,  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm. *Style* very slender, triquetrous, slightly pyramidally thickened at the base, glabrous,  $2\frac{1}{2}$ -3 mm; stigmas 3, much shorter than the style. *Nut* trigonous with somewhat convex sides, tricostate, obovoid or broadly obovoid, shortly stipitate, not or hardly umbonulate, smooth, stramineous to brown,  $\frac{2}{5}$ - $\frac{3}{4}$  by  $\frac{2}{5}$ - $\frac{1}{2}$  mm; epidermal cells roundish or elliptic.

Distr. *Malesia*: Malay Peninsula (P. Langkawi).

Ecol. On limestone screes in open places, especially where wet, c. 60 m.

43. *Fimbristylis disticha* BOECK. *Linnaea* 38 (1874) 393; CLARKE, Fl. Br. Ind. 6 (1893) 651, *excl. var. kurzii* CLARKE; KERN, *Blumea* 8 (1955) 130; *ibid.* 15 (1967) 438. — *Iriha disticha* O.K. Rev. Gen. Pl. 2 (1891) 753. — *F. fuscoides* (non CLARKE) CAMUS, Fl. Gén. 1.-C. 7 (1912) 124 p.p. (*specim. cochinch.*).

Glabrous annual with fibrous roots. *Stems* solitary or tufted, acutely 4-5-ribbed, smooth, 10-35 cm by  $\frac{1}{4}$ - $\frac{1}{2}$  mm, the base clothed with 1-2 short-bladed sheaths. *Leaves* much shorter than the stems, rather rigid, falcate, flat, abruptly acuminate, scabrid on the margins in the upper part, 1-2 mm wide; ligule absent. *Inflorescence* subcompound to decompound, very loose, with several to numerous spikelets, 4-6 cm long. Involucral bracts 3-4, setaceous, often excurved, the lowest  $\frac{1}{2}$ - $2\frac{1}{2}$  cm. Primary rays 3-6, erecto-patent, filiform, angular, smooth, up to 4 cm. *Spikelets* solitary, oblong-lanceolate, strongly compressed, acute, ferruginous, 4-6 by c.  $1\frac{1}{2}$  mm; rachilla broadly winged. *Glumes* exactly distichous, very small, thinly membranous, glabrous, ovate, rather obtuse, minutely apiculate just below the apex, acutely keeled, with curved keel, distinct midnerve and nerveless sides,  $1\frac{1}{2}$ - $2(-2\frac{1}{2})$  by c.  $1\frac{1}{2}$  mm. *Stamens*  $2(-3)$ ; anthers oblong,  $\frac{1}{2}$ (-1) mm. *Style* triquetrous, pyramidally thickened at the base, glabrous,  $1-1\frac{1}{2}$ (-2) mm; stigmas 3, much shorter than the style. *Nut* trigonous, narrowly obovoid or obovoid, cuneate at the base, shortly stipitate, minutely umbonulate, more or less verruculose, whitish or stramineous,  $\frac{3}{5}$ - $\frac{7}{10}$  by  $\frac{1}{3}$ - $\frac{1}{2}$  mm; epidermal cells isodiametric to suboblong.

Distr. Burma, Central and Peninsular Thailand, Cochinchina, Tenasserim and Andamans, Teressa, Mergui, S. China; in *Malesia*: N. Sumatra.

Ecol. In Sumatra in open grassy plains, 1200-1400 m.

Note. Rather variable. The Chinese plants differ from the type collection by taller stems, longer glumes

(2½ mm), anthers (1 mm), and styles (2 mm), and by the obovoid, densely verruculose nuts. Several other collections connect the two extremes.

44. *Fimbristylis calcicola* KERN, *Blumea* 8 (1955) 129, f. 5, *ibid.* 15 (1967) 439.

Very slender annual with fibrous roots, glabrous except for the glumes, pale green. *Stems* very densely tufted, setaceous, sharply 4-ribbed, smooth, 10–20 cm by ¼–⅓ mm, the base clothed with 1–2 tubular short-bladed sheaths. *Basal leaves* much shorter than the stems, rather rigid, falcate, rather abruptly acuminate, ½–1 mm wide; ligule absent. *Inflorescence* simple or subcompound, loose, with 3–9 spikelets, up to 4 cm long. *Involucral bracts* 3–4, erect with more or less excurved tip, setaceous, dilated at the base, the lowest ½–1 cm. *Rays* 2–5, filiform, obliquely patent, often upcurved, compressed, smooth, 1–2½ cm. *Spikelets* solitary, lan-

ceolate to almost linear, strongly compressed, acute, densely many-flowered, 3–7 (ultimately up to 12) by 1¼ mm; rachilla winged. *Glumes* exactly distichous, membranous, obliquely erect, ovate, acute, mucicous or minutely apiculate, 1-nerved, sharply keeled, with straight keel, densely pubescent, ferruginous, paler towards the margins, 1½–1¾ by 1–1¼ mm. *Stamens* 2; anthers oblong-linear, c. ½ mm. *Style* slender, triquetrous, pyramidally thickened at the base, glabrous, 1 mm; stigmas 3, much shorter than the style. *Nut* very obtusely trigonous, oblong-obovoid to ellipsoid, shortly stipitate, minutely umbonulate, not verruculose, finely longitudinally striate and transversely lineolate by the transversely linear epidermal cells in 3–4 vertical rows on each face, at first whitish, finally yellowish brown; c. ⅔ by ⅓ mm.

*Distr. Malesia:* Malay Peninsula (Kedah: P. Langkawi).

*Ecol.* On limestone screes.

#### 10. Section *Dichelostylis*

BENTH. *Fl. Austr.* 7 (1878) 299. — *Fimbristylis sect. Ferrugineae* OHWI, *J. Jap. Bot.* 14 (1938) 573, p.p. — *Fimbristylis ser. Ferrugineae* OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B18 (1944) 55, p.p.

*Type species:* *F. ferruginea* (L.) VAHL (*Scirpus ferrugineus* L.).

45. *Fimbristylis ferruginea* (L.) VAHL, *En.* 2 (1806) 291; KUNTH, *En.* 2 (1837) 236; STEUD. *Syn.* 2 (1855) 118; BOECK. *Linnaea* 37 (1871) 16; BENTH. *Fl. Austr.* 7 (1878) 312; CLARKE, *Fl. Br. Ind.* 6 (1893) 638; K. SCH. & LAUT. *Fl. Schutzgeb.* (1900) 197; CLARKE, *Philip. J. Sc.* 2 (1907) Bot. 94; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 92; CLARKE, *Ill. Cyp.* (1909) t. 42 f. 9–10; KOORD. *Exk. Fl. Java* 1 (1911) 199; *ibid.* 4, *Atlas* (1922) f. 255; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 108, f. 16, 9; MERR. *En. Philip.* 1 (1923) 123; KÜK. *Bot. Jahrb.* 59 (1924) 48; 69 (1938) 258; RIDL. *Fl. Mal. Pen.* 5 (1925) 576; BACK. *Onkr. Suiker.* (1928) 161, t. 168; *Bekn. Fl. Java (em. ed.)* 10 (1949) fam. 246, p. 23; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 211; KERN in *Back. & Bakh. f. Fl. Java* 3 (1968) 465. — *Scirpus ferrugineus* LINNÉ, *Sp. Pl.* (1753) 50. — *Scirpus arvensis* RETZ. *Obs.* 4 (1786) 11. — *F. arvensis* VAHL, *En.* 2 (1806) 291. — *F. marginata* LABILL. *Sert. Austr. Caled.* 2 (1825) t. 16 f. 1. — *F. trispicata* STEUD. *Syn.* 2 (1855) 107; MIQ. *Fl. Ind. Bat.* 3 (1856) 317. — *F. cyrtophylla* MIQ. *l.c.* 325. — *Iriha ferruginea* O.K. *Rev. Gen. Pl.* 2 (1891) 752. — *F. polytrichoides* (non R.Br.) RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 90 p.p.; *Fl. Mal. Pen.* 5 (1925) 154 p.p. — *F. longispica* (non STEUD.) CAMUS, *Fl. Gén. I.-C.* 7 (1912) 107.

Perennial with shortly creeping, woody rhizome. *Stems* approximate, forming tufts, rigid, striate, compressed, smooth, greyish green, 20–80 cm by 1½–3 mm. *Cauline leaves* much shorter than the stems, rigid, erect, conduplicate or triquetrous, scabrid at the top, 2–10 cm by ½–1½ mm, those of the sterile shoots much longer; lower sheaths bladeless, coriaceous, shining brown to castaneous, upper ones ferruginous-membranous in front, ciliate at the mouth; ligule a dense fringe of short hairs.

*Inflorescence* simple or subcompound, usually contracted, with (1–)5–10(–25) spikelets, 3–5 cm long. *Involucral bracts* 2–3, the lowest suberect, shorter to slightly longer than the inflorescence, scarious-margined at the dilated base. *Primary rays* compressed, smooth, up to 2½ cm. *Spikelets* solitary, ovoid to oblong-ovoid, terete, acute, densely many-flowered, dull brown, 5–20 by 3–4 mm; rachilla narrowly winged. *Glumes* spiral, subchartaceous, ovate to oblong, obtuse, scarcely keeled, apiculate, with green, 1-nerved keel and nerveless sides, ciliate at the upper edge, appressed-puberulous in the apical part, rarely subglabrous, 3–4½ by 2½–3 mm. *Stamens* 3; anthers oblong-linear, 1–1½ mm. *Style* flat, slightly dilated at the base, densely ciliate, 2–3 by ¼ mm; stigmas 2, shorter than the style. *Nut* biconvex, strongly compressed, obovate or oblong-obovate, shortly stipitate, obsolete umbonulate, smooth, stramineous to fuscous, 1–1¼ by ¾–1 mm; epidermal cells isodiametric or almost so.

*Distr.* Pantropical, probably common throughout *Malesia* (but still unknown from the Lesser Sunda Is.).

*Ecol.* In sunny wet localities with clayish soil, especially those subject to the influence of brackish water, rarely more inland near saline pools and mud-wells; locally often abundant; 0–100 m.

*Vern.* *Ba'ileu*, Atjeh, *rumpul rüchüt*, Mal. Pen., *sukët dot*, *sukët godokan*, *kodokan*, *J. kodoan*, *Bawean*, *gërinting*, *Karimundjawa*, *purum*, W. Borneo.

46. *Fimbristylis sieberiana* KUNTH, *En.* 2 (1837) 237; STEUD. *Syn.* 2 (1855) 118; MIQ. *Fl. Ind. Bat.* 3 (1856) 326; KERN, *Blumea* 8 (1955) 131. — *F. ferruginea* (non VAHL) DECNE, *Nouv. Ann. Mus. Hist. Nat. Paris* 3 (1834) 352; *Descr. Herb. Timor.* (1835)

34. — *F. paucispicata* F. v. M. Fragm. 1 (1859) 197. — *F. ferruginea* var. *sieberiana* BOECK. Linnaea 37 (1871) 17; CHERMEZ. in Humbert, Fl. Madag. fam. 29 (1937) 181. — *F. ferruginea* var. *foliata* BENTH. Fl. Austr. 7 (1878) 312, excl. syn. *F. arvensis* VAHL et *F. tristachya* R. BR.

Closely related to *F. ferruginea*, from which it is distinguishable by the following characters:

Cauline leaves well developed, less stiff, flat, up to 35 cm by  $1\frac{1}{2}$ -2 mm; lower sheaths herbaceous, laminiferous, stramineous or ferrugineous; sheaths of the cauline leaves pilose, especially towards the top, finally more or less glabrescent. Lowest involucre bract as long as or usually distinctly overtopping the inflorescence, up to 10 cm. *Spikelets* obtusish. *Glumes* very broadly ovate, usually dark castaneous, densely tomentose in the apical part, 3-4½ mm long and wide. *Style* broader, c.  $\frac{2}{3}$  mm wide. *Nut* broadly obovate or orbicular, distinctly stipitate (gynophore  $\frac{1}{4}$ - $\frac{2}{5}$  mm), umbonulate, larger ( $1\frac{1}{4}$ -1½ by  $1\frac{1}{10}$ -1¼ mm).

Distr. Africa (Erythraea, S. Africa, Madagascar, Mauritius, Réunion), Asia (from Syria through Arabia and Persia to India), tropical Australia (Queensland); in *Malesia* very rare, only a few times collected in the Lesser Sunda Is.: Timor (LESCHENAULT; also recently collected near Tjamplong and Dili); Philippines (Mindanao, Cotabato Prov.: Buayan).

Ecol. Probably less halophilous than *F. ferruginea*, but in Port. Timor in brackish marshes, at low altitude.

Note. CLARKE, Fl. Cap. 7 (1898) 201 referred *F. sieberiana* to the synonymy of *F. ferruginea*, from which it is, however, clearly distinct.

47. *Fimbristylis tristachya* R. BR. Prod. (1810) 226; KERN, Blumea 8 (1955) 131; in BACK & BAKH. f. Fl. Java 3 (1968) 465, non THWAITES, 1864. — *F. marianna* GAUDICH. in Freyc. Voy. Bot. (1826) 413, excl. varr.; KUNTH, En. 2 (1837) 236; STEUD. Syn. 2 (1855) 109; KÜK. Bot. Jahrb. 59 (1924) 5; S. T. BLAKE, J. Arn. Arb. 35 (1954) 212. — *F. bispicata* var. *monostachya* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 29. — *F. polymorpha* BOECK. var. *c* BOECK. Linnaea 37 (1871) 16. — *F. nutans* (non VAHL) NAVES, Nov. App. (1882) 307; VIDAL, Phan. Cuming. (1885) 156; Rev. Pl. Vasc. Filip. (1886) 284. — *F. maxima* K. SCH. in K. Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 24, non K. SCH. & LAUT. Fl. Schutzgeb. (1900) 196. — *F. subbispicata* (non NEES) CLARKE, Fl. Br. Ind. 6 (1893) 634, *quoad specim. Ind.*; Philip. J. Sc. 2 (1907) Bot. 92, *incl. var. caesia quoad specim. cit.*; MERR. En. Philip. 1 (1923) 126. — *F. annamica* CAMUS, Not. Syst. 1 (1910) 245; Fl. Gén. I.-C. (1912) 95. — *F. alleizettei* CAMUS, Not. Syst. 1 (1910) 291; Fl. Gén. I.-C. 7 (1912) 112. — *F. marianna* var. *foenea* KÜK. in Fedde, Rep. 16 (1920) 432; MERR. En. Philip. 1 (1923) 124. — *F. podocarpa* (non NEES) RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 222; Fl. Mal. Pen. 5 (1925) 155. — *F. schoenoides* (non VAHL) BACK. Onkr. Suiker. (1928) 159 p.p.; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 23 p.p.

Glabrous perennial with short rhizome. *Stems* tufted, rigid, sulcate-angular, compressed, smooth, or scabrid at the top, somewhat incrassate at the base, up to 65(–100) cm by 1-1½ mm. *Leaves* about ½ as long as the stems, canaliculate, rigid, rather abruptly acuminate, scabrid on the margins in the

upper part, greyish green or glaucous, ½-1½ mm wide; sheaths brownish; ligule a dense fringe of short hairs. *Inflorescence* simple or subcompound, loose, with (1-)3-7(–11) spikelets. Involucral bracts 1-2, much shorter than the inflorescence, erect or suberect, scarious-margined at the dilated base, up to 3 cm (usually much shorter). Primary rays 0-5, compressed, smooth, up to 4 cm. *Spikelets* solitary, ovate or ovate-lanceolate, terete, acute, densely many-flowered, (6-)10-25 by 4-6 mm; rachilla narrowly winged. *Glumes* spiral, chartaceous, appressed, broadly ovate, obtuse, mucronulate, scarcely keeled, many-(up to 20)-nerved, fulvous-ferrugineous, 4-6 by 3-4½ mm. *Stamens* 3; anthers linear, (1½-)2-2½ mm. *Style* flat, broad, slightly dilated at the base, densely long-ciliate in the upper half, 3-3¾ mm; stigmas 2, shorter than the style. *Nut* biconvex, obovate, distinctly stipitate (gynophore obconical, ½-½ mm), not or hardly umbonulate, smooth, stramineous, (1-)1¼-1½ by ¼-1 mm, obscurely reticulate by the isodiametric epidermal cells.

Distr. From India to Micronesia and tropical Australia; widely distributed in *Malesia*: Sumatra (E. Coast Res.), Malay Peninsula (Setul, Perlis, Kedah, Selangor, Singapore), Java, Madura, Lesser Sunda Is. (Sumba, Port. Timor), N. Borneo (Labuan), Philippines (Palawan, Busuanga, Luzon, Guimara Is., Bohol, Mindanao), Celebes, New Guinea.

Ecol. Open grassy fields, damp heaths, sometimes in teak-forests and rice-fields, usually below 200 m, in Sumba at 500 m, in W. New Guinea up to 540 m.

Vern. *Tihe-tihe*, Sum. E.C., *komes bu-u*, Md.

Note. *F. subbispicata* NEES & MEY. ex NEES from Japan, Korea, Ryu Kyu Is., Formosa and China, and *F. pacifica* OHWI from Japan and Ryu Kyus are closely related to *F. tristachya*. Both were reduced to varieties of *F. tristachya* by KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 114.

48. *Fimbristylis schoenoides* (RETZ.) VAHL, En. 2 (1806) 286; KUNTH, En. 2 (1837) 222; STEUD. Syn. 2 (1855) 107; MIQ. Fl. Ind. Bat. 3 (1856) 315; BOECK. Linnaea 37 (1871) 5, *excl. var. β*; CLARKE, Fl. Br. Ind. 6 (1893) 634; Philip. J. Sc. 2 (1907) Bot. 92; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 90; KOORD. Exk. Fl. Java 1 (1911) 199; CAMUS, Fl. Gén. I.-C. 7 (1912) 99, f. 16, 1-2; MERR. En. Philip. 1 (1923) 125; RIDL. Fl. Mal. Pen. 5 (1925) 154; BACK. Onkr. Suiker. (1928) 159, *non t.* 165; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 23 p.p.; KERN in BACK & BAKH. f. Fl. Java 3 (1968) 465. — *Scirpus schoenoides* RETZ. Obs. 5 (1789) 14. — *Scirpus bispicatus* ROXB. Fl. Ind. 1 (1820) 223. — *Abildgaardia nervosa* PRESL, Rel. Haenk. 1 (1828) 180; STEUD. Syn. 2 (1855) 73. — *F. bispicata* NEES in Wight, Contr. (1834) 97; MIQ. Fl. Ind. Bat. 3 (1856) 317; BOECK. Linnaea 37 (1871) 6. — *Iriha schoenoides* O.K. Rev. Gen. Pl. 2 (1891) 752. — *Iriha bispicata* O.K. l.c. 753. — *F. longifolia* S. T. BLAKE, Un. Queensl. Papers, Dept Biol. I, 13 (1940) 9.

Glabrous perennial with short rhizome. *Stems* densely tufted, compressed, sulcate, smooth, often somewhat incrassate at the base, 10-45 cm by ½-1 mm. *Leaves* shorter than the stems, very narrow, with involute margins, abruptly acuminate, spinulose-scabrous on the margins in the upper part, greyish green or glaucescent, ⅔-1 mm wide; lower sheaths

stramineous or ferruginous; ligule a dense fringe of short hairs. *Inflorescence* consisting of a single terminal spikelet, or 1–2 lateral peduncled spikelets added, the 1–2 rays when present 1–2½ cm. Involucral bracts usually glume-like, the lowest sometimes leafy and up to 4 cm. *Spikelets* solitary, globose-ovoid or oblong-ovoid, terete, subacute, densely many-flowered, whitish ferruginous to fulvescent, 5–10 (ultimately up to 15) by 3–4 mm; rachilla narrowly winged. *Glumes* very regularly spiral, subchartaceous, appressed, very broadly ovate, usually somewhat broader than long, obtuse, mucous or apiculate, scarcely keeled, many-nerved almost over the whole breadth, 2½–3 by 3–3½ mm. *Stamens* 3; anthers oblong-linear, ¾ mm. *Style* flat, dilated at the base, ciliate in the upper half, 1¼–1½ mm; stigmas 2, much shorter than the style. *Nut* biconvex, obovate, distinctly stipitate (gynophore obconical, c. ¼ mm), umbonulate, smooth, at first whitish, brownish at maturity, 1¼–1½ by 1–1½/10 mm; epidermal cells minute, isodiametric.

*Distr.* From SE. Asia (India, Thailand, Indo-China, S. China, Formosa) to tropical Australia (Queensland); sparingly introduced in America, see SVENSON, N. Am. Fl. 18 (1957) 553; in *Malesia*: Sumatra, Malay Peninsula, Java, Kangean Arch., Madura, Lesser Sunda Is. (Tanimbar), W. and N. Borneo, Philippines (Palawan, Luzon).

*Ecol.* In open grasslands, fallow rice-fields, at low altitudes, up to 400 m.

*Uses.* Where in the Malay Peninsula it forms a fair proportion of the weeds of somewhat dry rice-fallows, it gets turned in at ploughing time to make green manure (BURKILL).

*Vern.* Philippines: *gumi-gumi*, Tag.

49. *Fimbristylis caesia* MIQ. Fl. Ind. Bat. 3 (1856) 315; KERN, Blumea 8 (1955) 134; in Back. & Bakh. f. Fl. Java 3 (1968) 465. — *F. subbispicata* NEES var. *caesia* CLARKE, Philip. J. Sc. 2 (1907) Bot. 92, *haud quoad specim. cit.* — *F. monostachya* (non HASSK.) BACK. Onkr. Suiker. (1928) t. 174. — Fig. 44.

Probably annual; glabrous. *Stems* tufted, obtusely compressed-trigonus, striate, smooth, 20–40 cm by ½–1 mm. *Leaves* much shorter than the stems, flat, obtuse, smooth except for the margins scabrid in the upper part, glaucous, 1–1¼ mm wide; sheaths pale green to cinnamonaceous, hardly keeled, ligule a dense fringe of short hairs. *Inflorescence* simple, with 1–3 spikelets, the lateral spikelet(s) shortly peduncled (peduncles up to 1 cm). Involucral bracts glume-like when the inflorescence consists of a single spikelet, always short, 3–10(–40) mm. *Spikelets* solitary, oblong-ovoid, terete, very acute, densely many-flowered, often contorted, pale stramineous, brownish variegated, 10–20 by 3–4 mm; rachilla narrowly winged. *Glumes* spiral, subtristichous, chartaceous, broadly ovate-deltoid, obtuse, mucronulate, hardly keeled, many-nerved, with broad hyaline margins, glabrous, 4½–5 by 4 mm. *Stamens* 3; anthers linear, 1 mm. *Style* flat, slightly dilated at the base, ciliate in the upper half, c. 2 by ¼ mm; stigmas 2, much shorter than the style. *Nut* biconvex, obovate-elliptic, smooth, long-stipitate (gynophore ¾ mm), stramineous, 1½–2 by 1½–1⅓ mm, the apex emarginate by the c. ½ mm wide style-scar; epidermal cells minute, isodiametric.

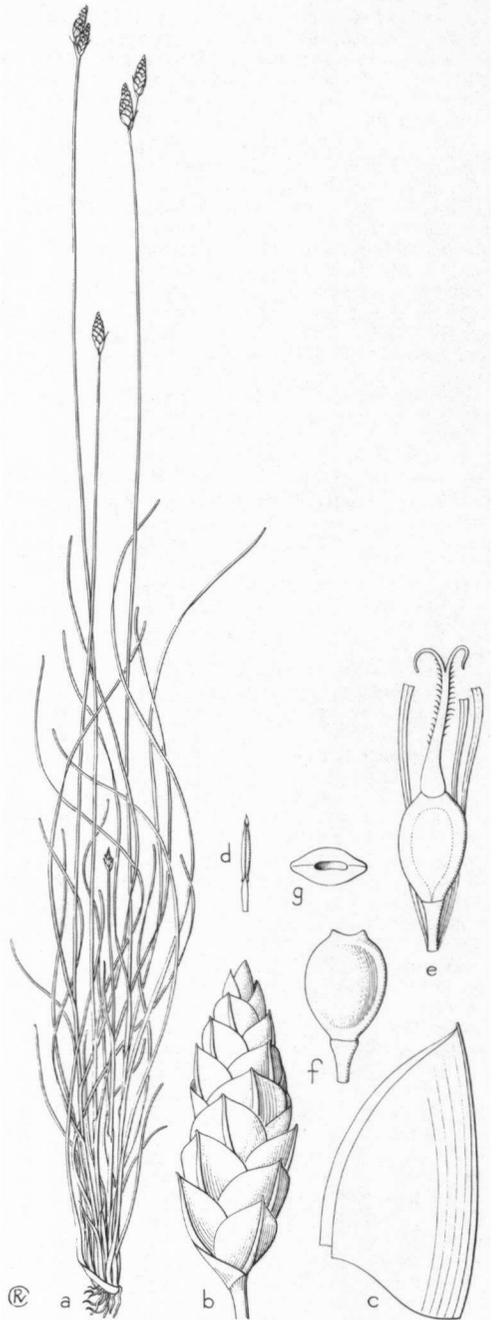


Fig. 44. *Fimbristylis caesia* MIQ. a. Habit,  $\times \frac{1}{2}$ , b. spikelet,  $\times 5$ , c. glume d. stamen, e. deflorate flower, f. nut, g. ditto from top, all  $\times 10$  (a–g JUNGHUHN 532).

Distr. *Malesia*: W.-E. Java, Philippines (Luzon). Apparently very rare.

Ecol. In grassy fields, margins of rice-fields, among grasses on dry road-sides, in brushwood, also on heavy brackish moist clay, at low altitudes, up to 600 m.

Note. This well-characterized species was neglected or misunderstood since MIQUEL published it.

**50. *Fimbristylis subalata* KERN**, *Blumea* 8 (1955) 133, f. 2; *Reinwardtia* 6 (1961) 46. — *F. alata* CAMUS, *Not. Syst.* 1 (1910) 244 p.p.; *Fl. Gén. I.-C.* 7 (1912) 94 p.p.

Glabrous perennial with horizontal, shortly creeping, up to 4 cm long, woody rhizome clothed with ovate, striate, fuscous sheaths. *Stems* approximate, uniseriate on the rhizome, very slender, obtusely trigonous, striate-sulcate, smooth, 50–65 cm by 1 mm. *Leaves* few (c. 2) to the stem, somewhat shorter than the stems, rigid, erect, filiform, with inrolled margins, acute, smooth, or scabrid at the very top,  $\frac{1}{2}$ – $\frac{3}{4}$  mm wide; ligule short, membranous. *Inflorescence* consisting of a single terminal spikelet. *Spikelet* erect, ellipsoid or oblong-ellipsoid, terete, acute, many-flowered, ferruginous, 15–35 by 4–5 mm; rachilla narrowly winged. *Glumes* spiral,

chartaceous, appressed, ovate, obtuse, muticous or inconspicuously apiculate, scarcely keeled, with strong midnerve and about 10 less prominent nerves on either side, hyaline-margined in the upper part, 6–7 by  $4\frac{1}{2}$ –5 mm. *Stamens* 3; anthers linear,  $2\frac{1}{2}$ –3 mm. *Style* flat, slightly dilated at the base, fimbriate-ciliate in the upper half,  $3\frac{1}{2}$ –4 by  $\frac{1}{2}$  mm; stigmas 2, shorter than the style. *Ovary* in the upper half with thinly membranous, transversely striate wings. *Nut* biconvex, obovate, conspicuously stipitate (gynophore  $\frac{1}{2}$ – $\frac{3}{4}$  mm), emarginate at the top by the  $\frac{3}{5}$ – $\frac{4}{5}$  mm broad style-scar, whitish, c. 2 by  $1\frac{1}{2}$ – $1\frac{2}{3}$  mm; epidermal cells minute, isodiametric; wings of the ovary indurate in the mature nuts and only discernible by their transverse striation different from the reticulation of the nut proper.

Distr. Peninsular Thailand, Cochinchina, Cambodia; in *Malesia*: New Guinea (Papua: Lake Daviumbu, Middle Fly R.).

Ecol. In savannahs, in small wiry tufts on wet grassy plains, at low altitudes.

Note. Closely allied to *F. alata* CAMUS from Laos, which is an annual with spikelets 3 mm wide, glumes 4 mm long and wide, a glabrous style 2 mm long, anthers  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm long, and nuts broadly winged even when mature.

### 11. Section *Fimbristylis*

*Fimbristylis* sect. *Eufimbristylis* BOECK. *Linnaea* 37 (1871) 3. — *Fimbristylis* sect. *Dichotomae* OHWI, *J. Jap. Bot.* 14 (1938) 573. — *Fimbristylis* ser. *Dichotomae* OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B18 (1944) 55.

Type species: *F. dichotoma* (L.) VAHL (*Scirpus dichotomus* L.).

**51. *Fimbristylis dichotoma* (L.) VAHL**, *En.* 2 (1806) 287, excl. var.; HASSK. *Pl. Jav. Rar.* (1848) 64; FISCHER, *Kew Bull.* (1935) 150; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 213; KOYAMA, *Contr. Inst. Bot. Un. Montréal n.* 70 (1957) 39; *J. Fac. Sc. Un. Tokyo III*, 8 (1961) 111; KERN in *Back. & Bakh. f. Fl. Java* 3 (1968) 466. — *Scirpus dichotomus* LINNÉ, *Sp. Pl.* (1753) 50. — *Scirpus diphyllus* RETZ. *Obs.* 5 (1789) 15. — *F. diphylla* VAHL, *En.* 2 (1806) 289; STEUD. *Syn.* 2 (1855) 116; BENTH. *Fl. Austr.* 7 (1878) 311; CLARKE, *Fl. Br. Ind.* 6 (1893) 636, excl. var. *pluri-striata* CLARKE; Philip. *J. Sc.* 2 (1907) Bot. 93; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 91; CLARKE, *Ill. Cyp.* (1909) t. 42 f. 1–2; KOORD. *Exk. Fl. Java* 1 (1911) 199; *ibid.* 4, *Atlas* (1922) f. 253; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 103; BROWN, *Min. Prod. Philip. For.* 1 (1920) 348; RIDL. *Fl. Mal. Pen.* 5 (1925) 155. — *F. annua* (non R. & S.) MERR. *En. Philip.* 1 (1923) 121; KÜCK. *Bot. Jahrb.* 59 (1924) 47; BACK. *Onkr. Suiker.* (1928) 160, t. 166; BERN. *Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 21. — *F. pilosa* (non VAHL) PRESL, *Rel. Haenk.* 1 (1828) 191, cf. MERR. *Philip. J. Sc.* 35 (1928) 5. — *F. affinis* PRESL, *l.c.*; F.-VILL. *Nov. App.* (1882) 308. — *F. communis* KUNTH, *En.* 2 (1837) 234; MIQ. *Fl. Ind. Bat.* 3 (1856) 323. — ? *Scirpus falcatus* LLANOS, *Fragm. Pl. Filip.* (1851) 20; MERR. *Sp. Blanc.* (1918) 83. — ? *F. brizoides* SM. var. NEES in Hook. *J. Bot. Kew Misc.* 6 (1854) 28. — *F. philippica* STEUD. *Syn.*

2 (1855) 116; MIQ. *Fl. Ind. Bat.* 3 (1856) 324; F.-VILL. *Nov. App.* (1882) 308. — *F. calocarpa* STEUD. *l.c.* 117; MIQ. *l.c.* 325. — *F. ambigua* STEUD. *l.c.* 117; MIQ. *l.c.* 323. — *F. circinnata* STEUD. *l.c.* 116; MIQ. *l.c.* 324. — *F. squarrosa* (non VAHL) MIQ. *l.c.* 319. — *F. polymorpha* BOECK. *Linnaea* 37 (1871) 14; SCHEFF. *Nat. Tijd. N. I.* 34 (1874) 56. — *F. novae-britanniae* BOECK. *Bot. Jahrb.* 5 (1884) 93. — *F. communis* var. *gracillima* RIDL. in *Forbes, Nat. Wand.* (1885) 521. — *Iriha polymorpha* O.K. *Rev. Gen. Pl.* 2 (1891) 752. — *F. longispica* (non STEUD.) CLARKE, *Fl. Br. Ind.* 6 (1893) 639; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 93; *Fl. Mal. Pen.* 5 (1925) 156 p.p. — *F. germanii* CAMUS, *Not. Syst.* 1 (1910) 246; *Fl. Gén. I.-C.* 7 (1912) 105. — *F. annua* var. *diphylla* KÜCK. *Act. Hort. Got.* 5 (1929) 109; *Bot. Jahrb.* 59 (1924) 47. — *F. ramosii* KÜCK. *Mitt. Thür. Bot. Ver. N.F.* 50 (1943) 10.

Annual, or perennial with very short rhizome. *Stems* slender to rather stout, tufted, angular, compressed especially below the inflorescence, striate, glabrous or pilose, smooth, 10–75(–100) cm by 1–2 mm. *Leaves* basal, from much shorter than to about as long as the stems, weak or rigid, flat, abruptly acuminate, glabrous or more or less pubescent, scabrid on the margins in the upper part, green or glaucous,  $1\frac{1}{2}$ –5 mm wide; ligule a dense fringe of short hairs. *Inflorescence* simple to decomposed, loose or dense, with few to numerous spikelets,

up to 20 cm long. Involucral bracts 2-5, much shorter to somewhat longer than the inflorescence. Primary rays obliquely patent, smooth, glabrous or pilose, up to 10 cm. *Spikelets* solitary or more or less aggregated, ovoid or oblong-ovoid, terete, acute, densely many-flowered, rufous, fuscous, or castaneous, 5-10(-20) by  $2\frac{1}{2}$ -3(-5) mm; rachilla narrowly winged. *Glumes* spiral, chartaceous, very broadly ovate to oblong-ovate, obtuse, often mucronulate, scarcely keeled, glabrous, sometimes minutely ciliate at the upper edge, with 3-nerved, green keel and obscurely few-nerved sides, 2-3(- $4\frac{1}{2}$ ) mm long. *Stamens* 1-3; anthers oblong or linear,  $\frac{1}{2}$ -1(- $1\frac{3}{4}$ ) mm. *Style* flat, broad, hyaline-margined, slightly dilated at the base, ciliate at least in the upper half, 2-2 $\frac{1}{2}$ (-4) mm; stigmas 2, somewhat shorter than the style. *Nut* biconvex, obovate or broadly obovate, shortly stipitate, umbonulate, smooth, more rarely sparsely verruculose, conspicuously trabeculate by 5-10 (rarely some more) longitudinal ribs on either face and numerous cross-bars, glistening white to stramineous, rarely brown, 1-1 $\frac{1}{4}$  by  $\frac{3}{4}$ -1 mm; epidermal cells transversely elliptic to oblong.

*Distr.* All warmer parts of the whole world, one of the most widely distributed species; very common in S. and E. Asia and throughout *Malesia*.

*Ecol.* Open waste places, grassy road-sides, *Imperata*-fields, tea-plantations, teak-forests, more rarely in swamps; when growing abundantly often a troublesome weed difficult to eradicate completely, 0-1500(-1750) m.

*Uses.* The leaves furnish a rather large quantity of forage with sufficient food-value. In the Philippines the stems are used for matting, but they are inferior to those of *F. globulosa*.

*Vern.* *Tjikukok*, *Atjeh*, *tihe-tihe*, *tihe solar*, *si marburi tano*, *imbulu tano*, Sum. E.C., *gujan kambang*, *djanggut kambang*, *ikal-ikal*, S. Sum., *rumpit injep*, *Banka*, *rumpit purun batu*, *r. parâh*, *r. kâpala lalat*, Mal. Pen., *djuduluk*, *djampang muta*, *bulu mata munding*, *djukut mata munding*, *dodombaân*, S, *sukêt kodokan*, *komis*, J, *rheba komês*, *komis bungkol*, Md, *burun*, *Borneo*, *werot intalun*, *Minah.*, *tentarilomé*, *Talau*, *fajoa*, *Sulu Is.*, *mentembu*, *emsumi*, *Jappen-Biak*; *New Guinea*: *balimbuli*, NE. *New Guinea*, *kikisanki*, *Wapi*, *tumbu*, *Enga*; *Philippines*: *baliôtas*, *talágig*, *Bag.*, *bubáging*, *gílal*, *Sub.*, *tabtábin*, *tayok-tayok*, *Sbl.*, and many others.

*Notes.* An exceedingly polymorphous species, burdened with hundreds of synonyms. Now the stems are filiform, then again rather robust; stems, leaf-blades, sheaths, and rays of the inflorescence are normally glabrous, but frequently long-hairy; the inflorescence may be widely branched with some hundred spikelets, or reduced to a few spikelets or a single one; size of the glumes, number of stamens, shape of the fruit, etc. are variable. An attempt to disentangle this polymorphism was given by Koyama, *Contr. Inst. Bot. Ün. Montréal n. 70 (1957) 40*.

*F. ramosii* KÜK., based on a very young collection (RAMOS BS 7816 from Manila), is merely a hairy form of *F. dichotoma*. There is no close affinity to *F. ferruginea*, with which KÜENTHAL compares it.

RIDLEY'S '*F. longispica* STEUD.' is a remarkable, coarse plant from the sandy sea-shore. Similar plants occur in Cochinchina (e.g. CLEMENS 3046 from the sandy sea-shore near Tourane). The stems are stout, up to 80 cm by 2 mm, the rigid leaves 3-4 mm

wide, the involucral bracts short, the relatively few (c. 20) spikelets 4-5 mm wide, the glumes up to  $4\frac{1}{2}$  mm long, the style 3-4 mm, the anthers 1-1 $\frac{3}{4}$  mm, with the connective distinctly produced and often somewhat bristly at the top. It is quite distinct from E. Asian *F. longispica* STEUD., but may represent a well-distinct race of *F. dichotoma*.

An eastern race of *F. dichotoma* is *F. depauperata* R. BR., see below:

*ssp. dichotoma.* — Perennial. *Inflorescence* usually compound or decomposed with many to numerous spikelets. *Glumes* ovate or oblong-ovate, not ciliate; cells in the upper part of the glumes oblong-linear. *Anthers* linear, c. 1(- $1\frac{3}{4}$ ) mm. *Style* ... mm long. Stems, leaves and bracts sometimes stiffly hairy.

*Synonymy, distribution and ecology* as above.

*ssp. depauperata* (R. BR.) KERN, *stat. nov.* — *F. depauperata* R. BR. *Prod.* (1810) 227; KUNTH, *En.* 2 (1827) 227; STEUD. *Syn.* 2 (1855) 120; BENTH. *Fl. Austr.* 7 (1878) 311; DOMIN, *Bibl. Bot.*, Heft 85 (1915) 455; S. T. BLAKE, *Contr. Queensl. Herb.* 8 (1969) 8. — *F. spirostachya* F. V. M. ex BENTH. *Fl. Austr.* 7 (1878) 311. — *F. diphylla* var. *depauperata* CLARKE, *Fl. Br. Ind.* 6 (1893) 637. — *F. diphylla* var. *spirostachya* CLARKE, *l.c.* — *F. annua* (non R. & S.) S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 212-214.

*Annual.* *Inflorescence* simple or compound, with few to several spikelets; spikelets pale brown, turgid. *Glumes* very broadly ovate, broader than long, often minutely ciliate at the upper edges; cells in the upper part of the glume nearly square. *Anthers* oblong,  $\frac{1}{2}$ - $\frac{3}{4}$  mm. *Style* short and broad,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by c.  $\frac{1}{4}$  mm. Stems, leaves, bracts, and rays of the inflorescence often softly hairy.

*Distr.* Australia (N. Australia, Queensland), Micronesia; in *Malesia*: only in the extreme SE. part of the Archipelago and here much rarer than *ssp. dichotoma*: Lesser Sunda Is. (Timor), S. Moluccas (Tanimbar Is.: P. Jamdena), New Guinea.

*Ecol.* Wet grasslands, savannahs, *Melaleuca*-forests, at low altitudes.

*Notes.* By habit, shape of style, pubescence, etc. reminding one of *F. tomentosa* VAHL, but in the latter the nut is seated on a conspicuous gynophore, not strikingly longitudinally ribbed, and with epidermal cells in numerous rows.

S. T. BLAKE, *l.c.*, treats *F. depauperata* R. BR. (as *F. annua* R. & S.) as specifically distinct from *F. dichotoma*. To my mind it is rather a geographical race not identical with the European *F. annua* (ALL.) R. & S. The latter differs by the ovate glumes with different structure of the composing cells, the slender style half as broad as that of *F. dichotoma ssp. depauperata*, and is always a dwarf, subglabrous plant.

The North American *F. baldwiniana* (SCHULT.) TORR. is also a closely related annual. Both *F. annua* and *F. baldwiniana* may better be treated as races of *F. dichotoma* s.l.

52. *Fimbristylis tomentosa* VAHL, *En.* 2 (1806) 290; S. T. BLAKE, *Contr. Queensl. Herb.* 8 (1969) 13. — *F. affinis* PRESL, *Rel. Haenk.* 1 (1828) 191. — *F. podocarpa* NEES & MEY. ex NEES in WIGHT, *Contr.* (1834) 98, *p.p. typ.*; *Nov. Act. Ac. Caes. Leop.-Car.* 19

Suppl. 1 (1843) 77 p.p.; STEUD. Syn. 2 (1855) 117; CLARKE, Fl. Br. Ind. 6 (1893) 638; Philip. J. Sc. 2 (1907) Bot. 94; Ill. Cyp. (1909) t. 42 f. 5-6; KOORD. Exk. Fl. Java 1 (1911) 199; CAMUS, Fl. Gén. 1.-C. 7 (1912) 107; MERR. En. Philip. 1 (1923) 125; KERN, Blumea 8 (1955) 139; in Back. & Bakh. f. Fl. Java 3 (1968) 466. — *F. cincta* NEES in Wight, Contr. (1834) 98. — *F. squarrosa* (non VAHL) ZOLL. Syst. Verz. 1 (1854) 61 p.p. (*specim. glaucescentia*). — *F. subtristachya* STEUD. Syn. 2 (1855) 109. — *F. diphylla* var. *pluristriata* CLARKE, Fl. Br. Ind. 6 (1893) 637; Ill. Cyp. (1909) t. 42 f. 3-4; CHERM. in Humb. Fl. Madag., fam. 29 (1937) 179. — *F. diphylla* (non VAHL) K.SCH. & LAUT. Fl. Schutzgeb. (1900) 196 (*quoad* LAUTERBACH 348). — *F. annua* var. *podocarpa* KÜK. Bot. Jahrb. 59 (1924) 5, 48. — *F. schoenoides* (non VAHL) BACK. Onkr. Suiker. (1928) 1, 165, non p. 159. — *F. diphylla* var. *podocarpa* KÜK. Bot. Jahrb. 69 (1938) 257. — *F. pluristriata* BERH. Bull. Soc. Bot. Fr. 101 (1955) 376. — *F. dichotoma* ssp. *podocarpa* KOYAMA, Micronesica 1 (1964) 87. — Fig. 45.

Annual with fibrous roots. *Stems* tufted, angular, compressed just below the inflorescence, smooth, 40-60 cm by  $\frac{1}{2}$ -1 mm. *Leaves* shorter than to about as long as the stems, flat, abruptly acuminate, softly hairy, rarely glabrous, scabrid on the margins in the upper part, 2-3 mm wide; ligule a fringe of short hairs. *Inflorescence* simple or compound, loose, with 5-25 spikelets, very rarely reduced to a single spikelet, up to 8 cm long. *Involucral bracts* up to 5, the longest overtopping the inflorescence, up to 10 cm. *Primary rays* obliquely erect, compressed, glabrous and smooth, the longest 2-4 cm. *Spikelets* solitary, ovoid or oblong-ovoid, rarely oblong, terete, acute, densely many-flowered, brown, 5-10(-15) by  $(2\frac{1}{2}$ -)3-4 mm; rachilla narrowly winged. *Glumes* spiral, chartaceous, appressed, broadly ovate or orbicular, mucronulate, scarcely keeled, with strong midnerve and nerveless or faintly nerved sides, hyaline-margined, glabrous or with some soft hairs on the midnerve,  $\frac{3}{4}$ - $3\frac{1}{2}$  mm long and wide. *Stamens* (1-2); anthers oblong-linear,  $\frac{1}{4}$ -1 mm. *Style* flat, short and broad, hyaline-margined, gradually but slightly dilated towards the base, ciliate in the upper  $\frac{2}{3}$ - $\frac{3}{4}$ ,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by  $\frac{1}{4}$ - $\frac{1}{2}$  mm; stigmas 2, shorter than the style. *Nut* biconvex, broadly elliptic to orbicular, prominently stipitate (the gynophore obpyramidal, often somewhat saucer-shaped,  $\frac{1}{2}$ - $\frac{1}{2}$  mm long and wide), umbonulate, sometimes tuberculate, especially towards the obtuse, thickened edges, at first white, finally stramineous,  $1\frac{1}{10}$ - $1\frac{1}{2}$  by  $\frac{1}{10}$ - $1\frac{1}{3}$  mm, reticulate by the impressed epidermal cells superposed in 16-24 vertical rows on either face.

*Distr.* Tropical Africa, Madagascar, Mauritius; from India through Farther India to S. China, Ryu Kyu Is., Micronesia and Queensland (Cape York Peninsula); widely distributed in *Malesia*, but much rarer than *F. dichotoma*: Malay Peninsula (a single collection from Pahang), W. Sumatra, W. Java (Tjikoya, Cheribon), E. Java (Madiun), Kangean Arch., Lesser Sunda Is. (Alor), Philippines (Luzon, Leyte, Bohol, Panay), N. Celebes (Tondano), Molucas (Halmaheira), New Guinea, New Britain.

*Ecol.* In open places or in light shade: moist grasslands, grassy road-sides, in and along rice-fields, forest-clearings, at low altitudes (usually below 200 m, in W. Sumatra at 600 m); in Khasia up to 1200 m.

Vern. *Mâtequila*, Alor (probably for several *Cyperaceae*; see *F. microcarpa*).

*Notes.* I fail to distinguish between the specimens rightly named by CLARKE *F. podocarpa* NEES and those he referred to his var. *pluristriata* of *F. diphylla*. I consider them conspecific.

*F. cincta* NEES from Mauritius differs from *F. tomentosa* only in some minor points (see WIGHT, Contr.). *F. pluristriata* (C. B. CLARKE) BERH. and *F. subtristachya* STEUD. are superfluous names for the African plant, which to my mind cannot be separated specifically from *F. tomentosa*.

### 53. *Fimbristylis lineatisquama* OHWI, Blumea 8 (1955) 109, f. 10.

Perennial with short rhizome. *Stems* tufted, compressed-trigonal, striate, glabrous or sparsely soft-hairy, few-leaved at the base, 30-40 cm by  $\frac{1}{2}$ -1 mm. *Leaves* half as long as the stems, rather stiff, curved, flat, rather abruptly acuminate, densely hairy in the lower part, scabrid on the margins,  $1\frac{1}{2}$ -2 mm wide; sheaths pale, densely hairy in the upper part; ligule a dense fringe of hairs. *Inflorescence* simple or compound, loose, with 4-10 spikelets, 2-5 cm long. *Involucral bracts* up to 5, the lowest shorter than to as long as the inflorescence. *Primary rays* few, compressed, smooth and glabrous, 2-4 cm. *Spikelets* solitary, oblong-ovoid, terete, acute, many-flowered, 7-10 (ultimately up to 14) by  $2\frac{1}{2}$ -3 mm; rachilla narrowly winged. *Glumes* spiral, membranous, oblong-ovate, rather acute, apiculate or mucronulate, scarcely keeled, glabrous, distinctly many-nerved almost over the whole breadth, brown, 3-4 $\frac{1}{2}$  by  $1\frac{1}{2}$ -3 mm. *Stamens* 3; anthers linear,  $1\frac{1}{2}$ - $1\frac{3}{4}$  mm, with distinctly  $\gamma$ -oduced, papillose-setulose appendage of the connective. *Style* flat, rather broad, slightly dilated at the base, densely ciliate in the upper half, 2-2 $\frac{1}{2}$  mm; stigmas 2, about as long as the style. *Nut* turbidly biconvex, with obtuse edges, oblong-obovate, broadly stipitate, umbonulate, reticulate by the roundish or transversely elliptic, slightly impressed epidermal cells superposed in 12-16 vertical rows on either face, greyish brown,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by  $\frac{1}{10}$ - $\frac{9}{10}$  mm.

*Distr. Malesia:* Philippines (Sulu Is.: Golo). With certainty only known from the type-collection (MERRILL 11546); a poor collection from Luzon (Benguet Subprov., Pauai: CLEMENS 9145) may belong here.

*Notes.* The description of *F. urakasiana* KÜK. Bot. Jahrb. 59 (1924) 5, based on a collection from the Mariannas, Urakas Island (GIBBON 1158, not seen), agrees very well with that of *F. lineatisquama*, so that I presume that the former name is the correct one for this species.

According to KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 113, *F. urakasiana* is conspecific with *F. boninensis* HAYATA, Ic. Pl. Form. 6 (1916) 109, f. 27 [*F. longispica* STEUD. var. *boninensis* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 80. — *F. dichotoma* ssp. *longispica* KOYAMA var. *boninensis* KOYAMA, l.c.], but this is very unlikely, as *F. boninensis* is a plant with contracted, head-like inflorescence, glabrous leaves, and broad, obtriangular-obovate nuts. *F. boninensis* is recorded for the Philippines: Batan Island, on the littoral cliff on the eastern foot of Mt Iraya, frequent: HATUSIMA



Fig. 45. *Fimbristylis tomentosa* VAHL. a. Habit,  $\times \frac{1}{2}$ , b. spikelet,  $\times 5$ , c. glume, d. anther, e. nut with persistent filaments and style, all  $\times 10$ , f. outer cells of nut strongly enlarged (a-f BACKER 27124).

28713 (not seen). See Mem. Fac. Agric. Kagoshima Un. V, 3 (1966) 60.

In shape and texture of the nuts and in the setulose top of the connective *F. lineatisquama* shows much affinity to *F. trichophylla*. It can be distinguished by the long-ciliate ligule and the longer, more distinctly nerved glumes. The delimitation against *F. trichophylla* and *F. tomentosa* requires further investigation.

**54. *Fimbristylis bisumbellata* (FORSK.) BUB.** Dodec. (1850) 30; FISCHER, Kew Bull. (1935) 149; Fl. Madr. 11 (1936) 1898, in corrig.; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 85; KERN, Blumea 8 (1955) 135; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 113; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 466. — *Scirpus bisumbellata* FORSK. Fl. Aeg.-Arab. 1 (1775) 15. — *Scirpus dichotomus* (non L.) ROTTB. Descr. & Ic. (1786) 57, t. 13 f. 1. — *F. dichotoma* var. *villosa* VAHL, En. 2 (1806) 287. — *F. dichotoma* (non VAHL) KUNTH, En. 2 (1837) 225; BOECK. Linnaea 37 (1871) 12 p.p.; MIO. Fl. Ind. Bat. 3 (1856) 319; BENTH. Fl. Austr. 7 (1878) 310; CLARKE, Fl. Br. Ind. 6 (1893) 635; Philip. J. Sc. 2 (1907) Bot. 93; KOORD. Exk. Fl. Java 1 (1911) 199; CAMUS, Fl. Gén. I.-C. 7 (1912) 102 p.p. — *Scirpus pallescens* ROXB. Fl. Ind. 1 (1820) 229. — *F. pallescens* NEES in Wight, Contr. (1834) 101; STEUD. Syn. 2 (1855) 111. — *Iriha bisumbellata* O.K. Rev. Gen. Pl. 2 (1891) 752.

Annual with fibrous roots. *Stems* slender, densely tufted, trigonous, smooth, 7–25 cm by  $\frac{1}{2}$ –1 mm. *Leaves* shorter to somewhat longer than the stems, flat, abruptly acuminate, glabrous or pubescent beneath, scabrid on the margins in the upper part, 1–2 mm wide; sheaths membranous, stramineous or ferruginous; ligule a dense fringe of short hairs. *Inflorescence* compound or decompound, loose, with many spikelets, 2–6 cm across. *Involucral bracts* 2–3, suberect, the lowest as long as or overtopping the inflorescence. *Primary rays* 5–10, slender, smooth, 1–3 cm. *Spikelets* solitary, oblong-ovoid to narrowly oblong, angular, acute, 3–8 by c.  $1\frac{1}{2}$  mm; rachilla narrowly winged. *Glumes* spiral, membranous, glabrous, broadly ovate, acute, mucronulate, sharply keeled, with 3-nerved, green keel, brownish, lineolate-punctulate sides, and hyaline margins, c.  $1\frac{1}{2}$  by  $1\frac{1}{4}$  mm. *Stamen* 1; anther oblong,  $\frac{1}{2}$  mm. *Style* slender, flat, with dilated base, ciliate in the upper half,  $\frac{3}{4}$ –1 mm; stigmas 2, somewhat shorter than the style. *Nut* biconvex, broadly obovate or obovate, shortly stipitate, umbonulate, conspicuously trabeculate, stramineous,  $\frac{3}{5}$ – $\frac{7}{10}$  by  $\frac{2}{5}$ – $\frac{1}{2}$  mm; epidermal cells impressed, transversely oblong, in 5–9 vertical rows on either face.

Distr. From the Mediterranean region through the Old World Tropics to Australia (N.S. Wales); in *Malesia* with certainty only known from E. Java (Modjokerto, along Brantas R.) and the Philippines (Luzon).

There are also specimens in the Florence Herbarium from "Java, LABILLARDIÈRE", and in the British Museum from "Malaya; probably Borneo, LOBB" without precise localities.

Ecol. Along rivers, on sandy river bars; in India a common weed of the rice-fields.

Note. MERRILL merged the Philippine collections into *F. dichotoma* (L.) VAHL (as *F. annua* R. & S.), but it is one of the best characterized species of the

difficult group, readily distinguishable by its angular spikelets and membranous, acutely keeled, mucronulate glumes.

**55. *Fimbristylis merrillii* KERN,** Blumea 8 (1955) 135, f. 6; in Back. & Bakh. f. Fl. Java 3 (1968) 466. — *F. squarrosa* (non VAHL) MERR. En. Philip. 1 (1923) 126 p.p. (quoad BS 26093). — *F. annua* var. *gracilis* BACK. Onkr. Suiker. (1928) 160 p.p.; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 21 p.p.

Annual with fibrous roots. *Stems* tufted, compressed-trigonous, smooth, often slightly pubescent at the top, leafy at the base, (2–)15–30(–40) cm by  $\frac{1}{2}$ –1 mm. *Leaves*  $\frac{1}{2}$ – $\frac{2}{3}$  as long as the stems, often curved, flat, rather abruptly acuminate, glabrous, or pubescent beneath, often ciliate on the margins, scabrid in the upper part, 1–2 mm wide; ligule a dense fringe of short hairs. *Inflorescence* simple or compound, loose, diffuse, with several spikelets but sometimes reduced to a single spikelet, up to 5(–10) cm long and wide. *Involucral bracts* 1–3, shorter than the inflorescence, often ciliate-puberulous at the dilated base, 1–3(–6) cm long. *Primary rays* up to 8, obliquely patent, glabrous and smooth, 1–4(–8) cm. *Spikelets* solitary, ovoid or oblong-ovoid, terete, acute, densely few- to several-flowered, 3–5(–7) by  $1\frac{1}{2}$ –2 mm; rachilla narrowly winged. *Glumes* spiral, appressed, subchartaceous, broadly ovate, rather acute, mucicous or apiculate, slightly keeled, glabrous, with 3-nerved keel, nerveless shining rufous sides, and hardly hyaline margins, ( $1\frac{1}{3}$ –)1 $\frac{1}{2}$ –2 by c.  $1\frac{1}{2}$  mm. *Stamens* 1(–2); anthers oblong,  $\frac{1}{3}$ – $\frac{1}{2}$  mm. *Style* slender, flat, not or hardly hyaline-margined, glabrous or with 1–4 short cilia at the very top,  $\frac{3}{4}$ –1 mm; stigmas 2, shorter than the style. *Nut* biconvex, obovate or broadly obovate, shortly stipitate, minutely umbonulate, sometimes sparsely verruculose, conspicuously trabeculate by the impressed, transversely oblong epidermal cells in 5(–6(–9) vertical rows on either face,  $\frac{3}{5}$ – $\frac{3}{4}$ (– $\frac{9}{10}$ ) by  $\frac{1}{2}$ – $\frac{7}{10}$  mm.

Distr. SE. Thailand, S. China, Queensland (Cape York Peninsula); in *Malesia*: N. Sumatra (Atjeh: Ketol Valley), throughout Java, Kangean Arch., Madura, Tanimbar Is., Philippines (Luzon, Panay, Mindanao), Celebes, New Guinea (Papua).

Ecol. In swamps, wet rice-fields, grass-fields, teak-forests, at low altitudes (0–300 m), in Atjeh at 800–1000 m.

**56. *Fimbristylis tenuinervia* KERN,** Blumea 8 (1955) 137, f. 7; *ibid.* 13 (1965) 121. — *F. diphylla* VAHL f. *malasica* CLARKE in sched.

Probably annual. *Stems* densely tufted, very slender, obtusely trigonous, somewhat compressed, striate-sulcate, glabrous and smooth, leafy at the base, 15–35(–75) cm by c.  $\frac{1}{2}$  mm. *Leaves* somewhat shorter than to about as long as the stems, almost filiform, often with inrolled margins, acute, glabrous, or slightly puberulous on the sheaths, scabrid towards the apex, 1–1 $\frac{1}{2}$  mm wide; ligule a fringe of short hairs. *Inflorescence* simple or compound, very loose, with (3–)10–35 spikelets, (2–)3–8 cm long. *Involucral bracts* 3–5, erecto-patent, scariously-margined at the dilated base, glabrous or ciliolate, the lowest overtopping the inflorescence, up to 10 cm. *Primary rays* 5–7, very slender, erecto-patent, compressed, glabrous and smooth, the longest up to 4 cm. *Spikelets*

solitary, oblong-lanceolate, terete, very acute, densely many-flowered, 4–5 by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm; rachilla narrowly winged. *Glumes* spiral, appressed, chartaceous, glabrous, broadly ovate, apiculate, scarcely keeled, with prominent midnerve, faintly 5–8-nerved sides, and hyaline margins, shining brown in the apical part, much paler below,  $2\frac{1}{4}$ – $2\frac{3}{4}$  by  $2$ – $2\frac{1}{2}$  mm. *Stamens* (2–)3; anthers linear, (1–) $1\frac{1}{2}$  mm. *Style* slender, flat, not hyaline-margined, hardly dilated at the base, ciliate in the upper half,  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm; stigmas 2, shorter than the style. *Nut* biconvex, narrowly obovate, shortly stipitate, umbonulate, trabeculate by 4–6 longitudinal ribs and numerous cross-bars, smooth, stramineous,  $\frac{7}{10}$ – $\frac{9}{10}$  by  $\frac{1}{2}$ – $\frac{3}{4}$  mm; epidermal cells impressed, transversely oblong-linear.

Distr. Insufficiently known; *Malesia*: Philippines (Central Luzon), NE. New Guinea (Sepik Distr.).

Ecol. Grassy road-sides, moist meadows, growing in dense mats.

57. *Fimbristylis perlaxa* OHWI, *Blumea* 8 (1955) 101, f. 3.

Annual with fibrous roots. *Stems* very slender, tufted, compressed, obtusely trigonous, smooth, 30–50 cm by  $\frac{1}{4}$ –1 mm. *Leaves* in the lower  $\frac{1}{4}$ – $\frac{1}{2}$  of the stem,  $\frac{1}{2}$ – $\frac{1}{3}$  as long as the latter, weak, flat, shortly acuminate to very acute, glabrous above, more or less pubescent beneath and on the pale green sheaths,  $\frac{1}{2}$ – $1\frac{1}{2}$  mm wide; ligule a dense fringe of hairs. *Inflorescence* compound, very loose, with c. 10–20 spikelets, 8–15 cm long. *Involucral bracts* erect, pubescent beneath, the lowest somewhat shorter than to about as long as the inflorescence. *Primary rays* very slender, suberect, compressed, glabrous and smooth, 4–6 cm. *Spikelets* solitary, long-peduncled, oblong-ovoid, slightly angular, very acute, densely many-flowered, light brown, 6–8 by 2 mm; rachilla very narrowly winged. *Glumes* spiral, membranous, appressed, ovate, mucronulate, slightly keeled, glabrous, with 3-nerved keel, obsoletely 1–2-nerved sides and scarcely hyaline margins,  $2$ – $2\frac{1}{2}$  by  $1\frac{1}{2}$  mm. *Stamens* 2; anthers oblong,  $\frac{1}{2}$ – $\frac{2}{3}$  mm. *Style* slender, flat, not hyaline-margined, slightly dilated at the base, sparsely ciliate at the top, 1 mm; stigmas 2, shorter than the style. *Nut* biconvex with acutish edges, broadly elliptic or suborbicular, shortly stipitate, umbonulate, finely cancellate by the roundish or transversely elliptic, slightly impressed epidermal cells in 15–18 vertical rows on either face, shining, stramineous or brownish,  $\frac{3}{4}$ – $\frac{7}{8}$  by  $\frac{1}{2}$  mm.

Distr. *Malesia*: Moluccas (Ceram), New Guinea (W. New Guinea: Mamberamo Distr.; NE. New Guinea: Sepik Distr.).

Ecol. In swampy places at low altitudes.

Note. By its very slender habit much resembling *F. gracilentia*, from which it is readily distinguishable by the hairy ligule (absent in *F. gracilentia*), the glabrous rays of the inflorescence (see, however, *F. gracilentia* var. *psilopoda*) and the different shape and texture of the nut.

58. *Fimbristylis alboviridis* CLARKE, *Fl. Br. Ind.* 6 (1893) 638; KERN, *Blumea* 8 (1955) 140; in Back. & Bakh. f. *Fl. Java* 3 (1968) 466. — ? *F. annua* var. *pluristriata* BACK. *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 21, non *F. diphylla* var. *pluristriata* CLARKE. — Fig. 46.

Annual with fibrous roots. *Stems* slender, tufted, compressed, obtusangular, glabrous and smooth, 20–50 cm by  $\frac{1}{2}$ –1 mm. *Leaves* half as long as the stems, sometimes slightly falcate, rather firm, flat, obtuse to rather acute, glabrous, scabrid on the margins in the upper part, greyish green, 1–2 mm wide; ligule a fringe of short, white hairs (see Note). *Inflorescence* simple or subcompound, loose, with few to several spikelets, 2–7 cm long. *Involucral bracts* 1–2, suberect, the lowest somewhat shorter than to twice as long as the inflorescence, up to 12 cm. *Primary rays* few, suberect, compressed, smooth, up to 5 cm. *Spikelets* solitary, ovoid to oblong-ovoid, terete, acutish, densely many-flowered, whitish or greyish green, often brownish variegated, 5–7 (ultimately up to 10) by c.  $2\frac{1}{2}$  mm; rachilla narrowly winged. *Glumes* spiral, subchartaceous, glabrous, appressed, broadly ovate, obtuse, mucous or scarcely apiculate, not keeled, with greenish, 3-nerved keel and nerveless sides brownish except for the whitish basal part and margins, c. 2 mm long and wide. *Stamen* 1; anther oblong, c.  $\frac{1}{2}$  mm. *Style* slender, flat, slightly dilated at the base, ciliate in the upper  $\frac{1}{2}$ – $\frac{3}{4}$ , c. 1 mm; stigmas 2, shorter than the style. *Nut* biconvex, obovate, shortly stipitate, umbonulate, scaly-verruculose, obsoletely reticulate by the transversely elliptic or oblong, not impressed epidermal cells in 10–16 vertical rows on either face, stramineous,  $1$ – $1\frac{1}{4}$  by  $\frac{3}{4}$ – $\frac{9}{10}$  mm.

Distr. SE. Asia, from India to *Malesia*: Malay Peninsula (Kedah, Selangor), ? W. and E. Java, Philippines (Luzon).

Ecol. Dry grass-fields, road-sides, at low altitudes.

Note. The collections from the Malay Peninsula and the Philippines perfectly agree with the type-collection from India. In the Java collections the ligule consists of a few hairs only, the glumes are more acute, and the nuts slightly different in shape. They may represent a local race or a closely related species.

## 12. Section Rigidulae

KERN, *Blumea* 8 (1955) 161.

Type species: *F. rigidula* NEES.

59. *Fimbristylis trichophylla* RIDL. *Fl. Mal. Pen.* 5 (1925) 155; HENDERS. *J. Mal. Br. R. As. Soc.* 17 (1939) 86; KERN, *Blumea* 8 (1955) 140; *ibid.* 10 (1960) 648; Reinwardtia 6 (1961) 47.

var. *trichophylla*.

Perennial with short rhizome. *Stems* very slender, setaceous, densely tufted, decumbent or hanging in tresses over rocks, subterete, finely striate, glabrous and smooth, 15–60 cm by  $\frac{1}{4}$ – $\frac{1}{3}$  mm. *Leaves* often very long (up to 50 cm), weak, filiform, very acute, with incrassate margins scabrid at the top, glabrous,

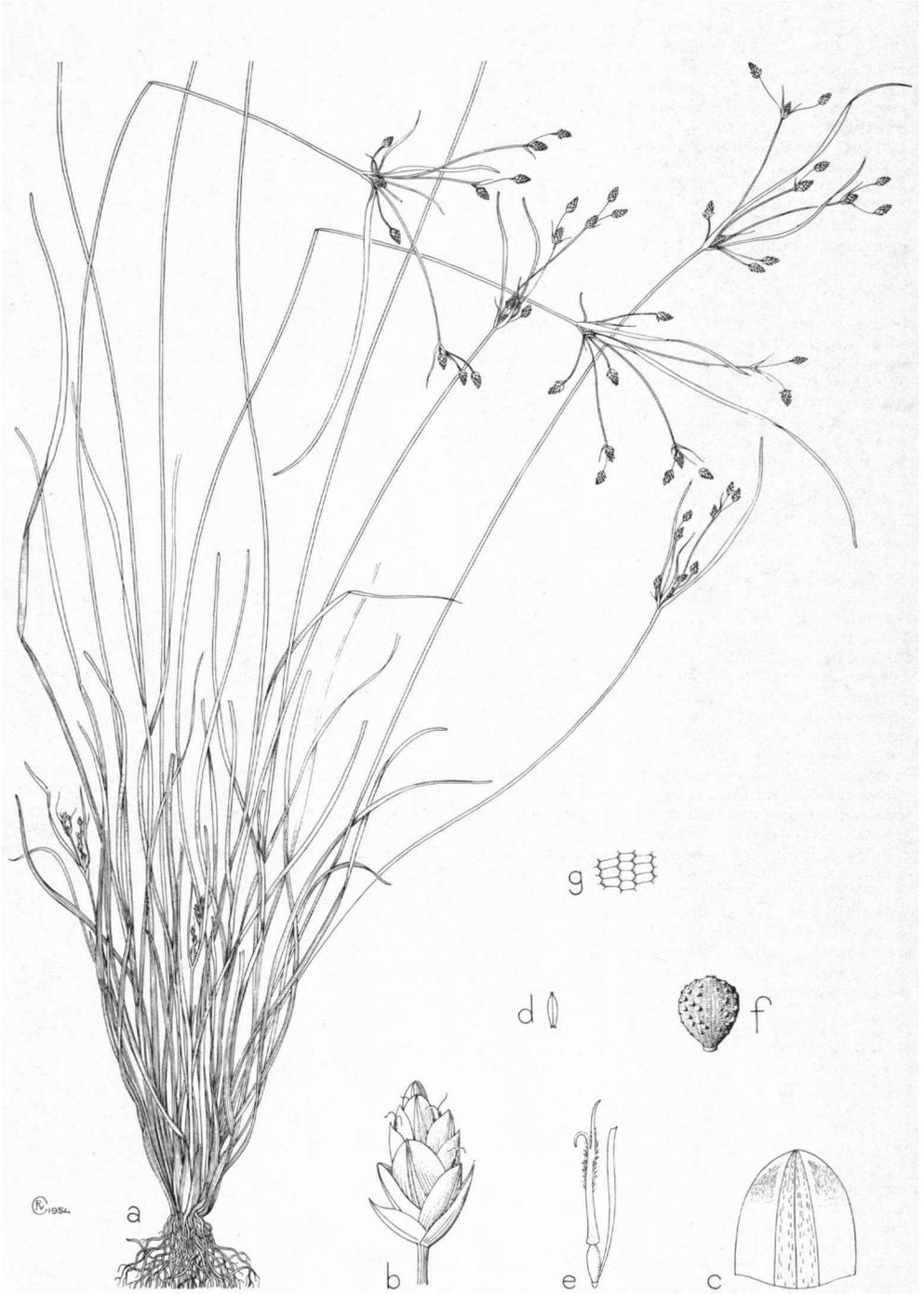


Fig. 46. *Fimbristylis alboviridis* CLARKE. *a.* Habit,  $\times \frac{1}{2}$ , *b.* spikelet,  $\times 5$ , *c.* glume, *d.* anther, *e.* deflorate flower, *f.* nut, all  $\times 10$ , *g.* outer cells of nut strongly enlarged (*a-g* BACKER *s.n.*, Weltevreden *a.* 1903).

or sparsely hairy also on the sheaths, deep green,  $\frac{1}{3}$ - $\frac{2}{3}$  mm wide; ligule absent. *Inflorescence* simple or subcompound, loose, with (1-3)-5(-10) spikelets. Involucral bracts 1-3, erect, the lowest usually much overlapping the inflorescence, up to 8(-15) cm. Rays spreading, often curved, compressed, smooth, 1-2 cm. *Spikelets* solitary, ovoid, terete, acute, shining brown, 4-6 (ultimately up to 10) by  $2-2\frac{1}{2}$  mm; rachilla very narrowly winged. *Glumes* spiral, membranous, ovate or broadly ovate, obtuse, apiculate, not keeled, obscurely many-nerved with prominent midnerve, glabrous or sparsely short-hairy, minutely ciliate, brown with paler margins,  $2\frac{1}{2}$ -3 by  $2-2\frac{1}{4}$  mm. *Stamens* 3; anthers linear,  $1-1\frac{1}{2}$  mm, with distinctly produced connective bristly at the top. *Style* flat, scarcely dilated at the base, densely ciliate in the upper half,  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm; stigmas 2, about as long as the style. *Nut* biconvex, oblong-obovate, or suboblong, shortly stipitate, scarcely umbonulate, smooth or sparsely verruculose, minutely cancellate by the slightly impressed, roundish or transversely elliptic epidermal cells in 10-12 vertical rows on either face, brown,  $1-1\frac{1}{2}$  by  $\frac{1}{2}$ - $\frac{2}{3}$  mm.

*Distr. Malesia:* Malay Peninsula, in the typical form described above only known from Pulu Langkawi.

*Ecol.* In crevices of limestone rocks in dry open places, 60-240 m.

*var. erecta* HOLT. ex KERN, *Blumea* 8 (1955) 41. — *Fimbristylis* sp. prox. *F. fusca* HENDERS. J. Mal. Br. R. As. Soc. 17 (1939) 86.

Less slender. *Stems* erect, subterete or bluntly trigonous. *Leaves* stiffer and paler,  $1-1\frac{1}{2}$  mm wide. *Inflorescence* usually ampler, compound or subdecompound, rarely simple, with up to 20 spikelets. Primary rays up to 7 cm. *Anthers*  $1\frac{1}{2}$ -2 mm.

*Distr.* Peninsular Thailand; in *Malesia:* Malay Peninsula (Kedah: Pulu Langkawi, Gunung Baling; Kelantan: Gua Teja, Pahang: Gunung Senyum; Selangor: Bukit Takun near Kanching).

*Ecol.* As the typical variety.

*Note.* The Pulu Langkawi specimens of this variety have densely pubescent stems and leaves, the others are glabrous. In the specimens from Pahang (summit of Gunung Senyum, 1600 ft) the spikelets are somewhat larger than in the others, the nuts slightly broader ( $\frac{1}{5}$  mm), and the appendage of the connective is smooth.

60. *Fimbristylis rigidula* NEES in Wight, *Contr.* (1834) 99; Hook. J. Bot. Kew Misc. 6 (1854) 29; STEUD. *Syn.* 2 (1855) 116; CLARKE, *Fl. Br. Ind.* 6 (1893) 640; J. Linn. Soc. Bot. 36 (1903) 242; Philip. J. Sc. 2 (1907) Bot. 95; Ill. Cyp. (1909) t. 42 f. 7-8; MERR. *En. Philip.* 1 (1923) 125, p.p.; KERN, *Blumea* 8 (1955) 141; Reinwardtia 6 (1961) 47; TANG & WANG, *Fl. Reip. Pop. Sin.* 11 (1961) 91, t. 29 f. 9-12. — *F. hanceana* BOECK. *Linnaea* 38 (1874) 394. — *F. ferruginea* (non VAHL) VIDAL, *Phan. Cuming.* (1885) 156; *Rev. Pl. Vasc. Filip.* (1886) 284, p.p.

Perennial with thick, woody, shortly horizontally creeping rhizome clothed with the fibrous remains of old leaf-sheaths. *Stems* closely uniseriate on the rhizome, compressed, conspicuously (often bulbously) thickened at the base, smooth, 10-40(-70) cm by  $1-1\frac{1}{2}$ (-3) mm. *Leaves* about half as long as the

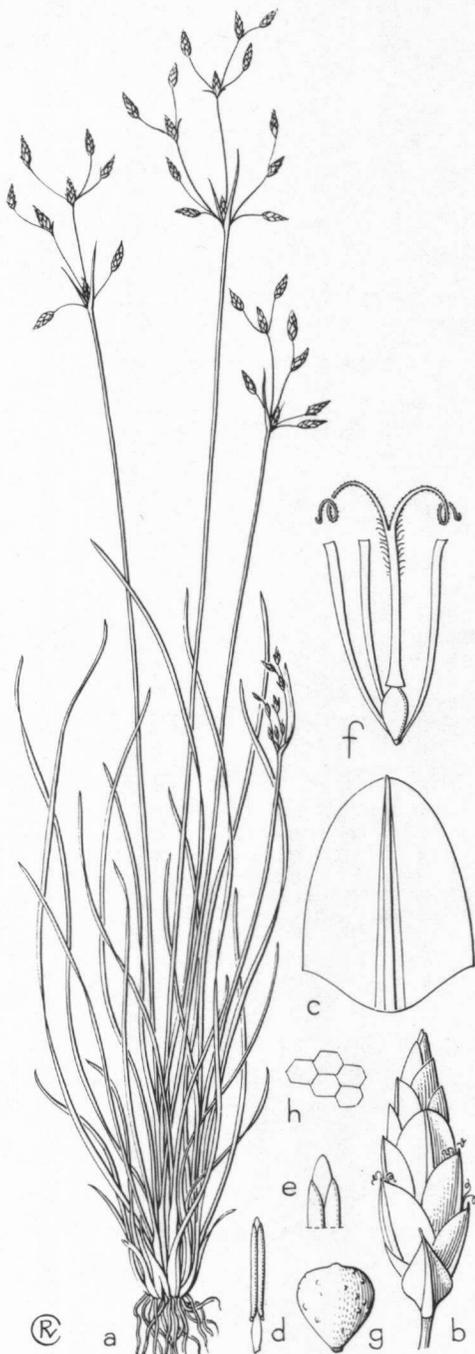


Fig. 47. *Fimbristylis semarangensis* OHWI. a. Habit,  $\times 5$ , b. spikelet,  $\times 6$ , c. glume, d. stamen, e. ditto, apex, f. defflorate flower, g. nut, all  $\times 12$ , h. outer cells of nut, strongly enlarged (a-h KOORDERS 42656).

stems, rigidulous, flat, abruptly acuminate, scabrid on the margins in the upper part, glabrous or (with their sheaths) pubescent, greyish green, 2-3(-5) mm wide; ligule absent. *Inflorescence* simple or compound, loose, often diffuse, with (4-6-12(-35) spikelets. Involucral bracts 3-4, usually shorter than the inflorescence, sometimes slightly longer, erect, up to 6 cm. Primary rays smooth, compressed, with 1-3 spikelets, or again branched, 1-6 cm. *Spikelets* solitary or partly paired, ellipsoid or subglobose, terete, very obtuse, densely many-flowered, fuscous to castaneous, 5-10 by 3-4 mm; rachilla very narrowly winged. *Glumes* spiral, membranous, ovate or broadly ovate, obtuse, apiculate, scarcely keeled, with prominent midrib and obscurely many-nerved sides, glabrous, or (in some of the continental Asian specimens) sparsely hairy and ciliate at the apex, 3-4 by 2-3 mm. *Stamens* 3; anthers linear, 1 mm. *Style* flat, dilated at the base, long-ciliate in the upper half, 2-3 mm; stigmas 2, about as long as the style. *Nut* biconvex, obovate, minutely stipitate, umbonulate, smooth or sparsely verruculose, finely reticulate by the isodiametric epidermal cells in 20-30 vertical rows on either face,  $1\frac{1}{3}$ - $1\frac{1}{2}$  by  $1\frac{1}{10}$ - $1\frac{1}{4}$  mm.

Distr. From Nepal and N. India to N. Thailand and S. China; in *Malesia*: Philippines (Luzon, Mindanao).

Ecol. In Luzon in wet open grassland at low and medium altitudes; in Thailand also in deciduous forests, in India up to 1800 m.

Note. The specimens of MCGREGOR BS 32233 and RAMOS BS 32811, cited by MERRILL *l.c.* under *F. rigidula* belong to *F. insignis*.

**61. *Fimbristylis sumbaensis* OHWI, Blumea 8 (1955) 106, f. 9.**

Perennial with short rhizome. *Stems* slender, densely tufted, compressed-trigonous, obtusangular, striate, slightly puberulous or scabrid at the top, 30-40 cm by  $\frac{1}{2}$ - $\frac{3}{4}$  mm. *Leaves* half as long as the stems, erect, often with circinnate top, rigidulous, flat, abruptly acuminate, at first slightly pubescent, soon glabrescent, scabrid on the margins at least in the upper part, greyish green or glaucous with brownish sheaths, 1- $1\frac{1}{4}$  mm wide; ligule absent. *Inflorescence* subcompound to subdecompound, loose, with several to many spikelets, 3-10 cm long. Involucral bracts 3-4, the lowest somewhat shorter than the inflorescence, up to 8 cm. Primary rays ascendent-erect, compressed, scabrid-pilose, up to 7 cm. *Spikelets* solitary, ovoid or oblong-ovoid, somewhat angular, acute, densely many-flowered, dull greyish brown, 4-6 by 2- $2\frac{1}{2}$  mm; rachilla narrowly winged. *Glumes* spiral, membranous, glabrous, ovate, acutish, apiculate or minutely mucronulate, with c. 5-nerved, green keel, prominent midnerve, fulvous nerveless sides, and very broad hyaline margins,  $2\frac{3}{4}$ -3 by c. 2 mm. *Stamens* 3; anthers linear, 1- $1\frac{1}{2}$  mm. *Style* slender, flat, scarcely margined, ciliate in the upper half, retrorsely his-

pidulous at the abruptly dilated base, c. 2 mm; stigmas 2, somewhat shorter than the style. *Nut* turbidly biconvex, broadly obovate, with acutish edges, shortly stipitate, minutely umbonulate, smooth, delicately trabeculate by longitudinal ribs and transverse lines, at first white, ultimately shining brown,  $\frac{3}{4}$  by  $\frac{3}{2}$  mm; epidermal cells slightly impressed, transversely oblong-linear, in 8-10 vertical rows on either face.

Distr. *Malesia*: Lesser Sunda Is. (Sumba: near Waingapu; here repeatedly collected, as yet not known elsewhere).

Ecol. Open or shaded meadows, burnt-over grassy plains, abundant.

Note. OHWI supposed it to be a hybrid of *F. sericea* and *F. dichotoma*. It has certainly nothing to do with *F. sericea* (which is not known from the Lesser Sunda Islands!), and because of its freely fruiting I do not see any reason to suppose hybrid nature.

**62. *Fimbristylis semarangensis* OHWI, Blumea 8 (1955) 106, f. 8; KERN, *l.c.* 141; in Back. & Bakh. f. Fl. Java 3 (1968) 467. — *F. annua* var. *gracilis* BACK. Onkr. Suiker. (1928) 160, p.p.; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 21, p.p. — Fig. 47.**

Glabrous annual with fibrous roots. *Stems* slender, tufted, compressed, obtusangular, smooth, 20-40 cm by c. 1 mm. *Leaves*  $\frac{1}{3}$ - $\frac{1}{2}$  as long as the stems, erect, rather firm, flat, acute, scabrid on the margins in the upper part, 1-2 mm wide; ligule absent. *Inflorescence* subcompound or compound, very loose, with 5-20 spikelets, 3-6 cm long and wide. Involucral bracts 1-2, the lowest shorter than the inflorescence, 1-2 cm. Primary rays obliquely ascending, compressed, smooth, up to 4 cm. *Spikelets* solitary, narrowly ovoid, terete, acute, densely many-flowered, 6-8 by 2 mm; rachilla narrowly winged. *Glumes* spiral, membranous, ovate, obtusish with rounded apex, mucous, scarcely keeled, with a midnerve not reaching the apex, nerveless, light brown sides, and broad hyaline margins, c.  $2\frac{1}{2}$  by  $1\frac{3}{4}$  mm. *Stamens* (2-3); anthers linear, 1 mm. *Style* slender, flat, not margined, slightly dilated at the base, ciliate in the upper  $\frac{1}{3}$ - $\frac{1}{2}$ ,  $1\frac{1}{2}$  mm long; stigmas 2, shorter than the style, 1 mm long. *Nut* biconvex, obovate, with acutish edges, shortly stipitate, umbonulate, verruculose, finely reticulate by the minute, roundish or transversely elliptic, not impressed epidermal cells, c.  $\frac{3}{4}$  by  $\frac{3}{8}$  mm.

Distr. Insufficiently known; Indo-China (Cam Ranh Peninsula, KIÉT 224 in P); in *Malesia*: Central Java (Res. Semarang: Bledug-Kuwu; Res. Rembang: Kesongo).

Ecol. Along mud-wells, in saline pools in small tufts scattered among *Xerochloa imberbis* R.Br., at low altitudes.

Note. In habit very similar to *F. merrillii*, but well distinct by the eligulate leaves, the broad hyaline margins of the glumes, the longer anthers, the ciliate style, and the reticulate (not trabeculate) nuts.

### 13. Section *Pogonostylis*

(BERTOL.) PAX in E. & P. Nat. Pfl. Fam. 2, 2 (1887) 113. — *Pogonostylis* BERTOL. Fl. Ital. 1 (1833) 312. — *Fimbristylis* sect. *Squarrosae* OHWI, J. Jap. Bot. 14

(1938) 573. — *Fimbristylis ser. Squarrosae* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 55.

Type species: *F. squarrosa* VAHL.

63. *Fimbristylis aestivalis* (RETZ.) VAHL, En. 2 (1806) 288; KUNTH, En. 2 (1837) 226; STEUD. Syn. 2 (1855) 110; BOECK. Linnaea 37 (1871) 11, *excl. var.*; BENTH. Fl. Austr. 7 (1878) 310; F.-VILL. Nov. App. (1882) 308; CLARKE, Fl. Br. Ind. 6 (1893) 637, *p.p.*; Philip. J. Sc. 2 (1907) Bot. 94; Ill. Cyp. (1909) t. 41 f. 14–15; KOORD. Exk. Fl. Java 1 (1911) 199; *ibid.* 4, Atlas (1922) f. 254; CAMUS, Fl. Gén. I.-C. 7 (1912) 106, f. 16, 7–8; MERR. En. Philip. 1 (1923) 121; BACK. Onkr. Suiker. (1928) 160, t. 167; Becn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 22; S. T. BLAKE, J. Arn. Arb. 35 (1954) 212; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 116, *excl. varr.*; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 467. — *Scirpus aestivalis* RETZ. Obs. 4 (1768) 12. — *F. dichotoma* (non VAHL) PRESL. Rel. Haenk. 1 (1828) 191. — *F. squarrosa* (non VAHL) ZOLL. Syst. Verz. 1 (1854) 61, *p.p.* (*specim. parva*); DE VRIESE, Pl. Ind. Bat. Or. (1856–57) 141; MERR. En. Philip. 1 (1923) 126, *excl.* BS 26093. — *F. griffithiana* STEUD. Syn. 2 (1855) 110. — *F. tricholepis* MIQ. Fl. Ind. Bat. 3 (1856) 319. — *Iriha aestivalis* O.K. Rev. Gen. Pl. 2 (1891) 751.

*var. aestivalis*. — Synonymy as above.

Annual with fibrous roots. Stems very slender, densely tufted, setaceous, angular, smooth, 3–20 cm by  $\frac{1}{3}$ – $\frac{1}{2}$  mm. Leaves shorter than the stems, filiform, flat or canaliculate, acute, densely soft-hairy also on the stramineous or ferruginous sheaths,  $\frac{1}{5}$ – $\frac{1}{2}$  mm wide; ligule absent. Inflorescence compound, more rarely subsimple, loose, with many spikelets, 1–7 cm long. Involucral bracts up to 6, similar to the leaves, the lower 1–2 somewhat shorter than the inflorescence to slightly overtopping it. Primary rays filiform, obliquely patent, glabrous and smooth (see *var. trichopoda* !), up to 5 cm. Spikelets solitary, ovoid or oblong-lanceolate, angular, acute, densely many-flowered, greenish brown, 3–7 by 1– $\frac{1}{2}$  mm; rachilla narrowly winged. Glumes spiral, thinly membranous, subpatulous at the top, ovate, obtusish, mucronulate, with sharp, green, pubescent 3-nerved keel, prominent midnerve, and obscurely or glabrescent nerveless sides, ferruginous, darker lineolate,  $\frac{1}{4}$ – $1\frac{1}{2}$  by  $\frac{3}{4}$ –1 mm. Stamens 1; anther oblong,  $\frac{1}{3}$ – $\frac{1}{2}$  mm. Style flat, not hyaline-margined, dilated at the base, sparsely ciliate at the top, glabrous or with a few short cilia at the base,  $\frac{1}{2}$ – $\frac{3}{4}$  mm; stigmas 2, shorter than the style. Nut biconvex, with acute edges, elliptic or obovate, shortly stipitate, umbonulate, obscurely reticulate by the hexagonal, not impressed epidermal cells, smooth, shining stramineous,  $\frac{1}{2}$ – $\frac{2}{3}$  by  $\frac{1}{5}$ – $\frac{1}{2}$  mm.

Distr. From Ceylon and India through Thailand and Indo-China to China, Formosa, Japan and Amurland, southward to tropical Australia; in Malesia: Sumatra, W. and Central Java, Philippines (Luzon, Mindanao), N. Celebes, New Guinea (Papua).

Ecol. In open damp places, in swamps, and especially as a weed in wet rice-fields, at low and medium altitudes, up to 1800 m.

Vern. *Djukut mumundingan*, S; Philippines: *bo-boók, lamlamsit*, Bon., *sirau-sirau*, Ilk.

Note. The specimens of '*F. aestivalis*' from the Malay Peninsula in the Singapore Herbarium belong all to *F. griffithii* (I have not seen RIDLEY 43 from Pahang).

*var. trichopoda* KERN, Blumea 12 (1963) 27.

Rays and raylets of the inflorescence densely pilose.

Distr. India; in Malesia: NE. New Guinea, on bank of Sepik River.

*var. macrostachya* BENTH. Fl. Austr. 7 (1878) 310 (with ?); CLARKE, Philip. J. Sc. 2 (1907) Bot. 94; DOMIN, Bibl. Bot., Heft 85 (1915) 458; MERR. En. Philip. 1 (1923) 121.

Stronger in almost every part. Stems about 30 cm tall. Leaves 1– $\frac{1}{2}$  mm wide. Lower bract distinctly overtopping the inflorescence. Spikelets 2 mm wide. Glumes  $2\frac{1}{2}$  by  $1\frac{1}{2}$  mm. Stamens 2, Style  $1\frac{1}{4}$  mm long. Nut more distinctly reticulate,  $\frac{7}{8}$  by  $\frac{5}{8}$  mm.

Distr. Queensland; in Malesia: Philippines (Leyte), JAGOR 1008, according to CLARKE, *l.c.*, not seen.

Note. CLARKE, *l.c.*, thinks that this variety tends to *F. bisumbellata*, but this is certainly not the case. From the characters given above I get the impression that it is a polyploid derived from *F. aestivalis var. aestivalis*.

64. *Fimbristylis griffithii* BOECK. Flora 43 (1860) 241; KERN, Blumea 8 (1955) 142; Reinwardtia 6 (1961) 48; in Back. & Bakh. f. Fl. Java 3 (1968) 467. — *F. aestivalis*  $\beta$  *glaberrima* BOECK. Linnaea 37 (1871) 11, *p.p.* (*quoad specim. Indiae or.*). — *F. aestivalis* (non VAHL) CLARKE, Fl. Br. Ind. 6 (1893) 637, *p.p.*; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 92; Fl. Mal. Pen. 5 (1925) 155. — *F. dichotoma* (non VAHL) CAMUS, Fl. Gén. I.-C. 7 (1912) 102, *p.p.* — *F. aestivalis f. glabra* KÜK. Bot. Jahrb. 59 (1924) 49, *ex descr.*

Glabrous annual with fibrous roots. Stems slender but rigid, densely tufted, compressed, 3–5-angled, smooth, (3–)10–30 cm by  $\frac{1}{2}$ –1 mm, the base clothed with 1–2 tubular, bladeless or short-bladed, obliquely truncate, 2–3 cm long sheaths. Leaves shorter than to as long as the stems, often falcate, scabrid on the often involute margins, with pale, stramineous lower sheaths, 1–2 mm wide; ligule absent. Inflorescence compound or subcompound, loose, with many spikelets, 5–8 cm long. Involucral bracts up to 6, filiform, more or less recurved, usually much shorter than the inflorescence, much dilated at the base, scabrid, 1–3 cm. Primary rays several, obliquely erect, compressed-angular, smooth, up to 5 cm. Spikelets solitary, ovoid or lanceolate, angular, acute, densely many-flowered, stramineous or brownish, 3–7 by 1– $\frac{1}{4}$ –(1– $\frac{1}{2}$ ) mm; rachilla narrowly winged. Glumes spiral, thinly membranous, triangular-ovate, acutish, sharply keeled, with prominent midnerve excurrent in a short, more or less excurved mucro, nerveless sides, and hyaline margins,  $1\frac{1}{4}$ – $1\frac{1}{2}$  by c. 1 mm. Stamens 1(–2); anthers oblong,  $\frac{1}{4}$ – $\frac{1}{3}$  mm. Style slender, flat, not hyaline-margined, glabrous,  $\frac{3}{4}$ –1 mm; stigmas 2, shorter than the style. Nut biconvex, with acute edges, obovate or broadly

obovate, shortly stipitate, umbonulate, smooth, shining yellowish brown, obsoletely reticulate by the transversely elliptic, not impressed epidermal cells,  $\frac{1}{2}$ - $\frac{7}{10}$  by  $\frac{1}{5}$ - $\frac{1}{2}$  mm.

Distr. Bengal, Burma, Thailand, Indo-China, Tenasserim and Andamans; in *Malesia*: Central Sumatra, Malay Peninsula (Perak, Kelantan, Trengganu, Pahang, Malacca, Singapore), W. Java, Borneo, Celebes (Central: Posso Lake; SE. Peninsula: Kendari), Moluccas (W. Ceram), W. New Guinea.

Ecol. Wet or swampy places, river-banks, edges of lakes, road-sides, at low altitudes, up to c. 700 m.

Vern. *Rumput sèrai*, *r. sèrai jantan*, *r. salah pèmakai*, *r. kèpala lalat halus*, *r. janggut kuau*, Mal. Pen., *kanta jambun*, S. and E. Borneo.

Notes. BOECKELER's type specimen (Bengal, GRIFFITH in B) got lost by war action; his description perfectly matches the species described above (neotype: GRIFFITH 6331, K).

A collection of this species in the Copenhagen Herbarium (KAMPHOEVENER 2785 from Sambelong) was annotated by BOECKELER "*Fimbristylis (Eufimbr.) aestivalis* (VAHL)  $\beta$  *glaberrima* = *F. limosa* POEPP. ex KUNTH". I have not seen the S. American *F. limosa*, which is apparently very close to, but probably not conspecific with *F. griffithii*, as KUNTH, En. 2 (1837) 225, ascribes obovate-pyriform, often verruculose nuts, and purplish leaf-sheaths to it.

Often confounded or united with *F. aestivalis*, which is, however, a dwarfed, weaker, hairy plant lacking the tubular leaf-sheaths surrounding the base of the stem.

65. *Fimbristylis squarrosa* VAHL, En. 2 (1806) 289; KUNTH, En. 2 (1837) 224; STEUD. Syn. 2 (1855) 110; MIQ. Fl. Ind. Bat. 3 (1856) 319, *quoad descr.*; BOECK. *Linnaea* 37 (1871) 10; CLARKE, Fl. Br. Ind. 6 (1893) 635; Ill. Cyp. (1909) t. 41 f. 8-10; CAMUS, Fl. Gén. I.-C. 7 (1912) 101, f. 16, 3-6; KOYAMA, Contr. Inst. Bot. Un. Montréal n. 70 (1957) 44. — *Pogonostylis squarrosa* BERTOL. Fl. Ital. (1833) 312. — *F. aestivalis* var. *squarrosa* KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 116.

var. *squarrosa*. — Synonymy as above. Not in *Malesia*; see Notes.

var. *esquarrosa* MAKINO, Bot. Mag. Tokyo (1903) 47; KERN, *Blumea* 8 (1955) 143; Reinwardtia 6 (1961) 48; in Back. & Bakh. f. Fl. Java 3 (1968) 467. — *F. velata* R. BR. Prod. (1810) 227; KUNTH, En. 2 (1837) 243; BENTH. Fl. Austr. 7 (1878) 309. — *F. propinqua* R. BR. Prod. (1810) 227; KUNTH, En. 2 (1837) 243. — *Iriha velata* O. K. Rev. Gen. Pl. 2 (1891) 753. — *F. squarrosa* var. *velata* CLARKE ex CHESEM. Man. New Zeal. Fl. (1906) 770. — *F. makinoana* OHWI, J. Jap. Bot. 14 (1938) 578; Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 83. — *F. aestivalis* var. *esquarrosa* KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 116.

Annual with fibrous roots. Stems slender, densely tufted, setaceous, compressed-subtrigonal, smooth, 10-25 cm by  $\frac{1}{2}$ -1 mm. Leaves shorter than the stems, very narrow, flat or canaliculate, acute, more or less soft-hairy at least on the sheaths,  $\frac{1}{3}$ -1 mm wide; ligule absent. Inflorescence compound or decomposed, loose, with several to many spikelets,

2-5 cm long. Involucral bracts 3-7, dilated at the base, soft-hairy, the lowest shorter than to about as long as the inflorescence. Primary rays up to 6, slender, filiform, smooth, up to  $2\frac{1}{2}$  cm. Spikelets solitary, lanceolate, angular, acute, rather densely many-flowered, stramineous or ferruginous, 4-7 by 1-1 $\frac{1}{2}$  mm; rachilla narrowly winged. Glumes spiral, thinly membranous, suberect, ovate, or oblong-ovate, acutish, acutely keeled, 3-nerved, with nerveless sides, and a strong midnerve excurrent in a straight or slightly excurved, up to  $\frac{1}{2}$  mm long mucro, glabrous or pubescent, 1 $\frac{1}{2}$ -2 by 1 mm. Stamen 1; anther oblong,  $\frac{1}{4}$ - $\frac{1}{3}$  mm. Style slender, flat, not hyaline-margined, dilated at the base, sparsely ciliate at the top,  $\frac{3}{4}$ -1 mm, the lower margin fringed with a whorl of long, pendent hairs closely appressed to the nut and covering  $\frac{1}{2}$ - $\frac{3}{4}$  of it; stigmas 2, shorter than the style. Nut biconvex, with acute edges, obovate, shortly stipitate, minutely umbonulate, smooth, obscurely reticulate by the not impressed, hexagonal epidermal cells, shining stramineous,  $\frac{3}{5}$ - $\frac{3}{4}$  by  $\frac{1}{2}$  mm.

Distr. *F. squarrosa* var. *squarrosa* is widely distributed in the tropical and warm-temperate regions of Asia (also in Japan and Korea, but absent from *Malesia*), S. Europe, Africa, and S. America (not in N. America); var. *esquarrosa* is known from Thailand, Indo-China, NE. and E. China, S. Korea, Japan, Polynesia, Australia, and New Zealand; very rare in *Malesia*: Sumatra (Toba Lake), W. Java (Mt Patuha), Philippines (Luzon: Cagayan).

Ecol. Shores of lakes, on wet sandy soil, on Mt Patuha at 1600 m, along Toba Lake at c. 900 m.

Notes. KOYAMA (1957) thinks that the E. and S. China Seas draw a clear line of demarcation between the areas of the two varieties, but in E. Asia there is a considerable overlapping.

The collections mentioned by MERRILL, En. Philip. 1 (1923) 126 under *F. squarrosa* belong partly to *F. aestivalis*, partly to *F. merrillii*. The only Philippine collection of *F. squarrosa* var. *esquarrosa* I have seen is CURRAN FB 16783, distributed as *F. aestivalis*.

*F. squarrosa* is intimately related to *F. aestivalis*, with which F. VON MÜLLER, Fragm. 9 (1875) united it. KOYAMA, 1961, followed von MÜLLER, possibly with good reason. For, although typical *F. squarrosa* is clearly distinct from *F. aestivalis* by the much longer, strongly recurved mucros of the glumes giving the spikelets a squarrose aspect, and by the long pendent hairs of the style-base (taken by NEES for fibres of the pericarp!), the mucros of var. *esquarrosa* do not differ from those of *F. aestivalis*. So the trichomes of the style-base (absent or very short in *F. aestivalis*), the slightly longer style and the often somewhat larger nut are the only characters to distinguish between *F. squarrosa* var. *esquarrosa* and *F. aestivalis*. Anyway, by assigning specific rank to var. *esquarrosa* (*F. velata*), its taxonomic value is over-estimated. According to TANAKA the chromosome number in var. *squarrosa* is  $n = 10$ , in var. *esquarrosa*  $n = 12$ . See also KERN, 1955 and 1961.

66. *Fimbristylis gracilentia* HANCE, J. Bot. Lond. 6 (1868) 89; CLARKE, J. Linn. Soc. Bot. 36 (1903) 237; CAMUS, Fl. Gén. I.-C. 7 (1912) 103; KERN, *Blumea* 8 (1955) 144; *ibid.* 10 (1960) 647; Reinwardtia 6

(1961) 49. — *F. thorelii* CAMUS, Not. Syst. 1 (1910) 246; Fl. Gén. I.-C. 7 (1912) 105.

Annual with fibrous roots. *Stems* very slender, setaceous, tufted, slightly compressed, obtusangular, glabrous, or hairy at the top, 15–30 cm by  $\frac{1}{2}$ – $\frac{3}{4}$  mm. *Leaves* somewhat shorter to longer than the stems, filiform, involute, abruptly acuminate, soft-hairy also on the sheaths,  $\frac{1}{2}$ – $1\frac{1}{2}$  mm wide; ligule absent. *Inflorescence* compound, very loose, with several to many spikelets, narrow, 3–10 cm long. Involucral bracts 2–3, erect, the lowest up to twice as long as the inflorescence, 6–12 cm. Primary rays 5–7, very unequal, suberect, filiform, slightly compressed, pilose (like the short, suberect secondary rays), rarely glabrous (see Notes), up to 7 cm. *Spikelets* solitary, (narrowly) lanceolate, angular, acute, loosely many-flowered, dull brown. 3–8 by  $1\frac{1}{4}$  mm; rachilla distinctly winged. *Glumes* spiral (see Notes), membranous, oblong-ovate, acutish, mucronate, keeled, glabrous, with 3–5-nerved keel (midnerve prominent) and nerveless sides, 2– $2\frac{1}{4}$  by  $1\frac{1}{2}$ – $1\frac{1}{2}$  mm. *Stamens* 1(–2); anthers oblong-linear,  $\frac{1}{2}$  mm. *Style* slender, flat, not hyaline-margined, slightly dilated at the base, glabrous or sparsely ciliate, 1– $1\frac{1}{2}$  mm; stigmas 2, shorter than the style. *Nut* biconvex, with acute, obscurely costulate edges, obovate, rounded or subtruncate at the apex, smooth or sparsely white-scaly, shortly stipitate, minutely umbonulate, obscurely reticulate by the hexagonal or transversely elliptic, not impressed epidermal cells, shining, whitish to pale brown,  $\frac{3}{4}$ – $\frac{9}{10}$  by  $c. \frac{1}{2}$  mm.

Distr. S. China, Thailand, Indo-China; in *Malesia*: N. Sumatra (between Aek Bila and Aek Marbau; Rantau Parapat, Bila).

Ecol. Grassy places, forest-clearings, at low altitudes.

Notes. The rays and raylets of the inflorescence are generally pilose, a rare feature in *Fimbristylis*; in var. *psilopoda* KERN, Reinwardtia 6 (1961) 49, only known from NE. Thailand, they are glabrous.

In a collection from Central Thailand (SMITNAND 6084) the upper glumes of the spikelets are regularly 2-ranked.

See also the note under 57. *F. perlaxa*.

67. *Fimbristylis argentea* (ROTTB.) VAHL, En. 2 (1806) 294; KUNTH, En. 2 (1837) 223; STEUD. Syn. 2 (1855) 108; MIQ. Fl. Ind. Bat. 3 (1856) 317; BOECK. Linnæa 37 (1871) 8; CLARKE, Fl. Br. Ind. 6 (1893) 640; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 93; CAMUS, Fl. Gén. I.-C. 7 (1912) 110, f. 15, 1; RIDL. Fl. Mal. Pen. 5 (1925) 157; KERN, Reinwardtia 6 (1961) 49. — *Scirpus argenteus* ROTTB. Progr. (1772) 27; Descr. et Ic. (1773) 51, t. 17 f. 6. — *Scirpus monander* ROTTB. Descr. et Ic. (1773) 50, t. 14 f. 3. — *Iriha monandra* O.K. Rev. Gen. Pl. 2 (1891) 753.

Glabrous annual with fibrous roots. *Stems* densely tufted, setaceous, trigonous, slightly compressed, smooth, 3–10(–20) cm by  $\frac{1}{2}$ – $\frac{3}{4}$  mm. *Leaves* usually shorter than the stems, flat or canaliculate, rather abruptly acuminate, smooth or slightly scabrid at the top, glaucous, with stramineous sheaths,  $\frac{1}{2}$ – $\frac{3}{4}$  mm wide; ligule absent. *Inflorescence* capitate, semi-globose to globose, with (2–)4–10(–25) spikelets,  $\frac{1}{2}$ –1 cm across. Involucral bracts 2–4, somewhat dilated at the base, finally patent to reflexed, the lowest much longer than the inflorescence. *Spikelets* sessile, oblong-ovoid or cylindrical, slightly angular, acutish, very densely many-flowered, 4–10 by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm; rachilla narrowly winged. *Glumes* spiral, membranous, broadly ovate-deltoid, obtusish, mucous or apiculate, slightly keeled, 3-nerved, with strong midnerve, and nerveless, silvery grey, ferruginous or fuscous sides,  $c. 1$  by 1 mm. *Stamen* 1; anther oblong,  $\frac{1}{2}$  mm. *Style* flat, not hyaline-margined, dilated at the base, minutely ciliate in the upper part,  $\frac{3}{4}$  mm long; stigmas 2, somewhat shorter than the style. *Nut* biconvex, with acute edges, broadly obovate or suborbicular, shortly stipitate, minutely umbonulate, smooth or sparsely verruculose, obscurely reticulate by the transversely elliptic or oblong, not impressed epidermal cells,  $\frac{1}{2}$  by  $\frac{2}{5}$ – $\frac{1}{2}$  mm.

Distr. S. and SE. Asia: Ceylon, India, Bengal, Peninsular Thailand; in *Malesia* only known from a few localities in the Malay Peninsula (Kelantan: Kamposa; Trengganu: Kuala Trengganu).

Ecol. In wet or swampy places, in the Malay Peninsula in damp hollows on the sea-shore.

#### 14. Section Neodichelostylis

CAMUS, Fl. Gén. I.-C. 7 (1912) 89. — *Fimbristylis* sect. *Ferrugineae* OHWI, J. Jap. Bot. 14 (1938) 573, p.p. — *Fimbristylis* ser. *Ferrugineae* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 55, p.p.

Type species: *F. polytrichoides* (RETZ.) R.BR. (*Scirpus polytrichoides* RETZ.).

68. *Fimbristylis polytrichoides* (RETZ.) R.BR. Prod. (1810) 226; KUNTH, En. 2 (1837) 221; STEUD. Syn. 2 (1855) 106; MIQ. Fl. Ind. Bat. 3 (1856) 315; BENTH. Fl. Austr. 7 (1878) 304; CLARKE, Fl. Br. Ind. 6 (1893) 632; Bot. Tidsskr. 24 (1901) 88; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 90, p.p.; CLARKE, Philip. J. Sc. 2 (1907) Bot. 92; Ill. Cyp. (1909) t. 40 f. 8–9; KOORD. Ek. Fl. Java 1 (1911) 198, non *ibid.* 4, Atlas (1922) f. 250; CAMUS, Fl. Gén. I.-C. 7 (1912) 96, f. 13, 9; MERR. En. Philip. 1 (1923) 125; RIDL. Fl. Mal. Pen. 5 (1925) 154, p.p.; BACK. Onkr. Suiker. (1928) 159, t. 164; Bkn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 20; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 465. — *Scirpus polytrichoides* RETZ. Obs. 4

(1786) 11; VAHL, En. 2 (1806) 248 ('*polytrichoides*'). — *Abildgaardia javanica* STEUD. [in ZOLL. Syst. Verz. 1 (1854) 63 ('*Abildgardia*'), nom. nud.] Syn. 2 (1855) 72; MIQ. Fl. Ind. Bat. 3 (1856) 297; non *A. javana* NEES, 1834. — *F. albescens* STEUD. Syn. 2 (1855) 107; MIQ. Fl. Ind. Bat. 3 (1856) 316. — *F. subbulbosa* BOECK. Flora 41 (1858) 598; Cyp. nov. 2 (1890) 39. — *F. juncea* (non R. & S.) BOECK. Linnæa 37 (1871) 4. — *Iriha polytrichodes* O.K. Rev. Gen. Pl. 2 (1891) 753.

Perennial (always?), forming dense tufts, glabrous (except for the ligule), glaucescent. *Stems* erect or curved, setaceous, sulcate, smooth, incrassate at the base, 5–30 cm by up to 1 mm. *Leaves* half as long to

as long as the stems, setaceous, wiry, obtusish, complicate-canalliculate, smooth, with obliquely truncate, ferruginous sheaths,  $\frac{1}{2}$ -1 mm wide; ligule a row of short hairs. *Inflorescence* often consisting of a single, terminal or pseudo-lateral spikelet, more rarely 1 or 2 lateral spikelets added. *Spikelets* erect, solitary, ovoid-ellipsoid or oblong, terete, acute, densely many-flowered, pale brown, 5-15 by 2-3 mm, the subtending bract sometimes glume-like, but often with an erect blade as long as or slightly overtopping the inflorescence; rachilla narrowly winged. *Glumes* spiral, densely imbricate, thinly membranous, oblong-ovate or oblong, more than twice as long as broad, obtuse, scarcely keeled, muticous or apiculate with green midnerve, otherwise nerveless,  $2\frac{1}{2}$ -3 by  $1\frac{1}{3}$  mm; lowest 2 sterile glumes acute, often mucronate. *Stamens* 1-2; anthers linear,  $\frac{5}{8}$ -1 mm. *Style* slender, flat, not hyaline-margined, slightly dilated at the base, sparsely ciliate at the top,  $\frac{1}{2}$ -1 mm; stigmas 2, about as long as or longer than the style. *Nut* biconvex, with acute angles, cuneate-obovate or oblong-obovate, shortly stipitate, rounded at the apex (not umbonulate), smooth or verruculose, delicately reticulate by the minute, transversely elliptic or oblong, not impressed epidermal cells in c. 30 vertical rows on either face, greyish or blackish brown,  $\frac{5}{8}$ - $1\frac{1}{10}$  by  $\frac{1}{2}$ - $\frac{3}{5}$ ( $\frac{3}{4}$ ) mm.

*Distr.* Tropical Africa, Asia, and Australia; in *Malesia*: Malay Peninsula (Kedah: P. Langkawi; Perak: Lumut Dindings; Pahang; Selangor; P. Penang), Sumatra, Java (along N. coast), Madura, Philippines (Luzon, Panay), New Guinea (Merauke, Port Moresby).

*Ecol.* In open wet places, especially on sandy or muddy sea-shores and in rock-crevices near the sea, sometimes more inland on saline soil.

*Vern.* *Rèbha kaproléam*, Md.

**69. *Fimbristylis tenuicula* BOECK.** *Linnaea* 38 (1874) 385; CLARKE, *Fl. Br. Ind.* 6 (1893) 632. — *Iriha tenuicula* O.K. *Rev. Gen. Pl.* 2 (1891) 753.

Probably annual, with fibrous roots, growing in dense tufts. *Stems* erect or curved, setaceous or capillary, sulcate, smooth, 10-25 cm by c.  $\frac{1}{4}$  mm. *Leaves* much shorter than the stems, flattish but very narrow, weak, obtusish, smooth, glabrous or sparsely hairy, with obliquely truncate, cinnamomeous, hairy sheaths,  $\frac{1}{3}$ - $\frac{1}{2}$  mm wide; ligule absent. *Inflorescence* always consisting of a single, terminal spikelet. *Spikelet* erect, ebracteate, lanceolate or oblong-lanceolate, terete, acute, densely many-flowered, pale brown, 5-10 by  $\frac{1}{2}$ -2 mm. *Glumes* spiral, densely imbricate, thinly membranous, oblong-ovate or oblong, twice or more than twice as long as broad, scarcely keeled, minutely but distinctly mucronulate, ferruginous, with green midnerve, otherwise nerveless, glabrous, 2- $2\frac{3}{4}$  mm long. *Stamen* 1; anther oblong-linear,  $\frac{1}{2}$ -1 mm. *Style* slender, flat, not hyaline-margined, dilated at the base, sparsely ciliate, 1- $1\frac{1}{2}$  mm; stigmas 2, much shorter than the style. *Nut* biconvex, with acute angles, obovate, shortly stipitate, rounded at the apex (not umbonulate), sparsely verruculose, reticulate-trabeculate by the transversely oblong, somewhat impressed epidermal cells in c. 15 vertical rows on either face, brown,  $\frac{2}{5}$ -1 by  $\frac{3}{8}$ - $\frac{4}{5}$  mm.

*Distr.* Only known from a few localities in India, Tenasserim, Indo-China (Haut Dormai: near Blao);

in *Malesia*: S. Sumatra (S of Palembang, along Lake Pedammaran).

*Ecol.* In Sumatra along shore of lake, at low altitude; in Indo-China in a swamp at c. 850 m.

*Notes.* The collection *Reliquiae Helferianae* 146, distributed by the National Museum in Prague as *F. polytrichoides*, belongs here, and is in all probability not from Calcutta, but part of HELFER's type-collection from Tenasserim.

In the Leyden Herbarium there is also an excellent collection of this species, inadequately labelled "Arch. Ind. leg. WAITZ."

**70. *Fimbristylis celebica* OHWI,** *Blumea* 8 (1955) 103, f. 6. — Fig. 48.

Glabrous annual forming dense tufts. *Stems* setaceous, striate, slightly compressed, smooth, 5-10 by  $\frac{1}{2}$  mm. *Leaves* about as long as the stems or somewhat longer, filiform, curved, very acute, smooth except for the scabrid top, with membranous, stramineous or brownish sheaths,  $\frac{1}{4}$ - $\frac{1}{3}$  mm wide. *Inflorescence* always consisting of a single terminal spikelet. *Spikelet* erect, oblanceolate or narrowly oblong, angular, acute, few- or several-flowered, pale, fuscous-variegated, 5-7 by 2 mm, usually ebracteate but sometimes subtended by an up to 1 cm long bract. *Glumes* spiral, thinly membranous, erect, oblong-lanceolate, acutish, sharply keeled, shortly mucronulate, with 3-5-nerved keel, whitish stramineous, fuscous-variegated, nerveless sides and hyaline margins, 3 by 1 mm. *Stamens* (1-)2-3; anthers linear, 1- $1\frac{1}{2}$  mm. *Style* very slender, flat, not hyaline-margined, scarcely dilated at the base, glabrous, 1- $1\frac{1}{2}$  mm; stigmas 2, somewhat shorter than the style. *Nut* biconvex, with acute edges, narrowly obovate, shortly stipitate, minutely umbonulate, smooth, obscurely reticulate by the minute, not impressed epidermal cells, whitish,  $\frac{1}{10}$ - $\frac{4}{5}$  by  $\frac{1}{2}$  mm.

*Distr.* *Malesia*: Celebes (Lake Tuwuti, Lake Posso, Lake Matano).

*Ecol.* On shores of lakes and in *Imperata*-fields, 300-400 m.

**71. *Fimbristylis wetarensis* OHWI,** *Blumea* 8 (1955) 103, f. 7.

Densely tufted perennial. *Stems* erect, very slender, sulcate-angular, compressed, pubescent or glabrescent, 30-45 cm by  $\frac{1}{2}$ - $\frac{2}{3}$  mm. *Leaves* much shorter than the stems, rather firm, flat, abruptly acuminate, pubescent especially beneath, scabrid on the margins, with scarcely keeled, pubescent sheaths, 1- $1\frac{1}{2}$  mm wide; ligule absent. *Inflorescence* consisting of a single terminal spikelet. *Spikelet* erect or slightly oblique, ebracteate, lanceolate, terete, acute, densely many-flowered, 7-15 (ultimately up to 20) by 3-4 mm; rachilla narrowly winged. *Glumes* spiral, appressed, membranous, ovate or oblong-ovate, acutish, mucronulate, scarcely keeled, 1-nerved, glabrous, shining brown in the upper half, much paler below, hyaline-margined, c. 5 by 3 mm. *Stamens* 3; anthers linear, 2 mm. *Style* flat, scarcely dilated at the shortly setulose base, densely ciliate in the upper half, 4- $4\frac{1}{2}$  mm; stigmas 2, somewhat shorter than the style. *Nut* biconvex, with acute edges, obtriangular-obovate, obtuse or subtruncate, shortly stipitate, scarcely umbonulate, densely verruculose

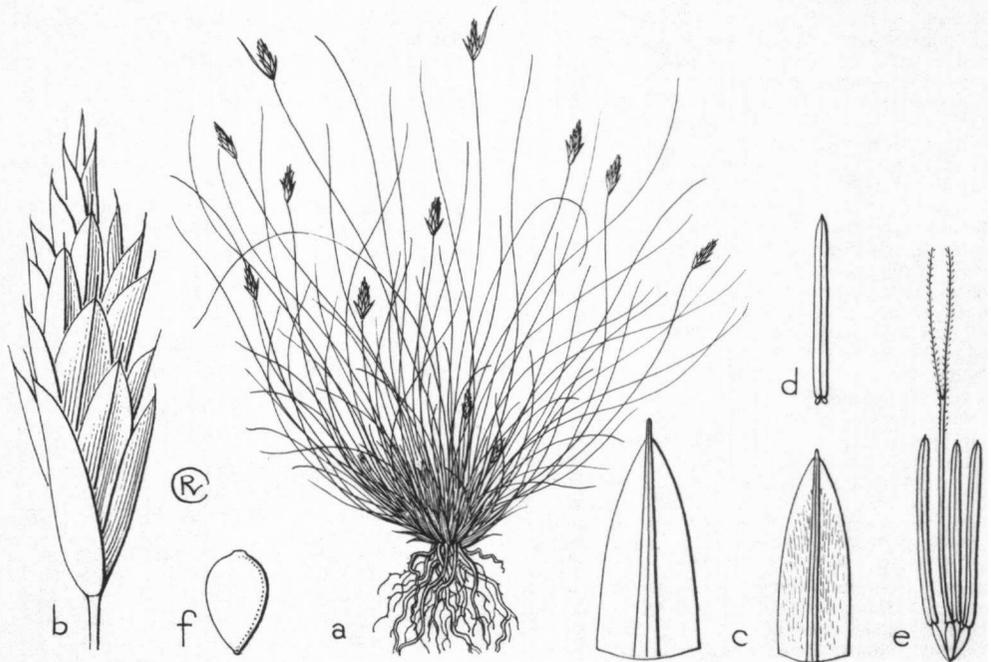


Fig. 48. *Fimbristylis celebica* OHWI. a. Habit,  $\times \frac{4}{5}$ , b. spikelet, c. two glumes, both  $\times 8$ , d. anther, e. deflorescent flower, f. nut, all  $\times 16$  (a-f EYMA 4113).

all over, obscurely reticulate by the small, roundish or hexagonal epidermal cells, whitish or stramineous,  $1\frac{1}{2}$  by  $\frac{5}{6}$  mm.

Distr. *Malesia*: Lesser Sunda Is. (Wetar, along the Meta Lerai).

Ecol. In *Eucalyptus* savannah above the rain-forest bordering the river, 700–900 m.

Note. Remote from the other *spp.* of the section; only known from the type collection, but hardly endemic in Wetar.

### 15. Section Nutantes

OHWI, J. Jap. Bot. 14 (1938) 573. — *Fimbristylis ser. Nutantes* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 55.

Type species: *F. nutans* (RETZ.) VAHL (*Scirpus nutans* RETZ.).

72. *Fimbristylis acuminata* VAHL, En. 2 (1806) 285; KUNTH, En. 2 (1837) 221; NEES in Hook. J. Bot. Kew Misc. 6 (1854) 29; STEUD. Syn. 2 (1855) 106; MIQ. Fl. Ind. Bat. 3 (1856) 314, excl. var.  $\beta$ ; BOECK. Linnaea 37 (1871) 3; CLARKE, Fl. Br. Ind. 6 (1893) 631; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 89; CLARKE, Philip. J. Sc. 2 (1907) Bot. 91, excl. AHERN 3390; Ill. Cyp. (1909) t. 40 f. 5–7; KOORD. Exk. Fl. Java 1 (1911) 198; *ibid.* 4, Atlas (1922) f. 251; CAMUS, Fl. Gén. I.-C. 7 (1912) 95, f. 13, 8; MERR. En. Philip. 1 (1923) 121; RIDL. Fl. Mal. Pen. 5 (1925) 153; BACK. Onkr. Suiker. (1928) 158, t. 163; BEKN. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 19; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 464. — *F. rhyticarya* F.v.M. Fragm. 1 (1859) 215; BENTH. Fl. Austr. 7 (1878) 302. — *Iriha acuminata* O.K. Rev. Gen. Pl. 2 (1891) 751. — *F. setacea* (non BENTH.) CLARKE, Fl. Br. Ind. 6 (1893) 632, p.p.; J. Linn. Soc. Bot. 34 (1898) 54, p.p.; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 89;

Fl. Mal. Pen. 5 (1925) 153. — *F. nutans* var. *minor* CAMUS, Fl. Gén. I.-C. 7 (1912) 96.

Glabrous perennial with very short rhizome. Stems slender, erect, densely tufted, obtusely 3–4-angled, sulcate, smooth, 5–30 cm by  $\frac{1}{2}$ –1 mm. Leaves reduced to obliquely truncate, bladeless (or in the uppermost short-bladed) sheaths. Inflorescence consisting of a single terminal spikelet. Spikelet erect or slightly oblique, ebracteate, ovoid or lanceolate, terete, acute, many-flowered, 6–12 by 2–3½ mm; rachilla narrowly winged. Glumes spiral, chartaceous, ovate, obtuse or acutish, scarcely mucronulate, slightly keeled, stramineous to brownish, with green, darker lineolate, 3–5(–7)-nerved keel, 3½–4½ by 2¼–4 mm. Stamens 2–3; anthers oblong-linear or linear, ¾–1¼ mm. Style flat, scarcely dilated at the base, ciliate in the upper half, 2–3½ by ¼–¾ mm; stigmas 2, much shorter than the style. Nut biconvex, with obtuse edges, broadly obovate or orbicular,

sometimes somewhat broader than long, with very short, broad stipe, not umbonulate, with 5-8 strong transverse wavy ridges, obscurely reticulate by the minute, not impressed, hexagonal epidermal cells, dirty stramineous or brownish, rarely dark brown,  $1\frac{1}{4}$ - $1\frac{3}{4}$  mm long and wide.

Distr. SE. Asia (from Ceylon and India to S. China), tropical Australia; in *Malesia*: Sumatra and adjacent islands P. Simalur, Mentawai Is., Banka, P. Lingga), Malay Peninsula, Java, Madura, Tanimbar Is., Borneo (W. Borneo, N. Borneo, Sarawak), Philippines (Luzon), New Guinea (W. New Guinea: Kurik near Merauke: Papua: Morehead R.).

Ecol. In open wet and muddy places: swamps, rice-fields, river-banks, at low altitudes, up to 350 m.

Vern. *Balihin bu udeung*, Simalur, *rumpit janggok keli*, Mal. Pen.; Philippines: *puyóng-usa*, Tag., *surusibuyas*, Bik.

73. *Fimbristylis nutans* (RETZ.) VAHL, En. 2 (1806) 285; KUNTH, En. 2 (1837) 221; STEUD. Syn. 2 (1855) 106; BOECK. *Linnaea* 37 (1871) 5; BENTH. Fl. Austr. 7 (1878) 303; CLARKE, Fl. Br. Ind. 6 (1893) 632; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 89; KOORD. Exk. Fl. Java 1 (1911) 198; CAMUS, Fl. Gén. I.-C. 7 (1912) 96, f. 15, 10-11; RIDL. Fl. Mal. Pen. 5 (1925) 154; S. T. BLAKE, J. Arn. Arb. 35 (1954) 208. — *Scirpus nutans* RETZ. Obs. 4 (1786) 12. — *Iriha nutans* O.K. Rev. Gen. Pl. 2 (1891) 753.

Glabrous perennial with very short rhizome. *Stems* slender, densely tufted, obtusely 3-4-angled, sulcate, smooth, 15-40(-70) cm by  $\frac{1}{3}$ -1 mm. *Leaves* reduced to tubular, bladeless or short-bladed, stramineous or ferruginous sheaths. *Inflorescence* consisting of a single terminal spikelet. *Spikelet* more or less nodding, ebracteate, ovoid or broadly ovoid, terete, obtuse or acutish, densely many-flowered, stramineous and castaneous variegated, 5-15 by 3-5 mm; rachilla narrowly winged. *Glumes* spiral, chartaceous, broadly ovate, very obtuse, apiculate, scarcely keeled, 3-5(-9)-nerved in the centre, with shining brown, nerveless sides,  $3\frac{1}{2}$ - $4\frac{1}{2}$  by  $3$ - $3\frac{1}{2}$  mm. *Stamens* 3; anthers linear,  $1\frac{1}{2}$ -2 mm. *Style* flat, relatively broad, liguliform, not or scarcely dilated at the base, ciliate in the upper half,  $2\frac{1}{2}$ - $3\frac{1}{2}$  by  $\frac{1}{2}$ - $\frac{7}{10}$  mm; stigmas 2, much shorter than the style. *Nut* biconvex or almost flat on the inner side, with obtuse edges, obovate, shortly and broadly stipitate, not or scarcely umbonulate, tuberculate towards the margins or throughout, with 3-5(-6) transverse wavy ridges, obscurely reticulate by the minute, hexagonal epidermal cells, whitish,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by  $1$ - $1\frac{1}{4}$  mm.

Distr. From Ceylon and India through Farther India to S. China, Formosa, and the Ryu Kyu Is., southwards to tropical Australia; in *Malesia*: Sumatra (E. Coast Res.; Palembang), Malay Peninsula (Kelantan, Trengganu, Malacca, P. Besar, Johore, Singapore), Borneo (Sarawak, W. Borneo, N. Borneo, Labuan), New Guinea.

Ecol. Damp sandy spots, moist places in forests,

wet grass-plains, savannahs, wet rice-fields, swamps, also on brackish soil, at low altitudes (0-70 m).

Vern. *Rumpit buntit*, Borneo.

74. *Fimbristylis acicularis* R.BR. Prod. (1810) 226; BENTH. Fl. Austr. 7 (1878) 301; KERN, *Blumea* 8 (1955) 148. — *Gramen polytrichum* RUMPH. Herb. Amb. 6 (1750) 17, t. 7 f. 1. — *F. setacea* BENTH. in Hook. Lond. J. Bot. 2 (1843) 239; STEUD. Syn. 2 (1855) 106; CLARKE, Fl. Br. Ind. 6 (1893) 632, p.p., incl. var. *setacea* CLARKE; Philip. J. Sc. 2 (1907) Bot. 91; KOORD. Exk. Fl. Java 1 (1911) 198; VALCK. SUR. Nova Guinea 8 (1912) 702; CAMUS, Fl. Gén. I.-C. 7 (1912) 96; MERR. En. Philip. 1 (1923) 126; S. T. BLAKE, J. Arn. Arb. 35 (1954) 208. — *F. acuminata* var. *pumila* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 29. — *Abildgaardia brevifolia* STEUD. Syn. 2 (1855) 72; MIQ. Fl. Ind. Bat. 3 (1856) 297. — *Isolepis cochleata* STEUD. Syn. 2 (1855) 100. — *F. acuminata* var. *setacea* MIQ. Fl. Ind. Bat. 3 (1856) 314; BENTH. Fl. Austr. 7 (1878) 301; KÜK. Bot. Jahrb. 59 (1924) 47; *ibid.* 69 (1938) 257. — *F. acuminata* var. *minor* NEES ex BOECK. *Linnaea* 37 (1871) 4; ROLFE, J. Bot. 24 (1886) 59 in nota ('*F. acutifolia* var. *minor*', *sphalm.*). — *F. australica* BOECK. *Linnaea* 38 (1874) 384, *fide* BENTH. — *F. bursifolia* (*sphalm.*) VIDAL, Phan. Cuming. (1885) 156; Rev. Pl. Vasc. Filip. (1886) 284. — *Iriha acicularis* O.K. Rev. Gen. Pl. 2 (1891) 753.

Closely related to *F. acuminata*. *Stems* very slender, setaceous, spreading to decumbent, 5-20 cm by  $\frac{1}{4}$  mm. *Leaves* often all reduced to sheaths, but frequently some with well developed, filiform, acute,  $\frac{1}{2}$  mm wide blades scabrid on the margins near the top. *Spikelet* narrowly lanceolate, pale green, 4-6 by  $1$ - $1\frac{1}{2}$ (-2) mm. *Glumes* membranous, the lower ones oblong, the upper ones oblong-ovate. *Stamens* 1-2; anthers linear, c.  $1\frac{1}{2}$  mm. *Style* very slender, distinctly dilated at the base, c.  $2\frac{1}{4}$  mm long,  $\frac{1}{10}$  mm wide. *Nut* obovate, white or pale stramineous,  $\frac{3}{4}$ - $\frac{9}{10}$ (-1) by  $\frac{1}{2}$ - $\frac{2}{3}$ (- $\frac{1}{5}$ ) mm.

Distr. Tropical Australia, Bougainville; in *Malesia*: Philippines (Luzon), S. Celebes (Makassar); Moluccas (Halmahera, Buru, Amboina), New Guinea, Aru Is.

Ecol. In open wet localities: edges of swamps, wet grass-fields, damp places in savannah-forests, trails in secondary forests, also on the sea-shore, at low altitudes, rarely up to 800 m.

Notes. According to BENTHAM *F. acicularis* and *F. setacea* differ in the style (glabrous in *acicularis*, ciliate in *setacea*) and the number of stamens (1 and 3 respectively). In the type collection of *F. acicularis* the style is ciliate ("style basi dilatata nudâ," R. BROWN), and in both *F. acicularis* and *F. setacea* there are 1 or 2 stamens. I have not seen SCHULTZ 79, type collection of *F. australica* BOECK., in which the style is said to be glabrous.

In the upper flowers of the spikelet I frequently find the upper flowers female, without a trace of stamens; cf. *F. androgyna* R.BR.

#### 16. Section *Mischospora*

(BOECK.) CAMUS, Fl. Gén. I.-C. 7 (1912) 89. — *Mischospora* BOECK. *Flora* 43 (1860) 113. — *Fimbristylis* sect. *Tetragonae* OHWI, J. Jap. Bot. 14 (1938) 571.

Type species: *Mischospora foliata* BOECK. (*F. tetragona* R.BR.)

75. *Fimbristylis tetragona* R.Br. Prod. (1810) 226; KUNTH, En. 2 (1837) 242; STEUD. Syn. 2 (1855) 108; BENTH. Fl Austr. 7 (1878) 305; CLARKE, Fl. Br. Ind. 6 (1893) 631; Philip. J. Sc. 2 (1907) Bot. 91; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 88; CLARKE, Ill. Cyp. (1909) t. 40 f. 1-4; KOORD. Exk. Fl. Java 1 (1911) 198; CAMUS, Fl. Gén. I.-C. 7 (1912) 93, f. 13, 6-7; MERR. En. Philip. 1 (1923) 127; RIDL. Fl. Mal. Pen. 5 (1925) 153; BACK. Onkr. Suiker. (1928) 158, t. 162; KÜCK. Mitt. Thür. Bot. Ver. N.F. 50 (1943) 8; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 55; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 19; S. T. BLAKE, J. Arn. Arb. 35 (1954) 208; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 462. — *F. cylindrocarpa* KUNTH, En. 2 (1837) 222; STEUD. Syn. 2 (1855) 107; KURZ, J. As. Soc. Beng. 39, ii (1870) 85; BOECK. Linnaea 37 (1871) 7. — *F. abjiciens* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 107; MIQ. Fl. Ind. Bat. 3 (1856) 316. — *Mischospora efoliata* BOECK. Flora 43 (1860) 113. — *F. oxyrhachis* MIQ. Sum. (1861) 601. — *F. arnotii* THWAITES, En. Pl. Zeyl. (1864) 348. — *Iriha tetragona* O.K. Rev. Gen. Pl. 2 (1891) 753.

Glabrous, glaucous perennial with short rhizome, or annual in unfavourable circumstances. *Stems* densely tufted, erect, rigid, quadrangular, strongly ribbed, smooth, 10-60 cm by  $\frac{1}{2}$ -1 mm. *Leaves* of the flowering stems reduced to 2-3 obliquely truncate, membranous, ferruginous or fuscous, 3-10 cm long sheaths, bladeless or the uppermost with a short, lanceolate blade; those of the sterile shoots filiform, c.  $\frac{1}{2}$  mm wide. *Inflorescence* consisting of a single

terminal spikelet. *Spikelet* erect, ebracteate, globose, ovoid or oblong-ovoid, terete, obtuse, very densely many-flowered, dull brown, 6-15 by 4-6 mm; rachilla ragged by narrow wings. *Glumes* spiral, closely imbricate, membranous, oblong-ovate or oblong, very obtuse, with rounded apex, mucicous, concave, faintly many-nerved (3 central nerves more prominent), 3-5 by 2-3 mm. *Stamens* 1-3; anthers linear,  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm. *Style* subpersistent on the nut, flat, slightly dilated at the base which is nearly as wide as the nut, sparsely ciliate, dark brown, 2-3 mm; stigmas 2 or 3, much shorter than the style. *Nut* planoconvex or subterete, oblong-cylindrical, slightly curved, conspicuously stipitate, trabeculate by the hexagonal or transversely elliptic, slightly impressed epidermal cells in c. 9 vertical rows on either face, stramineous,  $1\frac{1}{2}$ -2 by  $\frac{1}{2}$  mm; gynophore (stipe) spongy, ( $\frac{1}{3}$ - $\frac{1}{2}$ -1 mm long).

Distr. From Ceylon and India through Thailand and Indo-China to S. China, Formosa, and tropical Australia; in *Malesia*: N. Sumatra, Banka, Malay Peninsula (very local: Kuala Pahang, Singapore), W. and Central Java, Madura, Kangean, Lesser Sunda Is. (Lombok, Sumba), N. Borneo (Jesselton, Kuching), Philippines (Luzon), S. Celebes, New Guinea (very local).

Ecol. On heavy soil in open, wet places: swamps, swampy grasslands, wet rice-fields, at low altitudes (usually below 300 m, in Sumba at 500 m, in Sumatra up to 1000 m).

Vern. *Komis*, Md.

#### 17. Section Dipsaceae

OHWI, J. Jap. Bot. 14 (1938) 571. — *Echinolytrum* DESV. J. Bot. 1 (1808) 20. — *Fimbristylis* sect. *Echinolytrum* OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 53. — *Fimbristylis* ser. *Echinolytrum* KOYAMA J. Fac. Sc. Un. Tokyo III, 8 (1961) 101.

Type species: *F. dipsacea* (ROTTB.) CLARKE (*Scirpus dipsaceus* ROTTB.).

76. *Fimbristylis dipsacea* (ROTTB.) CLARKE, Fl. Br. Ind. 6 (1893) 635; Philip. J. Sc. 2 (1907) Bot. 93; Ill. Cyp. (1909) t. 41 f. 4-7; MERR. En. Philip. 1 (1923) 123; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 19; S. T. BLAKE, J. Arn. Arb. 35 (1954) 214; KERN, Blumea 9 (1958) 234; KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 118, incl. var. *verrucifera* KOYAMA; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 462. — *Scirpus dipsaceus* ROTTB. Descr. & Ic. (1773) 56, t. 12 f. 1; VAHL, En. 2 (1806) 276; BOECK. Linnaea 36 (1870) 736; F.v.M. Descr. Not. 2 (1886) 35. — *Echinolytrum dipsaceum* DESV. J. Bot. 1 (1808) 21, t. 1; NEES in WIGHT, Contr. (1834) 96; CAMUS, Fl. Gén. I.-C. 7 (1912) 130, f. 17, 3-5. — *Isolepis dipsacea* R. & S. Syst. 2 (1811) 119; KUNTH, En. 2 (1837) 205; STEUD. Syn. 2 (1855) 99; MIQ. Fl. Ind. Bat. 3 (1856) 309. — *Isolepis verrucifera* MAXIM. Prim. Fl. Amur. (1859) 300. — *F. verrucifera* MAKINO, Bot. Mag. Tokyo 9 (1895) 259; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18 (1944) 56.

Glabrous annual with fibrous roots. *Stems* very slender, densely tufted, setaceous, angular, smooth, (2-)-5-15(-25) cm by  $\frac{1}{4}$ - $\frac{1}{3}$  mm. *Leaves* short, filiform, smooth, or scabrid at the top,  $\frac{1}{4}$ - $\frac{1}{3}$  mm wide; ligule absent; sheaths obliquely truncate, the lower ones bladeless or short-bladed, brownish. *Inflo-*

*rescence* simple or subcompound, umbelliform, with up to 15 spikelets, but not rarely much reduced. Involucral bracts 3-5, shorter to longer than the inflorescence, dilated at the base. Primary rays up to 10, smooth, up to 2 cm. *Spikelets* solitary, subglobose or oblong, terete, obtuse, squarrose, very densely many-flowered, pale green, 3-6 by 2-3 mm; rachilla densely ragged by minute wings. *Glumes* spiral, thinly membranous, spreading, oblong or lanceolate, keeled, the blade c. 1 by  $\frac{1}{2}$  mm, with hyaline, obscurely 1-2-nerved sides and a strong green midrib excurrent into a  $\frac{1}{2}$ -1 mm long recurved awn slightly scabrid at the top. *Stamen* 1; anther oblong,  $\frac{1}{3}$  mm. *Style* glabrous, slightly dilated at the base, ferruginous,  $\frac{1}{4}$  mm long; stigmas 2, about as long as the style. *Nut* scarcely compressed, subterete, oblong-linear, very rarely narrowly obovoid, slightly curved, obscurely transversely lineolate by the minute, hexagonal or elliptic epidermal cells, ferruginous or brown,  $\frac{1}{2}$ - $\frac{3}{4}$  by  $\frac{1}{6}$  mm (or, when obovoid,  $\frac{2}{5}$  by  $\frac{1}{4}$  mm), on either margin ornamented with a row of clavate appendages (glands?), which often fall off with age.

Distr. Tropical Africa, S. and E. Asia; in *Malesia* very rare: S. Sumatra (near Palembang), Madura, Bawean, E. Borneo (Kutei), Philippines (Luzon,

Mindanao, Central Celebes (Lake Posso), New Guinea (Papua, W. Division).

Ecol. Muddy lake-shores, river-banks, wet rice-fields, at low altitudes. Along Kastoba Lake (Bawean I.) forming a dense mat in association with *F. aestivalis*.

Notes. Specimens with reduced inflorescence may be mistaken for *Lipocarpa microcephala*, which shares the squarrose spikelets and oblong-linear nuts with it. In *Lipocarpa*, however, the nuts are minutely punctulate (not transversely lineolate), never beset with gland-like appendages, and enclosed in two thinly membranous scales.

DESVAUX (1808) took the pericarp for a utricle surrounding the fruit (like in *Carex*); on this supposed feature the genus *Echinolytrum* was based.

The specimens collected in Borneo deviate from the other Malesian materials by their narrowly obovoid nuts; similar fruits I have seen in Indian plants.

*F. verrucifera* is said to differ from *F. dipsacea* by the shorter and less recurved awns of the glumes and hence less squarrose spikelets. Similar plants occur in Africa; probably they even do not deserve varietal rank.

### 18. Section Actinoschoenus

(BENTH.) KERN, *Blumea* 8 (1955) 160. — *Actinoschoenus* BENTH. in B. & H. Gen. Pl. 3 (1883) 1058. — *Arthrostylis* subg. *Actinoschoenus* KÜK. in Fedde, Rep. 53 (1944) 197.

Type species: *F. thouarsii* (KUNTH) MERR. (*Arthrostylis thouarsii* KUNTH).

77. *Fimbristylis thouarsii* (KUNTH) MERR. En. Philip. 1 (1923) 127; KERN, *Reinwardtia* 6 (1961) 44. — *Arthrostylis thouarsii* KUNTH, En. 2 (1837) 284; MIO, Fl. Ind. Bat. 3 (1856) 335; KÜK. in Fedde, Rep. 53 (1944) 199. — *Arthrostylis chinensis* BENTH. Fl. Hongk. (1861) 397; KÜK. in Fedde, Rep. 53 (1944) 198, incl. var. *filiformis* KÜK. — *Arthrostylis filiformis* THWAITES, En. Pl. Zeyl. (1864) 352; BOECK. *Linnæa* 37 (1873) 524. — *Actinoschoenus filiformis* BENTH. in Hook. Ic. Pl. 14 (1881) 33, t. 1346; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 84; Fl. Mal. Pen. 5 (1925) 165, incl. var. *rupestris* RIDL. — *Actinoschoenus chinensis* BENTH. in Hook. Ic. Pl. 14 (1881) 33, t. 1346. — *Actinoschoenus thouarsii* BENTH. l.c.; CHERMEZ. in Humbert, Fl. Madag., fam. 29 (1937) 224, t. 20, f. 8–10. — *F. actinoschoenus* CLARKE, Fl. Br. Ind. 6 (1893) 650, incl. var. *chinensis* CLARKE, Philip. J. Sc. 2 (1907) Bot. 98. — *F. actinoschoenus* var. *thouarsii* CLARKE, Ill. Cyp. (1909) t. 44 f. 5–10. — *Actinoschoenus filiformis* RIDL. J. Fed. Mal. St. Mus. 6 (1915) 192. — *F. filiformis* H. PFEIFF. in Fedde, Rep. 29 (1931) 183, non KUNTH, 1837. — *F. chinensis* TANG & WANG, Fl. Reip. Pop. Sin. 11 (1961) 106.

Glabrous perennial with short rhizome. *Stems* very densely tufted, setaceous, trigonous, sulcate, smooth, (15–)30–75 cm by  $\frac{3}{4}$ –1 mm. *Leaves* reduced to 2–3 bladeless or short-bladed sheaths, obliquely truncate, glabrous, stramineous or ferruginous, up to 10 cm long. *Inflorescence* capitate, globose, with up to 20 spikelets, 5–12 mm across. Involucral bracts very short, usually hidden by the spikelets, setaceous, the longest up to 8 mm. *Spikelets* sessile, stellately spreading, the lower ones finally reflexed, falling off as a whole, strongly compressed, acute, 1(–3)-flowered, 5–6 by c. 1 mm. *Glumes* 4–6, usually only 1 flower-bearing, distichous, the lowest ovate,  $\frac{3}{4}$  mm, the upper ones gradually longer, lanceolate, acute, mucronate, with acute 3-nerved keel and nerveless sides, up to 5 mm; mucro more or less recurved. *Stamens* 3; anthers linear, 2–3 mm. *Style* triquetrous, slightly thickened at the base,

glabrous or sparsely setulose at the top, 4–4½ mm; stigmas 3, somewhat shorter than the style. *Nut* obtusely trigonous, ellipsoid or obovoid, sessile, not or hardly umbonulate, smooth or sparsely verrucose, reticulate, whitish to stramineous,  $\frac{1}{3}$ – $\frac{1}{2}$  by c. 1 mm; epidermal cells hexagonal or transversely elliptic.

Distr. Madagascar, Mauritius, Ceylon, Thailand, Indo-China, S. China; in *Malesia*: Banka, P. Lingga, Malay Peninsula (Johore, Pahang, Malacca, Perak, Kedah, P. Penang), Anambas Is., Borneo (Sarawak), Philippines (Culion, Busuanga); not in the SE. part of the Archipelago.

Ecol. In sandy fields, secondary forests, on rocky slopes, in the Philippines back of the mangrove swamps, usually below 500 m, in the Malay Peninsula at 300–2100 m, occasionally lower.

Vern. *Série bēni*, Banka.

Notes. As appears from the synonymy the systematic place of this species has been much disputed. The flower-structure is that of *Fimbristylis* but there are several indications that the relationship may lay elsewhere (eucyperoid anatomical structure, turbinate embryo, spikelets falling off as a whole) and that for these reasons one could argument its reinstatement to generic rank.

This was recently done by RAYNAL, *Adansonia* 7 (1967) 89–95, who asserts that the rachilla is persistent and it is only the glumes that fall off as a whole. For the Malesian plants he accepted the binomial *Actinoschoenus filiformis* (THWAITES) BENTH., because he thinks that they are specifically distinct from the Hongkong and the greater part of the Madagascar specimens (*A. thouarsii sensu stricto*). To me the differences are too slight for specific separation.

To judge from gross morphological characters *F. yunnanensis* CLARKE, J. Linn. Soc. Bot. 36 (1903) 247; TURR. Kew Bull. (1912) 425; KERN, *Blumea* 10 (1960) 648; *Reinwardtia* 6 (1961) 44, known from N. Thailand, Yunnan and N. India, is a close ally of *F. thouarsii*, but anatomical and embryographic details of this species are lacking.

## Species of doubtful place

78. *Fimbristylis fenestrata* KÜK. Bot. Jahrb. 59 (1924) 49.

Annual. *Stems* weak, densely tufted, compressed, sulcate, few-leaved at the base, 10–20 cm tall. *Leaves* shorter than the stems, setaceous, with pale brown sheaths. *Inflorescence* usually consisting of a single pseudolateral spikelet, sometimes a second spikelet on a reflexed peduncle added. *Spikelet* oblong-lanceolate, 4–5 by 1½ mm. Bract erect, as though continuing the stem, overtopping the spikelet(s). *Glumes* spiral, ovate, shortly mucronate, pale ferrugineous with green keel. *Style* long, with pyramidally thickened base; stigmas 3, short. *Nut* trigonous, broadly obovoid, truncate and quadrilateral at the apex, minutely reticulate, stramineous.

Distr. *Malesia*: NE. New Guinea, Sepik Distr. (LEDERMANN 12523, not seen).

Ecol. On steep seepage in scrubby mountain-forest with few large trees, 1400–1500 m.

Note. According to KÜKENTHAL intermediate between *F. cardiocarpa* F.v.M. and *F. spiralis* R.Br., both occurring in Australia.

## Excluded or doubtful

*Abildgaardia javanensis* GANDOGER, Bull. Soc. Bot. Fr. 66 (1920) 296. — “Java, JUNGHUHN”. Not seen. The description is quite inadequate. Probably *F. ovata* (BURM. f.) KERN.

*Fimbristylis longispica* STEUD. Syn. 2 (1855) 118; MIQ. Fl. Ind. Bat. 3 (1856) 325; KOORD. Exk. Fl.

Java 1 (1911) 199. — The type collection “Hrbr. GOERING nr. 10. Java” (P!) is certainly not from Java, but from Japan. The species is closely related to, but in my opinion well distinct from *F. dichotoma* (L.) VAHL; see, however, KOYAMA, J. Fac. Sc. Un. Tokyo III, 8 (1961) 112, who reduced it to subspecific rank. It is known from Japan, Korea, Quelpaert I., and China, but not from Malesia.

CLARKE's record for Singapore in Fl. Br. Ind. 6 (1893) 639 refers to a coarse, coastal form of *F. dichotoma*, which in outward appearance is similar to *F. longispica*, but differs in several details. RIDLEY's “*F. longispica*” is partly that form, partly *F. insignis* THWAITES. See also the notes under *F. dichotoma*.

*Fimbristylis separanda* STEUD. ex JARD. Mém. Soc. Imp. Sc. Nat. Cherb. 5 (1857) 299, 324. — I have not seen the type. According to DRAKE DEL CASTILLO, Fl. Polyn. Franç. (1893) 245, it is synonymous with *F. nukahiwensis* STEUD. Syn. 2 (1855) 117. In the Paris Herbarium there are some specimens determined by CLARKE as *F. separanda*, from “Baie de Sanpoong-Sumatra, détroit de la Sonde. Voyage de l'Astrolabe et de la Zélée 1838–1840; M. HOMBRON, 1841”. They represent a species related to *F. dichotoma* (L.) VAHL, with very short, narrow leaves, glumes hairy in the upper part, and nuts with 16–18 longitudinal series of epidermal cells on either face.

The specimens of the Astrolabe expedition are often mislabeled, and it is very unlikely that HOMBRON collected the plants in S. Sumatra. (Sanpoong should possibly be Lampong).

See also S. T. BLAKE, Contr. Queensl. Herb. 8 (1969) 10–12.

## 14. CYPERUS

LINNÉ, Gen. Pl. ed. 5 (1754) 26; Sp. Pl. ed. 1, 1 (1753) 44; KUNTH, En. 2 (1837) 2; STEUD. Syn. 2 (1855) 2; MIQ. Fl. Ind. Bat. 3 (1856) 254; BOECK. Linnaea 35 (1868) 436; *ibid.* 36 (1870) 271; B. & H. Gen. Pl. 3 (1883) 1043; C. B. CLARKE, J. Linn. Soc. Bot. 21 (1884) 33; PAX in E. & P. Pfl. Fam. 2, 2 (1887) 107; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 41; KÜK. Pfl. R. Heft 101 (1935–1936) 41; KOYAMA, Quart. J. Taiwan Mus. 14 (1961) 159. — *Mariscus* GAERTN. Fruct. & Sem. 1 (1788) 11. — *Juncellus* C. B. CLARKE, Fl. Br. Ind. 6 (1893) 594. — *Chlorocyperus* RIKLI in Pringsh. Jahrb. 27 (1895) 563. — *Duvaljouvea* PALLA in Koch, Syn. ed. 3, 2 (1905) 2555. — Fig. 49–70.

For the other generic names referred to *Cyperus* in the present treatment, see under the synonymy of the subgenera and sections.

Perennial or annual herbs, tufted or with creeping rhizome. *Stems* erect or obliquely erect, solid, triquetrous, trigonous, or sometimes subterete, usually leafy only at the base, rarely halfway up. *Leaves* tristichous, narrowly linear, grass-like, rarely lanceolate or elliptic, the lower ones often scale-like, covering the base of the stem and the rhizome, rarely all reduced to their sheaths. *Inflorescence* terminal, often anthelate (terminal spike or cluster overtopped by the lateral ones), simple to decompound, umbel-like, not rarely capitate by suppression of the rays, in a few spp. truly umbellate. Rays subtended by a foliaceous bract similar to the leaves, the base enclosed in a tubular, two-keeled prophyll (*cladoprophyll*; see below, note), the bracts usually approximate as though forming an involucre. *Spikelets* more or less compressed, quadrangular, or

subterete, 1-many-flowered; axis (*rachilla*) often winged by the decurrent base of the glumes, persistent or caducous (in the latter case spikelets falling off as a whole). *Glumes* distichous, rarely nearly so, usually 2 basal ones empty (bracteole and prophyll), rarely 3 or 4 so. *Flowers* bisexual, the uppermost of the spikelet often male or barren by reduction; very rarely male and female flowers in different individuals (dioecious; not in Malesia). Hypogynous bristles or scales absent. *Stamens* 3, 2, or 1, the median one anterior, the others transversal; connective often produced into an apical appendage. *Style* continuous with the ovary, not or hardly incrassate at the base, caducous, 3-fid or 2-fid, very rarely almost undivided. *Nut* sessile or shortly stipitate, trigonous or lenticular (planoconvex, concave-convex, or biconvex).

**Distr.** About 600  *spp.*, the vast majority of them in the tropics and subtropics. In *Malesia* 76  *spp.*, most of them of pantropical or paleotropical distribution. A few  *spp.* are apparently endemic in New Guinea (*C. neoguineensis*, *C. subpapuanus*, *C. cinereobrunneus*, *C. meistostylus*, *C. pachycephalus*). Several  *spp.* are very rare in Malesia and show large disjunctions (*C. ohwii*, *C. exaltatus*, *C. alopecuroides*, *C. bulbosus*, *C. zollingeri*, *C. babakan*, *C. multispicatus*, *C. teneriffae*, *C. diaphanus*, *C. substramineus*). Recent introductions are *C. aromaticus* and *C. sphacelatus*.

**Ecol.** Most  *spp.* are hygrophilous; they grow in moist or wet localities at low and medium altitudes. Only a few ascend to above 1600 m. The  *spp.* of  *sect. Diffusi* prefer moist forests. *C. stoloniferus*, *C. radians*, *C. dubius*, and *C. pedunculatus* grow on sandy sea-shores and in sandy dunes, those with creeping stolons often acting as sandbinders. *C. procerus* and especially *C. malaccensis* prefer muddy places within the influence of salt or brackish water. *C. iria*, *C. difformis*, *C. pulcherrimus*, *C. halpan*, and *C. tenuispica* are characteristic of inundated rice-fields, *C. rotundus* is a troublesome weed in gardens and on road-sides.

**Uses.** Economically the genus is unimportant. The dried stems of some  *spp.* (e.g. *C. elatus*, *C. malaccensis*, *C. procerus*) are used for making mats or as strings. *C. brevifolius*, *C. kyllingia*, and *C. rotundus* make rather good pasturage when they are young and grow extensively. *C. flabelliformis* and *C. papyrus* are grown as ornamentals in ponds. For *C. flabelliformis* see p. 618.

*Cyperus papyrus* L., indigenous in Central tropical Africa, is readily recognizable by its up to 5 m tall, pithy stems at the base covered with bladeless sheaths, the umbellate inflorescence with very numerous, subequal rays, and the lanceolate involucre bracts much shorter than the inflorescence. It was early used for paper-making and cultivated for this purpose in Egypt, Palestine, and S. Europe. See CHIOVENDA, Mem. Istit. Bot. Modena 1 (1931) 1-120, t. 1-4.

The tubers of *C. esculentus* and *C. bulbosus* are edible, but their use is not recorded for Malesia.

**Notes.** Flower-structure in *Cyperus* is as in those *Scirpus spp.* which lack hypogynous bristles; *Cyperus* differs in that the glumes are distichously arranged (spirally in *Scirpus*). See note under *C. pygmaeus*, p. 635.

There is no unanimity on the delimitation of the genus (type species *C. esculentus* L.). C. B. CLARKE, the founder of modern Cyperology, originally took *Cyperus* in a wide sense, but in his later publications he proposed the following subdivision:

- 1. Style 2-branched.
- 2. Rachilla deciduous . . . . . *Kyllinga*
- 2. Rachilla persistent.
- 3. Nut laterally compressed . . . . . *Pycurus*
- 3. Nut dorsally compressed . . . . . *Juncellus*
- 1. Style 3-branched.
- 4. Rachilla persistent . . . . . *Cyperus*
- 4. Rachilla deciduous.
- 5. Rachilla deciduous in one piece.
- 6. Glumes not winged . . . . . *Mariscus*
- 6. Glumes winged . . . . . *Courtoisia*
- 5. Rachilla breaking up into as many joints as nuts . . . . . *Torulinium*

This classification is artificial in many respects. More recently two other (monotypic) genera have been segregated, *Sphaeromariscus* CAMUS for *C. compactus*, and *Queenslandiella* DOMIN (= *Mariscopsis* CHERM.) for *C. hyalinus*.

In VALCKENIER SURINGAR's excellent revision of *Cyperus* in the Malay Archipelago (1898), the genus is taken in its wide sense, and so it is in KÜKENTHAL's monograph in the Pflanzenreich (1935-36). With the exception of *Courtoisia* the genera accepted by CLARKE were here reduced to subgeneric rank. As also *Juncellus*, *Mariscus* and *Torulinium* are ill-defined even as subgenera, in the present treatment only *Cyperus*, *Pycurus*, and *Kyllinga* are accepted as such. See also O'NEILL, Rhodora 44 (1942) 43-47.

VAN DER VEKEN, Bull. Jard. Bot. Brux. 35 (1965) 285-354, studied the embryos of 132 species of *Cyperus* belonging in different groups. The uniformity of the embryos appears to support the wide conception of the genus.

The function of the cladoprophyll in *Cyperus* was pointed out by TH. HOLM, Am. J. Sc. 18 (1904) 304. It is by means of the cladoprophylls that the primary rays of the anthela attain their more or less spreading position.

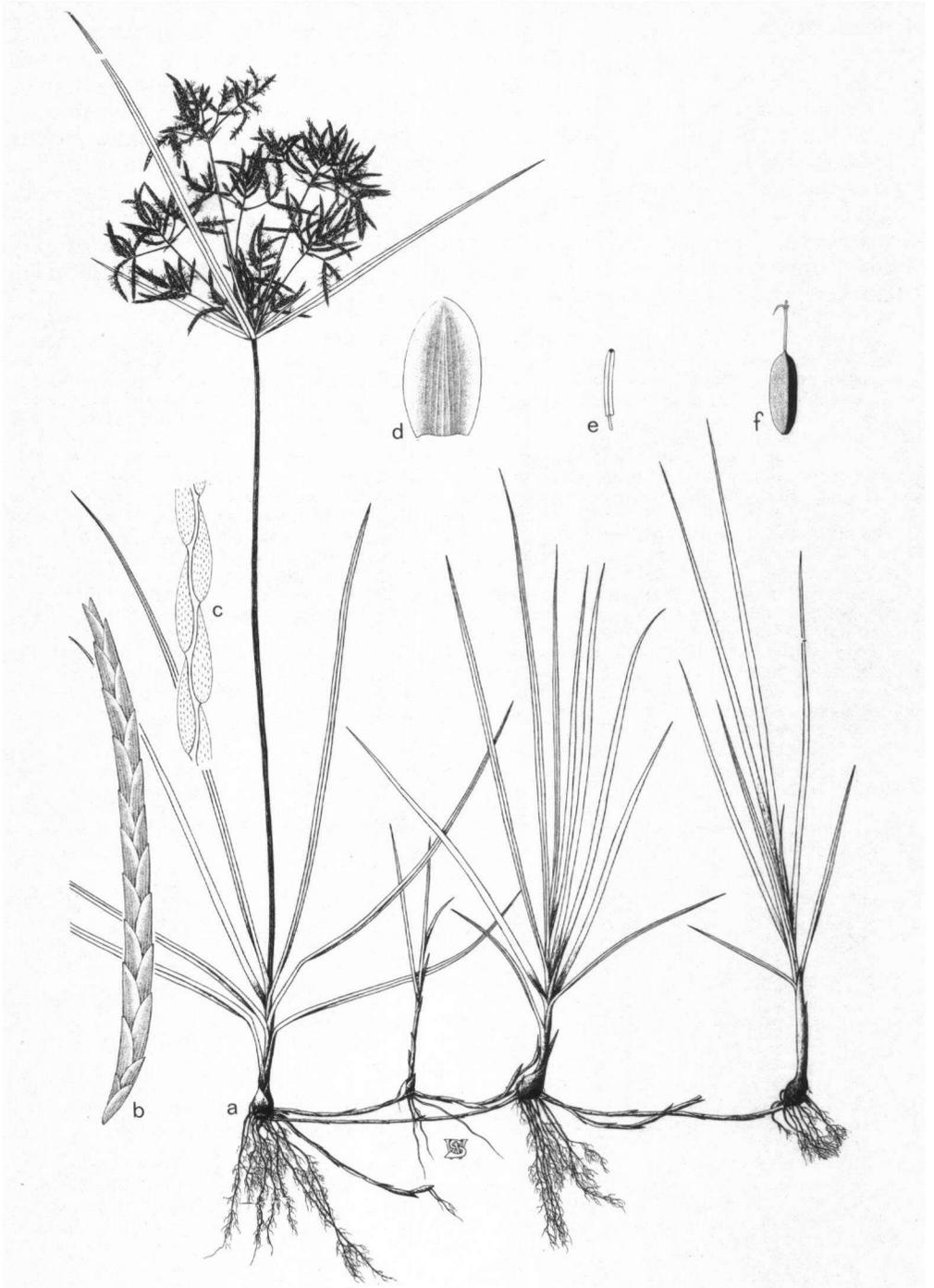


Fig. 49. *Cyperus rotundus* L. a. Habit,  $\times \frac{1}{3}$ , b. spikelet,  $\times 3$ , c. broadly winged rachilla, d. glume, e. anther, f. nut, all  $\times 7$  (a-f IBOET 157).

Before the flowers are fully developed the rays are erect and congested. When mature the tubular prophylls show a prominent swelling at their base on the adaxial side. This swelling consists of a rapidly developing tissue without chlorophyll. By the rapid growth of this local tissue the rays are pushed away from the central axis.

KEY TO THE SECTIONS  
represented in *Malesia*

The circumscription of several sections is wider than in KÜENTHAL'S monograph. It has been tried to bring the sectional names into accordance with the Rules (in the said monograph they are often not).

1. Nut with a face towards the rachilla, trigonous or, when lenticular, dorsoventrally compressed. *Spp.* 1-60.
  - I. SUBG. CYPERUS
  2. Rachilla persistent after the glumes and nuts have fallen off.
  3. Spikelets spicately arranged on a more or less elongated rachis.
  4. Spikes cylindrical, much longer than wide, with very numerous spikelets. Tall perennials with long, broad leaves and bracts. Inflorescence antherlate, large, compound. Stolons absent.
  5. Stigmas 3. Nut trigonous. *Spp.* 1-5. . . . . 1. *Sect. Exaltati*
  5. Stigmas 2, or only in some flowers 3. Nut planoconvex, or only some of them with a raised dorsal angle. *Sp.* 6 . . . . . 2. *Sect. Alopecuroidei*
  4. Spikes ovoid or obovoid, usually less than thrice as long as wide, with much less numerous spikelets. Stigmas 3. Nut trigonous.
  6. Rachilla broadly winged.
    7. Rhizome horizontally creeping or emitting long stolons, often tuberiferous. Glumes densely imbricate.
    8. Leaves and involucre bracts long. Stems trigonous. *Spp.* 7-10 . . . . . 3. *Sect. Cyperus*
    8. Leaves reduced to bladeless or very shortly laminate sheaths. Involucre bracts short. Stems subterete. *Sp.* 11. . . . . 4. *Sect. Corymbosi*
    7. Rhizome very short, without long, tuberiferous stolons, rarely annuals with fibrous roots. Glumes remote, not or scarcely imbricate.
    9. Spikelets subquadrangular (rhomboidal in cross-section), distinctly compressed. Slender, medium-sized perennials or annuals. *Spp.* 12-14 . . . . . 5. *Sect. Subimbricati*
    9. Spikelets subterete, but slightly compressed. Perennials, often robust. *Spp.* 15-16. . . . . 6. *Sect. Distantes*
  6. Rachilla not or hardly winged.
    10. Stout or rather stout perennial with rhizomes emitting long stolons. Glumes rounded on the back, mucous or inconspicuously mucronulate, broadly hyaline-margined in the upper part. *Spp.* 17-20. . . . . 7. *Sect. Proceri*
    10. Annuals with fibrous roots. Glumes distinctly keeled and mucronate.
      11. Nut about as long as the subtending glume. Glumes orbicular to broadly ovate, rounded or emarginate at the apex. Style hardly any, stigmas short. *Sp.* 21 . . . . . 8. *Sect. Iriae*
      11. Nut about half as long as the subtending glume. Glumes ovate, acuminate. Style and stigmas long. *Sp.* 22 . . . . . 9. *Sect. Compressi*
3. Spikelets digitately or stellately arranged on a much abbreviated rachis (often some solitary in the same inflorescence), or inflorescence capitate. Rachilla wingless or but narrowly winged.
  12. Inflorescence antherlate (umbel-like), with more or less developed rays. Stigmas 3. Nut trigonous.
  13. Leaves of the flowering stems reduced to their sheaths. Involucre bracts numerous (up to 20), subequal in length, somewhat distant from one another. Perennials with large, compound inflorescences. *Sp.* 23 . . . . . 10. *Sect. Alternifolii*
  13. Leaves with well-developed blades. Involucre bracts less numerous, unequal in length, close together.
  14. Perennials with very short rhizome; stolons absent. Involucre bracts long. Spikelets turgid-compressed. Glumes usually mucronate.
    15. Nut with corky angles. Style flattened, fimbriate. Leaves septate-nodulose. *Sp.* 24. . . . . 11. *Sect. Pseudanosporum*
    15. Angles of nut not corky. Style not flattened, glabrous or ciliate. Leaves not or inconspicuously septate-nodulose. . . . . 12. *Sect. Diffusi*
    16. Stems longer than the inflorescence. *Spp.* 25-32 . . . . . 13. *Sect. Radiantes*
    16. Stems very short, much shorter than the primary rays of the inflorescence. *Sp.* 33. . . . . 14. *Sect. Tenelli*
  18. Glumes not cellular-reticulate.
    19. Nut much shorter than the subtending glume. Annuals or perennials. *Spp.* 35-37. . . . . 15. *Sect. Halpani*
    19. Nut about as long as the subtending glume. Spikelets crowded into very dense clusters. Annuals. *Sp.* 38 . . . . . 16. *Sect. Fusci*
  17. Glumes (in *Malesian spp.*) with conspicuous, spreading or recurved mucro. Dwarf annuals with narrow leaves
    20. Glumes truncate, with 3-nerved keel and nerveless sides. *Spp.* 39-40 . . . . . 17. *Sect. Amabiles*
    20. Glumes attenuate, strongly nerved over the whole breadth. *Sp.* 41 . . . . . 18. *Sect. Aristati*

12. Inflorescence capitate, without any trace of rays.  
 21. Stigmas in all the flowers 3 (in *sect. Anosporum* style almost undivided). Nut trigonous. Perennials.  
 22. Angles of the nut not corky. Style deeply trifid.  
 23. Glumes mucronate. Lower leaf-sheaths scarious, inflated. Involucral bracts short, not or but slightly overtopping the inflorescence. *Sp. 42.* 19. *Sect. Humiles*  
 23. Glumes muticous. Lower leaf-sheaths not inflated. Involucral bracts much overtopping the inflorescence. *Sp. 43.* 20. *Sect. Platystachyi*  
 22. Angles of nut corky. Style almost undivided. *Sp. 44.* 21. *Sect. Cephalotes*  
 21. Stigmas in flowers of the same inflorescence partly 2, partly 3. Nut lenticular, dorsoventrally compressed, or (in the same inflorescence) trigonous. Angles of the nut acute, often narrowly winged. Annuals. *Spp. 45-46.* 22. *Sect. Dichostylis*
2. Rachilla disarticulating, falling off with the glumes and nuts.  
 24. Rachilla disarticulating only at the base; mature spikelets falling off entire. Stigmas 3. Nut trigonous. Perennials.  
 25. Internodes of the rachilla not corky. Spikelets rarely strictly 1-flowered.  
 26. Stem-base not strikingly pseudo-bulbous.  
 27. Spikelets several- to many-flowered, maturing at least 3 nuts. Glumes not tightly clasping the nut.  
 28. Spikelets oblong or lanceolate. Nut oblong-ellipsoid or oblong-obovoid, rarely narrower.  
 29. Glumes appressed. Spikelets subterete, turgid. Glumes rounded on the back. Stout plants with large inflorescences and septate-nodulose leaves. *Spp. 47-48.* 23. *Sect. Pennati*  
 29. Glumes patulous, at least at the top. Spikelets not turgid.  
 30. Rachilla broadly winged. Leaves broad. *Sp. 49.* 24. *Sect. Thunbergiani*  
 30. Rachilla not or but narrowly winged. Leaves narrow. *Spp. 50-51.* 25. *Sect. Pinnati*  
 28. Spikelets linear. Nut oblong-linear or oblong.  
 31. Spikes hemispherical or subglobose. Spikelets subulate, subterete. *Spp. 52-53.* 26. *Sect. Flabelliformes*  
 31. Spikes broadly cylindrical. Spikelets linear, compressed. *Sp. 54.* 27. *Sect. Strigosi*  
 27. Spikelets few-flowered, maturing 1-2(-3) nuts. Glumes tightly clasping the nuts. Inflorescence simple, rarely subcompound. *Spp. 55-57.* 28. *Sect. Mariscus*  
 26. Stem-base pseudo-bulbous by turgid, membranous sheaths. Inflorescence capitate. *Sp. 58.* 29. *Sect. Kyllingioides*
25. Nut-bearing internode of the rachilla corky. Spikelets 1-flowered. Rhizome long-creeping. *Sp. 59.* 30. *Sect. Remirea*  
 24. Rachilla disarticulating at each node. Spikelets breaking up into short segments each bearing 1 nut tightly embraced by the much thickened wings of the rachilla. *Sp. 60.* 31. *Sect. Diclidium*
1. Nut with one of the two edges towards the rachilla, laterally compressed. Stigmas 2.  
 32. Rachilla persistent after the glumes and nuts have fallen off. *Spp. 61-69.* II. SUBG. PYCREUS  
 33. Epidermal cells of the nut isodiametric. Nut smooth.  
 34. Glumes muticous.  
 35. Stems decumbent at the base, rooting at the nodes, leafy in the lower  $\frac{1}{3}$ - $\frac{1}{2}$ . *Sp. 61.* 32. *Sect. Vestiti*  
 35. Stems erect, leafy only at the very base.  
 36. Spikelets lanceolate or oblong. Glumes at least 3 mm long. *Sp. 62.* 33. *Sect. Chrysanthi*  
 36. Spikelets linear. Glumes at most 3 mm long. *Spp. 63-65.* 34. *Sect. Pycreus*  
 34. Glumes mucronate. *Spp. 66-67.* 35. *Sect. Pumilli*  
 33. Epidermal cells of the nut longitudinally stretched. Nut rugulose with transverse wavy lines. *Spp. 68-69.* 36. *Sect. Flavescens*
32. Rachilla disarticulating at the base. Spikelets falling off entire. *Spp. 70-76.* III. SUBG. KYLLINGIA  
 37. Inflorescence anthelate (umbel-like). Spikelets several-flowered. *Sp. 70.* 37. *Sect. Queenslandiella*  
 37. Inflorescence capitate. Spikelets 1-2-flowered.  
 38. Glumes wingless. *Spp. 71-75.* 38. *Sect. Kyllinga*  
 38. Glumes with winged keel. *Sp. 76.* 39. *Sect. Alati*

## KEY TO THE SPECIES

*Only specimens with subterranean parts and ripe or almost ripe fruits are identifiable*

1. Nut with a face against the rachilla (axis) of the spikelet, trigonous, or, when 2-sided, dorsoventrally compressed.  
 2. Style entire or but slightly notched at the top. Inflorescence a dense head. Nut corky on the angles below. 44. *C. cephalotes*  
 2. Style distinctly cleft into 2 or 3 stigmas. Other characters not united.  
 3. Stigmas 2 or in part of the flowers 3. Nut 2-sided or partly trigonous (several flowers should be dissected!).  
 4. Inflorescence with well-developed rays and oblong to cylindrical spikes. Stout perennial up to more than 1 m tall, with broad leaves up to 16 mm wide. 6. *C. alopecuroides*  
 4. Inflorescence capitate, consisting of some sessile glomerules. Dwarf or medium-sized annuals, rarely up to 75 cm tall, with narrow leaves rarely up to 5 mm wide.  
 5. Glumes 3(-5)-nerved, with more or less spinulose keel, acute or minutely mucronulate. Stamens 1-2. Dwarf, rarely up to 25 cm tall. 46. *C. pygmaeus*

5. Glumes 7-9-nerved, with smooth keel, distinctly mucronate. Stamens 3. Usually medium-sized, up to 75 cm tall . . . . . 45. *C. pachycephalus*
3. Stigmas always 3. All the nuts trigonous.
6. Ripe nut tightly clasped by a much thickened, corky internode of the rachilla (in *C. pedunculatus* this internode is easily mistaken for an anomalous glume!).
7. Rhizome long-creeping. Spikelets 1-flowered, disarticulating at the base, falling off entire. . . . . 59. *C. pedunculatus*
7. Rhizome short, not stoloniferous. Spikelets several- to many-flowered, when mature breaking up into short segments each containing a nut . . . . . 60. *C. odoratus*
6. Rachilla-internodes not becoming corky.
8. Spikelets spicately arranged, *i.e.* at some distance from one another upon a more or less elongated rachis.
9. Primary rays of the inflorescence very numerous (30-100). Flowering stems 2-5 m tall, obtusely trigonous or subterete, pithy, the base surrounded by bladeless sheaths. Involutral bracts much shorter than the umbellate inflorescence . . . . . See p. 593 *C. papyrus*
9. Primary rays of the inflorescence much less numerous.
10. Spikelets 3-5 mm wide (mucros included). Glumes with strong, up to 1 mm long mucro. Annuals with fibrous roots.
11. Spikelets not squarrose, the mucros of the glumes at most slightly excurved; body of the glumes 3-4 mm long. Nut broadly ovoid, *c.*  $1\frac{1}{2}$  by 1 mm. Stamens 3 . . . . . 22. *C. compressus*
11. Spikelets finally squarrose by the strongly excurved mucros of the glumes; body of the glumes 1-2 mm long. Nut oblong-obovoid to almost linear,  $\frac{2}{3}$ -1 by  $\frac{1}{3}$ - $\frac{1}{2}$  mm. Stamen 1. . . . . 41. *C. squarrosus*
10. Spikelets narrower and/or glumes muticous.
12. Stems with concave sides, almost 3-winged above, spongy, robust.
13. Glumes finally crispidly incurved all round, smooth. Inflorescence compound. Nut narrowly oblong . . . . . 20. *C. malaccensis*
13. Glumes not crispidly incurved, hispid-scabrous on the keel at least above. Inflorescence simple. Nut broadly ellipsoid or obovoid . . . . . 19. *C. babakan*
12. Stems with flat or convex sides.
14. Leaves strongly septate-nodulose, coriaceous, very scabrous on the margins and keel.
15. Stems densely papillose (hand-lens!). Nut ellipsoid or subobovoid,  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm long. . . . . 47. *C. javanicus*
15. Stems not papillose. Nut oblong-linear,  $2\frac{1}{2}$ - $2\frac{3}{4}$  mm long . . . . . 49. *C. lucidus*
14. Leaves not strongly septate-nodulose.
16. Each spikelet maturing several to many nuts.
17. Rachilla (axis) of the spikelet distinctly winged.
18. Spikes cylindrical, with long rachis, much longer than wide, with very numerous (more than 30) many-flowered spikelets. Tall perennials with broad leaves and bracts, and large, compound or decompound inflorescences. Rhizome short, not stoloniferous.
19. Glumes in the upper half with a broad, white, scarios margin, soon incised at the tip and bicuspidate, mucronulate somewhat below the apex. Spikelets suberect. Appendage of connective smooth . . . . . 15. *C. nutans*
19. Glumes not scarios-margined, with entire tip, muticous or with a short apical mucro.
20. Connective of anthers produced into a setulose appendage  $\frac{1}{3}$ - $\frac{1}{2}$  as long as the anther-cells.
21. Spikes dense, 3-5 mm thick. Spikelets suberect, linear, 1 mm wide. Cladophylls (tubular bracts surrounding the base of the rays of the inflorescence) scabrous on the keel at least above. Nut  $\frac{1}{2}$  mm long . . . . . 2. *C. elatus*
21. Spikes very dense, 6-8 (ultimately up to 10) mm wide. Spikelets obliquely patent, linear-oblong,  $1\frac{1}{2}$  mm wide. Cladophylls smooth. Nut  $1\frac{1}{10}$ - $1\frac{1}{2}$  mm long . . . . . 3. *C. ohwii*
20. Connective of anthers but shortly produced, smooth.
22. Glumes muticous or apiculate. Spikelets but slightly compressed, subterete, when ripe at right angles to the rachis . . . . . 1. *C. digitatus*
22. Glumes with a short but distinct mucro. Spikelets distinctly compressed.
23. Secondary rays of the inflorescence (in decompound inflorescences the tertiary rays) very short, hence the spike sessile or almost so. Spikelets suberect, completely hiding the rachis of the spike . . . . . 5. *C. imbricatus*
23. Secondary rays of the inflorescence up to 5 cm long, hence the spikes at least partly distinctly peduncled. Spikelets obliquely patent to almost at right angles to the rachis, the latter therefore visible . . . . . 4. *C. exaltatus*
18. Spikes ovoid or broadly ovoid. Other characters not united.
24. Rhizome horizontally long-creeping or emitting slender to thread-like stolons (often lacking in herbarium specimens!), often tuberiferous. Glumes imbricate, *i.e.* tip of each glume distinctly (at least  $\frac{1}{3}$ ) overlapping the next higher glume on the same side of the spikelet.
25. Stems subterete in the lower part, triangular only just below the inflorescence. Leaf-blades short to almost wanting, rarely half as long as the stem. Lowermost involucrel bract usually erect, as though continuing the stem, pushing aside the small inflorescence. . . . . 11. *C. scariosus*

25. Stems triquetrous. Leaf-blades well-developed.
26. Involucral bracts distinctly separated from one another or only the lowermost obvious. Stolons thread-like, producing bulb-like tubers enclosed in a hard, black, irregularly splitting coat. Inflorescence often reduced to a simple or compound spike. **8. C. bulbosus**
26. Involucral bracts close together or only the lowermost a little distant. Tubers not bulb-like, when young covered by membranous scales soon disintegrating into fibres. Inflorescence umbel-like.
27. Nut strongly compressed dorsally, the ventral side usually somewhat concave, the dorsal side with a raised angle. Ripe spikelets turgid, subterete. . . . **10. C. stoloniferus**
27. Nut equally trigonous (in *C. rotundus* rarely maturing; examine ovary!). Ripe spikelets not turgid, strongly compressed.
28. Glumes with 7-9 prominent nerves equally distributed over the whole breadth (outermost nerves near the margin), golden yellow to pale brown. Stolons very slender, yellowish, producing globose or ovoid tubers covered with a grey tomentum. **9. C. esculentus**
28. Glumes with 5-7 nerves, the lateral nerves becoming much less prominent away from the keel, usually deep brown, rarely yellowish. Stolons stoutish, dark brown, forming ellipsoid tubers without grey tomentum . . . . . **7. C. rotundus**
24. Rhizome neither long-creeping nor emitting slender stolons, at most with very short, ascending surculi, never tuberiferous, or annuals with fibrous roots.
29. Nut turbinate-obovoid, truncate or even slightly depressed at the top. Annual with fibrous roots . . . . . **13. C. zollingeri**
29. Nut not turbinate, not truncate.
30. Annual with fibrous roots. Glumes as a rule with a purplish spot on one or both sides giving the impression of a purplish stripe along the centre of the spikelet. **14. C. sphacelatus**
30. Perennials with short rhizome. Glumes not purplish spotted.
31. Rachilla persistent on the rachis after the glumes and nuts have fallen off acropetally.
32. Glumes  $3\frac{1}{2}$ -4 mm long, with broad green keel and golden yellow to fulvous sides. Spikelets subquadrangular, *i.e.* rhomboidal in cross-section . . . . . **12. C. tenuiculmis**
32. Glumes 2-2 $\frac{1}{2}$  mm long, the keel not strikingly broad. Spikelets circular or elliptic in cross-section.
33. Spikelets narrowly linear, almost subulate, *c.* 1 mm wide, usually spreading at right angles. Glumes very distant, those on one side of the spikelet not overlapping. **16. C. distans**
33. Spikelets oblong-linear, compressed, *c.* 2 mm wide, suberect. Glumes  $\frac{1}{3}$  or more overlapping **15. C. nutans**
31. Rachilla disarticulating at the base, the spikelets falling off entire. Glumes 3-4 mm long, strongly nerved over the whole breadth. Nut 2-2 $\frac{1}{4}$  mm long.
34. Glumes slightly imbricate (those on one side of the spikelet somewhat overlapping). Spikelets 1-1 $\frac{1}{2}$  mm wide. Nut oblong-obovoid . . . . . **54. C. stenophyllus**
34. Glumes distant, those on one side of the spikelet not overlapping. Spikelets subulate, *c.*  $\frac{1}{2}$  mm wide. Nut oblong-linear . . . . . **53. C. dietrichiae**
17. Rachilla not or hardly winged.
35. Glumes orbicular or broadly ovate, keeled, mucronulate, 1-1 $\frac{1}{2}$  mm long. Rachis of the spikes glabrous and smooth. Nut as long as the subtending glume. Estoloniferous. **21. C. iria**
35. Glumes ovate or elliptic, rounded on the back, muticous, 2-3 mm long. Rachis of the spikes hispidulous or scabrid (sometimes but sparsely so). Nut about  $\frac{1}{2}$  as long as the subtending glume. Perennials with creeping stolons.
36. Keel of the glumes scabrid at least towards the top. Inflorescence simple, with very dense spikes . . . . . **19. C. babakan**
36. Keel of the glumes smooth.
37. Inflorescence simple or subcompound. Rachis of the spikes sparsely scabrid to almost smooth. Spikelets 2 $\frac{1}{2}$ -3 $\frac{1}{2}$  mm wide. Anthers (1-) $\frac{1}{2}$ -2 mm long. Nut 1 $\frac{1}{2}$  mm long. **17. C. procerus**
37. Inflorescence compound. Rachis of the spikes rather to very densely hispidulous. Spikelets 2-2 $\frac{1}{2}$ (-3) mm wide. Anthers  $\frac{1}{2}$ - $\frac{3}{4}$  mm long. Nut 1-1 $\frac{1}{4}$  mm long . . . . . **18. C. pilosus**
16. Each spikelet maturing 1-2(-3) nuts, rarely more than  $\frac{1}{2}$  cm long, falling off as a whole. Spikes dense, exactly cylindrical to slightly obovoid, up to 1 cm wide.
38. Rhizome emitting slender stolons. Spikelets always bearing 1 nut . . . . . **57. C. panicus**
38. Rhizome not stoloniferous. Spikelets usually bearing 2-3 nuts.
39. Spikes exactly cylindrical, usually distinctly peduncled. Spikelets finally at right angles to the rachis or reflexed. Nut linear, 0.5 mm wide. . . . . **56. C. cyperoides**
39. Spikelets attenuate to the base, sessile or almost so. Spikelets obliquely erect (*sec.*, however, *var. maximus*). Nut ellipsoid or oblong-ellipsoid, 0.6-0.9 mm wide . . . . . **55. C. cyperinus**
8. Spikelets digitately or stellately arranged, *i.e.* at practically the same level upon a much shortened

- rachis, forming several to numerous clusters, sometimes part of them solitary, or inflorescence capitate.
40. Involucral bracts numerous (up to 20), almost equal in length, evidently distant from one another. . . . . 23. *C. fiabelliformis*
40. Involucral bracts much less numerous, unequal, close together.
41. Angles of nut much thickened by a corky tissue. Stout perennial with thick, funiliform roots and broad, septate-nodulose leaves. Style flattened, fimbriate . . . . . 24. *C. platystylis*
41. Angles of nut not corky-thickened.
42. Stems shorter than the remarkably long primary rays of the inflorescence (those rays are easily mistaken for stems when the true stem is only a few cm long!) . . . . . 33. *C. radians*
42. Stems longer than the inflorescence.
43. Glumes very small,  $\frac{3}{5}$ - $\frac{4}{5}$  mm long, orbicular or broadly ovate. Spikes globose, very dense, with numerous spikelets . . . . . 38. *C. difformis*
43. Glumes larger.
44. Leaves septate-nodulose (see 46. *C. fulvus*!).
45. Clusters of spikelets ( $1\frac{1}{2}$ -)2-4 cm across. Spikelets subulate, 1-1 $\frac{1}{2}$  mm wide. Glumes 3-4 $\frac{1}{2}$  mm long. Leaves 5-12 mm wide . . . . . 52. *C. compactus*
45. Clusters of spikelets at most 1 cm across. Spikelets 2 mm wide. Glumes 2-2 $\frac{1}{2}$  mm long. Leaves 2-4 mm wide.
46. Inflorescence compound. Leaves strikingly septate-nodulose, especially their lower, spongy sheaths. Spikelets 2-3 mm long, few-flowered. Nut oblong,  $\frac{1}{2}$  mm wide. . . . . 48. *C. holoschoenus*
46. Inflorescence simple. Leaves not strikingly septate-nodulose. Lower leaf-sheaths not spongy; stem-base almost bulbous. Spikelets 6-many-flowered, 5-20 mm long. Nut oblong-obovoid,  $\frac{2}{3}$ -1 mm wide . . . . . 51. *C. fulvus*
44. Leaves not septate-nodulose.
47. Glumes truncate or emarginate, with 3-nerved keel, nerveless sides, and strong, more or less recurved mucro. Small annuals with very narrow leaves  $\frac{1}{2}$ -1 mm wide.
48. Stamens 2 or 3. Nut obovoid,  $\frac{1}{3}$ - $\frac{2}{5}$  mm wide . . . . . 39. *C. cuspidatus*
48. Stamen 1. Nut oblong,  $\frac{1}{4}$ - $\frac{1}{3}$  mm wide . . . . . 40. *C. castaneus*
47. Glumes not truncate or emarginate. Other characters not united.
49. Inflorescence capitate.
50. Glumes mucronate, strongly many-nerved over the whole breadth.
51. Base of the plant much thickened by inflated, scarious, purplish striate sheaths. Body of the glumes 2-3 mm long, cinnamomeous to purplish. Stamens 3 . . . . . 42. *C. teneriffae*
51. Base of the plant not thickened.
52. Body of the glumes 1-2 mm long, with strongly recurved mucro. Stamen 1. Nut  $\frac{2}{5}$ -1 mm long . . . . . 41. *C. squarrosus*
52. Body of the glumes 3-4 mm long, the mucro not or slightly recurved. Stamens 3. Nut c.  $\frac{1}{2}$  mm long . . . . . 22. *C. compressus*
50. Glumes muticous.
53. Inflorescence a single, whitish, globose head 5-10 mm across. Glumes 1-1 $\frac{3}{4}$  mm long. Stamen 1. Nut 0.5-0.9 by 0.25 mm . . . . . 43. *C. pulchellus*
53. Inflorescence a lobed head consisting of up to 6 confluent glomerules, 10-20 mm across. Glumes 3-4 mm long. Stamens 3. Nut 1 $\frac{3}{5}$ -2 $\frac{1}{2}$  mm long . . . . . 58. *C. dubius*
49. Inflorescence umbel-like, sometimes more or less contracted, but not truly capitate.
54. Nut very small, at most  $\frac{3}{4}$  mm long.
55. Glumes cellular-reticulate, narrowly winged on the keel, with strong midnerve and a faint nerve in the centre of either side . . . . . 34. *C. aquatilis*
55. Glumes neither cellular-reticulate nor winged.
56. Involucral bracts very long and broad, the lowermost up to 50 by 1 cm, far overtopping the inflorescence. Many spikelets solitary. Sides of the glumes slightly sulcate. Stamen 1. Nut  $\frac{3}{4}$  mm long . . . . . 32. *C. multispicatus*
56. Involucral bracts much shorter. Nut at most  $\frac{1}{2}$  mm long.
57. Glumes straight, obliquely erect, the ripe spikelets not perspicaceous. Stamens 1, 2, or 3. Connective of the anthers produced into a setulose appendage . . . . . 36. *C. halpan*
57. Glumes spreading, the ripe spikelets perspicaceous. Stamen 1(-2). Appendage of connective smooth.
58. Glumes ultimately incurved. Nut sharply trigonous, with flat sides, c.  $\frac{1}{2}$  mm long, minutely punctulate . . . . . 35. *C. pulcherrimus*
58. Glumes ultimately excurved. Nut very obtusely trigonous, with convex sides, subglobose.  $\frac{1}{4}$ - $\frac{1}{3}$  mm long, densely tuberculate. . . . . 37. *C. tenuispica*
54. Nut more than 1 mm long.
59. Nut linear-oblong. Spikelets narrowly linear, 1 mm wide . . . . . 50. *C. angustatus*
59. Nut ellipsoid or obovoid. Spikelets wider.
60. Anthers with smooth appendage of the connective. (*Spp.* 27-31 from New Guinea inadequately known).
61. Glumes with scabrid keel and excurved top, 9-11-nerved. Leaves 8-11 mm wide. Style very short,  $\frac{1}{5}$ - $\frac{1}{4}$  mm long . . . . . 29. *C. subpauanus*

61. Glumes with smooth keel, not excurved.  
 62. Leaves 10–18 mm wide . . . . . 28. *C. neoguineensis*  
 62. Leaves much narrower, 3–7 mm wide.  
 63. Spikelets 3–5 mm wide . . . . . 22. *C. compressus*  
 63. Spikelets  $1\frac{1}{2}$ –2 mm wide.  
 64. Style distinct,  $\frac{1}{2}$ –1 mm long, fimbriate. Stems scaberulous at the top. Glumes  $2\frac{1}{2}$ –3 mm long . . . . . 30. *C. cinereobrunneus*  
 64. Style hardly any, 0.1–0.3 mm long. Stems smooth. Glumes 2–2 $\frac{1}{2}$  mm long . . . . . 31. *C. meistostylus*
60. Anthers with setulose apical appendage of the connective.  
 65. Style distinct, fimbriate. Glumes 11–17-nerved, ferruginous to blackish brown. . . . . 27. *C. pedunculosus*
65. Style hardly any, stigmas long.  
 66. Stems wingless. Spikelets oblong, up to 20-flowered . . . . . 25. *C. diffusus*  
 66. Stems 3-winged. Spikelets ovoid, up to 8-flowered . . . . . 26. *C. trialatus*
1. Nut with an edge against the rachilla, bilaterally compressed, 2-sided. Stigmas always 2.  
 67. Each spikelet maturing several to many nuts. Inflorescence often umbel-like, more rarely contracted to subcapitate.  
 68. Epidermal cells of the nut isodiametric, roundish or hexagonal. Nut under the lens punctulate or finely reticulate.  
 69. Midnerve of the glumes excurrent into a distinct, usually more or less recurved mucro.  
 70. Nut  $1\frac{1}{10}$ – $1\frac{3}{4}$  mm long, c. 1 mm wide. Rachilla broadly winged, disarticulating at the base, hence spikelets falling off entire . . . . . 70. *C. hyalinus*  
 70. Nut  $\frac{1}{2}$ – $\frac{3}{4}$  by  $\frac{1}{3}$ – $\frac{1}{2}$  mm. Rachilla almost or quite wingless, persistent on the rachis, the glumes and nuts seriatim deciduous.  
 71. Glumes with 3-nerved keel and nerveless sides. Stamens 1(–2) . . . . . 66. *C. pumilus*  
 71. Also the sides of the glumes distinctly nerved. Stamens 2 . . . . . 67. *C. nervulosus*  
 69. Glumes muticous or at most with a very short, indistinct subula.  
 72. Glumes c. 4 mm long. Spikelets 4–5 mm wide, somewhat turgid. Stamens 3 . . . . . 62. *C. unioides*  
 72. Glumes  $1\frac{1}{2}$ –2(–2 $\frac{1}{2}$ ) mm long. Spikelets  $1\frac{1}{2}$ –3(–3 $\frac{1}{2}$ ) mm wide, flat. Stamens 1, 2, or 3.  
 73. Stems decumbent at the base, rooting at the nodes, leafy in the lower  $\frac{1}{3}$ – $\frac{1}{2}$ . Glumes with arcuate keel, usually with a depression on either side. Nut obovate to almost orbicular. . . . . 61. *C. sanguinolentus*
73. Stems erect, leafy only at the very base. Glumes with straight keel, without depressions. Nut oblong or oblong-obovate.  
 74. Nut with a median, longitudinal, shallow depression on either side. Stamen 1 . . . . . 65. *C. sulcinux*  
 74. Nut with flat or slightly convex sides. Stamens usually 2, rarely 1.  
 75. Leaves flat. Glumes acute. Rachilla narrowly winged. Spikelets gradually tapering to the acute apex. Nut narrowly oblong, subtruncate at the top, minutely apiculate . . . . . 64. *C. polystachyos*  
 75. Leaves canaliculate, often almost filiform. Glumes obtuse. Rachilla straight, wingless. Spikelets exactly parallel-sided. Nut oblong-obovate to oblong-elliptic, not truncate, evidently apiculate. . . . . 63. *C. flavidus*
68. Epidermal cells of the nut longitudinally stretched, oblong or linear. Nut under the lens appearing wrinkled by the prominent short sides of the epidermal cells running into wavy or broken transverse lines.  
 76. Spikelets suberect even in fruit, 2 mm wide. Glumes mucronulate, stramineous-yellowish, 2 mm long. . . . . 69. *C. substramineus*  
 76. Spikelets finally spreading, (2 $\frac{1}{2}$ )–3–4 mm wide. Glumes muticous, fulvous, castaneous, or purplish,  $2\frac{1}{2}$ –3 mm long . . . . . 68. *C. diaphanus*
67. Each spikelet usually maturing 1 nut, but not rarely some of them with 2 nuts in the same inflorescence. Inflorescence a whitish or greenish head of 1–5 sessile glomerules with densely crowded, sessile spikelets. Rachilla disarticulating at the base, hence spikelets falling off entire.  
 77. Keel of the glumes distinctly winged . . . . . 76. *C. kyllingia*  
 77. Keel of the glumes wingless.
78. Rhizome densely caespitose; stolons wanting.  
 79. Central glomerule of the inflorescence cylindrical, 10–12 mm long, lateral ones when present much smaller, subglobose. Nut truncate at the apex, 1 mm wide, ultimately black . . . . . 74. *C. sesquiflorus*  
 79. Central glomerule of the inflorescence subglobose, 5–8 mm long, lateral ones but slightly smaller. Nut not truncate, c.  $\frac{1}{2}$  mm wide, yellowish brown to brown . . . . . 75. *C. triceps*
78. Rhizome horizontally creeping.  
 80. Involucral bracts (5–)7–8 . . . . . 72. *C. aromaticus*  
 80. Involucral bracts 3–4.  
 81. Rhizome slender, 1–2(–3) mm thick. Stems rather approximate to very distant, rarely more than 30 cm tall,  $\frac{1}{2}$ – $1\frac{1}{2}$  mm thick, triquetrous with flat sides. Leaf-blades usually well-developed. Stamens 1–2(–3) . . . . . 73. *C. brevifolius*  
 81. Rhizome stout, 3–4 mm thick. Stems approximate, 30–175 cm tall, 2–4 mm thick, sharply triquetrous, with more or less concave sides. Leaves reduced to the sheaths or only the upper 1–2 shortly laminate. Stamens 3 . . . . . 71. *C. melanospermus*

I. Subgenus *Cyperus*Type species: *C. esculentus* L.1. Section *Exaltati*

KUNTH, En. 2 (1837) 70. — *Cyperus* sect. *Longispicati* c. *Digitati* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 133. — *Cyperus* sect. *Fastigiati* KÜK. Pfl. R. Heft 101 (1935) 53.

Type species: *C. exaltatus* RETZ.

1. *Cyperus digitatus* ROXB. [Hort. Beng. (1814) 81, *nom. nud.*] Fl. Ind. 1 (1820) 209; CLARKE, Fl. Br. Ind. 6 (1893) 618; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 133, t. 1 f. 10, t. 4 f. 35; CLARKE, Philip. J. Sc. 2 (1907) Bot. 86; KOORD. Exk. Fl. Java 1 (1911) 191; *ibid.* 4 (1922) f. 226; CAMUS, Fl. Gén. I.-C. 7 (1912) 74, f. 9, 5-6; MERR. En. Philip. 1 (1923) 105; BACK. Onkr. Suiker. (1928) 139, t. 137; KÜK. Pfl. R. Heft 101 (1935) 55; S. T. BLAKE, J. Arn. Arb. 28 (1947) 213; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 38; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 480. — *C. venustus* (non R.Br.) NEES in Wight, Contr. (1834) 86; KUNTH, En. 2 (1837) 68; MIO. Fl. Ind. Bat. 3 (1856) 280; BOECK. Linnaea 36 (1870) 316, p.p. — *C. strigosus* (non L.) LLANOS, Fragn. Pl. Filip. (1851) 16. — *C. auricomus* (non SIEB.) BENTH. Fl. Austr. 7 (1878) 286; NAVES, Nov. App. (1882) 305; CLARKE, J. Linn. Soc. Bot. 21 (1884) 188, p.p., t. 4 f. 31; CERON, Cat. Pl. Herb. Manila (1892) 177; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 191. — *C. auricomus* var. *microstachyus* BOECK. in K.Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 23. — *C. racemosus* (non RETZ.) K.SCH. & HOLLR. l.c. 24; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 192. — *Mariscus sieberianus* var. *evolutior* (non CLARKE) RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 73, p.p.; Fl. Mal. Pen. 5 (1925) 149, p.p. — *C. elatus* (non L.) CAMUS, Fl. Gén. I.-C. 7 (1912) 70, *incl. var. laxus* CAMUS.

Perennial with very short rhizome. *Stems* tall, tufted, obtusely trigonous, often triquetrous above, smooth, 50-150(-200) cm by 3-4(-7) mm. *Leaves* flat or the larger ones slightly plicate with 3 prominent nerves, coriaceous, scabrous on the margins, glaucous. 4-10(-15) mm wide; lower sheaths purplish. *Inflorescence* compound or decomposed, up to 40 cm across. Involucral bracts 3-8, spreading, much overtopping the inflorescence, up to 60 cm long. Primary rays 6-10, unequal, smooth, the longest 15-30 cm; secondary ones 2-3 cm. *Spikes* digitately arranged, cylindrical, rather loose, 3-6 cm by 1-3 cm; rachis glabrous, narrowly winged. *Spikelets* spicately arranged, finally at right angles to the rachis, linear, but slightly compressed, 8-24(-44)-flowered, 5-20 by 1-1½ mm; rachilla straight, persistent; internodes c. ½ mm; wings caducous, yellow, ⅓-¼ mm wide. *Glumes* membranous, appressed, elliptic-oblong, acute, apiculate, 1¾-2¼ by c. 1 mm, halfway imbricate; keel green or reddish brown, 3-5-nerved; sides yellowish to rufous, nerveless. *Stamens* 3; anthers linear, ½ mm long; connective shortly produced, smooth. *Stigmas* 3. *Nut* trigonous, ellipsoid to oblong-obovoid, apiculate, yellowish brown, c. 1 by ⅓-½ mm.

Distr. Pan-tropical: tropical America, rare in tropical Africa; from India, Farther India, S. China,

and Formosa to Queensland; throughout *Malesia*, but here everywhere scattered.

Ecol. In swamps, wet rice-fields, swinging bogs, on river-banks and in other open, wet places at low altitudes, 0-800 m.

Vern. Mal. Pen.: *bunga sadaian rumput*, *rẽmpara*, *rumput musiang*, M; N. Borneo: *pajong krah*, *rumput kara*, *r. triwak*, M; *rumput dẽkeng*, J; *kakanin kara*, Menado; New Guinea: *simbuai*, Sepik.

2. *Cyperus elatus* LINNÉ, Cent. Pl. 2 (1756) 301; Sp. Pl. ed. 2 (1762) 67; CLARKE, J. Linn. Soc. Bot. 21 (1884) 189, *excl. var. macronux* CLARKE; Fl. Br. Ind. 6 (1893) 618; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 135, t. 4 f. 36; CLARKE, Philip. J. Sc. 2 (1907) Bot. 86; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 71; KOORD. Exk. Fl. Java 1 (1911) 191; *ibid.* 4 (1922) f. 225; CAMUS, Fl. Gén. I.-C. 7 (1912) 70 (non f. 8, 1); MERR. En. Philip. 1 (1923) 105; RIDL. Fl. Mal. Pen. 5 (1925) 148; BACK. Onkr. Suiker. (1928) 140, t. 138; KÜK. Pfl. R. Heft 101 (1935) 59; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 38; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 479. — *C. racemosus* RETZ. Obs. 6 (1789) 20; NEES in Wight, Contr. (1834) 85; KUNTH, En. 2 (1837) 100; STEUD. Syn. 2 (1855) 52, p.p.; MIO. Fl. Ind. Bat. 3 (1856) 278; BOECK. Linnaea 36 (1870) 310. — *C. scoparius* (non POIR.) DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 359; Descr. Herb. Timor. (1835) 31; MIO. Fl. Ind. Bat. 3 (1856) 279. — *C. bispicatus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, *nom. nud.*] Syn. 2 (1855) 49; MIO. in De Vriese, Pl. Ind. Bat. Ór. (1856) 140; Fl. Ind. Bat. 3 (1856) 285; NAVES, Nov. App. (1882) 303. — *C. auricomus* (non SIEB.) RIDL. in Forbes, Wand. (1885) 521. — *C. radiatus* (non VAHL) CAMUS, Fl. Gén. I.-C. 7 (1912) 72, f. 9, 1-4. — *C. digitatus* (non ROXB.) RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 71; MERR. En. Born. (1921) 105; WINKL. Bot. Jahrb. 44 (1923) 523; RIDL. Fl. Mal. Pen. 5 (1925) 147.

Perennial with very short rhizome. *Stems* tall, tufted, trigonous but triquetrous at the top, smooth, 50-100(-200) cm by (3-)4-7(-10) mm. *Leaves* flat or often somewhat plicate with the midrib prominent beneath and 2 lateral nerves strongly marked above, scabrous on the margins, bright green above, pale green beneath, 4-10(-15) mm wide; lower sheaths purplish to almost black. *Inflorescence* compound or decomposed, up to 30 cm across. Involucral bracts 4-8, much overtopping the inflorescence, up to 60(-75) cm long. Keel of the cladophylls scabrous, at least in the upper part. Primary rays up to 10, unequal, smooth, up to 20 cm long; secondary ones 2-5 cm. *Spikes* digitately arranged, narrowly cylindrical, dense, 2-7 cm by 3-5 mm; rachis glabrous,

narrowly winged. *Spikelets* spicately arranged, sub-erect, linear, compressed, 6–16-flowered, 3–6 by c. 1 mm; rachilla slightly flexuous, persistent; internodes  $\frac{1}{2}$ – $\frac{2}{3}$  mm; wings caducous, yellow, c.  $\frac{1}{2}$  mm wide. *Glumes* membranous, appressed, ovate, acute, mucronulate,  $\frac{1}{4}$ – $1\frac{1}{4}$  by 1 mm,  $\frac{1}{2}$ – $\frac{2}{3}$  imbricate; keel green or reddish brown, 3–5-nerved; sides golden to rufous. *Stamens* 3; anthers oblong-linear, c.  $\frac{1}{2}$  mm long; connective produced into an apical appendage c.  $\frac{1}{3}$  as long as the anther-cells and setulose at the top. *Stigmas* 3. *Nut* trigonous, ellipsoid, apiculate, yellowish to greyish brown, 0.8–0.9 by 0.3–0.4 mm.

**Distr.** From India and Farther India to *Malesia*: rather common in Sumatra, the Malay Peninsula, and Java; but a few times collected in the Lesser Sunda Is. (Sumba, Timor), Borneo, and Celebes; rare in the Philippines (Luzon, Biliran, Leyte, Ticao). Apparently not reaching the Moluccas and New Guinea.

**Ecol.** In swamps, wet rice-fields and meadows, on river-banks, and in other open wet places at low altitudes, 0–700 m, very rarely up to 1000 m.

**Uses.** In Besuki (E. Java) and Gorontalo (Celebes) the leaves are used for making hats and mats.

**Vern.** *Bëlumbungan, korisan, ombok, përumbungan, rombok, si marappang-appang, umbut, M, babeleni, lilisungan, rumput adem, walingi, S, luru, sukët dëkëng, J, bura, wingi, Mad., pea-pea, tintilohuanga*, Celebes; Philip.: *kobong-köbong*. Bis.

3. *Cyperus ohwii* KÜK. in Fedde, Rep. 29 (1931) 197; Pfl. R. Heft 101 (1935) 60, f. 8 A-E; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 127; KERN, Reinwardtia 2 (1952) 97, f. 1; KOYAMA, Nat. Canad. 82 (1955) 205; Contr. Inst. Bot. Un. Montréal n. 70 (1957) 23; Quart. J. Taiwan Mus. 14 (1961) 166; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 479. — *C. elatus* L. var. *macronux* CLARKE, J. Linn. Soc. Bot. 21 (1884) 190; Fl. Br. Ind. 6 (1893) 618; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 136; KÜK. Pfl. R. Heft 101 (1935) 60, p.p., non CAMUS, Fl. Gén. I.-C. 7 (1912) 72.

Closely allied to *C. elatus*. Usually more robust. *Leaves* often broader, up to 18 mm wide. Cladophylls with smooth keel. *Spikelets* very dense (usually c. 70 spikelets to the spike), 6–8 mm (ultimately up to 10 mm) wide. *Spikelets* somewhat broader, c.  $1\frac{1}{2}$  mm wide, obliquely patent. Wings of the rachilla lanceolate,  $\frac{1}{5}$  mm wide. *Glumes* ovate to elliptic, ( $\frac{1}{4}$ –) $1\frac{1}{4}$ –2 by 1– $1\frac{1}{4}$  mm. *Anthers* with a large, setulose appendage of the connective about half as long as the anther-cells. *Nut* oblong-ellipsoid, c.  $1\frac{1}{2}$  by  $\frac{2}{5}$  mm.

**Distr.** Insufficiently known, probably rare, though widely distributed in SE. Asia: Bengal, Indo-China; in Japan (Kyushu) probably introduced; in *Malesia*: W. Java (Danau swamp and Rawah Tembaga near Bekasi).

**Ecol.** In swamps, swinging bogs, at low altitudes.

4. *Cyperus exaltatus* RETZ. Obs. 5 (1789) 11; VAHL, En. 2 (1806) 366; MIQ. Fl. Ind. Bat. 3 (1856) 276; BOECK. Linnaea 36 (1870) 319; BENTH. Fl. Austr. 7 (1878) 285; CLARKE, J. Linn. Soc. Bot. 21 (1884) 186, incl. var. *amoena* CLARKE; Fl. Br. Ind. 6 (1893) 617; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 139, t. 4 f. 40; ? CLARKE, Philip. J. Sc. 2 (1907) Bot. 86 [cf. MERR. En. Philip. 1 (1923) 109]; KOORD. Exk. Fl.

Java 1 (1911) 191; *ibid.* 4 (1922) f. 227; CAMUS, Fl. Gén. I.-C. 7 (1912) 73, excl. var. *dignynus* WILLIAMS; KÜK. Pfl. R. Heft 101 (1935) 64, f. 9 A-F; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 37; KERN, Reinwardtia 2 (1952) 99, f. 2; in Back. & Bakh. f. Fl. Java 3 (1968) 480. — *C. venustus* R. BR. Prod. (1810) 217; MIQ. Fl. Ind. Bat. 3 (1856) 280; RIDL. in Forbes, Wand. (1885) 520. — *C. altus* NEES in Wight, Contr. (1834) 84; MIQ. Fl. Ind. Bat. 3 (1856) 276. — *C. digitatus* (non ROXB.) VALCK. SUR. Nova Guinea 8 (1912) 699, p.p. — *C. elatus* var. *macronux* (non CLARKE) CAMUS, Fl. Gén. I.-C. 7 (1912) 72.

Perennial with very short rhizome. *Stems* tall, densely tufted, trigonous, smooth, 100–180 cm by up to 8 mm. *Leaves* flat or plicate with the midrib prominent beneath and 2 lateral nerves strongly marked above, coriaceous, scabrous on the margins and scaberulous on the upper surface, bright green above, pale green beneath, 8–15 mm wide; lower sheaths somewhat spongy, reddish to blackish brown. *Inflorescence* compound or decomposed, up to 25 cm long. Involucral bracts 4–6, erecto-patent, up to 80 cm long. Primary rays 6–9, slender, unequal, smooth, up to 18 cm long, secondary ones up to 5 cm. *Spikelets* digitately arranged, usually some of them solitary on slender peduncles, cylindrical, loose to rather dense (up to c. 40 spikelets to the spike), finally 2–5 by 1– $1\frac{1}{2}$  cm; rachis visible among the spikelets, somewhat flexuous, glabrous, narrowly winged. *Spikelets* spicately arranged, subdistichous, obliquely patent or almost at right angles to the rachis, oblong to linear, compressed, 10–20-flowered, 5–10 by  $1\frac{1}{2}$ –2 mm; rachilla straight, persistent; internodes c.  $\frac{2}{5}$  mm; wings caducous, narrowly oblong, whitish or yellowish. *Glumes* membranous-chartaceous, patent, ovate or broadly ovate, obtuse, mucronate,  $1\frac{1}{2}$ –2 by  $1\frac{1}{4}$ – $1\frac{1}{2}$  mm,  $\frac{1}{2}$  imbricate; keel green, 3–(3–7)-nerved especially above, sides nerveless or obscurely striate, shining brown or greenish. *Stamens* 3; anthers oblong,  $\frac{1}{2}$ – $\frac{2}{3}$  mm long; connective shortly produced, smooth. *Stigmas* 3. *Nut* trigonous, ellipsoid, shortly apiculate, yellow or yellowish brown,  $\frac{2}{3}$ – $\frac{4}{5}$  by  $\frac{1}{3}$ – $\frac{2}{5}$  mm.

**Distr.** Scattered in tropical Africa; rather common from India to Indo-China, E. China, and Japan, southward extending to S. Australia; doubtful for tropical S. America; in *Malesia* very rare: a few times collected in the Malay Peninsula (Singapore, Penang), W. Java (near Djakarta), the Lesser Sunda Is. (Timor), and W. New Guinea (Merauke).

**Ecol.** In wet places at low altitudes: embankments in tidal forests, grassy swamps behind the beach-wall, in Timor in grass-flats at 400 m.

**Notes.** Closely allied to *C. imbricatus*, from which it is sometimes difficult to be distinguished, as both are very polymorphous. *C. exaltatus* is often more robust, its spikes are less dense and peduncled, and the glumes more closely imbricate. From *C. digitatus*, also with patent spikelets, it can be distinguished by the broader spikelets, the broader, mucronate glumes, and the smaller nuts.

KOYAMA opposed the E. Asian-Australian plants to the typical Indian ones as var. *iwaskii* (MAKINO) KOYAMA, Act. Phytotax. Geobot. 16 (1955) 11. *C. venustus* R. BR. L.c.; *C. iwaskii* MAKINO, Bot. Mag. Tokyo 17 (1903) 49]. I am unable to draw a line between the Indian forms and those from Korea, Japan, China, Malesia, and Australia.

The records for the Malay Peninsula are old: Singapore, 1853, ANDERSSON; Penang, 1904-06, BIRCH. The specimen from Sumatra, WAITZ, mentioned by VALCKENIER SURINGAR, 1898, *l.c.*, is much too young for identification.

5. *Cyperus imbricatus* RETZ. Obs. 5 (1789) 12; LLANOS, *Fragm. Pl. Filip.* (1851) 17; F-VILL. & NAVES in Blanco, *Fl. Filip. ed. 3, 4* (1880) 11; FISCHER, *Kew Bull.* (1931) 262; KÜK. *Pfl. R. Heft 101* (1935) 69, f. 9 G-J, *incl. var. elongatus* KÜK.; BACK. *Bekn. Fl. Java (em. ed.) 10* (1949) fam. 246, p. 37; KERN in Back. & Bakh. *f. Fl. Java 3* (1968) 480. — *C. radiatus* VAHL, *En. 2* (1806) 369; *Miq. Fl. Ind. Bat. 3* (1856) 277; BOECK. *Linnaea 36* (1870) 317, *incl. var. elongatus* BOECK.; CLARKE, *J. Linn. Soc. Bot. 21* (1884) 185; *Fl. Br. Ind. 6* (1893) 617; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 137, t. 4 f. 38, 39; CLARKE, *Philip. J. Sc. 2* (1907) Bot. 85; RIDL. *Mat. Fl. Mal. Pen. (Monoc.) 3* (1907) 70; KOORD. *Exk. Fl. Java 1* (1911) 191; *ibid.* 4 (1922) f. 228; BROWN, *Min. Prod. Philip. For. 1* (1920) 348; MERR. *En. Philip. 1* (1923) 107; RIDL. *Fl. Mal. Pen. 5* (1925) 147; BACK. *Onkr. Suiker.* (1928) 140, t. 139. — *C. involucratu* POIR. in Lamk. *Encycl. 7* (1806) 253; DECNE, *Nouv. Ann. Mus. Hist. Nat. Paris 3* (1834) 360; *Descr. Herb. Timor.* (1835) 32. — *C. verticillatus* ROXB. *Fl. Ind. (1820) 209*; *Miq. Fl. Ind. Bat. 3* (1856) 276. — *C. spicatus* PRESL, *Rel. Haenk. 1* (1828) 173; STEUD. *Syn. 2* (1855) 52; *Miq. Fl. Ind. Bat. 3* (1856) 287; NAVES, *Nov. App. (1882) 306*; CLARKE, *Philip. J. Sc. 2* (1907) Bot. 87; KÜK. *Pfl. R. Heft 101* (1935) 73. — *C. racemosus* RETZ. *var. spicatus infuscatus* NEES in Hook. *J. Bot. Kew Misc. 6* (1854) 27. — *C. obscurus* NEES, *l.c.*, in *synon.* — *C. macrosciadion* STEUD. *Syn. 2* (1855) 37; *Miq. Fl. Ind. Bat. 3* (1856) 277; NAVES, *Nov. App. (1882) 305.* — *C. anabaptistus* STEUD. *Syn. 2* (1855) 37; *Miq. Fl. Ind. Bat. 3* (1856) 277; NAVES, *Nov. App. (1882) 305.* — *Dichostylis radiata* PALLA, *Allg. Bot. Zeitschr. 17*, Beil. (1912) 8.

Perennial with very short rhizome. *Stems* slender to robust, tufted, trigonous, smooth, 50-100(-150) cm by up to 8 mm. *Leaves* canaliculate, coriaceous, scabrous on the margins, pale green beneath, 5-10(-15) mm wide; lower sheaths somewhat spongy, stramineous to purplish black. *Inflorescence* compound or subdecompound, up to 20 cm long and wide. Involucral bracts 3-5, obliquely erect to patent, up to 65 cm long. Primary rays 6-8, unequal,

stiff, smooth, up to 15 cm; secondary rays usually very short, rarely up to 3 cm. *Spikes* digitately arranged, cylindrical, very dense (usually 60-70 spikelets to the spike), sessile or subsessile (rarely 2-3 cm peduncled), 2-3 cm by 5-10 mm; rachis glabrous, narrowly winged, hidden by the spikelets or almost so. *Spikelets* spicately arranged, suberect, rarely obliquely erect, oblong to oblong-linear, imbricate, compressed, 6-20(-30)-flowered, 4-6 by finally up to 2 mm; rachilla straight, persistent; internodes  $\frac{1}{2}$ - $\frac{1}{4}$  mm; wings narrow, oblong, whitish hyaline, long-persistent. *Glumes* membranous, at first appressed, finally obliquely patent, ovate to broadly ovate, obtuse, mucronate, without mucro 1-1 $\frac{1}{2}$  by c. 1 mm,  $\frac{1}{2}$ - $\frac{3}{4}$  imbricate; keel green, faintly 3-nerved, sides fulvous to spadiceous, nerveless. *Stamens* 3; anthers oblong, c.  $\frac{1}{4}$  mm; connective shortly produced, smooth. *Stigmas* 3. *Nut* trigonous, slightly compressed dorsoventrally, ovoid to ellipsoid, shortly apiculate, yellowish brown, 0.6-0.8 by 0.4 mm.

*Distr.* Pantropical; widely distributed in *Malesia*, not yet known from the Moluccas. Only recently collected in New Guinea; "Guinea" in MIQUEL, *l.c.* 277, does not relate to New Guinea, as VALCKENIER SURINGAR and KÜENTHAL supposed.

*Ecol.* In swamps, wet rice-fields, on river-banks, and in other open wet places, at low altitudes, rarely up to 900 m.

*Uses.* According to BROWN (1920) *l.c.*, in some parts of the Philippines the outer portions of the stems are stripped, dried in the shade, and used for weaving mats, mattings, and screens.

*Vern.* *Bendong*, N. Borneo, *tilinto*, Gorontalo; Philip.: *alinang*, *dagkó*, *óbod-óbod*, *Bis.*, *balabal-anguton*, Tag., *balayang*, *Ilk.*, *upópi*, *Ibn.*

*Notes.* A highly polymorphous species. The common Malaysian form is figured in VALCKENIER SURINGAR's t. 4 f. 38b, whereas the plant of f. 38a (not distinguished nomenclaturally) is very rare in Malesia (*e.g.* BACKER 8131, 24423). The two forms are connected by many intermediates. The latter one is possibly identical with *C. imbricatus var. densespicatus* (HAYATA) OHWI, *Mem. Coll. Sc. Kyoto Imp. Un. B18* (1944) 128. — *C. densespicatus* HAYATA, *l.c. Pl. Form. 6* (1916) 105.

SURINGAR's f. 39 represents an anthelule of a specimen determined by CLARKE as *C. exaltatus var. amoena* CLARKE, but which belongs to *C. imbricatus*, as was already pointed out by SURINGAR.

## 2. Section Alopecuroidei

CHERM. *Fl. Madag. fam. 29* (1937) 138.

Type species: *C. alopecuroides* ROTTB.

6. *Cyperus alopecuroides* ROTTB. *Descr. Pl. rar. Progr.* (1772) 20; *Descr. & Ic.* (1773) 38, t. 8 f. 2; KUNTH, *En. 2* (1837) 19; *Miq. Fl. Ind. Bat. 3* (1856) 261; BOECK. *Linnaea 36* (1870) 321 (*var. β digynus*, *excl. var. α et γ*); BENTH. *Fl. Austr. 7* (1878) 264; CLARKE, *J. Linn. Soc. Bot. 21* (1884) 30, 74, t. 2 f. 12; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 72, t. 2 f. 21; KOORD. *Exk. Fl. Java 1* (1911) 186, *non ibid.* 4 (1922) f. 200; KÜK. *Pfl. R. Heft 101* (1935) 71; *Bull. Jard. Bot. Btzg III*, 16 (1940) 300; in Fedde, *Rep. 53* (1944) 101; KERN, *Reinwardtia 2* (1952) 101; in Back. & Bakh. *f. Fl. Java 3* (1968) 472. — *Juncellus*

*alopecuroides* CLARKE, *Fl. Br. Ind. 6* (1893) 595; CAMUS, *Fl. Gén. I.-C. 7* (1912) 38; BACK. *Bekn. Fl. Java (em. ed.) 10* (1949) fam. 246, p. 42.

Perennial with very short rhizome. *Stems* stout, tufted, trigonous, smooth, leafy at the much thickened base, up to 125 by 1 cm. *Leaves* flat or somewhat plicate with the midrib prominent beneath and 2 lateral nerves strongly marked above, coriaceous, scabrous on margins and nerves, 6-16 mm wide; lower sheaths spongy, cinnamomeous to fuscous. *Inflorescence* compound or decompound, up to 30 cm long. Involucral bracts 4-7, much overtopping

the inflorescence, erecto-patent, up to 65 by 1 cm. Primary rays 5–10, unequal, smooth, suberect, rigid, up to 20 cm; secondary ones usually very short, up to 6 cm. *Spikes* digitately arranged, oblong-cylindrical to cylindrical, divergent, very dense, 2–4 cm by 8–15 mm; rachis hidden by the densely crowded spikelets. *Spikelets* spicately arranged, ultimately at right angles to the rachis, somewhat turgid, ovate to oblong-lanceolate, 12–30-flowered, 4–6(–8) by 2–2½ mm; rachilla straight, strongly compressed, persistent; internodes ½–¾ mm; wings very narrow, long-persistent, whitish. *Glumes* membranous, concave, not keeled, with finally inrolled margins, obliquely patent, finally wide-spreading, ovate or elliptic-ovate, obtuse, apiculate or minutely mucronulate, 5–7-nerved in the centre, yellowish or golden with purple stripes, 1½–2¼ by 1–1¼ mm, very densely (⅔–¾) imbricate. *Stamens* 2(–3); anthers

linear-oblong, ½–1 mm long; connective shortly produced, smooth. *Stigmas* in most flowers 2, not rarely 3 in some flowers of the same inflorescence. *Nut* dorsoventrally compressed, planoconvex or (in the trigynous flowers) with a raised dorsal angle, elliptic to slightly obovate, shortly apiculate, golden yellow or stramineous, 0.8–0.9 by 0.5–0.6 mm.

*Distr.* In Africa from the Mediterranean region to the tropics, Madagascar; from India and Farther India extending to Queensland; West Indies (Guadeloupe); in *Malesia* very rare: Central Java (Depok E. of Jogjakarta, *leg.* JUNGHUHN, not recently collected), Lesser Sunda Is. (Bali, Sumba, Timor); not known from the Malay Peninsula (KÜKENTHAL's record, 1935, *l.c.*, is erroneous).

*Ecol.* In swamps and along margins of lakes, from the lowlands up to 1000 m (Bali).

### 3. Section *Cyperus*

*Cyperus* sect. *Bulbosi* CLARKE, Fl. Br. Ind. 6 (1893) 611. — *Cyperus* sect. *Rotundi* CLARKE, *l.c.* 614. — *Cyperus* sect. *Tunicati* CLARKE in Thiseit.-Dyer, Fl. Trop. Afr. 8 (1902) 314. — *Cyperus* sect. *Esculentii* KÜK. Pfl. R. Heft 101 (1935) 116.

Type species: *C. esculentus* L.

7. *Cyperus rotundus* LINNÉ, Sp. Pl. (1753) 45; HASSK. Pl. Jav. Rar. (1848) 80; MIQ. Fl. Ind. Bat. 3 (1856) 274; BOECK. Linnaea 36 (1870) 283; BENTH. Fl. Austr. 7 (1878) 279, *p.p.*; CLARKE, J. Linn. Soc. Bot. 21 (1884) 167, t. 2 f. 16; Fl. Br. Ind. 6 (1893) 614; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 107, t. 4 f. 23; CLARKE, Philip. J. Sc. 2 (1907) Bot. 85; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 68; KOORD. Exk. Fl. Java 1 (1911) 190 (*rotundatus*?); *ibid.* 4 (1922) f. 216; CAMUS, Fl. Gén. I.-C. 7 (1912) 65; BACK. Trop. Natuur 9 (1920) 174, f. 2; MERR. En. Philip. 1 (1923) 107; RIDL. Fl. Mal. Pen. 5 (1925) 145; BACK. Onkr. Suiker. (1928) 135, t. 132; KÜK. Pfl. R. Heft 101 (1935) 107, f. 13; S. T. BLAKE, Univ. Queensl. Pap. 2, 2 (1942) 8, t. 4; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 33; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 479. — *C. rotundus* 1 *bulbosus* sive *legitimus* RUMPH. Herb. Amb. 6 (1750) 2, t. 1 f. 2. — *Schoenus tuberosus* BURM. f. Fl. Ind. (1768) 19. — *C. curvatus* (non VAHL) LLANOS, Fragm. Pl. Filip. (1851) 15; F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4 (1880) 9. — *Chlorocyperus rotundus* PALLA, Allg. Bot. Zeit. 6 (1900) 201. — *C. longus* (non L.) K.SCH. & LAUT. Fl. Schutzgeb. (1901) 192; VALCK. SUR. Nova Guinea 8 (1912) 698. — *C. bulbosus* (non VAHL) CAMUS, Fl. Gén. I.-C. 7 (1912) 64, *quoad specim. cochinch.* — Fig. 49.

*ssp. rotundus.* — Synonymy as above.

Perennial. Rhizome emitting long, slender, wiry stolons ending in a subglobose or ellipsoid, not or obscurely zoned, finally blackish tuber; scales of rhizome soon disintegrating and usually not present on last year's growth. *Stems* slender, triquetrous, smooth, tuberous at the base, 15–30(–75) cm by 1–2 mm. *Leaves* several, flat, rigidulous, scabrid on the margins in the upper part, gradually acuminate, dark green above, light green beneath, 2–6 mm wide,

lower sheaths reddish brown, soon disintegrating. *Inflorescence* simple or compound, up to 15 by 10 cm, usually much smaller. Involucral bracts 2–4(–6), patent, as long as or overtopping the inflorescence, up to 30 cm. Primary rays 3–9, very unequal, obliquely erect to spreading, slender, up to 10 cm. *Spikes* ovoid, loose to rather dense, with glabrous rachis. *Spikelets* spicately arranged, obliquely patent, linear, acute, strongly compressed, 10–40-flowered, sometimes strongly accrescent and up to 100-flowered, 1–3½ cm by c. 2 mm; rachilla flexuous, broadly winged, persistent; internodes c. ¾ mm; wings persistent, c. ½ mm wide. *Glumes* membranous, obliquely erect, ovate, keeled, subobtuse, rubiginous to deep brown, with narrow hyaline margins, 5–7-nerved over ⅓–½ of either side (the midnerve disappearing or minutely excurrent just below the apex), with green keel more or less curved and slightly recurved at the top, 3–3½ by c. 2 mm, ½ imbricate. *Stamens* 3; anthers linear, c. 1 mm long, with small, smooth, reddish appendage of the connective. *Stigmas* 3. *Nut* trigynous, oblong-obovoid, apiculate, brownish to black, 1½ by ½–¾ mm, rarely maturing (plants reproducing almost exclusively by stolons).

*Distr.* Widely distributed in the warmer parts of the whole world; very common throughout *Malesia*.

*Ecol.* In sunny or lightly shaded localities: in lawns, along roads, in waste places, at low and medium altitudes, up to c. 1000 m. Often a serious pest in cultivated land.

*Uses.* The young tubers are sometimes eaten and used in native medicine. The leaves furnish a rather good pasturage.

*Vern.* *Nut grass*, E, *tëki*, M, S, J, *djukut beuti*, *muta*, S, *tjébuka*, J, *mota*, Md, *manggata*, Gorontalo, *rukut tëki*, *wuta*, Alf. Minah., *kareha wai*, Sumba, *rumpit haliya hitam*, Mal. Pen.: Philip.: *barsangá*,

Ilk., boto-botónes, taruqug, Bik., galonálpas, kusung, malaapúlid, motá, omadiung, onoran, sur-sur, Pamp., muthá, Tag.

Notes. *Var. salsolus* CLARKE, J. Linn. Soc. Bot. 21 (1884) 171, is a small, coastal form. The Malasian specimens cited are to me normal *C. rotundus*.

Specimens in which the spikelets are exceedingly elongated, up to 5 cm long, and up to 100-flowered, have been described as *var. centiflorus* CLARKE, l.c. (? *var. elongatus* BOECK. Linnaea 36, 1870, 285). The strong accrescence of the spikelets is probably due to the fact that the flowers do not set fruit. The variety has no taxonomical value.

For *C. distans* × *C. rotundus* see p. 660.

*ssp. retzii* (NEES) KÜK. Pfl. R. Heft 101 (1935) 114, incl. *var. disruptus* KÜK. — *C. retzii* NEES in Wight, Contr. (1834) 82; S. T. BLAKE, Univ. Queensl. Pap. 2, 2 (1942) 8, t. 5, non POIR. 1806. — *C. rotundus var. pallidus* BENTH. Fl. Austr. 7 (1878) 280, p.p. — *C. disruptus* CLARKE, Kew Bull. add. ser. 8 (1908) 12. — *C. bifax* CLARKE, l.c. 13. — *C. rotundus var. pseudesculentus* KÜK. Bot. Jahrb. 59 (1924) 44. — ? *C. weinlandii* KÜK. Pfl. R. Heft 101 (1935) 131.

Differs from *ssp. rotundus* by its stouter habit (stems 50–75 cm tall); the scales of the stolons usually persisting through the second year; the somewhat broader spikelets (c. 2½ mm wide when ripe); the thinly membranous, elliptic-oblong, 3½–4 mm long, paler (usually ferruginous) glumes, which soon spread and inroll, and are striate on either side for ½–⅔ of the breadth; the straight keel of the glumes; and its freely fruiting.

Distr. India; widely spread in Australia; according to KÜKENTHAL, l.c., in tropical S. America and widely spread in Africa; in *Malesia*: Lesser Sunda Is. (Alor), E. New Guinea, New Britain; a specimen collected in the Bogor Botanic Gardens on a compost heap may be introduced.

Ecol. In moist localities: creek flats, silty flood-banks, sometimes as a weed, but never a pest.

Notes. Difficult to distinguish from stout forms of *C. rotundus ssp. rotundus*, and hardly if at all from *C. rotundus ssp. tuberosus* (ROTTB.) KÜK. (*C. tuberosus* ROTTB. Descr. Pl. rar. Progr. 1772, 18; Descr. & Ic. 1773, 18, t. 7 f. 1). See S. T. BLAKE, l.c. 13, who takes *C. rotundus*, *C. retzii*, and *C. tuberosus* for separate species.

The bright colour of the spikelets is similar to that of *C. esculentus*, with which species *C. rotundus ssp. retzii* is often confused.

8. *Cyperus bulbosus* VAHL, En. 2 (1806) 342; MIQ. Fl. Ind. Bat. 3 (1856) 274; BOECK. Linnaea 36 (1870) 300; CLARKE, Fl. Br. Ind. 6 (1893) 611; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 116, t. 4 f. 27, t. 5 f. 8; HOOK. f. in Trimen, Handb. Fl. Ceyl. 5 (1900) 22, t. 96; KÜK. Pfl. R. Heft 101 (1935) 125, t. 15 f. C-E; S. T. BLAKE, Univ. Queensl. Pap. 2, 2 (1942) 9, t. 8; KERN, Reinwardtia 2 (1952) 107; in Back. & Bakh. f. Fl. Java 3 (1968) 478. — *C. jeminicus* (non ROTTB.) CLARKE, J. Linn. Soc. Bot. 21 (1884) 175, t. 2 f. 17–18.

Perennial. Stolons capillary, disappearing after having formed ovoid to fusiform, at first whitish, ultimately shining black, bulb-like, 1–1½ cm long tubers; coat of tubers coriaceous, striate, splitting into some caducous, blackish segments. Stems arising from a tuber, slender, triquetrous, smooth, (5–)15–

30 cm by ½–1 mm. Leaves several, often recurved, as long as or longer than the stem, gradually acuminate, scaberulous in the upper part, 1–2(–4) mm wide. Inflorescence simple, often imperfect (reduced to a spike) or with a few short rays, 2–3 by 1–3(–5) cm. Involucral bracts (1–)2–3, patent to reflexed, 1–2 mm spaced or only the lowermost obvious, usually overtopping the inflorescence, up to 10 cm. Spikelets spicately arranged, patent, linear, compressed, 8–28-flowered, 1–3 cm by c. 2 mm; rachilla flexuous, broadly winged, persistent; wings persistent; internodes c. 1 mm. Glumes chartaceous, obliquely erect, ovate to oblong-lanceolate, subacute, mucicous or minutely mucronulate, 9–11-nerved, with green keel and shining reddish to castaneous sides, (3–)4 by 2 mm, ½ imbricate. Stamens 3; anthers linear, 1½–2 mm, with short, smooth, red appendage of the connective. Stigmas 3. Nut trigonous, obovoid to ellipsoid, obtuse, apiculate, ultimately black, c. 1½ by ½ mm.

Distr. Tropical Africa, S. Asia, tropical Australia; in *Malesia* very rare: W. Java (Island of Damar Besar in Bay of Djakarta), Madura, Lesser Sunda Is. (Timor).

Ecol. On dry sandy soil, in *Malesia* only near the sea.

Notes. In the absence of the characteristic tubers, which is often the case in herbarium specimens, *C. bulbosus* may easily be confused with *C. rotundus*, but can be distinguished by the imperfection of the inflorescence, the spaced lower bracts, and the more distinctly nerved glumes.

In countries where the species is common the young tubers are eaten.

9. *Cyperus esculentus* LINNÉ, Sp. Pl. (1753) 45; BOECK. Linnaea 36 (1870) 287; CLARKE, J. Linn. Soc. Bot. 21 (1884) 178; Fl. Br. Ind. 6 (1893) 616; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 120; KÜK. Pfl. R. Heft 101 (1935) 116; S. T. BLAKE, Univ. Queensl. Pap. 2, 2 (1942) 9.

Perennial. Stolons several, very slender, yellowish, clothed with ovate-lanceolate, acute, pale scales ending in ovoid to globose, c. 1 cm thick tubers which are transversely zoned when young and covered with a grey tomentum when ripe; after the tubers have been formed the stolons often disappear. Stems slender, rigid, triquetrous, smooth, 10–50 cm by 1–2 mm. Leaves several, somewhat shorter or longer than the stems, rather rigid, gradually acuminate, 3–6 mm wide; lower sheaths stramineous to reddish brown. Inflorescence simple or compound, rather loose to dense, (3–)5–10(–18) by (2–)4–6(–10) cm. Involucral bracts 3–6, obliquely patent, usually the lower 1–2 much overtopping the inflorescence. Primary rays 3–8, unequal, smooth, 3–10(–15) cm long. Spikes ovoid, with few to numerous spikelets; rachis glabrous. Spikelets spicately arranged, divaricate, oblong-linear, subcompressed, obtuse, 8–16-flowered, 5–18 by c. 2 mm; rachilla slightly flexuous, broadly winged; internodes ¾–1 mm. Glumes membranous, obliquely erect, hardly keeled, ovate to elliptic, very obtuse, sometimes minutely mucronulate, golden yellow to pale brown with whitish hyaline margins especially above, distinctly 7-nerved over their whole breadth, 2½–3 by 2–2¼ mm, ½–½ imbricate. Stamens 3; anthers linear, 1½–2 mm, with short, smooth, red appendage of the

connective. *Stigmas* 3. *Nut* trigonous, obovoid to oblong-obovoid, obtuse, hardly apiculate, c.  $1\frac{1}{2}$  by 1 mm.

**Distr.** Widely distributed: from the Mediterranean region to S. Africa and through India and Farther India to N. Queensland; abundant in America; also cultivated; in *Malesia* only known from a single, suspected collection: E. Java, Tosari 1915, RIDLEY; see under *Carex divulsa* and *C. muricata* (*C. pairaei*).

**Ecol.** "In fields along road".

**Note.** In many countries the tubers, which contain

sugar and oil, are roasted and eaten. Cultivation is not reported from *Malesia*.

**10. *Cyperus stoloniferus* RETZ.** Obs. 4 (1786) 10; PRESL, Rel. Haenk. 1 (1828) 169; MIQ. Fl. Ind. Bat. 3 (1856) 265; BOECK. Linnaea 35 (1868) 489, *excl. var.*; NAVES, Nov. App. (1882) 302; CLARKE, J. Linn. Soc. Bot. 21 (1884) 172; Fl. Br. Ind. 6 (1893) 615; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 115, t. 4 f. 26, t. 5 f. 5; CLARKE, Philip. J. Sc. 2 (1907) Bot. 85 (*'stolonifer'*); Ill. Cyp. (1909) t. 19 f. 1-3; RIDL. Mat. Fl. Mal.



Fig. 50. *Cyperus stoloniferus* RETZ. on the sandy beach near Kuala Takadai (Endau, eastcoast of Johore), occurring from below mean highwater level to about highwater springtide level. The trees are tjemara (*Casuarina equisetifolia*) (photogr. H. M. BURKILL, 1960).

Pen. (Monoc.) 3 (1907) 69; KOORD. Exk. Fl. Java 1 (1911) 190; *ibid.* 4 (1922) f. 218; BACK. Trop. Natuur 9 (1920) 173, f. 1; MERR. En. Philip. 1 (1923) 108; RIDL. Fl. Mal. Pen. 5 (1925) 145; KÜK. Pfl. R. Heft 101 (1935) 106; S. T. BLAKE, Univ. Queensl. Pap. 2, 2 (1942) 9, t. 7; J. Arn. Arb. 28 (1947) 213; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 33; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 478. — *C. litoralis* R.Br. Prod. (1810) 216. — *C. tuberosus* (non ROTTB.) KUNTH, En. 2 (1837) 50; MOR. Syst. Verz. (1846) 96. — *C. lamprocarpus* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 27; BOECK. Linnæa 35 (1868) 490. — *C. bulboso-stoloniferus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, *nom. nud.*] Syn. 2 (1855) 18; MIQ. Fl. Ind. Bat. 3 (1856) 266. — *C. rotundus* (non L.) BENTH. Fl. Austr. 7 (1878) 279, p.p. — *C. bulbosus* (non VAHL) CAMUS, Fl. Gén. I.-C. 7 (1912) 64, *incl. var. elatus* CAMUS, *excl. specim. cochinch.* — *C. mayeri* KÜK. in Fedde, Rep. 29 (1931) 194; Pfl. R. Heft 101 (1936) 162, *ex descr.* — *C. carrii* KÜK. Bot. Jahrb. 69 (1938) 256. — **Fig. 50.**

Perennial. Stolons long-creeping, hardening into a woody rhizome forming stout, irregular tubers. Stems slender, distant, rigid, triquetrous, smooth, distinctly incrassate at the base, 15–50 cm by 1–2(–3) mm. Leaves gradually acuminate, scabrid in the upper part, glaucous, in dry localities rigid and narrow (1½ mm), in wet places more flaccid and up to 4 mm wide. Inflorescence simple or subcompound, dense to rather loose, often small, rarely up to 6 by

5 cm. Involucral bracts 2–3, suberect, the lower 1 or 2 (much) overtopping the inflorescence, sometimes up to 30 cm. Primary rays 2–5, obliquely erect, very unequal, smooth, 1–6 cm. Spikes ovoid or broadly ovoid, 1½–2½ cm long and wide; rachis very short, glabrous. Spikelets spicately arranged, 3–10 to the spike, patent, linear-lanceolate, often somewhat curved, turgid, almost terete, 8–20-flowered, 5–15 by 2–2½ mm; rachilla slightly flexuous, broadly winged, persistent; internodes ½–¾ mm; wings hyaline, long-persistent. Glumes membranous, obliquely erect, ovate or broadly ovate, obtuse, not keeled, indistinctly 5–7-nerved, 2½–3 by 2–2½ mm, ⅓ imbricate; midnerve green, sides ferruginous to rubiginous, margins (often glistening) white or yellowish hyaline in the upper part. Stamens 3; anthers linear, up to 2 mm, with short, smooth, reddish appendage of the connective. Stigmas 3. Nut strongly dorsoventrally compressed, broadly ovate to ovate, convex with a raised angle on the dorsal side, often somewhat concave on the ventral side, obtuse, shining, dark brown to blackish, 1–1½ by c. 1 mm.

Distr. Mauritius, Madagascar; from SE. Asia to Melanesia and Queensland; throughout *Malesia*, in the Philippines rare and local (Luzon, Panay).

Ecol. On coastal sands, often acting as a sand-binder on dunes and beaches, occasionally also in salt, muddy places. Fig. 50.

#### 4. Section Corymbosi

KUNTH, En. 2 (1837) 53. — *Cyperus sect. Brevifoliati* CLARKE, Fl. Br. Ind. 6 (1893) 611.

Type species: *C. corymbosus* ROTTB.

11. *Cyperus scariosus* R.Br. Prod. (1810) 216; CLARKE, J. Linn. Soc. Bot. 21 (1884) 159; Fl. Br. Ind. 6 (1893) 612; Ill. Cyp. (1909) t. 15 f. 2–3; S. T. BLAKE, Univ. Queensl. Pap. 2, 2 (1942) 9, t. 2; KERN, Reinwardtia 2 (1952) 103, f. 3; non VALCK. SUR. Nova Guinea 8 (1912) 699. — *C. rotundus* L. var. *pallidus* BENTH. Fl. Austr. 7 (1878) 280, p.p. — *C. diphyllus* (non RETZ.) VALCK. SUR. Nova Guinea 8 (1912) 698. — *C. corymbosus* ROTTB. var. *scariosus* KÜK. Pfl. R. Heft 101 (1935) 83.

Perennial with creeping rhizome; stolons slender, rather short, up to 5 cm, covered with lanceolate, reddish brown, striate sheaths, forming small tubers. Stems slender, almost terete in the lower part, gradually becoming trigonous upwards, somewhat incrassate at the base, rigid, smooth, 50–80 cm by 1½–2 mm. Leaves few, up to 3, very short, rarely half as long as the stems, weak, gradually acuminate, scaberulous at the triquetrous top, ½–12 cm by c. 2 mm; lower sheaths stramineous to purplish. Inflorescence small, simple, usually thrown to one side by the erect lowermost bract, with short rays or reduced to a single spike, 2–5 cm long and wide. Involucral bracts much shorter than the inflorescence when

leaves short, exceeding the inflorescence when leaves longish, erect or suberect, ½–6 cm, embracing the stem with minute, dark brown, scarios auricles. Primary rays filiform, erect or suberect, with few spikelets, 2–3 cm. Spikelets spicately arranged, obliquely erect to patent, linear, strongly compressed, up to 26-flowered, 1–2(–2½) cm by 2–2½ mm; rachilla rather flexuous, broadly winged, persistent; internodes c. ¾ mm; wings whitish hyaline, long-persistent. Glumes membranous, erecto-patent, ovate, obtuse, muticous, 2¾ by 1½(–2) mm, ½ imbricate; keel green, 3-nerved; sides faintly 3–4-nerved, stramineous, tinged with red; upper margin narrowly banded with brown. Stamens 3; anthers linear, c. 1½ mm; connective shortly produced, smooth. Stigmas 3. Nut trigonous, slightly obovoid to ellipsoid, broadly stipitate, shortly apiculate, brown, ¼–1½ by c. ½ mm.

Distr. From Bengal and Farther India to tropical Australia; in *Malesia*: South coast of W. New Guinea; Papua: Central Distr., Kairuku Subdistr.

Ecol. Coastal species, almost restricted to swampy, brackish or near-brackish localities.

## 5. Section Subimbricati

CLARKE, Fl. Br. Ind. 6 (1893) 612. — *Cyperus* sect. *Zollingeriani* CLARKE, Kew Bull. add. ser. 8 (1908) 100. — *Cyperus* sect. *Subquadrangulares* KÜK. Pfl. R. Heft 101 (1936) 127.

Type species: *C. zollingeri* STEUD.

12. *Cyperus tenuiculmis* BOECK. Linnaea 36 (1870) 286; SCHEFFER, Nat. Tijds. N. I. 34 (1874) 50; NAVES, Nov. App. (1882) 306; KERN, Reinwardtia 3 (1954) 30; in Back. & Bakh. f. Fl. Java 3 (1968) 481. — *C. rotundus* (non L.) PRESL, Rel. Haenk. 1 (1828) 175; MIQ. Sum. (1861) 260, 600. — *C. longus* L. var.  $\beta$  MIQ. Fl. Ind. Bat. 3 (1856) 275. — *C. rotundus* L. var. *carinalis* BENTH. Fl. Austr. 7 (1878) 280. — *C. lucidulus* (non KLEIN) CLARKE, J. Linn. Soc. Bot. 21 (1884) 99. — *C. zollingeri* (non STEUD.) CLARKE, Fl. Br. Ind. 6 (1893) 613; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 118, t. 4 f. 28, excl. ZOLLINGER 2689; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 68; CLARKE, Philip. J. Sc. 2 (1907) Bot. 85; Ill. Cyp. (1909) t. 8 f. 1–2; KOORD. Exk. Fl. Java 1 (1911) 190; *ibid.* 4 (1922) f. 219; CAMUS, Fl. Gén. I.-C. 7 (1912) 67, f. 7, 3–5; MERR. En. Philip. 1 (1923) 108, excl. RAMOS 7672; RIDL. Fl. Mal. Pen. 5 (1925) 144; KÜK. Pfl. R. Heft 101 (1935) 133, incl. var. *condensatus* KÜK., excl. ZOLLINGER 2689; S. T. BLAKE, J. Arn. Arb. 28 (1947) 214; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 37; KERN, Reinwardtia 2 (1952) 107, f. 6. — *C. scariosus* (non R.Br.) VALCK. SUR. Nova Guinea 8 (1912) 699, non al.

Perennial with short-creeping, woody rhizome. Stems solitary or subcespitose, slender but rigid, triquetrous, smooth, 20–70(–100) cm by 1–2 mm, the incrassate base surrounded by some purplish-striate, bladeless sheaths. Leaves several, shorter than the stems, canaliculate, rigid, very gradually acuminate in a long, setaceous point, scabrid in the upper part, c. 3(–6) mm wide. Inflorescence simple or subcompound, open, sometimes reduced to a single cluster. Involucral bracts 3–7, erecto-patent, the longest as long as or overtopping the inflorescence, up to 20 cm. Primary rays 4–10, obliquely erect, very unequal, slender, smooth, up to 20 cm; secondary rays when present up to 3 cm. Spikes broadly ovoid, up to 5 by 6 cm, with 3–10(–15) spikelets; rachis glabrous or slightly scabrid. Spikelets spicately arranged, at first suberect, finally patent to horizontally spreading, linear or linear-lanceolate, slightly compressed, subquadrangular (i.e. rhomboidal in cross-section), 8–20(–rarely more)-flowered, 2–3(–5) cm by c. 2 mm, the lowest of each spike often with a setaceous, up to 1 cm long bract; rachilla flexuous, broadly winged, persistent, blackish, internodes c. 1½ mm; wings oblong, caducous, whitish hyaline, ½ mm wide. Glumes chartaceous, appressed, keeled, ovate or elliptic, obtuse or acutish, muticous or minutely mucronulate, 7–9-nerved, (3–)3½(–4) by 2–2¼ mm, remote (not or scarcely imbricate); keel broad, green, sides golden yellow to fulvous, margins narrow, hyaline. Stamens 3; anthers linear, 1–1½ mm long, the connective hardly produced. Stigmas 3. Nut triquetrous, ellipsoid or slightly obovoid, broadly stipitate, minutely apiculate, castaneous to blackish, (1½–)1¾–2 by ½–1 mm.

Distr. Tropical Africa, S. and SE. Asia to Micronesia and Australia; throughout Malesia, but everywhere scattered.

Ecol. In open grassland, savannahs, fallow fields, along grassy road-sides, sometimes in wet places in forests, on rather dry to swampy soil, 0–1600 m.

Vern. Siani, Sum. W. C., *kəkuda*, *teleles*, Gajolands, *diyangere*, New Guinea (Maniki); Philip.: *daat-lāua*, Tag., *pakama*, Bag.

13. *Cyperus zollingeri* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 17; MIQ. Fl. Ind. Bat. 3 (1856) 264; BOECK. Linnaea 36 (1870) 352; KERN, Reinwardtia 3 (1954) 28; in Back. & Bakh. f. Fl. Java 3 (1968) 480. — *C. ramosii* KÜK. in Fedde, Rep. 21 (1925) 326; Pfl. R. Heft 101 (1935) 136; Bot. Jahrb. 69 (1938) 255; KERN, Reinwardtia 2 (1952) 109, f. 7. — *C. rubroviridis* CHERM. Bull. Soc. Bot. Fr. 66 (1919) 350; KÜK. Pfl. R. Heft 101 (1935) 135, f. 16 G-J. — *C. sphacelatus* ROTTB. var. *tenuior* CLARKE, Fl. Trop. Afr. 8 (1901) 347.

Annual with fibrous roots. Stems slender, tufted, triquetrous, smooth, up to 30 cm by ½–1 mm. Leaves few, shorter than the stems, flat, flaccid, very gradually acuminate, scabrid towards the top, grass-green or light green, 1–3 mm wide; lower sheaths bladeless, membranous, stramineous, purplish striate. Inflorescence simple, loose. Involucral bracts 3–6(–9), obliquely patent, the lowest as long as or slightly overtopping the inflorescence, up to 12 cm. Spikes consisting of 1 erect terminal spikelet and 1–3(–6) ultimately horizontally spreading lateral ones, often some reduced to a single spikelet; rachis glabrous. Spikelets spicately arranged, linear, acute, slightly compressed, subquadrangular (i.e. rhomboidal in cross-section), 6–16-flowered, 1–2½ cm by c. 1½ mm; rachilla flexuous, broadly winged; persistent; internodes c. 1½ mm; wings rather firm, soon caducous, stramineous, often brownish lineolate. Glumes appressed or somewhat recurved at the top, remote (hardly overlapping the next higher one), ovate or elliptic, acutish, 7–9-nerved, 3–3½ by c. 2 mm, the slightly excurrent midnerve setulose at the top; keel broad, green, sides stramineous to brownish, purplish lineolate, margins hyaline. Stamens 3; anthers oblong, ¼–¾ mm. Stigmas 3. Nut trigonous, turbinate-obovoid, truncate or somewhat depressed at the apex, broadly stipitate, brown to blackish, 1¼–1½ by ⅓–1⅓ mm.

Distr. Tropical Africa, Madagascar, tropical Australia (N. Australia, Queensland), in Malesia very rare: E. Java (Puger, ZOLLINGER 2689, type coll. of *C. zollingeri*, not collected afterwards), Lesser Sunda Is. (NW. Bali: Perapatagung), Philippines (Luzon: Ilocos Norte Prov., RAMOS 7672, type coll. of *C. ramosii*; Coron I.), New Guinea (W. New Guinea: Kebar Valley; Papua: Hisiu, Port Moresby).

Ecol. In Java collected on road-sides, in Bali in

open forest on limestone rocks at 100 m, in New Guinea in open sandy places at sealevel and on the sea-shore.

**14. *Cyperus sphacelatus* ROTTB.** Descr. Pl. rar. Progr. (1772) 21; Descr. & Ic. (1773) 26; BOECK. *Linnaea* 36 (1870) 292; CLARKE, J. Linn. Soc. Bot. 21 (1884) 183; KÜK. Pfl. R. Heft 101 (1935) 129; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 39; KERN, Reinwardtia 2 (1952) 107, f. 5; Blumea 8 (1955) 162; in Back. & Bakh. f. Fl. Java 3 (1968) 481.

Annual with fibrous roots. *Stems* slender to rather firm, tufted, triquetrous, smooth, 10–30(–60) cm by 1–2 mm. *Leaves* few, shorter than the stems, rather rigid, flat or slightly canaliculate, gradually acuminate, scabrid in the upper half on margins and underside of midrib, 2–4 mm wide. *Inflorescence* simple or compound, open. *Involucral bracts* 3–5, obliquely spreading, the lower ones overtopping the inflorescence, up to 20 cm long. *Primary rays* 3–5(–8), unequal, erecto-patent, slender, smooth, up to 10(–15) cm; secondary rays when present very short,  $\frac{1}{2}$ –1 cm. *Spikes* broadly ovoid, usually c. 2 by 3 cm, sometimes up to 5 by 8 cm, with glabrous rachis. *Spikelets* spicately arranged, 3–10 to the spike, ultimately widely spreading or the lower ones somewhat reflexed, linear-lanceolate, acute, slightly compressed, subquadrangular (*i.e.* rhomboidal in cross-section), 10–20(–50)-flowered, 1–2(–4) cm by c. 2 mm; rachilla flexuous, broadly winged, persistent; internodes  $\frac{3}{4}$ –1 mm; wings whitish hyaline, c.  $\frac{1}{2}$  mm wide. *Glumes* membranous, obliquely erect, ovate to elliptic, subobtusate, sometimes minutely

mucronulate, 7–9-nerved,  $2\frac{1}{2}$ –3 by  $1\frac{1}{2}$ –2 mm,  $\frac{1}{3}$  imbricate; keel green; sides stramineous, usually with a purple spot; margins white-hyaline. *Stamens* 3; anthers oblong,  $\frac{1}{2}$  mm long. *Stigmas* 3. *Nut* triquetrous, concave on the ventral side, ellipsoid or slightly obovoid, broadly stipitate, minutely apiculate, brown,  $1\frac{1}{2}$ – $1\frac{1}{2}$  by  $\frac{3}{4}$ –1 mm.

*Distr.* Widely distributed in tropical Africa and tropical America, elsewhere introduced (Coromandel, Ceylon, Queensland, Tahiti), in *Malesia*: N. Sumatra, Malay Peninsula (P. Penang, Johore, Singapore), Northern Borneo (Kuching, Jesselton, Brunei, Labuan I., Nunukan), W. New Guinea (McCluer Gulf, Merauke), New Britain (Gazelle Peninsula), obviously naturalising.

*Ecol.* In grassy fields, often as a weed on air-strips, in Brunei collected in *Shorea albida* peat-swamp.

*Notes.* The earliest Malesian collection may be that of VESTERDAL ("Malacca", without date). In Sumatra it was first collected in 1922, in the other islands more recently. It is said to be collected in E. Java (Lawang) as early as 1905 by MOLHUYSSEN, but since MOLHUYSSEN's collections include several plants certainly not native to Java, this statement is very doubtful.

The species is very similar to *C. tenuiculmis*; it can be distinguished by its annual habit, the smaller, distinctly imbricate glumes, the oblong anthers, the somewhat smaller nuts, and usually at once by the purple spots on either side of the glumes (sometimes on one side only, rarely lacking), together giving the impression of a purple stripe along the centre of the spikelet.

## 6. Section Distantes

CLARKE, Kew Bull. add. ser. 8 (1908) 99. — *Cyperus sect. Longispicati a. Distantes* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 123.

Type species: *C. distans* L. f.

**15. *Cyperus nutans* VAHL,** En. 2 (1806) 363; MIQ. Fl. Ind. Bat. 3 (1856) 286; BOECK. *Linnaea* 35 (1868) 597; CLARKE, J. Linn. Soc. Bot. 21 (1884) 143, *excl. specim. madag.*; Fl. Br. Ind. 6 (1893) 607; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 126, t. 4 f. 30a, b, *excl. specim. discrep., non f. 30c*; KOORD. Exk. Fl. Java 1 (1911) 190; *ibid.* 4 (1922) f. 221; KÜK. Pfl. R. Heft 101 (1935) 144, f. 5 A-D; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 38; KERN, Reinwardtia 3 (1954) 31; KOYAMA, Quart. J. Taiwan Mus. 14 (1961) 168; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 481. — *C. calopterus* MIQ. Fl. Ind. Bat. 3 (1856) 282. — *C. eleusinoides* (non KUNTH) K. SCH. & LAUT. Fl. Schatzgeb. (1900) 191; MERR. En. Philip. 1 (1923) 105, p. 2.

*var. nutans.* — Synonymy as above.

Perennial with short rhizome. *Stems* tall, tufted, trigonous, triquetrous just below the inflorescence, smooth, up to 100(–150) by 1 cm. *Leaves* coriaceous, flat, the larger ones somewhat plicate with the midrib prominent beneath and 2 lateral nerves marked above, scabrous on the margins in the upper part, dark green or glaucous above, whitish striate beneath, 6–15 mm wide. *Inflorescence* compound or decomposed, usually large. *Involucral bracts* 4–6, the larger ones far overtopping the inflorescence, up

to 75 cm. *Primary rays* 6–10, very unequal, obliquely patent, rigid, smooth, up to 30 cm, the larger ones bearing 5–7 up to 6 cm long secondary rays. *Spikes* narrow, more or less penicillate, 3–4 cm by 5–10 mm, loose, with glabrous rachis and 15–25 spikelets. *Spikelets* spicately arranged, suberect, oblong-linear, distinctly compressed, 8–14-flowered, 6–14 by c. 2 mm; rachilla slightly flexuous, winged, persistent; internodes c.  $\frac{3}{4}$  mm; wings lanceolate, whitish hyaline, persistent, c.  $\frac{1}{4}$  mm wide. *Glumes* membranous, obliquely erect to patulous, keeled, oblong, obtuse, broadly whitish hyaline-margined in the upper half, soon incised at the tip and mucronulate by the excurrent midrib, 7-nerved,  $\frac{1}{3}$  imbricate, 2– $2\frac{1}{2}$  by c. 1 mm; keel greyish green, sides pale fuscous. *Stamens* 3; anthers oblong-linear,  $\frac{1}{2}$ –1 mm, with distinctly produced, smooth appendage of the connective. *Stigmas* 3. *Nut* triquetrous, oblong to oblong-ovoid, apiculate, brown, c.  $1\frac{1}{2}$  by  $\frac{1}{2}$  mm.

*Distr.* Tropical West Africa (according to CLARKE and KÜENTHAL, not in HUTCHINSON & DALZIEL, Fl. W. Trop. Afr. 2, 1, 1931); from Ceylon and India to S. China, Farther India, and *Malesia*: in a few localities in Sumatra, W. and E. Java, Lesser Sunda Is. (Sumbawa, Flores, Alor), the Philippines (Luzon, Mindanao), Celebes, and New Guinea.

*Ecol.* Swamps, wet rice-fields, moist places in

forests, margins of pools, river-banks, at low altitudes (up to 800 m, in New Guinea, Western Highlands, collected at c. 1500 m).

Vern. *Pèrèmpungan*, M, N. Sum., *djukut leuleutan*, S, *mau-mau*, Alor; Philip.: *gauang*, *salingānga*, Bon.

Note. For the differences with *C. distans* var. *pseudonutans* see there. The species is closely allied to *C. distans*, but in general appearance and several characters it shows affinity to the species of sect. *Exaltati*, especially to *C. elatus*, from which it is distinguishable by the loose spikes, the broader spikelets, the twice as long internodes of the rachilla, the smooth appendage of the connective, and the larger nuts.

var. *eleusinoides* (KUNTH) HAINES, Bot. Bihar Orissa 5 (1924) 898; KOYAMA, Quart. J. Taiwan Mus. 14 (1961) 168, in nota. — *C. eleusinoides* KUNTH, En. 2 (1837) 39; MIQ. Fl. Ind. Bat. 3 (1856) 270; BOECK. Linnaea 35 (1868) 596; BENTH. Fl. Austr. 7 (1878) 277; CLARKE, J. Linn. Soc. Bot. 21 (1884) 142; Fl. Br. Ind. 6 (1893) 608; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 128, t. 4 f. 31; CLARKE, Philip. J. Sc. 2 (1907) Bot. 84; CAMUS, Fl. Gén. I.-C. 7 (1912) 60, f. 6, 7-11; MERR. En. Philip. 1 (1923) 105, p.p.; KÜK. Pfl. R. Heft 101 (1935) 144; KERN, Reinwardtia 2 (1952) 111. — *C. xanthopus* STEUD. Flora 25 (1842) 595; Syn. 2 (1855) 36, excl. pl. jav.

Differs from var. *nutans* by: Inflorescence less compound. Primary rays suberect, the secondary ones often beset with spikelets almost to the base. Spikes shorter, denser. Spikelets usually fewer-flowered. Glumes less remote because of the slightly shorter, c. 1/2 mm long internodes of the rachilla, more distinctly mucronate (mucro 1/4-1/2 mm). Nut more obovoid, 1.1-1.25 by 0.6-0.7 mm.

Distr. Tropical Africa, S. and SE. Asia, Formosa, Ryu Kyu Is., tropical Australia, in Malesia very rare: Lesser Sunda Is. (Flores, Timor), Philippines (Luzon), New Guinea (Morobe Distr.).

Ecol. In swamps, sometimes abundant, at low altitudes (in Timor at 750 m).

Note. The African specimens I have seen look rather different from var. *nutans*, but the Asian often approach it very much, and no sharp line between the two varieties can be drawn. The collection from West Java determined by CLARKE as *C. eleusinoides*, and the greater part of the collections cited under this name by MERRILL, l.c., belong to var. *nutans*. The Philippine collection cited by KÜKENTHAL, l.c., under var. *subpeltatus* KÜK. I take for a depauperate var. *nutans*.

16. *Cyperus distans* LINNÉ f. Suppl. (1781) 103; BOECK. Linnaea 35 (1868) 612; BENTH. Fl. Austr. 7 (1878) 277; CLARKE, J. Linn. Soc. Bot. 21 (1884) 144; Fl. Br. Ind. 6 (1893) 607; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 123, t. 1 f. 9, t. 4 f. 29; CLARKE, Philip. J. Sc. 2 (1907) Bot. 84; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 69; KOORD. Exk. Fl. Java 1 (1911) 191; *ibid.* 4 (1922) f. 222; CAMUS, Fl. Gén. I.-C. 7 (1912) 60; MERR. En. Philip. 1 (1923) 105; RIDL. Fl. Mal. Pen. 5 (1925) 145; BACK. Onkr. Suiker. (1928) 137, t. 134; KÜK. Pfl. R. Heft 101 (1935) 137, incl. f. *pachyanthos* KÜK.; S. T. BLAKE, J. Arn. Arb. 28 (1947) 214; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 35; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 481. — *C. elatus* (non L.) ROTTB. Descr. & Ic. (1773) 37, t. 10; ZOLL. Syst. Verz. 1 (1854) 63;

STEUD. Syn. 2 (1855) 49; MIQ. Fl. Ind. Bat. 3 (1856) 284, incl. var. *graminicola* MIQ.; Sum. (1861) 260, 600; BOECK. Flora 62 (1879) 551. — *C. graminicola* STEUD. [in Zoll. Syst. Verz. 1 (1854) 63, nom. nud.] Syn. 2 (1855) 49. — *C. kurrii* STEUD. Syn. 2 (1855) 38; MIQ. Fl. Ind. Bat. 3 (1856) 279; NAVES, Nov. App. (1882) 305. — *C. digitatus* (non ROXB.) KÜK. Bot. Jahrb. 69 (1938) 255, non al.

Perennial with shortly creeping rhizome. Stems subcespitose, slender to rather stout, triquetrous, smooth, 10-50(-100) cm by 2-3(-5) mm, leafy in the lower 1/4-1/3. Leaves shorter than or as long as the stems, rigid to flaccid, flat, gradually acuminate, scabrous in the upper part, 5-8(-10) mm wide; lower sheaths purplish. Inflorescence compound or decomposed, often large, usually open. Involutural bracts 4-6(-8), spreading, the lower ones overtopping the inflorescence, 20-40(-60) cm. Primary rays 6-12, obliquely patent, very unequal, rigid, smooth, up to 20 cm; secondary ones up to 8 cm. Spikes broadly ovoid-pyramidal, with slightly flexuous, glabrous rachis and c. 15 (5-20) spikelets. Spikelets spicately arranged, ultimately spreading at right angles, the lower ones often somewhat reflexed (see var.), narrowly linear, almost terete, 6-10(-30)-flowered, 1-2(-3) cm by c. 1 mm; rachilla flexuous, distinctly winged, persistent; internodes 1(-1 1/2) mm, wings lanceolate, whitish hyaline, caducous, c. 1/4 mm wide. Glumes membranous, appressed, oblong-ovate or elliptic, hardly keeled, obtuse, remote (not imbricate), (1 1/4-2(-2 1/2) mm by 1-1 1/4 mm; keel green, 3-5-nerved; sides nerveless, reddish brown, rarely stramineous; margins broad, whitish hyaline. Stamens 3; anthers oblong, 1/2-3/4 mm, with hardly produced appendage of the connective. Stigmas 3. Nut trigonous, oblong-cylindrical, broadly stipitate, apiculate, blackish brown under the greyish, detergible outer layer of cells, 1 1/2-1 3/4 by 1/2-1 1/2 mm.

Distr. Widely spread over the warmer regions of the whole world; throughout Malesia and presumably everywhere common.

Ecol. In wet or rather wet places: swamps, river-banks, grassy road-sides, wet rice-fields and meadows, open places in secondary forests; 0-1800 m.

Vern. *Pajungan*, *rumpit pèrèmpungan*, *tèki rawah*, M, *djukut djampang*, *ilat*, *lilik sunge*, *manjèratan*, S, *lingi*, *mèndongan*, *wèligi*, J, *dingi*, M, *rumpit rusa*, *tali juru*, Brunei, *bobarai*, Halmahera, *sinasoan*, Talaud; Philip.: *amisan bakabakahan*, *muthang-kalabau*. Tag., *barisaṅgá*, Ilk., *burabongdai*, S.L.Bis., *gagauan*, Bon., *haṅgaṅga*, If., *langalang*, Bik., *pulok-galo*, *talubak*, Buk.

Notes. Very variable in all its parts. The forms and varieties described have no or little taxonomic value, probably except for:

var. *pseudonutans* KÜK. Pfl. R. Heft 101 (1935) 140. — Spikelets suberect, even in fruit, the spikes therefore more or less penicillate. — Ceylon, India, Formosa, Ryu Kyu Is., according to KÜKENTHAL also in Africa; in Malesia: Singapore (KÜKENTHAL, l.c., not seen), Central Java (Djapara, forest complex Ngarengan). — Strongly resembling *C. nutans* and confused with it by CLARKE; distinguishable by the remote, not imbricate glumes with nerveless sides and the long internodes of the rachilla.

For *C. distans* × *C. rotundus* see p. 660.

## 7. Section Proceri

KUNTH, En. 2 (1837) 72. — *Cyperus sect. Longispicati b. Pilosi* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 128. — *Cyperus sect. Latifolii* CLARKE, Kew Bull. add. ser. 8 (1908) 99.

Type species: *C. procerus* ROTTB.

17. *Cyperus procerus* ROTTB. Descr. & Ic. (1773) 29, t. 5 f. 3; MIO. Fl. Ind. Bat. 3 (1856) 278; CLARKE, J. Linn. Soc. Bot. 21 (1884) 152; Fl. Br. Ind. 6 (1893) 610; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 131, t. 4 f. 34; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 70; KOORD. Exk. Fl. Java 1 (1911) 191; *ibid.* 4 (1922) f. 223; CAMUS, Fl. Gén. I.-C. 7 (1912) 62; RIDL. Fl. Mal. Pen. 5 (1925) 147; BACK. Onkr. Suiker. (1928) 138, t. 136; KÜK. Pfl. R. Heft 101 (1935) 91; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 36; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 478. — *C. ornatus* R. BR. Prod. (1810) 217; BENTH. Fl. Austr. 7 (1878) 276; NAVES, Nov. App. (1882) 303. — *C. heynei* BOECK. Linnaea 35 (1868) 600; SCHEFFER, Nat. Tijds. N. I. 34 (1874) 48. — *Pycurus puncticulatus* (non NEES) RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 61; Fl. Mal. Pen. 5 (1925) 140. — *Pycurus baccha* (non NEES) CAMUS, Fl. Gén. I.-C. 7 (1912) 36. — *Duvaljouvea procera* H. PFEIFF. Mitt. Inst. Bot. Hamb. 7 (1928) 167. — *C. puncticulatus* (non VAHL) KÜK. Pfl. R. Heft 101 (1936) 362, *quoad specim. malacc.* — Fig. 51.

Perennial with stoloniferous rhizome. Stems stout, triquetrous, smooth, 70–125(–175) cm by 4–7(–10) mm, the base clothed with spongy, greyish brown to purplish sheaths. Leaves canaliculate, spongy or coriaceous, firm, gradually acuminate, scabrid at the top, up to 9(–15) mm wide. Inflorescence simple or subcompound, loose, relatively small, 10–15 cm long. Involucral bracts 3–4, obliquely erect to spreading, the larger one(s) far overtopping the inflorescence, up to 50(–70) cm long. Primary rays 3–7, very unequal, more or less spreading, smooth, the longest 6–12(–20) cm; secondary rays when present very short. Spikes broadly ovoid, loose, 2–4 cm long and wide; rachis angular, (in Malesian specimens) more or less scabrous-hispid. Spikelets up to 10(–18) to the terminal spike, only 3–4 to the lateral ones, spicately arranged, patent, the lower ones at right angles to the rachis, oblong to broadly linear, often slightly curved, compressed, up to 40-flowered, 10–35 by  $2\frac{1}{2}$ – $3\frac{1}{2}$  mm; rachilla straight, not or hardly winged, persistent; internodes c.  $\frac{3}{4}$  mm. Glumes membranous, patulous, ovate or elliptic, obtuse, hardly keeled, c. 7-nerved, reddish brown with broad hyaline margins in the upper part,  $\frac{1}{2}$  imbricate,  $2\frac{1}{2}$ –3 by c. 2 mm. Stamens 3; anthers linear, (1–) $1\frac{1}{2}$ –2 mm long, with very short, smooth appendage of the connective. Stigmas 3. Nut triquetrous, obovoid or ellipsoid, minutely apiculate, blackish brown, c.  $1\frac{1}{2}$  by  $\frac{3}{4}$  mm.

Distr. From Ceylon and India to Cochinchina, E. China, and Formosa, southward to Queensland, in Malesia rather rare: Malay Peninsula, Java and adjacent islands, N. Borneo, Philippines (Luzon). According to KÜKENTHAL varieties in tropical Africa and Madagascar; see, however, CHERMEZON in Fl. Madag. fam. 29 (1937) 115 & 117.

Ecol. In open, moist or wet, often brackish localities: swamps, pools, wet rice-fields, often near

the sea, 0–50 m, a few times collected near Bogor (W. Java) at c. 250 m.

Use. The tough stems split in three are sometimes used as strings or binder twines.

Notes. In typical *C. procerus* the rachis of the spikes is smooth, while in all Malesian specimens it is more or less scabrous-hispid. The Malesian plants may therefore be referred to:

*var lasiorrhachis* CLARKE, Fl. Br. Ind. 6 (1893) 610; KÜK. Pfl. R. Heft 101 (1935) 91. — *C. procerus f. lasiorrhachis* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 131. — Axes of the spikes scabrous-pilose. — In the type of this variety (from Chota Nagpore, CLARKE 33818, K) the rachis is more densely hispid than in the Malesian plants. Erroneously the variety was described as having "axis of spikelets scabrous pilose", which error was copied by KÜKENTHAL. This variety is sometimes difficult to distinguish from stout specimens of *C. pilosus*. The inflorescence is less compound and more open than in that species, the spikelets are larger and more distant, the anthers longer, and the nuts larger.

KÜKENTHAL, *l.c.*, mentions from Singapore (MAYER 328 p.p.) *var. griffithianus* (BOECK.) KÜK. — *C. griffithianus* BOECK. Linnaea 35 (1868) 601, according to him with compound inflorescence and oblong-elliptic glumes. I have not seen the type of *C. griffithianus* (GRIFFITH *s.n.* in herb. Boeck.) from India, nor MAYER's Singapore collection. CLARKE reduced BOECKELER's species to *C. pilosus*, but from the original description I might rather refer it to *C. procerus var. lasiorrhachis*. KAMPHÖVENER 786 (C), also cited by KÜKENTHAL, I take for typical *C. procerus* on account of the simple inflorescence and the smooth rachis.

18. *Cyperus pilosus* VAHL, En. 2 (1806) 354; BOECK. Linnaea 35 (1868) 598, *incl. var. muticus* BOECK.; BENTH. Fl. Austr. 7 (1878) 275; CLARKE, J. Linn. Soc. Bot. 21 (1884) 148, *incl. var. obliquus* CLARKE *et var. polyanthus* CLARKE; O.K. Rev. Gen. Pl. (1891) 750, *incl. f. pallidus* O.K. *et f. badius* O.K.; CLARKE, Fl. Br. Ind. 6 (1893) 609; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 128, t. 4 f. 32; CLARKE, Philip. J. Sc. 2 (1907) Bot. 84; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 67; KOORD. Exk. Fl. Java 1 (1911) 191; *ibid.* 4 (1922) f. 224; CAMUS, Fl. Gén. I.-C. 7 (1912) 62, f. 6, 12; MERR. En. Philip. 1 (1923) 107; RIDL. Fl. Mal. Pen. 5 (1925) 144; BACK. Onkr. Suiker. (1928) 138, t. 135; KÜK. Pfl. R. Heft 101 (1935) 92, *incl. var. contractus* KÜK.; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 34; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 477. — *C. obliquus* NEES in Wight, Contr. (1834) 86; BOECK. Linnaea 35 (1868) 611; NAVES, Nov. App. (1882) 305. — *C. marginellus* NEES in Wight, *l.c.* 83; in Hook. J. Bot. Kew Misc. 6 (1854) 28. — *C. venustus* (non R. BR.) MOR. Syst. Verz. (1846) 96. — *C. piptolepis* STEUD. [in Zoll. Syst. Verz. 1 (1854) 63, *nom. nud.*] Syn. 2 (1855) 40;

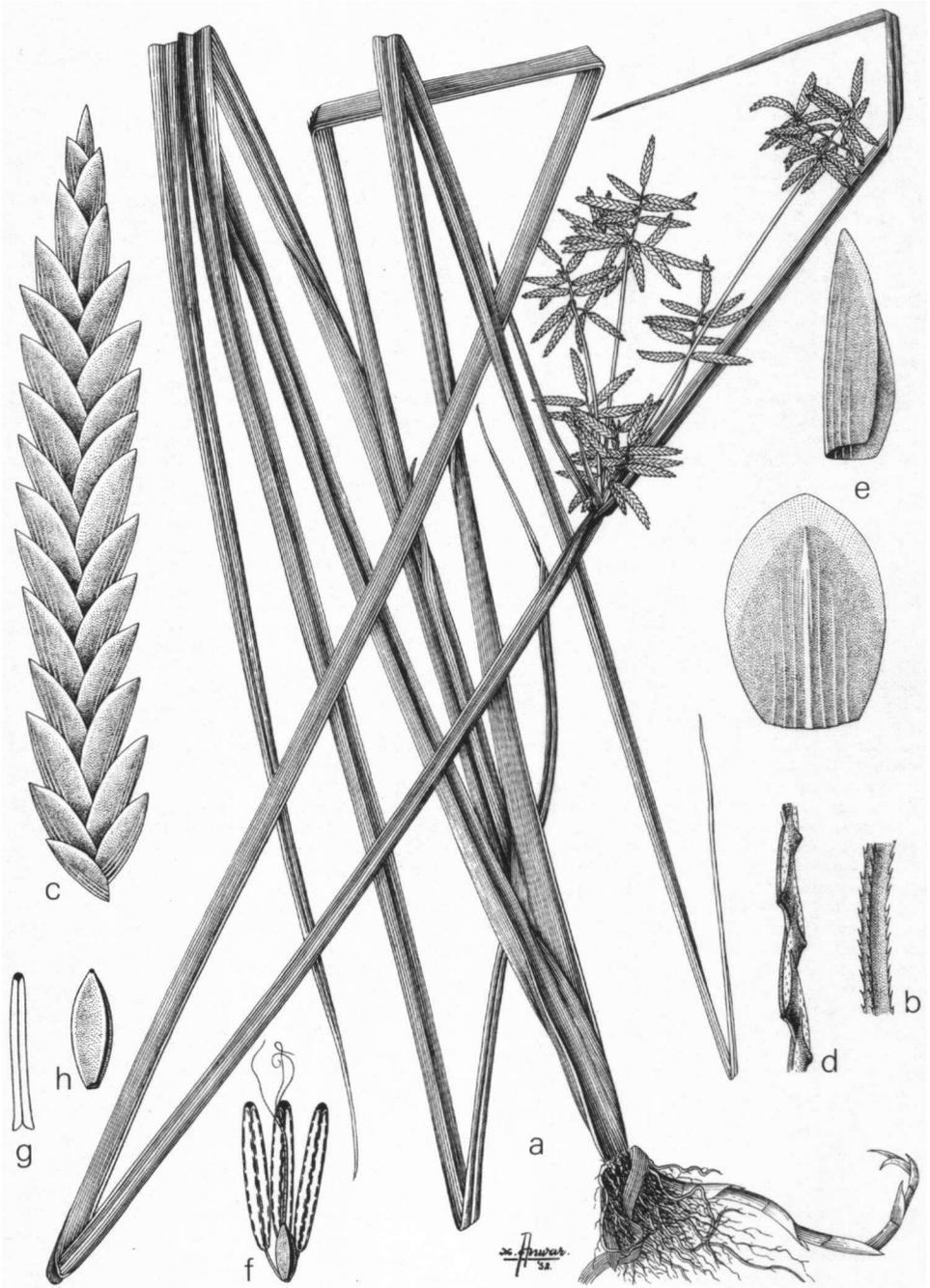


Fig. 51. *Cyperus procerus* ROTTB. a. Habit,  $\times \frac{1}{2}$ , b. rachis of spike, c. spikelet, both  $\times 5$ , d. persistent rachilla hardly winged, e. glumes, f. deflorate flower, g. anther, h. nut, all  $\times 10$  (a HEYNE s.n., b-h DANSER 6470).

MIQ. Fl. Ind. Bat. 3 (1856) 279, incl. var.  $\beta$ , var. *contractus* MIQ. et var. *pyrophilus* MIQ.; MIQ. in De Vriese, Pl. Ind. Bat. Or. (1856) 139. — *C. pennatus* (non LAMK) ZOLL. Syst. Verz. 1 (1854) 62. — *C. pauciflorus* STEUD. Syn. 2 (1855) 34; MIQ. Fl. Ind. Bat. 3 (1856) 275; NAVES, Nov. App. (1882) 304. — *C. hebes* STEUD. Syn. 2 (1855) 315. — *C. pyrophilus* REINW. ex MIQ. in De Vriese, Pl. Ind. Bat. Or. (1856) 139. — *C. nutans* (non VAHL), *specim. discrep.* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 127, t. 4 f. 30 C. — *Duvaljouvea pilosa* PALLA in Koch, Syn. ed. 3, 3 (1905) 2555; Allg. Bot. Zeitschr. 17 (1912) Beil. 8. — Fig. 52.

Perennial, the rhizome emitting slender stolons clothed with lanceolate scales. *Stems* stoutish, solitary or subscespitose, triquetrous, smooth or scaberulous just below the inflorescence, 10–50(–110) cm by up to 6 mm. *Leaves* shorter than to as long as the stems, canalicate or somewhat plicate with 3 prominent nerves, weak to rather rigid, gradually acuminate, scabrous on margins and nerves in the upper part, 4–10(–13) mm wide; lower sheaths brown-purplish. *Inflorescence* compound, very variable in size and density. Involucral bracts (3–)4–5, obliquely erect to spreading, the larger ones far overtopping the inflorescence, up to 50 cm. Primary rays (2–)6–7(–10), very unequal, spreading, smooth, the larger ones 5–15(–20) cm with 3–6 short secondary rays. *Spikes* ovoid, 2–3 cm long, with angular, rather to very densely hispidulous or pubescent rachis. *Spikelets* 6–25 to the spike, at right angles to the rachis or often reflexed, very rarely remaining suberect, elliptic to linear-lanceolate, compressed, 7–20(–50)-flowered, 5–10(–20) by 2–2½(–3) mm; rachilla straight, wingless or almost so, persistent; internodes ¾–¾ mm. *Glumes* membranous, patulous, ovate, obtuse, sometimes minutely mucronulate, hardly keeled, 5–7-nerved, ½–¾ imbricate, with green midrib, stramineous to reddish brown sides, and broad, whitish hyaline margins in the upper part, 2–2½ mm by c. 1½ mm. *Stamens* 3; anthers oblong, ½–¾ mm long, with short, smooth, reddish appendage of the connective. *Stigmas* 3. *Nut* triquetrous, obovoid or ellipsoid, broadly stipitate, apiculate, blackish brown, 1–1¼ by ½–¾ mm.

Distr. From Central Asia and Japan through the whole of tropical Asia and tropical Australia, very rare in tropical W. Africa; throughout *Malesia*, common and often abundant.

Ecol. In open wet places; swamps, rice-fields, grasslands, river-banks, etc.; 0–1500 m.

Vern. *Rumput djéking*, M. *hilut*, *ilat*, *ilat walini*, S. *lumbungan sapi*, J. *rija-rija*, *rumput randjang*, *sibanglulu*, Sum. E. C., *bola-bola tapongan*, Batak, *rombok*, *siangit padang*, Sum. W. C., *para-para*, Riouw, *subah përa*, Siberut, *madarong darat*, Mal. Pen., *mauffès*, Timor, *bundung*, *tali juru*, Borneo: Dusun; Philip.: *paragi*, Sub.; New Guinea: *buatak*, Andjai, *akarebok*, Kapauku.

Notes. For the differences with the very closely related *C. procerus*, see under that species.

*C. pilosus* is very variable in size, colour of the glumes, number of the flowers in the spikelets, etc., but the species, varieties, and forms based on these differences have no taxonomic value and were already merged into the species by VALCKENIER SURINGAR. CLARKE mentions specimens with glabrous or almost glabrous rachis of the spikes; they

have not yet been collected in *Malesia*. Some specimens from W. Java and the Kangean Archipelago have persistently erect spikelets and therefore penicillate spikes. They may represent a distinct variety analogous to *C. distans* var. *pseudonutans*.

19. *Cyperus babakensis* STEUD. Syn. 2 (1855) 6; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 34; KERN, Reinwardtia 2 (1952) 105, f. 4; *ibid.* 3 (1954) 66; *ibid.* 6 (1961) 54; in BACK. & BAKH. f. Fl. Java 3 (1968) 477. — *C. babakensis* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, *nom. nud.*] ex MIQ. Fl. Ind. Bat. 3 (1856) 257; BOECK. Linnaea 35 (1868) 521; CLARKE, Fl. Br. Ind. 6 (1893) 610; Ill. Cyp. (1909) t. 15 f. 1–3; CAMUS, Fl. Gén. I.-C. 7 (1912) 61; RIDL. Fl. Mal. Pen. 5 (1925) 144; KÜK. Pfl. R. Heft 101 (1935) 94. — *C. pilosus* VAHL var. *babakensis* CLARKE, J. Linn. Soc. Bot. 21 (1884) 151. — *C. benghalensis* CLARKE, l.c. — *C. pilosus* VAHL f. *babakensis* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 129, t. 4 f. 33. — *Duvaljouvea babakensis* H. PFEIFF. Mitt. Inst. Bot. Hamb. 7 (1928) 167.

Perennial, the rhizome emitting slender stolons clothed with broadly ovate-lanceolate, brownish scales. *Stems* stoutish, solitary, triquetrous with somewhat concave sides, smooth, up to 90 cm by 5–7 mm. *Leaves* few, shorter than to as long as the stems, flat or canalicate, gradually acuminate, scabrous on the margins in the upper part, 5–10 mm wide; basal sheaths often bladeless, somewhat spongy. *Inflorescence* simple, relatively small. Involucral bracts 3–4, patent to reflexed, the lower 2 very long, much overtopping the inflorescence. Rays 2–5, unequal, erect or suberect, firm, short, rarely up to 5(–9) cm. *Spikes* ovoid or oblong-ovoid, very dense, up to 5 by 4 cm; rachis hispidulous. *Spikelets* spicately arranged, patent to reflexed, oblong to linear, compressed, 10–20(–40)-flowered, 6–20 by 2½–3 mm; rachilla straight, wingless or nearly so, persistent; internodes ½–¾ mm. *Glumes* membranous, obliquely erect, boat-shaped, ovate, subacute, minutely mucronulate, 7–9-nerved, stramineous to reddish brown, ⅔ imbricate, 2½–3 by 2 mm, the keel antrorsely hispid-scabrous at least towards the top; margins hyaline. *Stamens* 3; anthers oblong-linear, ¾–1 mm long, with short, smooth, reddish appendage of the connective. *Stigmas* 3. *Nut* triquetrous, broadly ellipsoid or obovoid, apiculate, broadly stipitate, black, 1¼–1½ by 0.8–0.9 mm.

Distr. From Hindustan and Assam to Cochinchina and *Malesia*: Malay Peninsula (Wellesley, Perak, Kelantan, Pahang, Selangor, Malacca, P. Penang), W. Java (Babakan, Rangkasbetung), S. Borneo, the Philippines (Panay, Iloilo Prov.), Celebes (Laso), and W. New Guinea (Kurik near Merauke). Apparently a rare species.

Ecol. In swamps and wet rice-fields, in light forests, at low altitude, up to 100 m.

Note. STEUDEL, followed by MIQUEL, wrongly placed this well characterised species in *sect. resp. subg. Pycneus*.

20. *Cyperus malaccensis* LAMK, Ill. 1 (1791) 146; MIQ. Fl. Ind. Bat. 3 (1856) 297; BOECK. Linnaea 35 (1868) 603; CLARKE, J. Linn. Soc. Bot. 21 (1884) 147; Fl. Br. Ind. 6 (1893) 608; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 121, t. 4 f. 22; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 70; CLARKE, Philip. J. Sc.



Fig. 52. *Cyperus pilosus* VAHL. a. Habit,  $\times \frac{1}{2}$ , b. part of spikelet,  $\times 5$ , c. glumes, d. rachilla, e. pistil, f. anther, also enlarged, g. nuts, all  $\times 10$  (a-g BACKER 27746).



Fig. 53. *Cyperus malaccensis* LAMK. The long, serpentine string-brushes consist of intertwined stem parts in rope of this species. They float and are set out perpendicular to the beach and serve for attracting young fish (*bibit* or *bandeng*) which are then bred in artificial brackwater fish ponds (*tambaks*) behind the beach. Pemalang, northcoast of Central Java; beach wall grown with *Pandanus odoratissimus* (photogr. VAN STEENIS).

2 (1907) Bot. 84; KOORD. Exk. Fl. Java 1 (1911) 190; *ibid.* 4 (1922) f. 220; CAMUS, Fl. Gén. I.-C. 7 (1912) 63; BROWN, Min. Prod. Philip. For. 1 (1920) 346, t. 13, 14; MERR. En. Philip. 1 (1923) 106; RIDL. Fl. Mal. Pen. 5 (1925) 147; BACK. Onkr. Suiker. (1928) 136, t. 135; KÜK. Pfl. R. Heft 101 (1935) 86; S. T. BLAKE, J. Arn. Arb. 28 (1947) 214; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 35; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 478. — *C. spaniophyllus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, *nom. nud.*] Syn. 2 (1855) 21; MIQ. Fl. Ind. Bat. 3 (1856) 267. — *C. corymbosus* (non ROTTB.) MIQ. *l.c.* 272. — *C. tegetiformis* (non ROXB.) BENTH. Fl. Austr. 7 (1878) 278. — *C. diffiformis* (non L.) BLANCO, Fl. Filip. ed. 3, 4 (1886) 302. — *C. tegetum* (non ROXB.) RIDL. J.

Str. Br. R. As. Soc. n. 46 (1906) 222; MERR. En. Born. (1921) 56. — *Chlorocyperus malaccensis* PALLA, Allg. Bot. Zeitschr. 17 (1912) Beil. 6 — Fig. 53.

Perennial with stout stolons clothed with ovate, scarios, dark brown scales hardening into a woody rhizome. Stems approximate, robust, spongy, triquetrous with concave sides, almost 3-winged above, smooth, 60–175 cm by up to 12(–15) mm. Lower leaves on the flowering stems reduced to spongy, bladeless greyish black to purplish sheaths, the upper ones with very long (up to 20 cm) sheaths, often laminate but the blades always very short, the uppermost reaching up to halfway the stem; blades of the sterile shoots abruptly acuminate, scabrid at the top, 5–10(–18) mm wide. Inflorescence

compound or subdecompound, usually broader than long, sometimes congested, up to 10 by 15 cm. Involucral bracts 3-4, flat, abruptly acuminate, scabrid at the top, much overtopping the inflorescence, shining green above, greyish beneath, the lowest usually erect, up to 30 cm by 8-15 mm, the others patent to reflexed. Primary rays 3-6(-10), very unequal, spreading, slender, smooth, 3-10 cm, secondary ones setaceous, *c.* 2 cm. *Spikelets* broadly ovoid, with glabrous rachis. *Spikelets* spicately arranged, 6-12 to the spike, linear, often somewhat curved, subterete, 1-3 cm by  $1\frac{1}{4}$ - $1\frac{3}{4}$  cm, 16-20(-40)-flowered; rachilla straight, very narrowly winged, persistent; wings persistent, whitish or yellowish; internodes  $\frac{3}{5}$ - $\frac{4}{5}$  mm. *Glumes* chartaceous, ovate to elliptic, obtuse, mucous, not keeled (rounded on the back), indistinctly 5-7-nerved, *c.*  $\frac{1}{4}$  imbricate, pale fuscous with yellowish margins, when dry crispidly incurved all round,  $2\frac{1}{2}$  by  $1\frac{1}{2}$  mm. *Stamens* 3; anthers linear,  $\frac{3}{4}$ -1 mm. *Stigmas* 3. *Nut* trigonous, narrowly oblong, slightly compressed dorsally, hardly apiculate, dark brown to black,  $1\frac{3}{4}$ -2 by  $\frac{1}{2}$  mm.

**Distr.** Widely spread in the eastern hemisphere, from Mesopotamia through India to S. China, Northern Australia, and Polynesia; throughout *Malesia*, in Java not rare along the muddy north coast, in the south coast only in Besuki (E.).

**Ecol.** On moist localities, usually within the in-

fluence of salt or brackish water, a coloniser along muddy river-mouths, on mud flats, sandy foreshores covered by springtides; often abundant.

**Uses.** The stems are often used for tying purposes and for making mats, baskets, and hats; the manufacture of slippers of this material is carried on to a considerable extent in some towns of Bulacan Prov., Luzon (see BROWN, *l.c.*). In Pekalongan (Central Java) the stems are used by the fishermen; pieces of the stems are plaited in ropes which are brought into the sea. The fry, attracted by the stems, is caught and then planted in fish-ponds. See VAN STEENIS, *Trop. Natuur* 29 (1940) 20, fig.

**Vern.** *Bundjung*, *wlingi laut*, *M. darèngdèng*, *S. kèdot*, *sukèt dem*, *J. kumbu*, *Sum.*, *sèlimbu*, *Johore*, *pea-pea*, *rumput kuluwing*, *Celebes*, *geida*, *Papua*; *Philip.*: *bagá-as*, *P.Bis.*, *balangót*, *balongát*, *Tag.*, *Bik.*, *Bis.*, *Pamp.*, *barangót*, *Bik.*, *talaid*, *Bag.*, *tikog*, *Mbo.*

**Note.** *C. malaccensis* var. *brevifolius* BOECK. *Linnaea* 35 (1868) 604; *Kük. Pfl. R. Heft* 101 (1935) 87; KOYAMA, *Quart. J. Taiwan Mus.* 14 (1961) 171. — *C. monophyllum* VAHL, *En.* 2 (1806) 352; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18 (1944) 136.

BOECKLER wrongly cited *C. spaniophyllum* STEUD. (type ZOLLINGER 1209 from Java) as a synonym of this distinct E. Asiatic taxon, and therefore mentioned it for that island. It does not extend to Malesia.

## 8. Section Iriae

KUNTH, *En.* 2 (1837) 38.

Type species: *C. iria* L.

21. *Cyperus iria* LINNÉ, *Sp. Pl.* (1753) 45; HASSK. *Pl. Jav. Rar.* (1848) 83; MIQ. *Fl. Ind. Bat.* 3 (1856) 269, *incl. var. parviflorus* MIQ. *et var. diaphaniria* MIQ.; BOECK. *Linnaea* 35 (1868) 595; BENTH. *Fl. Austr.* 7 (1878) 276; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 137; *Fl. Br. Ind.* 6 (1893) 606; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 105, t. 4 f. 16; CLARKE, *Philip. J. Sc.* 2 (1907) Bot. 83; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 66; CLARKE, *Ill. Cyp.* (1909) t. 4 f. 2, *non f. 1*; KOORD. *Exk. Fl. Java* 1 (1911) 189; *ibid.* 4 (1922) f. 215; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 59, f. 6, 4-6; MERR. *En. Philip.* 1 (1923) 106; RIDL. *Fl. Mal. Pen.* 5 (1925) 143; BACK. *Onkr. Suiker.* (1928) 135, t. 131; KÜK. *Pfl. R. Heft* 101 (1935) 150; S. T. BLAKE, *J. Arn. Arb.* 28 (1947) 214; BACK. *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 34; KERN in BACK. & BAKH. *f. Fl. Java* 3 (1968) 479. — *C. parviflorus* (*non* VAHL) NEES in WIGHT, *Contr.* (1834) 87. — *C. seminudus* ZOLL. & MOR. in *Mor. Syst. Verz.* (1846) 96, *non* ROXB. 1820. — *C. diaphaniria* STEUD. [in *Zoll. Syst. Verz.* 1 (1854) 62, *nom. nud.*] *Syn.* 2 (1855) 23. — *C. nuttallii* (*non* TORR.) LLANOS, *Fragm. Pl. Filip.* (1851) 14; F.-VILL. & NAVES in Blanco, *Fl. Filip. ed.* 3, 4 (1880) 9. — *Chlorocyperus iria* RIKLI, *Jahrb. Wiss. Bot.* 27 (1895) 564; PALLA, *Allg. Bot. Zeitschr.* 17 (1912) Beil. 6.

Annual, or perennial in favourable circumstances; roots yellowish red. *Stems* tufted, slender to rather stout, triquetrous, smooth, (5-)15-50(-80) cm by (1-)2-3(-5) mm. *Leaves* basal, shorter than to somewhat longer than the stems, flat or channelled, rather flaccid, gradually acuminate, scabrous on the

margins in the upper parts, 3-6(-8) mm wide. *Inflorescence* greatly varying in size, simple or compound, usually loose, up to 20 cm long. Involucral bracts 3-5(-7), obliquely erect to patent, the larger 1-3 overtopping the inflorescence, up to 40 cm long. Primary rays 3-5(-8), very unequal, obliquely patent, slender, smooth, up to 10(-18) cm, the larger ones usually umbellately or paniculately branched, the secondary rays very short. *Spikelets* narrow, oblong-ovoid, often elongate, rather dense or loose, with 5-25 spikelets; rachis flexuous, glabrous. *Spikelets* spicately arranged, oblong-linear, strongly compressed, obtuse, (in the Malesian specimens) erecto-patent, 6-20(-24)-flowered, 3-10(-13) by  $1\frac{1}{2}$ -2 mm; rachilla straight, wingless, persistent; internodes *c.*  $\frac{1}{2}$  mm. *Glumes* membranous, spreading-ascending, orbicular or broadly ovate, not rarely broader than long, sharply keeled, rounded to emarginate at apex, very shortly mucronulate with green, arched, 3-5-nerved keel, cellular-reticulate, nerveless, golden to fulvous sides, and broadly whitish hyaline margins towards the top,  $\frac{1}{2}$ - $\frac{3}{4}$  imbricate,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by  $1\frac{1}{2}$  mm. *Stamens* 2-3; anthers very small, oblong, *c.*  $\frac{1}{4}$  mm, with short, smooth, reddish appendage of the connective. *Style* hardly any; stigmas 3,  $\frac{1}{4}$ - $\frac{1}{2}$  mm long. *Nut* about as long as the subtending glume, triquetrous with slightly concave sides, obovoid-ellipsoid, broadly stipitate, hardly apiculate, shining dark brown to black,  $1\frac{1}{2}$ - $1\frac{1}{2}$  by  $\frac{1}{2}$ - $\frac{3}{4}$  mm.

**Distr.** Widely spread in tropical Asia, extending northwards to Iran, Afghanistan, China, and Japan,

southwards to Australia, and westwards to tropical E. Africa; introduced and naturalised in the SE. United States and the West Indies; common throughout Malesia.

Ecol. In open wet places, on road-sides, river-banks, and especially a characteristic weed in wet rice-fields; at low altitudes up to 700 m, rarely to 1200 m.

Vern. *Babawangan*, S, *dèkèng wangin*, *njur-njuran*, *rumpit djèkèng kungit*, *umbung*, J, *djung padjungan*, Md, *blumbungan*, *papungan*, *rumpit silupak*, Sum. E. C., *bua bua tapongan*, Batak, *kumis*, Kangean; Philip.: *alinang*, *paiung-paiung*, *sud-sud*, *taga-tag*, Bik., *okokiang*, Bon.

Notes. Very variable in size and the number of flowers in the spikelets. The extremes are connected by numerous intermediates and do not deserve nomenclatural recognition. LOHER 7159 from the Philippines represents *f. chrysomelinus* (LINK) KÜK. Pfl. R. Heft 101 (1935) 151 [*C. chrysomelinus* LINK, Hort. Berol. 1 (1827) 305], with setaceous stems and leaves, and the inflorescence reduced to 1–2 spikelets. It is probably a depauperated form, also of little or no taxonomical value.

*C. microiria* STEUD., wrongly referred to *C. iria* var. *parviflorus* MIQ., is a well-characterised, E. Asian species not extending to Malesia.

### 9. Section *Compressi*

KUNTH, En. 2 (1837) 23.

Type species: *C. compressus* L.

22. *Cyperus compressus* LINNÉ, Sp. Pl. (1753) 46; HASSK. Pl. Jav. Rar. (1848) 77; MIQ. Fl. I. d. Bat. 3 (1856) 263, incl. var. *meyenii* MIQ.; BOECK. Linnaea 35 (1868) 517, incl. var. *brachiatus* BOECK.; CLARKE, J. Linn. Soc. Bot. 21 (1884) 97, incl. var. *pectiniformis* CLARKE; Fl. Br. Ind. 6 (1893) 605; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 82, t. 4 f. 6; CLARKE, Philip. J. Sc. 2 (1907) Bot. 84; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 67; KOORD. Exk. Fl. Java 1 (1911) 189; *ibid.* 4 (1922) f. 208; CAMUS, Fl. Gén. I.-C. 7 (1912) 57, f. 5, 3–5; MERR. En. Philip. 1 (1923) 103; RIDL. Fl. Mal. Pen. 5 (1925) 144; BACK. Onkr. Suiker. (1928) 132, t. 126; KÜK. Pfl. R. Heft 101 (1935) 156, f. 4 A–D; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 32; KERN in Back & Bakh. f. Fl. Java 3 (1968) 480. — *C. brachiatus* POIR. Enc. 7 (1806) 259. — *C. pectiniformis* R. & S. Mant. 2 (1824) 128; NEES in Wight, Contr. (1834) 77. — *C. meyenii* NEES, Nov. Act. Ac. Caes. Leop.-Car. 19, Suppl. 1 (1843) 57. — *C. humilis* (non KUNTH) LLANOS, Fragm. Pl. Filip. (1851) 13; F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4 (1880) 7. — *Chlorocyperus compressus* PALLA, Denkschr. K. Ak. Wiss. M.-N. Kl. Wien 84 (1909) 451.

Annual. Stems tufted, triquetrous, smooth, very variable in height, up to 50 cm by 1–2 mm. Leaves shorter to somewhat longer than the stems, flat or channelled, rigid, gradually acuminate, scabrous at the top, ( $\frac{1}{2}$ –)2–4 mm wide; lower sheaths reddish brown. Inflorescence simple, open, not rarely reduced to a single sessile cluster. Involucral bracts 3–5, patent, the lower ones overtopping the inflorescence, up to 30 cm. Rays 0–8, obliquely patent to widely spreading, slender, smooth, up to 15 cm. Spikes broadly ovoid, with 3–7(–10) spikelets. Spikelets subdigitately arranged on the very short, up to 5 mm long rachis, obliquely patent to horizontally spreading or slightly reflexed, oblong to linear, acute, rhomboid

in cross-section, strongly compressed, up to 40-flowered, 1–3 cm by 3–5 mm; rachilla flexuous, persistent, initially winged; wings very thinly membranous, caducous; internodes c.  $\frac{1}{4}$  mm. Glumes chartaceous, rigid, ovate, acute, strongly keeled, conspicuously multinerved, more than  $\frac{1}{2}$  imbricate, with green keel, pale green to yellowish brown sides, and silvery-hyaline margins, 3–4 by 2–2 $\frac{1}{4}$  mm; mucro strong, often slightly incurved, up to 1 mm. Stamens 3; anthers small, oblong-linear,  $\frac{2}{3}$ –1 mm, with scarcely produced, smooth appendage of the connective. Stigmas 3. Nut trigonous with incrassate angles, broadly obovoid, broadly stipitate, obtuse, shortly apiculate, shining dark brown to blackish, 1 $\frac{1}{2}$ –1 $\frac{2}{3}$  by c. 1 mm.

Distr. Pantropical; throughout Malesia.

Ecol. A common weed of open grasslands, waste places, fallow rice-fields, road-sides, premises, seashores; in the lowlands and lower hills, rarely up to 900 m.

Vern. *Rumput kotor*, *rumpit kuning*, *Banka*, *nanen*, *Deli*, *tèki gedé*, S, *dèkèng*, J, *lumbungan*, Md, *takimai*, Mol.; Philip.: *ananá*, Ibn., *gisai-kalabáu*, *tuhog-dalág*, Tag., *kaptos*, Iv., *sangsañga*, Bon.

Note. Extremely tall or low specimens, and those with many-flowered spikelets, were described as separate species, subsequently reduced to varietal rank (see synonymy). They hardly deserve nomenclatural recognition. A collection from Jappen-Biak, with very slender stems, capillary leaves, inflorescences consisting of 1–4 spikelets only, and 2 involucral bracts the lower of which seemingly continues the stem, answers the description of var. *capillaceus* CLARKE in Urb. Symb. Ant. 2 (1900) 32, recorded from the Antilles and the Himalaya. Presumably it is merely a depauperated form.

In African specimens the glumes are sometimes strikingly purple-spotted (like in *C. sphacelatus*).

### 10. Section *Alternifolii*

KUNTH, En. 2 (1837) 31. — *Cyperus* sect. *Textiles* CLARKE, Kew Bull. add. ser. 8 (1908) 98.

Type species: *C. alternifolius* L.

23. *Cyperus flabelliformis* ROTTB. Descr. Pl. rar. Progr. (1772) 22; Descr. & Ic. (1773) 42, t. 12 f. 2; KUNTH, En. 2 (1837) 32; CLARKE, Fl. Trop. Afr. 7 (1902) 336; MERR. Fl. Manila (1912) 110; En. Philip. 1 (1923) 105; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 475. — *C. flabelliformis* var. *obtusangulus* BOECK. Linnaea 35 (1868) 566. — *C. alternifolius* L. ssp. *flabelliformis* KÜK. Pfl. R. Heft 101 (1936) 193. — *C. alternifolius* (non L.) BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 30. — *C. alternifolius* L. var. *obtusangulus* KOYAMA, Quart. J. Taiwan Mus. 14 (1961) 177.

Perennial with stout, horizontal rhizome. *Stems* stout, densely tufted, obtusely trigonous to subterete, sulcate, scaberulous at the top, 50–175 cm by 3–8 mm. Normal *leaves* only present on the first sterile shoots, leaves on the flowering stems reduced to long, wide, brownish sheaths. *Inflorescence* large, decompound, 10–30 cm across. Involucral bracts numerous, up to 20, distinctly spaced, flat, obliquely patent to reflexed, rather abruptly acuminate, nearly equal in length, much overlapping the inflorescence, 25–50 cm by 8–15 mm. Primary rays numerous, subequal in length, slender, smooth, obliquely erect, 5–10 cm long. *Spikelets* digitately arranged, stately spreading, in clusters of 3–7(–15), ovate to oblong-linear, compressed, 10–40-flowered, 5–10 by c. 2 mm; rachilla straight, wingless, persistent;

internodes c.  $\frac{1}{4}$  mm. *Glumes* membranous, obliquely patent, ovate, obtuse, acutely keeled, mucronulate, faintly 3–5-nerved, with green keel and shining ferruginous sides often tinged with red, broadly hyaline-margined, densely (c.  $\frac{3}{4}$ ) imbricate, c. 2 by

*Stamens* 3; anthers linear, c. 1 mm, the apical appendage of the connective setulose at the top. *Nut* trigonous, broadly ellipsoid or slightly obovoid, apiculate, yellowish brown,  $\frac{3}{5}$ – $\frac{3}{4}$  by  $\frac{1}{2}$  mm.

*Distr.* Native to Arabia, tropical and South Africa; elsewhere often cultivated for ornamental purposes and sometimes running wild, e.g. in Queensland, New Caledonia, Hawaii, Ryu Kyu Is.; also in *Malesia* escaped from cultivation: Sumatra West Coast, W. Java, Philippines (Manila, Lamac), often naturalised.

*Ecol.* Waste places, river-banks, wet rice-fields, along ditches, etc.; at low and medium altitudes, up to 1200 m.

*Vern.* *Umbrella plant*, *E. parapluplant*, *D. papayungan*, *M. mansiang babunga*, Sum. W. C.

*Note.* The very closely related *C. alternifolius* L. differs by its smooth stems, narrower leaves, lanceolate glumes, and narrowly oblong, blackish nuts measuring c. 1 by  $\frac{1}{2}$  mm. It is native to Madagascar, Mauritius, and the Mascarenes; not found growing wild in *Malesia*.

#### 11. Section Pseudanosporum

CLARKE, J. Linn. Soc. Bot. 21 (1884) 117. — *Cyperus* sect. *Natantes* CLARKE, Fl. Br. Ind. 6 (1893) 597.

Type species: *C. platystylis* R.BR.

24. *Cyperus platystylis* R.BR. Prod. (1810) 214; KUNTH, En. 2 (1837) 111; BENTH. Fl. Austr. 7 (1878) 264; CLARKE, J. Linn. Soc. Bot. 21 (1884) 27, 117, t. 1 f. 7–9; Fl. Br. Ind. 6 (1893) 598; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 103, t. 4 f. 21; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 63; KOORD. Exk. Fl. Java 1 (1911) 189; *ibid.* 4 (1922) f. 214; MERR. En. Born. (1921) 55; RIDL. Fl. Mal. Pen. 5 (1925) 141; BACK. Onkr. Suiker. (1928) 134, t. 130; KÜK. Pfl. R. Heft 101 (1936) 185, f. 21; S. T. BLAKE, J. Arn. Arb. 28 (1947) 215; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 31; KERN, Reinwardtia 2 (1952) 112, f. 8; in Back. & Bakh. f. Fl. Java 3 (1968) 472. — *C. pallidus* NEES [Linnaea 9 (1835) 284, *nom. nud.*] in Wight, Contr. (1834) 79; KUNTH, En. 2 (1837) 40. — *Anosporum pallidum* BOECK. Linnaea 36 (1870) 412; SCHEFFER, Nat. Tijds. N. I. 34 (1874) 52.

Perennial with very short rhizome; stolons wanting; roots thick, funiliform. *Stems* solitary or subcespitose, stout, rigid, triquetrous, smooth, or scabrous on the angles above, up to 80(–110) cm by (3–)5–8 mm. *Leaves* basal, channelled or flat, as long as or longer than the stems, gradually acuminate, septate, nodulose, coriaceous, very scabrous (cutting) on margins and midrib, glaucous or greyish green, 8–12(–20) mm wide, lower sheaths bladeless, strongly keeled, cinnamonaceous to purplish. *Inflorescence* compound or decompound, often with very numerous spikelets, depressed-corymbose or semiglobose, very

dense to rather loose, up to 30 cm across. Involucral bracts 5–8, slightly distant, patent to reflexed, the larger ones much overlapping the inflorescence, up to 80 cm. Primary rays up to 12, rigid, smooth, widely spreading, often slightly upcurved, up to 10 cm; secondary rays divaricate, up to 4 cm, tertiary ones when present very short. *Spikelets* often very numerous, digitately arranged, in clusters of 3–8, widely spreading, ovate to linear-lanceolate, acute, compressed but somewhat turgid, c. 5–20 by  $2\frac{1}{2}$ –3 mm, up to 60-flowered; rachilla straight, wingless, persistent; internodes  $\frac{1}{4}$ – $\frac{1}{3}$  mm. *Glumes* firmly membranous, appressed, ovate to broadly ovate, obtusish, mucronulate, with rounded, strongly 3-nerved, green back, nerveless, cellular-reticulate, yellowish or brownish sides and narrow, whitish hyaline margins, very densely ( $\frac{3}{4}$ – $\frac{2}{5}$ ) imbricate,  $2$ – $2\frac{1}{2}$  by  $1\frac{1}{2}$ –2 mm. *Stamens* 3; anthers linear, c. 1 mm, the connective produced into a bristly appendage. *Style* flattened, ciliate; stigmas 3, short. *Nut* unequally trigonous, dorsally compressed, with corky, much thickened angles, ellipsoid, apiculate, shining greyish brown to blackish with straw-coloured or yellow angles,  $1\frac{3}{4}$ –2 by 1 mm; ventral side somewhat concave, dorsal side with a raised angle.

*Distr.* From Ceylon and India to Formosa (here only known from a single locality), and through *Malesia* to N. Australia, Queensland, and New South Wales; in *Malesia* very rare in Sumatra, the Malay

Peninsula, W. and E. Java, the Lesser Sunda Is. (Sumba), Borneo, Celebes, the Moluccas (Ceram), and New Guinea; not known from the Philippines.

Ecol. Very wet places in swamps, on swinging bogs, sometimes in wet rice-fields; at low altitudes,

usually below 500 m, in Sumatra (Atjeh) up to 1200 m.

Vern. *Para*, Borneo (Kutei), *kēbuamba*, Sumba. Note. The corky tissue on the nuts enables dispersal by water. See RIDLEY, *Disp.* (1930) 238.

## 12. Section Diffusi

KUNTH, En. 2 (1837) 25. — *Cyperus sect. Incurvi* KÜK. Pfl. R. Heft 101 (1936) 216.

Type species: *C. diffusus* VAHL.

*Spp.* 27–32 from New Guinea are insufficiently known.

25. *Cyperus diffusus* VAHL, En. 2 (1806) 321; MIQ. Fl. Ind. Bat. 3 (1856) 264; BOECK. Linnaea 35 (1868) 534; K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 24; CLARKE, Fl. Br. Ind. 6 (1893) 603; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 97, t. 4 f. 17, 18, incl. *f. microstachyus* VALCK. SUR., excl. *f. turgidulus* VALCK. SUR.; CLARKE, Philip. J. Sc. 2 (1907) Bot. 83; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 65; KOORD. Exk. Fl. Java 1 (1911) 189; *ibid.* 4 (1922) f. 213; CAMUS, Fl. Gén. I.-C. 7 (1912) 54; MERR. En. Philip. 1 (1923) 104; RIDL. Fl. Mal. Pen. 5 (1925) 142; KÜK. Pfl. R. Heft 101 (1936) 208, incl. var. *celebicus* KÜK., excl. *ssp. bancanus* KÜK.; S. T. BLAKE, J. Arn. Arb. 28 (1947) 215; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 32; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 477. — *C. sorzogonensis* PRESL, Rel. Haenk. 1 (1830) 351. — *C. scirpoides* (non VAHL) PRESL, *ibid.* 1 (1828) 178. — *C. longifolius* (non POIR.) DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 359; Descr. Herb. Timor. (1835) 31; KUNTH, En. 2 (1837) 30, *quoad specim. timor.*; MIQ. Fl. Ind. Bat. 3 (1856) 265; RIDL. in Forbes, Wand. (1885) 520. — *C. moestus* KUNTH. En. 2 (1837) 31; MIQ. Fl. Ind. Bat. 3 (1856) 265. — *C. racemosus* (non RETZ.) MOR. Syst. Verz. (1846) 96; ZOLL. Syst. Verz. 1 (1854) 63; STEUD. Syn. 2 (1855) 52, p.p.; MIQ. Fl. Ind. Bat. 3 (1856) 270. — *C. lagorensis* STEUD. Syn. 2 (1855) 36, p.p. — ? *C. auriculatus* (non NEES) STEUD. Lc. 44, p.p.; MIQ. Fl. Ind. Bat. 3 (1856) 283. — *C. holophyllus* MIQ. l.c., incl. var. *celebicus* MIQ. — *C. elegans* (non L.) BOECK. Linnaea 35 (1868) 532, p.p., incl. var. *moestus* BOECK.; CLARKE, J. Linn. Soc. Bot. 21 (1884) 125, p.p. — *C. kurzii* (non CLARKE) CAMUS, Fl. Gén. I.-C. 7 (1912) 54.

var. *diffusus*. — Synonymy as above.

Perennial with very short rhizome. Stems tufted, rather stout, trigonous below, triquetrous above, smooth, 15–80 cm by 3–5 mm. Leaves as long as or longer than the stems, channelled at the base, otherwise flat, flaccid, with 3 prominent nerves, rather abruptly acuminate, light green beneath, grassgreen above, 5–10(–20) mm wide; margins scabrous nearly throughout, nerves scaberulous in the upper half; lower sheaths purplish. Inflorescence decomposed or supradecomposed, diffuse, usually lax, up to 30 cm across. Involutural bracts 4–10, spreading or reflexed, unequal, the larger ones much overtopping the inflorescence, up to 50 cm by 16 mm. Primary rays up to 20, unequal, spreading, rigid, smooth, up to 20 cm, secondary ones up to 4 cm, tertiary ones short, setaceous. Spikelets digitately

arranged, 2–9 together but often some solitary, oblong, turgid-compressed, (4–)6–12(–20)-flowered, (3–)7–10 by 2–3 mm; rachilla partly visible, straight, persistent, narrowly winged; internodes c.  $\frac{1}{2}$  mm. Glumes membranous, patulous, boat-shaped, broadly ovate to suborbicular, very obtuse, densely imbricate, with strongly 3-nerved, arcuate, green keel, fuscous, faintly nerved sides and whitish hyaline margins,  $1\frac{1}{4}$ (– $1\frac{1}{2}$ ) by  $1\frac{1}{4}$ (–2) mm; mucro slightly recurved, setulose at the top,  $\frac{1}{3}$ – $\frac{1}{2}$  mm. Stamens 3; anthers linear-oblong, rostrate by the produced connective setulose at the top,  $\frac{3}{4}$ –1 mm. Style hardly any; stigmas 3, exerted from the glume. Nut triquetrous, ellipsoid or subpyramidal, often somewhat surpassing the body of the glume, acute, shortly apiculate, dark brown to dusky black, ( $1\frac{1}{5}$ –) $1\frac{1}{3}$ – $1\frac{1}{2}$  mm by c.  $\frac{3}{4}$  mm.

Distr. India, Farther India, S. China, Formosa, Solomon Islands; almost throughout *Malesia* (not known from the Lesser Sunda Is.).

Ecol. In thickets, moist forests (often in deep shade) on river-banks, shady road-sides, at low altitude, rarely up to 700 m.

Use. In Mindanao the roots are used as a medicine for diseased lips.

Vern. *Pukul sēdapan*, Riouw, *parah-parah*, *rumpit bumbat*, *rumpit chukor karbau*, Mal. Pen., *tjekēng*, *J. tataboh*, *tutobok*, N. Borneo, *ibu, mom*, New Guinea; Philip.: *barsaṅgā-bākīr*, Ilk., *gumi-gumi*, *haras*, *tuhog-dalág*, Tag., *nipinpin-dī-gūbat*, Sbl., *singao*, Mindanao.

var. *macrostachyus* BOECK. Linnaea 35 (1868) 534; KÜK. Pfl. R. Heft 101 (1936) 209. — *C. pubisquama* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, *nom. nud.*] Syn. 2 (1855) 20; MIQ. Fl. Ind. Bat. 3 (1856) 266; CLARKE, Fl. Br. Ind. 6 (1893) 604; Philip. J. Sc. 2 (1907) Bot. 83; CAMUS, Fl. Gén. I.-C. 7 (1912) 56, f. 57. — *C. lagorensis* STEUD. Syn. 2 (1855) 36, p.p.; MIQ. Fl. Ind. Bat. 3 (1856) 275. — *C. calacaryensis* STEUD. Syn. 2 (1855) 34; MIQ. Fl. Ind. Bat. 3 (1856) 275; NAVES, Nov. App. (1882) 304. — *C. bancanus* (non MIQ.) NAVES, l.c. 302; CLARKE, Philip. J. Sc. 2 (1907) Bot. 83. — *C. diffusus* (non VAHL) CLARKE, J. Linn. Soc. Bot. 21 (1884) 127. — *C. diffusus f. macrostachyus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 99, t. 4 f. 20. — *C. diffusus* var. *pubisquama* HOOK. f. in Trimen, Handb. Fl. Ceyl. 5 (1900) 28; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 65, p.p.; MERR. En. Philip. 1 (1923) 104; RIDL. Fl. Mal. Pen. 5 (1925) 143. — Fig. 54.

Spikelets usually linear, densely up to 30-flowered, less compressed than in var. *diffusus*, 8–12 by 2 mm.



Fig. 54. *Cyperus diffusus* VAHL var. *macrostachyus* BOECK. a. Habit,  $\times \frac{1}{2}$ , b. spikelet, c. glumes, d. rachis of spikelet, e. deflorate flower, f. nut, all  $\times 10$  (a-f BÄCKER 4268).

Rachilla hidden by the glumes, also in fruit. *Glumes* closely clasping each other even at maturity, appressed, the body somewhat larger than in *var. diffusus* ( $1\frac{1}{2}$  mm), the mucro shorter ( $\frac{1}{5}$ – $\frac{1}{4}$  mm). *Nut* usually smaller,  $1\frac{1}{4}$  by  $\frac{3}{5}$ – $\frac{3}{4}$  mm.

*Distr. & Ecol.* As in *var. diffusus*; apparently much rarer.

*Note.* Typical *var. diffusus* and *var. macrostachyus* look like different species, but they are connected by numerous intermediates precluding specific separation.

26. *Cyperus trialatus* (BOECK.) KERN, Reinwardtia 3 (1954) 32, f. 1, 2; in Back. & Bakh. f. Fl. Java 3 (1968) 477. — *Scirpus trialatus* BOECK. Flora 42 (1859) 445; Linnaea 36 (1870) 721. — *C. bancanus* MIQ. Sum. (1861) 599; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 65; CAMUS, Fl. Gén. I.-C. 7 (1912) 56, f. 5, 10; RIDL. Fl. Mal. Pen. 5 (1925) 143. — *C. turgidulus* CLARKE, J. Linn. Soc. Bot. 21 (1884) 130; Fl. Br. Ind. 6 (1893) 604; Ill. Cyp. (1909) t. 13, f. 4–5. — *C. diffusus* f. *turgidulus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 100, t. 4 f. 19. — *C. helferi* (non BOECK.) CAMUS, Fl. Gén. I.-C. 7 (1912) 55. — *C. diffusus* ssp. *bancanus* KÜK. Pfl. R. Heft 101 (1936) 209, excl. *specim. philip.*

Differs from the closely allied *C. diffusus* by: *Stems* 3-winged. *Leaves* rather rigid. *Inflorescence* simple or compound, dense. *Primary rays* short, up to 4 cm. *Spikelets* 8–16 together in globose clusters of 5–7 mm  $\varnothing$ , ovoid, turgid, subterete, 6–8-flowered, 3–4 by 2 mm. *Glumes* mm long, distinctly many-nerved, very shortly mucronulate. *Nut* larger,  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm long.

*Distr.* SE. Asia: Thailand, Farther India, S. China, in *Malesia* only in the western part: Sumatra (East Coast), Banka, Billiton, Malay Peninsula (Setul, Wellesley, Perak, Pahang, Malacca, P. Penang, Singapore), Java (Karimundjawa Is.), S. & SE. Borneo. Fig. 55.

*Ecol.* In secondary forests, wet rice-fields, on road-sides, only in the lowlands, up to 60 m.

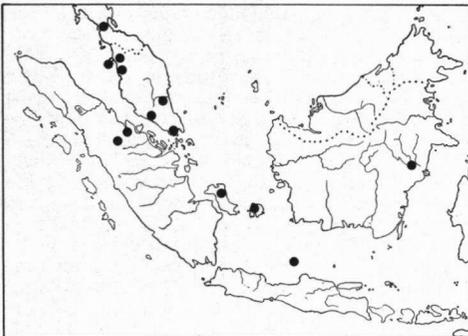


Fig. 55. Range of *Cyperus trialatus* (BOECK.) KERN.

27. *Cyperus pedunculatus* F. v. M. Fragm. 8 (1874) 266; BENTH. Fl. Austr. 7 (1878) 272; CLARKE, J. Linn. Soc. Bot. 21 (1884) 131; VALCK. SUR. Nova Guinea 8 (1912) 697; KÜK. Bot. Jahrb. 59 (1924) 43, incl. *var. floribundus* KÜK.; *ibid.* 69 (1938) 256, incl. *var. atrocastaneus* KÜK.; Pfl. R. Heft 101 (1936) 222; Mitt. Thür. Bot. Ver. N. F. 50 (1943) 3, incl. *var.*

*alatus* KÜK.; S. T. BLAKE, J. Arn. Arb. 28 (1947) 218. — *C. montis-sellae* K. SCH. Bot. Jahrb. 18 (1894) 186; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 191. — ? *C. papuanus* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 241; KÜK. Pfl. R. Heft 101 (1936) 222.

Perennial with very short rhizome. *Stems* tufted, usually rather stout, triquetrous with concave sides to distinctly 3-winged, smooth, (5–)10–45 cm by  $1\frac{1}{2}$ –5 mm. *Leaves* linear, canaliculate at the base, otherwise flat, longer than the stems, gradually attenuate in the long, triquetrous top, scabrid on nerves and margins, with 3 more prominent nerves, 6–20 mm wide; lower sheaths rubiginous. *Inflorescence* simple or subcompound, usually loose. *Involucral bracts* 5–6(–8), patent, linear or linear-lanceolate, the longer ones much overtopping the inflorescence, up to 30(–45) by 2 cm. *Primary rays* 6–12, obliquely spreading, slender, smooth, 4–10(–20) cm. *Spikelets* digitately arranged, 2–4(–7) together or some solitary, oblong-linear, obtusish, compressed though somewhat turgid, 10–40(–50)-flowered, 5–25 (–40) by  $2\frac{1}{2}$ –3 mm; rachilla straight, hardly winged, persistent; internodes  $\frac{2}{3}$ –1 mm. *Glumes* subcoriaceous, patulous at the top, broadly ovate to ovate-lanceolate, not rarely broader than long, incurved, c.  $\frac{1}{2}$  imbricate, obtuse, minutely mucronulate, 11–17-nerved, ferruginous to blackish brown,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by 2–3 mm. *Stamens* 3; anthers linear, c. 1 mm, with bristly appendage of the connective. *Style* ciliate,  $\frac{3}{4}$ – $1\frac{1}{4}$  mm. *Nut* trigonous, obovoid or ellipsoid, obtuse or acutish, blackish brown,  $1\frac{1}{2}$ –2 by 1– $1\frac{1}{4}$  mm.

*Distr.* Australia (E. Queensland); in *Malesia*: scattered throughout New Guinea.

*Ecol.* In primary forests, on shady creek-banks and river-banks, 0–2000 m (according to KÜKENTHAL on Mt Saruwaged up to 2700 m).

*Vern.* *Gudua*, Papua.

*Notes.* Very variable as to size and density of inflorescence, size and colour of glumes, and shape of nut. The varieties described by KÜKENTHAL (*var. floribundus*: stout, with broad leaves and many-flowered spikelets; *var. atrocastaneus* with blackish brown glumes; *var. alatus* with distinctly winged stems) do not deserve nomenclatural recognition.

*C. papuanus* RIDL. is only known from the type collection consisting of very young specimens collected on Mt Carstensz in W. New Guinea at c. 1300 m. According to RIDLEY it should be allied to *C. babakan* STEUD., with which species it has nothing to do. It is impossible to distinguish it satisfactorily from the other species of this badly known group. See for instance KÜKENTHAL, l.c. 216–217, where *C. pedunculatus* and *C. papuanus* are opposed by the colour of the glumes.

28. *Cyperus neoguineensis* KÜK. Bot. Jahrb. 59 (1924) 43 ('*neoguineensis*'); Pfl. R. Heft 101 (1936) 229. — *C. platyphyllos* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 242, non R. & S. 1817. — ? *C. rigidulus* RIDL. l.c. 241, non VAHL, 1806. — ? *C. subrigidulus* KÜK. Pfl. R. Heft 101 (1936) 230.

Perennial with very short rhizome. *Stems* tufted, rather stout, smooth, 15–35 cm by 2–3 mm (see note). *Leaves* few, linear-lanceolate, as long as or longer than the stems, flat, distinctly narrowed towards the base, gradually long-acuminate, scabrid in the upper part, 10–18 mm wide; lower sheaths

rubiginous. *Inflorescence* simple, contracted into a hemispheric head 1–4 cm across. Involucral bracts 3–5, lanceolate, patent, finally reflexed, up to 25 by 2 cm. Rays hardly developed, up to 1 cm long. *Spikelets* in c. 4 dense clusters, patent, ovate-lanceolate or oblong-lanceolate, compressed but somewhat turgid, c. 10-flowered, 5–6 by  $2\frac{1}{2}$ –3 mm; rachilla straight, hardly winged, persistent; internodes c.  $\frac{1}{2}$  mm. *Glumes* coriaceous, keeled, ovate, acuminate, strongly incurved,  $\frac{2}{3}$  imbricate, strongly 11–13-nerved, with pale fuscous sides and whitish hyaline margins, 3 by  $2-2\frac{1}{4}$  mm. *Stamens* 3; anthers linear, c. 1 mm, with short, smooth appendage of the connective. *Style* short,  $\frac{1}{8}$ – $\frac{1}{2}$  mm; stigmas 3. *Nut* trigonous, ellipsoid, obtuse, reddish brown,  $\frac{1}{2}$  by  $\frac{9}{10}$  mm.

Distr. *Malesia*: New Guinea (W.: Carstens Peak; NE.: Sepik Distr.; Papua).

Ecol. In open mountain forests, 1000–1200 m.

Note. *C. subrigidulus* KÜK. (based on *C. rigidulus* RIDL.), only known from the very poor type collection, most probably represents a depauperate state of *C. neoguineensis* with stems only a few cm tall. The structure of spikelets, flowers, and nuts is the same as in the latter species. RIDLEY's inadequate description contains several incorrect data ("glumes nearly 1 mm long; nut obovate, distinctly attenuate towards the base; allied perhaps to *C. stoloniferus* RETZ.").

29. *Cyperus subpapuanus* KÜK. in Fedde, Rep. 29 (1931) 196; Pfl. R. Heft 101 (1936) 222. — *C. papuanus* (non RIDL.) KÜK. Bot. Jahrb. 59 (1924) 45.

Perennial with very short rhizome. *Stems* tufted, firm, triquetrous, smooth, 30–60 cm by 2–3 mm. *Leaves* several, rigid, linear, canaliculate at the base, otherwise flat, longer than the stems, gradually long-acuminate, with 3 more prominent nerves, 8–11 mm wide. *Inflorescence* subcompound, loose, up to 8 by 6 cm. Involucral bracts 3–4, patent, much overtopping the inflorescence, the longest up to 70 cm. Primary rays 6–7, spreading, slender, up to 4 cm; secondary rays very short. *Spikelets* subdigitately arranged, 3–7 together, stellately spreading, linear, subcompressed, 14–22-flowered, up to 20 by c. 2 mm; rachilla straight, hardly winged, persistent; internodes c. 1 mm. *Glumes* subcoriaceous, distant, slightly (up to  $\frac{1}{3}$ ) imbricate, oblong-ovate, with truncate or slightly emarginate, excurved apex, keeled, minutely mucronulate, scabrid on the upper part of the keel, with fuscous sides and whitish hyaline margins,  $2\frac{1}{2}$ – $2\frac{3}{4}$  by  $1\frac{3}{4}$ –2 mm. *Stamens* 3; anthers linear, c. 1 mm, with short, smooth appendage of the connective. *Style* very short,  $\frac{1}{8}$ – $\frac{1}{4}$  mm; stigmas 3. *Nut* trigonous, ellipsoid, brownish, c.  $\frac{1}{3}$  by 1 mm.

Distr. *Malesia*, only known from the type collection: NE. New Guinea, Sepik Distr.

Ecol. Along brooklet in dense primary forest with few large trees, many *Freyinetia* and climbing *Araceae*.

Note. Differs from *C. papuanus* RIDL. by the less numerous rays of the inflorescence and the more distant, distinctly nerved oblong-ovate glumes with scabrid keel and fuscous sides.

30. *Cyperus cinereobrunneus* KÜK. Mitt. Thür. Bot. Ver. 50 (1943) 3; S. T. BLAKE, J. Arn. Arb. 28 (1947) 216, f. 1 A; KERN, Reinwardtia 3 (1954) 34, f. 3.

Perennial with very short rhizome. *Stems* tufted, rigid, triquetrous, scabrid at the top, up to 50 cm by 2 mm. *Leaves* several, linear, canaliculate at the base, otherwise flat, up to twice as long as the stems, gradually attenuate into the long, triquetrous top, scabrous on nerves and margins, with 3 more prominent nerves,  $3\frac{1}{2}$ –6 mm wide; sheaths purplish brown. *Inflorescence* subcompound, loose. Involucral bracts 4–6, patent, the longer ones far overtopping the inflorescence, up to 50 cm. Primary rays 5–10, spreading, slender, almost filiform, smooth or scabrid at the top, the longest up to 4 cm; secondary rays very short. *Spikelets* digitately arranged, 3–10 together or some solitary, stellately spreading, oblong-linear, acute, compressed, 12–20-flowered, greyish brown, 6–10 by c. 2 mm; rachilla straight, hardly winged, persistent; internodes c.  $\frac{1}{2}$ – $\frac{2}{3}$  mm. *Glumes* subcoriaceous, involute and distinctly keeled in the upper part, oblong-ovate, incurved,  $\frac{2}{3}$  imbricate, obtuse, apiculate, 15–17-nerved,  $2\frac{1}{2}$ –3 mm long; lower 3–4 glumes shorter, empty. *Stamens* 3; anthers oblong-linear,  $\frac{3}{4}$ –1 mm, with short, smooth appendage of the connective. *Style*  $\frac{1}{2}$ –1 mm long, ciliate except for the base; stigmas 3, pilose,  $\frac{1}{2}$ – $\frac{3}{4}$  mm long. *Nut* trigonous, ellipsoid, acute, with concave brown sides and strongly incrassate greyish angles, about half as long as the glumes, c.  $\frac{1}{2}$  by  $\frac{3}{4}$ – $\frac{4}{5}$  mm.

Distr. *Malesia*: only known from the type collection: New Guinea: Papua, Western Div., Fly River.

Ecol. In tufts on forest-floor.

31. *Cyperus meistostylus* S. T. BLAKE, J. Arn. Arb. 28 (1947) 217, f. 1 B; KERN, Reinwardtia 3 (1954) 36, f. 4.

Perennial with very short rhizome. *Stems* tufted, slender, triquetrous, smooth, 10–35 cm by  $2$ (– $2\frac{1}{2}$ ) mm. *Leaves* few, linear, long-attenuate, flat, much longer than the stems, with 3 more prominent nerves, scabrid on margins and nerves in the upper part, 5–8 mm wide; lower sheaths purplish. *Inflorescence* subcompound or compound, rather loose or contracted, up to 5 cm across. Involucral bracts very unequal, 3 or 4 much overtopping the inflorescence, the lowest up to 30 cm. Primary rays 4–5, rigid, smooth, up to 5 cm, secondary ones very short. *Spikelets* subdigitately arranged, stellately spreading, 3–8 together, linear, acute, compressed, 8–16-flowered, (5)–7–8(–12) by  $1\frac{1}{2}$  mm; rachilla straight, hardly winged, persistent; internodes  $\frac{1}{2}$ – $\frac{2}{3}$  mm. *Glumes* subcoriaceous, oblong-ovate, somewhat incurved,  $\frac{1}{2}$  imbricate, rounded at the top, muticous, 13–15-nerved, minutely setulose at apex, brownish red with scarcely hyaline margins, 2– $2\frac{1}{2}$  mm long. *Stamens* 3; anthers linear, c.  $\frac{3}{4}$  mm, with short, smooth appendage of the connective. *Style* hardly any (rarely up to  $\frac{1}{2}$  mm); stigmas 3, pilose, rarely glabrous, c.  $\frac{1}{2}$  mm. *Nut* trigonous, with rounded angles and concave sides, ellipsoid, acute, about  $\frac{2}{3}$  as long as the glume, brown,  $1\frac{1}{4}$ – $1\frac{1}{2}$  by  $\frac{1}{2}$  mm.

Distr. *Malesia*: New Guinea, scattered (W.: Mamberamo Distr.; NE.: Mt Michael; Papua: Dieni, Koitaki).

Ecol. In rain-forests, usually below 500 m, on Mt Michael at c. 2000 m.

Note. Very close to *C. cinereobrunneus* KÜK. and possibly not specifically distinct. It differs by the

smooth stem, the less scabrid leaves, the less distinctly digitate, narrower spikelets, the smaller glumes, and the shorter style.

**32. *Cyperus multispicatus* BOECK.** *Linnaea* 38 (1874) 362; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 129; *Fl. Br. Ind.* 6 (1893) 604; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 102; CLARKE, *III. Cyp.* (1909) t. 13 f. 1-3; KÜK. *Pfl. R. Heft* 101 (1936) 213; KERN, *Reinwardtia* 2 (1952) 114, f. 9; in *Back. & Bakh. f. Fl. Java* 3 (1968) 476.

Perennial with very short rhizome. *Stems* triquetrous, smooth, 30-80 cm by 3-4 mm. *Leaves* flat, herbaceous, rather abruptly acuminate, with scabrous margins and scabrid nerves, grassgreen on both sides, 5-8 mm wide; sheaths membranous in front, purplish punctulate. *Inflorescence* compound to supradecomposed, diffuse, lax, up to 40 cm across. *Involucral bracts* 5-6, patent, the lowest up to 50 by 1 cm. *Primary rays* 8-many, very unequal, spreading, smooth, up to c. 15 cm, secondary ones up to 5(-7) cm. *Spikelets* very numerous, partly solitary and long-peduncled, partly 2-3 digitately fascicled, oblong-

linear, compressed, 12-18(-30)-flowered, 6-8(-10) by  $1\frac{1}{2}$ -2 mm; rachilla straight, hardly winged, persistent; internodes  $\frac{1}{3}$ - $\frac{2}{5}$  mm. *Glumes* membranous, somewhat excurved at the top, ovate or broadly ovate, obtuse, mucicous or minutely mucronulate, with green, 3-nerved keel and nerveless, slightly sulcate, stramineous or ferruginous, purplish punctulate-striate sides,  $1\frac{1}{4}$ - $1\frac{1}{2}$  by  $1-1\frac{1}{2}$  mm,  $\frac{1}{3}$ - $\frac{1}{2}$  imbricate. *Stamen* 1; anther oblong-linear, c.  $\frac{3}{5}$  mm; connective produced, bristly at the top. *Style* short; stigmas 3. *Nut* trigonous, ovoid or ellipsoid, granulate, c.  $\frac{3}{4}$  by  $\frac{1}{2}$  mm.

*Distr.* Obviously a very rare species, only known from the type collection (Tenasserim or Andamans), Assam, and *Malesia*: W. Java (Banten: Mt Halimun near Nirmala).

*Ecol.* In Java in swampy open locality in primary forest, at 1500 m.

*Note.* In *sect. Diffusi* the species stands rather apart by the numerous solitary spikelets, the nerveless grooved sides of the glumes, the single stamen (CLARKE, 1884, wrongly indicates stamens 2), and the small nut. There are strong affinities with *sect. Halpani*.

### 13. Section Radiantes

VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 84.

Type species: *C. radians* KUNTH.

**33. *Cyperus radians* NEES & MEYEN** [in Nees, *Linnaea* 9 (1835) 285, *nom. nud.*] ex KUNTH, *En.* 2 (1837) 95 ('*radicans*'); BOECK, *Linnaea* 35 (1868) 515; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 100; *Fl. Br. Ind.* 6 (1893) 605; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 86, t. 5 f. 2-4; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 66; *Fl. Mal. Pen.* 5 (1925) 143; KÜK. *Pfl. R. Heft* 101 (1936) 214, *incl. var. griffithii* KÜK. *et var. compositus* KÜK. — *C. griffithii* STEUD. *Syn.* 2 (1855) 316; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 101. — *C. macropus* MIQ. *Sum.* (1861) 599; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 84, t. 4 f. 7; t. 5 f. 1. — *C. sinensis* DEBEAUX, *Act. Soc. Linn. Bord.* 31 (1877) 14, t. 12; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 52, f. 6, 1-3.

Perennial with very short rhizome. *Stems* tufted, firm, rigid, trigonous, smooth, much shorter than the inflorescence, 1-5(-10) cm by c. 2 mm (see Notes). *Leaves* surpassing the stem, canaliculate to conduplicate, rigid, often recurved, gradually acuminate, more or less scaberulous at the top, 2-5(-8) mm wide; lower sheaths purplish. *Inflorescence* simple or compound, loose. *Involucral bracts* 5-7, patent, shorter than to equalling the primary rays, up to 30 cm long. *Primary rays* 4-7, remarkably long, spreading, firm, smooth, up to 30 cm. *Spikelets* 8-15(-30) together in globose or subglobose clusters 8-20 (rarely more) mm ø, sometimes a few binate or solitary, stellately spreading, lanceolate to linear, turgid, acute, 4-6(-32)-flowered, 5-10(-20) by 3-4 mm; rachilla slightly flexuous, persistent, narrowly winged; internodes  $\frac{1}{5}$ - $\frac{1}{3}$  mm. *Glumes* chartaceous,

appressed, broadly ovate, keeled only towards the top, strongly 11-13-nerved, c. 3 mm long and wide,  $\frac{1}{2}$  imbricate, with short, more or less excurved mucro, green, straight or curved keel, rufous to sanguineous sides and narrow whitish hyaline margins. *Stamens* 3; anthers linear, with short, smooth, reddish appendage of the connective. *Style* c. 1 mm, ciliate; stigmas 3. *Nut* trigonous, ellipsoid, broadly stipitate, very shortly apiculate, shining brownish black,  $1\frac{1}{2}$ - $1\frac{3}{4}$  by c. 1 mm.

*Distr.* SE. Asia: Farther India, S. and E. China, and Formosa, in *Malesia* restricted to the western part: Malay Peninsula, Banka, Borneo.

*Ecol.* Coastal plant, growing in the sand of the sea-shore, in open dunes, and on wet rocks in the *Terminalia*-zone.

*Notes.* The long rays of the inflorescence are easily mistaken for stems. The real stem is often extremely shortened and hardly visible.

Highly variable species. In 1884 CLARKE distinguished between *C. griffithii* and *C. radians*, which he even would like to place in different sections, but which he united in 1893. Also VALCKENIER SURINGAR took *C. radians* (*C. griffithii* *sensu* CLARKE 1884) and *C. macropus* (*C. radians* *sensu* CLARKE 1884) for different species. The extreme forms are connected by a long series of intermediates.

KÜKENTHAL's *var. compositus* was based on a specimen from Trengganu, leg. RIDLEY, merely a luxuriant plant of otherwise normal *C. radians*.

## 14. Section Tenelli

CLARKE, Kew Bull. add. ser. 8 (1908) 96. — *Cyperus sect. Graciles* BENTH. ex KÜK. Pfl. R. Heft 101 (1936) 292, non CLARKE, Fl. Trop. Afr. 8 (1902) 311.

Type species: *C. tenellus* L. f.

34. *Cyperus aquatilis* R.Br. Prod. (1810) 213; S. T. BLAKE, Proc. R. Soc. Queensl. 51 (1940) 40; J. Arn. Arb. 28 (1947) 219; KERN, Reinwardtia 3 (1954) 46, f. 6. — *C. trinervis* R.Br. var. *aquatilis* KÜK. Pfl. R. Heft 101 (1936) 294.

Annual with fibrous, yellowish roots. *Stems* very slender, tufted, weak to rather stiff, strongly compressed, triquetrous at the top, smooth, 10–35 cm by 1(–2) mm. *Leaves* few, flat, weak, gradually acuminate, smooth, slightly septate-nodulose, 2–3 mm wide; lower sheaths scarious, stramineous or cinnamonaceous, bladeless or shortly laminate. *Inflorescence* simple or subcompound, very loose. Involucral bracts (1–)2, erect or suberect, usually much shorter than the inflorescence, rarely overtopping it, the longest 3–10(–17) cm. Primary rays 3–5, suberect, slender, often filiform, one of them usually strongly elongated, up to 25 cm. *Spikelets* digitately arranged, (1–)2–6 together, spreading or

reflexed, oblong to oblong-linear, subobtuse, strongly compressed, 10–30-flowered, 4–15 by c. 3 mm; rachilla nearly straight, wingless, persistent; internodes c.  $\frac{1}{2}$  mm. *Glumes* thinly membranous, finally patulous, ovate, acute or apiculate, cellular-reticulate, with strong midrib and a faint nerve in the centre of either side,  $1\frac{1}{2}$ – $1\frac{3}{4}$  by c.  $1\frac{1}{2}$  mm, when young c.  $\frac{1}{3}$  overlapping; centre (c.  $\frac{1}{4}$  the width) green, sides pale stramineous, hyaline, keel slightly arcuate with somewhat excurved top, narrowly winged, not serrulate. *Stamens* 2; anthers elliptic, c.  $\frac{1}{4}$  mm. *Stigmas* 3. *Nut* equally trigonous, ellipsoid to slightly obovoid,  $\frac{1}{3}$ – $\frac{1}{2}$  as long as the subtending glume, broadly stipitate, not or hardly apiculate, minutely tuberculate, pale brown, c.  $\frac{3}{4}$  by  $\frac{1}{2}$  mm.

Distr. N. and E. Australia, in *Malesia*: a few times collected in SW. New Guinea and Papua.

Ecol. In wet places at low altitude, chiefly in coastal districts.

## 15. Section Halpani

KUNTH, En. 2 (1837) 34 ('*Haspani*').

Type species: *C. halpan* L.

35. *Cyperus pulcherrimus* WILLD. ex KUNTH, En. 2 (1837) 35; MIQ. Fl. Ind. Bat. 3 (1856) 267; BOECK. Linnæa 35 (1868) 573; SCHEFFER, Nat. Tijd. N. I. 34 (1874) 48; CLARKE, J. Linn. Soc. Bot. 21 (1884) 132; Fl. Br. Ind. 6 (1893) 600; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 94, t. 4 f. 12–13, incl. f. *rectiglumis* VALCK. SUR.; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 64; CLARKE, Ill. Cyp. (1909) t. 10 f. 1–3; KOORD. Exk. Fl. Java 1 (1911) 189, non *ibid.* 4 (1922) f. 211; CAMUS, Fl. Gén. I.-C. 7 (1912) 48; RIDL. Fl. Mal. Pen. 5 (1925) 142; BACK. Onkr. Suiker. (1928) 133; KÜK. Pfl. R. Heft 101 (1936) 242, incl. var. *rectiglumis* KÜK.; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 30; KERN, Reinwardtia 3 (1954) 36; in Back. & Bakh. f. Fl. Java 3 (1968) 476. — *C. eumorphus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 22; MIQ. Fl. Ind. Bat. 3 (1856) 268. — *C. siletensis* (non NEES) CAMUS, Fl. Gén. I.-C. 7 (1912) 47.

Perennial, often flowering the first year; rhizome short, stolons wanting. *Stems* firm, rigid, tufted, trigonous below, triquetrous above, smooth, 10–40 cm by 1–2(–4) mm. *Leaves* flat or slightly canaliculate, rigidulous, gradually acuminate, scaberulous at the top, 2–4(–6) mm wide; lower sheaths stramineous to cinnamonaceous. *Inflorescence* compound or decompound, rather open to very dense, 3–10(–20) cm across. Involucral bracts 3–6, somewhat (1–2 mm) distant, obliquely patent to horizontally spreading, 5–15(–25) cm. Primary rays up to 20, spreading, slender, smooth, 3–5(–12) cm, sometimes very short, secondary ones divergent,  $\frac{1}{2}$ – $1\frac{1}{2}$  cm, tertiary ones up to 1 cm. *Spikelets* digitately arranged in dense glomerules of 5–20, oblong to linear, acute, strongly compressed, finally perspicacious because of the

wide-spreading glumes, 10–30(–50)-flowered, 3–10 by 1– $1\frac{1}{4}$  mm; rachilla wingless, straight, persistent; internodes c.  $\frac{1}{2}$  mm. *Glumes* membranous, keeled, ovate, obtuse, minutely mucronulate just below the apex, with arcuate, 3-nerved, green keel, nerveless sides tinged with red or purple, and broad, hyaline margins, c. 1 by  $\frac{1}{4}$  mm,  $\frac{2}{3}$ – $\frac{3}{4}$  imbricate but finally wide-spreading and discrete; tip incurved when dry. *Stamen* 1; anther oblong-linear, with short, smooth appendage of the connective, c.  $\frac{1}{3}$  mm. *Stigmas* 3. *Nut* trigonous, broadly ellipsoid, distinctly broad-stipitate, shortly apiculate, stramineous, c.  $\frac{1}{2}$  by  $\frac{1}{3}$  mm.

Distr. From Ceylon and India through Thailand and Indo-China to *Malesia*: not rare in the Malay Peninsula, rather common throughout Java, but a few times collected in Sumatra, Borneo, Celebes, and New Guinea; still unknown from the Lesser Sunda Is. and the Moluccas; apparently very rare in the Philippines; Luzon, Palawan, Tawitawi (not mentioned in MERRILL's Enumeration, although already collected in 1906).

Ecol. In open, moist or wet localities: swamps, pools, rice-fields, 0–750 m.

Note. Whether or not the glumes in herbarium specimens are incurved depends on the degree of maturity of the spikelets. Before the glumes have curled inwards the spikelets are c.  $1\frac{1}{4}$  mm wide, later on 1 mm. VALCKENIER SURINGAR's f. *rectiglumis* (with straight glumes and spikelets  $1\frac{1}{4}$  mm wide) was based on specimens with relatively young spikelets.

36. *Cyperus halpan* LINNÉ, Sp. Pl. (1753) 45 ('*haspan*'); MOR. Syst. Verz. (1846) 96; ZOLL. Syst. Verz. 1

(1854) 63; MIQ. Fl. Ind. Bat. 3 (1856) 267; BOECK. Linnaea 35 (1868) 574; *excl. var. indicus*; BENTH. Fl. Austr. 7 (1878) 270; CLARKE, J. Linn. Soc. Bot. 21 (1884) 119, t. 3 f. 23, 24, t. 4 f. 34; Fl. Br. Ind. 6 (1893) 600; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 91, t. 1 f. 6, t. 4 f. 9, *excl. f. flavidus*; CLARKE, Philip. J. Sc. 2 (1907) Bot. 82; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 64; KOORD. Exk. Fl. Java 1 (1911) 189; *ibid.* 4 (1922) f. 209; CAMUS, Fl. Gén. I.-C. 7 (1912) 50; MERR. En. Philip. 1 (1923) 105, p.p.; RIDL. Fl. Mal. Pen. 5 (1925) 142; BACK. Onkr. Suiker. (1928) 132, t. 127; KÜK. Pfl. R. Heft 101 (1936) 247, f. 28 E-G; S. T. BLAKE, J. Arn. Arb. 28 (1947) 219; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 30; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 476. — *C. micranthus* PRESL, Rel. Haenk. 1 (1828) 178, *non* NEES. — *C. minutiflorus* PRESL, *ibid.* 1 (1830) 351; KUNTH, En. 2 (1837) 102 ('*multiflorus*'); MIQ. Fl. Ind. Bat. 3 (1856) 287; NAVES, Nov. App. (1882) 306. — *C. dehiscens* (*non* NEES) NAVES, l.c. 303. — *C. flavidus var. africanus* CAMUS, Fl. Gén. I.-C. 7 (1912) 51. — Fig. 56-57.

*ssp. halpan.* — Synonymy as above.

Perennial, but often flowering the first year, with short rhizome and reddish roots. *Stems* slender, weak, solitary or tufted, triquetrous to almost 3-winged, often with a longitudinal median rib on each side, smooth, 10-40 cm. *Leaves* flat, smooth or scaberulous at the top, 2-5 mm wide; lower sheaths scarious, inflated, cinnamomeous or reddish; sometimes all the leaves reduced to ovate or lanceolate appendages of the sheaths. *Inflorescence* compound or decompound, loose to rather dense, up to 15 cm across. Involucral bracts 2-3, obliquely patent to widely spreading, all shorter than the inflorescence or one rather longer, up to 10(-15) cm. Primary rays numerous, up to 20, obliquely patent, slender, smooth, up to 15(-20) cm, secondary ones up to 2½ cm, tertiary ones when present very short. *Spikelets* digitately arranged, in clusters of 3-6(-10), stellately spreading, linear or linear-lanceolate, acute, strongly compressed, 10-30(-40)-flowered, 5-10 by 1-2 mm; rachilla completely hidden by the glumes or almost so, straight, persistent; internodes ¼-½ mm. *Glumes* membranous, suberect, keeled, oblong-ovate, rather obtuse, muticous, 1-1½ mm long, ½-⅔ imbricate; keel 3-nerved, green, sides fuscous to sanguineous or paler, nerveless. *Stamen* 1; anther oblong, c. ½ mm, with bristly appendage of the connective. *Stigmas* 3. *Nut* trigonous, broadly obovoid, broadly stipitate, shortly apiculate, densely granulate to verruculose (less distinctly so than in *C. tenuispica*), whitish, later on yellowish, 0.4-0.45 mm long and wide.

*Distr.* Tropical and subtropical regions of the whole world; throughout *Malesia*.

*Ecol.* In open, very wet places; a common and characteristic weed of inundated rice-fields, 0-1900 m.

*ssp. juncoides* (LAMK) KÜK. in Fedde, Rep. 23 (1926) 184; Pfl. R. Heft 101 (1936) 249. — *C. juncoides* LAMK, Ill. 1 (1791) 147. — *C. halpan var. americanus* BOECK. Linnaea 35 (1868) 575. — *C. halpan f. evoluta* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 92, t. 4 f. 11. — *C. halpan var. flaccidissimus* KÜK. Pfl. R. Heft 101 (1936) 248, *saltem p.p.*

Differs from *ssp. halpan* by: Rhizome creeping.

*Stems* usually more robust, up to 80(-100) cm tall, at the base surrounded by long, bladeless, reddish sheaths, rarely leaf-blades well-developed. *Spikelets* often longer, 1½ mm wide; internodes of the rachilla ⅓-½ mm. *Glumes* less densely imbricate, not completely hiding the rachilla, narrower, mucronulate, 1¼-1¾ mm long. *Stamens* (2-3); anthers linear-oblong. *Nut* slightly larger, 0.55-0.75 mm long.

*Distr.* Pantropical.

*Ecol.* Prefers more natural habitats than *ssp. halpan*: swamps, margins of lakes, muddy places in marshy forests, swampy grasslands, floating islands; at low and medium altitudes; on Bali, Mt Agung, near fumaroles at 3150 m.

*Vern.* (of *C. halpan s.l.*) Rëmbang, Sum. E. C., *para-para*, Riouw, *para ayër*, *rumput bilis gantan*, *r. sumbõ*, *r. tadah ambong*, *umbot-umbot*, Mal. Pen., *hiring banju*, *rumput kudung*, Borneo; Philip.: *balabalangitan*, *manik-manikan*, *misai-kalabau*, Tag., *barsanga*, Ilk., *bungot-bungot*, P. Bis., *zaingal*, Sub.; and many others.

*Notes.* *C. halpan* is extremely polymorphic. The two subspecies are connected by numerous intermediates.

LINNAEUS misread the vernacular name *halpan* as *haspan*. According to Art. 73 of the Code (example of *Gluta rhengas*) this orthographic error must be corrected.

37. *Cyperus tenuispica* STEUD. Syn. 2 (1855) 11; KÜK. Pfl. R. Heft 101 (1936) 245, f. 28 A-D; KERN, Reinwardtia 2 (1952) 116; *ibid.* 3 (1954) 38; in Back. & Bakh. f. Fl. Java 3 (1968) 476. — *C. halpan* (*non* L.) ROTTB. Descr. & Ic. (1773) 36, t. 6 f. 2; MERR. En. Philip. 1 (1923) 105, p.p. — *Scirpus n. 78* ROTTB. Descr. & Ic. (1773) 58, t. 17 f. 3, *non Scirpus autumnalis* L. — *C. caespitosus* (*non* POIR.) LLANOS, Fragm. Pl. Filip. (1851) 14 ('*caespitosus*'); F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4 (1880) 8. — ? *C. halpan var. dicranolepis* MIQ. Fl. Ind. Bat. 3 (1856) 268, p.p. — *C. halpan var. indicus* BOECK. Linnaea 35 (1868) 574 (*etiam quoad pl. jav. et born. ?*). — *C. flavidus* (*non* RETZ.) CLARKE, J. Linn. Soc. Bot. 21 (1884) 122, t. 3 f. 25; Fl. Br. Ind. 6 (1893) 600; Philip. J. Sc. 2 (1907) Bot. 82; CAMUS, Fl. Gén. I.-C. 7 (1912) 51, f. 4, 12, *excl. var. africanus* CAMUS. — *C. halpan f. flavidus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 92, t. 4 f. 10, *quoad specim.* — Fig. 58.

Annual with fibrous, reddish roots, or longer-lived in favourable circumstances. *Stems* slender, weak, solitary or tufted, triquetrous, smooth, (2-)5-40 cm by 1-2 mm. *Leaves* flat, gradually acuminate, smooth or scaberulous at the top, flaccid, 2-4 mm wide; lower sheaths bladeless or shortly laminate, scarious, stramineous to cinnamomeous. *Inflorescence* compound or decompound, relatively large, loose, 3-10 cm across. Involucral bracts 2-3, obliquely patent, the longest somewhat to conspicuously overtopping the inflorescence, up to 15(-25) cm. Primary rays 5-10, suberect to obliquely patent, slender, smooth, up to 10 cm, secondary ones 2-2½ cm, tertiary ones when present very short. *Spikelets* digitately arranged in clusters of 3-9, stellately spreading, oblong to linear, rather acute, compressed, 8-30(-50)-flowered, 3-8(-13) by 1-1½ mm; rachilla slightly flexuous, soon visible between the glumes, wingless, persistent; internodes c. ½ mm. *Glumes* membranous, ovate, slightly keeled towards the top,



Fig. 56. *Cyperus halpan* L. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 13$ , c-d. glumes,  $\times 20$ , e. rachis,  $\times 13$ , f. stamen,  $\times 45$ , g. nut with style and one stamen,  $\times 20$  (a-g LÖRZING 13609).



Fig. 57. *Cyperus halpan* L. (fine, pale) in marshy place, with in front *Limnophila aromatica*, surrounded by the tall grass *Sorghum nitidum* (stii). Lowland grass thickets at Plosokerep (Indramaju, W of Cheribon) (photogr. VAN STEENIS, 1935).

obtuse, soon excurved,  $\frac{3}{4}$ -1 by  $\frac{1}{2}$ - $\frac{3}{4}$  mm; keel green, 3-nerved; sides nerveless, hyaline, purplish lineolate or with a purplish spot on one side; midrib excurrent as a minute mucro just below the apex.

*Stamens* 1(-2); anthers oblong,  $\frac{1}{5}$ - $\frac{2}{5}$  mm, the short apical appendage of the connective smooth. *Stigmas* 3. *Nut* very obtusely trigonous with convex sides, subglobose or broadly obovoid or ellipsoid,



Fig. 58. *Cyperus tenuispica* STEUD. *a*. Habit,  $\times \frac{1}{2}$ , *b*. fruiting spikelet,  $\times 10$ , *c*. glume,  $\times 20$ , *d*. wingless persistent rachilla, enlarged, *e*. pistil with two stamens, *f*. two defflorate flowers, with one or two stamens, all  $\times 10$ , *g*. nut,  $\times 20$  (*a-g* BACKER 27362).

distinctly broadly stipitate, not or hardly apiculate, densely tuberculate, marbly white,  $\frac{1}{4}$ - $\frac{1}{3}$ ( $-\frac{2}{5}$ ) by  $\frac{1}{4}$ - $\frac{1}{5}$  mm.

Distr. Widely distributed in the warm regions of the eastern hemisphere: tropical Africa, Ceylon, Nepal, India, Farther India, extending northward to China and S. Japan, southward to tropical Australia; in *Malesia*: Malay Peninsula (according to KÜKENTHAL, *l.c.*), Sumatra, Java and adjacent islands, Philippines (Luzon); a few times also collected in the Lesser Sunda Is. (Lombok, Timor) and Celebes.

Ecol. In very wet places, especially in inundated rice-fields, 0-500 m.

Notes. Often overlooked by confusion with *C. halpan*, but well characterised by the small, obtuse, patulous glumes with excurved top, the rachilla soon visible from the outside, the smooth anthers, and the minute nuts.

CLARKE and KÜKENTHAL consider it to be always a very short-living plant soon becoming yellowish or blackish. Small specimens flowering and fruiting in a short time are indeed characteristic of the regularly cultivated rice-fields. In wet, grassy places, fallow fields, *etc.* the plants grow much larger and may live for a considerable time, just as is the case in *C. halpan*.

#### 16. Section Fusci

KUNTH, En. 2 (1837) 37. — *Cyperus sect. Difformes* CLARKE, Fl. Br. Ind. 6 (1893) 599.

Type species: *C. fuscus* L.

38. *Cyperus difformis* LINNÉ, Cent. Pl. 2 (1756) 6; Amoen. 4 (1760) 302; Sp. Pl. ed. 2 (1762) 67; MIQ. Fl. Ind. Bat. 3 (1856) 269; BOECK. Linnaea 35 (1868) 586; BENTH. Fl. Austr. 7 (1878) 268; CLARKE, J. Linn. Soc. Bot. 21 (1884) 133; Fl. Br. Ind. 6 (1893) 599; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 96, t. 4 f. 15; CLARKE, Philip. J. Sc. 2 (1907) Bot. 82; KOORD. Exk. Fl. Java 1 (1911) 189; *ibid.* 4 (1922) f. 212; CAMUS, Fl. Gén. I.-C. 7 (1912) 49, f. 5, 1-2; MERR. En. Philip. 1 (1923) 104; RIDL. Fl. Mal. Pen. 5 (1925) 142; BACK. Onkr. Suiker. (1928) 133, t. 129; KÜK. Pfl. R. Heft 101 (1936) 237, f. 27 F-H, *incl. var. breviglobosus* KÜK.; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 29; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 475. — *C. subrotundus* LLANOS, Fragm. Pl. Filip. (1851) 14; F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4 (1880) 8. — *C. goeringii* STEUD. Syn. 2 (1855) 24; MIQ. Fl. Ind. Bat. 3 (1856) 271; NAVES, Nov. App. (1882) 303.

Annual with fibrous, reddish roots. Stems rather weak, tufted, triquetrous, smooth, 10-40(-65) cm by (1-)2-3 mm. Leaves flaccid, slightly canaliculate, rather abruptly acuminate, smooth or somewhat scaberulous on the margins at the top, 2-5 mm wide; lower sheaths stramineous to brown. Inflorescence simple or compound, usually rather lax,  $1\frac{1}{2}$ -5(-7) cm across. Involucral bracts 2-3, patent, but the lowest often suberect (and then the inflorescence seemingly lateral), the 2 largest far overtopping the inflorescence, up to 25 cm. Primary rays usually 5-9, spreading, smooth, up to 3(-5) cm, secondary ones when present up to 1 cm. Spikes globose, very dense, with very numerous spikelets, 8-15 (rarely 3-4) mm across. Spikelets stellately spreading, linear or oblong-

linear, compressed but slightly turgid, obtuse, 10-30-flowered,  $2\frac{1}{2}$ -5 by 1-1 $\frac{1}{4}$  mm; rachilla straight, wingless, persistent; internodes c.  $\frac{1}{2}$  mm. Glumes very small, membranous, patulous, slightly keeled, orbicular to broadly obovate, very obtuse or somewhat emarginate, mucous, with arcuate, green, faintly 3-nerved keel, purplish or sometimes pale, nerveless sides and broad whitish hyaline margins, mucous,  $\frac{3}{5}$ - $\frac{4}{5}$  by  $\frac{3}{4}$ -1 mm,  $\frac{1}{2}$  imbricate. Stamens (1-2); anthers elliptic or elliptic-oblong, c.  $\frac{1}{10}$  mm. Style very short,  $\frac{1}{10}$ - $\frac{1}{3}$  mm; stigmas 3, somewhat longer than the style. Nut triquetrous, ellipsoid to slightly obovoid, broadly stipitate, conically apiculate, about as long as the subtending glume, shining stramineous or pale brown,  $\frac{1}{2}$ - $\frac{2}{3}$  by c.  $\frac{1}{3}$  mm.

Distr. Tropical and warm temperate regions of the Old World; Australia; in Central America presumably introduced; from S. Europe to Japan, S. Africa, and through India and Farther India to the Pacific Islands; in *Malesia*: rare in the Malay Peninsula and Sumatra, common throughout Java, not known from Borneo and the Moluccas, only a few times collected in the Lesser Sunda Is. (Bali, Timor, Alor, Tanimbar Is.), Celebes, and New Guinea; throughout the Philippines.

Ecol. In very wet places: open grasslands, river-banks, *etc.*, but especially a characteristic weed of wet rice-fields, often associated with *C. halpan*, *C. iria*, and *C. sanguinolentus*, 0-1400 m (according to MERRILL 2000 m); flowering throughout the year.

Vern. Djukut pëndul, S, djëbungan, ramon brëndëlan, J, kamis, Kangean; Philip.: baki-bäki, bankoan, gilamhon, Bis., ballayang, Ilk., pukuungan, Bon.

#### 17. Section Amabiles

CLARKE, Fl. Br. Ind. 6 (1893) 598.

Type species: *C. amabilis* VAHL.

39. *Cyperus cuspidatus* KUNTH in H. B. K. Nov. Gen. & Sp. 1 (1815) 204; BOECK. Linnaea 35 (1868) 496; BENTH. Fl. Austr. 7 (1878) 267; CLARKE, J. Linn. Soc. Bot. 21 (1884) 88; Fl. Br. Ind. 6 (1893) 598;

VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 79, t. 4 f. 2; KOORD. Exk. Fl. Java 1 (1911) 188; KÜK. Pfl. R. Heft 101 (1936) 261, f. 29 E, *incl. var. angustifolius* KÜK.; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam.

246, p. 31; KERN in Back. & Bakh. *f. Fl. Java* 3 (1968) 475. — *C. angustifolius* NEES in Wight, *Contr.* (1834) 79. — *C. pusillus* (non VAHL) NEES, *J. Bot. Kew Misc.* 6 (1854) 27. — *C. solutus* STEUD. *Syn.* 2 (1855) 14; MIQ. *Fl. Ind. Bat.* 3 (1856) 263; NAVES, *Nov. App.* (1882) 302. — *C. castaneus f. sundaicus* MIQ. *Fl. Ind. Bat.* 3 (1856) 261. — *C. squarrosus* (non L.) F.v.M. *Fragm.* 8 (1874) 262; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 58. — *C. uncinatus* (non POIR.) CLARKE, *Philip. J. Sc.* 2 (1907) Bot. 82; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 64; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 47, f. 4, 5–7; MERR. *En. Philip.* 1 (1923) 108; RIDL. *Fl. Mal. Pen.* 5 (1925) 141; BACK. *Onkr. Suiker.* (1928) 131, t. 124. — *Dichostylis cuspidata* PALLA, *Bot. Jahrb.* 10 (1888) 296. — *Fig. 59.*



*Fig. 59. Cyperus cuspidatus* KUNTH. *a.* Habit, nat. size, *b.* part of spikelet,  $\times 10$  (*a-b* VAN STEENIS 12018).

Small annual with fibrous, yellowish roots. Stems tufted, trigonous, smooth, 2–15 cm by  $\frac{1}{2}$ –1 mm. Leaves very narrow, often setaceous, gradually acuminate, rigid, scaberulous in the upper part,  $\frac{1}{2}$ –1 mm wide; sheaths membranous, striate, reddish brown. Inflorescence simple, often reduced to a single head. Involucral bracts 3–4(–6), patent, the longer ones overtopping the inflorescence. Rays 0–4, filiform, obliquely erect to spreading, smooth, up to 3 cm. Spikelets digitately arranged, stellately

spreading, in clusters of up to 20, linear, strongly compressed, up to 40(–60)-flowered,  $\frac{1}{2}$ –1 $\frac{1}{2}$ (–2) cm by (2–)2 $\frac{1}{2}$ –3 mm (mucros included); rachilla slightly flexuous, wingless, persistent; internodes c.  $\frac{1}{2}$  mm. Glumes subchartaceous, finally obliquely patent, oblong-spatulate,  $\frac{1}{2}$  imbricate, the body strongly 3-nerved, emarginate at apex, with green, often purplish lineolate keel and nerveless, ferruginous to castaneous sides, 1–1 $\frac{1}{2}$  by  $\frac{1}{4}$ –1 mm, the strong mucro spreading to recurved,  $\frac{2}{3}$ –1 mm. Stamens (2–)3; anthers elliptic,  $\frac{1}{4}$ – $\frac{1}{2}$  mm. Stigmas 3. Nut trigonous, obovoid to oblong-obovoid, about half as long as the subtending glume, shortly apiculate, brown to castaneous, ( $\frac{1}{2}$ –) $\frac{1}{2}$ – $\frac{3}{4}$  by  $\frac{1}{4}$ – $\frac{3}{4}$  mm.

Distr. Pantropical: tropical Africa, throughout India, extending northwards to S. China and S. Formosa, southwards to Queensland; from southern N. America through Mexico and the West Indies to Brazil; almost throughout *Malesia* (still unknown from New Guinea), but nowhere common.

Ecol. In open, moist to rather dry localities, on sandy arable fields with previous soil, sometimes a weed in rice-fields, 0–1100 m.

Vern. *Rumput para-para*, M, *wátjè námüt*, Alor; Philip.: *salasa*, Tag.

40. *Cyperus castaneus* WILLD. *Sp. Pl.* 1 (1797) 278; BOECK. *Linnaea* 35 (1868) 496; BENTH. *Fl. Austr.* 7 (1878) 267; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 87; *Fl. Br. Ind.* 6 (1893) 598; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 81, t. 4 f. 4; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 63; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 46, *p.p.*, f. 4, 8–11; RIDL. *Fl. Mal. Pen.* 5 (1925) 141; KÜK. *Pfl. R. Heft* 101 (1936) 264; KERN, *Reinwardtia* 2 (1952) 117. — *Dichostylis castanea* PALLA, *Bot. Jahrb.* 10 (1888) 296. — *C. amabilis* (non VAHL) CAMUS, *Fl. Gén. I.-C.* 7 (1912) 45.

Closely allied to *C. cuspidatus*. Spikelets narrower, c.  $\frac{1}{2}$  mm wide (mucros included c. 2 mm), often multiflorous, up to 50(–80)-flowered. Glumes less patent, chestnut-brown, rarely ferruginous; mucros often less recurved, shorter,  $\frac{1}{3}$ – $\frac{3}{4}$  mm. Stamen 1. Nut usually oblong with exactly parallel sides, c. 0.9 by 0.25(–0.3) mm, sometimes smaller and sub-obovoid.

Distr. From India, Tonkin, and Cochinchina to tropical Australia, everywhere scattered, in *Malesia*: Banka, Krakatau, Malay Peninsula (Perak, Kelantan), N. Borneo.

Ecol. In open sandy localities, up to 300 m.

Note. Also closely related to and possibly not specifically distinct from *C. amabilis* VAHL, *En.* 2 (1806) 318. The latter species, not known from *Malesia*, is mainly characterized by the very shortly mucronulate, golden or ferruginous glumes. However, in an Australian variety of *C. castaneus*: *var. brevimucronatus* KÜK. *Pfl. R. Heft* 101 (1936) 264, the glumes are also but shortly mucronate, and this variety is therefore only distinguishable from *C. amabilis* by the slightly smaller, dark glumes and the somewhat smaller nut and anther.

#### 18. Section Aristati

KUNTH, *En.* 2 (1837) 20.

Type species: *C. aristatus* ROTTB.

41. *Cyperus squarrosus* LINNÉ, Cent. Pl. 2 (1756) 6; BENTH. Fl. Austr. 7 (1878) 268; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 473. — *C. aristatus* ROTTB. Descr. Pl. rar. Progr. (1772) 22; Descr. & Ic. (1773) 23, t. 6 f. 1; MIQ. Fl. Ind. Bat. 3 (1855) 262; BOECK. Linnaea 35 (1868) 500; CLARKE, J. Linn. Soc. Bot. 21 (1884) 91; Fl. Br. Ind. 6 (1893) 606; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 81, t. 4 f. 5; KOORD. Exk. Fl. Java 1 (1911) 188, 192, non *ibid.* 4 (1922) f. 207; BACK. Onkr. Suiker. (1928) 131, t. 125; KÜK. Pfl. R. Heft 101 (1936) 502, f. 55 F-J. — *C. inflexus* MUEHLENB. Descr. (1817) 16. — *Mariscus squarrosus* CLARKE, Fl. Br. Ind. 6 (1893) 623, *quoad* *synon.* — *Dichostylis aristata* PALLA, Bot. Jahrb. 10 (1888) 296. — *Mariscus aristatus* CHERM. Bull. Soc. Bot. France 85 (1938) 366; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 45.

Small annual with fibrous roots, when bruised or dry smelling of fenugreek. *Stems* tufted, triquetrous to almost 3-winged, smooth, 1–10 cm by  $\frac{1}{2}$ – $1\frac{1}{2}$  mm. *Leaves* few, weak, canaliculate, gradually acuminate, nearly smooth, 1–2 mm wide; lower sheaths membranous, purplish. *Inflorescence* simple, often reduced to a single hemispherical head, or with 1–3 rays more or less developed. *Involucral bracts* 2–4, patent, at least 1 overtopping the inflorescence, up to 7 cm. *Rays* 0–3, filiform, smooth, up to 3(–5) cm. *Spikes* very dense, oblong-ovoid to subglobose, appearing echinate,  $\frac{1}{2}$ –2 cm  $\emptyset$ ; rachis 1–5 mm. *Spikelets* densely spicate, spreading, oblong to oblong-linear, strongly compressed, 6–30-flowered, 5–10(–15) by 3–4 mm (awns included); rachilla straight or slightly flexuous, wingless; internodes  $\frac{1}{3}$ – $\frac{1}{2}$  mm. *Glumes* membranous, patulous, elliptic-ovate to elliptic-oblong, the blades 1–2 by  $\frac{1}{2}$ –1 mm,  $\frac{1}{2}$  imbricate, strongly (5)–7–9-nerved over the whole breadth, ferruginous to fuscous, tapering into a strong, recurved, ( $\frac{1}{3}$ –) $\frac{1}{2}$ – $1\frac{1}{4}$  mm long awn. *Stamen*

1; anther elliptic to elliptic-oblong,  $\frac{1}{2}$ – $\frac{3}{4}$  mm. *Stigmas* 3. *Nut* very variable, trigonous, oblong-obovoid, oblong, or almost linear,  $\frac{1}{2}$ – $\frac{2}{3}$  as long as the blade of the subtending glume, broadly stipitate, obtuse, very shortly apiculate, dull greyish brown,  $\frac{2}{3}$ –1 by  $\frac{1}{5}$ – $\frac{1}{2}$  mm.

*Distr.* Tropical Africa, extending to S. Africa; tropical Asia, to S. China; Australia; in the western hemisphere from S. Canada through the United States and tropical America to Argentina and Chile; in *Malesia*: Madura, Lesser Sunda Is. (Sumba, Timor).

KOORDER's statement that it occurs in the Javan mountains has never been verified.

*Ecol.* In Madura and Sumba in sandy grassy fields, 1–50 m; in Timor on limestone-rocks, up to 900 m.

*Vern.* *Pun ana*, Timor.

*Notes.* The sheet in the Linnean herbarium marked "squarrosus" in LINNÉ's handwriting contains two species, one of them represented by a tuft of complete plants, the other by a single inflorescence only. The description in Cent. Pl. 2 was undoubtedly drawn up from the complete specimens, which belong to the species described above. For this species CLARKE, KÜKENTHAL, and others wrongly accepted ROTTBOELL's younger synonym *C. aristatus*. The correct name for the fragment (*C. squarrosus sensu* CLARKE, KÜK.) is apparently *C. maderaspatanus* WILLD. (not in *Malesia*). See also CLARKE, J. Linn. Soc. Bot. 21 (1884) 92; *ibid.* 30 (1894) 305; BENTH. Fl. Austr. 7 (1878) 268 in *nota*.

On account of the spikelets allegedly falling off as a whole, KÜKENTHAL referred this species to *subg. Mariscus*. However, the caducity of the rachilla varies considerably. In the Timor specimens the glumes are more readily caducous than the rachilla. See also O'NEILL, Rhodora 44 (1942) 47.

### 19. Section Humiles

KUNTH, En. 2 (1837) 51. — *Cyperus sect. Rupestres* CLARKE, Kew Bull. add. ser. 8 (1908) 96.

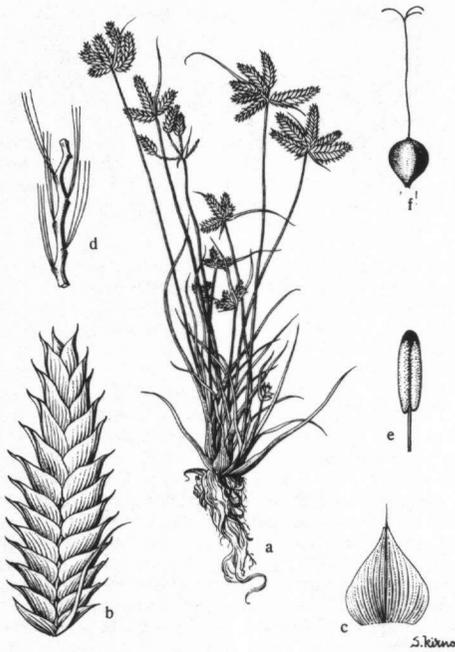
Type species: *C. rupestris* KUNTH.

42. *Cyperus teneriffae* POIR. in Lamk, Encycl. 7 (1806) 245; CLARKE, Fl. Br. Ind. 6 (1893) 601; KÜK. Pfl. R. Heft 101 (1936) 306, f. 34 H-K; S. T. BLAKE, Proc. R. Soc. Queensl. 51 (1940) 40; KERN, Reinwardtia 2 (1952) 122, f. 11. — *C. rubicundus* VAHL, En. 2 (1806) 308; BOECK. Linnaea 35 (1868) 507; CLARKE, J. Linn. Soc. Bot. 21 (1884) 104. — *C. calcicola* DOMIN, Bibl. Bot. Heft 85 (1915) 422, t. 17 f. 10–13 ('*calcololus*'). — Fig. 60.

Annual with fibrous roots. *Stems* tufted, slender, triquetrous, smooth or scabrid above, 5–15(–20) cm by  $\frac{1}{2}$ (–1) mm, surrounded at the base by broad, inflated, scarious, purplish striate sheaths. *Leaves* few, weak, flat or conduplicate, gradually acuminate, smooth or scaberulous at the top, 1(–2) mm wide. *Inflorescence* a single, hemispherical or subglobose head, up to  $2\frac{1}{2}$  cm across. *Involucral bracts* 2–3, spreading, short, the lowest usually slightly overtopping the inflorescence, rarely up to 5 cm long. *Spikelets* digitately arranged, stellately spreading,

2–6(–15) together, oblong, obtusish, strongly compressed, up to 30(–40)-flowered, 6–20 by 3–4 mm; rachilla straight, wingless, persistent; internodes *c.*  $\frac{1}{2}$  mm. *Glumes* membranous, patulous at the top, acutely keeled, ovate, acuminate, 9–13-nerved over the whole breadth, cinnamomeous to purplish with whitish hyaline margins, about  $\frac{3}{4}$  imbricate, the body 2–3 by  $1\frac{1}{2}$ –2 mm, the midrib excurrent in a recurved, *c.*  $\frac{1}{2}$  mm long mucro. *Stamens* 3; anthers oblong, *c.* 1 mm, with short, smooth appendage of the connective. *Style* long (*c.*  $1\frac{1}{2}$  mm); stigmas 3, much shorter than the style. *Nut* triquetrous, with somewhat concave sides, obovoid, attenuate towards the base, hardly apiculate, brown under the whitish or greyish outermost layer of cells,  $\frac{3}{4}$ –1 by  $\frac{1}{2}$ – $\frac{3}{4}$  mm.

*Distr.* Widely distributed in Africa (from Teneriffe through tropical Africa to S. Africa and Madagascar), S. Arabia, India (Deccan Peninsula, Poona, Nilghiris), N. Queensland (see below); in *Malesia*: Lesser Sunda Is. (Timor).



Ecol. In Timor in dry pastures on limestone hills, associated with *C. squarrosus* and *C. hyalinus*, up to 900 m.

Vern. *Pun métan*, Timor.

Notes. As in N. Queensland this species was observed on one only of the numerous karst hills near Chillagoe, BLAKE *l.c.* supposed it to have been introduced there. In Timor it is abundant on calcareous soil and it is rather unlikely that it was introduced.

Some of the Timor specimens agree very well with the type collection of *f. petraeus* (STEUD.) KÜK. Pfl. R. Heft 101 (1936) 307. — *C. petraeus* HOCHST. ex STEUD. Syn. 2 (1855) 29 (Stems very short, 2 cm; spikelets few, shorter). — Most probably a depauperate form not deserving nomenclatural distinction.

Fig. 60. *Cyperus teneriffae* POIR. a. Habit, nat. size, b. spikelet,  $\times 6$ , c. glume,  $\times 5$ , d. old rachilla, with persistent filaments,  $\times 5$ , e. stamen,  $\times 10$ , f. nut,  $\times 7\frac{1}{2}$  (a-f WALSH 167).

## 20. Section Platystachyi

KUNTH, En. 2 (1837) 44. — *Sorostachys* STEUD. Flora 33 (1850) 229; Syn. 2 (1855) 71. — *Cyperus* sect. *Leucocephali* CHERM. ex KÜK. Pfl. R. Heft 101 (1936) 276.

Type species: *C. leucocephalus* RETZ.

43. *Cyperus pulchellus* R. BR. Prod. (1810) 213; KUNTH, En. 2 (1837) 110; STEUD. Syn. 2 (1855) 53; BENTH. Fl. Austr. 7 (1878) 265; NAVES, Nov. App. (1882) 301; F. M. BAILEY, Queensl. Fl. 6 (1902) 1735; KERN, Reinwardtia 3 (1954) 39, f. 5 *dextr.* — *C. leucocephalus* (non RETZ.) NEES in Hook. J. Bot. Kew Misc. 6 (1854) 28; CLARKE, J. Linn. Soc. Bot. 21 (1884) 107, *p.p.*; VIDAL, Phan. Cuming. Philip. (1885) 155; CLARKE, Philip. J. Sc. 2 (1907) Bot. 82; MERR. En. Philip. 1 (1923) 106; KÜK. Pfl. R. Heft 101 (1936) 278, *p.p.* — *Sorostachys kyllingoides* STEUD. [Flora 33 (1850) 229. *nom. nud.*] Syn. 2 (1855) 71; MIQ. Fl. Ind. Bat. 3 (1856) 296. — *C. sorostachys* BOECK. Linnaea 35 (1868) 588; SCHEFFER, Nat. Tijd. N. I. 34 (1874) 48.

Perennial with short rhizome; stolons wanting. Stems very slender, tufted, trigonous below, triquetrous above, smooth, 10–20(–40) cm by  $\frac{1}{2}$ –1 mm, at the base surrounded by stramineous to brownish cataphylls. Leaves 1 or 2 to the stem, very narrow to almost setaceous, rigid, smooth or scaberulous at the top, 1(– $1\frac{1}{2}$ ) mm wide. Inflorescence a single, globose, whitish or pale cinnamon-coloured head 5–10 mm  $\phi$ . Involucral bracts (2–)3(–4), much overlapping the inflorescence, patent, finally reflexed, the largest up to 10 cm. Spikelets numerous, ovate, strongly compressed, 8–12-flowered, (2–)3(–5) by

$1\frac{1}{4}$ –2 mm; rachilla straight, wingless, persistent; internodes  $\frac{1}{4}$ – $\frac{1}{2}$  mm. Glumes membranous, almost hyaline, obliquely patent, elliptic to oblong, obtusish, slightly keeled, faintly 3-nerved, whitish, purplish lineolate, 1– $1\frac{3}{4}$  by  $\frac{3}{4}$ –1 mm. Stamen 1, sometimes in some flowers 2; anther oblong,  $\frac{1}{3}$ – $\frac{1}{2}$  mm. Style c.  $\frac{1}{2}$  mm; stigmas 3. Nut trigonous, obovoid to oblong, slightly attenuate towards the base, shortly apiculate, yellowish to fuscous, 0.5–0.9 by c.  $\frac{1}{4}$  mm.

Distr. Tropical Africa, Asia, and Australia, everywhere scattered; in Malesia: Philippines (Luzon, twice collected).

Ecol. In open damp places.

Notes. By many authors united with *C. leucocephalus* RETZ. Obs. 5 (1789) 11 (*Kyllinga pierreana* CAMUS, Not. Syst. 1, 1910, 290; Fl. Gén. 1.–C. 7, 1912, 27; see KERN, Blumea 10, 1960, 642), which in my opinion is a distinct species occurring from India to Indo-China, mainly characterised by its semi-globose, paucispiculate heads, larger, truncate glumes, and larger, linear-oblong, black nuts.

Due to the wrong citation of the Cuming-number collected between 1836 and 1840 (1617 should be 1417), MERRILL *l.c.* indicated as locality: Mindanao (Misamis). The species was again collected in Luzon in 1918.

21. Section *Cephalotes*

VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 76. — *Anosporum* NEES in Wight, Contr. (1834) 70. — *Hydroschoenus* ZOLL. & MOR. in Mor. Syst. Verz. (1846) 95. — *Trentepohlia* BOECK. Bot. Zeit. 16 (1858) 249. — *Cyperus* subg. *Anosporum* CLARKE, Fl. Br. Ind. 6 (1893) 597. — *Cyperus* sect. *Anosporum* CLARKE in Thiselt.-Dyer, Fl. Trop. Afr. 7 (1902) 310.

Type species: *C. cephalotes* VAHL.

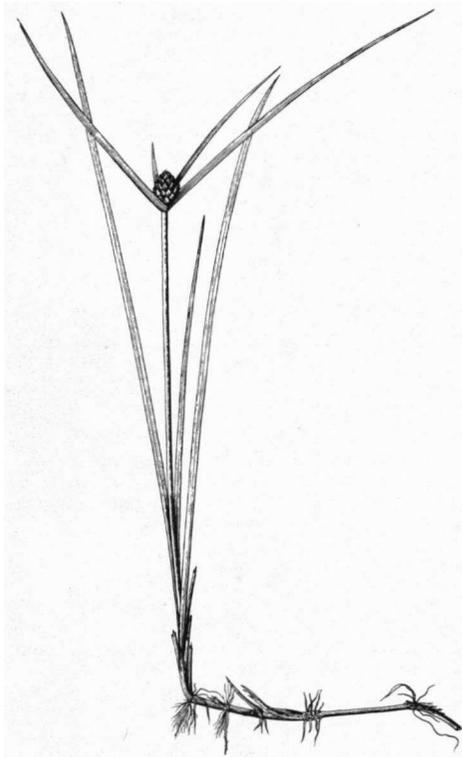


Fig. 61. *Cyperus cephalotes* VAHL. Habit, small specimen from Rawah Bening,  $\times \frac{1}{2}$ .

44. *Cyperus cephalotes* VAHL, En. 2 (1806) 311; MIQ. Fl. Ind. Bat. 3 (1856) 271; BENTH. Fl. Austr. 7 (1878) 263; CLARKE, J. Linn. Soc. Bot. 21 (1884) 25, 34, t. 1 f. 1-6; Fl. Br. Ind. 6 (1893) 597; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 77, t. 4 f. 1; CLARKE, Ill. Cyp. (1909) t. 6; KOORD. Exk. Fl. Java 1 (1911) 188; *ibid.* 4 (1922) f. 206; CAMUS, Fl. Gén. I.-C. 7 (1912) 44, f. 4, 1-4; COERT, Trop. Natuur 23 (1934) 12, f. 8; KÜK. Pfl. R. Heft 101 (1936) 291; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 28; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 469. — *C. monocephalus* ROXB. Fl. Ind. 1 (1820) 193. — *Anosporum monocephalum* NEES, Edinb. New Phil. J. 17, n. 34 (1834) 263; in Wight, Contr. (1834) 92; BOECK. Linnæa 36 (1870) 411. — *Hydroschoenus kyllingoides* ZOLL. & MOR. in Mor. Syst. Verz. (1846) 95; ZOLL. Syst. Verz. 1 (1854) 63; STEUD. Syn. 2 (1855) 71;

MIQ. Fl. Ind. Bat. 3 (1856) 296. — *Trentepohlia bifoliata* BOECK. Bot. Zeit. 16 (1858) 249. — *C. monogynus* BOECK. Linnæa 35 (1868) 565; SCHEFFER, Nat. Tijd. N. I. 34 (1874) 47. — *Anosporum cephalotes* KURZ, J. As. Soc. Beng. 39, ii (1870) 84. — *Ficinia foliaceo-bracteata* PFEIFF. Rev. Gatt. Ficinia (1921) 35. — Fig. 61-62.

Perennial. Rhizome emitting slender stolons rooting at the nodes. Stems solitary, rigidulous, trigonous, smooth, 15-40(-55) cm by  $1-1\frac{1}{2}$ (-2) mm, few-leaved in the lower  $\frac{1}{3}$ . Leaves rather rigid, canaliculate at the base, otherwise flat, gradually narrowed into the triquetrous, scabrid top, grassgreen or greyish green, 2-4 mm wide; lower sheaths cinnamomeous to reddish. Inflorescence an ovoid or conical, lobed head consisting of 1-4 glomerules,  $\frac{1}{2}-1\frac{1}{2}$  cm across. Involucral bracts 3-5, one long remaining erect, finally all widely spreading to reflexed, up to 30 cm, the dilated base purplish striate, scariously margined. Spikelets numerous,

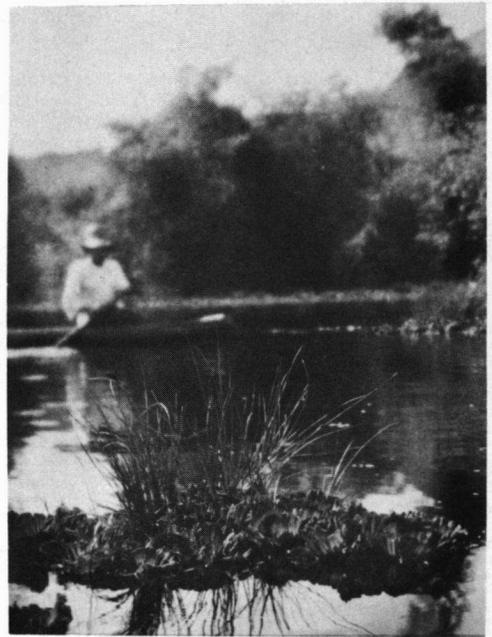


Fig. 62. *Cyperus cephalotes* VAHL in a drifting mass of *Pistia stratiotes* in the lowland. Rawah Bening (S. Kediri, East Java) (photogr. COERT, 1927).

erect to patent, ovate or lanceolate, often curved, 10–16(–24)-flowered, 4–6(–10) by 3–4 mm; rachilla straight, wingless, persistent; internodes  $\frac{1}{2}$ – $\frac{3}{4}$  mm. *Glumes* subcoriaceous, ovate, very densely imbricate, pale brown to castaneous, 3–4 by c. 2 mm; keel acutely prominent to narrowly winged, often scabrid, strongly 3-nerved, produced into a short, slightly excurved mucro; sides obscurely several-nerved. *Stamens* 3; anthers linear, up to  $1\frac{1}{2}$  mm. *Style* undivided or obscurely 3-lobed, 3–4 mm long, gradually widened into the conical, 3-winged, serrulate base. *Nut* trigonous, ovoid, dorsally compressed, long-stipitate, apiculate by the c. 1 mm long, persistent style-base, shining brown,  $1-1\frac{1}{2}$  by  $\frac{3}{4}$ –1 mm; stipe of the nut at first narrowly winged, the wings ultimately strongly incrassate, corky, forming 3 yellowish ridges projecting up the angles of the nut.

*Distr.* From India, Farther India, and S. China to tropical Australia, in *Malesia*: in a few localities in W. and E. Java, E. Borneo (W. Kutei), and New

Guinea (Papua: Agu River branch of Middle Fly River).

*Ecol.* On floating islands in tanks, the roots entangled in the mass of the decaying surface vegetation (*Pistia*, *Salvinia*, etc.); in W. Kutei floating in rivers; up to 100 m.

*Vern.* *Djukut bawangan*, S, *gëlunggung*, W. Kutei. *Notes.* On this species with its curious style and nut the genera *Hydroschoenus*, *Anosporum*, and *Trentepohlia* were based. The corky thickenings on the nut were mistaken for a gynophore by PFEIFFER, *l.c.*, who described a collection from W. Java as a new species of the African genus *Ficinia*; see KERN, *Blumea* 9 (1958) 222.

The corky tissue on the nuts enables dispersal by water, like in *C. platystylis*. See RIDLEY, *Disp.* (1930) 238.

KÜKENTHAL, *l.c.*, mentions the species also from "Malakka (GRIFFITH!)". The GRIFFITH collection (n. 6172) originates from Burma.

## 22. Section *Dichostylis*

(LESTIB.) BAILLON, *Hist. Pl. fam. CXIX* (1893) 338. — *Dichostylis* LESTIB. *Ess. Fam. Cyp.* (1819) 39, *nom. illeg.* — *Scirpus sect. Dichostylis* FIEK, *Fl. Schles.* (1881) 473.

*Type species: Scirpus michelianus* L.

45. *Cyperus pachycephalus* KERN, *Reinwardtia* 2 (1952) 119, f. 10; *Blumea* 13 (1965) 123. — *C. pygmaeus* (non ROTTB.) S. T. BLAKE, *J. Arn. Arb.* 28 (1947) 219, *p.p.*

*Annual.* *Stems* tufted, rigidulous, triquetrous, smooth, up to 75 cm by 1–3 mm. *Leaves* flat, gradually acuminate, scabrid on the margins and nerves, (2–)3–4(–5) mm wide; basal sheaths brownish. *Inflorescence* consisting of several very dense glomerules, contracted into a subtriangular-ovoid to subglobose, lobed head,  $1\frac{1}{2}$ –3 cm across. *Involucral bracts* several, patent, much overtopping the inflorescence, with reddish brown dilated base, the longest up to 40 cm. *Spikelets* often incurved and contorted, lanceolate, strongly compressed, 6–12-flowered, 4–8 by  $1\frac{1}{2}$ –2(–3) mm; rachilla straight, wingless, persistent; internodes c.  $\frac{1}{2}$  mm. *Glumes* pellucid-membranous, oblong, with smooth keel, distinctly 7–9-nerved,  $\frac{1}{2}$ – $\frac{3}{5}$  imbricate, with pale stramineous sides and green nerves, the body  $2-2\frac{1}{4}$  by 1 mm, the mucros of the lower glumes c.  $\frac{1}{2}$  mm, those of the upper ones  $\frac{3}{5}$ – $\frac{4}{5}$  mm, slightly excurved, smooth or sparsely setulose at the top. *Stamens* 3; anthers oblong, the cells c.  $\frac{1}{3}$  mm, the appendage of the connective c.  $\frac{1}{10}$  mm. *Style* up to 1 by c.  $\frac{1}{10}$  mm, epapillose; stigmas (2–)3. *Nut* oblong, nearly always biconvex, strongly dorsoventrally compressed, pale brown, c.  $1-1\frac{1}{2}$  mm long,  $\frac{1}{2}$  mm wide,  $\frac{1}{4}$  mm thick.

*Distr. Malesia:* W. New Guinea, NE. New Guinea (Sepik Distr.).

*Ecol.* Mud-banks along rivers and channels, on logs floating in lagoons, 50–90 m.

*Vern.* *Sera*, Maibrat language, *simbuai*, Sepik.

*Note.* Differs from *C. pygmaeus* by the stouter stems, the larger heads, the broader leaves, the less

densely imbricate, distinctly nerved glumes, with smooth keel, the 3 stamens, the crested anthers, the broader styles, the number of stigmas (preponderantly 3), and the larger nuts.

46. *Cyperus pygmaeus* ROTTB. *Descr. & Ic.* (1773) 20, t. 14 f. 4, 5; KUNTH, *En.* 2 (1837) 18; MIQ. *Fl. Ind. Bat.* 3 (1856) 261; BOECK. *Linnaea* 35 (1868) 493, *excl. var. michelianus*; BENTH. *Fl. Austr.* 7 (1878) 262; NAVES, *Nov. App.* (1882) 301; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 28, 81, t. 2 f. 10; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 74, t. 2 f. 22; KOORD. *Exk. Fl. Java* 3 (1912) 357; BACK. *Onkr. Suiker.* (1928) 130, t. 123; S. T. BLAKE, *J. Arn. Arb.* 28 (1947) 219, *p.p.*; KERN in BACK. & BAKH. *f. Fl. Java* 3 (1968) 472. — *Dichostylis pygmaea* NEES, *Linnaea* 9 (1834) 289; PALLA in KOCH, *Syn. ed.* 3, 3 (1905) 2557. — *Juncellus pygmaeus* CLARKE, *Fl. Br. Ind.* 6 (1893) 596; Philip. *J. Sc.* 2 (1907) Bot. 81; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 38; MERR. *En. Philip.* 1 (1923) 114; BACK. *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 41. — *C. michelianus* (L.) DELILE *ssp. pygmaeus* ASCHERS. & GRAEBN. *Syn.* 2, 2 (1903) 273; KÜK. *Pfl. R. Heft* 101 (1936) 312, f. 3 F-G. — *Kyllinga squamulata* (non VAHL) CAMUS, *Fl. Gén. I.-C.* 7 (1912) 26.

*Annual.* *Stems* tufted, often pulvinate, triquetrous, smooth, 1–25 cm by  $\frac{1}{2}$ – $1\frac{1}{2}$  mm. *Leaves* canaliculate, gradually acuminate, scabrid on the margins in the upper part, 1–2 mm wide; basal sheaths brown or reddish. *Inflorescence* consisting of several very dense glomerules, contracted into a triangular-ovoid to subglobose, lobed head up to  $1\frac{1}{2}$  cm long and wide. *Involucral bracts* 2–7, patent, much overtopping the inflorescence, with dilated base, the longest up to 15 cm. *Spikelets* often incurved and

contorted, ovate to lanceolate, strongly compressed, 10–20-flowered, 3–5 by  $1\frac{1}{2}$ –2 mm; rachilla slightly flexuous, wingless, persistent; internodes c.  $\frac{1}{2}$  mm. *Glumes* thinly membranous, pellucid, distichous but often seemingly placed irregularly because of the twisted rachilla, lanceolate, keeled, acute or with a short (up to  $\frac{1}{2}$  mm long) mucro, 3–5-nerved, very densely (c.  $\frac{7}{8}$ ) imbricate, at first whitish, finally pale stramineous, c. 2 by  $\frac{1}{2}$  mm; keel more or less spinulose. *Stamens* 1–2; anthers linear,  $\frac{1}{3}$ – $\frac{1}{2}$  mm; connective hardly produced. *Style*  $\frac{1}{2}$ – $\frac{3}{4}$  by  $\frac{1}{20}$  mm, epapillose; stigmas 2–3. *Nut* trigonous or planoconvex, oblong, pale brown, c. 1 by  $\frac{1}{4}$ – $\frac{1}{5}$  mm.

Distr. Mediterranean region, E. Africa, from Asia Minor through S. and E. Asia to Australia; in *Malesia* very rare: in a few localities in W. and E. Java, the Philippines (Luzon, Mindanao), Central Celebes, and New Guinea.

Ecol. Dried-up pools and ditches, fallow rice-fields, muddy river-banks, 0–700 m.

Notes. As a rule *C. pygmaeus* is digynous, but there are often some to several trigynous flowers among the digynous ones. Whether the nut is planoconvex or trigonous does not entirely correlate with the number of stigmas: there are often 2 stigmas to the trigonous nuts.

The relations between this species and *Scirpus michelianus* L. (the latter not known from Malesia) constitute an interesting systematic problem. The two sometimes grow together and resemble each other deceptively. They differ mainly by the phyllotaxy of the spikelets (glumes distichous in *C. pygmaeus*, spiral in *Scirpus michelianus*). BOECKLER considered them conspicuous; he was followed by several authors (e.g. KÜKENTHAL). KUNTH and CLARKE treated them as belonging in different genera. If *Scirpus michelianus* is not included in *Cyperus*, the sectional name *Dichostylis*, of which it is the type species, cannot be used in this genus.

### 23. Section Pennati

KUNTH, En. 2 (1837) 79. — *Mariscus sect. Turgiduli* CLARKE, Fl. Br. Ind. 6 (1893) 623.

Type species: *C. pennatus* LAMK.

47. *Cyperus javanicus* HOUTT. Nat. Hist. 2, 13 (1782) Aanw. Pl. (1), t. 88 f. 1; MERR. J. Arn. Arb. 19 (1938) 321; S. T. BLAKE, J. Arn. Arb. 28 (1947) 222; KERN in BACK. & BAKH. f. Fl. Java 3 (1968) 474. — *C. stuppeus* FORST. f. [Fl. Ins. Austr. Prod. (1786) 89, nom. nud.] ex KÜK. Bot. Jahrb. 59 (1924) 45. — *C. pennatus* LAMK, Ill. 1 (1791) 144; MIQ. Fl. Ind. Bat. 3 (1856) 281; BENTH. Fl. Austr. 7 (1878) 284; CLARKE, J. Linn. Soc. Bot. 21 (1884) 194; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 148, t. 6 f. 4; KOORD. Exk. Fl. Java 1 (1911) 187; *ibid.* 4 (1922) f. 203; BACK. Onkr. Suiker. (1928) 142, t. 142; KÜK. Pf. R. Heft 101 (1936) 476, f. 53 A–G. — *C. canescens* VAHL, En. 2 (1806) 355; BOECK. Linnaea 36 (1870) 340; SCHEFFER, Nat. Tijd. N. I. 34 (1874) 51. — *C. parviflorus* VAHL, En. 2 (1806) 352. — *Mariscus albensens* GAUDICH. in Freyc. Voy. Bot. (1826) 415; CLARKE, Fl. Br. Ind. 6 (1893) 623; Philip. J. Sc. 2 (1907) Bot. 88; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 74; Fl. Mal. Pen. 5 (1925) 149. — *C. holciflorus* PRESL, Rel. Haenk. 1 (1828) 173; MIQ. Fl. Ind. Bat. 3 (1856) 282; NAVES, Nov. App. (1882) 305. — *C. firmus* PRESL, Rel. Haenk. 1 (1828) 173. — *C. imbricatus* (non RETZ.) LLANOS, Fragm. Pl. Filip. 14 (1851) 17. — ? *C. ovatus* LLANOS, l.c. 15; F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 3 (1880) 10. — *C. stigmatosus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 38; MIQ. Fl. Ind. Bat. 3 (1856) 278; NAVES, Nov. App. (1882) 305. — *C. anomalus* STEUD. Syn. 2 (1855) 37; MIQ. Fl. Ind. Bat. 3 (1856) 277; NAVES, Nov. App. (1882) 305. — *Duvaljouvea pennata* PALLA, Denkschr. K. Ak. Wiss. M.-N. Kl. Wien 84 (1909) 453. — *Mariscus stuppeus* MERR. Philip. J. Sc. 3 (1908) Bot. 398; *ibid.* 9 (1914) Bot. 62; Fl. Manila (1912) 113; Sp. Blanc. (1918) 80; En. Born. (1921) 57. — *Mariscus pennatus* DOMIN, Bibl. Bot. Heft 85 (1915) 440; MERR. En. Philip. 1 (1923) 113. — *Mariscus javanicus* MERR. & METC. Lingn. Sc. J. 21 (1945) 4; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 47. — Fig. 63.

Perennial with very short rhizome; stolons wanting. *Stems* stout, tufted, obtusely trigonous or subterete, smooth, densely papillose, 30–70(–110) cm by up to 4 mm. *Leaves* canaliculate, rigid, coriaceous, more or less spongy, septate-nodulose, very gradually acuminate, with drooping top, very scabrous on keel and margins by antrorse spinules, glaucous or greyish green, 5–10 mm wide; lower sheaths shining, cinnamomeous to castaneous. *Inflorescence* large, compound or decomposed, up to 15 cm across. *Involucral bracts* (3–)5–7, widely spreading with drooping top, the lower ones much overtopping the inflorescence, up to 75 cm. Primary rays up to 12, patent, rigid, papillose, up to 10 cm, secondary ones short, divaricate. *Spikes* broadly cylindrical, obtuse, with up to 50 spikelets,  $1\frac{1}{2}$ –2 by 1– $1\frac{1}{2}$  cm; rachis glabrous, up to 2 cm. *Spikelets* spicately arranged, at right angles to the rachis or the lower ones reflexed, oblong to lanceolate, hardly compressed, somewhat turgid, falling off as a whole, 6–10(–13)-flowered, 5–9(–13) by 2– $2\frac{1}{2}$  mm; rachilla flexuous, broadly winged; wings ovate, yellowish white; internodes  $\frac{1}{2}$ –1 mm. *Glumes* subcoriaceous, subpatulous, ovate or broadly ovate, rather acute, hardly keeled, cellular-reticulate, 7–9-nerved,  $\frac{1}{2}$ – $\frac{2}{3}$  imbricate, at first pale, afterwards shining brown or purplish-lineolate, with green keel and whitish hyaline margins,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by 2– $2\frac{1}{2}$  mm. *Stamens* 3; anthers oblong-linear,  $\frac{3}{4}$ – $1\frac{1}{4}$  mm long. *Style* 1– $1\frac{1}{4}$  mm; stigmas 3, about as long as the style. *Nut* trigonous, ellipsoid or subobovoid, apiculate, shining, dark brown to black,  $1\frac{1}{4}$ – $1\frac{1}{2}$  by  $\frac{3}{4}$ – $\frac{9}{10}$  mm.

Distr. From tropical Africa (very rare) and Madagascar through S. Asia to S. China, the Ryu Kyu Is. and Formosa to the Pacific islands, and through Malesia to tropical Australia; common throughout *Malesia*.

Ecol. Characteristic of open, moist to swampy, usually salt or brackish localities near the sea; sandy foreshores, coral reefs, muddy creek-banks, inner

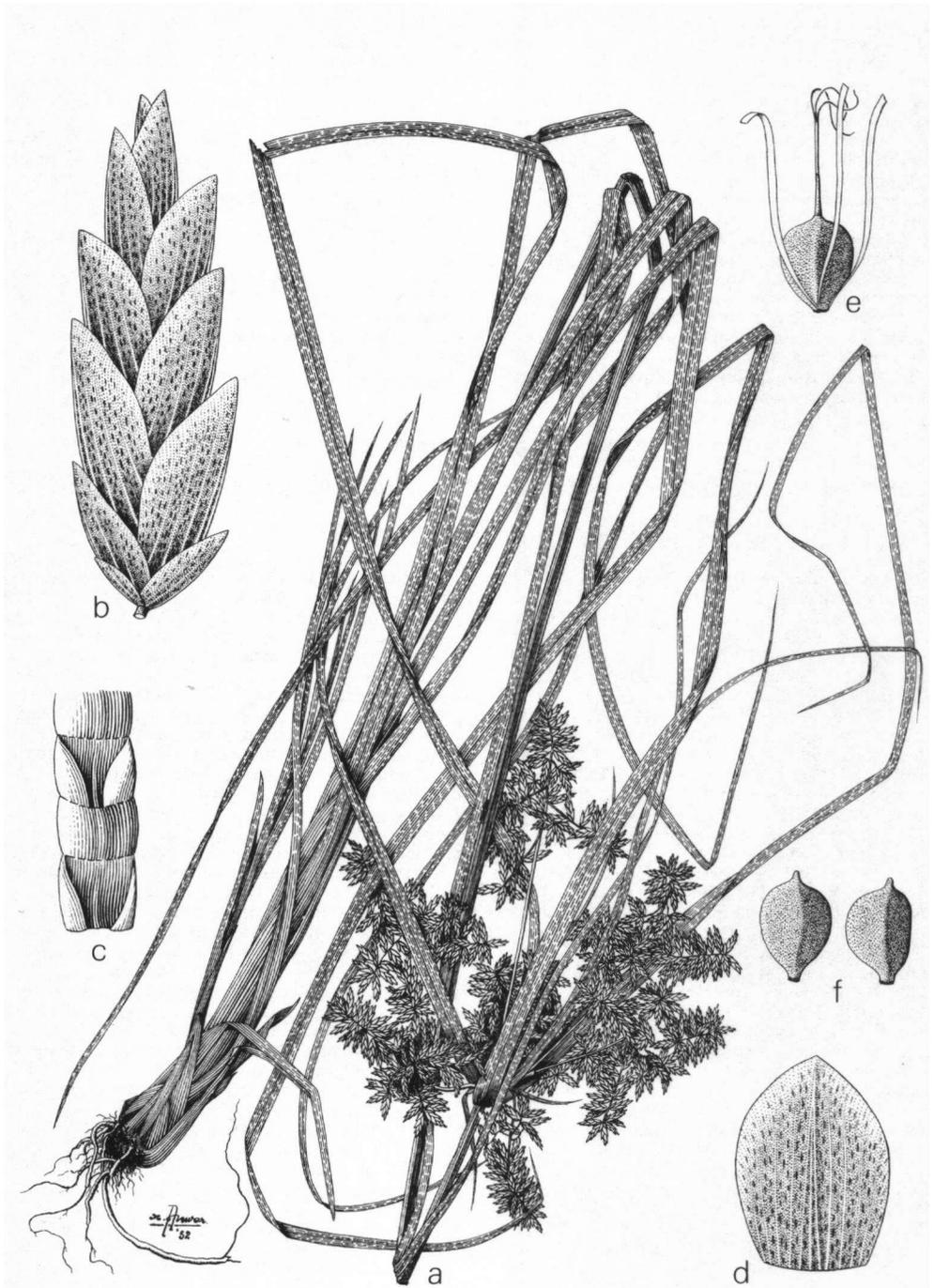


Fig. 63. *Cyperus javanicus* HOUTT. a. Habit,  $\times \frac{1}{2}$ , b. spikelet, c. broadly winged rachilla, enlarged, d. glume, e. deflorate flower, f. nuts, all  $\times 10$  (a ELMER 10295, details KERN 8404).

border of the mangrove; rarely more inland; 0–250 m. See RIDLEY, Disp. (1930) 328.

Vern. *Rumput lingsing*, *s. sarai*, *r. suléngsèng*, *sèndayan*, *M. ilat badak*, *S. dèkèng*, *djèkèng*, *J. adjèn-adjèn*, *wlingi*, *Md. sosa*, *Timor, pèpontak*, *Talau*, *kikisa*, *New Guinea: Wapi lang.*; *Philip: kai-kai*, *Mbo, obod-òbod*, *Ibn., tuhog-dalag*, *Tag.*

Notes. Very near to and possibly not specifically distinct from *C. ligularis* L., which is widely distributed in West Africa and tropical America.

KÜENTHAL, Bot. Jahrb. 69 (1938) 257, referred CARR 11390 to *C. pennatus* var. *armstrongii* (BENTH.) KÜK. Pfl. R. Heft 101 (1936) 479 [*C. armstrongii* BENTH. Fl. Austr. 7 (1878) 289]. To me it is typical *C. javanicus*. See also S. T. BLAKE, J. Arn. Arb. 28 (1947) 223.

48. *Cyperus holoschoenus* R.BR. Prod. (1810) 215; BENTH. Fl. Austr. 7 (1878) 273; KÜK. Pfl. R. Heft 101 (1936) 481; Bot. Jahrb. 70 (1940) 463; Bull. Jard. Bot. Btzg III, 16 (1940) 301, incl. var. *fuscisquamatus* KÜK.; in Fedde, Rep. 53 (1944) 101. — *Mariscus holoschoenus* CLARKE, Kew Bull. add. ser. 8 (1908) 19; DOMIN, Bibl. Bot. Heft 85 (1915) 441.

Perennial with short rhizome (according to BENTHAM *l.c.* rhizome thick, horizontal or creeping). Stems rigid, obtusely trigonous, smooth, leafy in the lower half, 30–60(–80) cm by up to 3 mm. Leaves coriaceous, canaliculate or conduplicate, septate-

nodulose, gradually acuminate, scabrid at the top, 3–4 mm wide; lower sheaths spongy, strongly septate-nodulose, fuscous to brown. Inflorescence compound or subdecompound, loose, up to 13 cm across. Involucral bracts 3–4, patent, the lower ones much overtopping the inflorescence, up to 70 cm. Primary rays 5–8, obliquely patent, slender, up to 8 cm, secondary ones up to 2½ mm, tertiary when present

*Spikes* contracted into dense, globular or ovoid clusters, with many spikelets, 4–7 mm ø. *Spikelets* squarrose, ovate, rather acute, turgid, falling off as a whole, stramineous to brown, 4–8-flowered, 2–3 by 2 mm; rachilla straight, wingless or nearly so; internodes *c.* ⅓ mm. *Glumes* chartaceous, with patulous top, elliptic, obtuse, hardly keeled, minutely mucronulate just below the apex, (7–)9–11-nerved, ½ imbricate, stramineous to brown, *c.* 2 by 1 mm. *Stamens* 3; anthers linear, *c.* ½ mm, the connective produced into an ovate, *c.* ⅓ mm long appendage. *Style* 1·1½ mm; stigmas 3, about as long as the style. *Nut* trigonous, oblong, about as long as the subtending glume, abruptly apiculate, brown, 1¾ by ½ mm.

Distr. Tropical N. Australia and Queensland, in *Malesia*: New Guinea (SW. New Guinea: Kurik nr Merauke; Papua: W. Division, Dagwa, Oriomo River; Morehead R.).

Ecol. In swampy places at low altitudes; in Papua on shallow margins of a lagoon on savannah, 40 m.

#### 24. Section Thunbergiani

CLARKE in Thiselt.-Dyer, Fl. Cap. 7 (1897) 186.

Type species: *C. thunbergii* VAHL.

49. *Cyperus lucidus* R.BR. Prod. (1810) 218; BOECK. Linnaea 36 (1870) 355, *p.p., excl. pl. brasil.*; BENTH. Fl. Austr. 7 (1878) 283; KÜK. Pfl. R. Heft 101 (1936) 448. — *Mariscus lucidus* CLARKE, Kew Bull. add. ser. 8 (1908) 18; DOMIN, Bibl. Bot. Heft 85 (1915) 442.

Rhizome very short, thick; stolons wanting. Stems tufted, stout, prominently trigonous, smooth, not papillose, 30–100(–120) cm by up to 8 mm. Leaves often longer than the stem, rigid, coriaceous, strongly septate-nodulose, flat or canaliculate, very scabrous on the margins in the upper part and on the midrib beneath, very gradually attenuate, 5–20 mm wide; lower sheaths brown, finally dark brown to blackish. Involucral bracts 5–7, often very broad, patent, the lower ones far overtopping the inflorescence, purplish brown at the very base. Inflorescence large, compound, up to 10-radiate. Primary rays very unequal in length, compressed, smooth, the longest up to 20 cm, their tubular prophylls purple, up to 4 cm; secondary rays short, sometimes up to 2 cm. *Spikes* rather dense to dense, the terminal one oblong-cylindric, 2–3 cm wide, the lateral ones smaller, divergent. *Spikelets* obliquely to widely spreading, spicately arranged, oblong-linear to linear-lanceolate, flattened, acute, falling off as a whole, 6–20 by 1½–2

mm, 3–8-flowered; rachilla distinctly winged; wings whitish hyaline. *Glumes* erect, finally somewhat patulous, oblong-ovate or elliptic, acute, of a rich brown, with green keel and 2–3-nerved sides, the longest 4–6 mm. *Stamens* 3; anthers linear, 1½–2 mm long; connective shortly produced. *Stigmas* 3. *Nut* oblong-linear, triquetrous, acuminate, greyish brown, 2½–2¾ by ¾ mm.

Distr. Australia (Queensland, New South Wales, Victoria, Tasmania), in *Malesia* twice collected in New Guinea: Western Highland Distr., Wabag area, Sirunke.

Ecol. In reed swamps, forming almost pure communities over large areas; *c.* 2500 m altitude.

Note. According to KÜENTHAL, *l.c.*, by far the greater part of the Australian specimens belong to:

*var. sanguineo-fuscus* (NEES) KÜK. Pfl. R. Heft 101 (1936) 449. — *C. sanguineo-fuscus* NEES, Ann. Nat. Hist. 6 (1841) 46, based on a Brazilian collection and a Tasmanian one. — Differing from typical *C. lucidus* by the more distant glumes and the linear-oblong nut (obovate in *var. lucidus*). The New Guinea specimens may belong here, but I have not seen BROWN's type of *C. lucidus*.

#### 25. Section Pinnati

KÜK. Pfl. R. Heft 101 (1936) 451.

Type species: *C. angustatus* R.BR.

50. *Cyperus angustatus* R.Br. Prod. (1810) 214; KUNTH, En. 2 (1837) 111; STEUD. Syn. 2 (1855) 53; BOECK. Linnaea 38 (1874) 366; BENTH. Fl. Austr. 7 (1878) 282; KÜK. Pfl. R. Heft 101 (1936) 452. — *Mariscus angustatus* CLARKE, Kew Bull. add. ser. 8 (1908) 19; DOMIN, Bibl. Bot. Heft 85 (1915) 444.

Perennial with very short rhizome. *Stems* slender but rigid, densely tufted, obtusely trigonous, smooth, striate, 30 cm by 2–3 mm. *Leaves* few, mostly shorter than the stems, narrowly linear, rigid, involute, not or hardly septate-nodulose, greyish green, scabrid on the margins in the upper part, 2–4 mm wide. *Inflorescence* compound, loose. Involucral bracts 3–6, the lower 1–2 much overtopping the inflorescence. Primary rays 6–12, obliquely spreading, very unequal, slender, smooth, the longest up to 12 cm, secondary ones capillary, divaricate, up to 3 cm. *Spikelets* stellately spreading, in clusters of 3–10 together, narrowly linear, acute, scarcely compressed, 8–14(–20)-flowered, 6–12 by 1 mm; rachilla narrowly hyaline-winged, persistent. *Glumes* membranous, ovate, appressed or finally slightly spreading, obtuse, keeled, shortly mucronulate just below the apex, rather remote (c.  $\frac{1}{2}$  imbricate), with green keel and yellowish to golden brown sides, 7-nerved, c. 2 by  $1\frac{1}{2}$  mm. *Stamens* 3; anthers short, linear-oblong, c.  $\frac{1}{2}$  mm long, with short, smooth, hyaline appendage of the connective. *Style* short; stigmas 3, longer than the style. *Nut* about as long as the subtending glume, triquetrous, linear-oblong, obtuse, apiculate, brown, c. 2 by  $\frac{1}{2}$  mm.

Distr. Tropical Australia (N. Australia, Queensland), in *Malesia*: once (1962) collected in S. New Guinea, near Kurik.

Ecol. In wet localities, at low altitude.

Notes. The species belongs to a most difficult group of Australian forms which needs to be monographed. According to S. T. BLAKE, Proc. R. Soc. Queensl. 51 (1940) 42–47, KÜKENTHAL's arrangement of the forms and his key to them in Pflanzenreich is very unsatisfactory.

The New Guinea specimens are much larger than the type, a single culm in BM, of which there seem to be no duplicates anywhere. Also in Australia the species has been rarely collected.

CLARKE and KÜKENTHAL placed *C. angustatus* and allies in the genus resp. subgenus *Mariscus*. DOMIN and S. T. BLAKE, *l.c.*, pointed to the fact that in some species of the group the rachilla is persistent and the glumes are deciduous, while in others the

characters of *subg. Mariscus* and *subg. Cyperus* are combined.

51. *Cyperus fulvus* R.Br. Prod. (1810) 215; KUNTH, En. 2 (1837) 111; STEUD. Syn. 2 (1855) 53; BENTH. Fl. Austr. 7 (1878) 274; KÜK. Pfl. R. Heft 101 (1936) 456; S. T. BLAKE, J. Arn. Arb. 35 (1954) 237. — *C. sieberi* KUNTH, En. 2 (1837) 96; STEUD. Syn. 2 (1855) 51; BOECK. Linnaea 35 (1868) 608. — *Mariscus fulvus* CLARKE, Kew Bull. add. ser. 8 (1908) 18; Ill. Cyp. (1909) t. 30 f. 7–8; DOMIN, Bibl. Bot. Heft 85 (1915) 443.

Perennial with very short rhizome. *Stems* rigid, densely tufted, trigonous, or triquetrous above, smooth or scabrid below the inflorescence, striate, (10–)30–60 cm by 2–3 mm, the base almost bulbous by broad, brown, many-nerved sheaths. *Leaves* crowded, mostly shorter than the stems, linear, rigid, keeled-complicate, septate-nodulose, light or greyish green, scabrous on the margins, (2–)4 mm wide. *Inflorescence* simple or subcompound. Involucral bracts 4–5, patent, finally reflexed, lower 2 overtopping the inflorescence. Primary rays 5–10, rather firm, obliquely spreading, unequal, up to 5 cm, secondary ones when present very short, divaricate. *Spikelets* globose or hemispherical, very dense, with 6–numerous spikelets, 5–10 mm ø. *Spikelets* stellately spreading, linear-lanceolate, rather acute, slightly compressed, 6–many-flowered, 5–20 by 2–3 mm; rachilla very narrowly winged, deciduous or persistent. *Glumes* firm, broadly ovate, finally patulous, obtuse, shortly mucronulate, somewhat remote, with green keel and fulvous or golden brown sides, shiny, 7–9-nerved, 2–2 $\frac{1}{2}$  mm long. *Stamens* 3; anthers linear,  $\frac{2}{3}$ –1 mm, with short, smooth appendage of the connective. *Style* very short; stigmas 3, longer than the style. *Nut* somewhat shorter than the subtending glume, triquetrous, oblong-obovate, conically apiculate, yellowish brown, densely punctulate,  $1\frac{1}{2}$ –2 by  $\frac{2}{3}$ –1 mm.

Distr. Widely distributed in NE. Australia, in *Malesia* once collected: New Guinea, Papua, near Quaipe (MACGREGOR in 1889). Not seen.

Note. Highly variable. S. T. BLAKE, *l.c.*, referred the Papuan collection to *var. confusus* (CLARKE) KÜK. Pfl. R. Heft 101 (1936) 456. — *Mariscus fulvus var. confusus* CLARKE ex DOMIN, Bibl. Bot. Heft 85 (1915) 444, although in his opinion it is doubtful how much importance can be assigned to the varieties that have been described. See also DOMIN, *l.c.*

## 26. Section Flabelliformes

(CLARKE) KERN, *comb. nov.* — *Mariscus sect. Flabelliformes* CLARKE, Fl. Br. Ind. 6 (1893) 624. — *Cyperus sect. Subulati* CLARKE, Kew Bull. add. ser. 8 (1908) 100.

Type species: *C. subulatus* R.Br.

52. *Cyperus compactus* RETZ. Obs. 5 (1789) 10; KÜK. Pfl. R. Heft 101 (1936) 423, *incl. var. macrostachys* KÜK. *et f. decolorans* KÜK., *excl. var. pauciflorus* KÜK.; Bot. Jahrb. 69 (1938) 256; S. T. BLAKE, J. Arn. Arb. 28 (1947) 221; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 473. — *C. dilatatus* VAHL, En. 2 (1806) 357; MIQ. Fl. Ind. Bat. 3 (1856) 285;

BOECK. Linnaea 36 (1870) 354, *incl. var. macrostachys* BOECK.; CLARKE, J. Linn. Soc. Bot. 21 (1884) 193; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 146, t. 5 f. 3; KOORD. Exk. Fl. Java 1 (1911) 187; *ibid.* 4 (1922) f. 202; KÜK. Bot. Jahrb. 59 (1924) 45, *incl. f. decolorans* KÜK.; BACK. Onkr. Suiker. (1928) 141, t. 141. — *Mariscus microcephalus* PRESL, Rel. Haenk. 1 (1828)



Fig. 64. *Cyperus dietrichiae* BOECK. a. Habit,  $\times \frac{2}{5}$ , b. spikelet,  $\times 4$ , c. rachilla,  $\times 8$ , d. glume,  $\times 8$ , e. nut,  $\times 8$  (a-e PARKINSON s.n., from New Britain).

182; MIQ. Fl. Ind. Bat. 3 (1856) 290; CLARKE, Fl. Br. Ind. 6 (1893) 624; Philip. J. Sc. 2 (1907) Bot. 88; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 74; Fl. Mal. Pen. 5 (1925) 149. — *Mariscus dilutus* NEES in Wight, Contr. (1834) 90; MERR. En. Philip. 1 (1923) 112. — *C. haenkeanus* KUNTH, En. 2 (1837) 93. — *C. quadriflorus* LLANOS, Fragm. Pl. Filip. (1851) 17 ('*cuadriflorus*'); F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 3 (1880) 12. — *C. septatus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, *nom. nud.*] Syn. 2 (1855) 46; MIQ. Fl. Ind. Bat. 3 (1856) 284. — *C. microcephalus* NAVES, Nov. App. (1882) 304, *non* R.Br. 1810. — ? *C. grabowskianus* BOECK. Bot. Jahrb. 5 (1884) 502. — *C. luzoniensis* LLANOS in Blanco, Fl. Filip. ed. 3, 3 (1880) 12. — *Sphaeromariscus microcephalus* CAMUS, Not. Syst. 1 (1910) 239; Fl. Gén. 1.-C. 7 (1912) 79. — *Mariscus compactus* BOLDINGH, Zakfl. Landbouwstr. Java (1916) 77; DRUCE, Rep. Bot. Exch. Cl. 1916 (1917) 634; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 49. — *Dualjouvea diluta* PALLA, Allg. Bot. Zeitschr. 17 (1912) Beil. 8.

Perennial with very short rhizome; stolons wanting. Stems subscapitose, usually robust, obtusely trigonous or subterete, smooth, (15-)50(-100) cm by up to 6 mm. Leaves rigid, strongly canaliculate, strikingly septate-nodulose, scabrous on the margins and midrib in the upper part, glaucous, 5-10(-12) mm wide; lower sheaths spongy, strongly septate-nodulose, reddish brown. Inflorescence usually large, compound or decompound, up to 20(-30) cm across. Involucral bracts numerous, patent, finally reflexed, the lower ones much overtopping the inflorescence, up to 1 m. Primary rays (6-)8-12, spreading, up to 18 cm long, secondary ones up to 3 cm, sometimes branched again. Spikes globose or subglobose, very dense, with numerous (-70) stellately spreading spikelets, 1-2(-4) cm across; rachis short, up to 4 mm. Spikelets squarrose, linear-lanceolate, almost subulate, subterete or slightly compressed, falling off as a whole, 4-8(-14)-flowered, 5-15 by 1-1½ mm; rachilla flexuous, distinctly winged; internodes 1¼-1¾ mm. Glumes membranous, convolute, with rounded or slightly keeled back, oblong-lanceolate, obtusish, muticous, 3-nerved in the green centre, with faintly 2-3-nerved, reddish brown sides (rarely paler), remote (¼-½ inbricate), 3-4½ by 1-1½ mm. Stamens 3; anthers oblong-linear, ¾-1 mm. Style halfway 3-fid. Nut trigonous, oblong-linear, slightly convex on one side, apiculate-rostrate, brown, 1½-2 by c. ½ mm.

Distr. From India to S. China and Formosa; introduced into Reunion and Mauritius; throughout *Malesia*, in most parts common.

Ecol. Swamps, wet rice-fields, swampy grassfields, coastal marshes, forest-edges, along ditches and river-banks, 0-500 m, sometimes up to 1000 m; often gregarious and then striking by the large, reddish brown inflorescences.

Vern. *Prumpungan*, M (Deli), *peperah*, Alas-lands, *djékèng*, S, *sukèt tèké*, J, *pajong krah*, *uru humbut*, E. Borneo, *totoboh*, N. Borneo, *kikisanki*, New Guinea; *Wampi lang.*; Philip.: *baki-báking-pulá*, S. L. Bis., *durugi*, Sub., *giron*, Bag., *kadang-kadang*, Bik., *tikai*, Tag.

Note. I have not seen the GRABOWSKY collection from Borneo on which BOECKLER founded his *C. grabowskianus*, "*species insignis in viciniam C. scabridis et C. ehrenberghiani*". I doubt whether KÜENTHAL's reduction to *C. compactus* is right as the young plant was described as having cylindrical-ovoid, small spikes and 2-flowered spikelets.

53. *Cyperus dietrichiae* BOECK. Flora 58 (1875) 87; KÜK. Bot. Jahrb. 59 (1924) 46; Pfl. R. Heft 101 (1936) 424, f. 48A-C. — *C. trichostachys* BENTH. Fl. Austr. 7 (1878) 287. — *Mariscus dietrichiae* CLARKE, Kew Bull. add. ser. 8 (1908) 20. — Fig. 64.

Perennial with very short rhizome; stolons wanting. Stems tufted, rigid, triquetrous, smooth, 30-80 cm by 1-2 mm. Leaves herbaceous, flat, gradually acuminate, scabrid in the upper part, (1-)2-4(-7?) mm wide; lower sheaths membranous, pale. Inflorescence simple or subcompound, loose. Involucral bracts 3-7, patent, the lower ones as long as or overtopping the inflorescence. Primary rays 5-10, spreading, very slender, smooth, the longer ones up to 20 cm, often with 1-2 setaceous, patent or reflexed, up to 4 cm long secondary rays. Spikes broadly ovoid, with 10-25 spikelets, 2½-3(-4) cm wide; rachis 1-1½ cm long. Spikelets filiform, subterete, acute, 4-8-flowered, 10-15 by ½ mm, the upper ones erect to spreading, the lower ones at right angles to the rachis to strongly reflexed, falling off as a whole; rachilla slightly flexuous, broadly winged; wings whitish hyaline; internodes c. 2 mm. Glumes remote (the top not reaching the base of the next higher one at the same side of the rachilla), appressed or only the apex somewhat patulous, narrowly oblong, acutish, not keeled, muticous, with green midnerve and rufous sides, 9-11-nerved, 3-3¼ by 1 mm. Stamens 3; anthers small, oblong-linear, c. ½ mm. Stigmas 3. Nut trigonous, oblong-linear, acuminate, apiculate, brown, 2-2¼ by ½-¾ mm.

Distr. Tropical Australia (Queensland), in *Malesia*: New Britain, twice collected.

Ecol. On black volcanic soil, at low altitude.

Note. In habit, and by the narrow spikelets, the distant glumes, and the narrow nut, very similar to and therefore confused with *C. distans* L. f., in which, however, the rachilla is persistent, the spikelets are c. 1 mm wide, the lowermost spikelets never strongly reflexed, the glumes shorter, more obtuse, with nerveless sides, and the rachilla-internodes and nuts shorter.

## 27. Section Strigosus

KÜK. Pfl. R. Heft 101 (1936) 404.

Type species: *C. strigosus* L.

54. *Cyperus stenophyllus* VALCK. SUR. Nova Guinea 8 (1912) 701, t. 114; KÜK. Bot. Jahrb. 59 (1924) 47, *incl. var. ornans* KÜK.; S. T. BLAKE, J. Arn. Arb.

28 (1947) 221; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 474. — *Mariscus flabelliformis* (*non* KUNTH) CLARKE, Philip. J. Sc. 2 (1907) Bot. 89. — *Mariscus*

*tenuifolius* (non NEES) CLARKE, *l.c.* 87; MERR. EN. Philip. 1 (1923) 114. — *C. ornans* VALCK. SUR. Nova Guinea 8 (1912) 700, t. 113; KÜK. Pfl. R. Heft 101 (1936) 418, *incl. var. stenophyllus* KÜK.; Bot. Jahrb. 69 (1938) 256.

Perennial with short rhizome; stolons absent. Stems tufted, slender, triquetrous, smooth, thickened at the base, 10–40 cm by  $\frac{1}{2}$ –1 mm. Leaves weak to rather stiff, gradually acuminate, scabrid in the upper part, (1)–2–4 mm wide; lower sheaths dark brown. Inflorescence simple, loose or more or less contracted, sometimes reduced to a single ray. Involucral bracts 3–5, patent, much overtopping the inflorescence, up to 30(–50) cm long. Rays (1)–3–6, divergent, slender or very slender, smooth, up to 4 cm. Spikes broadly ovoid, with c. 8–25 spikelets, 1–2 by 3(–4) cm; rachis short, 1–1½ cm. Spikelets at first obliquely erect, finally horizontally spreading to somewhat reflexed, linear, acute, slightly compressed, falling off as a whole, up to 12-flowered, 10–20 by 1–1½ mm; rachilla flexuous, broadly winged; wings hyaline, tightly clasping the nut; internodes 1½–2 mm. Glumes membranous, appressed, oblong, subacute,

minutely mucronulate, hardly or slightly imbricate, strongly 7–9-nerved, with green keel, stramineous sides, and hyaline margins,  $3\frac{3}{4}$ –4 by  $1\frac{3}{4}$ –2 mm. Stamens 3; anthers linear, 1–2 mm. Style 1–1½ mm; stigmas 3. Nut trigonous, oblong-ellipsoid, concave on the ventral side, with straight dorsal angle and convex lateral ones, shining, light brown, 2–2¼ by  $\frac{3}{4}$ –1 mm.

Distr. Solomon Islands, Melanesia, in *Malesia*: Java (mainly in the eastern part), Lesser Sunda Is. (Babar), Philippines (Palawan, Luzon, Panay, Mindanao, Sulu Is.), Moluccas (Ternate), New Guinea.

Ecol. Damp to dry places, usually under light shade: road-sides, open forests, river-banks, thickets, at low altitude, up to 750 m.

Vern. *Dèkèng*, *djèmbrahan raman*, J; Philip.: *bakis-bakistan*, Tag.

Note. Near to the Australian *C. bowmannii* F.v.M. ex BENTH., which differs by the slightly narrower spikelets, the lighter coloured basal sheaths, and the remote glumes.

## 28. Section *Mariscus*

(VAHL) BENTH. Fl. Austr. 7 (1878) 288. — *Mariscus* VAHL, En. 2 (1806) 372. — *Cyperus* sect. *Umbellati* CLARKE, Fl. Br. Ind. 6 (1893) 620.

Type species: *Mariscus capillaris* VAHL.

55. *Cyperus cyperinus* (RETZ.) VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 154, t. 6 f. 10; KOORD. Exk. Fl. Java 1 (1911) 187; BACK. Onkr. Suiker. (1928) 143, t. 143; KÜK. Pfl. R. Heft 101 (1936) 518; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 474. — *Kyllingia cyperina* RETZ. Obs. 6 (1791) 21. — *Mariscus cyperinus* VAHL, En. 2 (1806) 377; CLARKE, Fl. Br. Ind. 6 (1893) 621; Philip. J. Sc. 2 (1907) Bot. 87; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 73; CLARKE, Ill. Cyp. (1909) t. 22, f. 3–4; MERR. En. Philip. 1 (1923) 112; RIDL. Fl. Mal. Pen. 5 (1925) 149; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 47. — *Mariscus umbellatus* (non VAHL) MOR. Syst. Verz. (1846) 98; ZOLL. Syst. Verz. 1 (1854) 63. — *Mariscus sundaicus* MIQ. Fl. Ind. Bat. 3 (1856) 289. — *Mariscus umbellatus f. contractus* MIQ. Sum. (1861) 600. — *C. umbellatus* (non BENTH.) NAVES, Nov. App. (1882) 305. — *C. sundaicus* NAVES, *l.c.* 306. — *C. steudelianus* (non BOECK.) NAVES, *l.c.* 306. — *C. umbellatus f. cyperinus* CLARKE, J. Linn. Soc. Bot. 21 (1884) 200. — *C. manilensis* BOECK. Bot. Jahrb. 5 (1884) 501. — *C. panicus* (non BOECK.) O. K. Rev. Gen. Pl. 2 (1891) 750. — *Mariscus umbellatus* var. *cyperinus* CAMUS, Fl. Gén. I.-C. 7 (1912) 77. — *C. cyperoides* ssp. *cyperinus* KÜK. Bot. Jahrb. 59 (1924) 46; Candollea 6 (1936) 424.

Perennial with very short rhizome; stolons absent. Stems tufted, rigid, triquetrous, smooth, somewhat incrassate at the base which is clothed with the fibrous remains of old leaf-sheaths, 15–45(–60) cm by 1–3 mm. Leaves shining greyish green, rigid, flat or canaliculate, long-attenuate, scabrid on margins and keel, 3–6 mm wide; lower sheaths reddish to dark brown. Inflorescence simple (very rarely subcompound), usually contracted and head-like. Involucral bracts 5–10, obliquely patent to patent,

much overtopping the inflorescence, the longest up to 40 cm. Rays 5–10, spreading, usually less than 1 cm, rarely longer than 2 cm. Spikes broadly cylindrical to obovoid, usually attenuate towards the base, dense, with up to 80 spikelets, 1–2 cm by 8–10 mm. Spikelets obliquely erect, rarely more spreading, oblong-linear, subterete also in fruit, (1)–2–3(–4)-flowered, falling off as a whole, 3–5(–7) by 1–1¼ mm; rachilla broadly winged; wings hyaline, tightly clasping the nut, c. ½ mm wide; internodes 1½–2 mm. Glumes subchartaceous, appressed, elliptic, rather obtuse, mucronate or minutely mucronulate, ½ imbricate, with green, 3-nerved keel and brownish green to fuscous, 3–4-nerved sides, 3–4 by 1¾–2 mm. Stamens 3; anthers linear, 1–1½ mm. Stigmas 3, longer than the style. Nut trigonous, ellipsoid or oblong-ellipsoid, slightly curved, shortly apiculate, brown, (1¼–)2–2½ by  $\frac{3}{5}$ – $\frac{9}{10}$  mm.

Distr. From S.E. Asia (India, Farther India, S. and E. China, Formosa, Ryu Kyu Is.) to Melanesia, Polynesia and Australia (Queensland); common throughout *Malesia*.

Ecol. In open or partly shaded, somewhat moist to rather dry localities: secondary forests, old clearings, road-sides, river-banks, etc., at low and medium altitudes (0–1300 m); on Mt Tengger (E. Java) up to 2100 m, on Mt Rindjani (Lombok) up to 2000 m.

Vern. *Rumput katèlan*, *r. payong*, *r. pinang*, M, *walinian*, S, *papara*, Talaud; Philip.: *alúsang*, *alúsang-párang*, *ubud-ubud*, Tag., *bubuyankat*, Sub., *busikad-dako*, C. Bis., *hand*, Iv., *saka-an*, Ig., *silal*, Bik.

Note. Typical, fruiting specimens can be distinguished from the closely related *C. cyperoides* by the stiff leaves, the contracted inflorescence, the shorter and denser spikes, the obliquely erect, darker

spikelets, the broader, more obtuse glumes, and the broader, ellipsoid nuts; all these characters are very variable. See also varieties.

*var. maximus* (CLARKE) KÜK. Pfl. R. Heft 101 (1936) 520. — *C. andersonianus* BOECK. Bot. Jahrb. 5 (1884) 502. — *Mariscus cyperinus var. maximus* CLARKE, J. Linn. Soc. Bot. 34 (1898) 43. — *C. cyperinus f. maxima* CLARKE ex VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 156, t. 6 f. 11. — *C. cyperoides ssp. cyperinus var. andersonianus* KÜK. Bot. Jahrb. 59 (1924) 46.

Stems stouter, up to 3½ mm thick. Bracts up to 12, very long, up to 60 cm. Rays of the inflorescence up to 16, often well-developed, up to 8 cm. Spikes very dense, up to 1½ cm wide. Spikelets patent, up to 8 mm, 4-flowered.

Distr. India; in *Malesia*: Sumatra, Java, Borneo, Sumbawa, Mindanao.

Note. Shows several characters of *C. cyperoides*, but the nut is that of *C. cyperinus*.

*f. curvatus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 156.

Stems slender, c. 1 mm thick. Leaves narrow, 1–2 mm wide. Spikes short, c. 1 cm long and wide. Spikelets curved.

Distr. *Malesia*: W. Java (Wijkoopbaai, JUNGHUHN; Krawang, BLUME). Not recently collected.

Note. By KÜKENTHAL (Pfl. R. Heft 101, 1936, 519) referred to *C. cyperinus var. laxatus* (CLARKE) KÜK., though the specimens on which the forma was based are cited (*l.c.* 526) under *C. paniceus* (ROTTB.) BOECK. By its slender habit similar to this species, but differing by the absence of stolons, the larger, often 2-flowered spikelets, and the larger nuts.

The *Malesian* specimens cited by KÜKENTHAL, *l.c.*, under *C. cyperinus var. pictus* (NEES) KÜK. and *var. bengalensis* (CLARKE) KÜK. are in my opinion typical *C. cyperinus*.

56. *Cyperus cyperoides* (L.) O. KUNTZE, Rev. Gen. Pl. 3, 2 (1898) 333; KÜK. Pfl. R. Heft 101 (1936) 514; S. T. BLAKE, J. Arn. Arb. 28 (1947) 224; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 474. — *Scirpus cyperoides* LINNÉ, Mant. 2 (1771) 181. — *Kyllingia sumatrensis* RETZ. Obs. 4 (1786) 13. — *Kyllingia umbellata* ROTTB. Descr. & Ic. (1773) 15, non t. 4 f. 2. — *Kyllingia umbellata var. sumatrensis* WILLD. Sp. Pl. 1 (1797) 258. — *Mariscus umbellatus* VAHL, En. 2 (1806) 376; MIQ. Fl. Ind. Bat. 3 (1856) 288; CAMUS, Fl. Gén. I.-C. 7 (1912) 76, excl. *var. paniceus* CLARKE et *var. cyperinus* CAMUS. — *Mariscus sieberianus* NEES [Linnaea 9 (1835) 286, *nom. nud.*] ex CLARKE, Fl. Br. Ind. 6 (1893) 622; Philip. J. Sc. 2 (1907) Bot. 88; Ill. Cyp. (1909) t. 23 f. 5–6; MERR. En. Philip. 1 (1923) 114; RIDL. Fl. Mal. Pen. 5 (1925) 148. — *Mariscus philippensis* STEUD. Syn. 2 (1855) 66; MIQ. Fl. Ind. Bat. 3 (1856) 290; CLARKE, Philip. J. Sc. 2 (1907) Bot. 88. — *Mariscus concinnus* SCHRADER ex NEES, Fl. Bras. 2, 1 (1843) 47; MIQ. Fl. Ind. Bat. 3 (1856) 289. — *C. umbellatus* BENTH. Fl. Hongkong (1861) 386; Fl. Austr. 7 (1878) 289; F.v.M. Descr. Not. 7 (1886) 34; K. SCH. & HOLLR. Fl. Kais. Wilh. Land (1889) 24; SCHUM. in Warb. Bot. Jahrb. 12 (1891) 264, non BURM. f. 1768, nec ROXB. 1820. — *C.*

*cylindrostachys* BOECK. Linnaea 36 (1870) 383, p.p.; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 151, t. 6 f. 6; KOORD. Exk. Fl. Java 1 (1911) 187, non *ibid.* 4 (1922) f. 204. — *C. umbellatus var. cylindrostachys* CLARKE, J. Linn. Soc. Bot. 21 (1884) 201. — *C. rheedii* F.v.M. Descr. Not. 7 (1886) 34. — *C. incompletus* (non LINK) O. K. Rev. Gen. Pl. 2 (1891) 749. — *C. sieberianus* SCHUM. in Engler, Pflanzenw. O. Afr. C (1895) 122; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 193, p.p. — *Mariscus cyperoides* URB. Symb. Ant. 2, 1 (1900) 164; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 47. — ? *Mariscus rechingeri* PALLA, Denkschr. K. Ak. Wiss. M.-N. Kl. Wien 89 (1914) 499, ex descr. — *Mariscus microcephalus var. pauciflorus* PFEIFF. Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 167, f. 1. — *C. compactus var. pauciflorus* KÜK. Pfl. R. Heft 101 (1936) 424; cf. KERN, Reinwardtia 2 (1952) 126.

Perennial with very short rhizome; stolons absent. Stems tufted, rigid, triquetrous, smooth, incrassate at the base which is clothed with the remains of old leaf-sheaths, 20–75 cm by 1–3 mm. Leaves rather weak, flat, gradually long-attenuate, scabrid in the upper part, 3–6 mm wide; lower sheaths reddish brown. Inflorescence simple, rarely subcompound. Involucral bracts 5–10, patent, the lower ones much overtopping the inflorescence, up to 30 cm. Rays 5–17, slender, obliquely patent, straight, smooth, up to 6(–10) cm. Spikes exactly cylindrical when in fruit, obtuse, very dense, with numerous spikelets, 2–4 cm by 6–10 mm. Spikelets at first obliquely erect, finally at right angles to the rachis and the lower ones often reflexed, linear, acute, subterete, maturing (1–)2(–3) nuts (upper flower often ♂), falling off as a whole, 3½–4 by ½–1 mm; rachilla straight, broadly winged; wings hyaline, tightly clasping the nut, c. ½ mm wide; internodes 1½–2 mm. Glumes membranous, appressed, oblong-ovate, rather acute, not keeled, mucous, ½ imbricate, with 3-nerved, green keel and stramineous sides, often ferruginous lineolate, many-nerved, 3–3½ by c. 1 mm. Stamens 3: anthers oblong-linear, ¾–1 mm. Style ½–¾ mm; stigmas 3, longer than the style. Nut trigonous, linear, slightly curved, apiculate, rufous to castaneous, 1½–2¼ by ½ mm.

Distr. Widely spread in the tropics and subtropics of Africa, Asia, and Australia; in the New World only in the West Indies, probably introduced; throughout *Malesia*.

Ecol. Open or lightly shaded grassland, old clearings, secondary forests, road-sides, thickets, often a common weed in gardens, 0–1800 m.

Vern. *Teki idjem*, M, *sukët lumbungan*, *wlingin*, J, *djukut bëbalëan*, *lilisungan*, S, *kumis*, *mota*, *muta*, Md, *lëlassun*, Atjeh, *padang sila*, Asahan, *rumpit plintang dapur*, Banka, *tëtëmung*, S. Sumatra, *mëndarong ëkor tupai*, Johore, *bandang*, *kujuhu*, *kuriup sangau*, Borneo, *wawitiken*, Ceram; New Guinea: *etso*, Mendi, *simboru*, Orokaiva, *tidor*, Enga; Philip.: *kupiupi*, *mañgilar*, Sub., *okokiang*, Bon.

Notes. It seems superfluous to distinguish nomenclaturally such states as *var. subcompositus* (CLARKE) KÜK. Pfl. R. Heft 101 (1936) 516 [*Mariscus sieberianus var. subcompositus* CLARKE, Fl. Br. Ind. 6 (1893) 622; *C. cylindrostachys f. subcompositus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 153 (t. f. 7?)], with some of the spikes bearing a small secondary spike at the base; *var. evolutior* (CLARKE) KÜK. *Sinensia*

3(1932)80 (*Mariscus siberianus* var. *evolutior* CLARKE, l.c.), a more robust form, and var. *microstachys* KÜK. Pfl. R. Heft 101 (1936) 518, with narrower spikes and smaller spikelets.

KÜKENTHAL reduced *Mariscus rechingeri* PALLA to a variety of *C. stenophyllus* VALCK. SUR. (it is also cited in the synonymy of *C. ferax* var. *novae-hannoverae*). The original material (New Britain, RECHINGER 4235) got lost during World War II; from PALLA's description I might infer that it belonged to *C. cyperoides*.

57. *Cyperus paniceus* (ROTTB.) BOECK. Linnaea 36 (1870) 381, p.p.; KÜK. Pfl. R. Heft 101 (1936) 526, excl. *specim. males*. — *Schaenoides paniceus* ROTTB. Descr. Pl. rar. Progr. (1772) 15, nom. provis. — *Kyllinga panicea* ROTTB. Descr. & Ic. (1773) 15, t. 4 f. 1. — *Mariscus paniceus* VAHL, En. 2 (1806) 373; CLARKE, Fl. Br. Ind. 6 (1893) 620; Ill. Cyp. (1909) t. 22 f. 1-2. — *Mariscus pullu* STEUD. Syn. 2 (1855) 66. — *C. umbellatus* var. *paniceus* CLARKE, J. Linn. Soc. Bot. 21 (1884) 201. — *Mariscus umbellatus* var. *paniceus* CAMUS, Fl. Gén. I.-C. 7 (1912) 77.

Typical *C. paniceus* differs from *C. cyperoides* and *C. cyperinus* by the following characters: Rhizome emitting very slender, c. 1 mm thick stolons covered with lanceolate, reddish brown striate sheaths. Stems very slender, (3-)5-30 cm by c. 1/2 mm. Leaves narrow, 1-2 mm wide. Inflorescence simple. Spikes sessile or subsessile, shortly cylindrical, 8-10 by

4-6 mm. Spikelets finally horizontally spreading, lanceolate, slightly curved, 2 1/2-3 by c. 1/2 mm, always bearing 1 nut. Glumes 4, lanceolate-ovate, acute, obscurely nerved, reddish lineolate, the third nut-bearing, c. 2 1/2 mm, the fourth much reduced, sterile. Style very short, stigmas long, reflexed. Nut small, oblong, c. 1 1/3 by 1/2 mm.

Distr. From Lower Bengal and Ceylon to Cochinchina. Not known from Malasia; the records in KÜKENTHAL's monograph for Java refer to *C. cyperinus* f. *curvatus* (see there), that for Luzon to *C. cyperoides*.

In Malasia only:

var. *roxburghianus* (CLARKE) KÜK. Pfl. R. Heft 101 (1936) 526; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 474. — *Mariscus paniceus* var. *roxburghianus* CLARKE, Fl. Br. Ind. 6 (1893) 621.

More robust, with thicker, shorter stolons, and stouter stems up to 60 cm by 1-2 mm. Leaves 2-3 mm wide. Involucral bracts up to 25 cm long. Rays of the inflorescence up to 4 cm. Spikes 8-15 by 6-8 mm. Spikelets 3-4 1/2 by 3/4 mm. Nut-bearing glume 3-4 mm. Nut 2-2 1/4 by 3/5-3/4 mm.

Distr. India; in Malasia only in a few localities in W., Central and E. Java, and in Madura.

Ecol. In teak-forests, 0-150 m.

Note. Possibly more related to *C. cyperinus* than to *C. paniceus*.

## 29. Section *Kyllingioides*

KUNTH, En. 2 (1837) 94. — *Mariscus subg. Bulbocaulis* CLARKE, Fl. Br. Ind. 6 (1893) 619. — *Cyperus* sect. *Bulbocaulis* KÜK. Pfl. R. Heft 101 (1936) 538.

Type species: *C. kyllingaeoides* VAHL.

58. *Cyperus dubius* ROTTB. Descr. & Ic. (1773) 20, t. 4 f. 5; BOECK. Linnaea 36 (1870) 336; CLARKE, J. Linn. Soc. Bot. 21 (1884) 197; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 150, t. 6 f. 5; KOORD. Exk. Fl. Java 1 (1911) 187; *ibid.* 4 (1922) f. 205; KÜK. Pfl. R. Heft 101 (1936) 563; KERN, Reinwardtia 6 (1961) 65; in Back. & Bakh. f. Fl. Java 3 (1968) 473. — *C. kyllingaeoides* VAHL, En. 2 (1806) 312; MIQ. Fl. Ind. Bat. 3 (1856) 286, excl. *pl. molucc.* — *Mariscus dregeanus* KUNTH, En. 2 (1837) 120; CLARKE, Fl. Br. Ind. 6 (1893) 620; Ill. Cyp. (1909) t. 21 f. 1-6; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 72; CAMUS, Fl. Gén. I.-C. 7 (1912) 75, f. 10, 1-4; MERR. En. Born. (1921) 57; RIDL. Fl. Mal. Pen. 5 (1925) 148. — *Mariscus irroratus* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 28. — *Kyllingia multinervis* STEUD. Syn. 2 (1855) 317. — *Mariscus maritimus* MIQ. Sum. (1861) 600; cf. KERN, Reinwardtia 3 (1954) 59. — *C. cruentus* (non ROTTB.) BOECK. Linnaea 36 (1870) 338, p.p. — *C. maritimus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 160, t. 6 f. 13; KOORD. Exk. Fl. Java 1 (1911) 187, non POIR. 1806. — *Mariscus merrillii* CLARKE, Philip. J. Sc. 2 (1907) Bot. 87; MERR. En. Philip. 1 (1923) 113. — *Mariscus niveus* MERR. Philip. J. Sc. 14 (1919) 369; En. Philip. 1 (1923) 113, non *Schoenus niveus* MURR. 1774. — *Mariscus dubius* KÜK. ex FISCHER in Gamble, Fl. Madras 9 (1931) 1644; BACK. Bekn. Fl. Java (em. ed.)

10 (1949) fam. 246, p. 45. — *C. merrillii* KÜK. Pfl. R. Heft 101 (1936) 562.

Perennial with short rhizome; stolons wanting. Stems densely tufted, rather slender, triquetrous, smooth, (5-)15-45 cm by 1-2(-3) mm, the base apparently bulbous by the striate, turgid, scarious, pale to brown lower sheaths, finally surrounded by their fibrous remains. Leaves weak, flat, gradually acuminate, slightly scaberulous at the top, (1 1/2-)2-5 mm wide. Inflorescence contracted into a very dense, lobed head consisting of 1-6 confluent spikes, broadly ovoid, subglobose or suboblong, 1-2 cm long and wide. Involucral bracts 3-5, weak, patent to reflexed, up to 30 cm. Spikelets numerous, patent, ovate to broadly-lanceolate, acute, subterete, somewhat turgid, oblique at the base, falling off as a whole, (2-)3-6-flowered, 4-7 by (1-)1 1/2-2 1/4 mm; rachilla nearly straight, conspicuously winged; wings lanceolate, persistent, whitish hyaline. Glumes subcoriaceous, broadly ovate to lanceolate, obtusish, muticous, 15-19-nerved over the whole breadth, slightly keeled, with at first whitish, finally stramineous to brown sides and hyaline margins, c. 1/2 imbricate, 3-4 by 1 1/2-3 mm. Stamens 3; anthers oblong-linear, 1-1 1/2 mm. Stigmas 3. Nut trigonous, ellipsoid or slightly oblong-ellipsoid, apiculate, castaneous, 1 3/4-2 1/2 by 3/4 mm.

Distr. Widely distributed in the steppes and

coastal regions of Africa; from Ceylon and India through Further India to S. China: in *Malesia*: common on both coasts of the Malay Peninsula and on the sandy beaches of the East Coast of Sumatra; along the shores of the South China Sea (Victory I. near Borneo, Anambas and Natuna Is., Riouu Archipelago, Banka, Billiton, Merak I. in the Sunda Straits); also on the SW. coast of Java (Palabuan Ratu); Philippines (Luzon). See map in Reinwardtia 3 (1954) 61.

Ecol. In W. *Malesia* only near the sea, usually on sandy beaches in fully exposed places, acting as a sand binder; the plant is probably sea-dispersed; see RIDLEY, *Disp.* (1930) 327. In Luzon on wet

banks in ravines and on dry, open, rocky slopes at low altitudes.

Vern. *Umbut-umbut*, Billiton.

Notes. Owing to KUNTH's misinterpretation of RUMPHIUS's *Cyperus longus*, Herb. Amb. t. 2 f. 1, the species is also credited to the Moluccas by MIQUEL, VALCKENIER SURINGAR and KÜKENTHAL. It does not reach eastern *Malesia*. MERRILL rightly reduced RUMPHIUS's figure to *Cyperus pedunculatus* (= *Remirea*).

BOECKELER's 'Philippine' record (as *C. cruentus*) was based on CUMING 2372, which was from Malacca; see Fl. Mal. I, 1 (1950) 121.

### 30. Section *Remirea*

(AUBL.) KOYAMA, Quart. J. Taiwan Mus. 14 (1961) 162. — *Remirea* AUBL. Hist. Pl. Guian. Franç. 1 (1775) 44.

Type species: *Remirea maritima* AUBL.

59. *Cyperus pedunculatus* (R.Br.) KERN, Act. Bot. Neerl. 7 (1958) 798, f. 4; KOYAMA, Quart. J. Taiwan Mus. 14 (1961) 190; KERN in BACK & BAKH. f. Fl. Java 3 (1968) 473. — *C. longus* RUMPH. Herb. Amb. 6 (1750) 5, t. 2 f. 1. — *Remirea maritima* AUBL. Hist. Pl. Guian. Franç. 1 (1775) 45, t. 16; KUNTH, En. 2 (1837) 139; BOECK. Linnæa 35 (1868) 435; NAVES, Nov. App. (1882) 309; CLARKE, Fl. Br. Ind. 6 (1894) 677; Philip. J. Sc. 2 (1907) Bot. 103; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 99; CLARKE, Ill. Cyp. (1909) t. 102 f. 7-10; KOORD. Exk. Fl. Java 1 (1911) 201; *ibid.* 4 (1922) f. 263; CAMUS, Fl. Gén. I.-C. 7 (1912) 155; BACK. Trop. Natuur 8 (1919) 8, f. 15; MERR. En. Born. (1921) 63; En. Philip. 1 (1923) 130; RIDL. Fl. Mal. Pen. 5 (1925) 169; HEYNE, Nutt. Pl. 1 (1927) 312; OHWI, Bot. Mag. Tokyo 56 (1942) 209; KÜK. in Fedde, Rep. 53 (1944) 206; S. T. BLAKE, J. Arn. Arb. 29 (1948) 100; UITT. in BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 48; non *C. maritimus* POIR. 1806. — *Remirea pedunculata* R.Br. Prod. (1810) 236. — *Remirea wightiana* NEES in Wight, Contr. (1834) 92; in Hook. J. Bot. Kew Misc. 6 (1854) 29. — *Mariscus capitatus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 63, *nom. nud.*] Syn. 2 (1855) 60; MIQ. Fl. Ind. Bat. 3 (1856) 288. — *Mariscus pungens* STEUD. Syn. 2 (1855) 60; MIQ. Fl. Ind. Bat. 3 (1856) 288. — *Remirea rigidissima* STEUD. Syn. 2 (1855) 317. — *Lipocarpa foliosa* MIQ. Fl. Ind. Bat. 3 (1856) 332; Sum. (1861) 262. — *Remirea distichophylla* BOECK. Flora 41 (1858) 410. — *Remirea maritima* var. *pedunculata* BENTH. Fl. Austr. 7 (1878) 347; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 198; VALCK. SUR. Nova Guinea 8 (1912) 708; KÜK. Bot. Jahrb. 59 (1924) 53; PFEIFF. in Fedde, Rep. 29 (1931) 184; KÜK. in Fedde, Rep. 53 (1944) 207. — *C. capitatus* (non RETZ.) NAVES, Nov. App. (1882) 306. — *Dualjouea maritima* PALLA in Rech. Denkschr. K. Ak. Wiss. M.-N. Kl. Wien 89 (1913) 500. — Fig. 65.

Rhizome horizontally long-creeping, branched, rooting at the nodes, clothed with membranous, acute, brownish sheaths, 1-3 mm thick, the internodes 3-6 cm long. Stems distant or somewhat tufted from the branched head of the rhizome, rigid, trigonous, smooth, 3-12 cm by 1-2 mm, in the *Malesian* specimens usually well exerted from the

leaves. Leaves crowded, rigid, canaliculate, often recurved, scabrid on the margins in the upper part, 4-5 mm wide at the base, very gradually narrowed into the triquetrous pungent top. Inflorescence head-like, consisting of some digitately arranged, sessile, short spikes. Involucral bracts 3-5(-8), patent to somewhat reflexed, the longest up to 8 cm, much overlapping the inflorescence. Spikes ovoid or ellipsoid, 8-15 by 7-10 mm. Spikelets sessile, densely crowded, ovoid, acute, slightly compressed, 1-flowered, falling off as a whole, 4-5 by 1½-2 mm. Rachilla disarticulating above the basal 1-2 glumes; uppermost internode strongly flattened, similar to the glumes but nerveless, finally much thickened, corky, c. 3 mm long. Glumes broadly ovate, hardly keeled, many-nerved, acute or minutely apiculate, 3 lower ones empty, 2-3 mm long, the 4th flower-bearing, 3½-4½ mm long, the uppermost vestigial. Stamens 3; anthers linear, yellow, with short, conical appendage of the connective, c. 2 mm long. Nut trigonous, oblong, slightly compressed, shining, castaneous to blackish, tightly enclosed in the upper internode of the rachilla, c. 2½ by ¾ mm.

Distr. Pantropical; throughout *Malesia*. Map by MÈGE & BODARD, Bull. Inst. Franc. Afr. Noire A, 23 (1961) 704.

Ecol. On sandy sea-shores and in sandy dunes near the coast, locally often abundant. Fig. 65.

Taxon. The homology of the organ tightly clasping the nut has often been discussed: ROBERT BROWN (1810) took it for the incrassate flower-bearing glume. He was followed by nearly all later authors. KUNTH (1837) disagreed in assuming it to represent the thickened upper internode of the rachilla, but his undoubtedly correct interpretation was only sustained as late as 1922 (CHERMEZON, Bull. Soc. Bot. France 69, 1922, 812), whilst so recently as 1944 KÜKENTHAL stuck to the interpretation as a but slightly transformed glume hardly different from the other glumes.

From the facts mentioned below it can only be concluded that the nut is enclosed in the upper (or rather penultimate) rachilla-internode, and that the species does not belong in *Rhynchosporae*, but in *Cyperus* as circumscribed in the present treatment.

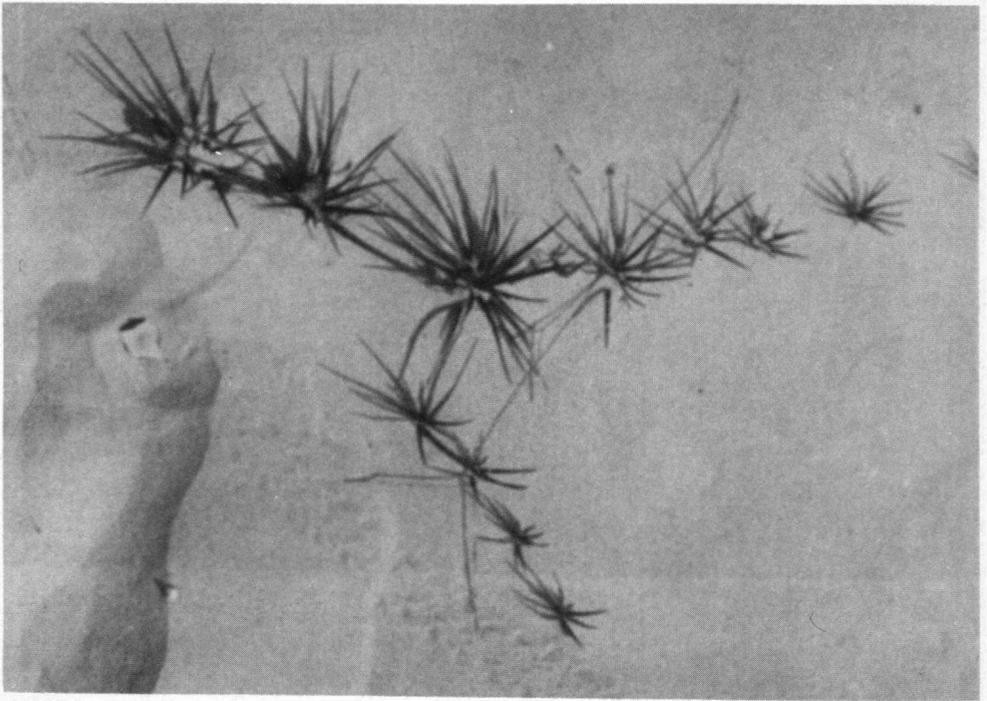


Fig. 65. *Cyperus pedunculatus* (R.Br.) KERN, a characteristic, common, creeping and rooting sedge of the sandy beach, taken from above. Madura I. near East Java (photogr. JESWIET).

- a) The stamens are placed between the 4th glume and the ovary, not between the corky organ and the ovary; as a rule stamens in *Cyperaceae* are placed between the flower-bearing glume and the ovary.
- b) The glumes are all many-nerved, the corky organ is nerveless.
- c) The 4th glume is distinctly longer than the corky organ; in *Cyperaceae* the flower-bearing glumes are always the largest.
- d) The corky organ bears a cucullate appendage with in its axil a short but distinct continuation of the axis; this appendage must be the 5th, vestigial glume.
- e) The nut is flattened against the corky organ; trigonous nuts in *Cyperaceae* are always flattened against the rachilla, having an edge next the subtending glume.

Anatomical and embryological characters corrob-

orate exclusion from *Rhynchosporae*; see VAN DER VEKEN, Bull. Jard. Bot. Brux. 35 (1965) 296.

Notes. The fruits, completely hidden by the corky rachilla-internode, which is moreover wrapped in the upper glumes, are buoyant and easily dispersed by the sea. See CHERMEZON, Bull. Soc. Bot. France 71 (1924) 854, and RIDLEY, Disp. (1930) 328.

The rhizome is fragrant; its use as an aromatic was mentioned by RUMPHIUS.

In American and African specimens the stems are usually leafy almost to the top, in Asiatic and Australian ones they are mostly well exerted from the leaves. On this ground R. BROWN distinguished the Australian plants as *Remirea pedunculata*. KÜKENTHAL, following BENTHAM, reduced BROWN's species to varietal rank. As there is every gradation from included to exerted stems and no differences in spikelets, fruits, etc. exist, nomenclatural recognition seems superfluous.

### 31. Section *Diclidium*

(NEES) BENTH. Fl. Austr. 7 (1878) 286. — *Torulinium* DESV. in Hamilt. Prod. Pl. Ind. Occ. (1825) 15. — *Diclidium* SCHRADER ex NEES, Fl. Bras. II, 1 (1842) 51. — *Cyperus* sect. *Feraces* KÜK. Pfl. R. Heft 101 (1936) 614.

Type species: *C. ferax* L. C. RICH.

60. *Cyperus odoratus* LINNÉ, Sp. Pl. 1 (1753) 46; VAHL, En. 2 (1806) 356; BOECK. Linnæa 36 (1870)

407; DANDY in Exell, Cat. Vasc. Pl. S. Thomé (1944) 360; KERN in Back. & Bakh. f. Fl. Java 3

(1968) 473. — *C. ferax* L. C. RICH. Act. Soc. Hist. Nat. Paris 1 (1792) 106; BOECK. *Linnaea* 36 (1870) 399; BENTH. *Fl. Austr.* 7 (1878) 286; CLARKE, J. *Linn. Soc. Bot.* 21 (1884) 191; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 142, t. 6 f. 1; KOORD. *Exk. Fl. Java* 1 (1911) 186; *ibid.* 4 (1922) f. 201; BACK. *Onkr. Suiker.* (1928) 141, t. 140; KÜK. *Pfl. R. Heft* 101 (1936) 615, f. 6, K-P; S. T. BLAKE, J. *Arn. Arb.* 28 (1947) 226. — *Torulinium ferax* HAMILT. *Prod. Pl. Ind. Occ.* (1825) 15 (*'ferox'*); MERR. *En. Philip.* 1 (1923) 114; BACK. *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 48. — *Torulinium confertum* DESV. *ex* HAMILT. *Prod. Pl. Ind. Occ.* (1825) 15; USTERI, *Beitr. Kenntn. Philip. Veg.* (1905) 131; CLARKE, *Philip. J. Sc.* 2 (1907) Bot. 89; III. *Cyp.* (1909) t. 31 f. 1-4. — *C. haenkei* PRESL, *Rel. Haenk.* 1 (1828) 172. — *Diclidium elatum* NEES in Hook. J. *Bot. Kew Misc.* 6 (1854) 27, non *C. elatus* L. — *C. bracteolatus* STEUD. *Syn.* 2 (1855) 49; MIQ. *Fl. Ind. Bat.* 3 (1856) 286. — *C. nitidulus* BOECK. *Linnaea* 36 (1870) 363; SCHEFF. *Nat. Tijd. N. I.* 34 (1874) 51. — *C. novae-hannoverae* BOECK. *Bot. Jahrb.* 5 (1884) 91; VALCK. *SUR. Nova Guinea* 8 (1912) 701. — *Mariscus ferax* CLARKE, *Fl. Br. Ind.* 6 (1893) 624; RIDL. *J. Str. Br. R. As. Soc.* 46 (1906) 223. — *C. michauxianus* (non TORR.) VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 143, t. 6 f. 2; KOORD. *Exk. Fl. Java* 1 (1911) 186. — *C. ferax* var. *novae-hannoverae* KÜK. *Bot. Jahrb.* 59 (1924) 46; Pfl. R. *Heft* 101 (1936) 618. — *Mariscus sieberianus* var. *evolutior* (non CLARKE) RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 73; *Fl. Mal. Pen.* 5 (1925) 149.

Annual with fibrous roots (perennial under favourable circumstances?). *Stems* usually stout, solitary or 2-3 together, trigonous, triquetrous in the upper part, smooth, 20-100 cm by up to 6 mm, leafy up to 30 cm above the incrassate base. *Leaves* subcoriaceous, flat, shortly acuminate, scabrid on the margins, up to 12 mm wide. *Inflorescence* compound or decompound, rather loose to dense, 5-25 cm across. *Involucral bracts* 6-8, spreading, the larger ones far overtopping the inflorescence, up to 50 cm. *Primary rays* 7-12, obliquely patent, smooth, up

to 20 cm; cladophylls usually with a short leafy blade. *Spikes* ovoid to oblong,  $1\frac{1}{2}$ -3 cm wide; rachis narrowly winged, with 20-30(-60) spikelets. *Spikelets* spicately arranged, horizontally spreading to reflexed, subterete, linear, somewhat flexuous, 4-20-flowered, 5-25 by  $1-1\frac{1}{2}$  mm, when mature breaking up into segments each containing 1 nut; rachilla flexuous, broadly winged; wings elliptic, at first hyaline, finally much thickened, corky, tightly clasping the nut; internodes  $1-1\frac{1}{2}$  mm. *Glumes* rigid, chartaceous, at first appressed, finally with patulous top, broadly ovate or elliptic, obtuse, mucous or minutely apiculate, rounded on the back, rather distant, up to  $\frac{1}{3}$  imbricate (rarely the tip not reaching the base of the next glume above), with green, 5-9-nerved back, yellowish, reddish brown striate sides, and hyaline margins,  $2-3\frac{1}{2}$  mm long. *Stamens* 3; anthers oblong-linear,  $\frac{1}{2}$ -1 mm. *Stigmas* 3. *Nut* falling off with an internode of the rachilla and the next higher glume, held by the persistent wings, trigonous, oblong, or narrowly obovoid, slightly incurved, apiculate, greyish brown to blackish,  $1\frac{1}{2}$ -2 by  $\frac{1}{2}$ - $\frac{3}{4}$  mm.

*Distr.* Widely spread, in the warm regions of the whole world; throughout *Malesia*, but apparently nowhere common.

*Ecol.* In marshes, wet rice-fields, along riverbanks, usually at low altitudes, 0-200 m; a few records from 1900-2100 m: Arfak Mts; hot spring Kokoh Puti on Lombok I.

*Use.* In Celebes used for making little mats.

*Vern.* *Rorisan*, Sum., *pèdu pappa*, Sulu Is., *ratriëë*, Tanimbar; New Guinea: *omureh*, Matapaili lang., *borrongor*, Biak; Philip.: *biliran*, S. L. Bis., *pulakgalau*, Sub.

*Note.* Polymorphic. *C. novae-hannoverae* BOECK., with few-flowered spikelets and narrow, dense spikes, cannot be separated satisfactorily from typical *C. odoratus*. In MAYR 230 from New Guinea, Arfak Mts, 1900-2100 m, the tips of the glumes do not reach the bases of those above, thus exposing a part of the rachilla, a character also found in the N. American *C. engelmannii* STEUD.

## II. Subgenus *Pycreus*

(BEAUV.) MIQ. *Fl. Ind. Bat.* 3 (1856) 254. — *Pycreus* BEAUV. *Pl. Oware et Benin* 2 (1807) 48.

*Type species:* *C. polystachyos* ROTTB.

### 32. Section *Vestiti*

(CLARKE) KERN, *comb. nov.* — *Pycreus* sect. *Vestiti* CLARKE, *Kew Bull.* add. ser. 8 (1908) 94. — *Cyperus* sect. *Sulcati* KÜK. *Pfl. R. Heft* 101 (1936) 379.

*Type species:* *C. sanguinolentus* VAHL.

61. *Cyperus sanguinolentus* VAHL, *En.* 2 (1806) 351; KÜK. *Pfl. R. Heft* 101 (1936) 385; KERN, *Reinwardtia* 3 (1954) 51; in Back. & Bakth. *f. Fl. Java* 3 (1968) 471. — *C. eragrostis* (non LAMK) VAHL, *En.* 2 (1806) 322; MOR. *Syst. Verz.* (1846) 96; MIQ. *Fl. Ind. Bat.* 3 (1856) 256, *incl. var. sanguinolentus* MIQ.; BOECK. *Linnaea* 35 (1868) 443; NAVES, *Nov. App.* (1882)

300; CLARKE, J. *Linn. Soc. Bot.* 21 (1884) 57; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 64, *incl. f. sanguinolentus* VALCK. *SUR. et f. comosus* VALCK. *SUR.*, t. 2 f. 15, 18; KOORD. *Exk. Fl. Java* 1 (1911) 186, f. 15B; *ibid.* 4 (1922) f. 199; BACK. *Onkr. Suiker.* (1928) 130, t. 122. — *Pycreus sanguinolentus* NEES, *Linnaea* 9 (1834) 283; CLARKE, *Fl. Br. Ind.* 6 (1893)

590; Philip. J. Sc. 2 (1907) Bot. 79; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 60; CAMUS, Fl. Gén. I.-C. 7 (1912) 30; RIDL. Fl. Mal. Pen. 5 (1925) 139; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 40. — *C. concolor* STEUD. Syn. 2 (1855) 6. — *C. atratus* STEUD. [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 12; MIQ. Fl. Ind. Bat. 3 (1856) 259; BOECK. Linnaea 35 (1868) 446. — *Pycreus eragrostis* PALLA, Ann. Naturh. Hofm. 23 (1909) 204; MERR. En. Philip. 1 (1923) 110. — *Pycreus latespicatus* var. *fagineicola* CAMUS, Not. Syst. 1 (1910) 240; Fl. Gén. I.-C. 7 (1912) 30.

Annual, or perennial with short rhizome without stolons. Stems slender, tufted, decumbent at the base, trigonous, smooth, 1–4-noded at the base, rooting at the nodes, up to  $\frac{1}{2}$  clothed with stramineous to reddish brown sheaths, 5–60 cm by  $\frac{1}{2}$ –2 mm. Leaves flat or canaliculate, gradually acuminate, scabrid on the margins in the upper part, 1–3(–4) mm wide. Inflorescence simple, either reduced to a cluster of few spikelets, or contracted into a dense head, or with 1–5 up to 5 cm long rays. Involucral bracts 2–5, obliquely erect to patent, the longer ones overtopping the inflorescence, the lowest sometimes erect, up to 15 cm. Spikes ovoid to broadly ovoid, with 3–18 spikelets; rachis very short. Spikelets divergent, ovate to oblong-lanceolate, compressed, 8–26-flowered,  $\frac{1}{2}$ –1 cm by 2–3(– $3\frac{1}{2}$ ) mm; rachilla straight, wingless, persistent; internodes  $\frac{1}{2}$ – $\frac{3}{4}$  mm. Glumes membranous, obliquely erect or finally patulous, ovate, keeled, obtuse, mucicous,  $\frac{1}{2}$  imbricate,  $1\frac{1}{2}$ – $2\frac{1}{2}$  by  $1\frac{1}{2}$ –2 mm; keel arcuate, green, 3–5-nerved; sides nerveless, whitish, ferruginous, brownish, or almost black, usually with a longitudinal depression in the centre. Stamens 2 or 3 (the number constant in the same specimen); anthers oblong-linear,  $\frac{1}{2}$ –1 mm. Style rather long; stigmas 2. Nut biconvex, laterally compressed, broadly obovate to orbicular, apiculate, brown to blackish,  $\frac{4}{5}$ – $1\frac{1}{2}$  by  $\frac{3}{5}$ – $1\frac{1}{4}$  mm; epidermal cells isodiametric.

Distr. Widely distributed in the warmer parts of the eastern hemisphere; tropical Africa; from the Black Sea through C. and E. Asia to Japan and Australia; throughout *Malesia*, often common.

Ecol. In wet open places: swamps, grassy fields; rice-fields, etc., 0–3125 m.

#### KEY TO THE MALESIAN SUBSPECIES

1. Stamens 3. Leaves flat, weak, 2–4 mm wide. Inflorescence capitate or nearly so, rarely the rays up to 3 cm. Involucral bracts patent. Spikelets ( $2\frac{1}{4}$ – $2\frac{1}{2}$ – $3$ (– $3\frac{1}{2}$ ) mm wide. Glumes ( $1\frac{3}{4}$ – $2$ – $2\frac{1}{4}$  mm long, distinctly depressed on either side, bordered by a well-marked sanguineous band. Nut medium-sized, (1–) $1\frac{1}{10}$ – $1\frac{1}{4}$  by  $\frac{4}{5}$ –1 mm.

#### a. *ssp. sanguinolentus*

1. Stamens 2.

2. Nut relatively large,  $1\frac{1}{5}$ – $1\frac{1}{2}$  by  $\frac{3}{10}$ – $1\frac{1}{4}$  mm. Stems very slender, often short. Leaves narrow,  $1$ – $1\frac{1}{2}$ (– $2\frac{1}{2}$ ) mm wide. Involucral bracts 2–3, the lowest usually erect or obliquely erect. Inflorescence capitate, with 3–9(–15) spikelets. Spikelets  $2\frac{3}{4}$ – $3\frac{1}{2}$  mm wide. Glumes 2– $2\frac{1}{2}$  mm long, without depressions, dark castaneous to almost black except for the pale keel and the narrow but distinct whitish hyaline margins, more rarely brown to pale brown.

#### b. *ssp. melanocephalus*

2. Nut smaller,  $\frac{2}{5}$ –1 by  $\frac{3}{5}$ – $\frac{4}{5}$  mm. Leaves flat, 2–4 mm wide. Involucral bracts spreading. Inflorescence more or less open, or, when capitate, with many spikelets. Glumes  $1\frac{1}{2}$ –2 mm long, ferruginous to whitish, often tinged with red.

3. Inflorescence more or less open, its rays up to 5 cm. Glumes with a distinct depression on either side, ferruginous, more or less tinged with red. Spikelets  $2\frac{1}{4}$ – $2\frac{1}{2}$  mm wide.

#### c. *ssp. cyrtostachys*

3. Spikelets densely crowded into a multispiculate head; rarely one of the rays somewhat elongated, up to 1 cm. Glumes without or with indistinct depressions, yellowish white, rarely somewhat ferruginous or slightly tinged with red, appressed, hence spikelets only c. 2 mm wide.

#### d. *ssp. teysmannii*

a. *ssp. sanguinolentus*. — Synonymy see above.

Distr. India, Farther India, Indo-China, China, Japan; in *Malesia*: Sumatra, Malay Peninsula, Java, Lesser Sunda Is. (Lombok, Flores), Celebes, Moluccas (Ambon), Philippines (Luzon).

Ecol. Grassy places, swamps, margins of pools, etc., often in incultivated localities, more rarely in wet rice-fields, 800–2000 m, sometimes lower.

b. *ssp. melanocephalus* (MIQ.) KERN, Reinwardtia 3 (1954) 55, f. 9. — *C. melanocephalus* MIQ. Fl. Ind. Bat. 3 (1856) 259. — *C. eragrostis* var. *humilis* MIQ. l.c. 257. — *C. eragrostis* f. *melanocephalus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 66. — *C. eragrostis* f. *humilis* VALCK. SUR. l.c. 69, t. 2 f. 19. — *C. sanguinolentus* f. *melanocephalus* KÜK. Pfl. R. Heft 101 (1936) 387. — *C. sanguinolentus* f. *humilis* KÜK. l.c. 386. — ? *C. globosus* f. *atrosanguineus* KÜK. Candollea 6 (1936) 422, ex descr. — *C. globosus* var. *latisquamatus* KÜK. Mitt. Thür. Bot. Ver. 50 (1943) 7.

Distr. India (Khasia Mts, Sikkim, E. Himalaya), in *Malesia*: on several mountains in Java, the Philippines, and New Guinea.

Ecol. In swampy grassy fields, etc., at high altitudes, from 1000 m upwards.

Vern. New Guinea: *Maitjop*, Hattam lang., *böh*, Kapauku lang.

c. *ssp. cyrtostachys* (MIQ.) KERN, Reinwardtia 3 (1954) 57. — *C. eragrostis* var. *cyrtostachys* MIQ. Fl. Ind. Bat. 3 (1856) 257; BOECK. Linnaea 35 (1868) 445 ('*cyrtolepis*'); CLARKE, J. Linn. Soc. Bot. 21 (1884) 59, p.p. — *C. eragrostis* f. *cyrtostachys* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 66, t. 2 f. 16. — *C. sanguinolentus* f. *cyrtostachys* KÜK. Pfl. R. Heft 101 (1936) 387.

Distr. Throughout *Malesia*.

d. *ssp. teysmannii* (BOECK.) KERN, Reinwardtia 3 (1954) 57, f. 10. — *C. teysmannii* BOECK. Flora 58 (1875) 259. — *C. eragrostis* f. *teysmannii* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 67, t. 2 f. 17. — *C. sanguinolentus* var. *teysmannii* KÜK. Pfl. R. Heft 101 (1936) 387.

Distr. *Malesia*: Sumatra (Lampungs), Java and Madura, Lesser Sunda Is. (Bali), Philippines (Luzon).

Ecol. Watersides, swampy places, wet rice-fields, 0–750 m.

33. Section *Chrysanthi*

CLARKE, Kew Bull. add. ser. 8 (1908) 95. — *Cyperus* sect. *Lancei* KÜK. Pfl. R. Heft 101 (1936) 330.

Type species: *C. chrysanthus* BOECK.

62. *Cyperus uniolooides* R.BR. Prod. (1810) 216; BENTH. Fl. Austr. 7 (1878) 260; CLARKE, J. Linn. Soc. Bot. 21 (1884) 60; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 71; KÜK. Pfl. R. Heft 101 (1936) 338, f. 2B, 4 E-G; KERN, Reinwardtia 2 (1952) 124, f. 12; in Back. & Bakh. f. Fl. Java 3 (1968) 471. — *C. angulatus* NEES in Wight, Contr. (1834) 73; BOECK. Linnaea 35 (1868) 465. — *Pycreus angulatus* NEES, Linnaea 9 (1834) 283; CLARKE, Fl. Br. Ind. 6 (1893) 593; Ill. Cyp. (1909) t. 4; CAMUS, Fl. Gén. I.-C. 7 (1912) 35. — *Pycreus uniolooides* URB. Symb. Ant. 2 (1900) 164; MERR. En. Philip. 1 (1923) 111.

Perennial (always?) with short rhizome; stolons wanting. Stems slender, somewhat tufted, rigid, triquetrous, smooth or scaberulous at the top, up to 90 cm by 1–2 mm. Leaves flat to conduplicate, rigid, very gradually acuminate, with cartilaginous margins scabrid in the upper part, 2–4 mm wide; lower sheaths reddish to blackish brown. Inflorescence simple, loose to contracted, 3–7 by 6–9 cm. Involucral bracts 2–4, patent, the longest much overtopping the inflorescence, up to 20 cm. Rays 3–6, suberect, smooth, up to 6 cm. Spikes broadly

ovoid, up to 3 cm long and wide, with 4–12 spikelets; rachis glabrous, up to 1 cm. Spikelets patent, oblong or lanceolate, compressed but slightly turgid, acute, 10–20(–30)-flowered, 8–15(–25) by 4–5 mm; rachilla flexuous, wingless, persistent; internodes  $\frac{3}{5}$ – $\frac{3}{4}$  mm. Glumes chartaceous, divergent, ovate to oblong, keeled, acute, mucicous,  $\frac{3}{4}$  imbricate,  $3\frac{3}{4}$ –4 by  $2\frac{1}{2}$ –3 mm; keel acute, 3-nerved; sides nerveless, shining yellowish green to brown; margins not or hardly hyaline, undulate when dry. Stamens 3; anthers linear, up to 2 mm. Style long ( $1\frac{1}{2}$ – $3\frac{1}{2}$  mm); stigmas 2, up to 3 mm. Nut relatively small, biconvex, laterally compressed, short-elliptic to slightly obovate, shortly apiculate, shining black, 1– $1\frac{1}{2}$  by  $\frac{4}{5}$ –1 mm; epidermal cells isodiametric.

Distr. Pantropic; in *Malesia* very local: N. Sumatra (Atjeh, East Coast Res., Tapanuli), W. Java, Philippines (Luzon, Mindanao), New Guinea.

Ecol. In open localities: swamps, marshes, borders of lakes, river-banks, usually at medium altitudes (up to 1900 m), in New Guinea up to 2800 m.

34. Section *Pycreus*

*Pycreus* sect. *Polystachyi* CLARKE, Kew Bull. add. ser. 8 (1908) 94. — *Pycreus* sect. *Globosi* CLARKE, l.c. 95 ('*Globosus*').

Type species: *C. polystachyos* ROTTB.

63. *Cyperus flavidus* RETZ. Obs. 5 (1789) 13; DECNE, Nouv. Ann. Mus. Hist. Nat. Paris 3 (1834) 359; Herb. Timor. Descr. (1835) 31. — *C. globosus* ALL. Fl. Pedem. Auct. (1789) 49, non FORSK. 1775; BOECK. Linnaea 35 (1868) 458; BENTH. Fl. Austr. 7 (1878) 260; CLARKE, J. Linn. Soc. Bot. 21 (1884) 47, incl. var. *nilagiricus* CLARKE; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 58, t. 2 f. 12, incl. f. *strictus* VALCK. SUR.; KOORD. Exk. Fl. Java 1 (1911) 186, 192; *ibid.* 4 (1922) f. 198; BACK. Onkr. Suiker. (1928) 128, t. 120; KÜK. Pfl. R. Heft 101 (1936) 352; S. T. BLAKE, J. Arn. Arb. 28 (1947) 220; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 471. — *C. capillaris* KOENIG ex ROXB. Fl. Ind. 1 (1820) 198. — *C. strictus* ROXB. l.c. 203; MIQ. Fl. Ind. Bat. 3 (1856) 258. — *C. lanceolatus* (non POIR.) PRESL, Rel. Haenk. 1 (1828) 167. — *Pycreus globosus* REICHENB. Fl. Germ. Exc. 2 (1830) 140; CLARKE, Philip. J. Sc. 2 (1907) Bot. 80, incl. var. *nilagiricus* CLARKE; CAMUS, Fl. Gén. I.-C. 7 (1912) 31, f. 3, 10; MERR. En. Philip. 1 (1923) 110; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 41. — *Pycreus capillaris* NEES, Linnaea 9 (1834) 283; CLARKE, Fl. Br. Ind. 6 (1893) 591. — *C. vulgaris* KUNTH, En. 2 (1837) 4; ? HASSK. Pl. Jav. Rar. (1848) 71; MIQ. Fl. Ind. Bat. 3 (1856) 256, incl. var. *polylepis* MIQ. — *C. mucronatus* (non ROTTB.) MOR. Syst. Verz. (1846) 95. — *C. nilagiricus* HOCHST. ex STEUD. Syn. 2 (1855) 2; BOECK. Linnaea 35 (1868) 457. — *C.*

*junghendus* STEUD [in Zoll. Syst. Verz. 1 (1854) 62, nom. nud.] Syn. 2 (1855) 3. — *C. junghuhnii* MIQ. Fl. Ind. Bat. 3 (1856) 260. — *C. flavescens* (non L.) BENTH. Fl. Austr. 7 (1878) 259. — *Chlorocyperus nilagiricus* RIKLI, Jahrb. Wiss. Bot. 27 (1895) 564. — *Chlorocyperus globosus* PALLA, Allg. Bot. Zeitschr. 6 (1900) 61. — *C. globosus* var. *oblongimix* KÜK. Mitt. Thür. Bot. Ver. 50 (1943) 7.

Annual with fibrous, yellowish roots, in favourable circumstances perennial with short rhizome; stolons wanting. Stems rigid, very slender, tufted, trigonous, smooth, 5–60 cm by 1– $1\frac{1}{2}$  mm. Leaves rigid, narrow, canaliculate, often almost setaceous, very gradually acuminate, smooth or slightly scabrid at the top, 1–2(–3) mm wide; lower sheaths ferruginous to dark reddish brown. Inflorescence simple or subcompound, rather open to contracted into a single cluster. Involucral bracts 2–4, obliquely erect to patent, the lower 1–2 much overtopping the inflorescence, often seemingly continuing the stem, up to 25 cm. Primary rays 3–6, erect or obliquely erect, very slender, smooth, up to 5 cm, secondary ones when present 1–3 mm. Spikes ovoid to broadly ovoid, with 5–20 spikelets; rachis short, 3–10 mm. Spikelets spreading, the lower ones often somewhat reflexed, linear, exactly parallel-sided, strongly compressed, 20–40(–60)-flowered, 1–2(–3) cm by  $2\frac{1}{2}$ –(3) mm; rachilla straight, wingless, persistent;

internodes  $\frac{2}{5}$ - $\frac{1}{2}$  mm. *Glumes* chartaceous, obliquely erect, sharply keeled, oblong-ovate, obtuse, mucous,  $\frac{2}{3}$  imbricate,  $1\frac{1}{2}$ - $2\frac{1}{2}$  by  $1$ - $1\frac{1}{2}$  mm; keel green, 3-nerved; sides shining, stramineous, brown, or blackish, nerveless; margins whitish hyaline especially towards the top. *Stamens* 2; anthers oblong, c.  $\frac{1}{2}$  mm. *Style* rather short; stigmas 2, longer than the style. *Nut* biconvex, laterally compressed, oblong-obovate to oblong-elliptic, distinctly apiculate, fuscous to dark castaneous,  $\frac{2}{5}$ - $1\frac{1}{3}$  by  $\frac{2}{5}$ - $\frac{2}{3}$  mm; epidermal cells isodiametric.

*Distr.* Widely distributed in the warmer parts of the eastern hemisphere: tropical Africa, from the Mediterranean region through Central and S. Asia to Australia; rather common in *Malesia*, but still unknown from the Malay Peninsula and Borneo.

*Ecol.* In open, wet places: swamps, grassy fields, watersides, rice-fields, etc., from the lowland (here apparently rare) up to 2100 m, in New Guinea up to 2800 m.

*Vern.* *Rumput toyan*, J; New Guinea: *komaruem*, Mendi, *tampi*, Enga; Philip.: *tantanud*, Bon.

*Notes.* Often confused with *C. sanguinolentus* and *C. polystachyos*. From the former distinguished by the enodulose stem-base and the shape of the nut, from the latter by the more obtuse glumes, the straight, wingless rachilla, the linear spikelets, and the shape of the nut.

Rather polymorphous. *C. nilagiricus* was mainly founded on the dark colour of the glumes, but CLARKE included all the forms with narrow spikelets whatever the colour. In *Malesia* the width of the spikelets varies between 2 and 3 mm, but the colour varies independently of the width. KÜENTHAL referred some apparently depauperate specimens from Java (not seen) to *f. pauperior* (BOECK.) KÜK. Pfl. R. Heft 101 (1936) 355 [*C. nilagiricus* var. *pauperior* HOCHST. ex BOECK. *Linnaea* 35 (1868) 458]. As to KÜENTHAL's var. *oblonginix* I agree with BLAKE *l.c.* that there exists an intergrading series from oblong-elliptic nuts to the much more usual obovate ones.

64. *Cyperus polystachyos* ROTTB. *Descr. Pl. rar. Progr.* (1772) 21; *Descr. & Ic.* (1773) 39, t. 11 f. 1; HASSK. *Pl. Jav. Rar.* (1848) 74; *Miq. Fl. Ind. Bat.* 3 (1856) 258; BOECK. *Linnaea* 35 (1868) 477; BENTH. *Fl. Austr.* 7 (1878) 261; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 51, t. 3 f. 27; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 61, t. 2 f. 13; KOORD. *Exk. Fl. Java* 1 (1911) 186, non *ibid.* 4 (1922) f. 196; KÜK. Pfl. R. Heft 101 (1936) 367; S. T. BLAKE, *J. Arn. Arb.* 28 (1947) 220; KERN, *Reinwardtia* 3 (1954) 48; in *Back. & Bakh. f. Fl. Java* 3 (1968) 472. — *C. rotundus floridus II mas* RUMPH. *Herb. Amb.* 6 (1750) 2, t. 1 f. 2. — *Pycureus polystachyos* BEAUV. *Pl. Oware & Benin* 2 (1807) 48, t. 86 f. 2; CLARKE, *Fl. Br. Ind.* 6 (1893) 592; Philip. *J. Sc.* 2 (1907) Bot. 80; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 60; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 34; RIDL. *Fl. Mal. Pen.* 5 (1925) 139; BACK. *Bekn. Fl. Java (em. ed.)* 10 (1949) fam. 246, p. 40. — *C. strigosus* (non L.) LLANOS, *Fragm. Pl. Filip.* (1851) 16; F.-VILL. & NAVES in Blanco, *Fl. Filip. ed.* 3, 4 (1880) 10. — ? *C. teretifractus* STEUD. [in *Zoll. Syst. Verz.* 1 (1854) 62, *nom. nud.* (*teretifractus*)] *Syn.* 2 (1855) 3. — ? *C. vulgaris* var. *teretifractus* MIQ. *Fl. Ind. Bat.* 3 (1856) 256. — *Chlorocyperus polystachyus* RIKLI, *Jahrb. Wiss. Bot.*

27 (1895) 563. — *Pycureus odoratus* URB. *Symb. Ant.* 2 (1900) 164; MERR. *En. Philip.* 1 (1923) 110, non *C. odoratus* L. — *Pycureus holosericeus* MERR. *Philip. J. Sc.* 12 (1917) 231, *quoad specim.*, non *C. holosericeus* LINK. — *C. odoratus* (non L.) BACK. *Onkr. Suiker.* (1928) 129, t. 121.

Annual, or perennial with short rhizome; stolons wanting. *Stems* slender but rather firm, tufted, trigonous, triquetrous just below the inflorescence, smooth, 5-60(-90) cm by 1-2(-3) mm. *Leaves* weak to rather rigid, flat or canaliculate, gradually acuminate, scabrid on the margins in the upper part, (1-)2-4 mm wide; lower sheaths membranous, light brown to purplish. *Inflorescence* simple or subcompound, strongly contracted (sometimes into a single head) to open, 2-15 cm across. *Involucral bracts* 3-6, obliquely to widely spreading, the lower one(s) overtopping the inflorescence, the longest up to 20 cm. *Primary rays* 3-8, spreading, very short to slender, up to 7 cm, secondary ones when present very short. *Spikelets* 2-15 to the spike, fasciculate to divergent, linear-lanceolate, gradually tapering to an acute apex, strongly compressed, 8-50-flowered,  $\frac{1}{2}$ - $2\frac{1}{2}$  cm by  $1\frac{1}{2}$ -2 mm; rachilla flexuous, narrowly winged, persistent; internodes c.  $\frac{1}{2}$  mm. *Glumes* thinly chartaceous, obliquely erect, sharply keeled, elliptic-ovate, subobtusely, mucous or minutely mucronulate,  $\frac{1}{2}$  imbricate,  $1\frac{3}{4}$ - $2\frac{1}{2}$  by c. 1 mm; keel green, 3-nerved; sides nerveless, pale ferruginous to fuscous, rarely castaneous; margins whitish hyaline. *Stamens* 2, very rarely in some or most flowers 1; anthers oblong or linear-oblong,  $\frac{1}{2}$ -1 mm. *Style* long; stigmas 2, about as long as the style. *Nut* 2-sided, laterally compressed, with flat to slightly convex sides, oblong with nearly parallel margins, somewhat asymmetric, abruptly rounded to truncate at the shortly apiculate apex, castaneous to black,  $1$ - $1\frac{1}{2}$  by  $\frac{1}{2}$ - $\frac{1}{2}$  mm; epidermal cells isodiametric.

*Distr.* Widely spread in the warmer parts of the whole world, in the eastern hemisphere extending northward to the Mediterranean (see MEROLA, *Delpinoa* 10, 1957, 21-92), S. China, and Japan, southward to Australia; throughout *Malesia*, presumably common everywhere, though only a few times collected in the eastern part.

*Ecol.* In open, usually damp places: grassy fields, fallow rice-fields, road-sides, river-banks, also in the salt mud of the sea-shore, 0-1800 m.

*Vern.* *Rumput parâh betina*, Negri Sembilan, *djukut bulu mata kibo*, S, *kankamut*, N. Borneo, *aduru*, Talaud; Philip.: *alûsang-pasigan*, Tag., *hanâ*, Iv.

*Notes.* Very variable, especially as to the size and density of the inflorescence. The varieties based on this variability have little or no taxonomic value, as there exists every gradation from the single dense cluster of suberect spikelets to the open inflorescence with rectangularly spreading spikelets. Plants with open inflorescences are rather common in *Malesia*, especially near the sea. They have been described as:

var. *laxiflorus* BENTH. *Fl. Austr.* 7 (1878) 261; CLARKE, *J. Linn. Soc. Bot.* 21 (1884) 53; VALCK. *SUR. Gesl. Cyp. Mal. Arch.* (1898) 62; KÜK. Pfl. R. Heft 101 (1936) 370. — *C. paniculatus* ROTTB. *Descr. Pl. rar. Progr.* (1772) 22; *Descr. & Ic.* (1773) 40. — *Pycureus polystachyos* var. *laxiflorus* CLARKE, *Fl. Br.*

Ind. 6 (1893) 592; Philip. J. Sc. 2 (1907) Bot. 80; CAMUS, Fl. Gén. I.-C. 7 (1912) 35. — *Pycurus polystachyos* var. *paniculatus* MERR. Fl. Manila (1912) 109; En. Philip. 1 (1923) 111.

The glumes are usually straw-coloured, but often tinged with red. Specimens with strikingly dark-coloured spikelets were collected in N. Sumatra (Toba Lake) at 900–1350 m.

The inadequately labelled specimen upon which *f. longispiculatus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 62, t. 2 f. 13a, was based, belongs to the N. American *C. filicinus* VAHL. See KERN, Reinwardtia 3 (1954) 48.

The Philippine specimens referred to the American var. *leptostachyus* BOECK. by KÜKENTHAL, Pfl. R. Heft 101 (1936) 371 (as *Pycurus holosericeus* by MERRILL, l.c.), were misnamed. See KERN, l.c.

I have not seen ZOLLINGER 456, type collection of *C. teretifructus* STEUD. According to ZOLLINGER it was collected in Java, according to STEUDEL in Japan. CLARKE (1884) and VALCKENIER SURINGAR referred it to *C. globosus*, CLARKE (1893), KÜKENTHAL, and the Japanese authors to *C. polystachyos*.

65. *Cyperus sulcinus* CLARKE, J. Linn. Soc. Bot. 21 (1884) 56; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 63, t. 2 f. 14, t. 3; KÜK. Pfl. R. Heft 101 (1936) 364, f. 43; S. T. BLAKE, J. Arn. Arb. 28 (1947) 220; KERN, Reinwardtia 3 (1954) 46, f. 7; in Back. & Bakh. f. Fl. Java 3 (1968) 471. — *Pycurus sulcinus* CLARKE, Fl. Br. Ind. 6 (1893) 593; Philip. J. Sc. 2 (1907) Bot. 80; CAMUS, Fl. Gén. I.-C. 7 (1912) 34; MERR. En. Born. (1921) 58; En. Philip. 1 (1923) 111; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 40. — *Pycurus substellatus* CAMUS, Not. Syst. 1 (1910) 240; Fl. Gén. I.-C. 7 (1912) 29. — *Pycurus odoratus* var. *holosericeus* MERR. J. Str. Br. R. As. Soc. n. 76 (1917) 79; En. Born. (1921) 58, *quoad specim., non C. holosericeus* LINK.

### 35. Section Pumili

KÜK. Pfl. R. Heft 101 (1936) 375.

Type species: *C. pumilus* L.

66. *Cyperus pumilus* LINNÉ, Cent. Pl. 2 (1756) 6; Amoen. 4 (1759) 302; Sp. Pl. ed. 2 (1762) 69; MIQ. Fl. Ind. Bat. 3 (1856) 255; NAVES, Nov. App. (1882) 300; CLARKE, J. Linn. Soc. Bot. 21 (1884) 43, *incl. var. punctatus* CLARKE *quoad pl. asiat. et f. borneensis* CLARKE; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 55, t. 2 f. 10; KOORD. Exk. Fl. Java 1 (1911) 186, 192; *ibid.* 4 (1922) f. 197; BACK. Onkr. Suiker. (1928) 128, t. 119; KÜK. Pfl. R. Heft 101 (1936) 375, f. 44 A–E; KERN, Reinwardtia 3 (1954) 50; in Back. & Bakh. f. Fl. Java 3 (1968) 470. — *C. nitens* RETZ. Obs. 6 (1789) 13; NEES in Hook. J. Bot. Kew Misc. 6 (1854) 28; MIQ. Fl. Ind. Bat. 3 (1856) 255; BOECK. Linnaea 35 (1868) 483; VIDAL, Phan. Cum. Philip. (1885) 155; Rev. Pl. Vasc. Filip. (1886) 283. — *C. punctatus* ROXB. Fl. Ind. 1 (1820) 197. — *C. pulvinatus* NEES & MEY. ex NEES in Wight, Contr. (1834) 74. — *Pycurus pumilus* NEES [Linnaea 9 (1835) 283, *nomen*] ex CLARKE, Fl. Br. Ind. 6 (1893) 591, *quoad basion., excl. descr.*; DOMIN, Bibl. Bot. Heft 85

Annual with fibrous, yellowish roots. *Stems* slender, tufted, trigonous below, triquetrous at the top, smooth, 5–30(–40) cm by up to 1 mm. *Leaves* rigid, flat or canalliculate, gradually acuminate, scabrid at the top, narrow,  $\frac{1}{2}$ –2 mm wide; lower sheaths purplish. *Inflorescence* relatively large, simple, loose, rarely subcapitate. Involucral bracts 3–4, obliquely patent, the lower one(s) overtopping the inflorescence, the longest up to 15 cm. Rays 3–6, slender, often capillary, spreading, up to 7 cm, sometimes very short. *Spikes* broadly ovoid, with (3–)5–10(–14) spikelets; rachis glabrous, up to 5 mm. *Spikelets* widely spreading, the lower ones more or less reflexed, lanceolate to linear, usually slightly curved, acute, strongly compressed, 10–50(–68)-flowered, 1–3(–4 $\frac{1}{2}$ ) cm by c. 1 $\frac{1}{2}$  mm; rachilla slightly flexuous, narrowly winged, persistent; internodes  $\frac{3}{5}$ – $\frac{3}{4}$  mm. *Glumes* membranous, obliquely erect, sharply keeled, obovate to oblong-obovate, obtuse, mucous,  $\frac{1}{6}$ – $\frac{1}{2}$  imbricate, 1 $\frac{1}{4}$ (–2) by 1–1 $\frac{1}{4}$ (–1 $\frac{1}{2}$ ) mm; keel fuscous, 3-nerved; sides ferruginous, nerveless; margins hyaline. *Stamen* 1; anther linear-oblong,  $\frac{1}{5}$ – $\frac{1}{2}$  mm. *Style* c.  $\frac{1}{2}$  mm; stigmas 2, short. *Nut* 2-sided, laterally compressed, on either side with a median longitudinal depression, oblong, somewhat asymmetric, truncate at the shortly spiculate apex, dark brown,  $\frac{1}{4}$ (–1 $\frac{1}{2}$ ) by  $\frac{1}{2}$  mm; epidermal cells isodiametric.

Distr. From India through Farther India to tropical Australia (Queensland), in *Malesia* very local: in a few localities in Java, Kangean Archipelago, Madura, Borneo (Sarawak, North Borneo), the Philippines (Palawan, Luzon, Mindanao), the Moluccas (Talaud Is., Buru, Ternate), Lesser Sunda Is. (W. Sumba), and New Guinea.

Ecol. In open places on dry soil: fields, road-sides, etc., 0–1200 m.

Note. According to CLARKE's original description the flowers should be diandrous. I always found only 1 stamen in the numerous flowers dissected.

(1915) 417; TURRILL, Kew Bull. (1922) 124. — *Pycurus pulvinatus* NEES, Linnaea 9 (1835) 283; CLARKE, Philip. J. Sc. 2 (1907) Bot. 79. — *Pycurus nitens* NEES, Nov. Act. Nat. Cur. 19, Suppl. 1 (1843) 53; CLARKE, Fl. Br. Ind. 6 (1893) 591; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 61; CAMUS, Fl. Gén. I.-C. 7 (1912) 33; MERR. En. Philip. 1 (1923) 110; RIDL. Fl. Mal. Pen. 5 (1925) 140; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 39. — *C. gymnoleptus* STEUD. Syn. 2 (1855) 3; MIQ. Fl. Ind. Bat. 3 (1856) 255. — *Dichostylis nitens* PALLA, Bot. Jahrb. 10 (1888) 296. — *Pycurus hyalinus* (non DOMIN) MERR. En. Born. (1921) 57. — *C. silletenis* (non NEES) ELMER, Leaf. Philip. Bot. 10 (1938) 3530. — Fig. 66.

Annual with fibrous, yellowish roots. *Stems* slender, tufted, often almost filiform, triquetrous, smooth, 1–20 cm by  $\frac{1}{2}$ –1 mm. *Leaves* weak or somewhat rigid, canalliculate, gradually acuminate, scabrid in the upper part, 1–2 mm wide; lower

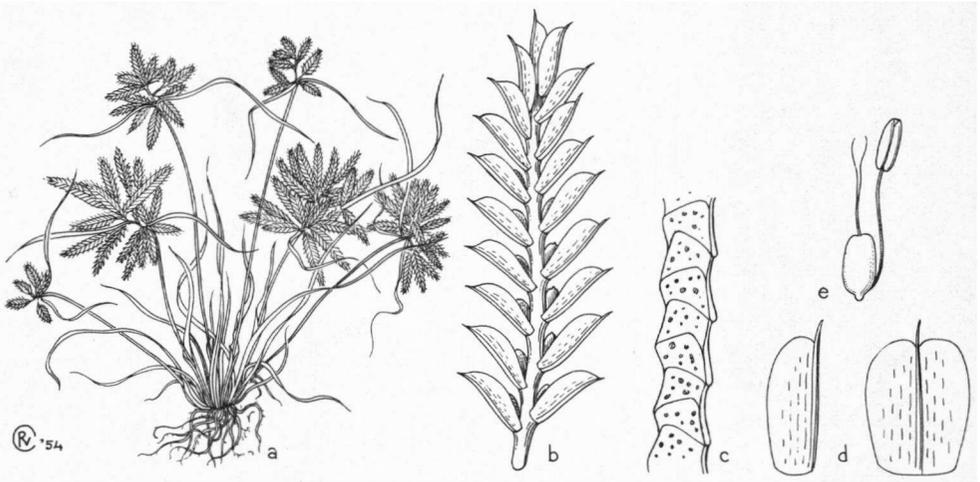


Fig. 66. *Cyperus pumilus* L. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 6$ , c. rachilla, d. glumes, e. nut with stamen and style, all  $\times 14$  (SCHIFFNER Iter jav. 1596).

sheaths stramineous to reddish brown. *Inflorescence* simple or subcompound. Involucral bracts 3–5, patulous, overtopping the inflorescence, the longest  $2\frac{1}{2}$ –15(–20) cm. Primary rays 3–6, divergent, slender, smooth, up to 3 cm, but often very short and then inflorescence head-like. *Spikes* ovoid or subglobose, dense, with 5–30 spikelets 1–2 cm  $\phi$ ; rachis short, up to 3 mm. *Spikelets* divergent, oblong to linear, subacute, strongly compressed, 8–30(–40)-flowered, 5–10(–13) by  $1\frac{1}{2}$ – $2\frac{1}{2}$  mm (mucros included); rachilla straight, almost wingless, persistent; internodes  $\frac{1}{4}$ – $\frac{1}{2}$  mm. *Glumes* membranous, obliquely patent, sharply keeled, ovate,  $\frac{1}{2}$  imbricate, the body (1–) $1\frac{1}{4}$ – $1\frac{3}{4}$  by 1– $1\frac{1}{4}$  mm; apex truncate or retuse; keel 3–5-nerved, green or reddish brown; sides nerveless, silvery, stramineous, or spadiceous; mucro erect or slightly recurved,  $\frac{1}{2}$ – $\frac{1}{2}$  mm. *Stamens* usually 1, but not rarely in some or all flowers stamens 2; anthers oblong, c.  $\frac{1}{2}$  mm. *Stigmas* 2. *Nut* biconvex, laterally compressed, oblong-obovate, obtuse to truncate at the apiculate apex, shining brown to castaneous,  $\frac{1}{2}$ – $\frac{3}{4}$  by  $\frac{1}{3}$ – $\frac{1}{2}$  mm; epidermal cells isodiametric.

Distr. India, Farther India, Formosa, S. China, Queensland (here known from 2 localities only); in *Malesia*: Sumatra (with certainty only known from Medan); in the Malay Peninsula and Java very local, but often abundant; in the Philippines from N. Luzon to Mindanao, in most or all islands; but a few times collected in the Lesser Sunda Is. (Flores), Borneo, Celebes, and the Moluccas (Ambon, Buru). Varieties in tropical America and Africa.

Ecol. In open, damp to rather dry localities:

fields, moist meadows, humid flats, etc., often on sandy soil, 0–600 m.

Note. According to KOORDERS, *l.c.*, in Java common in rice-fields and grassy localities in the plains and the mountains (quoted in KÜENTHAL's monograph). However, it is neither common in Java nor does it occur in the mountains.

67. *Cyperus nervulosus* (KÜK.) S. T. BLAKE, Proc. R. Soc. Queensl. 51 (1940) 41; J. Arn. Arb. 28 (1947) 221; KERN, Reinwardtia 3 (1954) 51. — *C. breviculmis* (non R.Br.) F.v.M. Fragm. 8 (1874) 267. — *C. pumilus* (non L.) BENTH. Fl. Austr. 7 (1878) 258; VALCK. SUR. Nova Guinea 8 (1912) 696, non al. — *C. pumilus* var. *punctatus* CLARKE, J. Linn. Soc. Bot. 21 (1884) 46, quoad pl. austr., non *C. punctatus* ROXB. — *Pycurus pumilus* var. *punctatus* DOMIN, Bibl. Bot. Heft 85 (1915) 417. — *C. pumilus* var. *nervulosus* KÜK. Ph. R. Heft 101 (1936) 378. — Fig. 67.

Closely allied to *C. pumilus*. Very slender. *Spikes* rather loose, with 5–7(–10) spikelets. *Spikelets* linear, up to 44-flowered, (5–)10–18 by 2–3 mm. *Glumes* obovate-spatulate, widely patent, with distinctly 2–3-nerved sides; mucro recurved,  $\frac{1}{3}$ – $\frac{2}{3}$  mm. *Stamens* 2.

Distr. N. Australia, NE. Queensland, in *Malesia*: New Guinea (south coast of W. New Guinea; Papua, Central Div.).

Ecol. Damp savannah flats, dune hollows, 0–30 m.

Note. As for the shape of the spikelets and glumes similar to *C. squarrosus*, which, however, is trigynous and has trigonous nuts.

### 36. Section Flavescentes

KÜK. Pfl. R. Heft 101 (1936) 395. — *Cyperus* sect. *Latespicati* KÜK. *l.c.* 388.

Type species: *C. flavescens* L.

68. *Cyperus diaphanus* SCHRADER ex R. & S. Mant. 2 (1824) 477; BOECK. Linnæa 35 (1868) 437; KERN, Blumea 10 (1960) 644.

var. *diaphanus*.

Only known from Nepal. *Glumes* very pale, sordidly white. Otherwise hardly different from the

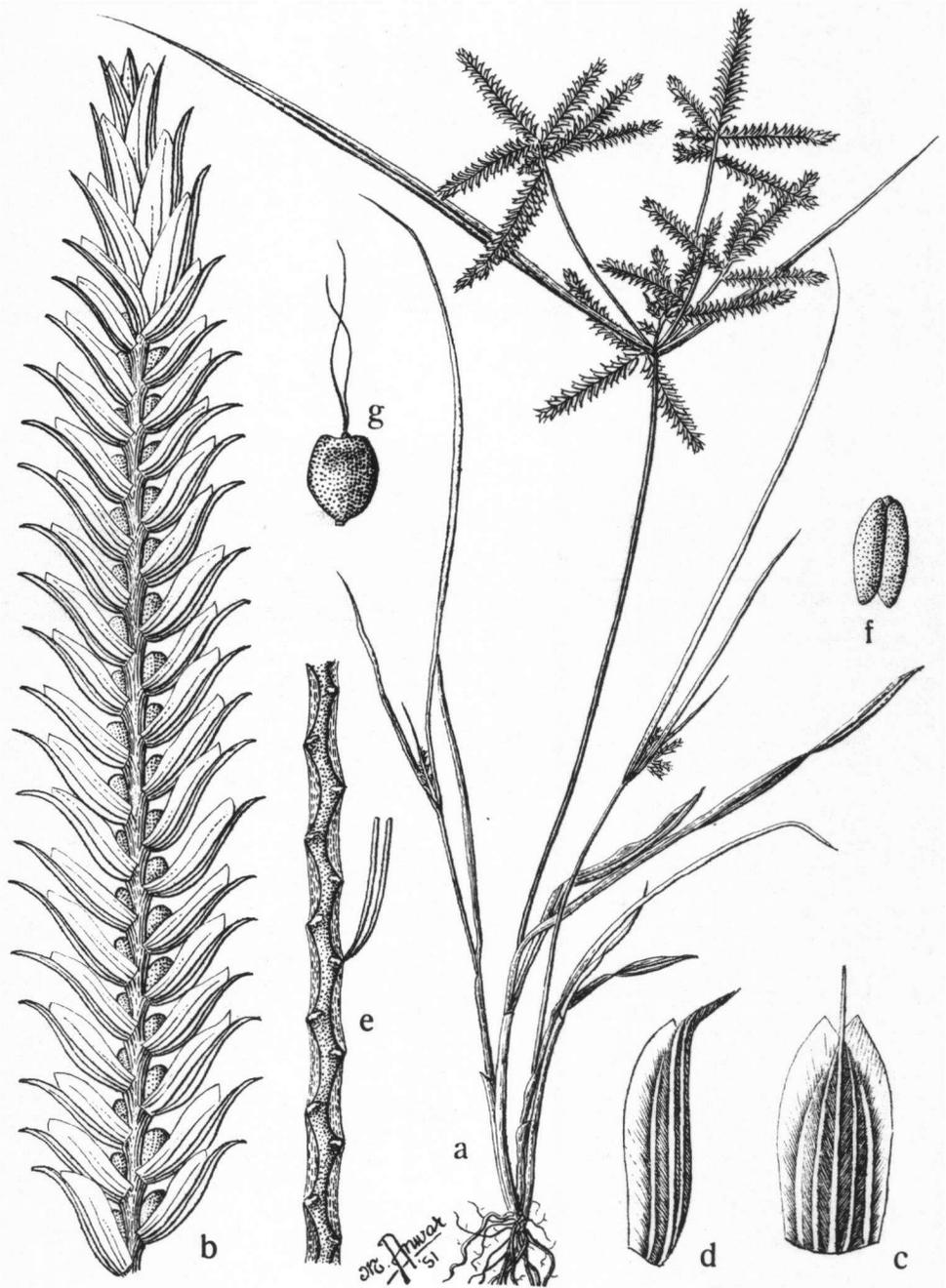


Fig. 67. *Cyperus nervulosus* (KÜK.) S. T. BLAKE. a. Habit, nat. size, b. spikelet in fruit,  $\times 10$ , c-d. glumes,  $\times 20$ , e. rachilla,  $\times 20$ , f. anther,  $\times 50$ , g. nut,  $\times 20$  (a-g BRASS 3731).

common Malesian form, which may be referred to as:

*var. latespicatus* (BOECK.) KERN, *comb. nov.* — *C. latespicatus* BOECK. Flora 42 (1859) 441 ('433'); Linnaea 35 (1868) 467; CLARKE, J. Linn. Soc. Bot. 21 (1884) 40; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 54; KÜK. Pfl. R. Heft 101 (1936) 392; KERN, Reinwardtia 2 (1952) 124, f. 13; *ibid.* 3 (1954) 66. — *Pycurus latespicatus* CLARKE, Fl. Br. Ind. 6 (1893) 590; Ill. Cyp. (1909) t. 3; CAMUS, Fl. Gén. I.-C. 7 (1912) 30, *excl. var. fagineicola* CAMUS. — *Chlorocyperus latispicatus* RIKLI, Jahrb. Wiss. Bot. 27 (1895) 564.

Annual. *Stems* tufted, rigid, trigonous, smooth, 10–40 cm by 1–2 mm. *Leaves* flat, gradually narrowed upwards, 1–2½ mm wide, the margins minutely scabrid in the upper part. *Inflorescence* simple, often contracted, sometimes with 2–3(–5) rays up to 7 cm long, or reduced to a single head. *Involucral bracts* 2–3(–4), patent, the lowest up to 15 cm long. *Spikes* broadly ovate; rachis short, up to 5 mm. *Spikelets* finally horizontally spreading, approximate, oblong, with nearly parallel margins, strongly compressed, subobtusate, 1–2 cm by (2½–)3–4 mm, 20–30(–40)-flowered; rachilla slightly flexuous, wingless, persistent; internodes *c.* ½ mm. *Glumes* membranous, obliquely patent, keeled, ovate, obtuse, mucous, *c.* ⅔ imbricate, (2½–)3 by 1¾–2 mm; keel curved, green, 3(–5)-nerved; sides nerveless, shining fulvous to castaneous; margins somewhat undulate. *Stamens* 2; anthers oblong to oblong-linear, ¾–1 mm. *Style* up to mm; stigmas 2, about as long as the style. *Nut* biconvex, laterally compressed, obovate to broadly obovate or elliptic, broadly stipitate, apiculate, 1–1¼ by ¼–1 mm, rugulose with transverse wavy lines, ultimately black; epidermal cells longitudinally oblong.

*Distr.* From Central Asia to India and Farther India, in *Malesia* very rare: Sumatra (Res. Tapanuli and West Coast), Celebes (near Malino), Philippines (Luzon).

*Ecol.* In grassy wildernesses and wet rice-fields, 300–1500 m.

*Notes.* Strikingly resembling *C. unioides*, but readily distinguished by the 2 stamens (3 in *C. unioides*) and the rugulose nut.

Taxonomically more important is probably:

*ssp. setiformis* (KORSH.) KERN, *comb. nov.* — *C. setiformis* KORSH. Act. Hort. Petrop. 12 (1892) 405; KÜK. Pfl. R. Heft 101 (1936) 393; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 158. — *Pycurus setiformis* B. SCHISK. Fl. U.R.S.S. 3 (1935) 5. — *C. latespicatus var. setiformis* KOYAMA, Act. Phytotax. Geobot. 16 (1955) 11.

*Stems* setaceous, 5–20 cm tall. *Leaves* filiform. *Inflorescence* consisting of a single head, with 1–3(–4) sessile spikelets. Bracts 1–2, the lowest erect. *Spikelets* 2½–3 mm wide. *Glumes* rufescent to purplish.

*Distr.* Amurlands, Japan, Korea, Manchuria, Bonin Islands, in *Malesia*: New Guinea (Western Highlands, Lake Inim, Lake Iviva). Apparently an eastern form of the species.

*Ecol.* In swards of *Juncus* and *Cyperus* species, in wet organic mud, *c.* 2500 m.

*VERN. Tampi*, Enga, New Guinea.

69. *Cyperus substramineus* KÜK. Pfl. R. Heft 101 (1936) 398. — *C. stramineus* NEES in Wight, Contr. (1834) 74, *non* DESF. 1820; CLARKE, J. Linn. Soc. Bot. 21 (1884) 39; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 54. — *Pycurus stramineus* CLARKE, Fl. Br. Ind. 6 (1893) 589; CAMUS, Fl. Gén. I.-C. 7 (1912) 29.

Annual with fibrous, yellowish roots. *Stems* very slender, tufted, often slightly curved, obtusely trigonous, smooth, 10–35 cm by ½–1 mm. *Leaves* very narrow, canaliculate, gradually acuminate, slightly scaberulous at the top, 1 mm wide; lower sheaths purplish. *Inflorescence* simple, spike-like or with a few short rays, congested, consisting of 2–15 spikelets. *Involucral bracts* 2(–3), suberect, overtopping the inflorescence, up to 10 cm. *Spikelets* suberect even in fruit, oblong to linear, acute, strongly compressed, up to 50(–70)-flowered, 2(–3½) cm by 2 mm; rachilla straight, wingless, persistent; internodes *c.* ½ mm. *Glumes* membranous, obliquely patent, sharply keeled, ovate, rather acute, shortly mucronate, with green, 3-nerved keel, stramineous to yellow nerveless sides and whitish hyaline margins, *c.* 2 by 1½ mm. *Stamens* 2; anthers linear, *c.* ½ mm. *Style* *c.* ¾ mm; stigmas 2, about as long as the style. *Nut* biconvex, laterally compressed, elliptic to slightly obovate, asymmetric, shortly apiculate, transversely rugulose, brown to blackish, ½–1 by ⅓–¾ mm; epidermal cells longitudinally oblong.

*Distr.* From Khasia and Ceylon through India to Farther India and *W. Malesia*: Malay Peninsula (Kedah, P. Penang).

*Ecol.* In moist localities: grassy fields, rice-fields, in India at 0–1000 m.

*Notes.* Closely allied to the widely distributed *C. flavescens* L., which is unknown from *Malesia*. *C. substramineus* is usually slenderer, its leaves and bracts are narrower, the lowest bract is nearly erect so that the inflorescence seems to be lateral, the spikelets are not patent, the glumes more acute, and the number of stamens is always 2 (3 in *C. flavescens*).

The roots are very aromatic, the stems and leaves extremely tough.

### III. Subgenus *Kyllinga*

(ROTTB.) VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 42. — *Kyllinga* ROTTB. Descr. & Ic. (1773) 12.

Type species: *Kyllinga brevifolia* ROTTB.

37. Section *Queenslandiella*

(DOMIN) KERN, *stat. nov.* — *Queenslandiella* DOMIN, *Bibl. Bot.* Heft 85 (1915) 415. — *Mariscopsis* CHERM. *Bull. Mus. Paris* 25 (1919) 60.

Type species: *Queenslandiella mira* DOMIN.

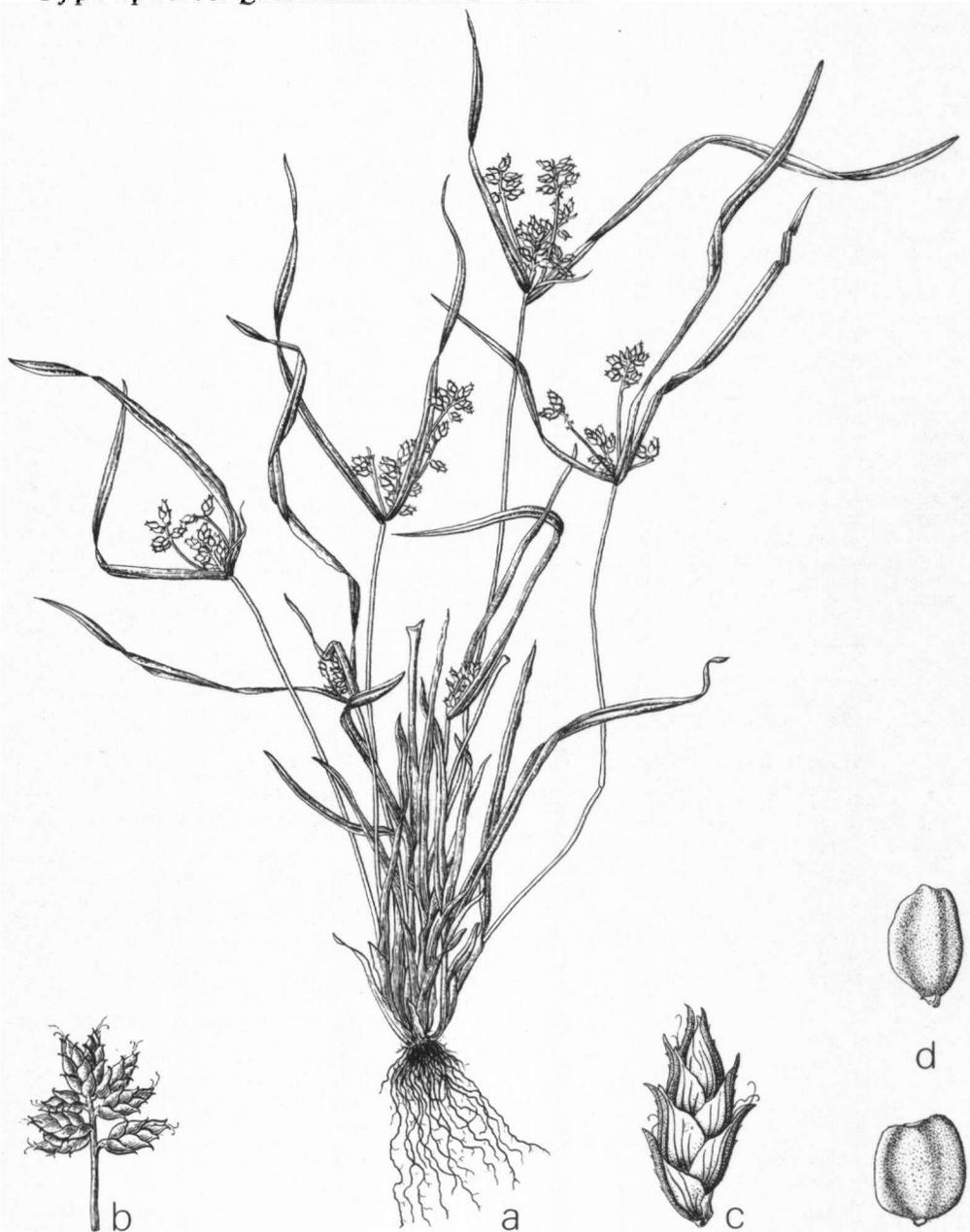


Fig. 68. *Cyperus hyalinus* VAHL. a. Habit,  $\times \frac{2}{3}$ , b. cluster of spikelets,  $\times \frac{4}{3}$ , c. spikelet,  $\times 3$ , d. nuts  $\times 13$  (a KERN 7888, b-d BACKER 27180).

70. *Cyperus hyalinus* VAHL, En. 2 (1806) 329; MIQ. Fl. Ind. Bat. 3 (1856) 254; BOECK. Linnaea 35 (1868) 482; CLARKE, J. Linn. Soc. Bot. 21 (1884) 46; RIDL. in Forbes, Wand. (1885) 520; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 57, t. 2 f. 11; KOORD. Exk. Fl. Java 1 (1911) 185; *ibid.* 4 (1922) f. 195; KÜK. Pfl. R. Heft 101 (1936) 498; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 470. — *C. pumilus* (non L.) NEES in Wight, Contr. (1834) 74. — *Pycurus pumilus* CLARKE, Fl. Br. Ind. 6 (1893) 591, *quoad descr.*; CAMUS, Fl. Gén. I.-C. 7 (1912) 32, *excl. f. 3.* — *Pycurus hyalinus* DOMIN, Bibl. Bot. Heft 85 (1915) 417 in *obs.*, non MERR. En. Born. (1921) 57. — *Queenlandiella mira* DOMIN, Bibl. Bot. Heft 85 (1915) 416, t. 11 f. 7-13. — *Mariscopsis suaveolens* CHERM. Bull. Mus. Paris 25 (1919) 60. — *Mariscopsis hyalinus* BALLARD, Kew Bull. (1932) 457. — *Queenlandiella hyalina* BALLARD in Hook. Ic. Pl. 33 (1933) t. 3208; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 43. — Fig. 68.

Annual with fibrous roots. Stems tufted, triquetrous, smooth, 3-20 cm by  $\frac{1}{2}$ -1 mm. Leaves weak, flat, gradually acuminate, scabrid on the margins towards the top, 1-3 $\frac{1}{2}$  mm wide. Inflorescence simple, anthelate but often contracted and head-like. Involucral bracts 3-6, obliquely erect to spreading, the longer ones much overlapping the inflorescence, up to 20 cm. Rays 3-6, with 5-20 spikelets, often very short, up to 6 cm. Spikes loose to rather dense, 8-12 by 8-10 mm; rachis 4-winged. Spikelets spicately arranged, obliquely to widely patent, ovate to oblong, strongly compressed, 4-7(-10)-flowered, 4-8 by 2-3 mm, falling entire; rachilla strongly flexuous, broadly winged, disarticulating at the base; internodes c. 1 mm. Glumes membranous, broadly ovate or ovate, with more or less falcate, strongly 3-nerved, serrate-scabrous green keel, whitish or yellowish, hyaline, strongly 3-nerved sides reticulate by the wide cells, 2-3 by c. 2 mm (the more or less recurved, up to  $\frac{1}{2}$  mm long mucro excluded), c.  $\frac{1}{2}$  imbricate. Stamens 2; anthers elliptic to oblong,  $\frac{1}{2}$ -1 mm. Stigmas 2. Nut biconvex,

laterally compressed, suborbicular to elliptic, usually asymmetric, truncate to emarginate at the apex, not or hardly apiculate, castaneous to black,  $1\frac{1}{10}$ -1 $\frac{1}{4}$  by c. 1 mm; epidermal cells isodiametric.

Distr. Tropical E. Africa, Mascarene Is., India, Farther India, tropical Australia (Queensland); in *Malesia*: islands near Java (coral islands in the Bay of Djakarta, Madura, Kangean Archipelago), Lesser Sunda Is. (Timor, Tanimbar Is.), Moluccas (Ceram, Key Is.).

Ecol. Sandy and calcareous localities near the sea, at low altitudes; in Timor also more inland, on calcareous hills, up to 900 m.

Vern. *Tualanga*, *krèmè*, Tanimbar Is.

Notes. On account of its bifid style and laterally compressed, biconvex nut, several authors placed this species in *subg. Pycurus*. It is the type-species of the monotypic genus *Queenlandiella* DOMIN (= *Mariscopsis* CHERM.), which is characterized by the disarticulation of the rachilla, the bifid style, and the biconvex, laterally compressed nut. However, all these characters are also found in *Cyperus subg. Kyllinga*, and so *Queenlandiella* differs from most *Kyllingae* only in the umbelliform inflorescence (not from all species of this subgenus, see e.g. *C. transitorius* KÜK. with anthelate inflorescence). Shape and texture of the glumes also point to its close relationship with the species of *subg. Kyllinga*. KÜKENTHAL referred *C. hyalinus* to *subg. Mariscus* in spite of the digynous flowers. It is certainly not closely related to any of the trigynous *Mariscus* species.

Since *C. hyalinus* was collected in Timor already by R. BROWN in 1803, it is unlikely that it was introduced there, as BALLARD supposes for Queensland. *C. squarrosus* L. and *C. teneriffae* POIR., which accompany *C. hyalinus* both in Timor and Queensland, show almost the same distribution.

The strong odour of dried specimens resembles that of fenugreek (*Trigonella foenum-graecum* L.).

### 38. Section *Kyllinga*

*Cyperus sect. Eu-Kyllinga* KÜK. Pfl. R. Heft 101 (1936) 576.

Type species: *Kyllinga brevifolia* ROTTB.

71. *Cyperus melanospermus* (NEES) VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 50, t. 2 f. 8; KOORD. Exk. Fl. Java 1 (1911) 185; KÜK. Pfl. R. Heft 101 (1936) 583; S. T. BLAKE, J. Arn. Arb. 28 (1947) 225; STEEN. Mt. Fl. Java (1972) t. 14: 14. — *Kyllinga melanosperma* NEES in Wight, Contr. (1834) 91; BOECK. Linnaea 35 (1868) 419; CLARKE, Fl. Br. Ind. 6 (1893) 588; MERR. En. Philip. 1 (1923) 115; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 59; J. Mal. Pen. 5 (1925) 138; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 44; KERN in BACK. & Bakh. f. Fl. Java 3 (1968) 470. — *C. aphyllus* HASSK. Cat. Hort. Bog. (1844) 24, *quoad specim.*, nec *Kyllinga vaginata* LAMK nec *C. aphyllus* VAHL, 1798. — *Scirpus aphyllus* HASSK. l.c. 352. — *Kyllinga vaginata* (non LAMK) ZOLL. Syst. Verz. 1 (1854) 63, *incl. var. major* HASSK. *nom. nud.*; MIQ. Fl. Ind. Bat. 3 (1856) 290. — *Kyllinga pungens* (non LINK) CLARKE, Philip. J. Sc. 2 (1907) Bot. 78.

Perennial with 2-4 mm thick, creeping rhizome covered by ovate-lanceolate, fuscous to blackish sheaths. Stems approximate, rigid, triquetrous, almost winged, smooth, 30-175 cm by 2-4 mm. Upper 1-2 leaves shortly to rather long-laminate, abruptly acuminate, the others reduced to membranous, purplish sheaths transversely corrugate on the anterior side. Inflorescence capitate, consisting of a single, ovoid to oblong-ovoid head, (6-)10-12(-16) by 6-8(-10) mm. Involucral bracts usually 3, spreading to reflexed, up to 20 cm. Spikelets numerous, obliquely spreading, oblong-elliptic or ovate-elliptic, strongly compressed, 1(-2)-flowered, stramineous to fuscous, falling off as a whole, 3-4 $\frac{1}{2}$  by 1-1 $\frac{1}{2}$  mm. Glumes hyaline, ovate-lanceolate or elliptic-ovate, mucronulate, with sharp, smooth or spinulose keel, 1st and 2nd small, 3rd 2 $\frac{1}{2}$ -3 $\frac{1}{2}$  mm, with 3-4-nerved sides, 4th 3-4 mm, with 2-nerved sides. Stamens 3; anthers linear,

1-1½ mm. *Stigmas* 2. *Nut* biconvex, laterally compressed, oblong to obovate, shortly apiculate, brown to black, 1½-2 by ⅔-1¼ mm.

*ssp. melanospermus*. — Synonymy see above.

*Stems* 30-175 cm by 2-4 mm. *Leaves* practically all reduced to membranous sheaths, only the upper 1-2 very shortly laminate. *Inflorescence* very dense, (6-)-10-12(-16) by 6-8(-10) mm. *Spikelets* oblong-elliptic, 3-4½ by 1 mm. *Glumes* ovate-lanceolate, the third 2½-3½ mm long, the fourth 3½-4 mm, both with distinct ferruginous nerves and smooth or sparsely spinulose keel. *Nut* oblong or elliptic-oblong, black, 1½-2 by ⅔-¾ mm.

*Distr.* Tropical and subtropical Africa, S. Asia, Fiji; widely spread in *Malesia*, but nowhere common: Sumatra, Malay Peninsula, Java, Philippines (Luzon, Mindanao) Lesser Sunda Is. (Flores), Celebes, New Guinea.

*Ecol.* Swamps, wet grassy fields, seepage hollows, open wet places in forests, usually 500-2000 m, sometimes up to 2200 m, one record (S. Sumatra, Lampongs) from 200 m.

*Vern.* *Rumput buwong*, Sum. W.C., *djukut bulu mata*, *djukut pëndul*, S. *peaã-peaã*, *tudju-tudju*, Celebes, *kokwakokwa*, New Guinea: Kapauku.

*ssp. bifolius* (MIQ.) KERN, Reinwardtia 3 (1954) 62, f. 12. — *Kyllinga bifolia* MIQ. Fl. Ind. Bat. 3 (1856) 293. — *C. brevifolius* f. *vaginatus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 47, t. 2 f. 4, p.p. — Fig. 69.

*Stems* up to 75 cm by c. 2 mm. Lower 1-2 leaves 10-25 cm by 3-4 mm. *Inflorescence* 6-10 by 6-8 mm, less dense than in *ssp. melanospermus*. *Spikelets* ovate-elliptic, 3-3½ by 1¼-1½ mm. *Glumes* elliptic-ovate, the first 2½-3 mm long, the second 3-¾ mm, with evidently serrate-spinulose keels. *Nut* broadly elliptic to obovate, 1½ by 1-1½ mm.

*Distr. Malesia:* Malay Peninsula (Pahang), Java, Lesser Sunda Is. (Bali), New Guinea (Papua).

*Ecol.* As in *ssp. melanospermus*, 1100-3000 m.

*Note.* In many respects intermediate between *ssp. melanospermus* and *C. brevifolius*. From the former it can be distinguished by the usually shorter stems, the fairly developed leaf-blades, and the different shape of spikelets and nuts; from the latter by its much stouter stems, relatively smaller leaf-blades, larger spikelets and nuts, and triandrous flowers.

72. *Cyperus aromaticus* (RIDL.) MATTF. & KÜK. Pfl. R. Heft 101 (1936) 581; KERN, Reinwardtia 3 (1954) 62; KOYAMA, Bot. Mag. Tokyo 83 (1970) 186. — *Kyllinga polyphylla* WILLD. ex KUNTH, En. 2 (1837) 134, non *C. polyphyllus* VAHL. — *Kyllinga aromatica* RIDL. Trans. Linn. Soc. II, Bot. 2 (1884) 146.

Very near to *C. melanospermus*. Involucral bracts more numerous, (5-)-7(-8). *Inflorescence* subglobose, consisting of a terminal head and some smaller sessile ones in the axils of the involucral bracts, all confluent into a head c. 1 cm ø. *Glumes* more distinctly mucronate.

*Distr.* Native to E. Africa; in *Malesia* introduced and naturalized in Singapore I.; the earliest collection is from 1941; nowadays very abundant.

*Ecol.* In grassy open places.

*Notes.* Also introduced into Ceylon, Solomon

Is., Samoa and in Fiji, where it is spreading rapidly and has become a noxious weed of pastures in the wet zone. See PARHAM, Plants of the Fiji Islands (1964) 296.

The *Malesian* specimens belong to the stout var. *elatus* (STEUD.) KÜK. Pfl. R. Heft 101 (1936) 582. — *Kyllinga elata* STEUD. Syn. 2 (1855) 70, non *C. elatus* L. — Up to, 90 cm. *Stems* rigid, strongly compressed, 2-3 mm thick. Involucral bracts up to 7 mm wide. *Spikelets* 4 mm long.

73. *Cyperus brevifolius* (ROTTB.) HASSK. Cat. Hort. Bog. (1844) 24; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 46, t. 2 f. 3, incl. f. *subtrifolius*, f. *gracilis* et f. *pumilus* VALCK. SUR., excl. f. *vaginatus*; KOORD. Exk. Fl. Java 1 (1911) 185, non *ibid.* 4 (1922) f. 193; KÜK. Pfl. R. Heft 101 (1936) 600, incl. f. *pumilus* et f. *firniculmis* KÜK.; S. T. BLAKE, J. Arn. Arb. 28 (1947) 225; KERN in BACK. & BAKH. f. Fl. Java 3 (1968) 470. — *Schoenus coloratus* LINNÉ, Sp. Pl. ed. 2 (1762) 64, p.p., non *C. coloratus* VAHL, 1806. — *Schaenoides brevifolius* ROTTB. Descr. Pl. rar. Progr. (1772) 15, nom. inval. (cf. Montreal Code art. 20, note 1). — *Kyllinga brevifolia* ROTTB. Descr. & Ic. (1773) 13, t. 4 f. 3; MIQ. Fl. Ind. Bat. 3 (1856) 291; BOECK. Linnaea 35 (1868) 424; NAVES, Nov. App. (1882) 300; CLARKE, Fl. Br. Ind. 6 (1893) 588; Philip. J. Sc. 2 (1907) Bot. 78; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 58; CLARKE, Ill. Cyp. (1909) t. 1 f. 1-4; CAMUS, Fl. Gén. I.-C. 7 (1912) 24, f. 3, 3-6; MERR. En. Philip. 1 (1923) 114; RIDL. Fl. Mal. Pen. 5 (1925) 138; BACK. Onkr. Suiker. (1928) 145, t. 145; BERN. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 45. — *Kyllinga cruciformis* SCHRADER ex R. & S. Mant. 2 (1824) 137; BOECK. Linnaea 35 (1868) 426. — *Kyllinga sororia* KUNTH, En. 2 (1837) 131; MIQ. Fl. Ind. Bat. 3 (1856) 293. — *Kyllinga gracilis* KUNTH, En. 2 (1837) 134; ZOLL. Syst. Verz. (1854) 63, p.p.; MIQ. Fl. Ind. Bat. 3 (1856) 292; NAVES, Nov. App. (1882) 300. — *Kyllinga pumilio* STEUD. [in Zoll. Syst. Verz. 1 (1854) 63, nom. nud.] Syn. 2 (1855) 67; MIQ. Fl. Ind. Bat. 3 (1856) 292. — *Kyllinga monocephala* (non ROTTB.) ZOLL. Syst. Verz. (1854) 63, p.p. — *Kyllinga longiculmis* MIQ. Fl. Ind. Bat. 3 (1856) 292; NAVES, Nov. App. (1882) 300. — *Kyllinga rigidula* STEUD. Syn. 2 (1855) 71, *quoad specim. philip.*; MIQ. Fl. Ind. Bat. 3 (1856) 294; NAVES, Nov. App. (1882) 300. — *Kyllinga squarrosa* STEUD. Syn. 2 (1855) 68; NAVES, Nov. App. (1882) 300. — *Kyllinga caespitosa* NEES var. *robusta* BOECK. Linnaea 35 (1868) 413; SCHEFFER, Nat. Tijds. N. I. 34 (1874) 45; VIDAL, Phan. Cum. Philip. (1885) 155; Rev. Pl. Vasc. Filip. (1886) 283. — *Pycnus pumilus* var. *substerilis* CAMUS, Not. Syst. 1 (1910) 241; Fl. Gén. I.-C. 7 (1912) 33, p.p. — *Kyllinga colorata* DRUCE, Rep. Bot. Exch. Club Br. Isl. 1916 (1917) 630. — *C. crypsoides* KERN, Reinwardtia 2 (1952) 128, f. 14. — Fig. 70.

Perennial; rhizome horizontally creeping, subterranean or close upon the ground, covered by ovate-lanceolate, reddish-brown scales, 1-3 mm thick, the internodes very variable in length (dependent on soil-conditions). *Stems* approximate to distant, rigidulous, triquetrous, smooth, 3-40 cm by ½-1½ mm. *Leaves* usually well-developed, weak to somewhat rigid, canalicate, scabrid on the margins in the upper part, grassgreen, 1-3 mm wide, very rarely only the upper one with a very short

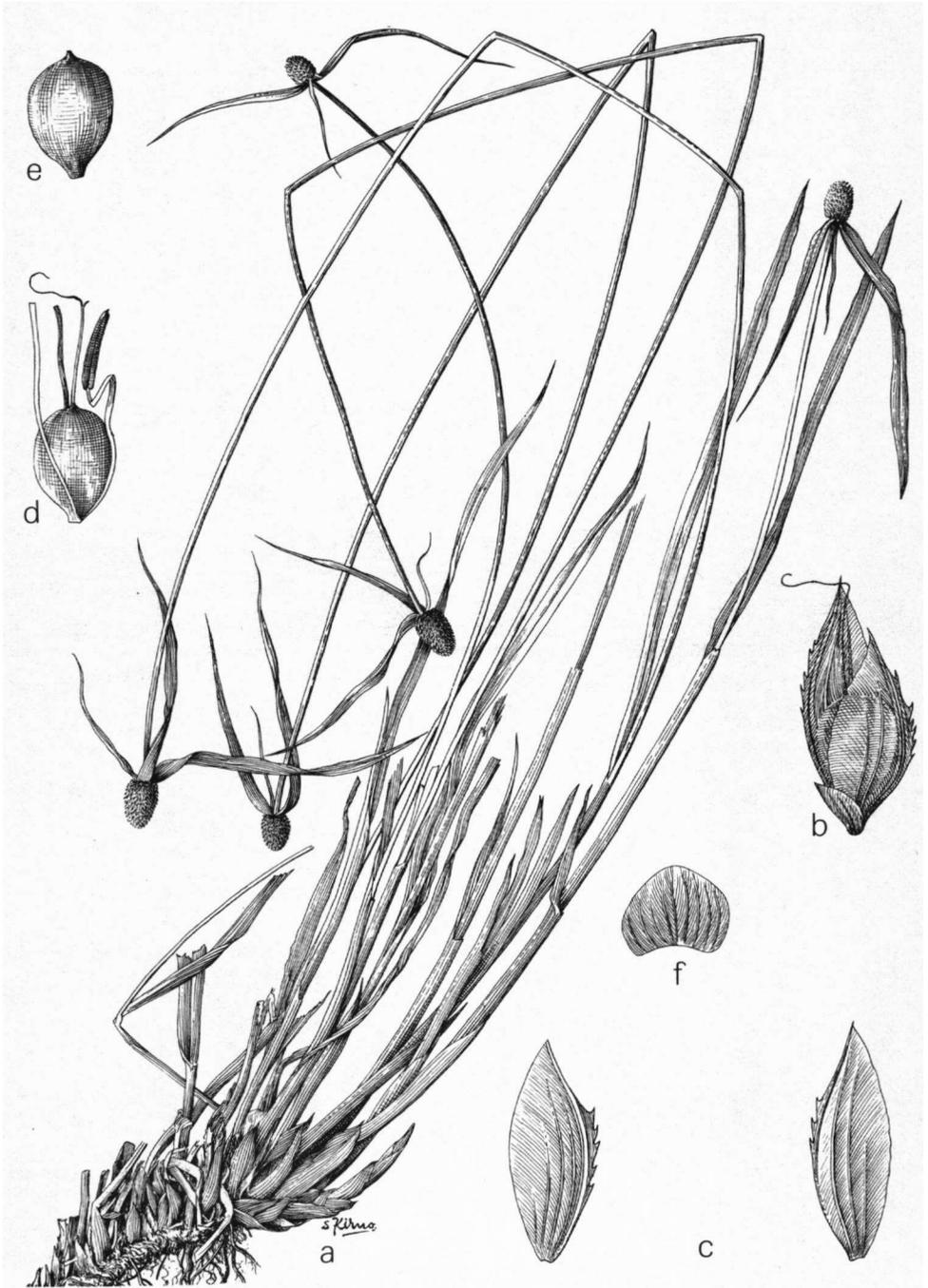


Fig. 69. *Cyperus melanospermus* (NEES) VALCK. SUR. ssp. *bifolius* (MIQ.) KERN. a. Habit,  $\times \frac{1}{2}$ , b. spikelet, c. glumes, d. deflorate flower, e. nut, f. prophyll, all  $\times 10$  (a-f VAN STEENIS 4360).



Fig. 70. *Cyperus brevifolius* (ROTTB.) HASSK. Habit of creeping rooting specimen in dry lawn at Djakarta,  $\times \frac{1}{2}$  (BACKER 33612).

blade. *Inflorescence* capitate, usually consisting of a terminal, globose to ovoid, 5–10 mm long and wide head, at first greenish, finally stramineous to fuscous, rarely with 1–2 smaller, sessile heads at the base; rachis narrowly conical. *Involucral bracts* 3–4, rarely 2 or 5–6, spreading to reflexed, but the lowest often remaining erect, 3–6(–20) cm long, very rarely all erect and very short (c. 2 cm). *Spikelets* closely packed, spreading or obliquely erect, elliptic-oblong or oblong-lanceolate, strongly compressed, 1(–2)-flowered, (2–)3(–4) by c. 1 mm, falling off as a whole. First *glume* elliptic-lanceolate,  $\frac{1}{2}$ –1 mm, 2nd ovate, 1 mm, 3rd and 4th boat-shaped, strongly compressed, mucronulate, acutely keeled, with 2–3-nerved sides and more or less spinulose, rarely smooth keel, resp.  $(1\frac{1}{2}$ –)2 $\frac{1}{2}$ (–3) mm and (2–)3(–4) mm long. *Stamens* 1–2(–3); anthers linear, c. 1 mm. *Stigmas* 2. *Nut* biconvex, laterally compressed, obovate or elliptic, apiculate, yellowish brown,  $1-1\frac{1}{4}$ (–1 $\frac{1}{2}$ ) by  $\frac{1}{2}$ – $\frac{3}{4}$  mm.

*Distr.* Widely spread in the tropical and warm-temperate regions of the whole world; very common throughout *Malesia*.

*Ecol.* In sunny or partly shaded localities, along roads, in grassy fields, damp forest clearings, on river-banks, etc.; 0–1500 m, rarely up to 1900 m (see var. *stellulatus*).

*Use.* Like *C. kyllingia* sometimes used as a fodder for cattle and horses; food value satisfactory, but yield scanty.

*Vern.* *Djukut pëndul*, *tëki*, S, *rumpul sadanan*, *tëki rowo*, J, *komes*, Md, *rumpul kapas*, Sumatra, *badjawa*, Timor, *wutu intalun*, N. Celebes, *kokolquli*, Aru Is.; Philip.: *bibi-inok*, Bon., *kadkadot*, Ig., *pugo-pugo*, C. Bis.; New Guinea: *punum*, Wapi, *ylampi*, Enga.

*Notes.* Extremely variable; the characters of the (certainly edaphic) forms distinguished by VALCKENIER SURINGAR and KÜKENTHAL are not constant.

*C. crypsoides* KERN from Celebes, with lower leaves reduced to bladeless sheaths, only the upper one with a short, rarely more than 2 cm long blade, and erect, linear to lanceolate, pungent involucral bracts, I now consider a form of *C. brevifolius* occurring in very wet localities.

Systematic value may have:

*var. stellulatus* (VALCK. SUR.) KÜK. Pfl. R. Heft 101 (1936) 603. — *C. brevifolius* f. *stellulatus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 48, t. 2 f. 5. — *Kyllingia fuscata* MIQ. Fl. Ind. Bat. 3 (1856) 294. — *Kyllingia intermedia* (non R.BR.) MERR. En. Philip. 1 (1923) 115. — *Kyllingia brevifolia* var. *stellulata* OHWI, Bot. Mag. Tokyo 56 (1942) 199.

*Dwarfish.* *Inflorescence* small, with fewer (c. 20) spikelets, 4–5(–7) mm across, finally fuscous. *Glumes* with smooth keel. *Stamens* 3 or 2. *Nut*  $1\frac{1}{4}$ – $1\frac{1}{2}$  by  $\frac{3}{4}$ –1 mm, brown to castaneous.

*Distr. Malesia:* Central and East Java, Lesser Sunda Is. (Lombok), Philippines (Luzon, Mindoro, Negros, Mindanao), W. New Guinea (Arfak Mts).

*Ecol.* Open marshy places, grassy fields, open *Casuarina* forests, 1400–2300 m.

74. *Cyperus sesquiflorus* (TORR.) MATTF. & KÜK. Pfl. R. Heft 101 (1936) 591, f. 6 E–J. — *Kyllingia sesquiflora* TORR. Ann. Lyc. N. York 3 (1836) 287.

In Malesia only:

*var. subtriceps* (NEES) KOYAMA, Quart. J. Taiwan Mus. 14 (1961) 191. — *Kyllinga cylindrica* NEES in Wight, Contr. (1834) 91, incl. *var. subtriceps* NEES; BOECK. Linnaea 35 (1868) 415, p.p.; CLARKE, Fl. Br. Ind. 6 (1893) 588, excl. *specim. malacc.*; Philip. J. Sc. 2 (1907) Bot. 79; CAMUS, Fl. Gén. 1-C. 7 (1912) 23; MERR. En. Philip. 1 (1923) 115; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 44, p.p.; non *C. cylindrica* CHAPM. 1878. — *C. viridulus* VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 51, t. 2 f. 7, 9, non BOECK. 1868 nec *Kyllingia viridula* HOCHST. ex A. RICH. — *Kyllinga odorata* VAHL var. *cylindrica* KÜK. in Merr. J. Str. Br. R. As. Soc. 76 (1917) 80; MERR. En. Born. (1921) 58; KÜK. Candollea 6 (1936) 422. — *C. sesquiflorus* var. *cylindricus* KÜK. Pfl. R. Heft 101 (1936) 593; Bot. Jahrb. 70 (1940) 463; KERN, Reinwardtia 3 (1954) 65. — *C. kernianus* OHWI & KOYAMA, J. Jap. Bot. 30 (1955) 126; KOYAMA, Act. Phytotax. Geobot. 16 (1955) 35, t. 4 f. B. — *C. sesquiflorus* ssp. *cylindricus* (NEES ex WIGHT) KOYAMA, Bot. Mag. Tokyo 83 (1970) 187.

Perennial with very short rhizome. *Stems* tufted, triquetrous, smooth, seemingly thickened at the base by reddish brown cataphylls, 10–30 cm by 1 mm. *Leaves* rigidulous, flat, gradually acuminate, scabrid on the margins in the upper part, 2–4 mm wide. *Inflorescence* capitate, whitish, finally straw-coloured, consisting of a terminal, cylindrical head 10–12 by 4–5 mm, and 0–2 lateral, subglobose, sessile heads much smaller than the terminal one. *Involucral bracts* 3–5, faintly reflexed, up to 10 cm. *Spikelets* numerous, patent, elliptic, strongly compressed though somewhat turgid, maturing 1 nut, 2–2½ by 1–1¼ mm, falling off as a whole; rachilla cylindrical, disarticulating at the base. *Glumes* hyaline, 1st and 2nd small, 3rd and 4th nearly equal in length, broadly ovate, acute or apiculate, with smooth or hardly spinulose, sharp keel, resp. strongly 9–11- and 5–7-nerved, 2–2½ mm. *Stamens* 2; anthers oblong, ½–¾ mm. *Stigmas* 2. *Nut* biconvex, laterally compressed, obovate or broadly obovate, obtuse, shortly apiculate, black, c. 1½ by 1 mm.

*Distr.* Tropical Africa; in SE. Asia from Ceylon and India to Yunnan, Formosa, and Malesia; scattered in Sumatra (Atjeh, Tapanuli, East Coast Res.), Java, Lesser Sunda Is. (Bali), N. Borneo, Philippines (Luzon, Mindanao), Aru Is. (Trangan I.), and New Guinea. Not known from the Malay Peninsula (see *C. triceps*).

*Ecol.* In open grasslands, usually 1000–1600 m, rarely at low altitudes.

*Note.* The typical *var. sesquiflorus*, occurring in tropical Africa, the warm parts of N. and S. America, and Australia, differs mainly by the larger, 3–3½ mm long spikelets.

75. *Cyperus triceps* ENDL. Cat. Hort. Ac. Vindob. 1 (1842) 94; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 50, t. 2 f. 6; KÜK. Pfl. R. Heft 101 (1936) 578; KERN, Reinwardtia 3 (1954) 61. — *Schaenoides triceps* ROTTB. Descr. Pl. rar. Progr. (1772) 15, *nom. inval.* (cf. Montreal Code, art. 20, note 1). — *Kyllinga triceps* ROTTB. Descr. & Ic. (1773) 14, t. 4 f. 6; BOECK. Linnaea 35 (1868) 413, p.p.; CLARKE, Fl. Br. Ind. 6 (1893) 587. — *Kyllinga pumila* STEUD. Flora 35 (1842) 596, non NAVES, Nov. App. (1882) 300. — *Kyllinga cylindrica* (non NEES) CLARKE, Fl. Br. Ind. 6 (1893) 588, *quoad specim. malacc.*; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 59; Fl. Mal. Pen. 5 (1925) 137.

Perennial with short rhizome; stolons wanting. *Stems* densely tufted, slender, sometimes setaceous, obtusely trigonous, smooth, 5–20(–40) cm by up to 1 mm, the incrassate base covered by brownish, desintegrating sheaths. *Leaves* flat or slightly conduplicate, weak, gradually acuminate, 1–2(–3) mm wide. *Inflorescence* capitate, consisting of (1–)3(–5) dense, sessile heads; central head subglobose, obtuse, 5–8 by 5 mm, lateral ones globose, somewhat smaller; rachis cylindrical. *Involucral bracts* 3–4, widely spreading to reflexed, up to 10 cm. *Spikelets* numerous, patent, oblong, strongly compressed, pale green to whitish, 1-flowered, c. 2 by ¾ mm, falling off as a whole; rachilla very short, disarticulating at the base. *Glumes* hyaline, ovate-oblong, acuminate or submucronulate, with sharp, smooth or hardly spinulose keel; 1st and 2nd glume small, 3rd 7-nerved, c. 1¾ mm, 4th glume 5-nerved, c. 2 mm; nerves less prominent than in *C. sesquiflorus*. *Stamens* 2; anthers oblong-linear. *Stigmas* 2. *Nut* biconvex, laterally compressed, oblong, apiculate, yellowish brown to brown, 1–1¼ by ½ mm.

*Distr.* Widely spread over tropical Africa, India, and Farther India to S. China and Australia (Queensland, New South Wales); in Malesia once collected (Singapore, 1885); probably an introduction.

*Ecol.* In Singapore as a weed on a sandy lawn.

*Notes.* Confused with *C. sesquiflorus*, from which it is distinguishable by the shape of the inflorescence, the narrow spikelets, and the narrow, brown fruits.

Although the basionym *Kyllinga triceps* ROTTB. is illegitimate, the correct name of this species in *Cyperus* is *C. triceps* ENDL. (1842), the synonym *Kyllinga bulbosa* BEAUV. (1804) already in 1842 not being transferable to *Cyperus* (art. 66 note 2 and art. 72 Montreal Code). ROTTBOELL's specific epithet was nomenclaturally superfluous because the name *Scirpus glomeratus* L. was cited in synonymy (art. 63), but the type of *Kyllinga triceps* is not that of *Scirpus glomeratus*, as ROTTBOELL indicated a definite type ("*Dominus Königius legit.*").

### 39. Section Alati

KÜK. Pfl. R. Heft 101 (1936) 604.

Type species: *Kyllinga alata* NEES.

76. *Cyperus kyllingia* ENDL. Cat. Hort. Ac. Vindob. 1 (1842) 94; KÜK. Pfl. R. Heft 101 (1936) 606, f. 64 C-D, incl. *f. humilis*, *f. tenuis* et *f. subtriceps* KÜK.; S. T. BLAKE, J. Arn. Arb. 28 (1947) 225; KERN in

Back. & Bakh. f. Fl. Java 3 (1968) 469. — *Gramen capitatum* RUMPH. Herb. Amb. 6 (1750) 8, t. 3 f. 2. — *Scirpus cephalotes* JAQC. Hort. Vind. 1 (1770) 42, t. 97, non *C. cephalotes* VAHL, 1806. — *Kyllinga*

*monocephala* ROTTB. Descr. & Ic. (1773) 13, t. 4 f. 4; ZOLL. Syst. Verz. 1 (1854) 63, p.p.; MIQ. Fl. Ind. Bat. 3 (1856) 291; BOECK. Linnaea 35 (1868) 427, incl. var. *subtriceps* KUNTH et var. *mindorensis* BOECK.; CLARKE, Fl. Br. Ind. 6 (1893) 588; Philip. J. Sc. 2 (1907) Bot. 77; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 58; CLARKE, Ill. Cyp. (1909) t. 2 f. 1-2; CAMUS, Fl. Gén. I.-C. 7 (1912) 25, f. 3, 1-2; MERR. En. Philip. 1 (1923) 115; RIDL. Fl. Mal. Pen. 5 (1925) 138; BACK. Onkr. Suiker. (1928) 144, t. 144; Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 44. — *Kyllinga gracilis* (non KUNTH) ZOLL. Syst. Verz. 1 (1854) 63, p.p. — *Kyllinga triceps* (non ROTTB.) BLANCO, Fl. Filip. (1837) 34 ('*Killinga*'); STEUD. Syn. 2 (1855) 72; NAVES, Nov. App. (1882) 330; K.SCH. & LAUT. Fl. Schutzgeb. (1900) 194. — *Kyllinga brevifolia* (non ROTTB.) MOR. Syst. Verz. (1846) 95. — *C. leucocephalus* HASSK. Pl. Jav. Rar. (1848) 87, non RETZ. 1789. — *Kyllinga gracilis* KUNTH var. *capitulo globoso* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 28. — *Kyllingamindorensis* STEUD. Syn. 2 (1855) 67; MIQ. Fl. Ind. Bat. 3 (1856) 292; NAVES, Nov. App. (1882) 300. — *C. monocephalus* F.V.M. Fragm. 8 (1874) 271; VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 44, t. 2 f. 1; KOORD. Exk. Fl. Java 1 (1911) 185; *ibid.* 4 (1922) f. 193, 194, non ROXB. 1832. — *Kyllinga cephalotes* DRUCE, Rep. Bot. Exch. Club Br. Isl. 1916 (1917) 630.

Perennial; rhizome horizontally creeping, covered by ovate-lanceolate scales, 1-2 mm thick, the internodes very variable in length (dependent on soil-conditions). Stems approximate to distant, rigidulous, triquetrous, smooth, 5-45 cm by 1-1½ mm. Leaves well-developed, flaccid or rigidulous, canaliculate, scabrid on the margins in the upper part, grassgreen, 2-4(-5) mm wide. Inflorescence capitate, consisting of a terminal, ovoid-globose or ellipsoid head 8-12 by 6-10 mm, with usually 1-3 much smaller, sessile heads at the base, at first snowy white, turning fulvous after anthesis; rachis conical. Involucral bracts 3-4, spreading to reflexed, the lowest up to 30 cm. Spikelets very closely packed, spreading, obliquely ovate-elliptic, strongly compressed, 3-3½ by (1-1½(-1¾)) mm, falling off as a whole. First and second glume narrow, membranous, 1-1½ mm long; other glumes boat-shaped, strongly compressed, apiculate or mucronulate, acutely keeled, broadly winged on the keel from somewhat above the base, green in the upper part of the keel, otherwise white, usually reddish brown punctulate; wings ciliate-serrate, ¼-½ mm broad; 3rd glume enclosing a ♀ flower, 2½-3 mm long, 4th glume with narrow, cuneate base (in fact the winged rachilla), enclosing a ♂ or ♀ (sometimes a barren) flower, 3-3½ mm, 5th glume when present small, sterile. Stamens 3; anthers linear, ½-1 mm. Stigmas 2. Nut biconvex, laterally compressed, oblong or oblong-obovate, apiculate, yellowish brown to castaneous, ¼-1½ by ½-¾ mm.

Distr. Common in the warmer parts of Asia, less so in tropical Africa and Australia, very rare in tropical America; common throughout Malesia.

Ecol. In sunny or somewhat shaded waste places, road-sides, open grasslands, secondary growths, etc., at low and medium altitudes, rarely up to 1750 m.

Use. In those regions where grass is scantily available in the dry monsoon, the plant is appreciated as a fodder for cattle and horses; the food value is satisfactory.

Vern. *Tèki, tèki badot, M, djukut pëndul bodas, S, mèlaran, sukèt wudèlan, udèl-udèlan-alit, J, ping ajuping, Md, rumput tai, Trengganu, rumput kutu radja, Lingga, andor si tiga bulung, Asahan, kèmbili-kèmbili, Karo-Batak, sèlang sajong, Karo, idjar kapas, Enggano, rumput iput-iput, Banka, kakamut, kingkimut, tomatong, N. Borneo, tèki sela, tinti lamonu, Celebes, nèsar leteng, Wetar, dodopala, tittingapu, Moluccas; Philip.: anuang, mustra, muthá, Tag., barubotónes, bolobotónes, borobotónes, boskad, bosobotónes, malabatónes, sud-sud, Bis., botoncillo, Sp., borsa ngadadakkel, Ilk., baki-báki, pungós, S. L. Bis., bosikad, C. Bis., busikad, P. Bis., katutu, Mag., kuru-kamóting-orig, Bik., sangsangitan, Bon., uli-uli, Bag.; New Guinea: lemisa'haru, Kutubu.*

#### Hybrid

*Cyperus distans* L. f. × *C. rotundus* L.

A Philippine collection from Negros, Prov. of Negros Oriental, Dumaguete (Cuernos Mts), June 1908, ELMER 10369, is in all respects intermediate between *C. distans* and *C. rotundus*, which species were collected in the same locality at the same time. There can be little doubt that it is a hybrid of the said species. The completely sterile spikelets are strongly accrescent, c. 5 cm long, 1½ mm wide, and c. 50-flowered. Glumes c. 2½ mm long, less broadly hyaline-margined than in *C. distans*, more obtuse than in *C. rotundus*, and but slightly overlapping. Internodes of the rachilla c. 1½ mm long. Anthers c. 1 mm long.

#### Doubtful and Excluded

A fairly great number of *Cyperus* species has been recorded for or described from Malesia which cannot be placed satisfactorily. Most of them must be referable to some of the species accepted above, but they are not determinable from the descriptions, and the specimens on which the records were based are unavailable. This is especially so with several names in NAVES's Novissimae Appendix (1882). Several of PRESL's records in Reliquiae Haenkeanae (1828-30) "in insula Luzon" are certainly not Philippine, but American. See also MERRILL, En. Philip. 1 (1923) 108-109, 111, 116, and KÜKENTHAL, Pfl. R. Heft 101 (1936) 626-627.

*Cyperus albus* PRESL, Rel. Haenk. 1 (1828) 175; KUNTH, En. 2 (1837) 102; STEUD. Syn. 2 (1855) 52; MIQ. Fl. Ind. Bat. 3 (1856) 287; NAVES, Nov. App. (1882) 306. — Luzon.

*Cyperus alternifolius* L. — VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 103. Native to Madagascar. The old specimen in L from "Java", without any details, was certainly mislabelled.

*Cyperus brunnescens* BOECK. Cyp. Nov. 2 (1890) 3; CLARKE, Fl. Br. Ind. 6 (1893) 619. — "Herb. Mus. botan. Hauniensis-Mis. Voigt. Singapore." — In all probability VOIGT never visited Malesia, and the type locality should read "Serampore" (in Bengal), where most of VOIGT's specimens were collected. The type is a poor fragment. See KÜK. Pfl. R. Heft 101 (1935) 159.

"*Cyperus clavatus* LAMK." — USTERI, Beitr.

Kenntn. Philip. Veg. (1905) 131. LAMARCK did not publish this name. The specific epithet was mis-spelt.

*Cyperus corymbosus* ROTTB. — MIQ. Sum. (1861) 600; NAVES, Nov. App. (1882) 303. — Not known from Banka, nor from the Philippines.

*Cyperus flavescens* L. — BOECK. Linnaea 35 (1868) 438, *quoad pl. Luzon*; NAVES, Nov. App. (1882) 301. — A widely distributed species, but in Asia extending eastward to the western Himalaya, not reaching Malesia. The records for Indo-China are also wrong. See KERN, Blumea 10 (1960) 641.

*Cyperus flavicomus* MICHX. — NAVES, Nov. App. (1882) 301. — A N. American species not occurring in Malesia.

*Cyperus haematodes* ENDL. — STEUD. Syn. 2 (1855) 44; MIQ. Fl. Ind. Bat. 3 (1856) 282; NAVES, Nov. App. (1882) 305. — The Philippine record is due to an error of STEUDEL. The type is from Norfolk Island.

*Cyperus hexastachyus B pendulus* NEES in Wight, Contr. (1834) 82. — "Java, Manila". Referred by KÜK. Pfl. R. Heft 101 (1936) 125 to *C. bulbosus* VAHL, which is unknown from the Philippines.

*Cyperus kükenhali* MERR. J. Arn. Arb. 19 (1938) 322. — *C. javanicus* KÜK. in Fedde, Rep. 29 (1931) 194; Pfl. R. Heft 101 (1936) 319, *non* HOUTT. 1782. — *Juncellus kükenhali* BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 42. — "Java, W. HILLEBRAND." Erroneously localized (see Fl. Mal. I, 1, 1950, 232). The type was destroyed during World War II.

*Cyperus laevigatus* L. — MIQ. Fl. Ind. Bat. 3 (1856) 260; NAVES, Nov. App. (1882) 301. — Not known from Malesia. A specimen in S labelled "e Java, leg. MELLERBORG s.n." was apparently wrongly localized.

*Cyperus lanceolatus* POIR. var. *compositus* PRESL, Rel. Haenk. 1 (1828) 167; KÜK. Pfl. R. Heft 101 (1936) 350. — Luzon, Sorsogon. — An American plant not occurring in the Philippines.

*Cyperus lanceus* THUNB. — VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 70, t. 2 f. 20. — A native of Africa. The specimens cited *l.c.* (in L, without authentic label) do not originate from Malesia. See KERN, Reinwardtia 2 (1952) 122.

*Cyperus longus* L. — MIQ. Fl. Ind. Bat. 3 (1856) 275; NAVES, Nov. App. (1882) 304. — A Eurasian species not extending to SE. Asia. The records for Indo-China (Fl. Gén. I.-C. 7, 1912, 68) refer to specimens of *C. corymbosus* ROTTB. See KERN, Blumea 10 (1960) 643.

*Cyperus luzonensis* PRESL, Rel. Haenk. 1 (1828) 174; KUNTH, En. 2 (1837) 101; STEUD. Syn. 2 (1855) 52; MIQ. Fl. Ind. Bat. 3 (1856) 287; NAVES, Nov. App. (1882) 306.

*Cyperus luzulae* (L.) RETZ. — VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 89, t. 4 f. 8. — *Courtoisia*

*cyperoides* (*non* NEES) MIQ. Fl. Ind. Bat. 3 (1856) 295. — "Java or Sumatra" (L). Supposed to be collected by JUNGHUHN, but no authentic label extant. Occurrence in Malesia at JUNGHUHN's time is very unlikely.

*Cyperus melanospermus* var. *plurifoliatus* KÜK. Pfl. R. Heft 101 (1936) 585. — "Java, HILLEBRAND." Wrongly localized. See Fl. Mal. I, 1 (1950) 232.

*Cyperus minutiflorus* PRESL, Rel. Haenk. 1 (1830) 351; KUNTH, En. 2 (1837) 102; STEUD. Syn. 2 (1855) 52; MIQ. Fl. Ind. Bat. 3 (1856) 287; NAVES, Nov. App. (1882) 306. — *C. micranthus* PRESL, Rel. Haenk. 1 (1828) 178, *non* R. & S. 1824. — *C. breviflorus* A. DIETR. Sp. Pl. 2 (1833) 316. — Luzon, *vide* PRESL.

*Cyperus pangorei* ROTTB. — NAVES, Nov. App. (1882) 304. — Not known from the Philippines.

*Cyperus philippensis* PRESL, Rel. Haenk. 1 (1828) 174; KUNTH, En. 2 (1837) 101; STEUD. Syn. 2 (1855) 52; MIQ. Fl. Ind. Bat. 3 (1856) 287; NAVES, Nov. App. (1882) 306. — Luzon, *vide* PRESL.

*Cyperus sexflorus* R.Br. — NAVES, Nov. App. (1882) 304. — An Australian species not known from the Philippines.

*Cyperus stenostachyus* (*non* BENTH.) VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 112, t. 4 f. 25, t. 5 f. 7. — "Prob. Java." The specimens on which this record was based belong to *C. longus* var. *badius* (DESF.) ASCH. & GR., a Mediterranean plant not occurring in Malesia. See KERN, Reinwardtia 3 (1954) 27.

*Cyperus tegetiformis* ROXB. — NAVES, Nov. App. (1882) 303. — Not occurring in the Philippines.

*Cyperus tenuiflorus* (*an* ROTTB.?) VALCK. SUR. Gesl. Cyp. Mal. Arch. (1898) 111, t. 4 f. 24, t. 5 f. 6; KOORD. Exk. Fl. Java 1 (1911) 196; *ibid.* 4 (1922) f. 217. — A poor, very old, inadequately labelled collection from W. Java ("Gedogan, bamboo-grove"), was determined by CLARKE as *C. tenuiflorus* ROTTB. and as such mentioned by VALCKENIER SURINGAR. Without having seen the specimens KÜKENHAL, Pfl. R. Heft 101 (1935) 103, referred SURINGAR's record to *C. mitis* STEUD. (*C. tenuiflorus* ROXB., *non* ROTTB.) and mentioned two other Java collections of this species (JUNGHUHN, N. J. ANDERSSON), which I have not seen. I cannot identify the specimens in the Rijksherbarium, which belong in the extremely difficult *sect. Cyperus*, but are only in very young flower.

*Cyperus tuberosus* ROTTB. — KUNTH, En. 2 (1837) 50; MIQ. Fl. Ind. Bat. 3 (1856) 265. — ? Luzon, *vide* KUNTH. — The record must be erroneous as the species is not known from the Philippines.

*Kyllinga pumila* (*non* STEUD.) NAVES, Nov. App. (1882) 300. — STEUDEL's name is a synonym of *Cyperus triceps* (ROTTB.) ENDL., which is unknown from the Philippines. See p. 659.

## 15. TETRARIA

BEAUV. Mém. Inst. Fr. (Acad. Sc. Paris) 1812, II (1816) 54; BAILLON, Hist. Pl. 12 (1894) 374; CLARKE, Fl. Cap. 7 (1898) 275; TURRILL, Kew Bull. (1925) 72;



Fig. 71. *Tetraria borneensis* KERN. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 8$ , c. glume,  $\times 4$ , d. defforate flower, e. sterile flower, f. nut, all  $\times 8$ , g. anther,  $\times 16$  (a PURSEGLOVE 5072, b-e, g KOSTERMANS 10737, f PURSEGLOVE 5559).

KÜK. in Fedde, Rep. 48 (1940) 195; LEVYNS, J. S. Afr. Bot. 13 (1947) 73. — *Elynanthus* NEES, Linnaea 7 (1832) 520; *ibid.* 9 (1835) 298; BOECK. Linnaea 38 (1874) 253; B. & H. Gen. Pl. 3 (1883) 1063, *vix* BEAUV. *ex* LESTIB. Essai Fam. Cyp. (1819) 32. — Fig. 71–72.

Perennial herbs with short woody rhizome. *Stems* tufted, erect, terete, trigonous or triquetrous. *Leaves* basal or also cauline, setaceous, subulate or flat, sheaths long, those of the cauline leaves often tubular, dark; ligule sometimes present. *Inflorescence* paniculate, narrow. *Bracts* leafy, not sheathing, or with tubular sheaths. *Spikelets* several to many, solitary or in clusters, oblong-lanceolate, more or less compressed, 2(–3)-flowered. *Rachilla* very short, straight, not produced beyond the upper flower. *Glumes* 4–12 (usually 5–7), distichous or subdistichous, the lower ones (usually 4–6) empty, small, the



Fig. 72. *Tetraria borneensis* KERN gregarious in thickets on kerangas soil in Bako National Park, Sarawak, with young *Ploiarium* and *Dacrydium* in background (photogr. SLEUMER, 1963).

upper ones flower-bearing. *Flowers* usually 2, close together, the lower male or functionally male (gynaceum abortive), the upper bisexual. Hypogynous bristles (0–)2–9(–14), delicate, sometimes shortly plumose. *Stamens* 3, 4, 6, or 8; anthers linear, with distinctly produced connective, often auricled at the base (ears without pollen). *Style* slender, continuous with the ovary, dilated at the base, with 3, 4, 6, or 8 stigmas; style-base persistent on the nut. *Nut* usually trigonous, ovoid-oblong or obovoid, with a (sometimes conspicuous) sterile apex (the persistent style-base).

Distr. About 35 spp., most of them in extra-tropical S. Africa, a few in Australia, in *Malesia* 1 sp. in Borneo.

1. *Tetraria borneensis* KERN, *Blumea* 9 (1958) 222, f. 2. — Fig. 71–72.

*Stems* rather stout, obtusely trigonous, smooth, c. 1½–2 m by 2–4 mm (5–6 mm at the base), the incrassate base covered with castaneous sheaths and their fibrous remains. Basal *leaves* coriaceous, much shorter than the stems, conduplicate at the base, otherwise canaliculate or flat, gradually narrowed into a long triquetrous point, scabrous on the margins, 4–10 mm wide; cauline leaves 3–4, shorter than the basal ones, with tubular castaneous 4–8 cm long sheaths; the emarginature at the orifice acute, v-shaped, with overlapping margins. *Inflorescence* loose, 40–90 cm long, consisting of 4–8 distant fascicles of branches; branches 2–4 together, erect, unequal, aciculate, scaberulous. Lower bracts similar to cauline leaves but shorter, 5–10 cm long, the upper gradually shorter. *Spikelets* numerous, solitary, shortly peduncled, narrowly lanceolate, acute, 2-flowered, 7–8 by 1–1½ mm. *Glumes* 7, subdistichous, castaneous; lower 4 empty, ovate, shortly aristate; flower-bearing glumes oblong, c. 6 mm long, asperous towards the apex; uppermost glume thinly membranous, empty. Lower *flower* male, or functionally male (with abortive gynaceum), upper bisexual. *Bristles* 2–3, capillary, white, minutely scaberulous at the top. *Stamens* in both flowers 6; anthers linear, rufescent, inconspicuously auricled

at the base, 2 mm long, with a c. 1½ mm long scabrous appendage of the connective. Persistent *style-base* narrowly pyramidal, antrorsely scabrous, stramineous, c. 2 mm. *Stigmas* 3. *Nut* trigonous, obovoid, attenuate at the base, smooth, castaneous, 2½–3 by 1–1½ mm.

Distr. *Malesia*: Borneo (E. Borneo, Kelindjau River region; Sarawak: Lobok Pasir, Telok Asam; W. Borneo: bank of Sendabai lakes, Mt Kenepai).

Ecol. Marshy 'padang', on sandy soil, at c. 100 m, locally very common and a dominant in this type of vegetation (E. Borneo); in Sarawak also in open heath forest (Bako National Park) and abundant but localized in the centre of peat swamp forest (ANDERSON, *Gard. Bull. Sing.* 20, 1963, 216).

Note. In view of the distribution of the other species the occurrence of a *Tetraria* in the equatorial lowland of Borneo is very surprising. The group of genera to which *Tetraria* belongs is extremely difficult, and the genera have been circumscribed in very different ways. The subdistichous glumes, the short straight rachilla, the barren lower flower, the number of stamens, the long appendage of the connective, the persistent style-base, the delicate hypogynous bristles, etc., of the Bornean plant compel to inclusion in the genus *Tetraria*. There are, however, strong affinities to *Costularia pilisepala*.

## 16. COSTULARIA

CLARKE [in Dur. & Schinz, *Consp. Fl. Afr.* 5 (1895) 658, *nom.* in Thiselt.-Dyer, *Fl. Cap.* 7 (1898) 274; *Kew Bull. add. ser.* 8 (1908) 125; KÜK. in Fedde, *Rep.* 46 (1939) 13–76. — *Lophoschoenus* STAPF, *J. Linn. Soc. Bot.* 42 (1914) 177; PFEIFF. in Fedde, *Rep.* 23 (1927) 343. — Fig. 73.

Perennial herbs with short woody rhizome. *Stems* stout, erect, obtusangular, noddy. *Leaves* basal and cauline, linear, broad, coriaceous; sheaths of the cauline leaves tubular. *Inflorescence* paniculate, loose, consisting of 5–10 distant fascicles of partial panicles. Bracts similar to the cauline leaves, but shorter. *Spikelets* numerous, solitary or 2–3 together, oblong-lanceolate, acute, compressed, usually 2-flowered, both flowers or only the upper one fertile. Rachilla short, not or only shortly produced beyond the upper flower. *Glumes* distichous, lowest 3–16 empty, small. *Hypogynous bristles* usually 6, ciliate or plumose. *Stamens* 3; anthers linear, yellow or ferruginous; connective ± produced. *Style* slender, continuous with the ovary, the base incrassate, conical or pyramidal, persistent, hispidulous; stigmas 3. *Nut* trigonous, sessile, indistinctly tessellate, rugulose, or almost smooth.



Fig. 73. *Costularia pilisepala* (STEUD.) KERN. *a-a'*. Habit,  $\times \frac{1}{2}$ , *a'*. lower branch, nat. size, *b*. spikelet,  $\times 3$ , *c*. uppermost internode of rachilla with sterile glume, *d*. deflobrate spikelet, left lower  $\sigma$  flower with abortive pistil, right bisexual flower,  $\times 5$ , *e*. deflobrate upper flower, *f*. LS of nut with 3 filaments and 6 plumose bristles (after BRONGNIART).

Distr. In the circumscription of KÜENTHAL the genus comprises about 20 *spp.*, 2 of them in S. Africa, 10 in Madagascar, the Mascarenes and the Seychelles, 9 in New Caledonia, and 1 in *Malesia*.

Note. KÜENTHAL divided the genus into 3 subgenera, of which in *Malesia* only *subg. Lophoschoenus* (STAFF) KÜ. in Fedde, Rep. 46 (1939) 26, characterized by the comose fibrous sheaths of the basal leaves, the densely plumose hypogynous bristles, the long-produced connective of the anthers, and the sessile, obsoletely tessellate nut.

1. *Costularia pilisepala* (STEUD.) KERN, Fl. Mal. I, 5 (1957) 420; *Blumea* 9 (1958) 234. — *Carpha arundinacea* BRONGN. in Duperrey, Voy. Coq. Bot. 2(1829) 169, t. 30, non *Costularia arundinacea* KÜK. — *Asterochaete arundinacea* KUNTH, En. 2 (1837) 312, p.p. (excl. pl. nov.-caled.); STEUD. Syn. 2 (1855) 155, p.p.; MIQ. Fl. Ind. Bat. 3 (1856) 338. — *Restio pilisepalus* STEUD. Syn. 2 (1855) 256. — *Carpha urvilleana* GAUDICH. [ex NEES, Linnaea 9 (1835) 300, nom. nud.] ex BOECK. Linnaea 38 (1874) 272. — *Lophoschoenus urvilleanus* STAFF, J. Linn. Soc. Bot. 42 (1914) 180; MERR. En. Born. (1921) 63; PFEIFF. in Fedde, Rep. 23 (1927) 346, in nota. — *C. urvilleana* KÜK. in Fedde, Rep. 46 (1939) 28; S. T. BLAKE, J. Arn. Arb. 29 (1948) 95. — Fig. 73.

*Stems* obtusely trigonous to subterete, striate, smooth, leafy, 120–150 cm by 4–6 mm, the base densely clothed with the brown fibrous remains of decayed leaf-sheaths. Basal leaves long, gradually narrowed into a long triquetrous point, sharply keeled, up to 8 mm wide, with revolute margins; margins and keel serrulate-scabrous; cauline leaves 3, narrower; sheaths 4–5 cm long, brown or fuscous, the emarginature at the orifice semicircular, the margins not overlapping. *Panicle* 35–60 cm long, narrow, loose to rather dense, compound; branches

in fascicles of 1–3, erect, slender, compressed-trigonous to ancipitous, smooth; branchlets filiform. *Spikelets* numerous, mostly solitary, peduncled, oblong-lanceolate, acute, 2-flowered, 6–7 by c. 1½ mm. Uppermost internode of the rachilla slightly elongated, bearing a sterile glume. *Glumes* 9–10, the lower ones ovate-lanceolate, the upper lanceolate, c. 5 mm, reddish brown, with acute scaberulous keel, minutely pubescent in the upper part, the lower 5–6 empty, shortly awned. Upper flower ♂, the lower one male with abortive gynaceum, or male, sometimes both flowers ♀. *Hypogynous bristles* 6, twice as long as the nut, c. 5 mm, flexuous, attenuate towards the apex, densely plumose up to the top. *Stamens* 3; anthers linear, with a moderately long, smooth or slightly antrorsely scabrous appendage of the connective. *Style-base* long-conical, pale, hispidulous, persistent. *Nut* surrounded by the persistent bristles, obovate-elliptic, trigonous, ferruginous, c. 2 mm long (immature).

Distr. *Malesia*: N. Borneo (Mt Kinabalu, common) and West New Guinea (Waigeo I.; P. Rawak; Hollandia and vicinity.; Mt Cycloop).

Ecol. In brushwood, in swampy localities, on stony patches of dry open slopes; in New Guinea up to 350 m, on Mt Kinabalu 1650–2640 m.

## 17. CARPHA

BANKS & SOL. ex R.BR. Prod. (1810) 230, p.p.; BOECK. Linnaea 38 (1874) 265–273, p.p.; KÜK in Fedde, Rep. 47 (1939) 108. — Fig. 74.

Perennial herbs with short woody rhizome. *Stems* tufted, erect, obtusely trigonous, leafy. *Leaves* basal and cauline, usually narrow. *Inflorescence* paniculate. *Spikelets* oblong-lanceolate, compressed, densely crowded. Rachilla short, straight, not produced beyond the flowers. *Flowers* in each spikelet 1–2(–3), ♂, fertile. *Glumes* 3–6, distichous, the lower ones small, empty. Perigone (in Mal.) consisting of 6 plumose bristles. *Stamens* 3, rarely 2; anthers linear, sulphureous; connective with short, conical appendage. *Style* slender, continuous with the ovary, the base incrassate, persistent; stigmas 3. *Nut* oblong, trigonous, tessellate or minutely punctulate, cuspidate by the persistent style-base.

Distr. In KÜENTHAL's circumscription the genus comprises 11 *spp.*, 9 of them endemic in Africa, 1 in Japan, and 1 circum-South Pacific, in *Malesia*: New Guinea.

LEVYNS (J. S. Afr. Bot. 13, 1947, 81) refers the S. African *spp.* to the genera *Asterochaete* and *Trianoptiles*.

1. *Carpha alpina* R.BR. Prod. (1810) 230; KUNTH, En. 2 (1837) 322; STEUD. Syn. 2 (1855) 159; BOECK. Linnaea 38 (1874) 269; HOOK. Ic. Pl. 13 (1877) 14, t. 1216; BENTH. Fl. Austr. 7 (1878) 381; F.V.M. Trans. R. Vict. n.s. 1<sup>2</sup> (1889) 35; CLARKE, Kew Bull. (1899) 114; VALCK. SUR. Nova Guinea 8 (1912) 706; PFEIFF. in Fedde, Rep. 29 (1931) 178; KÜK. in Fedde, Rep. 47 (1939) 112; S. T. BLAKE, J. Arn. Arb. 29

(1948) 93. — *Rhynchospora alpina* SPRENG. Syst. Veg. 1 (1825) 195. — *Chaetospora alpina* F.V.M. Fragm. 9 (1875) 39. — Fig. 74.

*Stems* slender but rigid, often curved, 5–25 cm, obtusangular, sulcate-striate, smooth, 5–30 cm by c. 1 mm, leafy towards the base. Basal leaves rigid, often recurved, flat or slightly canaliculate, obtuse, with slightly scaberulous margins, 1–3 mm wide;

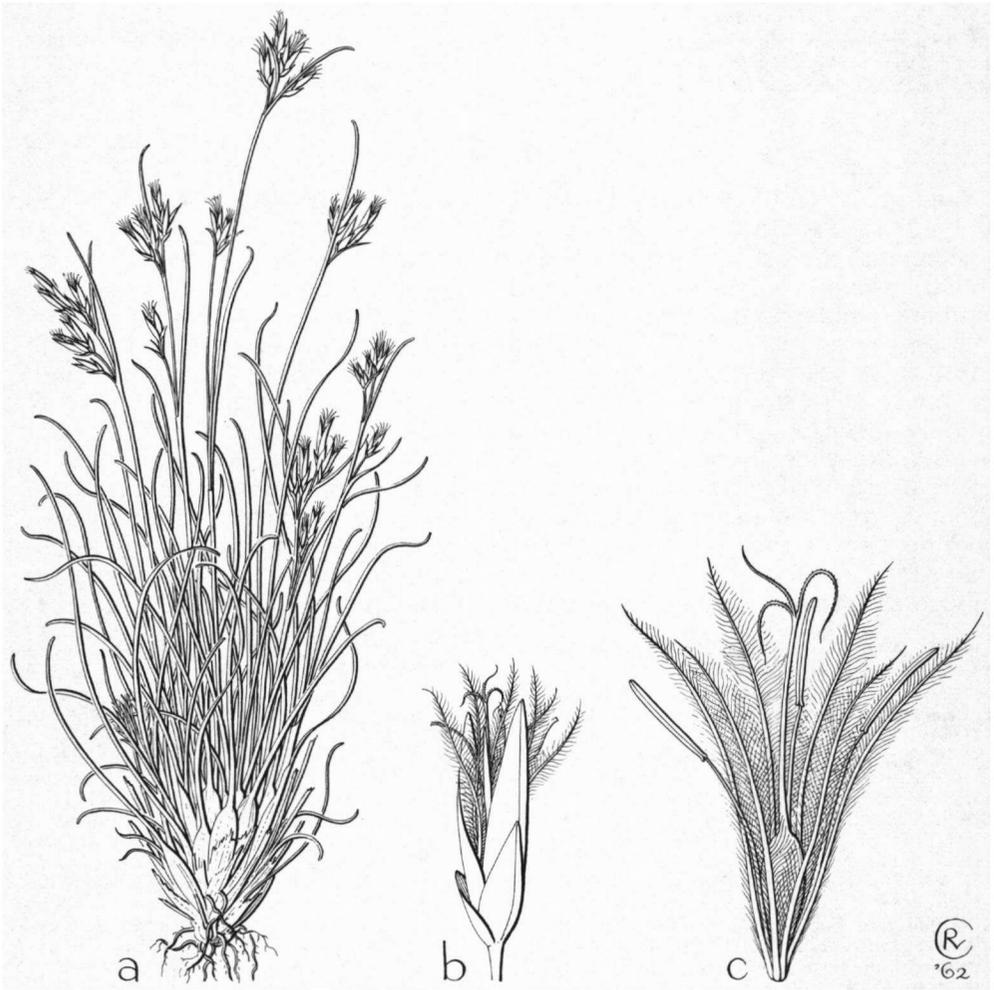


Fig. 74. *Carpha alpina* R.Br. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 4$ , c. deflorate flower,  $\times 6$  (a-c SCHODDE 1827).

sheaths shining brown; cauline leaves with tubular sheaths. *Panicle* contracted,  $1\frac{1}{2}$ -5 cm long; branches short, solitary or 2 together, smooth; Bracts 2-3, leaf-like, overtopping the inflorescence; inner ones scale-like. *Spikelets* few, 2-3 together, unequally peduncled, oblong-lanceolate, finally turbinate, obtuse, 1-flowered, 8-12 by  $2-2\frac{1}{2}$  mm. *Glumes* 4-5, distichous, chartaceous, narrowly lanceolate, stramineous, glabrous, almost obtuse, the lower 2-3 empty; above the flower often a narrow empty glume. *Hypogynous bristles* 6, exceeding the nut, 8-9 mm long, rigid, ferruginous, plumose almost the whole length, antrorsely scabrous at the top. *Stamens* 3. *Style-base* long, incrassate at the base, glabrous, persistent. *Nut* oblong, 3-4 by  $\frac{3}{4}$ -1 mm (beak excluded), trigonous, shortly stipitate (stipe c.  $\frac{1}{2}$  mm), brown, finely punctulate, beaked by the

persistent style-base, surrounded by the persistent, finally spreading bristles.

*Distr.* SE. Australia, Tasmania, New Zealand, Auckland Islands; KÜKENTHAL treats the South American *C. schoenoides* BANKS & SOL. ex HOOK. f. as a variety of *C. alpina*; it is evidently closely allied and probably a geographical race. In *Malesia*: W. New Guinea (Mt Wilhelmina) and E. New Guinea (Mt Sarawaket, Mt Amungwiwa, Mt Wilhelm, Kubor Range, Mt Hagen, Mt Sugarloaf, Mt Giluwe, Mt Piora, Mt Dickson, Mt Scratchley, Mt Albert Edward, Mt Knutsford).

*Ecol.* Microtherm; on alpine grasslands, sandy banks of streams, in marshy hollows, and on alpine seepage slopes, often a pioneer in shallow tarns, 3000-4200 m.

*Vern.* *Era*, New Guinea (Mendi lang.).

## Excluded

*Carpha paniculata* PHIL. *Linnaea* 29 (1858) 80; BOECK. *Linnaea* 38 (1874) 268. = *Schoenus rhynchosporoides* (STEUD.) KÜK. in Fedde, Rep. 44 (1938) 19.

A Chilean species, not belonging in *Carpha*, but in *Schoenus*. RIKLI (in *Jahrb. Wiss. Bot.* 27, 1895, 567) mentioned it for the Philippines. Obviously he took the name of the author PHILIPPI for the location.

## 18. LEPIDOSPERMA

LABILL. *Nov. Holl. Pl. Sp.* 1 (1804) 14; KÜK. in Fedde, Rep. 50 (1941) 19–50, 112–128. — Fig. 75–77.

Perennial herbs with short, woody rhizome, often stoloniferous. *Stems* tufted, usually nodeless, terete, compressed, or 3–4-angular. *Leaves* basal, equitant, similar to the stems. *Inflorescence* paniculate. Bracts shorter than the inflorescence, the lowest with a short pungent blade, the upper ones gradually shorter. *Spikelets* oblong-lanceolate. *Flowers* usually 2–4, the upper one the lower one(s) sterile, or ♂ by reduction. *Rachilla* short, straight. *Glumes* 4–7, spirally arranged, imbricate, scaberulous at the top. *Perianth* consisting of 6 biseriate, white hypogynous scales, which are narrow, hyaline (therefore easily overlooked in young flowers), under the fruit broadened and incrassate, spongy, ovate to lanceolate. *Stamens* 3, connective distinctly produced. *Style* continuous with the ovary, 3-fid; style-base persistent, at first bulbous to dome-shaped, ultimately depressed-hemispherical. *Nut* oblong or oblong-elliptic, obtusely trigonous, crusty, often smooth and shining when ripe.

Distr. About 40 spp., often difficult to delimit, mostly Australian, 1 endemic in New Zealand, 2 in New Caledonia. Fig. 76. In *Malesia* only:

1. *Lepidosperma chinense* NEES & MEYEN [*Linnaea* 9 (1834) 302, *nom. nud.*] in Kunth, *En.* 2 (Jan.–June 1837) 320; in Hook. & Arn. *Beech. Voy.* (July–Aug. 1837) 228; NEES, *Nov. Act. Caes. Leop.-Car.* 19, *Suppl.* 1 (1843) 117; STEUD. *Syn.* 2 (1855) 158; BOECK. *Linnaea* 38 (1874) 329, *p.p.*; CLARKE, *Fl. Br. Ind.* 6 (1894) 676; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 98; STAPF & TURRILL in Gibbs, *J. Linn. Soc. Bot.* 42 (1914) 179; RIDL. *J. Fed. Mal. St. Mus.* 6 (1915) 193; *Fl. Mal. Pen.* 5 (1925) 167, *excl. var.*; KÜK. *Bull. Jard. Bot. Bitz III*, 16 (1940) 306, *excl. pl. nov.-guin.*; in Fedde, Rep. 50 (1941) 123. — *Cladium borneense* CLARKE in Stapf, *Trans. Linn. Soc. II*, *Bot.* 4 (1894) 245. — *Cladium arfakense* RENDLE in Gibbs, *Arfak* (1917) 90, *p.p.* — *Mariscus borneensis* FERN. *Rhodora* 25 (1923) 52. — *L. striatum* (non R.Br.) OHWI, *Bot. Mag. Tokyo* 56 (1942) 207. — *Machaerina borneensis* KOYAMA, *Bot. Mag. Tokyo* 69 (1956) 62. — Fig. 75, 77.

*Stems* slender to rather stout, rigid, (25–)40–150(–250) cm by 1–3 mm, subterete or slightly angular, smooth, few-leaved at the base. *Leaves* shorter than the stems, almost terete, with a shallow, very inconspicuous groove, rigid, glaucous, pith chambered by numerous approximate transverse partitions; sheaths castaneous, lower ones bladeless. *Panicle* narrowly oblong, dense, often somewhat interrupted at the base, 3–10 cm long, consisting of several oblong-lanceolate, suberect spikes. *Involutral bracts* spathe-like, shortly sheathing, blackish brown, rounded at the apex, the lowest ending in a short pungent blade. *Spikelets* crowded, oblong-lanceolate, 5–6 mm long, 2-flowered. *Glumes* 5–7, firm, lanceolate, obtuse, black with ferruginous margins, the empty ones mucronulate, the upper ones subacute. *Hypogynous scales* small, connate at the base,

whitish,  $\frac{1}{2}$ – $\frac{3}{4}$  mm long. *Nut*  $2\frac{1}{2}$ –3 by  $1-1\frac{1}{2}$  mm, apiculate, shining ferruginous, purplish dotted.

Distr. Coastal regions of S. China, in *Malesia*: Malay Peninsula (Perak: G. Kerbau; Trengganu: G. Padang; Pahang: G. Tahan, G. Tapis, G. Tebu; Kelantan: G. Sagi; Malacca: Mt Ophir; Johore: G. Blumut), North to Central Sumatra (Mts Losir, Goh Lembuh, Sago, and Talang), Karimata Is., N. Borneo (Mt Kinabalu), West New Guinea (Arfak Mts). Fig. 76.

Ecol. Mountains: in heaths, on open rocks and in marshy meadows, often forming pure stands, (900–)1500–3000 m. In S. China also in rice-fields.

Notes. Closely allied to the W. Australian *L. striatum* R.Br., and hardly distinguishable from the E. Australian *L. neesii* KUNTH.

OHWI, *l.c.*, referred KANEHIRA & HATUSIMA 13555 and 13678 from West New Guinea (Arfak Mts) to *L. striatum*. As in both collections the glumes are obtusish and mucronate, and the hypogynous scales very small, they belong in my opinion to *L. chinense*.

BRASS 4644 from Papua, Wharton Range, cited in *Bull. Jard. Bot. Bitz III*, 16 (1940) 306 and in Fedde, Rep. 50 (1941) 123 under *Lepidosperma chinense*, belongs to *Machaerina gunnii* (HOOK. f.) KERN.

## Doubtful

*Lepidosperma waigiunse* STEUD. *Syn.* 2 (1855) 158; KÜK. in Fedde, Rep. 50 (1941) 41.

Distr. *Malesia*: Waigeo I., near West New Guinea, D'URVILLE.

Note. I have not seen the type specimen. It is very doubtful whether STEUDEL's incomplete description refers to a species of *Lepidosperma*. Nothing is said about the presence or absence and the shape of

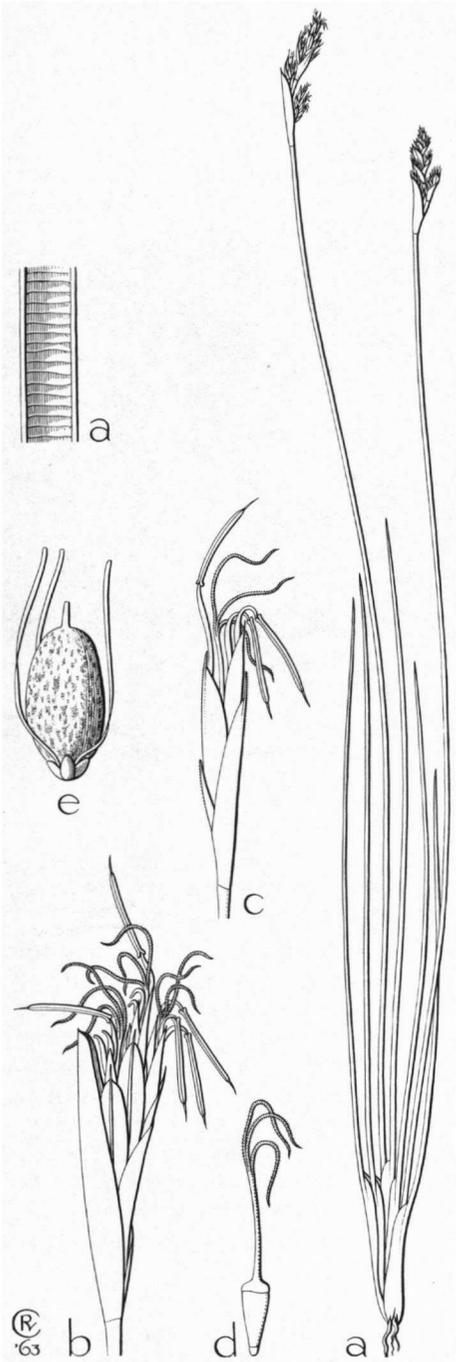


Fig. 75. *Lepidosperma chinense* NEES & MEYEN. a. Habit,  $\times \frac{1}{2}$ , a'. LS of stem, enlarged, b. cluster of spikelets, c. spikelet, d. pistil, all  $\times 5$ , e. nut with persistent perianth scales (3 visible) and three filaments,  $\times 7\frac{1}{2}$ .

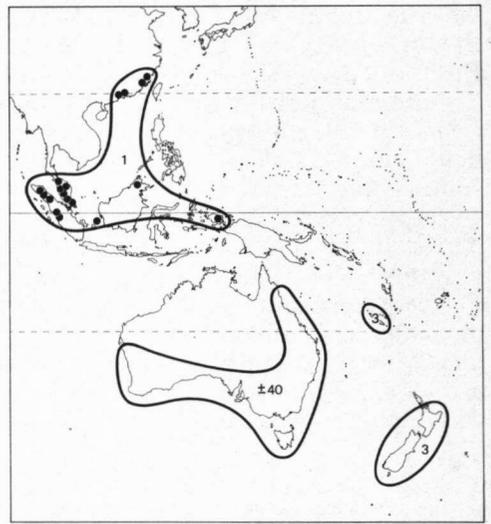


Fig. 76. Range of the genus *Lepidosperma* LABILL., the numbers indicating the number of species in each area. Of *L. chinense* NEES & MEYEN the localities are indicated by dots.



Fig. 77. *Lepidosperma chinense* NEES & MEYEN in stands of stiff clay in mountain heaths (*blangs*) of Mt Losir, at c. 2300 m alt. (photogr. VAN STEENIS).

a perigone. The description of the nut ("achenio . . . points to *Machaerina* than to *Lepidosperma*. See *stylo basi persistente tomentoso coronato*") rather *Machaerina glomerata* in note on p. 698.

### 19. TRICOSTULARIA

NEES in Lehm. Pugillus 8 (1844) 50; in Lehm. Pl. Preiss. 2 (1846–1847) 83; BENTH. Fl. Austr. 7 (1878) 382; in B. & H. Gen. Pl. 3 (1883) 1064; PAX in E. & P. Pfl. Fam. 2, 2 (1887) 115; KÜK. in Fedde, Rep. 53 (1944) 212. — Fig. 78.

Perennial herbs with short rhizome. *Stems* tufted, erect, terete or trigonous. *Leaves* basal, rarely 1 or 2 distant on the stem, often reduced to the sheaths; ligule absent. *Inflorescence* panicleate, spike-like to much branched. *Spikelets* solitary or clustered, sessile or peduncled, compressed, oblong-lanceolate, 1–2(–3)-flowered, the flower(s) fertile, or the lowest male or sterile. *Rachilla* persistent, straight, with very short internodes. *Glumes* 4–6, distichous, membranous, 1-nerved, keeled, glabrous, pale brown, 2–4 lower ones empty. *Perianth* consisting of (3–)6 lanceolate to linear, short, flat, hyaline, whitish or finally ferruginous scales not thickened under the fruit. *Stamens* 3; anthers linear, with distinctly produced connective. *Style* continuous with the ovary, caducous, 3-fid. *Nut* small, obovoid or pyriform, sessile, trigonous, brown with 3 pale ribs, hispid at the top; pericarp thin.

Distr. Small genus (c. 5 spp.), all Australian, one species extending to S. Asia.

Note. Allied to *Schoenus* and *Lepidosperma*; *Schoenus* is mainly characterized by the elongated, prominently zigzag upper internodes of the rachilla and the reduction of the upper flower in the spikelet; *Lepidosperma* can be recognized by the thick spongy perianth-scales under the fruit and the glabrous nuts.

The circumscription of the genus here accepted is that of BENTHAM in the Flora Australiensis. CLARKE and KÜENTHAL restricted *Tricostularia* to 3 extra-Malesian spp., and removed *T. undulata* and *T. paludosa* to *Cladium*, *Schoenus*, or *Costularia*, which in my opinion is contrary to their natural relationships.



Fig. 78. *Tricostularia undulata* (THW.) KERN. a. Habit,  $\times \frac{2}{5}$ , b. bract enclosing cluster of spikelets, c. spikelet,  $\times 4$ , d. anther,  $\times 6$ , e. deflorate flower,  $\times 8$ , f. nuts,  $\times 12$ , g. nut, with partially removed pericarp, showing ovule extending into hairy part of nuts,  $\times 6$  (a CARRICK JC/130, c-e MONDI 163, b, f (left), g BÜNNEMEIJER 1483, f (right) SINCLAIR & KIAH SF 40429).

**I. *Tricostularia undulata*** (THW.) KERN, Act. Bot. Neerl. 8 (1959) 267. — *Cladium undulatum* THW. En. Pl. Zeyl. (1864) 353; CLARKE, Fl. Br. Ind. 6 (1894) 674; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 86; CLARKE, Ill. Cyp. (1909) t. 83, f. 6–11; CAMUS, Fl. Gén. I.-C. 7 (1912) 152, f. 19, 2–8; MERR. En. Born. (1921) 62; RIDL. Fl. Mal. Pen. 5 (1925) 167; UITTEN, Rec. Trav. Bot. Néerl. 32 (1935) 194; KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 311; in Fedde, Rep. 51 (1942) 162, incl. var. *pulchrum* KÜK.; S. T. BLAKE, J. Arn. Arb. 29 (1948) 98. — *Carpha junctiformis* BOECK. Linnaea 38 (1874) 267. — *Lepidosperma zeylanicum* LINDL. ex BOECK. l.c. 332. — *Chaetospora fimbri-styloides* F.v.M. Fragm. 9 (1875) 34. — *T. fimbri-styloides* BENTH. Fl. Austr. 7 (1878) 384. — *Schoenus fimbri-styloides* F.v.M. First Cens. (1882) 128. — *T. borneensis* RIDL. J. Str. Br. R. As. Soc. n. 59 (1911) 52, nom. nud. — *Cladium undulatum* var. *fimbri-styloides* DOMIN, Bibl. Bot. Heft 85 (1915) 473. — *Lepidosperma chinense* var. *alpinum* RIDL. J. Fed. Mal. St. Mus. 6 (1915) 193. — *Cladium pulchrum* RIDL. l.c. 192; Fl. Mal. Pen. 5 (1925) 167. — *Machaerina pulchra* KOYAMA, Bot. Mag. Tokyo 69 (1956) 65. — *Machaerina undulata* KOYAMA, l.c. 66. — Fig. 78.

Forming dense tussocks; roots thick. Stems slender, rigid, obtusely trigonous, sulcate-striate, smooth, leafy only at the incrassate base, 30–90 cm by 1–2 mm. Leaves basal, shorter than to as long as the stems, rigid, strongly ribbed, obtusish, deeply channelled because of the involute margins, scaberulous, 1–3 mm wide. Panicle much branched, rather diffuse to dense, consisting of 4–5 distant to approximate fascicles of branches. Lowest bract similar to the leaves, shorter to slightly longer than the inflorescence, upper ones decreasing in length; sheaths short, reddish brown. Branches 2–3 together, unequal, more or less exerted from the sheath, rigid, flexuous, compressed, scaberulous. Spikelets almost sessile in clusters of 2–8, 1-flowered, 4–5 by 1–1½ mm. Glumes 4, oblong-lanceolate, acute, the upper 4–5 mm long, the lower 2 much shorter, c. 2 mm. Perianth-scales (3–)6, lanceolate to linear-lanceolate, densely covered with white antrorse short hairs, usually ½ mm long, rarely about as long as the nut. Anthers c. 2 mm; appendage of the connective triangular to oblong. Nut obtusely trigonous, slightly reticulate-rugulose, castaneous to blackish, with 3 whitish ribs, hispidulous at the top, 1⅓–1½ by ⅔–⅘ mm.

Distr. From N. Australia to Ceylon, Thailand and Indo-China<sup>1</sup>, in Malesia: Sumatra (Palembang), Banka, Billiton, Malay Peninsula (Trengganu: Padang Kandis, G. Padang; Pahang: G. Tahan;

Setul), N. Borneo & Sarawak, W. & S. Borneo, Labuan, Anambas Is., Karimata Is., New Guinea (NE. New Guinea: Sepik Distr., Green River; Papua: Wassi Kussa R.; West. Distr., Morehead Patrol Post).

Ecol. In open sandy heaths, savannah-forests, slightly damp spots on sandstone rocks, 0–1600 m.

Vern. *Rumput anjai*, Billiton.

Note. As will be evident from the synonymy the systematic place of this species has often been discussed. CLARKE and KÜKENTHAL considered it a member of *Cladium* subg. *Baumea* (*Machaerina* in the present treatment), but there cannot lie its true affinity. The leaves are spirally arranged in a basal rosette, flat hypogynous scales are found nowhere in *Machaerina*, and also the small 3-ribbed fruit with thin marcescent exocarp puts it out of this genus. As a rule the upper flower in *Machaerina* is reduced; in *Tricostularia undulata* the spikelets are always 1-flowered, but I never find a small barren glume above the fertile one. BENTHAM (1878) remarked that there might be question of a distinct genus, but in my opinion shape and texture of glumes, nuts, and hypogynous scales unmistakably point to its congenity with the other *Tricostularia* species.

#### Excluded

*Tricostularia paludosa* (R.BR.) BENTH. Fl. Austr. 7 (1878) 382. — *Chaetospora paludosa* R.BR. Prod. (1810) 233. — *Costularia paludosa* CLARKE, Kew Bull. (1899) 114; *ibid.* add. ser. 8 (1908) 47.

CLARKE's record for New Guinea of this Australian species was based on a collection by GIULIANETTI from Papua; this appeared to belong to *Schoenus curvulus*.

In passing I remark that the systematic place of *T. paludosa* has also been much disputed. CLARKE placed it in *Costularia*, but it does not fit the modern circumscription of this genus. Its original assignment to *Schoenus* (resp. *Chaetospora*) was maintained by KÜKENTHAL, who placed it in sect. *Helothrix* of this genus, but in doing so he made the section very heterogeneous, as *T. paludosa* widely differs by the reverse distribution of sexes in the spikelet (in *Schoenus* it is the upper flower which is reduced), and by the short straight rachilla neither elongated nor flexuous between the flowers. KÜKENTHAL's argument against placing in *Tricostularia* (in which genus according to him the glumes should be spirally arranged) is ineffective, as both in *Schoenus* and *Tricostularia* the glumes are distichous.

## 20. SCHOENUS

LINNÉ, Sp. Pl. 1 (1753) 42; Gen. Pl. ed. 5 (1754) 26; BOECK. Linnaea 38 (1874) 273; BENTH. Fl. Austr. 7 (1878) 352; in B. & H. Gen. Pl. 3 (1883) 1062; CLARKE, Kew Bull. add. ser. 8 (1908) 12; KÜK. in Fedde, Rep. 44 (1938) 5; l.c. 161; *ibid.* 48 (1940) 246. — *Chaetospora* R.BR. Prod. (1810) 232; BOECK. Linnaea

<sup>1</sup> The record in Fedde, Rep. 51 (1942) 163: "Formosa: TAKOW" was based on HENRY's List of Plants from Formosa (1896) 105; it refers, however, to a collection of *Schoenus falcatus* R.BR. (see OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B18, 1944, 28).

Specific delimitation is extremely difficult throughout the genus. BEETHAM's remark that further study from the living plants or from specimens gathered in all the different stages of development of the flowers is required, is in force up till the present day.

KEY TO THE SECTIONS  
represented in Malasia

1. Spikelets large, (in the Malasian *sp.*) 20–25 mm long. *Sp.* 1 . . . . . 1. *Sect. Calostachy*
1. Spikelets much smaller.
2. Leaves reduced to the mucronate or very shortly laminate sheaths, which (in the Malasian *sp.*) are bearded at the mouth. Glumes with woolly-ciliate margins. *Spp.* 2–4 . . . . . 2. *Sect. Nudicaules*
2. Leaves with well developed blades, their sheaths not bearded at the mouth. Glumes glabrous.
3. Inflorescence paniculate, compound or decomposed. Spikelets numerous, often falcate. Glumes ferruginous to brownish. Nut hispidulous at the top. *Spp.* 5–7 . . . . . 3. *Sect. Paniculati*
3. Inflorescence racemose or capitate. Spikelets few, straight. Glumes usually purplish or bluish. Nut glabrous.
4. Hypogynous bristles scabrous. Inflorescence racemose, sometimes contracted and head-like. Rhizome caespitose. *Spp.* 8–11 . . . . . 4. *Sect. Helothrix*
4. Hypogynous bristles plumose. Inflorescence capitate. Rhizome creeping. *Sp.* 12 . . . . . 5. *Sect. Repentes*

KEY TO THE SPECIES

1. Spikelets 20–25 mm long. Nut 3–3½ mm long . . . . . 1. *S. calostachyus*
1. Spikelets and nuts much smaller, the former up to 12 mm long, the latter up to 2 mm.
2. Leaves reduced to mucronate or shortly laminate sheaths (*i.e.* leaf-blades very short in proportion to the size of the plant, more rarely a few of them elongated<sup>1</sup>). Sheaths of leaves and bracts bearded at the mouth (more or less glabrescent with age). Glumes woolly-ciliate, at least when young.
3. Stems at least partly with 1–2 leaf-sheaths in or about the middle, very thin, ½–1(–1½) mm thick. Glumes dark brown, densely punctulate (gland-dotted). Nut papillose on the angles at the top, otherwise smooth, brown, blackish blotched . . . . . 2. *S. sparteus*
3. No leaf-sheaths between the basal sheaths and the bracts. Stems generally thicker, (1½–)2–4 mm across. Glumes not punctulate. Nut not papillose, concolorous.
4. Glumes blackish purple. Nut dull stramineous, more or less rugulose . . . . . 3. *S. melanostachys*
4. Glumes dark brown. Nut shining milky white, smooth . . . . . 4. *S. laevinux*
2. Leaves with well-developed prominent blades. Sheaths not bearded at the mouth. Glumes glabrous.
5. Inflorescence paniculate, compound or decomposed, at least part of the primary branches with several to numerous spikelets. Spikelets ferruginous to light brown. Nut setulose on the angles at the top.
6. Nut scrobiculate by the wide, pitted epidermal cells, rufous, only slightly asymmetric. Bristles usually present.
7. Leaves flat and 5–7 mm wide in the basal part, tapering into a very long subulate point. Spikelets 7–12 mm long, more or less falcate. Inflorescence stiffly erect . . . . . 5. *S. falcatus*
7. Leaves filiform almost from the base. Spikelets 5–6 mm long, not or hardly falcate. Inflorescence more or less drooping . . . . . 6. *S. punctatus*
6. Nut quite smooth (epidermal cells obscure, not pitted), milky white, distinctly asymmetric. Bristles absent. Spikelets 5–6 mm long . . . . . 7. *S. delicatulus*
5. Inflorescence racemose or almost so, or capitate; primary branches when present with 1–3 spikelets. Spikelets purplish, only in *S. maschalinus* often pale. Nut glabrous.
8. Hypogynous bristles absent. Spikelets 9–11 mm long . . . . . 11. *S. longibracteatus*
8. Hypogynous bristles present. Spikelets up to 8 mm long, often much shorter.
9. Hypogynous bristles plumose in the lower part. Rhizome creeping; stems distant or somewhat tufted. Inflorescence capitate . . . . . 12. *S. nitens*
9. Hypogynous bristles scabrous, not plumose. Rhizome caespitose, stems densely tufted. Inflorescence racemose, in *S. setiformis* strongly contracted and head-like.
10. Inflorescence dense, almost capitate (occasionally with a fascicle of 1–3 spikelets lower down). Nut smooth, brown . . . . . 10. *S. setiformis*
10. Inflorescence loose, racemose. Nut slightly scrobiculate, whitish.
11. Spikelets 6–8 mm long, purple. Anthers 2–3 mm. Nut 1½–2 mm long. Stems erect, rigid, 10–40 cm tall . . . . . 8. *S. curvulus*
11. Spikelets 2–4 mm long, pale or purplish variegated. Anthers *c.* 1½ mm. Nut 1–1½ mm long. Stems often decumbent and rooting at the nodes, 4–20 cm long, rarely longer. . . . . 9. *S. maschalinus*

<sup>1</sup> In *S. sparteus* some leaf-blades may attain a rather considerable length. The species may always be recognized as belonging *sub* 2 by the bearded leaf-sheaths and woolly-ciliate glumes.

38 (1874) 287. — *Helothrix* NEES, Ann. Mag. Nat. Hist. I, 6 (1841) 45. — *Cyclo campe* STEUD. Syn. 2 (1855) 1:5; MIQ. Fl. Ind. Bat. 3 (1856) 339 (*sphalm.* 'Cyclo-carpa'); non BENTH. in B. & Y. Gen. Pl. 3 (1883) 1063. — *Lophocarpus* BOECK. Allg. Bot. Zeitschr. 2 (1896) 110, non LINK, 1795. — *Neolophocarpus* CAMUS, Fl. Gén. I.-C. 7 (1912) 148, *quoad* syn. — Fig. 79.

Perennials with woody, abbreviated or shortly creeping rhizome, more rarely annuals. *Stems* erect, or ascending and rooting at the nodes, terete or obtusely trigonous striate or sulcate, usually smooth. *Leaves* either all basal, or basal and cauline, linear, often setaceous, canaliculate, sometimes reduced to mucronate sheaths; ligule absent; basal sheaths open, dark-coloured; sheaths of the cauline leaves closed, tubular, often bearded at the mouth. *Inflorescence* terminal racemose or paniculate, consisting of some distant fascicles of branches subtended by a leafy bract, or contracted and head-like. *Spikelets* solitary or clustered, (in the Malesian *spp.*) compressed, lanceolate to oblong-lanceolate, sometimes falcate, usually few-flowered. *Rachilla* straight and with very short internodes in the lower part (between the empty glumes), the upper internodes (between the fertile glumes) elongated and prominently zigzag. *Glumes* distichous, acropetally caducous, 1-nerved, keeled, frequently dark-coloured, the lower ones empty, the upper (flower-bearing) ones usually decurrent on the rachilla ('rachilla winged'), the terminal one often strongly reduced and empty. *Flowers* in the hollows of the zigzag rachilla, usually bisexual, but the uppermost often more or less reduced (male or functionally male). *Perigone* consisting of up to 6 filiform or linear-lanceolate, ciliate to plumose or antrorsely scabrous bristles, or absent. *Stamens* (1-)3(-6), (in Mal. (2-)3); anthers linear, with more or less produced glabrous connective. *Style* slender, continuous with the ovary, not or hardly dilated at the base, brown, caducous (often the very base remaining on the nut as an apiculus not separated from the nut proper by a constriction). *Stigmas* 3 (very rarely 2). *Nut* sessile or shortly stipitate, ovoid, obovoid, or ellipsoid, trigonous, often 3-ribbed, very rarely biconvex, glabrous, or hispidulous in the upper part, smooth, rugulose, or scrobiculate; epidermal cells isodiametric to oblong.

*Distr.* About 80 *spp.*, mainly distributed over SE. Asia and Australia; some *spp.* extend eastward to New Zealand, New Caledonia, and Micronesia, a few others westward to Europe; a few *spp.* occur in extratropical South America; *S. ferrugineus* L. is almost cosmopolitan. The centre of development of the genus is to be found in continental Australia (more than 60 *spp.*). In Malesia 13 *spp.*, 11 of which occur in New Guinea.

*Ecol.* In Malesia the members of *sect. Calostachyi*, *Paniculati*, and *Nudicaules* are mainly inhabitants of savannahs and savannah forests in the periodically dry regions; the species of *sect. Helothrix* occur only at high altitudes.

*Notes.* The 9 species LINNAEUS originally assigned to *Schoenus* have in the course of time all been transferred to other genera by VAHL, BROWN, LINK, NEES, and KUNTH. As more recent authors only two of them (*S. nigricans* L. and *S. ferrugineus* L.) recognized as true *Schoenus spp.*, it seems advisable to accept *S. nigricans* L. as the type species of the genus.

R. BROWN restricted *Schoenus* to those species in which the perianth is absent, and created the genus *Chaetospora* for the species in which the perianth is represented by hypogynous bristles. BENTHAM pointed out that often in the same species the bristles may be present or absent, and consequently he referred all *Chaetospora spp.* to *Schoenus*. His circumscription of the latter genus was accepted by nearly all subsequent authors.

*Schoenus* as circumscribed by BENTHAM and CLARKE is undoubtedly a rather homogeneous group, mainly characterized by the peculiar structure of the rachilla (lower internodes very short, upper ones elongated and zigzag).

It is easily discernible from the other Cyperaceous genera in Malesia with exactly distichous arrangement of the glumes as follows:

- (a) Hypogynous bristles are always absent in *Cyperus* and *Fimbristylis*, but often present in *Schoenus*.
- (b) Long-plumose bristles are characteristic of Malesian *Carpha* and *Costularia spp.*, but in Malesian *Schoenus spp.* only found in *S. nitens*.

## 1. Section Calostachyi

(BENTH.) CLARKE, Kew Bull. add. ser. 8 (1908) 123. — *Ser. Calostachyi* BENTH. Fl. Austr. 7 (1878) 355.

Lectotype: *S. calostachyus* (R. BR.) POIR.

1. *Schoenus calostachyus* (R. BR.) POIR. Enc. Suppl. 2 (1811) 251; BENTH. Fl. Austr. 7 (1878) 368; F. v. M. Descr. Not. 9 (1890) 69; RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 16; CLARKE, Fl. Br. Ind. 6 (1894) 673; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 85; CLARKE, Ill. Cyp. (1909) t. 78, f. 7-9; VALCK. SUR. Nova Guinea 8 (1912) 707; CAMUS, Fl. Gén. I.-C. 7 (1912) 150, t. 1, f. C, 6-9; KÜK. Bot. Jahrb. 59 (1924) 7; RIDL. Fl. Mal. Pen. 5 (1925) 166; KÜK. in Fedde, Rep. 44 (1938) 73; *ibid.* 48 (1940) 248; Bull. Jard. Bot. Btzg III, 16 (1940) 304; OHWI, Bot. Mag. Tokyo 56 (1942) 207; S. T. BLAKE, J. Agr. Arb. 29 (1948) 91. — *Chaetospora calostachya* R. BR. Prod. (1810) 233. — *Cyclocampe waigiouensis* STEUD. Syn. 2 (1855) 156; MIQ. Fl. Ind. Bat. 3 (1856) 339 ('*Cyclocarpa*'). — *S. triangularis* VOLKENS, Bot. Jahrb. 31 (1902) 458. — Fig. 79.

Perennial with short woody rhizome. *Stems* tufted, erect, rigid, obtusely trigonous or subterete, sulcate, smooth (often slightly scaberulous in the inflorescence), leafy, 30-75 cm by 1-2 mm. *Basal leaves* long, rigid, abruptly acuminate, 3-ribbed on the under side, scaberulous on the margins,  $1\frac{1}{2}$ -2 mm wide, with blackish purple sheaths; *cauline leaves* 1-3, much shorter, with narrow tubular purplish sheaths up to 3 cm long, and scarcely ciliate at the mouth. *Inflorescence* racemose or subpaniculate, narrow, very loose, up to 50 cm long, consisting of 2-5 very distant fascicles of branches. *Bracts* short, usually not exceeding the branches in their axils.

Branches solitary or 2(-3) together, unequal, erect, compressed, scaberulous on the angles, each bearing 1(-3) spikelets, up to  $12\frac{1}{2}$  cm. *Spikelets* oblong-lanceolate, acute, 3-5-flowered, chestnut brown, 20-25 by 3-5 mm. *Glumes* 9-14, coriaceous, narrowly lanceolate, acute, densely ciliate on the margins especially towards the top, the fertile ones 15-18 mm long, the lower 4-8 empty, gradually shorter. *Bristles* 4-6, about  $\frac{1}{2}$  as long as the nut, antrorsely scabrous in the upper part, white. *Stamens* 3; anthers c. 8 mm long; appendage of the connective very short, purplish. *Style* ciliate in the upper half, 15-18 mm long; stigmas 3, about  $\frac{1}{2}$  as long as the style. *Nut* trigonous, ovoid, oblique (1 angle straight, 2 curved), attenuate at the base, 3-dentate at the apex, irregularly transversely rugulose, finally blackish,  $3-3\frac{1}{2}$  by c.  $1\frac{1}{2}$  mm; epidermal cells obscure, isodiametric to longitudinally oblong.

Distr. From Australia (Queensland, N. S. Wales, W. Australia) and Micronesia to Indo-China, Thailand (KERR 7082, 13137, 16596 in K!), and the Ryu Kyu Is.; in *Malesia*: Sumatra, Banka, Billiton, Lingga Arch., Malay Peninsula (Kedah, Trengganu, Pahang, Singapore), Borneo, and New Guinea (W. New Guinea, Papua, Waigau Is., Aru Is., Louisiades).

Ecol. In savannahs and savannah forests, on rather damp open grassy slopes, a typical constituent of the flora of podsolc sands and heath forests, 0-1200 m.

## 2. Section Nudicaules

KÜK. in Fedde, Rep. 44 (1938) 26.

Lectotype: *S. melanostachys* R. BR.

2. *Schoenus sparteus* R. BR. Prod. (1810) 231; KUNTH, En. 2 (1837) 336; STEUD. Syn. 2 (1855) 165; BENTH. Fl. Austr. 7 (1878) 371; KÜK. in Fedde, Rep. 44 (1938) 28; *ibid.* 48 (1940) 247; S. T. BLAKE, J. Agr. Arb. 29 (1948) 90. — *S. sparteus* var. *paucispiculatus* KÜK. Bull. Jard. Bot. Btzg III, 16 (Feb. 1940) 304; in Fedde, Rep. 48 (Sept. 1940) 247. — *S. fusco-guttatus* OHWI, Bot. Mag. Tokyo 56 (1942) 206.

Perennial with short woody rhizome. *Stems* densely tufted, erect, very slender but rigid, terete, obscurely striate, smooth, at least partly with 1-2 nodes about the middle (*i.e.* with 1 or 2 sheaths between the basal sheaths and the bracts), 25-75 cm by  $\frac{1}{2}$ -1(- $1\frac{1}{2}$ ) mm, the incrassate base clothed with shining reddish brown sheaths, which are densely woolly bearded at the mouth and end in a usually very short, recurved, subulate point exceptionally lengthened into a setaceous blade up to 5(-15) cm long; *cauline leaves* 1-2 (often absent in part of the stems), similar to the basal ones, with narrow, dark brown, bearded,  $\frac{1}{2}$ -1 $\frac{1}{2}$  cm long sheaths. *Inflorescence* racemose, rarely subpaniculate, very narrow, loose, usually short, (2-7 cm long), consisting of 2-3 fascicles of branches (occasionally with a distant fascicle lower

down). *Bracts* very short, similar to the leaves. Branches solitary or 2-3 together, unequal, erect, compressed, scaberulous, with 1 (rarely 2-3) spikelets. *Spikelets* lanceolate, acute, (1-)2-3-flowered, dark brown, 6-9 by c.  $1\frac{1}{2}$  mm. *Glumes* 7-9, lanceolate, acute, gland-dotted, woolly ciliate on the margins (at length often glabrescent), the fertile ones 6-7 mm long, more or less hairy, the lower 5-6 empty, shorter, mucronulate. *Bristles* absent, sometimes vestigial. *Stamens* 3; anthers 2-3 mm; appendage of the connective distinct, dark purplish. *Style* 4-5 mm long; stigmas 3. *Nut* obtusely trigonous, ovoid or broadly ellipsoid, papillose on the angles at the top, otherwise smooth, brown, blackish blotched,  $1\frac{1}{4}$ - $1\frac{3}{4}$  by  $1-1\frac{1}{2}$  mm.

Distr. Northern and northeastern Australia; in *Malesia*: Lesser Sunda Is. (Wetar), New Guinea (W. New Guinea; Papua: Wassi Kussa R., Mai Kussa R., Morehead R.), Aru Is. (P. Trangan), Misool.

Ecol. In savannah forests, on wet flats, in along-alang fields, at low altitudes.

Note. In this species the reduction of the leaf-blades is less advanced than in the other members of *sect. Nudicaules*. The blades may sometimes attain



Fig. 79. *Schoenus calostachyus* (R.Br.) POIR. a. Habit,  $\times \frac{1}{2}$ , b. spikelet,  $\times 2$ , c. defflorate flower, d. nut, both  $\times 6$  (a-d SINCLAIR & KIAH SF 40431).

a considerable length, whereas in *S. melanostachys* and *S. laevinux* they are generally represented by a short mucro only. Still they are short in proportion to the size of the plant also in *S. sparteus*.

3. *Schoenus melanostachys* R.Br. Prod. (1810) 231; KUNTH, En. 2 (1837) 335; STEUD. Syn. 2 (1855) 165; BOECK. Linnaea 38 (1874) 284; BENTH. Fl. Austr. 7 (1878) 370; CLARKE in Stapf, Trans. Linn. Soc. II, Bot. 4 (1894) 245; MERR. Philip. J. Sc. 2 (1907) Bot. 263; STAPF & TURR. J. Linn. Soc. Bot. 42 (1914) 77; MERR. En. Born. (1921) 62; En. Philip. 1 (1923) 128; KÜK. in Fedde, Rep. 44 (1938) 30. — *S. halconensis* KÜK. l.c. 65.

Perennial, with abbreviated or shortly creeping rhizome. Stems densely tufted or very approximate on the creeping rhizome, erect, slender but rigid, terete, striate-sulcate with 1-3 deeper grooves, smooth, leafy only at the base, very variable in height, 30-125 cm by  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm. Leaves 1-2, with purplish sheaths woolly bearded at the mouth, and very short, spreading, obtuse blades  $\frac{1}{2}$ - $1\frac{1}{2}$  (sometimes up to 5) cm long. Inflorescence racemose or paniculate, narrow, loose, consisting of 4-5 fascicles of branches, 4-20 cm long. Bracts very short, with purplish sheaths woolly at the mouth, and small reflexed blades. Branches 2-5 together, unequal, erect, compressed, scaberulous on the angles. Spikelets rather numerous, lanceolate, acute, often slightly falcate, 1-3-flowered, blackish purple, 4-8(-10) by  $1\frac{1}{2}$ -2 mm. Glumes 7-11, lanceolate, acute, with densely woolly-ciliate margins, the fertile one(s) 4-7 mm long, the lower 4-6 empty, gradually shorter. Bristles usually absent, rarely up to 5, capillary, up to  $1\frac{1}{2}$  mm long. Stamens 3; anthers 2-3 mm; appendage of the connective distinct, dark purplish. Style 3-5 mm long; stigmas 3. Nut trigonous, ovoid or oblong-ovoid, more or less transversely rugulose, dull stramineous, c.  $1\frac{1}{2}$ - $1\frac{2}{3}$  by  $\frac{5}{8}$  mm.

Distr. Australia (Queensland, N. S. Wales, ? W. Australia); in Malesia: N. Borneo (Mt Kinabalu), Philippines (Mindoro: Mt Halcon).

Ecol. On Mt Kinabalu in open rocky localities, 1650-2400 m; on Mt Halcon in open heaths at 2400 m.

Note. The very juvenile collection from Mt Halcon (MERRILL 6173) was treated as a separate species (*S. halconensis*) by KÜKENTHAL, on account of the tufted shorter stems, the occasionally slightly elongated leaf-blades, the shorter racemose inflorescence, the less numerous 1-flowered spikelets, the filaments fuscous at the base, and the almost smooth nut. In the specimens from Mt Kinabalu, which KÜKENTHAL referred to *S. melanostachys*, the stems are also densely tufted and short, and the spikelets only 1-flowered. The nuts in MERRILL 6173 are immature. Cespitose rhizomes and filaments fuscous at the base I also observed in Australian specimens of *S. melanostachys*. To me the plants occurring at the isolated stations in Borneo and Mindoro cannot be separated specifically from *S. melanostachys*.

4. *Schoenus laevinux* (KÜK.) OHWI, J. Jap. Bot. 18 (1942) 136; Bot. Mag. Tokyo 56 (1942) 206; S. T. BLAKE, J. Arn. Arb. 29 (1948) 91. — *S. melanostachys* var. *laevinux* KÜK. Bot. Jahrb. 59 (1924)

52. — *S. curvulus* (non F.v.M.) KÜK. l.c., non al. — *S. tendo* var. *laevinus* KÜK. in Fedde, Rep. 44 (May 1938) 30, incl. f. *ebarbatus* KÜK.; Bot. Jahrb. 69 (Oct. 1938) 259; in Fedde, Rep. 48 (1940) 247; Bull. Jard. Bot. Btzg III, 16 (1940) 304.

Perennial with short woody rhizome. Stems tufted, rather stout, often subscented or pendent, terete, striate-sulcate with 1–3 deeper grooves throughout their length, smooth, leafy only at the base, up to 3½ m by (2–)3–4 mm. Leaves 1–2, much reduced, their sheaths shining blackish-purple, woolly-ciliate at the mouth (at length more or less glabrescent); blades very short, rigid, subulate, ½–1 cm long. Inflorescence paniculate, narrow, (10–)20–30 cm long, consisting of 5–7 fascicles of branches. Bracts very short, with dark brown narrow sheaths up to 1½ cm long, and ½–1 cm long blades. Branches 3–7 together, unequal, erect, compressed, scaberulous on the angles. Spikelets numerous, lanceolate or oblong-lanceolate, acute, more or less falcate, 2–3-flowered, fuscous, 5–8 by c. 1½ mm. Glumes 9–12, lanceolate, acute, woolly-ciliate on the margins (at length glabrescent), the fertile ones c. 6 mm long, densely villous on the back, the lower 6 empty, gradually shorter; also 1–3 uppermost glumes

sterile. Bristles absent. Stamens 3; anthers c. 3 mm long; appendage of the connective distinct, purplish. Style c. 4 mm; stigmas 3, about as long as the style. Nut obtusely trigonous, obovoid, truncate and slightly 3-dentate at the apex, smooth, glassy, shining milky white, 1–1½ by ⅔–⅘ mm.

Distr. Micronesia (Carolines: Ponape); in Malesia: Moluccas (Ambon); New Guinea (W. New Guinea: Arfak Mts, Hollandia, Rouffaer R., Idenburg R., Wissel Lakes; NE. New Guinea: Hunsteinspitze, Morobe, Dschidschugari Chimbu Subdistr.; Papua: S. Highlands), Normanby & Goodenough Is., New Britain.

Ecol. In grassy fields, in primary forests, on cliffs and open rock slides, 30–2150 m.

Note. The closely related *S. tendo* (HOOK. f.) HOOK f. from New Zealand differs from *S. laevinus* by the much less stouter habit, the less copious panicles, the smaller straight spikelets, the presence of hypogynous bristles, the 2 stamens, and the dull ferruginous nut. The demarcation of *S. laevinus* against *S. tendo* var. *triander* KÜK. from New Caledonia, which variety is stouter than typical *S. tendo*, triandrous, and with up to 6 hypogynous bristles, needs further investigation.

### 3. Section Paniculati

(BENTH.) CLARKE, Kew Bull. add. ser. 8 (1908) 123. — *Ser. Paniculati* BENTH. Fl. Austr. 7 (1878) 355. — *Sect. Scrobiculati* KÜK. in Fedde, Rep. 44 (1938) 22. Lectotype: *S. falcatus* R.BR.

5. *Schoenus falcatus* R.BR. Prod. (1810) 232; KUNTH, En. 2 (1837) 336; STEUD. Syn. 2 (1855) 165; BENTH. Fl. Austr. 7 (1878) 372; CAMUS, Fl. Gén. I.-C. 7 (1912) 150; MERR. Philip. J. Sc. 9 (1914) Bot. 268; En. Philip. 1 (1923) 128, p.p.; KÜK. Bot. Jahrb. 69 (1938) 259; in Fedde, Rep. 44 (1938) 24; *ibid.* 48 (1940) 247; Bull. Jard. Bot. Btzg III, 16 (1940) 304, excl. var. *borneensis* KÜK.; S. T. BLAKE, J. Arn. Arb. 29 (1948) 90; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 482. — *S. elatus* BOECK. Flora 58 (1875) 117. — *Lophocarpus tonquinensis* BOECK. Allg. Bot. Zeitschr. 2 (1896) 111. — *Neolophocarpus tonquinensis* CAMUS, Fl. Gén. I.-C. 7 (1912) 149, *quoad* syn.

Perennial with short woody rhizome. Stems tufted, erect, rather stout, rigid, obtusangular, often more or less flattened, striate-sulcate, smooth, distantly leafy up to the top, 60–90(–150) cm by (1–)2–5 mm. Basal leaves long, rigid, scaberulous on the margins, up to 7 mm wide in the basal part, narrowed into a long subulate point, with dark purplish to blackish sheaths; cauline leaves 2–4, shorter, with tubular, somewhat inflated, brownish sheaths not ciliate at the mouth. Inflorescence paniculate, decompound, erect, rigid, narrow, rather loose, 20–40 cm long, consisting of up to 10 distant fascicles of branches. Bracts similar to the leaves, but gradually shorter. Branches 2–4 together, unequal, erect, compressed, scaberulous on the angles. Spikelets numerous, peduncled, oblong-lanceolate, more or less falcate, acute, 3–(7–)9-flowered, light brown, 7–12 by c. 2½ mm. Glumes 8–10, narrowly ovate to oblong-lanceolate, acute, glabrous, with scabrous keel and hyaline margins, 5–6½ mm long, the lower 2–3

empty, shorter. Bristles 1–3, about as long as the nut, antrorsely scabrous, ferruginous. Stamens 3; anthers c. 3 mm; appendage of the connective rather conspicuous (⅓–⅓ mm), white. Style 3–4 mm; stigmas 3, much shorter than the style. Nut trigonous, broadly ellipsoid or broadly ovoid, slightly asymmetric, 3-ribbed, scrobiculate, densely setulose at the top, rufous, 1⅓–1⅔ by ⅔–1 mm; epidermal cells large, pitted, almost isodiametric to longitudinally oblong.

Distr. From Northern Australia and the Solomon Is. to Thailand, Tonkin, Formosa, and the Ryu Kyu Is.; in Malesia: Malay Peninsula (Perlis: Bukit Ketri), Riouw Arch. (Anambas Is.), W. Java (S. coast: Tjikepoh), Lesser Sunda Is. (Sumba, Misool, New Guinea (W. New Guinea: Rouffaer R.; NE. New Guinea: Sepik Distr.; W. Highlands: Goroka Subdistr.; Morobe Distr.; Markham Valley; Papua: Hisiu, Wassi Kussa R.), Normanby I.

Ecol. On river-banks, in open savannah land and in savannah forests, at low altitudes.

Note. Nomenclaturally the name *Neolophocarpus tonquinensis* (BOECK.) CAMUS belongs to *Schoenus falcatus*. The specimens cited in the Flore Générale de l'Indo-Chine, however, belong to *Cladium mariscus* (L.) POHL.

6. *Schoenus punctatus* R.BR. Prod. (1810) 232; KUNTH, En. 2 (1837) 336 p.p. (excl. SIEBER 19); STEUD. Syn. 2 (1855) 165; BENTH. Fl. Austr. 7 (1878) 372; KÜK. in Fedde, Rep. 44 (1938) 25; *ibid.* 48 (1940) 247; S. T. BLAKE, J. Arn. Arb. 29 (1948) 90. — *Cladium aromaticum* MERR. Philip. J. Sc. 9 (1914)

Bot. 59. — *Mariscus aromaticus* FERN. *Rhodora* 25 (1923) 51. — *Machaerina aromatica* KOYAMA, Bot. Mag. Tokyo 69 (1956) 62.

Closely related to the preceding species and possibly only racially distinct from it. *Stems* very slender, 1–2 mm thick. *Leaves* very narrow, involute, filiform almost from the base. *Panicle* very loose and narrow, more or less drooping. *Spikelets* smaller than in *S. falcatus*, 5–6 mm long, straight or hardly falcate, with only 1–2 flowers. Fertile *glumes* 4–5 mm long. *Bristles* up to 3 (according to BENTHAM and KÜKENTHAL also absent).

Distr. Tropical Australia (N. Queensland, Thursday I. in Torres Str., islands in the Gulf of Carpentaria), Marianas (Guam), Lower Thailand (Tan Sang); in *Malesia*: New Guinea (Papua, W. Division: Tarara, Wassi Kussa R., very young!).

Ecol. In New Guinea in a savannah forest, a characteristic cover on gray soil flats.

Note. According to MERRILL, *l.c.*, the roots are rather strongly aromatic when fresh.

7. *Schoenus delicatulus* (FERN.) KERN, *Blumea*, Suppl. 4 (1958) 167. — *Cladium filiforme* MERR.

#### 4. Section *Helothrix*

(NEES) KÜK. in Fedde, Rep. 44 (1938) 84. — *Helothrix* NEES, *Ann. Mag. Nat. Hist.* I, 6 (1841) 45. — *Ser. Microcarpi* BENTH. *Fl. Austr.* 7 (1878) 356; CLARKE, *Kew Bull.* add. ser. 8 (1908) 123.

Type: *Helothrix pusilla* NEES.

8. *Schoenus curvulus* F.v.M. *Trans. R. Soc. Vict.* n. s. 1<sup>2</sup> (1889) 36; CLARKE, *Kew Bull.* (1899) 114; VALCK. *SUR. Nova Guinea* 8 (1912) 707; KÜK. in Fedde, Rep. 44 (1938) 76; Bot. Jahrb. 69 (1938) 260 (*non ibid.* 59, 1924, 52); in Fedde, Rep. 48 (1940) 248; *Bull. Jard. Bot. Btzig III*, 16 (1940) 305; S. T. BLAKE, *J. Arn. Arb.* 29 (1948) 91. — *S. apogon* (non R. & S.) CLARKE in Stapf, *Trans. Linn. Soc. II*, Bot. 4 (1894) 245; RIDL. *J. Str. Br. R. As. Soc. n.* 46 (1906) 225; MERR. *En. Born.* (1921) 62. — *Costularia paludosa* CLARKE, *Kew Bull.* (1899) 114, *quoad specim. cit.*, *non al.*; VALCK. *SUR. Nova Guinea* 8 (1912) 707, *non Chaetospora paludosa* R.Br. (= *Tricostularia paludosa*, see p. 672). — *S. kinabaluensis* STAPF in Gibbs, *J. Linn. Soc. Bot.* 42 (1914) 176; MERR. *En. Born.* (1921) 62. — *S. philippinensis* var. *kinabaluensis* KÜK. in Fedde, Rep. 44 (1938) 90; Bot. Jahrb. 69 (1938) 260; *Bull. Jard. Bot. Btzig III*, 16 (1940) 305.

Perennial with short rhizome. *Stems* tufted, very slender but rigid, erect, subterete, striate, smooth, leafy, not rarely branched in the lower part, 10–40 cm by  $\frac{1}{2}$ – $\frac{2}{3}$  mm. *Leaves* filiform, rigid, canaliculate, scaberulous on the margins, up to 1 mm wide; sheaths dark purple, not bearded at the mouth, those of the cauline leaves narrowly tubular, up to  $2\frac{1}{2}$  cm long. *Inflorescence* racemose, narrow, very loose, 6–10(–15) cm long, consisting of 3–4 fascicles of branches. Bracts similar to the leaves, the lower ones long, overtopping the inflorescence. Branches 2–4 together, unequal, erect, compressed, scaberulous, each bearing 1 spikelet. *Spikelets* oblong-lanceolate, acute, glabrous, (1–)2-flowered, purple, 5–8 by  $1\frac{1}{2}$ –2 mm. *Glumes* 5–6(–7), narrowly lanceo-

late, acutish, with scaberulous keel, the fertile ones 4–6 mm long, the lower 4 empty, smaller. *Bristles* 6, capillary, antrorsely scabrous, from somewhat shorter than to slightly overtopping the nut, usually c. 3 mm long. *Stamens* 3, anthers yellow, 2–3 mm long, with distinctly (c.  $\frac{1}{2}$  mm) produced connective. *Style* 3–5 mm long; stigmas 3, about as long as the style. *Nut* trigonous, oblong-ellipsoid or oblong-obovoid, 3-ribbed, apiculate, minutely scrobiculate, whitish to stramineous,  $1\frac{1}{2}$ –2 by c.  $\frac{1}{2}$ –1 mm.

Distr. *Malesia*: N. Borneo (Mt Kinabalu, Sandakan Distr. Sg. Melian near Kiabau), Philippines (Palawan: Mt Victoria).

Ecol. On Mt Victoria on rocks at the base of a waterfall; at 600 m, on Mt Kinabalu at 1500 m, near Kiabau on river-bank at 15 m.

Ecol. On Mt Victoria on rocks at the base of a waterfall; at 600 m, on Mt Kinabalu at 1500 m, near Kiabau on river-bank at 15 m.

Ecol. On Mt Victoria on rocks at the base of a waterfall; at 600 m, on Mt Kinabalu at 1500 m, near Kiabau on river-bank at 15 m.

late, acutish, with scaberulous keel, the fertile ones 4–6 mm long, the lower 4 empty, smaller. *Bristles* 6, capillary, antrorsely scabrous, from somewhat shorter than to slightly overtopping the nut, usually c. 3 mm long. *Stamens* 3, anthers yellow, 2–3 mm long, with distinctly (c.  $\frac{1}{2}$  mm) produced connective. *Style* 3–5 mm long; stigmas 3, about as long as the style. *Nut* trigonous, oblong-ellipsoid or oblong-obovoid, 3-ribbed, apiculate, minutely scrobiculate, whitish to stramineous,  $1\frac{1}{2}$ –2 by c.  $\frac{1}{2}$ –1 mm.

Distr. *Malesia*: N. Borneo (Mt Kinabalu), SW. Celebes (Mt Bonthain, Latimodjong Mts), New Guinea.

Ecol. On banks of streams, wet rocks, damp grassy slopes, in swamps, open grasslands, swampy places in the mossy forest, 1500–4000 m.

Notes. "In his original description, F. v. Mueller lays considerable stress on the curved or twisted stems and leaves, but the appearance of the specimens suggests that the twisting is due to the method of collecting or their preparation." S. T. BLAKE, *l.c.*

KÜKENTHAL referred *S. curvulus* and *S. kinabaluensis* to different sections. I fail to find any differential character of sectional or even specific value between the two. This opinion is supported by the fact that BRASS 4672 and 5006, from New Guinea, according to KÜKENTHAL belonging to *S. kinabaluensis*, are rightly referred to *S. curvulus* by S. T. BLAKE. As *S. curvulus* is closely related to *S. maschalinus*, I placed it in *sect. Helothrix*.

9. *Schoenus maschalinus* R. & S. *Syst.* 2 (1817) 77; S. T. BLAKE, *Proc. R. Soc. Queensl.* 60 (1949) 47. —

*Chaetospora axillaris* R. BR. Prod. (1810) 233; HOOK. f. Fl. Nov. Zel. 1 (1853) 274, t. 62, f. A; BOECK. Linnaea 38 (1874) 289. — *S. axillaris* POIR. in Lamk. Enc. Suppl. 2 (1811) 251; BENTH. Fl. Austr. 7 (1878) 375; CLARKE, Ill. Cyp. (1909) t. 80, f. 1-2; MERR. En. Philip. 1 (1923) 128; non LAMK, 1791. — *Helothrix pusilla* NEES, Ann. Mag. Nat. Hist. I, 6 (1841) 45; STEUD. Syn. 2 (1855) 105, non *S. pusillus* Sw. — *Scirpus foliatus* HOOK. f. Lond. J. Bot. 3 (1844) 414. — *Scleria setifera* BOECK. Flora 41 (1858) 648. — *Helothrix axillaris* PALLA, Allg. Bot. Zeitschr. 8 (1902) 68. — *S. apogon* (non R. & S.) CLARKE, Philip. J. Sc. 2 (1907) Bot. 102; MERR. *ibid.* 5 (1910) Bot. 334. — *Helothrix philippinensis* PALLA, Allg. Bot. Zeitschr. 17 (1911) Beil. p. 1. — *S. philippinensis* KÜK. ex MERR. En. Philip. 1 (1923) 128; in Fedde, Rep. 44 (1938) 90; Bot. Jahrb. 69 (1938) 260; in Fedde, Rep. 48 (1940) 248; KOYAMA, Micronesica 1 (1964) 105. — *S. subaxillaris* KÜK. in Fedde, Rep. 44 (1938) 89; Bot. Jahrb. 69 (1938) 260. — *S. foliatus* S. T. BLAKE, Proc. R. Soc. Queensl. 51 (Feb. 1940) 48; KÜK. in Fedde, Rep. 48 (Sept. 1940) 248; S. T. BLAKE, J. Arn. Arb. 29 (1948) 93. — *S. philippinensis* var. *pachystylus* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 305; in Fedde, Rep. 48 (1940) 248. — *S. erythrosiphon* OHWI, Bot. Tokyo 56 (1942) 205.

Perennial. Stems loosely to densely tufted, very slender and weak, often decumbent at the base and rooting at the nodes, filiform, subterete, striolate, smooth, leafy up to the top, often branched, 4-20(-30) cm by  $\frac{1}{3}$ - $\frac{1}{2}$  mm. Leaves filiform, spreading or ascending, canaliculate, scaberulous on the margins, 1-3 cm by  $\frac{1}{2}$  mm, gradually passing into the leafy bracts; sheaths more or less purplish, those of the cauline leaves up to  $\frac{1}{2}$  cm. Inflorescence racemose, narrow, very loose, consisting of 3-4 distant fascicles of branches. Branches 1-3 together, very short, not or hardly exerted from the sheath, each bearing 1-2(-4) spikelets. Spikelets ovate-lanceolate, acute, glabrous, stramineous to purplish, 1-2-flowered, 2-4 by 1- $\frac{1}{2}$  mm. Glumes 3-5, lanceolate, obtusish, with slightly scaberulous keel, the fertile ones 2-3 $\frac{1}{2}$  mm long, the lower 1-2 empty, shorter. Bristles (3-6), capillary, antrorsely scabrous, about as long as to distinctly longer than the nut, whitish. Stamens (2-3); anthers yellow, c.  $\frac{1}{2}$  mm long, with short whitish appendage of the connective. Style 1-2 mm long; stigmas 3, about as long as to somewhat longer than the style. Nut trigonous, ovoid or ellipsoid, 3-ribbed, apiculate, minutely scrobiculate to almost smooth, whitish to stramineous, 1- $\frac{1}{2}$  by  $\frac{2}{5}$ - $\frac{2}{3}$  mm.

Distr. Australia (Queensland, N. S. Wales, Victoria, S. Australia), Tasmania, New Zealand, Marianas; in Malasia: Sumatra (Atjeh: Gajo Lands, Mt Losir), Philippines (Luzon: Mt Pulog; Negros: Canlaon Volcano; Mindanao: Mt Apo); New Guinea (W. New Guinea: Lake Habbema; NE. New Guinea: Mt Wilhelm, Mt Sarawaket, Mt Dayman, Maneau Range, Sugarloaf complex).

Ecol. On wet rocks, on sunny seepages, in open grassy places, often growing with mosses, 1800-3600 m.

Vern. Philip.: *kalesi*, Bag.

Note. PALLA distinguished between *Helothrix philippinensis* and *H. axillaris* as follows:

*H. philippinensis*. — Spikelets 4-4 $\frac{1}{2}$  mm long. Glumes purple or blackish purple, the fertile ones c.

3 mm long. Style 1 $\frac{1}{2}$ -1 $\frac{3}{4}$  mm. Nut 1-1 $\frac{1}{2}$  by  $\frac{3}{4}$ - $\frac{4}{5}$  mm.

*H. axillaris*. — Spikelets 2-2 $\frac{1}{2}$  mm long. Glumes green or purplish variegated, the fertile ones 1 $\frac{1}{2}$ -2 mm long. Style  $\frac{1}{2}$ - $\frac{3}{4}$  mm. Nut  $\frac{3}{4}$ -1 by c.  $\frac{1}{2}$  mm.

Although in general the Philippine plants have somewhat longer spikelets and slightly larger nuts than the Australian ones they cannot be separated specifically. The spikelets in Australian specimens are not rarely 3 mm long, sometimes up to 4 mm, in some Philippine specimens they are pale coloured. The New Guinea specimens have small nuts, but in other characters they are intermediate between the Australian plants and the Philippine ones. As in *S. erythrosiphon* OHWI the spikelets, nuts, anthers etc. completely agree with those of *S. maschalinus*, I take it for a slender form of the latter.

10. *Schoenus setiformis* S. T. BLAKE, J. Arn. Arb. 29 (1948) 92, f. 1. — *S. apogon* (non R. & S.) RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 243.

Perennial with short rhizome occasionally sending out long slender stolons. Stems numerous, densely tufted, erect or obliquely erect, very slender, setaceous but rigid, terete, striate, smooth, leafy in the lower part, 5-25 cm by  $\frac{1}{4}$ - $\frac{1}{2}$  mm. Leaves shorter than the stems, setaceous, canaliculate, scaberulous at the apex; sheaths of the cauline leaves narrowly tubular, not bearded at the mouth, purplish, 1-2 cm long. Inflorescence contracted, dense, almost capitate, 5-12 mm long and wide, consisting of 2-3 approximate fascicles of branches, sometimes a fascicle of 1-3 branches 2-4 cm lower down. Bracts similar to the leaves, the lowest much overtopping the inflorescence. Branches 1-4 to the sheath, undivided, up to 6 mm long (in the distant fascicle up to 15 mm). Spikelets 7-12, shortly peduncled, lanceolate to oblong-lanceolate, acute, 1-3-flowered, dark purple, 3 $\frac{1}{2}$ -4 $\frac{1}{2}$  by c. 1 mm. Glumes 6-7, lanceolate, acute, scaberulous on the keel in the upper part, glabrous, with narrow whitish hyaline margins, the fertile ones 2 $\frac{1}{2}$ -3 $\frac{1}{2}$  mm long, the lower 3-4 empty, smaller. Bristles 6, antrorsely scabrous, from about  $\frac{1}{2}$  as long as to slightly overtopping the nut, ferrugineous. Stamens 3; anthers yellow, c. 1 $\frac{1}{2}$  mm, with shortly ( $\frac{1}{5}$ - $\frac{1}{4}$  mm) produced connective. Style 1 mm; stigmas 3, about as long as the style. Nut trigonous, ellipsoid, with somewhat convex sides, 3-ribbed, apiculate, smooth, at first stramineous, shining brown when mature, 1-1 $\frac{1}{3}$  by  $\frac{1}{2}$ - $\frac{2}{3}$  mm; epidermal cells very small, obscure.

Distr. Malasia: W. New Guinea (Mt Carstensz, Mt Wilhelmia, Lake Habbema).

Ecol. In stony beds of streams, on grassy slopes and old landslips, 2750-3750 m.

Note. Very similar in habit to some forms of *S. apogon* R. & S. (distributed from Australia and New Zealand to the Ryu Kyu Is. and Japan), but mainly differing by the quite smooth, brown (not scrobiculate, white) nuts.

11. *Schoenus longibracteatus* KÜK. in Fedde, Rep. 44 (1938) 70; *ibid.* 48 (1940) 247; Bull. Jard. Bot. Btzg III, 16 (1940) 304. — *S. neoguineensis* KÜK. in Fedde, Rep. 44 (1938) 77; Bull. Jard. Bot. Btzg III, 16 (1940) 305.

Perennial with short rhizome. Stems densely

tufted, erect, slender but rigid, subterete, striate-sulcate, smooth, few-leaved at the base, 20–50 cm by *c.* 1 mm. *Leaves* about as long as the stems, rigid, very narrow, deeply channelled, with scaberulous margins, 1–2 mm wide; sheaths shining reddish brown to castaneous, not bearded at the mouth. *Inflorescence* racemose or subpaniculate, narrow, very loose, 6–10(–20?) cm long, consisting of 2–4 distant fascicles of branches. Bracts similar to the leaves, the lower 1–2 much overlapping the inflorescence, their sheaths narrowly tubular, blackish purple, not bearded at the mouth, 1–1½ cm long. Branches solitary or 2–3 together, very unequal, erect, compressed, each bearing 1–2 spikelets, up to 4 cm long. *Spikelets* peduncled, oblong-lanceolate, acute, 1–2-flowered, fuscous, 9–11 by 1½–2 mm. *Glumes* 4–5, narrowly lanceolate, long-acuminate, with scaberulous keel, the fertile ones 8–10 mm long, the lowest 1–2 empty, 5–8 mm. *Bristles* absent.

*Stamens* 3; anthers with distinctly produced whitish connective. *Style* *c.* 5 mm long; stigmas 3. *Nut* obtusely trigonous, ovoid or ellipsoid, 3-ribbed, very indistinctly scrobiculate or practically smooth, greyish brown, 1½–1¾ by *c.* 1 mm; epidermal cells small, almost isodiametric.

*Distr.* *Malesia*: N. Borneo (Mt Kinabalu), W. New Guinea (Mt Doorman).

*Ecol.* On Mt Kinabalu in open rocky localities and open places in *Leptospermum* forest, 1500–2700 m; on Mt Doorman at 3500 m altitude.

*Note.* KÜKENTHAL placed *S. longibracteatus* with doubt in *sect. Nudicaules*. In my opinion its close affinity to *S. curvulus* is evident. According to KÜKENTHAL *S. neoguineensis* is close to *S. curvulus*. The description agrees in almost every detail with that of *S. longibracteatus*. I do not hesitate to unite *S. neoguineensis* with *S. longibracteatus*, although the spikelets in the former are somewhat larger.

### 5. Section Repentes

KÜK. in Fedde, Rep. 44 (1938) 161. — *Ser. Laterales* BENTH. Fl. Austr. 7 (1878) 354, *p.p.*

*Lectotype*: *S. nitens* (R. BR.) POIR.

12. *Schoenus nitens* (R. BR.) POIR. Enc. Suppl. 2 (1811) 252; HOOK. *f. Handb. N. Zeal. Fl.* (1867) 299; BENTH. Fl. Austr. 7 (1878) 362; BLACK, Fl. S. Austr. 1 (1922) 91; ed. 2 (1948) 151; KÜK. in Fedde, Rep. 44 (1938) 162; KERN, *Blumea* 10 (1960) 639. — *Chaetospora nitens* R. BR. Prod. (1810) 233. — *Scirpus nitens* BOECK. *Linnaea* 36 (1870) 696.

Perennial, with rather slender creeping rhizome covered with purplish or brown scales. *Stems* distant or somewhat tufted, erect, slender but rigid, subterete, sulcate-striate, smooth, leafy at the base, 3–25 cm by *c.* ½ mm. *Leaves* few, erect, shorter or longer than the stems, setaceous, canaliculate; sheaths purplish, shining, not bearded at the mouth. *Inflorescence* capitate, apparently lateral, with (1–)2–6(–12) spikelets. Bracts 1–2, the lower one erect, as though continuing the stem, similar to the leaves, pungent, ½–2 cm long, the upper one when present much shorter, divergent. *Spikelets* sessile, ovate to ovate-lanceolate, rather obtuse, somewhat turgid, 2–3-flowered, purplish, 3–5 by 1½–2 mm. *Glumes* 5–7, coriaceous, broadly ovate, obtuse, mucous,

glabrous, with whitish hyaline margins, 3–4 mm long, the lower 2–3 empty, shorter. *Bristles* 6, longer than the nut, densely plumose in the lower part, antrorsely scabrous in the upper part, ferruginous. *Stamens* 3. *Style* deeply 3-fid. *Nut* ellipsoid to obovoid, obtusely trigonous, smooth, shining, stramineous to castaneous, *c.* 1¾ by 1 mm.

*Distr.* Throughout Australia and New Zealand; in *Malesia*: W. New Guinea (11 km NE of Wilhelmina top); the species is also in South America (Chile) in a digynous subspecies, *ssp. krausei* (PHIL.) KÜK.

*Ecol.* In New Guinea on a wet grassy slope, 3400 m.

*Note.* BOECKELER transferred this species to *Scirpus* on account of the glumes sometimes appearing not to be exactly distichously arranged. This is due to the twisting of the spikelet (*cf. Fimbristylis ovata*, p. 565); the rachilla is flexuous as in most *Schoenus* spp. and shows the regular distichous arrangement of the glumes by the scars left when the glumes have fallen off.

### 21. OREOBOLUS

R. BR. Prod. (1810) 235; BOECK. *Linnaea* 38 (1874) 230 (*'Oreobolus'*); PFEIFF. in Fedde, Rep. 23 (1927) 339, 350; KÜK. in Fedde, Rep. 48 (1940) 60. — Fig. 80–87.

Dwarf glabrous perennials, forming very dense cushion-like tufts. Rhizome woody, much branched, the base of the branches clothed with the sheaths of decayed leaves. *Stems* short, rigid, obtusangular, leafy, at first hidden by the leaves, finally more or less exserted. *Leaves* equitant, usually exactly distichous, sometimes less regularly imbricate, rigid, narrow, canaliculate, obtusish, dark-coloured at the top; ligule absent; sheaths strongly dilated, open, light

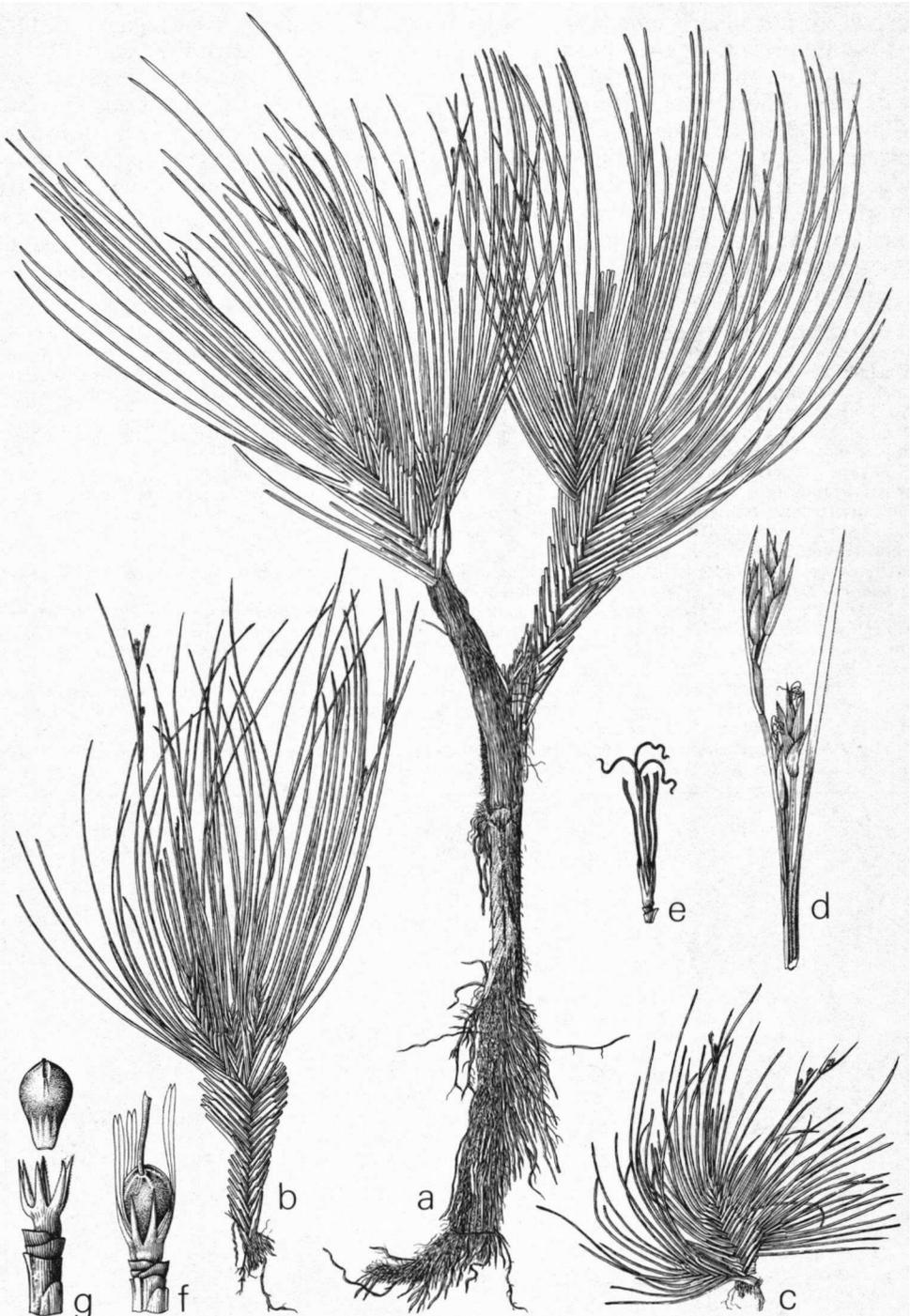


Fig. 80. *Oreobolus kükenenthalii* STEEN. *a-c*. Habit, different sizes,  $\times \frac{1}{3}$ , *d*. inflorescence,  $\times 2$ , *e*. flower,  $\times 4$ , *f*. fruiting stage, with persistent perianth scales and three filaments, *g*. nut lifted out of perianth, both  $\times 7$  (*a* HANIFF SF 14750, *b-c* RIDLEY 15946, *d-f* VAN STEENIS 8553).

brown to purplish. *Inflorescence* racemose (consisting of a few axillary, solitary or binate peduncles each bearing a single spikelet), almost capitate, or reduced to a single terminal spikelet. *Spikelets* compressed, 1-flowered. *Rachilla* persistent, with very short internodes. *Glumes* 3–5, erect, distichous, caducous, keeled. *Flower* pseudoterminal (see notes). *Hypogynous scales* 6 (rarely 5), perianth-like, biseriate, equal, or the outer ones slightly shorter, rigid, persistent on the rachilla when the fruit has fallen off. *Stamens* 3; anthers linear, yellow, with shortly produced connective. Style slender, continuous with the ovary, caducous, dark brown, the base usually hardly incrassate, rarely conical and persistent on the nut; stigmas 3. *Nut* obovoid, ellipsoid, or pyriform, very obtusely trigonous, smooth, shining; pericarp rather thick.

*Distr.* The number of species (about 8) is not unanimously agreed on; *O. obtusangulus* GAUD. in Chile, *O. goeppingeri* SUESSENG. (not seen) in Central America, *O. venezuelensis* STEYERM. (not seen) in Venezuela and Ecuador, *O. furcatus* H. MANN in the Hawaiian Islands, the remaining ones in Tahiti, New Zealand, Australia (and Tasmania), and *Malesia*. Of the 3 Malesian *spp.* 2 are endemic. See distribution maps in Fl. Mal. I, 5 (1957) cxiv and Pac. Pl. Areas 2 (1966) 134 (in which Tahiti is omitted). Fig. 81.

*Ecol.* Microtherm genus, in the tropics only on the high, ancient mountains, in swampy or rocky localities; in New Zealand descending to sea-level.

The species of *Oreobolus* form pin-cushions to dense tufts which may extend and merge into large cushions. When the tufts are separate the central part dies off, remains sterile and represents a hole, and this remarkable formation of 'fairy rings' is found in Malesian high mountains in several other pin-cushion plants (*Monostachya*, *Centrolepis*, *Eriocaulon*). See VAN STEENIS, Tijd. Kon. Ned. Aardr. Gen. 55 (1938) 753, 759, 760, 762, 782, 784, phot. 16, and Fl. Mal. I, 5 (1958) 422–423, 426 fig. 5.

*Oreobolus* is in Malesia nearly always found associated with the grass *Monostachya*, and with *Centrolepis*, *Gaimardia*, and *Eriocaulon*, which are all of similar life form.

*Notes.* The species of *Oreobolus* are similar in habit to and not rarely confused with some *Centrolepidaceae* (*Gaimardia*) and *Juncaceae* (*Distichia*). The hypogynous scales closely resemble the perianth segments in *Juncaceae* and *Restionaceae*. However, because of the structure of the spikelet and the single, basal, anatropous ovule *Oreobolus* must certainly be included in *Cyperaceae*.

According to PFEIFFER and KÜENTHAL the stamens are placed in 2 series, one belonging to the outer series, two to the inner one. This statement is obviously based on the diagram of the flower in CLARKE's Illustrations of Cyperaceae, t. 102, f. 105. In my opinion this diagram is wrong, as I always find the stamens opposite the outer perianth segments, consequently all belonging to a single (*viz* the outer) series, in agreement with PAX in E. & P. Pfl. Fam. 2, 2 (1887) 100, f. 110C.

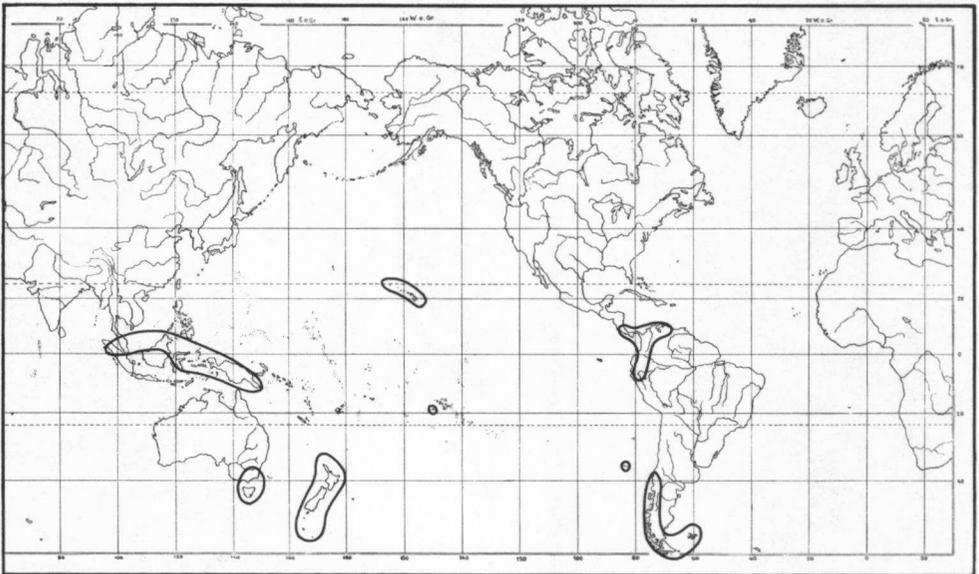


Fig. 81. Range of the genus *Oreobolus* R.Br.

The flower in *Oreobolus* is generally considered terminal, *i.e.* placed on the top of the rachilla. However, as next to the flower there is a minute rachilla internode bearing a vestigial glume, the internode bearing the flower is the penultimate one.

KÜKENTHAL (in Fedde, Rep. 48, 1940, 65 & 71) subdivided the genus into 2 sections:

*Sect. Squamellati.* Perigone consisting of 6 flat scales persistent on the rachilla when the fruit has fallen off. Style-base hardly incrassate, caducous. Nut  $1-1\frac{1}{2}$  mm long, truncate at the apex.

*Sect. Setiferi.* Perigone consisting of 6 whitish bristles apparently not persistent on the rachilla. Nut  $2\frac{1}{2}$  mm long, at the top contracted into the style-base.

To *sect. Setiferi* belongs only *O. ambiguus*, according to KÜKENTHAL in many respects a transition to *Schoenus* (hence the specific epithet). I find the hypogynous scales in this species persistent on the rachilla and, though very narrow, flat and similar in shape to those of *O. kükenthalii*. In *sect. Squamellati* the fruits are not always truncate, and in *O. kükenthalii* and *O. furcatus* up to 2 mm long. I do not see any reason for placing *O. ambiguus* in a separate section.



Fig. 82. Young tuft of *Oreobolus kükenthalii* STEEN, on Mt Losir (N. Sumatra) at c. 3400 m (photogr. VAN STEENIS, 1937).



Fig. 83. Older tufts of *Oreobolus kükenthalii* STEEN. assuming a ring-shape, same locality as fig. 82 (photogr. VAN STEENIS, 1937).

#### KEY TO THE SPECIES

1. Style-base much incrassate, conical, persistent on the nut, hispid. Hypogynous scales linear. Nut  $2\frac{1}{2}$ -3 mm long (style-base included). Inflorescence almost capitate, consisting of (1-)2-3 nearly sessile spikelets. 3. *O. ambiguus*
1. Style-base hardly incrassate, caducous. Hypogynous scales narrowly lanceolate. Nut  $1\frac{1}{3}$ -2 mm long. Inflorescence racemose (spikelets distinctly peduncled), or consisting of a single spikelet.
2. Inflorescence racemose, consisting of 2-3 distant fascicles of branches and 4-6 spikelets. Glumes 4-5. Nut glabrous,  $1\frac{2}{3}$ -2 by 1 mm. Stems usually taller than in next species, up to 15 cm. 1. *O. kükenthalii*
2. Inflorescence consisting of 1(-2) spikelets. Glumes 3. Nut hispidulous at the top,  $1\frac{1}{3}$ - $1\frac{1}{2}$  by  $\frac{2}{3}$  mm. Stems very short, 2-5 cm . . . . . 2. *O. pumilio*

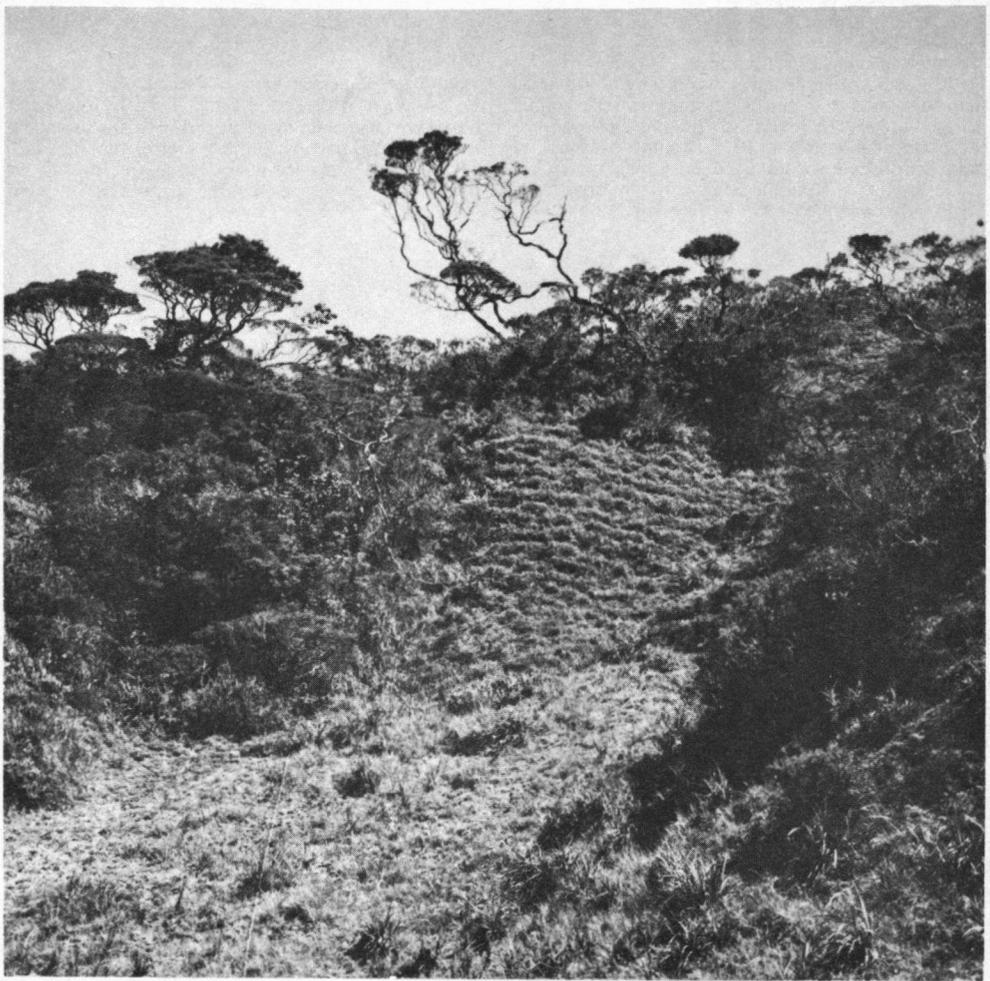


Fig. 84. Mountain heath (*blang*) dominated by *Oreobolus kükenenthalii* STEEN. ON Mt Kemiri (N. Sumatra) at c. 3200 m, the step-wise formation on the slope probably caused by the treading of Sumatran mountain goat (photogr. VAN STEENIS, 1937).

1. *Oreobolus kükenenthalii* STEEN. in Kük. in Fedde, Rep. 44 (1938) 187; Bull. Jard. Bot. Btzg III, 16 (1940) 305; KÜK. in Fedde, Rep. 48 (1940) 70. — *Schoenus distichus* RIDL. J. Fed. Mal. St. Mus. 6 (1915) 194; Fl. Mal. Pen. 5 (1925) 166. — *O. distichus* KÜK. & STEEN. Bull. Jard. Bot. Btzg III, 13 (1935) 292; *ibid.* III, 14 (1936) 48, non F.v.M. 1855; Tijd.

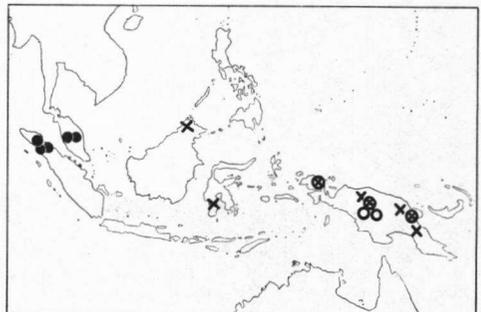


Fig. 85. Range of the Malesian species of *Oreobolus*: *O. kükenenthalii* STEEN. (dots), *O. ambiguus* KÜK. & STEEN. (crosses, also those in circles), *O. pumilio* R.BR., Tasmania, Australian Alps, New Guinea (circles).

Kon. Ned. Aardr. Gen. 55 (1938) 760, phot. 15. — Fig. 80, 82–84.

Stems sulcate-striate, smooth, 3–15 cm by  $\frac{1}{2}$ –1 mm. Leaves exactly distichous, as long as or longer than the stems, c. 1 mm wide; margins scaberulous at the top; sheaths yellowish brown. Inflorescence racemose, consisting of 2–3 distant fascicles of branches. Bracts sheathing, overtopping the spikelets in their axils, about as long as the inflorescence. Peduncles solitary or in twos, erect, rigid, 3-angular,

scaberulous on the angles, exerted from the sheaths, up to 3 cm long. Spikelets 4–6, unequally peduncled, oblong, 4–7 mm long. Glumes 4–5, lanceolate, acuminate, blackish purple with green keel, the lowest often with leaf-like tip. Hypogynous scales narrowly lanceolate, with antrorsely scabrous-ciliate margins, stramineous, slightly shorter than the nut. Style hardly thickened at the base. Nut ellipsoid or pyriform, obtuse or slightly acuminate, brown, glabrous,  $1\frac{2}{3}$ –2 by c. 1 mm.

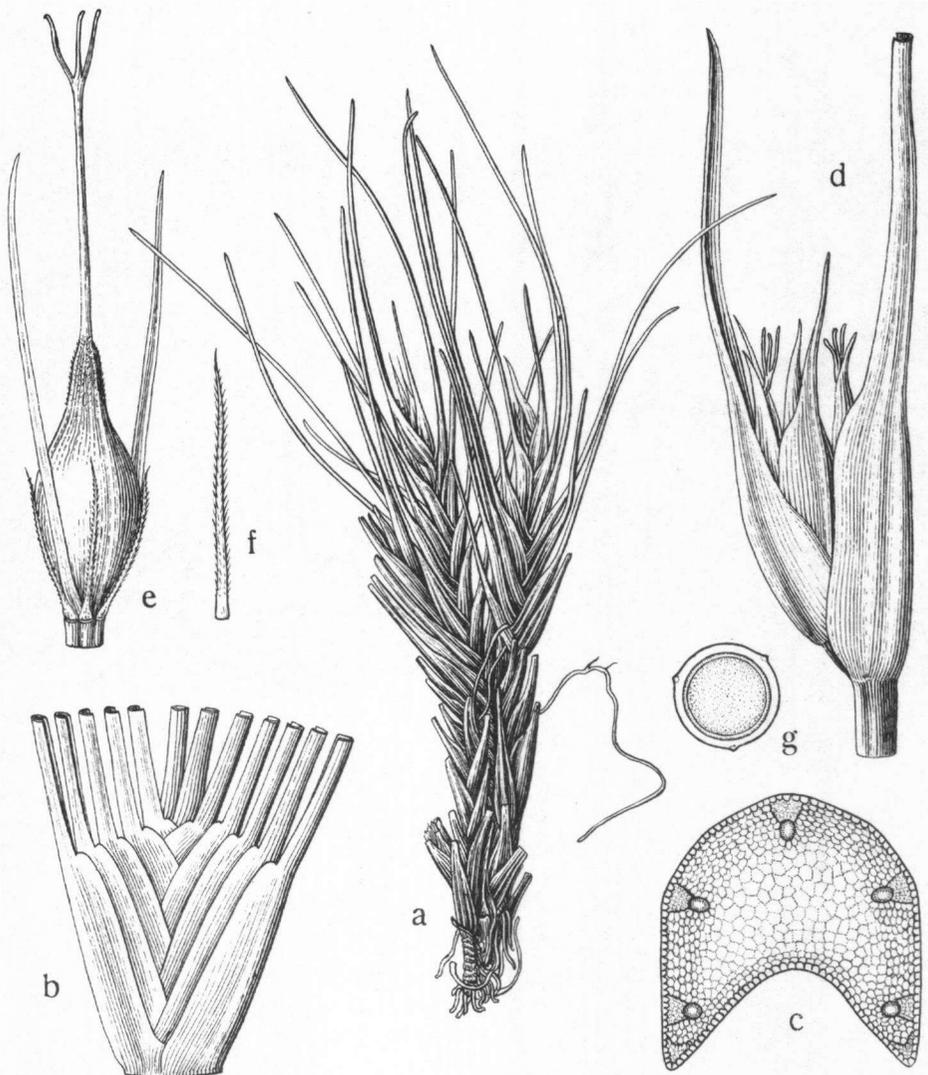


Fig. 86. *Oreobolus ambiguus* KÜK. & STEEN. *a*. Habit, nat. size, *b*. equitant sheaths,  $\times 3$ , *c*. CS of leaf, enlarged,  $\times 5$ , *d*. inflorescence, with two filaments,  $\times 10$ , *f*. perianth bristle,  $\times 15$ , *g*. CS of nut, enlarged (CLEMENS 29006 & 51348).

Distr. *Malesia*: N. Sumatra (Gajo Lands: Mts Losir, Kemiri, and Goh Lembuh), Malay Peninsula (Pahang: Mt Tahan; Perak: Mt Kerbau). Fig. 85.

Ecol. Forming semi-globose cushions in mountain heaths in dry or somewhat moist localities, also in open places on rocks, sometimes dominant; in the Malay Peninsula 1600–2150 m, in Sumatra 2450–3460 m.

2. *Oreobolus pumilio* R.Br. Prod. (1810) 236; KUNTH, En. 2 (1837) 367; BOECK. *Linnaea* 38 (1874) 230, p.p.; BENTH. Fl. Austr. 7 (1878) 346; CLARKE, Ill. Cyp. (1909) t. 102, f. 1–5; KÜK. Bot. Jahrb. 70 (1940) 464; in Fedde, Rep. 48 (1940) 66, p.p.; S. T. BLAKE, J. Arn. Arb. 29 (1948) 95. — *O. ciemensiae* KÜK. in Fedde, Rep. 48 (1940) 69.

Stems sulcate-striate, smooth, 2–5 cm by  $\frac{1}{2}$ –

1 mm. *Leaves* distichous, but often less regularly imbricate, overtopping the stems, c. 1 mm wide; margins scaberulous at the top; sheaths stramineous, often tinged with purple. *Spikelet* 1(–2), terminal or in one of the upper axils, oblong, usually 4–5 mm long, but the outermost glume often leaf-like and up to 9 mm. *Glumes* 3, lanceolate, brownish to purplish, with green keel, ciliate at the top. *Hypogynous scales* narrowly lanceolate, with antrorsely scabrous-ciliate margins, stramineous, about as long as the nut. *Style* hardly thickened at the base. *Nut* ellipsoid or sub-ovoid, stramineous to brown, hispidulous at the top,  $1\frac{1}{3}$ – $1\frac{1}{2}$  by  $\frac{2}{3}$  mm.

Distr. SE. Australia (Victoria, Tasmania); in *Malesia*: New Guinea (W. New Guinea: Arfak Mts, Lake Habbema, Mt Wichmann, Mt Goliath; NE. New Guinea: Mt Sarawaket, Mt Amungwiwa, Mt Wilhelm; Papua: Mt Giluwe). Fig. 85.



Fig. 87. *Oreobolus ambiguus* KÜK. & STEEN. Ring-shaped tufts, in damp spots on granite in summit zone of Mt Kinabalu, at c. 3800 m; background some *Schoenus curvulus* F.v.M. (photogr. SLEUMER, 1963).

Ecol. One of the characteristic plants of alpine bog turfs, forming carpets or in small rounded clumps, 2600–3800 m.

Vern. New Guinea: *ibrang'rank*, Mendi lang.

Note. KÜENTHAL treated the New Guinean specimens as a distinct species, *O. clemensiae*, but they perfectly agree with Tasmanian material of *O. pumilio* in L. The species has been recorded also for N. S. Wales and New Zealand, but according to S. T. BLAKE, *l.c.*, all the specimens from those regions belong to other species.

3. *Oreobolus ambiguus* KÜK. & STEEN. Bull. Jard. Bot. Botz III, 14 (1936) 48, f. 1; KÜK. in Fedde, Rep. 48 (1940) 72; Bot. Jahrb. 70 (1940) 463; S. T. BLAKE, J. Arn. Arb. 29 (1948) 96. — ? *Schoenus* sp. STEEN. Bull. Jard. Bot. Botz III, 13 (1934) 200. — *Oreobolus* sp. STEEN. Fl. Mal. I, 5 (1958) 426 f. 5. — Fig. 86–87.

Stems compressed, sulcate-striate, smooth, completely hidden by the leaves, 1–5 cm by c. 1 mm. Leaves exactly distichous, overtopping the stems, c. 1 mm wide; margins scaberulous at the top; sheaths shining yellowish brown. Inflorescence almost capitate, consisting of (1)–2–3 approximate subsessile

spikelets. Bracts overtopping the inflorescence, up to 5 cm. Spikelets oblong, 7–9 mm long (when there is only 1 spikelet the bracts assuming the aspect of glumes, up to 2 cm long). Glumes 3, lanceolate, acuminate, stramineous with green keel, often purplish lineolate. Hypogynous scales linear, bristle-like, with antrorsely scabrous-ciliate margins, whitish, about as long as the nut (without style-base), the outer ones slightly shorter than the inner ones. Style with incrassate conical base. Nut ellipsoid, stramineous or brown, at the top narrowed into the hispid, dark brown, persistent, conical style-base decurrent on the angles of the nut proper,  $2\frac{1}{2}$ –3 by  $1-1\frac{1}{2}$  mm (style-base included).

Distr. *Malesia*: N. Borneo (Mt Kinabalu), SW. Celebes (Latimodjong Range: Pokapindjang, Rante Mario), New Guinea (W. New Guinea: Arfak Mts, Lake Habbema, Mt Doorman; NE. New Guinea: Mt Sarawaket; Papua: Mt Albert Edward, Lake Aunde near Mt Wilhelm, Mt Dayman, Mt Donana, Mt Michael). Fig. 85.

Ecol. One of the characteristic plants of alpine bog turf, forming carpets or in small rounded clumps, also in dense masses on alpine seepage slopes, 2500–4000 m.

## 22. CLADIUM

P. BROWNE, Hist. Jamaica (1756) 114; CRANTZ, Inst. 1 (1766) 362; KERN, Act. Bot. Neerl. 8 (1959) 263. — *Mariscus* ZINN, Cat. Pl. Hort. Gott. (1757) 79, non GAERTN. 1788, *nom. rejic.* — *Cladium* sect. *Eucladium* BENTH. Fl. Austr. 7 (1878) 401; B. & H. Gen. Pl. 3 (1883) 1065; PAX in E. & P. Pfl. Fam. 2, 2 (1887) 116. — *Cladium* subg. *Eucladium* CLARKE, Fl. Br. Ind. 6 (1894) 673. — Fig. 88.

Perennial herbs with creeping stolons. Stems erect, hollow, obsoletely trigonous to terete, leafy throughout their length. Leaves 3-ranked, flat, linear, with long tubular sheaths and dorsiventrally compressed blades; ligule absent. Inflorescence paniculate, consisting of several remote corymbiform partial panicles; branches solitary or in twos in the axils of leafy bracts. Spikelets very numerous, in numerous capitate clusters, terete, 2(–3)-flowered, both flowers hermaphrodite or one of them (the lower or the upper one) male or functionally male. Rachilla persistent, straight, with very short internodes. Glumes spirally arranged, the lower 3–4 empty; usually no terminal empty glume. Perigone absent. Stamens 2 (according to several authors sometimes 3), with free filaments and linear anthers; connective distinctly produced. Style continuous with the ovary; style-base incrassate, conical, persistent on the fruit and fused into it, glabrous; stigmas (2)–3, or sometimes 4–6 due to division. Nut somewhat drupe-like, ovoid or conical, truncate at the base, inserted on a saucer-shaped disc; exocarp spongy, endocarp thick, hard.

Distr. Only 2 spp., one extending over the tropical and temperate regions of the whole world, the other, *C. mariscoides* (MÜHL.) TORR., restricted to N. America.

Note. For the circumscription of the genus see under *Machaerina*, p. 691.

1. *Cladium mariscus* (L.) POHL, Tent. Fl. Boh. 1 (1809) 32; KUNTH, En. 2 (1837) 303; BOECK. Linnaea 38 (1874) 232; BENTH. Fl. Austr. 7 (1878) 402; ? F. VILL. Nov. App. (1882) 309; CLARKE, Fl. Br. Ind. 6 (1894) 673; STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 281; KÜK. in Fedde, Rep. 51 (1942) 185. — *Schoenus*

*mariscus* L. Sp. Pl. 1 (1753) 42. — *Mariscus cladium* O.K. Rev. Gen. Pl. 2 (1891) 754.

Coarse, glabrous. Rhizome erect, woody, emitting horizontal, thick stolons clothed with 3-ranked, striate, ovate-lanceolate scales. Stems stout, striate, smooth, 80–200 cm tall. Leaves about as long as the



Fig. 88. *Cladium mariscus* (L.) POHL ssp. *jamaicense* (CRANTZ) KÜK. a. Lower part of stem, a'. inflorescence, both  $\times \frac{1}{2}$ , a''. flattened leaf piece,  $\times 2$ , b. spikelet in fruit,  $\times 5$ , c-c'. nut,  $\times 7\frac{1}{2}$  (a, b, c' VAN ROYEN 3811, c. MONOD DE FROIDEVILLE 1704).

stems, rigid, tough, complicate at the base, spinulose-serrulate on the margins and keel, 6–12 mm wide, gradually narrowed into a long triquetrous acumen with sharply cutting edges; sheaths yellowish to ferruginous, brown at the base. *Panicle* decompound, oblong, interrupted, 30–50 cm long; branches exerted from the sheaths, erect, compressed, much branched. Lower bracts similar to the leaves, longer than the partial inflorescences in their axils. *Spikelets* in globose clusters, young oblong-lanceolate, ripe ovoid or ellipsoid, acutish, 3–4 by  $1\frac{1}{2}$ –2 mm. *Glumes* 5–7, membranous, obtuse, concave, 1-nerved, ferruginous to brown, darker lineolate, the upper ones 2–4 mm long, the lower empty ones smaller, broadly ovate. *Anthers* 2–3 mm long. *Nut* terete, acute or acuminate, smooth or more or less rugulose, brown to dark castaneous, 2–4 by  $1\frac{1}{4}$ –2 mm, the hypogynous disc with the filaments often persisting on the rachilla.

*Distr.* Widely distributed over the tropical regions of the whole world, also in temperate Asia, Europe, Africa, and N. America, in *Malesia* very rare.

*Ecol.* In swamps and pools, on margins of lakes, sometimes in swampy forests, from a few m altitude up to 2100 m (in New Guinea), in Sumatra at 900 m, in Timor at 400 m.

*Vern. Kwargalan daai*, Aru Is.

*Notes.* Up to now the numerous attempts to divide this polymorphic species into subspecies or microspecies have not been very successful. S. T. BLAKE, *Trans. R. Soc. S. Austr.* 67 (1943) 57–58, split it up into 5 species, as follows:

- a. Stigmatic branches 4–6; spikelets rather pale-coloured. . . . *C. leptostachyum* NEES & MEY.
- a. Stigmatic branches 2–3; spikelets brown to rusty- or dark brown.
- b. Nut smooth, shining; partial panicles dense.
- c. Nut acuminate or beaked; culms not branched; rhizome long-creeping.

*C. mariscus* (L.) POHL

- c. Nut obtusely rounded at tip; culms with leafy branches in upper part; rhizome short (always?) . . . . *C. procerum* S. T. BLAKE

- b. Nut rather prominently tessellately rugose; partial panicles often loose.

- d. Nut acuminate; common rachis of panicle deeply canaliculate with scabrous margins; a rather slender plant from China and Japan.

*C. chinense* NEES

- d. Nut acute but scarcely acuminate; common axis not channelled, smooth; a stout American plant . . . *C. jamaicense* CRANTZ

*C. leptostachyum* NEES & MEY. *Nov. Act. Ac. Caes. Leop.-Car.* 19, Suppl. 1 (1843) 115, from Hawaii, was described by NEES as having 2 stigmas. In the Hawaiian specimens I examined I usually found 3 stigmas, more rarely 2 or 4. This varying number of stigmas I also found in European and Asian specimens. In my opinion *C. leptostachyum* can not be upheld as a separate race or species.

I fail to see the difference in the shape of the nut between Chinese or Japanese specimens and American ones. In several of the latter the nuts are certainly more acuminate than in the former. The slight difference in the rachis, even if holding good in all cases, seems insufficient for specific or racial discrimination.

*C. mariscus* s.s. (*C. germanicum* SCHRAD.) is apparently a well-characterized subspecies, confined to Europe, E. Asia, and parts of Africa. The shining dark brown to blackish nuts measure 3–4 by  $1\frac{1}{2}$ –2 mm, the spikelets are 3–4 mm long, and the connective of the anthers is conspicuously produced.

*C. procerum* S. T. BLAKE, *Trans. R. Soc. S. Austr.* 67 (1943) 57 (*C. mariscus* ssp. *intermedium* KÜK. in Fedde, *Rep.* 51, 1942, 188) has the small fruits of *C. jamaicense* and *C. chinense*, but they are quite smooth and somewhat rounded at the top. The same type of nut is met with in S. African specimens, which KÜKENTHAL referred to *C. mariscus* ssp. *jamaicense*.

In several respects the Malesian specimens are intermediate between the Australian and E. Asian ones. The nuts measure 2–2½ by  $1\frac{1}{2}$ –1¾ mm, they are more or less pitted-rugulose (much less than in the E. Asian specimens), and acute to distinctly acuminate. The stems often produce tufts of leaves or leafy branches breaking through the base of the leaf-sheaths finally falling off and quickly producing new clones. This feature, common in Australian plants and also observed in Japanese ones (OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18, 1944, 11), I found also in a Hawaiian collection.

As no sharp lines can be drawn it seems advisable to follow KÜKENTHAL, who divided *C. mariscus* into 3 subspecies, viz *ssp. mariscus*, *ssp. jamaicense* (incl. *C. leptostachyum* and *C. chinense*), and *ssp. intermedium*. The Malesian specimens may provisionally be referred to *ssp. jamaicense*.

*ssp. jamaicense* (CRANTZ) KÜK. in Fedde, *Rep. Beih.* 40<sup>1</sup> (1938) 523; *ibid.* 51 (1942) 189; *Bull. Jard. Bot. Btzig III*, 16 (1940) 311. — *C. jamaicense* CRANTZ, *Inst.* 1 (1766) 362. — *C. chinense* NEES in Hook. & Arn. *Bot. Beech. Voy.* (1837) 228; *Nov. Act. Ac. Caes. Leop.-Car.* 19, Suppl. 1 (1843) 116; OHWI, *Bot. Mag. Tokyo* 56 (1942) 208. — *Neolophocarpus tonquinensis* CAMUS, *Fl. Gén. I.-C.* 7 (1912) 149, *quoad specim. cit.*, non *Lophocarpus tonquinensis* BOECK. — *C. germanicum* (non SCHRAD.) RENDLE in Gibbs, *Arfak* (1917) 90. — *Fig. 88.*

Inflorescence copious, effuse. Partial panicles rather loose. Spikelets 2–3 mm long. Connective of the anthers shortly produced. Nut small, more or less rugulose, opaque, ferruginous to brown.

*Distr.* America, Oceania, E. Asia to *Malesia*: North Sumatra (Tapanuli: Toba), Lesser Sunda Is. (Timor), South Moluccas (Key & Aru Is.), and West New Guinea (Kebar Valley; Arfak Mts; Wissel Lake region), also in the Solomons (Rennell I.).

### 23. MACHAERINA

VAHL, *En.* 2 (1806) 238; KUNTH, *En.* 2 (1837) 313; BOECK, *Linnaea* 38 (1874) 251; KOYAMA, *Bot. Mag. Tokyo* 69 (1956) 61; KERN, *Act. Bot. Néerl.* 8 (1959) 263. — *Baumea* GAUD. in Freyc. *Voy. Bot.* (1829) 416; t. 29; KUNTH, *En.* 2 (1837) 313;

MIQ. Fl. Ind. Bat. 3 (1856) 339; BOECK. Linnaea 38 (1874) 237. — *Vincentia* GAUD. in Freyc. Voy. Bot. (1829) 417; KUNTH, En. 2 (1837) 314; MIQ. Fl. Ind. Bat. 3 (1856) 339; BOECK. Linnaea 38 (1874) 247; STAFF in Gibbs, J. Linn. Soc. Bot. 42 (1914) 178. — *Chapelliera* NEES, Linnaea 9 (1834) 298; KUNTH, En. 2 (1837) 315. — *Cladium* sect. *Baumea* & *Vincentia* B. & H. Gen. Pl. 3 (1883) 1065–1066; PAX in E. & P. Pfl. Fam. 2, 2 (1887) 116. — *Cladium* subg. *Machaerina*, *Vincentia* & *Baumea* CLARKE, Kew Bull. add. ser. 8 (1908) 124. — *Cladium* subg. *Machaerina* & *Baumea* KÜK. in Fedde, Rep. 51 (1942) 9, 149. — Fig. 89–94.

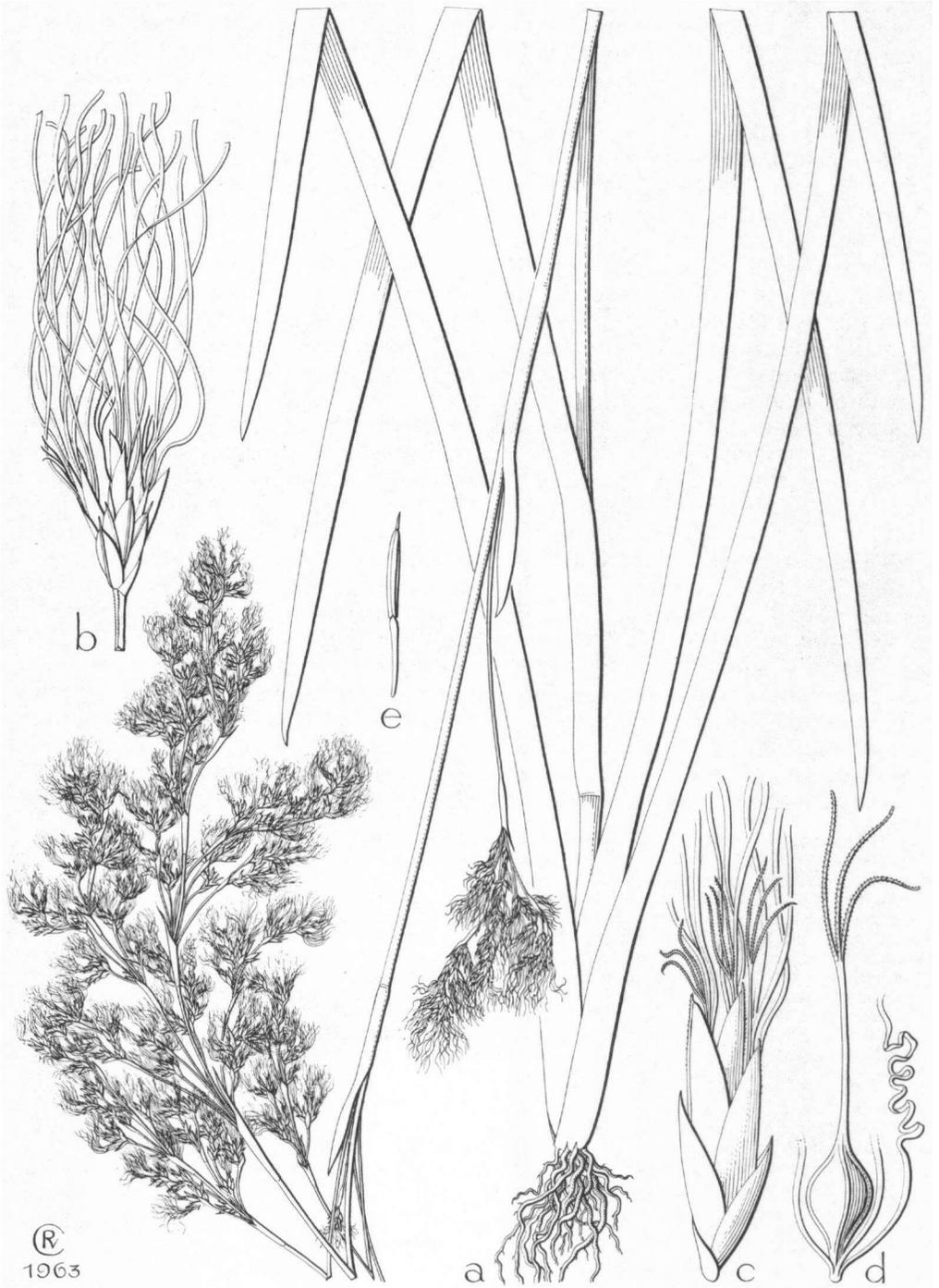
Perennial herbs with horizontally creeping or short rhizome often emitting creeping stolons. *Stems* erect, tufted, or approximate on the creeping rhizome, ancipitous or biconvex, rarely terete, pithy, sometimes transversely septate, usually smooth, rarely asperous. *Leaves* distichously arranged, vertically much flattened, angled, or terete, smooth, sometimes asperous, rarely transversely septate; blades sometimes much reduced; lower sheaths brown to purplish; ligule absent. *Inflorescence* paniculate, consisting of few to several partial panicles; branches often in fascicles and branchlets zig-zag. Bracts sheathing, with short blades. *Spikelets* often clustered, rarely solitary, ovate to lanceolate, compressed, 1–several-flowered, but often the lowest flower alone nut-bearing, the upper flower reduced. *Rachilla* persistent, straight, with very short internodes. *Glumes* distichous, subtended by 1–2 transverse bracts, keeled, the lower 1–4 empty, the one bearing the fertile flower usually the largest, the uppermost usually small, either empty or with a ♂ flower. *Perigone* usually absent, rarely consisting of up to 6 capillary, antrorsely scabrous bristles. *Stamens* (1–2–)3, with free filaments and linear anthers; connective more or less produced. *Style* continuous with the ovary, the base conspicuously incrassate, conical or pyramidal, often hairy, persistent on the fruit; stigmas 3. *Nut* ovoid, ellipsoid or oblong-ellipsoid, almost terete to triquetrous, stipitate or sessile, smooth or rugulose, crowned by the adnate base of the style, which is sometimes indistinguishable except for a slight discoloration.

Distr. About 45 spp., chiefly Australian, a few spp. in tropical Asia, Africa, and America, some spp. extending to the subtropics; in *Malesia* 12 spp., of which 3 endemic: *M. aspericaulis* (Mt Kinabalu), *M. disticha* (see map), and *M. lamii* (New Guinea).

Notes. In the first half of the 19th century *Cladium*, *Machaerina*, *Vincentia*, *Baumea*, and *Chapelliera* were generally treated as separate genera, e.g. by KUNTH, STEUDEL, and BOECKELER. Mainly on account of the supposedly spiral arrangement of the glumes in all these genera and the distribution of sexes in the spikelet (lowest flower fertile), BENTHAM united them under the name *Cladium*. He was followed by nearly all subsequent authors, such as CLARKE, and recently by KÜKENTHAL. However, only in *Cladium sensu stricto* the glumes are spirally arranged, and the distribution of sexes is less constant than assumed, especially in *Cladium mariscus*, in which often the lowest flower is male or functionally male. Already PALLA and STAFF were of the opinion that BENTHAM's circumscription was untenable, PALLA mainly for anatomical reasons, and recently KOYAMA divided *Cladium sensu BENTHAM* into two well characterized genera, which can be distinguished as follows:

<i>Cladium</i>	<i>Machaerina</i>
<i>Stems</i> hollow.	<i>Stems</i> pithy.
<i>Partial inflorescences</i> corymbiform.	<i>Partial inflorescences</i> paniculiform.
<i>Leaves</i> 3-ranked.	<i>Leaves</i> 2-ranked.
<i>Leaf-blades</i> horizontally flattened, serrate-scabrous on the margins.	<i>Leaf-blades</i> vertically flattened to terete, smooth on the margins or nearly so.
<i>Stamens</i> 2(–3?).	<i>Stamens</i> (1–)3.
<i>Glumes</i> spiral.	<i>Glumes</i> distichous.
<i>Nut</i> supported by a disc.	No disc under the <i>nut</i> .
<i>Pollen</i> of 1–6 aperture type (according to Miss M. IKUSE, in KOYAMA, l.c.).	<i>Pollen</i> of polyforate type.

*Machaerina* is undoubtedly much nearer to *Gahnia* than to *Cladium*. It seems advisable to keep *Gahnia* as a separate genus, as it is rather sharply distinguishable from *Machaerina* by the always terete stems, the



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Fig. 89. *Machaerina sinclairii* (Hook. f.) KOYAMA. a. Habit,  $\times \frac{2}{3}$ , b. cluster of spikelets,  $\times 4$ , c. spikelet,  $\times 8$ , d. deflorescent flower, e. stamen, both  $\times 12$  (a-e RAHMAT SI BOEEA 6109).

spirally arranged, horizontally flattened leaves scabrous on the margins and narrowed into a long subulate tail, the long lower bracts, the always 1-2-flowered spikelets (lower flower when present sterile or male), the small fertile glumes (smaller than the outer sterile ones), the number of stamens (3-6), and the very small style-base. The fact that in some *Machaerinae* fruit dispersal is similar to that found in *Gahnia*, also points to the close relationship between these two genera. Fixing mechanism is found in *M. mariscoides*, *M. gunnii*, and some extra-Malesian species. Fruit dispersal in *M. sinclairii* (strong postfloral growth of the filaments to which the nut remains attached) is similar to the braiding mechanism found in several *Gahniae*.

Specific delimitation presents great difficulties throughout the genus. Especially the delimitation of species 1-5 is rather vague. In *M. glomerata*, *M. mariscoides*, and *M. rubiginosa* several races are involved.

## KEY TO THE SPECIES

Unless otherwise stated the beak (persistent style-base) of the nut has been included in the measurements of the nut

1. Spikelets very small, 2-3 mm long. Glumes 2 mm long. Nut  $1\frac{1}{2}$ - $1\frac{3}{4}$  mm long. All the leaves usually much reduced, the basal ones bladeless, the cauline ones with a very short blade 1-2(-5) cm long.
  8. *M. disticha*
1. Spikelets, glumes, and nuts larger. At least part of the leaves with well-developed much longer blades.
  2. Leaves sword-shaped, very flat with sharp edges, equitant. Stems ancipitous.
  3. Stems and leaf-sheaths (often also the leaf-blades) asperous.
  4. Spikelets in clusters of 3-5. Glumes acute to mucronulate. Nut proper ellipsoid, c. 2 mm long, suddenly contracted into the densely sericeous c.  $1\frac{1}{2}$  mm long style-base . . . . . 7. *M. mariscoides*
  4. Most spikelets solitary, some of them in clusters of 2-3. Glumes acutish, mucous. Nut ovoid, gradually passing into the hispid, dark brown to blackish style-base, c. 3 mm long . . . . . 5. *M. aspericaulis*
  3. Stems and leaves smooth.
    5. Perianth consisting of (3-)6 bristles c. 2 mm long. Anthers with very shortly produced connective. Inflorescence stiffly erect . . . . . 1. *M. maingayi*
    5. Perianth absent (rarely a single very short bristle present). Anthers with distinctly produced connective.
    6. Branches of the inflorescence drooping. Filaments strongly elongated after anthesis, (1-)2- $2\frac{1}{2}$  cm long, comose . . . . . 2. *M. sinclairii*
    6. Branches of the inflorescence erect. Filaments shorter, only moderately elongated after anthesis, never comose.
    7. Leaves densely ciliate on the edges, narrow, 3-5(-7) mm wide. Stems low, 30-50 cm tall.
      4. *M. lamii*
  7. Leaves glabrous, usually broader. Stems usually taller.
    8. Nut at the base narrowed into a 3-winged stipe, triquetrous. Persistent style-base glabrous or more or less hispid, never densely sericeous . . . . . 3. *M. falcata*
    8. Nut sessile, obtusely trigonous to subterete. Persistent style-base densely sericeous.
      9. Lower bracts very shortly laminate. Nut gradually tapering into shortly pyramidal persistent style-base . . . . . 11. *M. rubiginosa*
      9. Lower bracts long, similar to the leaves. Nut abruptly narrowed into c.  $1\frac{1}{2}$  mm long persistent style-base.
        10. Glumes ovate-lanceolate, acute, the longest c. 5 mm. Spikelets 1-flowered, 5-6 mm long, in turbinate clusters. Nut ovoid-ellipsoid,  $3\frac{1}{2}$ -4 by  $1-1\frac{1}{2}$  mm . . . . . 7. *M. mariscoides*
        10. Glumes ovate, obtuse, up to 4 mm long. Spikelets (1-)2-3-flowered, 3-4 mm long, in ovoid to globose clusters. Nut broadly ovoid or subglobose, 3- $3\frac{1}{2}$  by  $1\frac{1}{2}$  mm . . . . . 6. *M. glomerata*
  2. Leaves terete, or biconvex with obtuse edges. Stems terete or somewhat compressed, not ancipitous.
    11. Leaves prominently transversely septate. Nut with thickened suberous angles . . . . . 9. *M. articulata*
    11. Leaves not septate, pithy within, the pith almost continuous, not divided into remote distinct septa.
    12. Stem leafless. Spikelets 1-flowered . . . . . 12. *M. gunnii*
    12. Stem with 1-2 short leaves. Spikelets 2-3-flowered.
    13. Nut ellipsoid to oblong-ellipsoid, 3-5 by  $1\frac{1}{2}$ -2 mm, smooth and shining. Glumes mucous.
      11. *M. rubiginosa*
      10. *M. teretifolia*
13. Nut obovoid or ellipsoid,  $1\frac{1}{2}$ -2 by  $1-1\frac{1}{4}$  mm, strongly rugulose by many much raised irregular ridges, opaque. Glumes usually mucronulate . . . . . 10. *M. teretifolia*

1. *Machaerina maingayi* (CLARKE) KOYAMA, Bot. Mag. Tokyo 69 (1956) 64. — *Cladium maingayi* CLARKE [ex RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 16, nom. nud.] Fl. Br. Ind. 6 (1894) 674; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 86; CLARKE, Ill. Cyp. (1909) t. 83, f. 1-4; RIDL. J. Fed. Mal. St. Mus. 6 (1915) 193; Fl. Mal. Pen. 5 (1925) 167; KÜK. in Fedde, Rep. 51 (1942) 11, excl. var. *subsesetosum* KÜK. — *Vincetia maingayi* STAPP, J. Linn. Soc. Bot. 42 (1914) 179. — *Mariscus maingayi* FERN. Rhodora 25 (1923) 53.

Rhizome short. Stems tufted, stout, ancipitous, smooth, 60-125 cm by up to 7 mm. Leaves crowded at the base (sometimes a single cauline leaf present), coriaceous, equitant, ensiform, gradually narrowed from the base and shortly acuminate, smooth, 10-20 mm wide. Panicle erect, oblong, rather narrow, interrupted, consisting of several distant fascicles of branches, 25-50 cm long. Bracts erect, shortly laminate, with long, brownish, ancipitous sheaths. Branches erect, rigid, unequal, smooth. Spikelets in numerous clusters, ovate, 2-4-flowered, deep reddish

brown, 4–5 by c. 2 mm. *Glumes* c. 5, ovate, slightly emarginate, mucronulate from the sinus, 3–4 mm long; margins densely ciliate in the upper half. *Bristles* (3–)6, delicate, the longest c. 2 mm. *Stamens* 3; filaments slightly elongated after anthesis, not comose; anthers  $1\frac{1}{2}$  mm long, with very shortly produced connective. *Nut* ovate, triquetrous with somewhat convex sides, slightly rugulose, brownish, c. 3 by 0.9 mm (stipe and beak included); stipe obpyramidal, 3-winged, short; persistent style-base narrowly pyramidal, much narrower than the nut, hispid, c. 1 mm long.

Distr. Tonkin (D'ALLEIZETTE in L), in *Malesia*: Malay Peninsula (Perak, Kelantan, Pahang, Malacca).

Ecol. On wet rocks and in open swampy places in the mountains, 900–2100 m.

Vern. *Jëringu laut*, M.

Note. Well-developed perigones are very rare in the genus. Besides in *M. maingayi* they are only found in a few W. Indian species.

2. *Machaerina sinclairii* (HOOK. f.) KOYAMA, Bot. Mag. Tokyo 69 (1956) 65. — *Vincentia anceps* HOOK. f. Fl. Nov. Zel. 1 (1853) 276, non KUNTH (1837) nec *Cladium anceps* HOOK. f. [Handb. N. Zeal. Fl. (1867) 305] ex CHERMEZ. Arch. Bot., Mém. 2 (1936) 75. — *Cladium sinclairii* HOOK. f. Handb. N. Zeal. Fl. (1867) 305; CLARKE, Ill. Cyp. (1909) t. 84, f. 4–5; KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 308; in Fedde, Rep. 51 (1942) 15, incl. var. *crinitum* KÜK. — *Cladium maingayi* (non CLARKE) KOORD. Minah. (1898) 283, p.p. — *Vincentia robinsonii* MERR. Philip. J. Sc. 11 (1916) Bot. 258. — *Vincentia crinita* STAFF. Philip. J. Sc. 19 (1921) 65. — *Cladium crinitum* MERR. En. Philip. 1 (1923) 129. — *Cladium latifolium* MERR. l.c., p.p. — *Cladium maingayi* var. *subesetosum* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 308; in Fedde, Rep. 51 (1942) 12. — *M. crinita* KOYAMA, Bot. Mag. Tokyo 69 (1956) 63. — *M. robinsonii* KOYAMA, l.c. 65. — Fig. 89.

Rhizome short. *Stems* tufted, slender to stout, ancipitous, smooth, 50–150 cm by (2–)4–7 mm. *Leaves* crowded at the base (or a single cauline leaf also present), coriaceous, equitant, ensiform, gradually narrowed upward and shortly acuminate, smooth, (4–)8–20 mm wide. *Panicle* more or less nodding, oblong, consisting of 4–6 distant fascicles of branches, 20–50 cm long. Bracts erect, shortly laminate, with long, brownish, ancipitous sheaths. Branches more or less drooping, slender, unequal, smooth. *Spikelets* in numerous clusters, more rarely solitary, ovate to oblong, (1–)2–3-flowered, reddish brown,  $3\frac{1}{2}$ –5 by c. 2 mm. *Glumes* 4–6, oblong-ovate, mucronulate, 3–4 mm long; margins sparsely ciliate in the upper half. *Bristles* absent (very rarely a single vestigial one present). *Stamens* 3; filaments greatly elongated after anthesis and finally (1–)2– $2\frac{1}{2}$  cm long, comose; anthers c. 2 mm, with distinctly produced connective. *Nut* ellipsoid, triquetrous with somewhat convex sides, slightly rugulose, brownish, c. 2 by  $\frac{3}{2}$  mm (stipe and beak included); stipe obpyramidal, 3-winged, c.  $\frac{1}{2}$  mm; persistent style-base pyramidal, hispid, c.  $\frac{1}{2}$  mm long.

Distr. New Zealand (North Island), in *Malesia*: Sumatra, Philippines (Luzon: Mt Mayon, Mt Maquiling, Sierra Madre W. of Baler), N. Celebes, Moluccas (Ambon).

Ecol. Open hillsides, moist mountain slopes, also in forests, 500–2000 m.

Vern. *Sibola sak-sak*, *duhut sanggeok*, *ihur sambut*, *halapupsis*, Sum., *karimënja-raindang*, *kapu-insaputan*, N. Celebes.

Notes. The authority of *Cladium anceps* is generally ascribed to HOOK. f., but it is very doubtful whether this is right, as in Handb. N. Zeal. Fl. (1867) 305 there is no reference to POIRET's basionym *Scirpus anceps*. The name *Cladium anceps* was validated by CHERMEZON, Arch. Bot., Mém. 2 (1936) 75.

*M. maingayi* and *M. sinclairii* are very closely related. The most striking character to distinguish between the two is furnished by the finally up to  $2\frac{1}{2}$  cm long filaments of the latter. However, in Sumatra some specimens have been collected with filaments only 1 cm long and sometimes traces of hypogynous bristles. In these respects they are intermediate between the two species; KÜKENTHAL distinguished these as *Cladium maingayi* var. *subesetosum*. On account of the slender nodding panicle, the less distinctly ciliate glumes, the distinct appendage of the connective, and the slightly smaller nuts, I have referred them to *M. sinclairii*.

*M. sinclairii* is very variable as to size, width of leaves, and length of panicle. The specimens from Mt Mayon, Luzon, were distinguished as *Vincentia crinita* STAFF, on account of the 1–2-flowered, less compact spikelets, and the wider, markedly white style-base, slightly smaller nuts with a short pyramidal pubescent top, sharper and almost winged, broader, narrowing stipe. In my opinion they do not deserve nomenclatural recognition.

3. *Machaerina falcata* (NEES) KOYAMA, Bot. Mag. Tokyo 69 (1956) 63. — *Baumea falcata* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 29. — *Cladium samoense* CLARKE in Stapf, Trans. Linn. Soc. II, Bot. 4 (1894) 245, p.p. (*quoad* HAVILAND 1405); RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 225. — *Cladium maingayi* (non CLARKE) KOORD. Minah. (1898) 283, p.p. — *Cladium latifolium* MERR. Philip. J. Sc. 2 (1907) Bot. 262; En. Philip. 1 (1923) 129, p.p., non DRAKE, 1892. — *Cladium falcatum* CLARKE, Kew Bull. add. ser. 8 (1908) 46; RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 243; GIBBS, Arfak (1917) 90; MERR. En. Philip. 1 (1923) 129; KÜK. in Fedde, Rep. 51 (1942) 144. — *Vincentia malesiaca* STAFF in Gibbs, J. Linn. Soc. Bot. 42 (1914) 178; MERR. En. Born. (1921) 62, excl. HAVILAND 1406. — *Vincentia falcata* STAFF, l.c. 179. — *Mariscus falcatus* FERN. Rhodora 25 (1923) 53. — *Mariscus platyphyllus* FERN. l.c. 54. — *Cladium angustifolium* (non DRAKE) KÜK. Bot. Jahrb. 59 (1924) 53; in Fedde, Rep. 51 (1942) 140, *quoad specim. nov. quin.* — *Cladium meyenii* var. *juncoides* f. *atrofusum* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 311, p.p. typ. — *Cladium iris* OHWI, Bot. Mag. Tokyo 56 (1942) 208. — *M. iris* KOYAMA, Bot. Mag. Tokyo 69 (1956) 64. — *M. latifolia* KOYAMA, l.c. — *M. malesiaca* KOYAMA, l.c. 65. — Fig. 90.

Rhizome short. *Stems* tufted, stout, ancipitous, smooth, up to 1 m by 3–6 mm, several-leaved at the base and usually with 1 cauline leaf halfway up. *Leaves* coriaceous, equitant, ensiform, gradually narrowed upwards and shortly acuminate, smooth, (7–)10–20 mm wide. *Panicle* erect, ovate to oblong, usually dense or very dense, consisting of c. 3



Fig. 90. Tufts of *Machaerina falcata* (NEES) KOYAMA on ultrabasic bedrock in glade in elfin forest below Paka Cave, Mt Kinabalu, at c. 2700 m alt. (photogr. W. MELJER, 1962).

approximate fascicles of branches, 8–12(–25) cm long. Bracts erect, shortly laminate, brown, with ancipitous sheaths. Branches erect, rigid, usually not or hardly exerted from the sheath, unequal, often hispidulous on the angles. *Spikelets* in numerous clusters, ovate, often falcate, 2–4(–6?)-flowered, dark purple, 6–7 by  $2\frac{1}{2}$ –3 mm. *Glumes* 5–7, ovate-lanceolate, obtusish, sometimes minutely mucronulate, with more or less scaberulous keel and ciliolate or glabrous margins, 5–6 mm long. *Bristles* usually absent (very rarely a single vestigial bristle present; see note). *Stamens* 3 (or in some flowers 2); filaments somewhat elongated after anthesis, up to c. 1 cm long, not comose; anthers 2–3 mm long, connective with distinct, c.  $\frac{1}{2}$  mm long appendage. *Nut* ovoid, triquetrous with convex sides and winged angles, ferruginous, 3–4 by c. 1 mm (stipe and beak included); stipe obpyramidal, 3-winged,  $\frac{1}{2}$ –1 mm long; persistent style-base narrowly pyramidal, glabrous, 1– $1\frac{1}{2}$  mm long.

Distr. Hawaii, Samoa Islands, Fiji, New Hebrides, Solomons (Bougainville), in *Malesia*: Sumatra (Mts Singgalang and Talamau), N. Borneo (Mt Kinabalu), Philippines (Luzon, Mindoro, Negros, Mindanao), N. & Central Celebes, New Guinea (Arfak Mts, Mt Carstenz, Bismarck Mts).

Ecol. In open swampy localities, along margins of lakes, in forest-borders, and on ridges in the mossy forest, 1900–3300 m.

Vern. *Karimënja-raindang*, N. Celebes; Philippines: *samalang*, Bag.

Notes. Very variable in stoutness, width of the leaves, etc. Stout specimens from Sumatra with leaves c. 2 cm wide, the lowest partial inflorescence more distant, the branches of the inflorescence more exerted from the sheath, and often a single, very short hypogynous bristle, were described as *Cladium falcatum* var. *sumatrense* CLARKE, Kew Bull. add. ser. 8 (1908) 46; Kük. Bull. Jard. Bot. Btzg III, 16 (1940) 308; in Fedde, Rep. 51 (1942) 146. Some specimens from Borneo and the Philippines are very similar to the Sumatran ones, which certainly do not represent a geographical race. The specimens collected in N. Celebes have looser panicles with branches more exerted from the sheaths. They were distinguished as *Cladium falcatum* var. *celebicum* KÜK. in Fedde, Rep. 51 (1942) 146. In my opinion both varieties have little or no taxonomic value.

*Machaerina angustifolia* (GAUDICH.) KOYAMA (= *Cladium angustifolium* DRAKE), to which species KÜKENTHAL referred two collections from New Guinea, is very near to *M. falcata*, but differs by the narrow, elongate panicle, the straight, oblong, somewhat larger spikelets, and the broadly winged stipe of the nut c. 2 mm long. It is apparently restricted to Hawaii.

4. *Machaerina lamii* (KÜK.) KERN, Act. Bot. Neerl. 8 (1959) 266. — *Cladium lamii* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 309; in Fedde, Rep. 51 (1942) 146. — Fig. 91.

Rhizome short. *Stems* densely tufted, slender, rigid, often slightly curved, ancipitous, smooth, several-leaved at the base, 30–50 cm by 2–3 mm. *Leaves* coriaceous, equitant, ensiform, usually falcate, gradually narrowed into the often undulate tip, densely ciliate on the margins, smooth, 3–5(–7) mm wide. *Panicle* erect, oblong, narrow, consisting of

3–4 distant fascicles of branches, 10–15 cm long. Bracts erect, very shortly laminate, with ancipitous brownish sheaths. Branches 2–5 together, erect, exerted from the sheath, densely hispid on the edges, up to 4 cm long. *Spikelets* in clusters of 3–5, oblong-lanceolate, 2–3-flowered, dark purple, 6–8 by  $2\frac{1}{2}$ –3 mm. *Glumes* c. 5, lanceolate, obtusish, scaberulous on keel and margins, up to 4 mm. *Bristles* absent. *Stamens* 3, filaments somewhat elongated after anthesis, up to 8 mm, not comose; anthers 3–4 mm long, connective with distinct c.  $\frac{1}{2}$  mm long appendage. *Nut* (very immature) narrowly elliptic, distinctly stipitate; persistent style-base narrowly pyramidal, hispid.

Distr. *Malesia*: W. New Guinea (Mt Doorman).

Ecol. In open swampy places, 3250–3520 m.

Note. Only known from two collections (LAM 1595 & 1667). Closely related to *C. falcatum*, but apparently sufficiently distinct to warrant specific separation. Striking differences are found in the narrow, usually falcate, densely ciliate leaves, and possibly in the shape of the nut.

5. *Machaerina aspericaulis* (KÜK.) KOYAMA, Bot. Mag. Tokyo 69 (1956) 62. — *Cladium samoense* CLARKE in Stapf, Trans. Linn. Soc. II, Bot. 4 (1894) 245, p.p. (quoad HAVILAND 1406). — *Cladium aspericaule* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 309; in Fedde, Rep. 51 (1942) 151. — *Baumea aspericaulis* S. T. BLAKE, Contr. Queensl. Herb. 8 (1969) 28.

Rhizome short. *Stems* tufted, stout, ancipitous, asperous (like the leaf-sheaths, bracts, and branches of the inflorescence), several-leaved at the base, 60–90 cm (according to a field-label up to 2 m) by 3–5 mm. *Leaves* coriaceous, equitant, ensiform, gradually narrowed upwards, smooth or slightly asperous, 7–20 mm wide. *Panicle* erect, oblong, narrow, loose, consisting of 4–5 distant fascicles of branches, 25–30 cm long. Bracts erect, long-sheathing, the lowest with a blade up to 30 cm long, upper ones much shorter. Branches slender, erect, exerted from the sheath, unequal, flexuous, the lowest usually solitary, the upper ones 5–10 together; branchlets finally recurved. *Spikelets* mostly solitary, some of them in clusters of 2–3, oblong-lanceolate to ovate or elliptic, often somewhat falcate, 2–4-flowered, brown to blackish purple, 6–8 by c. 3 mm. *Glumes* 5–6, ovate-lanceolate, acutish, scabrous, up to 6 mm. *Bristles* absent. *Stamens* 3; anthers c. 2 mm long, with distinctly produced connective. *Nut* ovoid, obtusely trigonous, slightly rugulose, light or greyish brown, 3–4 by  $1\frac{1}{2}$  mm (stipe and beak included); stipe broad, narrowly winged, c.  $\frac{1}{2}$  mm long; persistent style-base broadly pyramidal, gradually passing into the nut proper, hispid, dark brown to blackish.

Distr. *Malesia*: N. Borneo (Mt Kinabalu).

Ecol. On open mountain slopes, 1500–1650 m.

Note. *Cladium samoense* CLARKE was based on specimens from Polynesia (Fiji, Samoa, Tahiti) and N. Borneo (Mt Kinabalu), of which only the Bornean specimens (*viz* HAVILAND 1405 & 1406) were cited in detail by STAPF in his paper on the flora of Mt Kinabalu (1894). Later on (J. Linn. Soc. Bot. 42, 1914, 178) STAPF excluded HAVILAND 1405 from *Cladium samoense* and referred it to *Vincentia malesiaca* STAPF. Unfortunately the remaining HAVILAND specimen (1406) and the Polynesian ones



Fig. 91. *Machaerina lamii* (KÜK.) KERN. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 10$ , c. deflorate flower,  $\times 10$ , d. immature nut (a-d LAM 1595).

are not conspecific; the former belongs to the species described as *Cladium aspericaule* by KÜKENTHAL in 1940. Although it is not cited in detail in the original description it seems appropriate to designate the Samoa specimen in the Kew Herbarium as the lectotype of *Cladium samoense*, and to accept KÜKENTHAL's name as the earliest one for the species described above.

6. *Machaerina glomerata* (GAUD.) KOYAMA, Bot. Mag. Tokyo 69 (1956) 63. — *Baumea glomerata* GAUDICHAUD in Freyc. Voy. Bot. (1829) 416, t. 29; BRONGN. in Duperrey, Voy. Bot. (1834) 168; KUNTH, En. 2 (1837) 314; MIQ. Fl. Ind. Bat. 3 (1856) 339; BOECK. Linnaea 38 (1874) 239; MERR. Philip. J. Sc. 11 (1916) Bot. 257. — ? *Lepidosperma waiuiense* STEUD. Syn. 2 (1855) 158; KÜK. in Fedde, Rep. 50 (1941) 41 (cf. Notes). — *Cladium colpodes* LAUT. in K. Sch. & Laut. Nachtr. (1905) 59; VALCK. SUR. Nova Guinea 8 (1912) 707; KÜK. Bot. Jahrb. 59 (1924) 52; *ibid.* 69 (1938) 260; KANEHIRA, J. Dep. Agr. Kyushu Imp. Un. 4 (1935) 276; KÜK. in Fedde, Rep. 51 (1942) 155; S. T. BLAKE, J. Arn. Arb. 29 (1948) 96. — *Cladium glomeratum* F.-VILL. Nov. App. (1882) 309; H. PFEIFF. in Fedde, Rep. 23 (1927) 349, non R.Br. 1810. — *Cladium globiceps* CLARKE, Kew Bull. add. ser. 8 (1908) 46; KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 310, incl. var. *colpodes* KÜK.; in Fedde, Rep. 51 (1942) 154. — *Cladium juncooides* ELMER, Leaf. Philip. Bot. 3 (1910) 854; MERR. En. Philip. 1 (1923) 129. — *Cladium sinuatum* RIDL. Trans. Linn. Soc. II, Bot. 9 (1916) 243. — *Mariscus colpodes* FERN. Rhodora 25 (1923) 53. — *Mariscus globiceps* FERN. l.c. — *Cladium meyenii* var. *juncooides* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 310, incl. *f. atrofusum* KÜK. quoad RACHMAT 661. — *Cladium gaudichaudii* (non W. F. WIGHT) OHWI, Bot. Mag. Tokyo 56 (1942) 208. — *M. juncooides* KOYAMA, Bot. Mag. Tokyo 69 (1956) 64. — *M. sinuata* KOYAMA, l.c. 65.

Rhizome short. Stems tufted, slender to rather stout, acipituous, smooth, several-leaved up to the top and usually completely hidden by the sheaths, 30–90 cm by 2–5 mm. Leaves overlapping the stems, coriaceous, equitant, ensiform, gradually narrowed upwards and shortly acuminate, smooth, (3–)5–9 mm wide. Panicle erect, oblong, narrow, loose, consisting of 4–6 distant fascicles of branches, 15–30 cm long. Lower bracts long, similar to the leaves, the upper ones much shorter to almost spatheiform. Branches 2–5 together, erect, unequal, strongly flexuous, scabrous, usually short, rarely up to 15 cm. Clusters of (usually numerous) spikelets ovoid to globose, very dense, spicately arranged along the rachis, 5–10 mm across. Spikelets ovate, (1–)2–3-flowered, ferruginous to fuscous, 3–4 by c. 2 mm. Glumes 4–5, ovate, obtuse, hispid in the upper part, ciliate, up to 4 mm long. Bristles absent. Stamens (1–)3; anthers c. 2 mm long; connective shortly produced. Nut broadly ovoid or subglobose, obtusely trigonous, sessile, smooth, brown, 3–3½ by 1½ mm (beak included); persistent style-base pyramidal, much narrower than the nut, densely white-sericeous, c. 1½ mm long.

Distr. Pacific (Solomon Is., Palau Is., ?Bonin Is.), in Malasia: N. Borneo (Mt Kinabalu), Philippines (Palawan, Luzon, Sibuyan, Panay, Dinagat, Min-

danao), Celebes, Moluccas (Talaud Is., Ceram, Ambon), New Guinea and adjacent islands.

Ecol. In thickets and forests, in brushwood along river-banks and margins of lakes, on moist rocky slopes, usually below 600 m, on Mt Kinabalu up to 1500 m.

Vern. *Sèrèh utan*, Ambon; Philippines: *maqod-taŋgiad*, P. Bis.

Notes. Very polymorphic species, in which several races may be involved. KÜKENTHAL distinguished between *Cladium globiceps* and *C. colpodes* as follows:

*C. globiceps*: Panicle simple or subcompound, 6–14 cm long. Leaves 6–7 mm wide. Clusters of spikelets 5–8 mm across. Style-base as long as the smooth nut (Moluccas, Waigeo).

*C. colpodes*: Panicle subcompound, 5–15 cm long. Leaves 4 mm wide. Clusters of spikelets 4–6 mm across. Style-base half as long as the lacunose nut (Celebes, New Guinea).

I fail to trace a line between the two. The length of the style-base is variable in a single specimen; unripe nuts become wrinkled in the herbarium; also the reliability of the other very subtle characters is not corroborated by the specimens cited by KÜKENTHAL under each species.

The Philippine plants were described as *Cladium juncooides* ELMER. KÜKENTHAL referred them as var. *juncooides* to *Cladium meyenii* (= *M. mariscoides*), with which species they often agree in the elongated branches of the inflorescence; the glumes are more acute than in typical *M. glomerata* and there are often only 1 or 2 stamens. However, as the spikelets are only 3 mm long and usually 2–3-flowered, and the nuts are those of *M. glomerata*, I think their natural place is under this species.

*Lepidosperma waiuiense* STEUD. may belong here. I have not found the type in STEUDEL's herbarium, but there is a specimen of *M. glomerata* collected by D'URVILLE in Waigeo in the Paris Herbarium, and STEUDEL's description almost certainly refers to a species of *Machaerina* ("*culmo ancipiti compresso, foliis ensiformibus . . . ramis in folio reconditis, achenio brunneo glaberrimo apice stylo basi persistente tomentoso coronato*"). Stems and margins of the leaves are described as being scabrous, which possibly points to *M. mariscoides*.

7. *Machaerina mariscoides* (GAUD.) KERN, Act. Bot. Neerl. 8 (1959) 266. — *Baumea mariscoides* GAUDICHAUD in Freyc. Voy. Bot. (1829) 417; KUNTH, En. 2 (1837) 314; STEUD. Syn. 2 (1855) 156; BOECK. Linnaea 38 (1874) 240. — *Baumea meyenii* KUNTH, En. 2 (1837) 314; STEUD. Syn. 2 (1855) 156; BOECK. Linnaea 38 (1874) 240; HILLEBR. Fl. Hawaii. Isl. (1888) 479. — *Cladium mariscoides* F.-VILL. Nov. App. (1882) 309, quoad basion.; K. Sch. & Laut. Fl. Schutzgeb. (1900) 198; VALCK. SUR. Nova Guinea 8 (1912) 707, non TORR. 1836. — *Mariscus marianum* O.K. Rev. Gen. Pl. 2 (1891) 755. — *Mariscus meyenii* O.K. l.c. — *Cladium meyenii* DRAKE, Ill. Fl. Ins. Mar. Pacif. 2 (1892) 335; KÜK. in Fedde, Rep. 51 (1942) 156; S. T. BLAKE, J. Arn. Arb. 29 (1948) 96, excl. BRASS 3477. — *Cladium gaudichaudii* W. F. WIGHT, Contr. U.S. Nat. Herb. 9 (1905) 230; MERR. Philip. J. Sc. 9 (1914) Bot. 59; KÜK. Bot. Jahrb. 59 (1924) 7. — *Mariscus gaudichaudii* FERN. Rhodora 25 (1923) 53. — *Cladium meyenii* var. *gaudichaudii* KÜK. Bot. Jahrb. 69 (1938) 260; in

Fedde, Rep. 51 (1942) 157. — *M. gaudichaudii* KOYAMA, Bot. Mag. Tokyo 69 (1956) 64.

Rhizome short. Stems tufted, rather stout, ancipitous, more or less asperous at least on the angles, several-leaved (but often not completely hidden by the leaf-sheaths), 45–90 cm by 3–5 mm. Leaves as long as or overtopping the stems, coriaceous, equitant, ensiform, gradually narrowed upwards and shortly acuminate, more or less asperous to almost smooth, 7–12 mm wide, the cartilagineous margins often brown. Panicle erect, oblong, narrow, loose, consisting of 5–6 distant fascicles of branches, 20–40 cm long. Lower bracts long, similar to the leaves, the upper ones much shorter to almost spatheform. Branches 2–5 together, erect, rigid, very unequal, slightly flexuous, scabrous, elongate, up to 20 cm long. Clusters of 3–5 spikelets turbinate, spicately arranged along the branches, c. 4–5 by 4 mm. Spikelets oblong-lanceolate, 1-flowered, ferruginous to fuscous, 5–6 by c. 2 mm. Glumes 4–5, ovate-lanceolate, acute or minutely mucronulate, asperous, ciliolate, up to c. 5 mm long. Bristles absent. Stamens 3; anthers c. 2½ mm long; connective produced into a c. ½ mm long appendage. Nut ellipsoid, obtusely trigonous, sessile, smooth, shining reddish brown to castaneous, 3½–4 by 1–1½ mm (beak included); persistent style-base pyramidal, much narrower than the nut, densely white-sericeous, c. 1½ mm long.

Distr. Pacific (Hawaiian Is., Mariannas, Carolines, Solomon Is., Marquesas, Society Is.), in Malesia: New Guinea (W. New Guinea: Depapre, Jappen-Biak; NE. New Guinea: Morobe Distr., Mt Sarawaket; Papua: Misimi I.).

Ecol. In secondary forests, on open hillsides, at low altitudes, up to 350 m.

Note. The specimens from the Hawaiian Islands (*Cladium meyenii*) have remarkably vesiculous-asperous stems and leaves. Plants from the other Pacific islands and also those from New Guinea (*Baumea mariscoides* = *Cladium gaudichaudii*) are usually much less asperous to almost smooth. As they agree with *Cladium meyenii* in the shape of the panicle, the 1-flowered 5–6 mm long spikelets with acute glumes, and shape and size of the nut, I have followed BLAKE (1948) in treating them as conspecific with the Hawaiian plants. See also under *M. glomerata*.

8. *Machaerina disticha* (CLARKE) KOYAMA, Bot. Mag. Tokyo 69 (1956) 63. — *Cladium distichum* CLARKE, Philip. J. Sc. 2 (1907) Bot. 102; MERR. En. Philip. 1 (1923) 129; KÜK. in Fedde, Rep. 51 (1942) 164. — *Cladium micranthes* CLARKE, Kew Bull. add. ser. 8 (1908) 46; MERR. En. Born. (1921) 62; KÜK. in Fedde, Rep. 51 (1942) 153; KERN, Blumea 9 (1958) 226. — *Cladium philippinense* MERR. Philip. J. Sc. 5 (1910) Bot. 171; En. Philip. 1 (1923) 129; KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 311; in Fedde, Rep. 51 (1942) 163. — *Mariscus distichus* FERN. Rhodora 25 (1923) 53. — *Mariscus geniculatus* FERN. l.c. — *Mariscus micranthes* FERN. l.c. 54. — *M. micranthes* KOYAMA, Bot. Mag. Tokyo 69 (1956) 64. — *M. philippinensis* KOYAMA, l.c. 65. — *Baumea disticha* S. T. BLAKE, Contr. Queensl. Herb. 8 (1969) 29.

Rhizome short-creeping, horizontal; 2–3 mm thick stolons covered with distichous, lanceolate, acute, greyish-stramineous scales often present. Stems

approximate, slender, rigid, compressed-biconvex, acutely 2-angled, smooth, transversely septate (but septa not visible from the outside!), (60 cm–)1–2 m by 2–3 mm (according to a field-note up to 3½ m tall among bushes). Leaves as a rule much reduced, the basal ones bladeless, the 2–3 cauline leaves distant, conduplicate at the base, xiphoid in the upper part; sheaths brownish; blades 1–2(–5) cm by 2–3 mm, very rarely up to 25 cm long. Panicle erect, oblong, narrow, loose, consisting of 3–5 distant fascicles of branches, (5–)10–20 cm long. Lower bracts similar to the leaves, 10–15 mm long, the upper ones reduced to the sheaths. Branches usually in twos, erect, unequal, strongly flexuous, scaberulous. Spikelets in ovoid clusters of 2–4, or a few solitary, ovate-lanceolate, 1-flowered, ferruginous to brown, 2–3 mm long. Glumes 3–4, ovate-lanceolate, acuminate, scaberulous in the upper part, c. 2 mm long. Bristles absent. Stamens 3; anthers c. 1 mm long, with distinct c. ½ mm long appendage of the connective. Nut ovoid-ellipsoid, obtusely trigonous, sessile, wrinkled when dry, shining light-brown, 1½–2¼ by c. 1 mm (beak included); persistent style-base small, depressed, semi-globose, gradually passing into the nut, blackish, white-pubescent.

Distr. Malesia: Borneo (S. Borneo: Bandjermasin; N. Borneo: Bidu Bidu Hills, Mt Kinabalu), throughout the Philippines, Central Celebes (Malili), N. Moluccas (Talaud Is.), P. Waigeo near New Guinea. Fig. 92.

Ecol. Open hill-sides, also on ultrabasic soil, on ledges and boulders in stream-beds, margins of lakes, in periodically flooded riverine forests, from low altitude up to 1500 m.

Vern. Borneo: *bundusan*, Dusun Kenungan; *papara*, Talaud; Philippines: *kumpai*, *Bag.*, *barokibok*, Tag.

Note. The earliest binomial for this species, *Cladium distichum*, is sometimes rejected, as it was

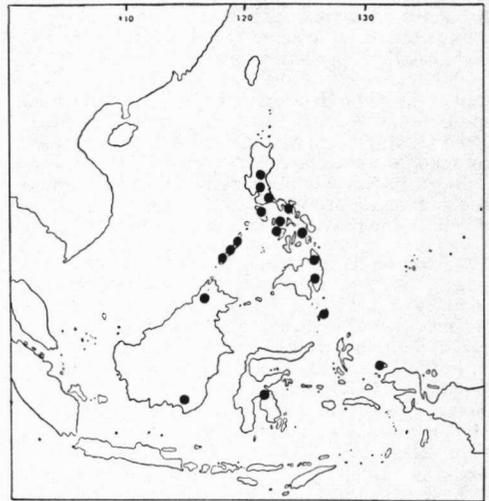


Fig. 92. Localities of *Machaerina disticha* (CLARKE) KOYAMA.

based on a so-called 'monstrosity' with badly deformed spikelets (besides the normal lower glumes each spikelet bears a great number of exactly distichous empty upper glumes). The same 'monstrosity' sometimes occurs in *Rhynchospora rubra* (see p. 717, notes).

9. *Machaerina articulata* (R. BR.) KOYAMA, Bot. Mag. Tokyo 69 (1956) 62. — *Cladium articulatum* R. BR. Prod. (1810) 237; KUNTH, En. 2 (1837) 304; HOOK. f. Fl. Nov. Zel. 1 (1853) 276; STEUD. Syn. 2 (1855) 152; BENTH. Fl. Austr. 7 (1878) 403; DOMIN, Bibl. Bot., Heft 85 (1915) 475, f. 105; OHWI, Bot. Mag. Tokyo 56 (1942) 208; KÜK. in Fedde, Rep. 51 (1942) 164; S. T. BLAKE in Black, Fl. S. Austr. ed. 2, 1 (1943) 165, f. 222. — *Baumea loculata* BOECK. Linnaea 38 (1874) 243. — *Mariscus articulatus* O.K. Rev. Gen. Pl. 2 (1891) 755.

Rhizome short, emitting stout stolons covered with pale scales. Stems tufted, stout, terete, striate, smooth, spongy inside, with more or less distinct transverse partitions (except at the top), 1–2 m by 5–8(–12) mm. Leaves basal, similar to the stems, terete, spongy, prominently transversely septate, tapering to the pungent top, 5–10 mm thick; sheaths shining brown, the lower ones bladeless. Panicle large, effuse, interrupted, 15–40 cm long, consisting of 4–6 fascicles of branches, the lower 1–2 fascicles remote, the upper ones approximate. Bracts similar to the leaves, septate, much shorter than the inflorescence, 4–15 cm long, the upper ones subspatheaceous. Lower branches solitary or binate, the upper ones 5 or more together, slender, unequal, compressed, often somewhat drooping. Spikelets very numerous, solitary or 2–3 together, ovate-lanceolate, 3–5-flowered (usually only 1 flower nut-bearing), brown, 4–6 by 1½–2 mm. Glumes 5–7, ovate-lanceolate, asperous, acuminate or mucronulate, more or less scabrous on the keel, up to 4–5 mm long. Bristles absent. Stamens 3 (or in some flowers 2); anthers c. 2 mm long; connective distinctly produced. Nut ovoid, trigonous, sessile, with thickened, suberous angles, strongly rugose, c. 2 by 1–1½ mm, the depressed-pyramidal, c. ⅔ mm high, papillose, persistent style-base included.

Distr. Widely distributed in Australia, New Caledonia, New Hebrides, New Zealand (North I.), in Malesia: W. New Guinea: Arfak Mts (Angi, Lake Gita); NE. New Guinea: Western Highlands, Sirunke; Morobe Distr. (Lake Trist).

Ecol. In New Guinea very rare in open marshes and swamps, at 1900–2500 m.

Note. The rhizome is eaten by the natives.

10. *Machaerina teretifolia* (R. BR.) KOYAMA, Bot. Mag. Tokyo 69 (1956) 66. — *Cladium teretifolium* R. BR. Prod. (1810) 237; KUNTH, En. 2 (1837) 304; STEUD. Syn. 2 (1855) 152; BOECK. Linnaea 38 (1874) 234; BENTH. Fl. Austr. 7 (1878) 406; KÜK. in Fedde, Rep. 51 (1942) 167, excl. varr. — *Mariscus teretifolius* O.K. Rev. Gen. Pl. 2 (1891) 755. — *Baumea teretifolia* PALLA, Allg. Bot. Zeitschr. 8 (1902) 69. — *Cladium teretifolium* var. *typicum* DOMIN, Bibl. Bot., Heft 85 (1915) 473, f. 104. — *Cladium arfakense* RENDLE in Gibbs, Arfak (1917) 90, p.p. typ.; OHWI, Bot. Mag. Tokyo 56 (1942) 208; KÜK. in Fedde, Rep. 51 (1942) 170; cf. KERN, Blumea 9 (1958) 225. — *M. arfakensis* KOYAMA, Bot. Mag. Tokyo 69 (1956) 62.

Rhizome short, emitting long-creeping stolons covered with 2-ranked lanceolate greyish scales. Stems tufted, slender, rigid, terete or more or less angular, striate, smooth, 30–90 cm by 1–2 mm. Leaves few, the basal ones shorter than to about as long as the stems, erect, subterete or somewhat angular towards the apex, smooth, pungent, internally with continuous pith, the 1–2 cauline ones with a short blade. Panicle erect, oblong, narrow, dense, much branched, 5–15 cm long. Lowest bract reduced to a membranous sheath with a short blade, upper ones gradually shorter to glume-like. Branches solitary or 2 together, obliquely erect, scaberulous. Spikelets numerous, in dense clusters, ovate to lanceolate, 2–3-flowered, usually perfecting 1 nut, dark reddish brown, 3–5 by 1½–2 mm. Glumes 5–6, ovate, acuminate or mucronulate, with scaberulous keel and ciliate margins, up to 4 mm long. Bristles absent. Stamens 3; anthers 1½–2 mm, with distinctly produced connective. Nut obovoid or ellipsoid, obscurely trigonous, sessile (? the very short smooth space at the base possibly the stipe fused with the nut proper), with many much raised ridges, opaque, crowned by the depressed, scarcely distinct, glabrous, persistent style-base, 1½–2 by 1–1½ mm.

Distr. E. Australia (Queensland, N.S. Wales), New Zealand, in Malesia: W. New Guinea: Arfak Mts (Angi Lakes).

Ecol. Abundant on sandy mountain lake beaches and in open marshes at c. 2100 m.

Notes. The habit of *M. teretifolia* much resembles that of *M. rubiginosa*, but in the former the panicle is denser and the glumes are usually shortly awned. With certainty the two can only be distinguished by the quite different nuts.

*M. teretifolia* is also very similar to and in herbaria often confused with *Lepidosperma chinense*. Even when in flower *M. teretifolia* can easily be recognized by the stem-leaves and the continuous pith of the basal leaves. In *Lepidosperma chinense* there are no stem-leaves and the pith of the basal leaves is divided into numerous transverse septa. In the fruiting state the two can also be distinguished by the nuts (smooth in *Lepidosperma chinense* with 6 thick scales attached to the base, strongly rugose in *M. teretifolia*, without hypogynous scales).

The specimens cited by RENDLE under his *Cladium arfakense* partly belong to *Lepidosperma chinense*, partly to *M. teretifolia*. The very inaccurate description is probably a mixture of *Lepidosperma* and *Machaerina* characters. The nut is not described, although there are many ripe ones in the *Machaerina* specimens.

DOMIN and KÜKENTHAL united *M. teretifolia* with the closely related *M. tetragona* (LABILL.) KOYAMA from S. Australia and Tasmania. The latter species is mainly characterized by the prominently 4-angled stems and leaves. In the wider circumscription the correct name is *M. tetragona*, and in *Cladium*: *C. tetragonum* (LABILL.) BLACK, not *C. teretifolium* as was accepted by both DOMIN and KÜKENTHAL.

11. *Machaerina rubiginosa* (SPRENG.) KOYAMA, J. Fac. Sci. Un. Tokyo III, 8 (1961) 123; HJ. EICHL. Suppl. Fl. S. Austr. (1965) 75; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 482. — *Schoenus rubiginosus* SOL. ex FORST. Fl. Ins. Austr. Prod. (1786) 89, nom. nud. — *Fuirena rubiginosa* SPRENG. Mant. Prima Fl. Hal.

(1807) 29. — *Cladium glomeratum* R.Br. Prod. (1810) 237; BENTH. Fl. Austr. 7 (1878) 404; CLARKE, Fl. Br. Ind. 6 (1894) 675; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 85; KOORD. Exk. Fl. Java 1 (1911) 201; *ibid.* 4 (1922) 115, f. 286; RIDL. Fl. Mal. Pen. 5 (1925) 166; ? S. T. BLAKE, J. Arn. Arb. 29 (1948) 97. — *Baumea crassa* Thw. En. Pl. Zeyl. (1864) 353; BOECK. Linnaea 38 (1874) 238. — *Baumea rubiginosa* BOECK. Linnaea 38 (1874) 241. — *Mariscus glomeratus* O.K. Rev. Gen. Pl. 2 (1891) 755. — *Mariscus crassus* O.K. *l.c.* — *Cladium riparium* [an BENTH. Fl. Austr. 7 (1878) 405, *quoad specim. cit.?*] MERR. Philip. J. Sc. 10 (1915) Bot. 288; En. Philip. 1 (1923) 129, non *Chapelliera riparia* NEES. — *Cladium riparium* var. *crassum* CLARKE, Fl. Br. Ind. 6 (1894) 675; III. Cyp. (1909) t. 85, f. 5–8. — *Cladium rubiginosum* DOMIN, Bibl. Bot., Heft 85 (1915) 476; STEEN. Arch. Hydrobiol. Suppl. 11 (1932) 281–282, f. 3, 51, 52; KÜK. in Fedde, Rep. 51 (1942) 171, *incl. var. sub-riparium* KÜK. — *Mariscus riparius* var. *crassus* FERN. Rhodora 25 (1923) 54. — *Cladium crassum* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 311; in Fedde, Rep. 51 (1942) 166; BACK. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 8. — *M. crassa* KOYAMA, Bot. Mag. Tokyo 69 (1956) 63. — Fig. 93–94.

Rhizome short, emitting long horizontal stolons covered with 2-ranked, pale, lanceolate scales. Stems tufted, slender, compressed-biconvex to subterete, usually with 1 node above the base, smooth, (30–)100–180 cm by (2–)3–6 mm. Basal leaves shorter than to about as long as the stems, erect, biconvex with obtuse edges to subterete, smooth, pungent, spongy inside, (2–)4–7 mm wide; cauline leaf long-sheathing, with short blade. Panicle erect, narrow, dense or interrupted, (10–)20–50 cm long, consisting of 3–7 fascicles of branches, the lower branches distant, subtended by long-sheathing, shortly laminate bracts; upper branches approximate, their bracts gradually shorter. Lower branches often solitary, up to 25 cm long, upper ones 2–4 together, erect, rigid, scaberulous, much shorter. Spikelets in oblong to almost globose clusters, lanceolate or finally ovate, 2–3-flowered, maturing 1 or 2 nuts, 4–7 by 2–2½ mm. Glumes 5, ovate to lanceolate, acuminate, long-ciliate, the longest 4½–6½ mm. Bristles absent. Stamens 3; anthers 1½–2 mm long, with distinctly produced connective. Nut ellipsoid to oblong-ellipsoid, trigonous, sessile, smooth, shining, orange to reddish-brown, 3–5 by 1½–2 mm, the depressed to shortly pyramidal, densely pubescent, persistent style-base included.

Distr. From Ceylon, Bengal, Khasia, the Ryu Kyu Islands, and Japan to Australia, New Zealand, and New Caledonia, in *Malesia*: Sumatra, Malay Peninsula (Singapore), W. Java (Danau swamp in Bantam and Rawah Tembaga near Djakarta), Central Java (Dieng), Philippines (Mindanao: Lake Lanao), Moluccas (Buru), and New Guinea.

Ecol. In swamps and on margins of lakes, sometimes dominant over wide areas of the marsh, but only so successful when the base of the plants are below water table, from low altitudes up to 2650 (3225?) m.

Uses. In Sumatra and W. Java the leaves are sometimes used for making mats. These mats are of inferior quality as they are not damp-proof. In New Guinea used as a temporary tying material, also to plait children's baskets.

Vern. Rumpul pohon, *M. walingi*, *wilingi*, *S. edong*, *J*; New Guinea: *kalke ka*, Kaugel dial., *gouldi*, Enga.

Notes. In the circumscription here accepted *M. rubiginosa* is extremely polymorphic; the extremes look like different species. KÜKENTHAL (1940, 1942) distinguished *Cladium crassum* (THW.) KÜK. from *M. rubiginosa* by the taller and broader stems, the thicker obsoletely septate leaves (not or very obsoletely septate in *M. rubiginosa*!), the longer inflorescence with less densely clustered spikelets, the longer style-base, and the larger nuts. I fail to see in what way he distinguished between *Cladium crassum*, *C. rubiginosum* var. *subriparium* (with stems up to 120 cm and leaves 4–6 mm thick), and *C. rubiginosum* var. *subseptatum* (with obsoletely septate leaves). In his keys these varieties are not taken into account at all. The type-collection of *Cladium crassum* (THWAITES CP845 from Ceylon), and also the specimens from India and Western Malesia (which perfectly agree with the Ceylon specimens) can easily be distinguished from typical *M. rubiginosa* by most of the characters indicated by KÜKENTHAL, although the leaves are certainly not more septate than in *M. rubiginosa*. The most striking differences are found in the larger spikelets (*c.* 7 mm long) and the larger nuts (*c.* 5 mm long including the *c.* 1 mm long pyramidal style-base). In typical *M. rubiginosa* the spikelets are 4–6 mm long, the nuts *c.* 3 mm with a much depressed style-base. In the few New Guinea collections available the spikelets are 5 mm long, the nuts 4 mm with small style-base, but stems and leaves are almost as coarse as in *Cladium crassum*. The only Philippine collection known was referred to *Cladium rubiginosum* var. *subriparium* by KÜKENTHAL, but I do not find any difference with *C. crassum*. The specimen from the Moluccas (Buru) is in flower; KÜKENTHAL referred it to *C. crassum*. Several of the collections from Australia and New Caledonia (all in flower only) are as coarse as *C. crassum*.

CLARKE (1894) treated the Ceylon and Indian specimens as a variety of the W. Australian *Cladium riparium*, but referred the Singapore ones, which are not separable, to *Cladium glomeratum* R.Br. (= *M. rubiginosa*).

As most collections I could study are in flower, I cannot solve the problem whether *Cladium crassum* is racially or even specifically distinct from *M. rubiginosa*.

OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 11, distinguished the Japanese plants as *Cladium nipponicum*, but I do not see any reason for separating them specifically from *M. rubiginosa*.

12. *Machaerina gunnii* (HOOK. f.) KERN, Act. Bot. Neerl. 8 (1959) 266. — *Cladium gunnii* HOOK. f. Fl. Tasm. 2 (1858) 95, t. 148 B; BOECK. Linnaea 38 (1874) 235; BENTH. Fl. Austr. 7 (1878) 407, *excl. syn. Schoenus punctatus et Cladium nudum*; S. T. BLAKE, Trans. R. Soc. S. Austr. 67 (1943) 59; in Black, Fl. S. Austr. ed. 2, 1 (1943) 167, f. 225. — *Cladium laxiflorum* HOOK. f. Fl. Tasm. 2 (1858) 95, t. 148 A. — *Cladium gunnii* var. *brevipaniculatum* KÜK. Bot. Jahrb. 69 (1938) 260. — *Cladium brevipaniculatum* KÜK. in Fedde, Rep. 51 (1942) 176. — *M. brevipaniculata* KOYAMA, Bot. Mag. Tokyo 69 (1956) 62. — *Baumea gunnii* S. T. BLAKE, Contr. Queensl. Herb. 8 (1969) 27.

Rhizome shortly creeping, covered with 2-ranked,

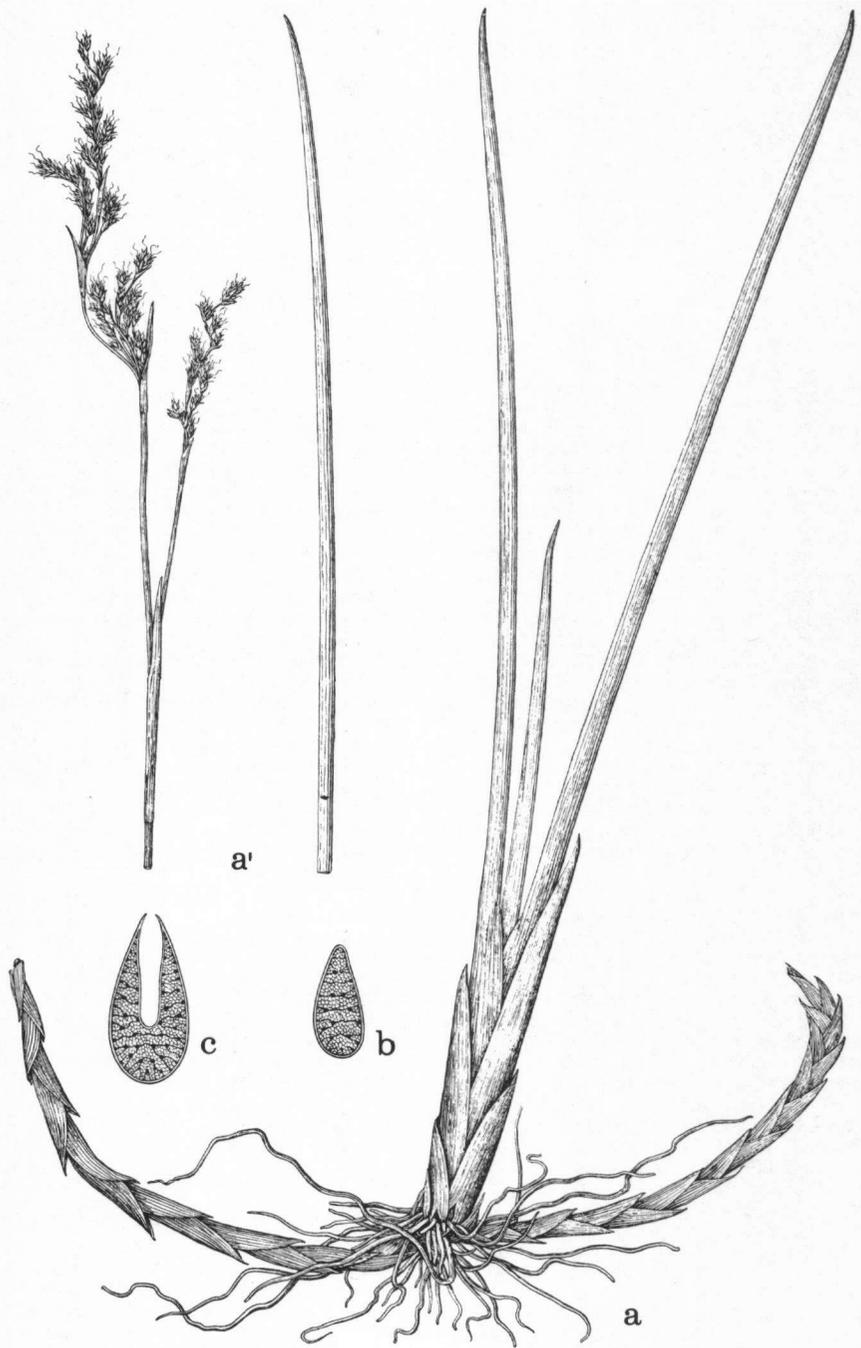


Fig. 93. *Machaerina rubiginosa* (SPRENG.) KOYAMA. *a*. Habit of sterile shoot, *a'*. inflorescence and leaf separate, both  $\times \frac{1}{2}$ , *b*. CS of leaf, *c*. ditto, near sheath (*a-c* RUTTNER 283, *a'* RUTTNER 111).



Fig. 94. Large pioneer stands of *Machaerina rubiginosa* (SPRENG.) KOYAMA on *Sphagnum* peat and quaking bogs along the lake Telaga Warna on Mt Dieng, Central Java, at c. 2000 m (photogr. VAN STEENIS, 1931).

ovate-lanceolate, pale sheaths. Stems approximate, slender, rigid, finely striate, terete, or with a longitudinal furrow, smooth, pungent, 25–60(–100) cm by 1–2 mm, the base tightly clothed with some purplish bladeless sheaths. Leaves 1–2 to the stem, basal, similar to the stems, terete, smooth, pungent, 1–2 mm thick. Panicle erect, oblong, narrow, loose to rather dense, 5–10(–25) cm long. Bracts spathe-like, brown, the lowest with very short blade, the upper ones gradually smaller. Branches usually in twos or threes, erect, with few spikelets, the lower ones more or less distant. Spikelets shortly peduncled, 1-flowered, 5–7 mm long. Glumes 3(–4), rigid, lanceolate, long-acuminate, with glabrous margins, at first erect, spreading in fruit, ferruginous to fuscous, up to 6 mm long, lower 2 empty. Bristles absent. Stamens 3, c. 3 mm long, with distinct, c. 1/2 mm long appendage of the connective (fixing mechanism, see p. 706). Nut ellipsoid, trigonous

with 3 indistinct ribs, smooth, shining, shortly and broadly stipitate, finally brown to blackish, 2 1/2–3 1/2 mm long; persistent style-base conical, glabrous, black.

Distr. Australia (Tasmania to S. Queensland), in Malesia: New Guinea (NE. New Guinea, Papua).

Ecol. In swampy grassland, 2250–3000 m.

Uses. According to Mrs. CLEMENS the stems are used by native women for making skirtlets.

Vern. *Guli*, Enga lang., Kepilan.

Note. *Cladium brevipaniculatum* (KÜK.) KÜK. is said to differ from '*C. tenax*' (wrongly accepted by KÜKENTHAL as the correct name for *C. gunnii*) by the more robust, 1-leaved stems, the shorter and narrower panicle, and the appressed uppermost glume. In the New Guinea collections I have seen the stems are very variable in width and 1–2-leaved; the uppermost glume is at first erect, finally spreading.

## 24. GAHNIA

J. R. & G. FORSTER, Char. Gen. Pl. (1776) 26, t. 26; CLARKE, Kew Bull. add. ser. 8 (1908) 127; BENL, Flora 131 (1937) 369; in Fedde, Rep. 44 (1938) 196–199; *ibid.* 49 (1940) 30–34; Bot. Arch. 40 (1940) 151–257; KÜK. in Fedde, Rep. 52 (1943) 52–111; KERN, Acta Bot. Neerl. 11 (1962) 216–224; S. T. BLAKE, Contr.

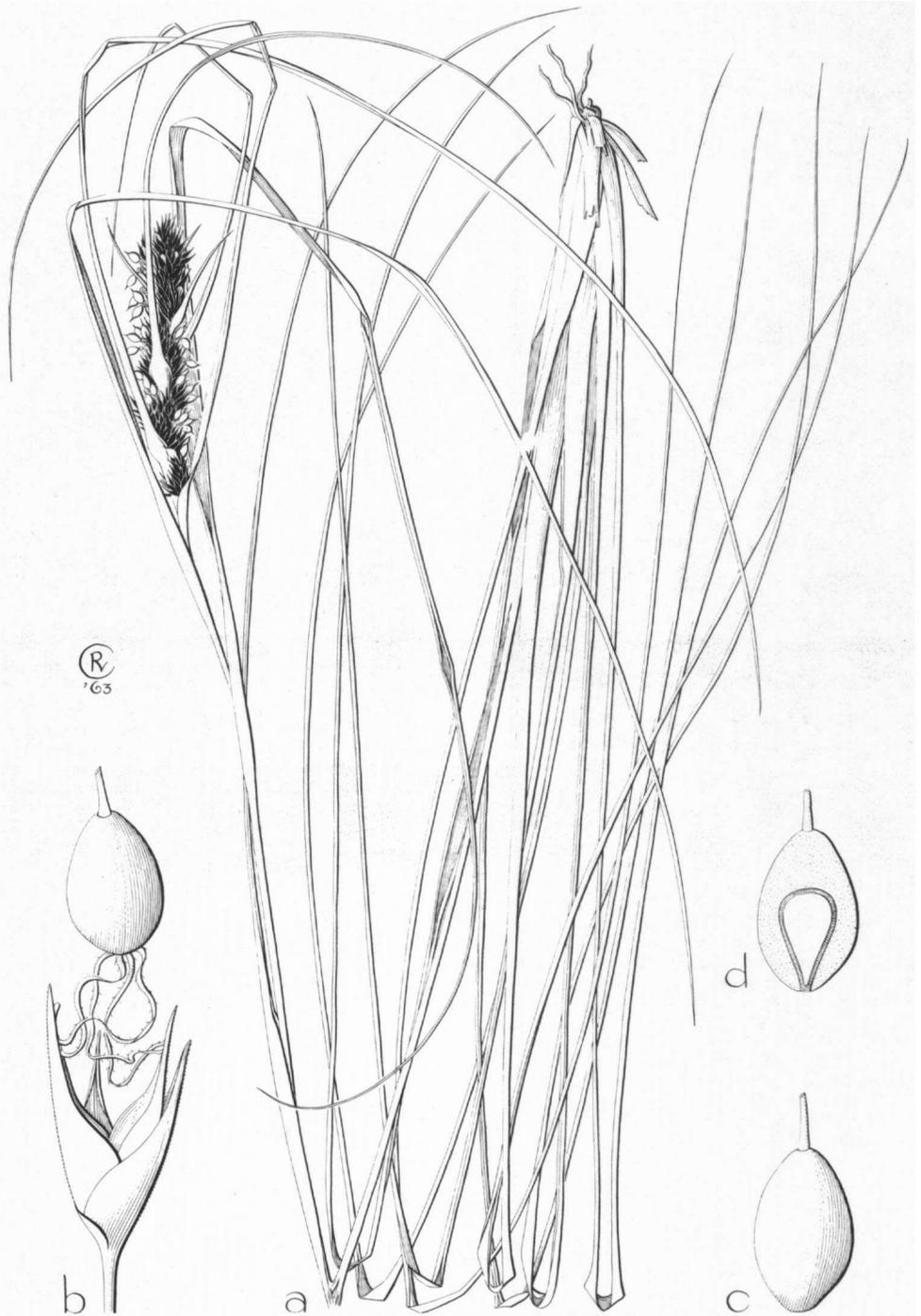


Fig. 95. *Gahnia aspera* (R.Br.) SPRENG. *a.* Habit,  $\times \frac{1}{2}$ , *b.* fruiting spikelet, the nut pushed out and dangling on the persistent filaments which are fixed by the incurved apices of the upper 2-3 sterile glumes, *c.* nut, *d.* ditto in LS, all  $\times 5$  (*a-d* G.A.L. DE HAAN 1739).

Queensl. Herb. 8 (1969) 30. — *Lampocarya* R. BR. Prod. (1810) 238. — *Phacelanthus* STEUD. ex ZOLL. Syst. Verz. (1854) 61, *nom. nud.*, non SIEB. & ZUCC. — *Syziganthus* STEUD. Syn. 2 (1855) 153. — Fig. 95–97.

Perennials with short, woody, descending rhizome, often forming large tussocks. Stolons absent. *Stems* erect, usually tall and stout, terete, multistriate, usually few-noded, many-leaved at the base. Basal *leaves* crowded, cauline ones spirally arranged, narrowed above the base, often scabrous on the margins, inrolled, narrowed into a long subulate point; ligule well developed. *Inflorescence* paniculate, consisting of several fascicles of secondary panicles, usually long and loose; bracts similar to the leaves, the upper ones gradually shorter; branches and branchlets never anfractuose; tubular prophylls (cladoprophylls) absent. *Spikelets* numerous, solitary or 2–4 together, brown or black. *Flowers* 1 or 2, the upper one ♂, fertile, the lower one when present sterile or ♂, usually very precocious. *Glumes* spirally arranged, outer ones lanceolate, acuminate, keeled, scabrous on back and margins, inner ones small, delicate in anthesis, in fruit elongated, hard, concave, obtuse, tightly enclaspings the flower(s). Hypogynous bristles absent (except in 2 extra-Malesian *spp.*). *Stamens* (2–)3–6; filaments often lengthening after anthesis, persistent at the base of the nut (see Note); anthers with produced connective. *Style* (2–)3-fid, sometimes 4-fid (due to one of the branches being bifid); style-base small, not swollen, adnate to the nut. *Nut* ovoid or ellipsoid, terete, trigonous, or obscurely 4-angled, shining; endocarp thick, hard, the inner side annulate-sulcate by 5–10 transverse grooves, or smooth.

Distr. About 30 *spp.*, from S. China, Thailand, Indo-China, the Bonin and Ryu Kyu Islands through *Malesia* (5 *spp.*) to Australia (incl. Tasmania), New Zealand, and through Oceania to the Hawaiian Islands. Fig. 96.

Distribution maps by BENL, Bot. Arch. 40 (1940) 158, and VAN BALGOOY, 'ac. Pl. Areas 2 (1966) 102, map 56.

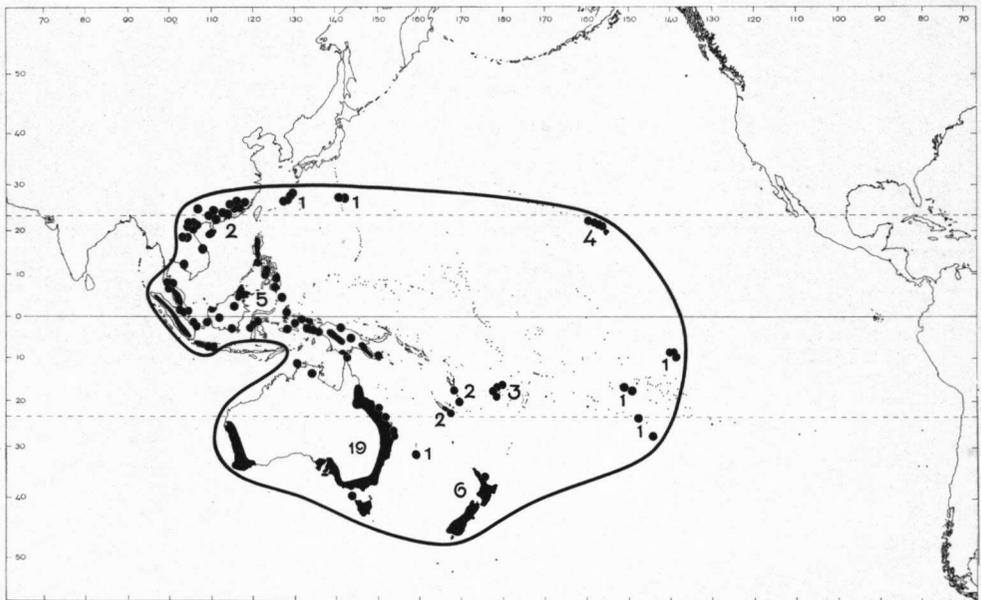


Fig. 96. Range of the genus *Gahnia* FORST. Number of species in the areas indicated.

Ecol. Swampy places in the plains and mountains: forest-swamps, river-banks, open heaths, mossy forests, mountain ridges, near craters and solfataras.

*Dispersal.* The brightly coloured nuts contrast strongly with the often blackish panicle. Very likely birds are attracted and eat the fruits, which are dispersed in this way. The seed is protected by the thick and extremely hard pericarp. JACOBSON (Trop. Natuur 8, 1919, 121) found the stomach of some specimens of *Pycnonotus bimaculatus*, a mountain bird, filled with the nuts of *Gahnia javanica*. See also RIDLEY, Disp. (1930) 117, t. 8 f. 5.

BENL (Flora 131, 1937, 369–386) described the various peculiar means of fruit dispersal in *Gahnia*.

In most of the species the filaments remain attached to the base of the nut when the fruits have fallen out of the glumes. The ripe nuts are suspended on the persistent filaments which often strongly increase in length, and they remain fixed on the surface of the panicle for a long time. BENL's ingenious researches showed that this is attained in various ways:

(a) The fixing-mechanism ('Klemm-Mechanismus'). — After anthesis the filaments lengthen considerably and intrude themselves into and are held by the inrolled tips of one or more sterile glumes. The anthers become free again beyond, dehisce and fall off. The inrolling of the glumes and the lengthening of the filaments take place simultaneously. After its dissolution from the receptacle, the fruit, pendulous on the filaments, projects freely into the air. — In Malesia in *G. javanica*, *G. aspera* (fig. 95) and *G. tristis*.

(b) The braiding-mechanism ('Flecht-Mechanismus'). — As in (a) the filaments show a strong post-floral growth, but they are hygroscopic and intertwine with those of adjacent spikelets (in 1-flowered spikelets), or with those of the male flower of the same spikelet (in 2-flowered spikelets). — Not in Malesian species.

(c) The cleaving-mechanism ('Kleb-Mechanismus'). — The sticky tips of the filaments of the upper ( $\delta$ ) flower adhere to those of the lower ( $\sigma$ ) flower of the same spikelet. — Only in species with 2-flowered spikelets, in Malesia in *G. sieberiana* and *G. baniensis*.

(d) The straddling-mechanism ('Spreiz-Mechanismus'). — The hardened filaments spread out so that the fruit when it falls out of the glumes is caught by some part of the panicle or other. — Only in the Hawaiian *G. beecheyi* MANN.

Note. It is often not easy to ascertain the number of flowers in the spikelet, as in the 2-flowered spikelets the flowers are very close together. It also requires some experience to use the characters derived from the behaviour of the stamens. Therefore two keys to the species are given, the first based on stamen characters, the second mainly on fruit characters.

Taxon. For the circumscription of the closely allied genera *Gahnia*, *Cladium*, and *Machaerina* see BENTHAM, Fl. Austr. 7 (1878) 410; BENL, Bot. Arch. 40 (1940) 156–157; KÜKENTHAL in Fedde, Rep. 52 (1943) 56; KERN, Acta Bot. Neerl. 11 (1962) 216.

KÜKENTHAL's subdivision of the genus into 7 sections is mainly based on the principles laid down in BENL's paper on fruit dispersal cited above. For the nomenclature of the sections see KERN, Taxon 6 (1957) 153.

In Malesia there are only 2 sections:

1. Section *Agglutinatae*. — Spikelets 2-flowered. Filaments of the two flowers cohering after anthesis hardly or moderately lengthening (*Spp.* 1 and 2).
2. Section *Lampocarya*. — Spikelets 1-flowered. Filaments conspicuously lengthening after anthesis, their tips included in the inrolled apex of the longest empty glume(s). (*Spp.* 3, 4 and 5).

#### KEY TO THE SPECIES

##### *Flowering material*

1. Spikelets 2-flowered. Filaments hardly lengthening after anthesis, those of the two flowers cohering with their tips.
2. Endocarp transversely grooved on the inner side (the 4–6 annular grooves to be observed in a longitudinal section of the fruit) . . . . . 1. *G. sieberiana*
2. Endocarp smooth on the inner side, not grooved . . . . . 2. *G. baniensis*
1. Spikelets 1-flowered. Filaments strongly lengthening after anthesis, their tips included by the apex of the longest empty glume(s).
3. All the filaments of one flower included by the involute apex of the uppermost sterile glume. Inflorescence more or less effuse, paniculate, rather flaccid, the primary branches usually several to many in each fascicle. Nut narrow, oblong, (2–)3½–5 by 1–1½ mm . . . . . 3. *G. javanica*
3. The filaments of one flower included by the apices of 2–3 upper sterile glumes. Inflorescence narrow, spike-like, stiff and prickly, the primary branches 1–3 in each fascicle. Nut broader, globose, ovoid, or ellipsoid, 4–6 by 1¾–4 mm.
4. Filaments with ciliolate-scabrid margins; anthers 1½–2 mm long; appendage of the connective short (¼ mm). Nut globose or ovoid, not or scarcely angular, distinctly mucronate, 3–4 mm wide. . . . . 4. *G. aspera*
4. Filaments glabrous; anthers 3–4 mm long, with subulate, ½–¾ mm long appendage of the connective. Nut ellipsoid, trigonous, not or scarcely mucronate, 1¾–2(–2½) mm wide . . . . . 5. *G. tristis*

#### KEY TO THE SPECIES

##### *Fruiting material*

1. Endocarp transversely grooved on the inner side (the 4–6 annular grooves to be observed in a longitudinal section of the fruit) . . . . . 1. *G. sieberiana*

1. Endocarp smooth on the inner side, not grooved.
2. Nut large, 4–6 by 3–4 mm, globose or ovoid, terete or almost so. Filaments with ciliolate-scabrid margins. 4. *G. aspera*
2. Nut smaller, ellipsoid or oblong, trigonous, up to  $2(-2\frac{1}{2})$  mm wide. Filaments glabrous.
3. Inflorescence narrow, with erect, usually very short branches, spike-like, ferruginous to brown, prickly by the stiff points of bracteoles and glumes. Nut  $1\frac{3}{4}$ –2 mm wide 5. *G. tristis*
3. Inflorescence paniculate, more or less effuse, blackish, not prickly. Nut  $1-1\frac{1}{2}$  mm wide.
4. Bracts not or scarcely overlapping the inflorescence. Nut ellipsoid,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by c.  $1\frac{1}{4}$  mm. Spikelets 2-flowered (lower flower ♂, upper one ♀) 2. *G. baniensis*
4. Bracts usually much overlapping the inflorescence. Nut oblong ( $2-3\frac{1}{2}$ –5 by  $1-1\frac{1}{2}$  mm. Spikelets 1-flowered) 3. *G. javanica*

### 1. Section Agglutinatae

KÜK. in Fedde, Rep. 52 (1943) 77.

Type species: *Gahnia sieberiana* KUNTH (lectotype).

1. *Gahnia sieberiana* KUNTH, En. 2 (1837) 332; KÜK. in Fedde, Rep. 52 (1943) 80; S. T. BLAKE, J. Arn. Arb. 29 (1948) 100. — *G. tetragonocarpa* BOECK. Linnaea 38 (1874) 347; BENTH. Fl. Austr. 7 (1878) 418; CLARKE, Ill. Cyp. (1909) t. 97, f. 7–10; BENL, Flora 131 (1937) 382; Bot. Arch. 40 (1940) 221, f. 21; S. T. BLAKE, Contr. Queensl. Herb. 8 (1969) 35. — *Mariscus tetragonocarpus* O.K. Rev. Gen. Pl. 2 (1891) 755. — *G. psittacorum* (non LABILL.) RENDLE in Gibbs, Arfak (1917) 91, p.p.; OHWI, Bot. Mag. Tokyo 56 (1942) 207. — *G. clarkei* BENL, Bot. Arch. 40 (1940) 220 & KÜK. in Fedde, Rep. 52 (1943) 78, p.p. (*quoad specim. novo-guin.*). — *G. penangensis* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 308, p.p. (*quoad specim. novo-guin.*).

Stems 1–3 m by 5–10 mm. Leaves as long as the stems, broadened at the base, with scabrous involute margins; sheaths dark brown. Inflorescence decomposed, up to 90 by 4–8 cm, rather dense, erect, consisting of numerous fascicles of partial panicles, the lower fascicles distant; primary branches up to 4 together, rigid, with scabrous margins; branchlets 2–4 together, often arcuately recurved. Bracts as long as or longer than the inflorescence; sheaths brown at the base. Spikelets oblong, finally subclavate, in clusters of 2–4, 5–6 mm long, shortly peduncled, 2-flowered. Glumes 5–7, the lower 3–5 empty, mucronulate, the upper 2–3 smaller. Stamens 3–4 in each flower; filaments scarcely elongated after anthesis, finally 3–4 mm long, their apices coherent. Nut ellipsoid, 3–4 by  $1\frac{1}{2}$ –2 mm, subtrigonous, shortly acuminate, smooth, densely punctulate, shining brown or red. Endocarp sulcate (with 5–6 grooves). — Cleaving-mechanism.

Distr. S. and E. Australia, New Caledonia (?), Solomon Is. (Guadalcanal); in Malesia: Central Celebes, New Guinea (W. New Guinea: Angi Lakes, Fak-fak, Wissel Lakes, Balim R.; NE. New Guinea: near Sirunke; Papua).

Ecol. Forming large clumps in swamps, moist localities in savannah-forests, on sandy soil in *Vaccinium*-scrubs, and in *Dacrydium*-forests; 300–2600 m.

Vern. New Guinea: *monnehehe*, *Esania*, *wideme*, *Kapauku*, *koali*, *Enga*, *lios*, *Hattam*.

Notes. The nuts are often deformed (by insects?). In the Malesian specimens the fruits are always obtusely tetragonous. The (immature) fruits of the type collection of *G. sieberiana* (SIEBER 536, L) seem to be trigonous.

The New Caledonian *G. novocaledonensis* BENL (Bot. Arch. 40, 1940, 225) is probably not specifically distinct from *G. sieberiana*. It is said to differ by the almost smooth leaf-margins, the less numerous partial panicles, and the black nuts.

2. *Gahnia baniensis* BENL [Flora 131 (1937) 382, *nom. inval.*] in Fedde, Rep. 44 (1938) 197, t. 248; Bot. Arch. 40 (1940) 227, 229, f. 23A; KÜK. in Fedde, Rep. 52 (1943) 83. — *G. javanica* var. *penangensis* CLARKE, Fl. Br. Ind. 6 (1894) 677; J. Linn. Soc. Bot. 34 (1898) 92; KOORD. Exk. Fl. Java 1 (1911) 202; RIDL, Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 99; Fl. Mal. Pen. 5 (1925) 168. — *G. sp.* RIDL, J. Str. Br. R. As. Soc. n. 23 (1891) 17. — *G. javanica* (non MOR.) RIDL, J. Str. Br. R. As. Soc. n. 46 (1906) 225; J. Fed. Mal. St. Mus. 6 (1915) 193; MERR. En. Born. (1921) 63, p.p. — *G. penangensis* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 308, *excl. specim. novo-guin.*

Stems 1–3 m by 4–8 mm. Leaves long, coriaceous, involute, scabrid on the margins; sheaths blackish brown. Inflorescence supradecomposed, 40–80 by 6–10 cm, loose, consisting of many more or less distant fascicles of loose, nodding partial panicles; primary branches 2 (more rarely 3) together, exerted from the sheath, rigid, erect, unequal in length, 10–20 cm long; secondary and tertiary branchlets arcuately recurved. Bracts usually shorter than the panicle, the lowest often not half the length of it. Spikelets in clusters of 2–3 or solitary, shortly peduncled, oblong, finally ovoid-ellipsoid, attenuate towards the base, blackish, 4–5 mm long, 2-flowered. Glumes 6–8, rigid, blackish brown, the lower 4 empty, keeled, shortly mucronate, the upper ones broader, obtuse, ciliolate on the margins. Stamens 2–3 in both flowers; filaments scarcely elongated after anthesis, cohering with their tips, finally c. 3 mm long. Nut ellipsoid, distinctly trigonous,  $2\frac{1}{2}$ – $3\frac{1}{2}$  by c.  $1\frac{1}{4}$  mm, shining stramineous to reddish brown, smooth. Endocarp not grooved. — Cleaving-mechanism.

Distr. Hainan, Annam, Tonkin; widely distributed in NW. Malesia: throughout Sumatra, Malay Peninsula (from P. Penang southward), throughout Borneo, Karimata Is.

Ecol. In thickets on hills and mountain ridges, in open country among bracken, mostly 900–2100 m, rarely down to 200 m.

Vern. *Urut bodat*, *ria ria* na *birong*, M (Sumatra), *sěrhé bukít*, *s. gunong*, M (Mal. Pen.).

Note. Similar to and often confused with *G. javanica*, but differing already by the cohering filaments, which are scarcely elongated after anthesis and not included in the apices of the glumes, and moreover by the looser inflorescence with finally nodding branches, the shorter bracts, the always

2-flowered spikelets, the more obtuse glumes, and the shorter ellipsoid nut. Distinguishable from *G. clarkei* and *G. sieberiana* especially by the absence of annular grooves and ridges on the inner side of the endocarp.

## 2. Section *Lampocarya*

(R.BR.) BENTH. Fl. Austr. 7 (1878) 411. — *Lampocarya* R.BR. Prod. (1810) 238. — *Gahnia* subg. *Lampocarya* MAIDEN & BETCHE, Census N.S.W. Pl. (1926) 33. — *Gahnia* sect. *Inclusae* KÜK. in Fedde, Rep. 52 (1943) 84.

Type species: *Lampocarya aspera* R.BR.

3. *Gahnia javanica* ZOLL. & MOR. ex MOR. Syst. Verz. (1846) 98; MIQ. Fl. Ind. Bat. 3 (1856) 340; in De Vriese, Pl. Ind. Bat. Or. (1857) 142; Sum. (1861) 262; BOECK. Linnaea 38 (1874) 339; F.-VILL. Nov. App. (1882) 309; VIDAL, Rev. Pl. Vasc. Filip. (1886) 285; CLARKE, Fl. Br. Ind. 6 (1894) 676, excl. var. *penangensis*; RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 17; CLARKE, Philip. J. Sc. 2 (1907) Bot. 103; Ill. Cyp. (1909) t. 96, f. 7; KOORD. Exk. Fl. Java 1 (1911) 202; Atlas (1922) 108, f. 265; VALCK. SUR. Nova Guinea 8 (1912) 708; STAPP & TURR. J. Linn. Soc. Bot. 42 (1914) 181; MERR. En. Born. (1921) 63, p. p.; En. Philip. 1 (1923) 131; KÜK. Candollea 6 (1936) 428; BENL, Flora 131 (1937) 375; Bot. Arch. 40 (1940) 169, f. 7A, 9A; OHWI, Bot. Mag. Tokyo 56 (1942) 207; KÜK. in Fedde, Rep. 52 (1943) 88; S. T. BLAKE, J. Arn. Arb. 29 (1948) 98; UITTEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 7; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 483; STEEN. Mt Fl. Java (1972) t. 14: 12. — *Schoenus paniculatus* HASSK. Cat. Hort. Bog. (1844) 296, non BURM. — *Phacelanthus multiflorus* STEUD. in Zoll. Syst. Verz. 2 (1854) 61. — *Schoenus hasskarli* STEUD. Syn. 2 (1855) 166. — *Syziganthus multiflorus* STEUD. Syn. 2 (1855) 153. — *Mariscus javanicus* O.K. Rev. Gen. Pl. 2 (1891) 755. — *G. castanea* RIDL. J. Fed. Mal. St. Mus. 6 (1915) 60; Fl. Mal. Pen. 5 (1925) 169; BENL, Bot. Arch. 40 (1940) 185, f. 10; cf. KERN, Blumea 9 (1958) 227. — *G. japonica* USTERI, Beitr. Kenntn. Philip. Veg. (1905) 469, sphalm. — *G. psittacorum* (non LABILL.) RENDLE in Gibbs, Arfak (1917) 91, p. p. — Fig. 97.

Stems 75–120 cm by 3–8 mm. Leaves as long as or longer than the stem, 1–1½ cm wide at the base, with inrolled scabrous margins; sheaths long, shining blackish-brown. Inflorescence erect, rather to very dense, (10–)20–50 by 4–7 cm, consisting of several approximate fascicles of secondary panicles; primary branches usually many (up to 50) together, in poor specimens 1–2 together, setaceous, scabrid, unequal in length, shortly exerted from the sheath, often nodding at the top, up to 8(–12) cm long; branchlets short. Bracts overlapping the inflorescence. Spikelets approximate, shortly peduncled, oblong, finally almost obovate, (3–)5–7 mm long, 1-flowered. Glumes 5–6, rigid, the lower 3–4 lanceolate from an ovate base, castaneous to black, more or less distinctly awned, the upper 2 shorter, broadly oblong, ciliolate on the margins towards the apex, obtusish. Stamens 3–4; filaments strongly elongated after anthesis, finally c. 1 cm long and their tips included in the

apex of the longest sterile glume. Nut oblong, attenuate at both ends, (2–)3¼–5 by 1–1½ mm, trigonous, often slightly curved, apiculate, ultimately shining brown. Endocarp not grooved. — Fixing-mechanism.

Distr. SW. China; widely distributed in *Malesia*: Sumatra, Malay Peninsula (Perak: G. Kerbau, G. Raya, G. Batu Poteh; Pahang: G. Terbakar, Fraser Hill, Cameron Highlands), West & Central Java (E. to Mt Lumbing), Borneo (Mts Kinabalu & Mulu), Philippines (Luzon, Mindoro, Negros, Mindanao), Central Celebes (once), New Guinea, ? Solomons (Guadalcanal).

Ecol. Forming dense, often large tussocks in open heaths, mossy forest, shrubberies and thickets, in dry alpine grassland, on mountain ridges and on stony volcanic soil near craters and solfataras, 1200–3560 m.

Vern. *Padi-padi*, M (Sumatra), *sëreh gunung*, *s. utan*, *s. luwung*, *s. hulung*, *s. wulung*, *s. tulong*, S; Philippines: *tamauan*, Buk.; New Guinea: *karerurum*, *kwajare*, Enga, *tsagar*, Mendi.

Notes. In my opinion the numerous varieties and forms described both by BENL and KÜKENTHAL do not deserve nomenclatural recognition, at least I am unable to find any reliable character by which distinction would be justified. They are: *f. sumatraensis* BENL, Bot. Arch. 40 (1940) 172; *f. borneensis* BENL, l.c. 173; *var. philippinensis* BENL, l.c. 174; *var. longearistata* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 306; *f. subcapitata* KÜK. l.c. 307 (*G. javanica* *f. sumatraensis* *f. subcapitata* KÜK. ex BENL, Bot. Arch. 40, 1940, 173); *var. castanea* (RIDL.) KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 307 (based on *G. castanea* RIDL.); and *var. paupercula* KÜK. Bot. Jahrb. 69 (1938) 260.

4. *Gahnia aspera* (R.BR.) SPRENG. Syst. Veg. 2 (1825) 114; BOECK. Linnaea 38 (1874) 344; BENTH. Fl. Austr. 7 (1878) 412; F.v.M. Descr. Not. 9 (1890) 69; CLARKE, Ill. Cyp. (1909) t. 96, f. 1–4; BENL, Flora 131 (1937) 373, f. 1–4; Bot. Arch. 40 (1940) 176, f. 8, 9C; KÜK. in Fedde, Rep. 52 (1943) 92, incl. var. *rawacensis* KÜK.; S. T. BLAKE, J. Arn. Arb. 29 (1948) 99; KERN, Blumea 9 (1958) 229, f. 3. — *Lampocarya aspera* R.BR. Prod. (1810) 238. — *Lampocarya rawacensis* KUNTH, En. 2 (1837) 33. — *G. rawacensis* STEUD. Syn. 2 (1855) 164; MIQ. Fl. Ind. Bat. 3 (1856) 340. — *Cladium asperum* F.v.M. Fragm. 9 (1875) 12, 56. — *Mariscus asper* O.K. Rev. Gen. Pl. 2 (1891) 755. — Fig. 95.



Fig. 97. Big tufts of *Gahnia javanica* Z. & M. on volcanic debris on Mt Papandajan, West Java (photogr. VAN STEENIS).

*Stems* smooth, (20-)30-90 cm by 3-8 mm. *Leaves* longer than the stems, strongly narrowed from a broader base, with scabrous inrolled margins; sheaths stramineous to shining dark brown. *Inflouescence* spike-like, oblong, subcylindrical, rigid, dense at the top, usually slightly interrupted at the base, (5-)10-25 cm by 3-5 cm, consisting of 7-10 fascicles of short (2-3½ cm long), dense, oblong to oblong-ovoid secondary panicles; primary branches 2-3 together, short, rigid, included by the sheath. Lower bracts dilated at the base, much overtopping the inflouescence; sheaths blackish brown. *Spikelets* densely crowded, shortly peduncled, broadly ovoid to globose, 6-8 mm long, 1-flowered. *Glumes* 7-8, blackish brown, the lower 4-5 empty, from an ovate

base contracted into the long-acuminate involute apex, mucronate; upper 3 glumes smaller, broadly ovate, rounded at the apex, very shortly cuspidate, ciliolate. *Stamens* 4-6; filaments accrescent, finally 10-13 mm long, sparsely ciliolate on the margins, included by the inrolled apices of the 2-3 upper sterile glumes; anthers 1½-2 mm long; appendage of the connective short, ¼ mm. *Nut* globose-ovoid to ovoid, very obtusely trigonous to almost terete, mucronate, smooth, shining reddish brown to dark castaneous, 4-6 by 3-4 mm. Endocarp not grooved. — Fixing-mechanism.

*Distr.* N. and E. Australia, New Caledonia, New Hebrides, Fiji, Tubuai, and Bonin Is., in *Malesia*: Moluccas (Talaud Is., Halmahera, Ceram)

and New Guinea (W. New Guinea; S. Papua; Daru I., Wassi Kussa; P. Rawak; P. Gebe; Normanby I.).

In the Hawaiian Islands a morphologically interesting subspecies: *G. aspera* (R.Br.) SPRENG. ssp. *globosa* (MANN) KERN, *stat. nov.* — *G. globosa* MANN, Proc. Amer. Acad. 7 (1867) 210. — *G. congesta* BOECK. Linnaea 38 (1874) 353. — *G. aspera* var. *globosa* (MANN) BENL, Bot. Arch. 40 (1940) 181; KERN, Act. Bot. Neerl. 11 (1962) 221, f. 2, 1-3. — Nut larger (up to 7 by 5½ mm); a few irregularly shaped, glume-like organs tightly appressed to the nut (see Notes).

Ecol. In light rain-forests, in *Eucalyptus* forests, on rocks near the coast, at low altitudes.

Vern. *Nanasi*, Talaud Is. (Karakelang).

Notes. KÜKENTHAL referred some of the Malesian specimens to var. *rawacensis* (KUNTH) KÜK. in Fedde, Rep. 52 (1943) 94, with dense panicle only 5-9 cm long. It seems superfluous to distinguish them nomenclaturally.

HILLEBRAND (Fl. Haw. Isl. 1888, 483) interpreted the glumes appressed to the nut of *G. aspera* ssp. *globosa* as the remnants of the perianth, KÜKENTHAL (in Fedde, Rep. 52, 1943, 52 & 95) as the remnants of a flower. The latter interpretation must be wrong, as in *G. beecheyi* MANN, a close ally of *G. aspera*, similar glumes are found, here with gradual transitions to hypogenous bristles.

The record "Celebes, Elphinstone's Bay", *sine coll.*, cf. BENL, Bot. Arch. 40 (1940) 178, must be erroneous.

5. *Gahnia tristis* NEES [Linnaea 9 (1834) 301, *nom. nud.*] in Hook. & Arn. Bot. Beech. Voy. (1837) 228; BOECK. Linnaea 38 (1874) 354 in nota, 355; RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 17; *ibid.* n. 46 (1906) 225; Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 98; STAPP & TURR. J. Linn. Soc. Bot. 42 (1914) 181; RIDL. J. Fed. Mal. St. Mus. 6 (1915) 193; MERR. En. Born. (1921) 64; RIDL. Fl. Mal. Pen. 5 (1925) 168; BENL, Flora 131 (1937) 374; Bot. Arch. 40 (1940) 182, f. 9E; KÜK. in Fedde, Rep. 52 (1943) 96; KERN, Blumea 9 (1958) 229, f. 3. — *G. wichurii* BOECK. Linnaea 38 (1874) 348. — *Mariscus tristis* O.K. Rev. Gen. Pl. 2 (1891) 755. — *M. wichurii* O.K. l.c.

755. — *G. boniana* BOECK. Allg. Bot. Zeitschr. 2 (1896) 141; CAMUS, Fl. Gén. I.-C. 7 (1912) 154. — *G. stricta* BOECK. l.c. 142; CAMUS, l.c. 155.

Stems smooth, 50-100 cm by 2-5 mm. Leaves overtopping the stem, with involucre scabrous margins; sheaths long, brown. Inflorescence spike-like, rigid, narrow, oblong, 15-45 cm by 3-7 cm, dense at the top, more or less interrupted at the base, consisting of 10-20 fascicles of short to rather long (1½-3 cm, rarely up to 8 cm long) secondary panicles; primary branches 1-3 together, short, rigid, included by the sheath. Lower bracts as long as or somewhat overtopping the inflorescence, dilated at the base; sheaths pale brown. Spikelets numerous, densely crowded, shortly peduncled, oblong-lanceolate, finally almost turbinate, 7-10 mm long, 1-flowered. Glumes 6-8, the lower 4-6 empty, ovate-lanceolate, ferruginous to brown, long-acuminate, the upper 2-3 much shorter, broadly ovate, rounded at the apex, ciliate. Stamens 3-4(-6?); filaments accrescent, finally up to 2 cm long, smooth, included by the inrolled apices of the upper sterile glumes; anthers 3-4 mm long; appendage of the connective subulate, ½-¾ mm. Nut ellipsoid, trigonous, acute, smooth, finally blackish brown to black, 4½ by 1¼-2(-2½) mm. Endocarp not grooved. — Fixing-mechanism.

Distr. Thailand, Indo-China, S. China, Ryu Kyu Is., in Malesia: S. Sumatra (once collected: Lampongs), Riouw Arch., Lingga Arch., Banka, Malay Peninsula (from Kedah to Singapore), Borneo.

Ecol. In dry spots near the sea, on riverbanks, also in rocky places and along trails in the mountains, up to 1200 m in the Malay Peninsula, up to 2000 m in Borneo.

Vern. *Pamping*, N. Borneo.

#### Excluded

*Gahnia trifida* LABILL. — "Malayischer Archipel (tide J. D. Hooker)". See BENL, Bot. Arch. 40 (1931) 231. — This record was based on HOOKER, Fl. Tasm. (1859) lxxxii, *sub n.* 228. The occurrence of this species in Malesia is very unlikely. As far as known no Malesian material is extant.

## 25. RHYNCHOSPORA

VAHL, En. 2 (1806) 229 ('*Rynchospora*'); *corr.* WILLD. En. Pl. Hort. Berol. 1809, 71); KUNTH, En. 2 (1837) 287; BOECK. Linnaea 37 (1872) 525; CLARKE, Kew Bull. add. ser. 8 (1908) 117; KÜK. Bot. Jahrb. 74 (1949) 375-509; *ibid.* 75 (1950) 90-195; *ibid.* 75 (1951) 273-314; KERN, Blumea 9 (1958) 229-233. — Fig. 98-102.

Perennials, more rarely annuals. Stems usually tufted, rarely solitary, erect, more or less trigonous, sometimes almost terete. Leaves linear, basal or also cauline, flat or canaliculate; ligule absent; sheaths of the cauline leaves long, at the orifice sometimes with a short scarios appendage opposite the leaf-blade. Inflorescence capitate, spike-like, or paniculate (in the last case consisting of a terminal and some axillary corymbiform anthelas). Bracts leafy. Spikelets solitary or in clusters, lanceolate or oblong-lanceolate, terete or flattish, sessile or peduncled, usually few-flowered. Rachilla straight, sometimes anfractuose. Glumes 5-8, spiral or subdistichous, imbricate, 1-nerved, the lower 3-4



Fig. 98. *Rhynchospora heterochaeta* S. T. BLAKE. a. Habit,  $\times \frac{2}{3}$ , b. spikelet,  $\times 6$ , c. stamen, d. nut, surrounded by persistent bristles, both  $\times 8$  (a-d BACKER 20052).

empty, shorter than the upper fertile ones. Flowers ♀, or lowest flower ♀, fertile, the upper ones ♂ or sterile, or lowest flowers ♀, upper one(s) ♂. Perigone consisting of 3–6 (rarely more) rigid or delicate bristles, more rarely absent. *Stamens* (1–)2–3; filaments ligulate; anthers linear, with shortly produced connective, sometimes with a short, narrowed sterile basal part. *Style* slender, articulated with the ovary, almost undivided to deeply bifid, dark brown, dilated at the base. *Style-base* (or even the greater part of the style) persistent on the nut, clearly distinct from the latter, compressed-conical, subulate, or semilunar. *Nut* sessile or shortly stipitate, 2-sided, obovate, elliptic, or oblong, (in the Malesian spp.) smooth or transversely rugulose, papillose, setulose, or glabrous.

Distr. Large genus of more than 200 spp., only a few of them widely distributed. In the Old World the genus is but sparingly represented, and it is absent in the arctic regions. Its full development is reached in the New World, especially in the SE. United States of America, the West Indies, and in tropical Central and South America. Of the 12 Malesian spp. *R. corymbosa* and *R. rugosa* inhabit the tropics and subtropics of the whole world. Also *R. triflora* and *R. gracillima* are widely distributed, but in Malesia they are only known from a few localities. *R. rubra*, *R. longisetis*, and *R. submarginata* extend from SE. Asia to tropical Australia, *R. malasica* from Japan southward to W. Malesia. In Malesia the SE. Asiatic *R. hookeri* and *R. wightiana* were only collected in one or two localities. Two spp. extend from tropical Australia to Malesia, viz *R. heterochaeta* to E. Java and the Philippines, *R. subtenuifolia* to New Guinea.

Ecol. Most *Rhynchospora* spp. prefer wet localities (moist grasslands, river-banks, fallow rice-fields, swamps), but several of the Malesian ones inhabit savannahs and savannah-forests in the periodically dry regions (*R. hookeri*, *R. heterochaeta*, and *R. wightiana*). They occur at low and medium altitudes, *R. rugosa* ascends to 2800 m.

Uses. Only *R. corymbosa* is of some economic value; see p. 714.

Note. In the list of *Nomina generica conservanda et rejicienda* the name *Rhynchospora* is conserved against "Triodon L. C. RICH. in Pers. Syn. 1: 60 col. 1. 1805 pro syn.". This conservation seems superfluous.

#### KEY TO THE SUBGENERA AND SECTIONS REPRESENTED IN MALESIA<sup>1</sup>

- |   |                         |
|---|-------------------------|
| 1. Style undivided or very shortly bilobed.   | 1. SUBG. HAPLOSTYLIS    |
| 2. Inflorescence paniculate, racemiform, or spiciform. Lowest flower hermaphrodite, upper one(s) male. Anther-cells completely filled with pollen.                                |                         |
| 3. Inflorescence paniculate. Spikelets in small fascicles. Hypogynous bristles rigid, antrorsely scabrous. Spikelets 2–4-flowered. Spp. 1–3                                       | 1. Sect. Longirostres   |
| 3. Inflorescence racemiform or spiciform. Spikelets in dense globose heads, stellately spreading. Hypogynous bristles capillary, smooth or almost so. Spikelets 1-flowered. Sp. 4 | 2. Sect. Echinoschoenus |
| 2. Inflorescence a single terminal globose or semiglobose head. Lowest flower female, upper one(s) male. Anther-cells destitute of pollen at the ± attenuate base. Spp. 5–10      | 3. Sect. Haplostylis    |
| 1. Style deeply bifid   | 2. SUBG. RHYNCHOSPORA   |
| 4. Hypogynous bristles present. Nut finely transversely wavy-wrinkled. Sp. 11   | 4. Sect. Glaucae        |
| 4. Hypogynous bristles absent. Nut transversely rugose. Sp. 12  | 5. Sect. Campylorhachis |

#### KEY TO THE SPECIES

(N.B. 'Nut' always refers to the nut proper, i.e. without the persistent style-base)

1. Inflorescence a single terminal globose or semiglobose head. Stems leafy only towards the base. Lowest flower ♀ (exceptionally in *R. rubra* with a single stamen), upper one(s) ♂. Involucral bracts sheathless.
2. Nut laterally compressed (its edge towards the axis of the spikelet), turgidly biconvex, obovate or broadly obovate. Bristles sometimes as long as the nut, usually distinctly shorter, sometimes obsolete. Inflorescence globose, brown. Stamens usually 3. Leaves and longest bracts almost keeled by the strong midrib.
  5. *R. rubra*
2. Nut strongly dorsiventrally compressed (its face towards the axis of the spikelet), with concave to slightly convex sides, oblong-obovate to oblong. Bristles at least partly distinctly longer than the nut. Inflorescence usually semiglobose, pale brown. Stamens usually (1–)2. Midrib of leaves and bracts not prominent.
  3. Nut usually with obtuse edges.
  4. Spikelets linear-lanceolate, 11–14 mm long. Bristles much exceeding the top of the style-base, the outer 3 densely long-plumose at the base, the longest (8–)11–12 mm long. Style-base about as broad as the nut.
    6. *R. longisetis*
  4. Spikelets lanceolate, (6–)8–10 mm long. Bristles about reaching the top of the style-base, at most slightly exceeding it, with glabrous or ciliate base, the longest 6–8 mm long. Style-base much narrower (about ½ as wide) as the nut
    7. *R. heterochaeta*

<sup>1</sup> KÜENTHAL'S subdivision of the genus has been followed; several changes in the subgeneric and sectional names appeared to be necessary; see KERN, *Blumea* 9 (1958) 229.

3. Nut with sharp edges.
5. Nut very small, obovate,  $1\frac{1}{2}$ - $1\frac{3}{4}$  mm long, shining brown when ripe, hispidulous at the top only. Longest bristles 3-4 times as long as the nut. Style-base distinctly constricted at the base, not decurrent on the shoulders of the nut **10. R. subtenuifolia**
5. Nut oblong-obovate,  $2-2\frac{3}{4}$ (-3) mm long, blackish brown when ripe, papillose or setulose all over, sometimes almost glabrous. Longest bristles slightly longer than to about twice as long as the nut, rarely longer. Style-base not or hardly constricted at the base, often slightly decurrent on the shoulders of the nut.
6. Nut papillose-tuberculate. Nut-bearing (5th) glume distinctly longer (c. 2 mm) than the next lower one. Ripe spikelets somewhat gaping, the bristles exerted (hence visible from the outside). Upper flower with 2(-3) stamens and 0-4 bristles. Very slender, with leaves 1-2 mm wide and stems  $\frac{1}{2}$ -1 mm thick **8. R. wightiana**
6. Nut setulose to almost glabrous. Nut-bearing glume about as long as the next lower one. Spikelets not gaping at maturity, the bristles completely hidden by the glumes. Upper flower with 1-2 stamens, without bristles. Less slender, with leaves up to 4 mm wide and stems 1-2 mm thick. **9. R. submarginata**
1. Inflorescence paniculate or consisting of 2-6 dense globose heads, in the latter case racemiform or spiciform. Stems leafy throughout. Lowest flower ♀, the upper one(s) ♂ or ♀.
7. Inflorescence consisting of 2-6 dense globose heads, with stellately spreading spikelets, one head to each primary sheathless bract. Spikelets 1-flowered. Bristles capillary, flexuous, smooth or almost so. **4. R. malasica**
7. Inflorescence paniculate, consisting of 1-4 superposed corymbiform antheras each subtended by a long-sheathing bract. Spikelets 2-several-flowered. Bristles rigid, straight, scabrous, or absent.
8. Apex of the nut suddenly narrowed into a distinct neck. Nut  $3\frac{1}{2}$ -5 mm long, smooth. **3. R. hookeri**
8. Apex of the nut obtuse or truncate, without neck. Nut  $1\frac{1}{4}$ -4 mm long, transversely wavy-ridged or irregularly plicate-rugose.
9. Bristles present. Style-base compressed-conical to almost subulate, from slightly broader than long to much longer than broad. Leaves flat or canaliculate, not setaceous.
10. Stems slender. Leaves 2-3(-5) mm wide, the sheaths of the cauline ones truncate at the orifice (without appendage). Spikelets with 2-4 ♀ flowers (upper ones often tabescent). Style-base  $\frac{1}{2}$  as long to as long as the nut. Glumes spirally arranged. Style deeply bifid. Nut  $1\frac{1}{2}$ -2 mm long, finely transversely wrinkled **11. R. rugosa**
10. Stems rather stout to stout. Leaves (3-)-4-20 mm wide, the sheaths of the cauline ones at the orifice with a membranous appendage opposite the blade. Only the lowest flower ♀. Style-base longer than the nut. Glumes distichous or almost so. Style shortly bilobed. Nut  $2\frac{1}{2}$ -4 mm long.
11. Style-base about as wide as the nut, deeply grooved on both sides. Nut irregularly plicate-rugose. Leaves 8-20 mm wide. **1. R. corymbosa**
11. Style-base much narrower than the nut, almost subulate, not grooved. Nut regularly transversely wrinkled. Leaves 4-6 mm wide **2. R. triflora**
9. Bristles absent. Style-base saddle-shaped, i.e. much depressed and much broader than high. Nut  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm long, coarsely transversely wrinkled. Leaves setaceous **12. R. gracillima**

### 1. Subgenus Haplostylis

(NEES) PAX in E. & P. Pfl. Fam. 2, 2 (1887) 116; KÜK. Bot. Jahrb. 74 (1949) 387 ('*Haplostyleae*'). — *Haplostylis* NEES, Edinb. New Phil. J. 17, n. 34 (1834) 265; in Wight, Contr. (1834) 115; Linnaea 9 (1835) 295. — *Ser. Haplostyleae* BENTH. in B. & H. Gen. Pl. 3 (1883) 1059; CLARKE, Fl. Br. Ind. 6 (1893) 668; Kew Bull. add. ser. 8 (1908) 117.

#### 1. Section Longirostres

KUNTH, En. 2 (1837) 292; KÜK. Bot. Jahrb. 74 (1949) 408. — *Calyptrostylis* NEES & MEY. ex NEES, Linnaea 9 (1835) 295. — *Sect. Calyptrostylis* BENTH. in B. & H. Gen. Pl. 3 (1883) 1060. — *Div. Calyptrostylis sect. Aureae* CLARKE, Kew Bull. add. ser. 8 (1908) 118.

**1. Rhynchospora corymbosa** (L.) BRITT. Trans. N.Y. Ac. Sc. 11 (1892) 84; MERR. En. Born. (1921) 63; En. Philip. 1 (1923) 130; KÜK. Bot. Jahrb. 59 (1924) 7, 52; S. T. BLAKE, J. Arn. Arb. 29 (1948) 101; UITTEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246,

p. 6; KÜK. Bot. Jahrb. 74 (1949) 410; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 484. — *Scirpus corymbosus* LINNÉ, Cent. Pl. 2 (1756) 7; Amoen. 4 (1759) 303. — *R. aurea* VAHL, En. 2 (1806) 229; PRESL, Rel. Haenk. 1 (1828) 199; MIQ. Fl. Ind. Bat. 3 (1856) 336; BOECK.

Linnaea 37 (1873) 626; F.v.M. Descr. Not. 4 (1876) 74; BENTH. Fl. Austr. 7 (1878) 348; F.-VILL. Nov. App. (1882) 309; CLARKE, Fl. Br. Ind. 6 (1893) 670; K. SCH. & LAUT. Nachtr. (1905) 60; CLARKE, Philip. J. Sc. 2 (1907) Bot. 102; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 83; KOORD. Exk. Fl. Java 1 (1911) 201; Atlas (1922) 107, f. 264; VALCK. SUR. Nova Guinea 8 (1912) 706; CAMUS, Fl. Gén. I.-C. 7 (1912) 147; RIDL. Fl. Mal. Pen. 5 (1925) 164; BACK. Onkr. Suiker. (1928) 165, t. 175. — *Schoenus articulatus* ROXB. Fl. Ind. 1 (1820) 189. — *R. articulata* R. & S. Mant. 2 (1824) 49; MOR. Syst. Verz. (1846) 98; ZOLL. Syst. Verz. (1854) 61; MIQ. Fl. Ind. Bat. 3 (1856) 337. — *Calyptrostylis articulata* NEES in Hook. J. Bot. Kew Misc. 6 (1854) 29. — *Scleria laevis* (non RETZ.) MIQ. Fl. Ind. Bat. 3 (1856) 341.

Perennial. Rhizome short, without stolons. *Stems* stout, triquetrous, smooth, or scaberulous on the angles upwards, multistriate, leafy up to the top, 60–100(–150) cm tall. *Leaves* subcoriaceous, complicate at the base, otherwise flat, long-acuminate, scabrous on the margins and often on the keel beneath, 8–20 mm wide; sheaths of the cauline leaves with a scarious obtuse appendage opposite the leaf-blade. *Inflorescence* copious, consisting of 2–5 distant corymbiform anthelas, 20–40 cm long, subtended by long leafy sheathing bracts 10–30 cm long. Anthelas compound, rather dense, diffuse, many-branched, up to 15 cm across. Branches unequal, up to 12 cm; branchlets up to 3 cm. *Spikelets* numerous, in fascicles of 2–5, lanceolate, acute, 2–3-flowered, rusty brown, finally brown, 6–8 mm long. Lowest flower ♂, upper one(s) ♀. *Glumes* subdistichous, 5–7, mucronulate. *Bristles* in the ♂ flower 6, antrorsely scabrous, unequal, exceeding the nut, the longest  $4\frac{1}{2}$ –5 mm, in the ♀ flower 1–3, shorter. *Stamens* 3; anthers 2–2½ mm long. *Style* shortly bilobed. *Style-base* long-conical, compressed, about as wide as the nut, conspicuously grooved on both sides, smooth or asperulous, 4–5 mm long. *Nut* obovate or oblong-obovate, compressed, truncate at the top, irregularly plicate-rugose, brown,  $2\frac{1}{2}$ –3½ by c. 2 mm, densely punctulate by the isodiametric epidermal cells.

Distr. Pantropical, throughout *Malesia*.

Ecol. In open swampy places, fallow rice-fields, on river-banks, at low altitudes ascending to 1200 m. often dominant.

Uses. In S. Luzon utilized to some extent in the manufacture of mats, sandals, baskets, and screens.

Vern. *Ilat*, *ilat rawah*, *S*, *sukét brem*, *J*, *rumpit sèndayan*, *r. sèriyan*, *r. siak-siak*, *sunayan*, *Mal. Pen.*, *korisan*, *ria*<sup>2</sup>, *sungkuh*<sup>2</sup>, *Sum.*, *si marappang-appang*, *Sum. E. C.*, *bondong*, *rèmbang*, *rumpit sèguntur*, *uhumbut*, *Borneo*, *kóra*, *N. Cel.*, *marobgènger*. *New Guinea*; *Philip.*: *agás*, *Bik.*, *Bis.*, *báriu-báriu*, *pisopiso*, *ragiudiu*, *rakido*, *Bik.*, *salagata*, *Maranao*.

Note. The inflorescences of this species are sometimes much deformed by a fungus, *Cintractia leucoderma* (BERK.) P. HENN.

2. *Rhynchospora triflora* VAHL, En. 2 (1806) 232; KUNTH, En. 2 (1837) 292; BOECK. Linnaea 37 (1873) 625; CLARKE, Fl. Br. Ind. 6 (1893) 670; Ill. Cyp. (1909) t. 68, f. 6; KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 303; S. T. BLAKE, J. Arn. Arb. 29 (1948) 101; KÜK. Bot. Jahrb. 74 (1949) 426, incl. var. *papuana*. — *Cephaloschoenus zeylanicus* NEES, Edinb. New Phil. J.

17, n. 34 (1834) 265. — *R. zeylanica* KUNTH, En. 2 (1837) 294 ('*ceylonica*'); THW. En. Pl. Zeyl. (1864) 352.

Perennial. Rhizome short, emitting rather slender stolons clothed by ovate striate scales. *Stems* rather stout, triquetrous, smooth or scaberulous on the angles upwards, striate, leafy, 75–90 cm tall. *Leaves* rigid, complicate at the base, otherwise flat, long-acuminate, scabrous on the margins, glaucous, (3)–4–6 mm wide; sheaths of the cauline leaves with a scarious obtuse appendage opposite the blade. *Inflorescence* consisting of 1 or 2 distant, loose, corymbiform anthelas, 25–50 cm long; terminal anthela much larger and more branched than the lateral one. Bracts leafy, sheathing, shorter than the inflorescence. Branches unequal, suberect or obliquely patent, up to 20 cm; branchlets up to 4 cm. *Spikelets* in fascicles of 2–3(–7), lanceolate-subulate, acute, 2–4-flowered, ferruginous to castaneous, 6–9 mm long. Lowest flower ♂, upper ones ♀. *Glumes* 6–8, subdistichous, mucronulate. *Bristles* in the ♂ flower 6, antrorsely scabrous, exceeding the nut, in the second flower 2–4, in the other flower(s) absent. *Stamens* 3; anthers 3–4 mm. *Style* shortly bilobed or almost undivided. *Style-base* narrowly conical, almost subulate, compressed, not grooved, much narrower and longer than the nut, antrorsely scabrous on the angles, stramineous, up to 6 mm long. *Nut* obovate or broadly elliptic, compressed, transversely undulate-rugulose, sparsely hispidulous at the top, shining brown, 3–4 by 2–2½ mm. Epidermal cells longitudinally stretched, linear.

Distr. America (West Indies, Honduras, Fr. Guyana, Brazil, Paraguay), Africa (Cameroon, Rhodesia, W. Africa, Angola, Congo), Ceylon, Indo-China; in *Malesia*: Malay Peninsula (Pahang: Tasek Bera) and SE. New Guinea (Lower Fly River).

Ecol. In swamps, swampy places in savannahs, on river-banks, at low altitudes.

Note. The habit is that of *R. corymbosa*, but more slender, and the leaves narrower. At once distinguishable by the subulate, not grooved beak of the nut. KÜKENTHAL (Bot. Jahrb. 74, 1949, 427) distinguished the Papuan collection (BRASS 8356) as var. *papuana*: Leaves and bracts narrower, scarcely wider than 2 mm; nut obovate-oblong, 4 mm long. In the specimens of this collection I have seen the leaves are 4 mm wide and the nuts not different from those of typical *R. triflora*. Like BLAKE (J. Arn. Arb. 35, 1954, 238) I think they do not deserve varietal distinction.

3. *Rhynchospora hookeri* BOECK. Linnaea 37 (1873) 621; CLARKE, Fl. Br. Ind. 6 (1893) 671; J. Linn. Soc. Bot. 34 (1898) 90; Ill. Cyp. (1908) t. 68, f. 7; KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 303; Bot. Jahrb. 74 (1949) 427; UTTIEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 7; KERN, Blumea 9 (1958) 230; in Back. & Bakh. f. Fl. Java 3 (1968) 484.

Perennial. Rhizome short, without stolons. *Stems* rather stout, trigonous, smooth, striate, leafy, 60–90 cm, sometimes up to 1½ m. *Leaves* rigid, complicate at the base, otherwise flat, long-acuminate, scaberulous on the margins, glaucous, 6–10 mm wide; sheaths of the cauline leaves with a very short obtuse scarious appendage opposite the blade. *Inflorescence* consisting of 1–4 distant corymbiform anthelas, loose, 25–50 cm long. Bracts leafy, sheathing, shorter than the inflorescence. Terminal anthela much

branched, often drooping. Branches very unequal, scaberulous, the central one very short, the lateral ones up to 20 cm; branchlets up to 5 cm. *Spikelets* in clusters of 2–6, ovate-lanceolate, acute, 2-flowered (lower flower ♀, upper one ♂), 6–8 mm long. *Glumes* 6–7, subdistichous, mucronulate, ferruginous, purplish lineolate. *Bristles* in the ♀ flower 6, antrorsely scabrous, ferruginous, slightly exceeding the nut, c. 5 mm, in the ♂ flower 0–2, 1–2 mm long. Stamens 3; anthers 3–4 mm. Style very shortly bilobed or almost undivided. *Style-base* conical-subulate, not grooved, greenish or stramineous, smooth or slightly scaberulous, about as long as the nut and half as wide, (2–)3–4 by  $\frac{3}{4}$ –1 mm at the base. *Nut* broadly obovate to suborbicular, attenuate at the base,

biconvex, densely punctulate, hispidulous at the top, shining brown to almost black, the apex suddenly narrowed into a short cylindrical neck hispidulous on the margins,  $3\frac{1}{2}$ –5 by 2–3 mm (the  $\frac{1}{2}$ –1 mm long neck included). Epidermal cells isodiametric, those of the neck longitudinally stretched.

*Distr.* India, Burma, Thailand, Tonkin; in *Malesia* very rare: Malay Peninsula (Perlis: Kanga fields), W. Java (Indramaju: Plosokerep); a very young specimen from Central Celebes, Timampu (KJELLBERG 3750) belongs probably here.

*Ecol.* In marshy lowland plains, in Java in periodically dry, pyrogenous savannahs with tall grasses and crooked teak trees, 20–30 m.

## 2. Section Echinoshoenus

(NEES) BENTH. in B. & H. Gen. Pl. 3 (1883) 1060; PAX in E. & P. Pfl. Fam. 2, 2 (1887) 116. — *Echinoshoenus* NEES & MEY. ex NEES, *Linnaea* 9 (1835) 297. — *Div. Polycephalae* CLARKE, *Kew Bull. add. ser.* 8 (1908) 118. — *Sect. Polycephalae* CLARKE in Urban, *Symb. Ant.* 2 (1900) 104; KÜK. *Bot. Jahrb.* 74 (1949) 429.

4. *Rhynchospora malasica* CLARKE, *Fl. Br. Ind.* 6 (1893) 670; RIDL. *J. Str. Br. R. As. Soc. n.* 46 (1906) 225; *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 83; CLARKE, *Ill. Cyp.* (1909) t. 67, f. 1–4; MERR. *En. Born.* (1921) 63; KÜK. *Bull. Jard. Bot. Btzg III*, 16 (1940) 303; *Bot. Jahrb.* 74 (1949) 438; KERN, *Reinwardtia* 4 (1956) 97. — *R. nipponica* MAKINO, *Bot. Mag. Tokyo* 18 (1904) 145; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B18 (1944) 17.

Perennial. Rhizome shortly creeping. *Stems* rather stout, rigid, trigonous below, triquetrous above, smooth, leafy up to the top, 60–90 cm tall. *Leaves* rather rigid, flat or somewhat keeled, long-acuminate, sparsely scaberulous-pilose on the margins, revolute when dry, 4–8 mm wide; sheaths of the cauline leaves long, truncate at the mouth or with a short membranous appendage. *Inflorescence* spiciform or racemiform, 3–10 cm long. *Spikes* 2–7, sessile or shortly peduncled, dense, c.  $1\frac{1}{2}$  cm across, the lower ones more or less distant, the upper ones contiguous. Bracts much overtopping the inflores-

cence, patent, ultimately reflexed, not sheathing, up to 15 cm long. *Spikelets* ovate-lanceolate, stellately spreading, acute, 1-flowered, 6–7 mm long. Flower ♀. *Glumes* 5–6, subdistichous, acute, keeled, ferruginous to brown. *Bristles* 5–6, capillary, flexuous, smooth or almost so, about twice as long as the nut (up to 5 mm). Stamens 3; anthers c. 2 mm. Style long, bilobed (stigmas c. 2 mm). *Style-base* conical-subulate, glabrous, longer than the nut, brown, 4–5 mm long,  $\frac{1}{2}$  mm wide at the base. *Nut* obovate or broadly obovate, attenuate at the base, laterally compressed, biconvex, indistinctly transversely rugulose, shining castaneous,  $(1\frac{3}{4})$ – $2\frac{1}{4}$  by  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm; epidermal cells longitudinally stretched, oblong.

*Distr.* From Japan (Hondo, Kyushu) southwards to the Ryu Kyu Islands (Okinawa) and Formosa, very rare in *Malesia*: Malay Peninsula (Trengganu, Malacca, Johore, Singapore), Banka, Borneo (Saribas).

*Ecol.* In swampy localities at low altitudes.

*Vern.* *Sëdinkra*, M (Banka).

## 3. Section Haplostylis

*Morisia* NEES, *Edinb. New Phil. J.* 34 (1834) 115; *Linnaea* 9 (1835) 295. — *Sect. Capitatae* KUNTH, *En.* 2 (1837) 288. — *Sphaeroschoenus* W.-A. & NEES ex NEES, *Nov. Act. Ac. Caes. Leop.-Car.* 19, *Suppl.* 1 (1843) 97. — *Sect. Haplostylis* BENTH. in B. & H. Gen. Pl. 3 (1883) 1059; CLARKE, *Fl. Br. Ind.* 6 (1893) 669. — *Sect. Sphaeroschoenus* CLARKE, *Fl. Br. Ind.* 6 (1893) 668. — *Sect. Pauciflorae* KÜK. *Bot. Jahrb.* 74 (1949) 479.

*Note.* Of all the Malesian members of this section KÜKENTHAL calls the lower flower hermaphrodite, the upper 1–2 male (triandrous) or sterile. Only in *R. rubra* I found in a few spikelets a single stamen in the lower flower and the upper flower(s) generally triandrous. In the other species the lower flower is always female, the upper one male (diandrous).

5. *Rhynchospora rubra* (LOUR.) MAKINO, *Bot. Mag. Tokyo* 17 (1903) 180, t. 7, f. 1a, b; MERR. *Fl. Manila* (1912) 119; *En. Born.* (1921) 63; *En. Philip.* 1 (1923)

130; KÜK. *Bot. Jahrb.* 59 (1924) 6, 52; PFEIFF. *Mitt. Inst. Allg. Bot. Hamb.* 7 (1928) 173; OHWI, *Bot. Mag. Tokyo* 56 (1942) 204; S. T. BLAKE, *J. Arn.*



Fig. 99. Tuft of *Rhynchospora rubra* (LOUR.) MAKINO along a ditch near Sanggau, W. Borneo (photogr. Father E. ELSENER).

Arb. 29 (1948) 100; UTTIEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 5; KÜK. Bot. Jahrb. 74 (1949) 491; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 483. — *Schoenus ruber* LOUR. Fl. Cochinch. 1 (1790) 41; ed. Willd. (1793) 52. — *R. haenkei* PRESL, Rel. Haenk. 1 (1828) 199; MIQ. Fl. Ind. Bat. 3 (1856) 336. — *Morisia wallichii* NEES, Edinb. New Phil. J. 17, n. 34 (1834) 265; in Wight, Contr. (1834) 115. — *Haplostylis meyenii* NEES, l.c., p.p. typ. — *R. wallichiana* KUNTH, En. 2 (1837) 289; MOR. Syst. Verz. (1846) 98; ZOLL. Syst. Verz. 1 (1854) 61; MIQ. Fl. Ind. Bat. 3 (1856) 335; BOECK. Linnaea 37 (1872) 542, p.p.; BENTH. Fl. Austr. 7 (1878) 349; F.-VILL. Nov. App. (1882) 309; CLARKE, Fl. Br. Ind. 6 (1893) 668; Philip. J. Sc. 2 (1907) Bot. 101; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 82; CLARKE, Ill. Cyp. (1909) t. 64, f. 1-7; KOORD. Exk. Fl. Java 1 (1911) 201; VALCK. SUR. Nova Guinea 8 (1912) 706; CAMUS, Fl. Gén. I.-C. 7 (1912) 145; RIDL. Fl. Mal. Pen. 5 (1925) 164. — *Mariscus umbellatus* var. *procerior* ZOLL. Syst. Verz. 1 (1854) 63. — *R. wallichii* K. SCH. in K. Sch. & Hollr. Fl. Kais. Wilh. Land (1889) 25; K. SCH. & LAUT. Fl. Schutzgeb. (1900) 198; STAPP & TURR. in Gibbs, J. Linn. Soc. Bot. 42 (1914) 181. — Fig. 99-100.

Perennial (always?), with short rhizome; stolons wanting. Stems tufted, slender, trigonous, or triquetrous in the upper part, striate, smooth, 25-70(-120) cm by 1-2(-3) mm. Leaves basal and 1-2 cauline at the base of the stem, much shorter than to as long as the stems, rather rigid, keeled, gradually attenuate, scaberulous on the margins near the apex, 2-3(-5) mm wide. Inflorescence capitate, globose, dense, 1-1½ cm across. Involucral bracts 4-8, rigid, unequal, patent, finally reflexed, not sheathing, densely ciliate at the dilated base, exceeding the inflorescence, the lowest keeled by the strong midnerve, up to 7½ cm long. Spikelets ovate-lanceolate, compressed, acuminate, (2-)3(-4)-flowered, reddish-brown, 5-8 mm long; lower flower ♀ (very rarely with a single stamen), upper one(s) ♂. Glumes 6-8, chartaceous, distichous, keeled, acute or minutely mucronulate, the nut-bearing one c. 2 mm longer than the next lower one. Bristles in the ♀ flower 3-6, thin, whitish, antrorsely scabrous, often ciliate or shortly plumose at the base, usually shorter than the nut (see note), in the lowest ♂ flower 0-3, in the other flowers absent. Stamens (2-)3; anthers destitute of pollen at the base, 2-3 mm long. Style very long, shortly bilobed. Style-base shortly pyramidal, usually much depressed (broader than high) and suddenly dilated at the base, much narrower than the nut (c. ½ mm wide), punctulate, stramineous. Nut broadly obovate, rarely oblong-obovate, laterally compressed, turgidly biconvex, castaneous, acutely margined, minutely punctulate, scabrous at the apex (more rarely all over), 1¼-1½ by 1-1½ mm; epidermal cells minute, isodiametric.

Distr. Widely distributed from SE. Asia (India to S. China and Japan) to tropical Australia and Oceania, common throughout Malasia.

Ecol. In dry open countries, on road-sides and grassy hills, in lalang-fields, in savannah-forests; at low and medium altitudes, in Java up to 400 m, in Sumatra up to 1300 m, in New Guinea up to 1000 m.

Vern. *Ngsanga*, M.

Notes. The shape of the nut and the length of the hypogynous bristles are very variable in Malasian



Fig. 100. Inflorescence of *Rhynchospora rubra* (LOUR.) MAKINO of the same locality as in fig. 99 (photogr. Father E. ELSENER).

specimens. The bristles are sometimes hardly discernable, sometimes (e.g. in ELBERT 3092, L, from SE. Celebes) slightly longer than the nut or even exceeding the style-base; not rarely they are shortly white-plumose at the base. To me it is therefore doubtful whether *R. parva* (NEES) STEUD. Syn. 2 (1855) 140; KÜK. Bot. Jahrb. 74 (1949) 489, from Africa, is really specifically distinct.

Stems and leaves are usually glabrous. Specimens with the stems setulose-pilose at the apex and the margins and midrib of the leaves densely ciliate may be distinguished as var. *hirticeps* KÜK. Bot. Jahrb. 74 (1949) 495; KERN, Blumea 9 (1958) 231. Such specimens have been collected in Luzon, SE. Celebes, and Papua.

In a peculiar monstrosous form the spikelets are proliferous, with numerous exactly 2-ranked glumes above the normal ones, the whole giving the impression of a *Cyperus*-spikelet (see *Machaerina disticha*).

6. *Rhynchospora longisetis* R. BR. Prod. (1810) 230; KUNTH, En. 2 (1837) 289; BOECK. Linnaea 37 (1872) 541; BENTH. Fl. Austr. 7 (1878) 350, p.p. (excl. syn. *R. pterochaeta*): CLARKE, Fl. Br. Ind. 6 (1893) 669; Ill. Cyp. (1909) t. 65, f. 2; CAMUS, Fl. Gén. I.-C. 7 (1912) 147; DOMIN, Bibl. Bot. Heft 85 (1915) 468; KÜK. Bot. Jahrb. 74 (1949) 488. — *Schoenus longisetis* POIR. in Lamk, Enc. Suppl. 2 (1811) 252. — *Cephaloschoenus longisetis* NEES, Linnaea 9 (1835) 296. — *R. massiana* CAMUS, Not. Syst. 1 (1910) 249; Fl. Gén. I.-C. 7 (1912) 147.

Annual, with fibrous roots. Stems tufted, slender, trigonous, striate, smooth, leafy at the base, 15-30(-45) cm tall. Leaves shorter than the stems, somewhat rigid, flat or complicate, gradually attenuate, scaberulous at the top, 1-2(-3) mm wide. Inflorescence a single globose or semiglobose dense

head (2-)2½-3½ cm across. Bracts 5-6, very unequal, patent or reflexed, sheathless, densely ciliate at the dilated base, not keeled, the lowest up to 10 cm. *Spikelets* numerous, linear-lanceolate, acuminate, 2(-3?)-flowered, 11-14 mm long; lower flower ♀, perfecting a nut, upper one ♂. *Glumes* 6-7, distichous, acute, keeled, fulvous-ferruginous. *Bristles* in the lower flower 6, 3 outer ones densely plumose at the base on the outer side, otherwise antrorsely scabrous, 3 inner ones antrorsely scabrous (not or hardly plumose), 5 of them 8-12 mm long, 1 shorter (4-8 mm); in the upper flower bristles absent. Stamens 2; anthers 2½-3 mm long, the base destitute of pollen. Style very long, shortly bilobed. *Style-base* oblong-conical, grooved on both sides, pale, antrorsely scabrous, ⅔ to about as long as the nut and about as broad as its apex, not decurrent on its shoulders. *Nut* oblong, strongly dorsiventrally compressed, hispidulous or tuberculate especially towards the apex, minutely punctulate, the sides slightly concave, the margins bordered by a pale line, brown, 3½-4 by c. 1¼ mm; epidermal cells isodiametric.

Distr. India [*cf.* J. Bombay Nat. Hist. Soc. 60 (1963) 479], Burma, Thailand, Cambodia, N. Australia, N. Queensland; in *Malesia*: W. New Guinea, once collected by JAHERI, no precise locality indicated.

Ecol. Moist localities in savannahs and savannah-forests.

7. *Rhynchospora heterochaeta* S. T. BLAKE, Proc. R. Soc. Queensl. 51 (1940) 47; J. Arn. Arb. 29 (1948) 101; KÜK. Bot. Jahrb. 74 (1949) 497, *excl.* ZOLLINGER 3945, *incl. var. irregularis* KÜK.; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 483. — *R. wightiana* (non STEUD.) CLARKE, Philip. J. Sc. 2 (1907) Bot. 101; MERR. En. Philip. Pl. 1 (1923) 131. — *R. longisetis ssp. exserta* KÜK. Bot. Jahrb. 70 (1940) 463; Bull. Jard. Bot. Btzg III, 16 (1940) 303, *quoad specim. males.*, non *R. exserta* CLARKE. — *R. longisetis* (non R. BR.) UITTEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 6. — Fig. 98.

Very near to *R. longisetis* and possibly only racially distinct from it. *Inflorescence* smaller, 1-2 cm across. *Spikelets* shorter, lanceolate, 6-10 mm long. *Bristles* glabrous or ciliate at the base, not plumose, 5 of them about reaching the top of the style-base, 6-7 mm long, 1 much shorter and very thin, almost smooth. Anthers usually somewhat shorter, 1½-2½ mm long, the base destitute of pollen. *Style-base* narrower, about ½ as wide as the apex of the nut. *Nut* hispidulous at the top, (2½-)3-4 by 1-1¼ mm.

Distr. Australia (N. Territory, Queensland); in *Malesia*: E. Java, Madura & Kangean Is., Lesser Sunda Is. (Kisar, Wetar), Philippines (Luzon), SE. New Guinea (Wuroi, Oriomo R.; near Port Moresby; Daru I.).

Ecol. On damp sandy soil in savannahs and savannah forests, in open grasslands, from low altitudes up to 300 m.

Notes. KÜENTHAL referred the Malesian specimens (except those from New Guinea) to *var. irregularis* KÜK. with equal bristles mostly exceeding the style-base. However, in all the Malesian collections cited by him I find one of the bristles much shorter and thinner than the other ones.

The species is also closely related to the Australian *R. exserta* C. B. CLARKE, in which the bristles are

also non-plumose, but much longer, the style-base as broad as the nut, scabrous only at the top, and to *R. pterochaeta* F.v.M. with all bristles plumose all round. The differential characters are apparently slight and probably insufficient for specific distinction.

8. *Rhynchospora wightiana* (NEES) STEUD. Syn. 2 (1855) 148; BOECK. Linnæa 37 (1872) 544; CLARKE, Fl. Br. Ind. 6 (1893) 669; Ill. Cyp. (1909) t. 64, f. 7-11; UITTEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 6; KÜK. Bot. Jahrb. 74 (1949) 498; KERN, Blumea 9 (1958) 233; in Back. & Bakh. f., Fl. Java 3 (1968) 484. — *Haplostylis wightiana* NEES, Nov. Act. Ac. Caes. Leop.-Car. 19, Suppl. 1 (1843) 101. — *R. discolor* HOCHST. ex STEUD. Syn. 2 (1855) 148. — Fig. 101c-d.

Annual, with fibrous roots. *Stems* solitary or tufted, slender, trigonous below, compressed above, striate, glabrous and smooth, 10-30(-40) cm by ½-1 mm. *Leaves* basal (and 1 cauline at the base of the stem), much shorter than the stems, flat or conduplicate, rather weak, gradually attenuate, scaberulous on the margins near the apex, pale green, 1-2 mm wide. *Inflorescence* capitate, semiglobose to globose, dense, c. 1½ (to nearly 2) cm across. Bracts 3-6, unequal, patent or reflexed, sheathless, not keeled, densely ciliate at the dilated base, rather short, the longest usually 2-3 times as long as the inflorescence, more rarely up to 5 cm. *Spikelets* linear-lanceolate, compressed, 2-flowered, ferruginous, 6-8 mm long; lower flower ♀, upper one ♂ (very rarely with a sterile pistil). *Glumes* 6, distichous, acute, keeled, the 4th distinctly (c. 2 mm) shorter than the 5th. *Bristles* in the ♀ flower 6, rigid, antrorsely scabrous, exceeding the style-base, 5-6(-7) mm long, exerted from the somewhat gaping spikelet, in the ♂ flower 0-4, shorter. Stamens 2 (very rarely 3); anthers destitute of pollen at the base, c. 1½ mm. Style shortly bilobed. *Style-base* strongly compressed, triangular, scabrous, stramineous, slightly (sometimes hardly) contracted at the base, ¾-1 by 0.4-0.6 mm. *Nut* oblong or obovate-oblong, strongly dorsiventrally compressed, papillose-tuberculate, blackish, the margins bordered by a whitish line, 2-2¼ by 0.6-0.9 mm; epidermal cells minute, isodiametric.

Distr. S. India, Ceylon; in *Malesia*: Madura Island (near Pamekasan, once found: ZOLLINGER 3945, L), W. New Guinea (JAHERI), Papua (W. Distr., near Weam).

Ecol. In Madura in fallow rice-fields, 180-300 m, near Weam in savannah grassland, 30 m.

9. *Rhynchospora submarginata* KÜK. Bot. Jahrb. 74 (1949) 498; KERN, Blumea 9 (1958) 231. — *R. marginata* CLARKE, Kew Bull. add. ser. 8 (1908) 89; DOMIN, Bibl. Bot. Heft 85 (1915) 469; non STEUD. 1855. — *R. wightiana* (non STEUD.) CAMUS, Fl. Gén. I.-C. 7 (1912) 146; RIDL. Fl. Mal. Pen. 5 (1925) 164. — Fig. 101a-b.

Annual, with fibrous roots. *Stems* solitary or tufted, compressed (elliptic in transverse section), trigonous just below the inflorescence, striate, glabrous and smooth, 15-40(-75) cm by 1-2 mm. *Leaves* basal and 1-2 cauline in the lower ⅓ of the stem, ½ as long to about as long as the stems, flat or conduplicate, rigid, gradually attenuate, scaberulous on the margins near the apex, greyish green, 2-4 mm

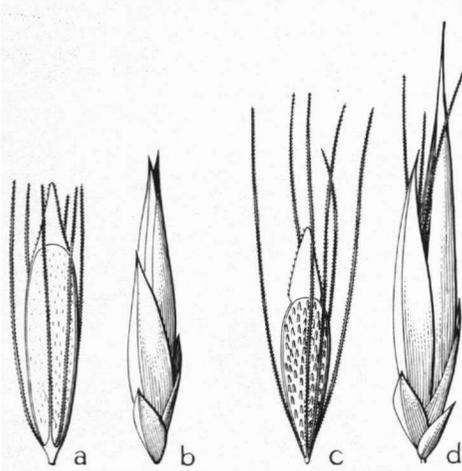


Fig. 101. *Rhynchospora submarginata* KÜK. a-b. Nut and spikelet,  $\times 8$ . — *R. wightiana* (NEES) STEUD. c-d. Nut and spikelet,  $\times 8$  (a-b NAUEN SF 35854, c-d SCHIFFNER 1591).

wide. Inflorescence capitate, semiglobose, dense, c.  $1-1\frac{1}{2}$  cm across. Bracts 4-6, unequal, patent (the lowest often erect), sheathless, not keeled, densely ciliate at the dilated base, the lowest much overtopping the inflorescence, up to 10(-20) cm long. Spikelets linear-lanceolate, acute, compressed, 2-flowered, ferruginous,  $4-5\frac{1}{2}$  mm long; lower flower ♀, upper one ♂. Glumes 6, distichous, keeled, the 4th and 5th about equal in length. Bristles in the ♀ flower 6, rather thin, antrorsely scabrous, reaching the top of the style-base or slightly exceeding it,  $3\frac{1}{2}-5$  mm long, included by the glumes, in the ♂ flower wanting. Stamens 1-2; anthers destitute of pollen at the base, c.  $1\frac{1}{2}$  mm. Style shortly bilobed. Style-base strongly compressed, triangular, scabrous, stramineous, decurrent on the shoulders of the nut, c.  $\frac{3}{4}$  by  $\frac{1}{2}$  mm. Nut oblong, strongly dorsiventrally compressed, slightly concave on the adaxial face, whitish setulose to almost glabrous, blackish, the margins bordered by a whitish line,  $2\frac{1}{4}-3$  by c.  $\frac{3}{4}$  mm; epidermal cells minute, isodiametric.

Distr. Insufficiently known because of confusion with the preceding sp.: India, Thailand, Tonkin (according to KÜKENTHAL), N. Australia; in *Malesia*: Malay Peninsula (Setul, Wellesley, Perak, Trengganu, Pahang, P. Langkawi, P. Penang), Sumatra (Lam-

pongs: Menggala), South New Guinea (Merauke region).

Ecol. In open sandy spots, also as a weed in rice-fields, at low altitudes.

Vern. *Rumput para*, M.

Notes. KÜKENTHAL l.c. 499 distinguished var. *glabrinux* KÜK.: nut 4 mm long, quite glabrous, somewhat concave on both sides. — Papua: Lake Daviumbu, Middle Fly R., on floating islands, BRASS 7705. I have not seen this collection; it seems very unlikely that it belongs to this species. The collection GWYNNE-VAUGHAN 378 from Nangchik, road to Bukit Besar, cited by RIDLEY, l.c., under *R. wightiana*, belongs to *R. rubra*.

*R. submarginata* is near to *R. wightiana*, but by its coarser habit very similar to *R. rubra*, from which it can readily be distinguished by the hardly keeled midrib on the lower surface of the leaves and lowest involucre bract, and especially by the quite different nuts.

10. *Rhynchospora subtenuifolia* KÜK. Bot. Jahrb. 74 (1949) 499. — *R. tenuifolia* BENTH. Fl. Austr. 7 (1878) 350; CLARKE, Kew Bull. add. ser. 8 (1908) 117; Ill. Cyp. (1909) t. 64, f. 12; DOMIN, Bibl. Bot. Heft 85 (1915) 469; non GRISEB. 1866.

Annual, with fibrous roots. Stems solitary or tufted, slender, trigonous, striate, smooth, leafy at the base. Leaves shorter to longer than the stems, very narrow, 1-2 mm wide. Inflorescence a single semiglobose to globose dense head  $1-1\frac{1}{2}$  cm across. Bracts 3-7, unequal, patent to reflexed, sheathless, not keeled, densely ciliate at the dilated base, the lowest up to 10 cm. Spikelets numerous, linear-lanceolate, acuminate, 2-flowered, 5-7 mm long; lower flower ♀, perfecting a nut, upper one ♂. Glumes 6, distichous, acute, keeled, fulvous-ferruginous. Bristles in the lower flower 6, antrorsely scabrous, at least 3 of them much exceeding the style-base ( $5\frac{1}{2}-7$  mm long), 1-3 much shorter, the shortest as long as or shorter than the nut, in the upper flower absent. Stamens 2; anthers attenuate and destitute of pollen at the base,  $\frac{3}{4}$  mm (young). Style very long, shortly bilobed or entire. Style-base strongly compressed, ovate, acute, scabrous, stramineous,  $\frac{2}{3}-\frac{1}{2}$  as long as the nut and  $\frac{1}{2}$  as wide as its apex, constricted at the base, not decurrent on the shoulders of the nut. Nut obovate, strongly dorsiventrally compressed, slightly biconvex, not grooved, bordered by a nerve-like margin, hispidulous at the top, shining brown, minutely punctulate,  $1\frac{1}{2}-1\frac{3}{4}$  by 0.8-0.9 mm; epidermal cells isodiametric.

Distr. Australia (N. Territory, Queensland); in *Malesia*: W. New Guinea (JAHERI).

Ecol. In savannahs and savannah-forests.

## 2. Subgenus *Rhynchospora*

*Ser. Dichostyleae* BENTH. in B. & H. Gen. Pl. 3 (1883) 1059. — *Ser. Diplostyleae* CLARKE, Fl. Br. Ind. 6 (1893) 671; Kew Bull. add. ser. 8 (1908) 119. — *Subg. Distylis* PAX in E. & P. Pfl. Fam. 2, 2 (1887) 117. — *Subg. Diplostyleae* KÜK. Bot. Jahrb. 74 (1949) 500.

## 4. Section Glaucæ

CLARKE in Urban, Symb. Ant. 2 (1900) 106; Kew Bull. add. ser. 8 (1908) 120. — *Sect. Stenophyllæ* KÜK. Bot. Jahrb. 75 (1950) 142.

11. *Rhynchospora rugosa* (VAHL) GALE, Rhodora 46 (1944) 275, t. 835, f. 1 A-B; KERN in Back. & Bakh. f. Fl. Java 3 (1968) 484; STEEN. Mt Fl. Java (1972) t. 14: 15. — *Schoenus rugosus* VAHL, Eclog. Am. (1798) 5. — *R. glauca* VAHL, En. 2 (1806) 233, *nom. illegit.*; BOECK. Linnaea 37 (1873) 585; F.-VILL. Nov. App. (1882) 309; CLARKE, Fl. Br. Ind. 6 (1893) 671; Ill. Cyp. (1909) t. 73, f. 7; KOORD. Exk. Fl. Java 1 (1911) 202; VALCK. SUR. Nova Guinea 8 (1912) 706; RENDLE in Gibbs, Arfak (1917) 91; MERR. En. Born. (1921) 63; KÜK. Bot. Jahrb. 69 (1938) 259, *incl. var. condensatus* KÜK.; UITTEN in Back. Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 6; KÜK. Bot. Jahrb. 75 (1950) 143. — *R. laxa* R.BR. Prod. (1810) 230; MIQ. Fl. Ind. Bat. 3 (1856) 337; *non* VAHL, 1806. — *R. brownii* R. & S. Syst. 2 (1817) 86; BOECK. Linnaea 37 (1873) 581; OHWI, Bot. Mag. Tokyo 56 (1942) 205, *incl. var. condensata* OHWI; S. T. BLAKE, J. Arn. Arb. 29 (1948) 102. — *R. chinensis* [vix NEES & MEY. ex NEES in Wight, Contr. (1834) 115; Act. Ac. Caes.

Leop.-Car. 19, Suppl. 1 (1843) 108; Mtq. Fl. Ind. Bat. 3 (1856) 336] BOECK. Linnaea 37 (1873) 586; OHWI, Bot. Mag. Tokyo 56 (1942) 205. — *R. glauca* var. *chinensis* CLARKE, Fl. Br. Ind. 6 (1893) 672; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 84; CLARKE, Philip. J. Sc. 2 (1907) Bot. 102; Ill. Cyp. (1909) t. 73, f. 8-11; MERR. En. Philip. 1 (1923) 130; RIDL. Fl. Mal. Pen. 5 (1925) 165; KÜK. Bot. Jahrb. 75 (1950) 148. — Fig. 102.

Perennial, with short rhizome; stolons absent. Stems densely tufted, slender, trigonous, smooth, or slightly scaberulous at the top, many-leaved at the base and with some distant cauline leaves, 30-75(-100) cm tall. Leaves shorter than the stems, rigid, flat or canaliculate, long-acuminate, with strong midrib and scaberulous margins, 2-3(-5) mm wide; basal sheaths brown. Inflorescence paniculate, narrow, consisting of 3-4(-6) distant, dense to rather loose corymbiform anthelas, the lateral peduncles compressed, often long-exserted from the



Fig. 102. Behind the stands of *Scirpus mucronatus* in the water (centre, left) is a zone characterized by tufted *Rhynchospora rugosa* (VAHL) GALE. Taman Hidup, an old silted crater lake on Mt Jang, East Java, c. 2000 m alt. (photogr. VAN STEENIS, 1938).

sheath, solitary or 2 together; branches very unequal, erect. Bracts erect, about as long as the antheras in their axils to reaching the next higher anthera, sheathing. *Spikelets* solitary or in small clusters, shortly peduncled, ovate to ovate-lanceolate, terete, 2-4-flowered, (3-)-4-6 mm long. *Glumes* 5-8, spiral, membranous, shortly mucronate, fuscous. Flowers ♀, upper one(s) tabescent. *Bristles* 5-6, from somewhat shorter to distinctly longer than the nut, antrorsely scabrous. *Stamens* (1-)-2(-)-3; anthers 1-2½ mm long. *Style* halfway bifid. *Style-base* conical, glabrous, ½ as long to about as long as and almost as wide as the nut. *Nut* obovate to broadly obovate, biconvex, dorsiventrally compressed, finely transversely wrinkled, light brown to castaneous, 1½-2 by 1-1¼ mm; epidermal cells longitudinally oblong.

*Distr.* Widely distributed in the tropics and subtropics of the whole world, in *Malesia*: Sumatra, Banka, Riouw Arch., Malay Peninsula, W. and E. Java, Borneo, Philippines (Luzon, Mindanao), Celebes, New Guinea.

*Ecol.* In swampy places, open grasslands, on river-banks, seepage-slopes, from low altitudes up to 2800 m (in New Guinea), in the Malay Peninsula in sandy places near the sea, rarely up to c. 2100 m, in Java between 1600 and 2100 m.

*Vern. Rumpu purin, bai ie bai ie*, M; New Guinea: *es, pfemp*, Mendi lang.

*Note.* As can be expected from a pantropic species, *R. rugosa* in the wide sense here accepted is extremely polymorphous. Although none of the characters given below can be considered absolute, the Malesian material is fairly well divisible into two groups characterized as follows:

- I. *Spikelets* (3-)-4-5 mm long, 2-3-flowered, usually maturing only 1 nut. *Nut* 1½-1¾ by 1-1½ mm. *Style-base* ½-1 mm long, about half as long as the nut. *Bristles* somewhat shorter to slightly longer than the nut (without style-base), the longest 1½-2 mm. *Anthers* 1-1½ mm. *Epidermal cells of the nut* ± pitted. — Sumatra,

Java, New Guinea (Celebes, Philippines according to KÜKENTHAL).

- II. *Spikelets* 5-6 mm long, 3-4-flowered, usually maturing 2(-)3 nuts. *Nut* 1¾-2 by 1½-1¾ mm. *Style-base* 1½-2 mm long, ¾ to about as long as the nut. *Bristles* almost reaching the top of the style-base or even slightly longer, the longest 2½-4 mm. *Anthers* 2-2½ mm. *Epidermal cells of the nut* not or hardly pitted. — Sumatra, Malay Peninsula, Borneo, Philippines (according to CLARKE), New Guinea. (In Japanese material the spikelets and bristles are still longer).

The type of *R. rugosa* is from America. American material is said (GALE, S. T. BLAKE) to differ from the Old World specimens by the smaller spikelets and smaller pyriform nuts with prominent band-like corrugations. In the scant American material I could examine I found the spikelets not smaller than in group I, and the length of the nut varying between 1¼ and 2 mm. KÜKENTHAL unites group I with the American plants in ascribing to both bristles as long as or shorter than the nut; already VAHL rightly described the bristles of *R. rugosa* s.s. as longer than the nuts. Also *R. lavarum* GAUD. from the Hawaiian Islands, and *R. griffithii* BOECK. and *R. sikkimensis* C. B. CLARKE from India apparently belong to *R. rugosa* s.l. If treated as specifically distinct the correct names of the Malesian races are probably *R. brownii* R. & S. (based on *R. laxa* R.Br., non VAHL) for group I, and *R. japonica* MAKINO for group II. However, I agree with KÜKENTHAL that they do not deserve specific rank; subspecific names are not available, but I refrain from coining them as the species is greatly in need of a systematic and nomenclatural study. KÜKENTHAL called the Malesian plants respectively *R. glauca* VAHL [ssp. *glauca*] and *R. glauca* ssp. *chinensis* ("BOECK.") C. B. CLARKE. The former name is illegitimate and in the narrower sense only refers to the American race, the latter is nomenclaturally based on *R. chinensis* NEES, which partly refers to group I, partly to a different plant.

### 5. Section *Campylorhachis*

BENTH. in B. & H. Gen. Pl. 3 (1883) 1061. — *Sect. Tenues* KÜK. Bot. Jahrb 75 (1950) 186.

12. *Rhynchospora gracillima* THWAITES, En. Pl. Zeyl. (1864) 435; BOECK. *Linnaea* 37 (1873) 597; CLARKE, Fl. Br. Ind. 6 (1893) 671; Ill. Cyp. (1909) t. 71, f. 6-7; DOMIN, Bibl. Bot. Heft 85 (1915) 469, f. 103; KÜK. Bot. Jahrb. 75 (1951) 273; KERN, *Blumea* 8 (1955) 162. — *R. kamphoeveneri* BOECK. Bot. Jahrb. 5 (1884) 508.

Perennial (always?). *Stems* densely tufted, very slender, filiform, trigonous, smooth, leafy, 20-60 cm tall. *Leaves* shorter than the stems, setaceous, canaliculate, scaberulous at the apex, ½-1(-1½) mm wide. *Inflorescence* very loose, consisting of 1-3 distant, up to 4 cm long corymbiform antheras subtended by short, setaceous, sheathing bracts; terminal anthera larger than the lateral ones, simple or subcompound; lateral antheras simple, their peduncles exerted from the sheaths; rays capillary, often upcurved, smooth, subtended by setaceous

bracteoles, 2-4 cm long. *Spikelets* solitary, long-peduncled, lanceolate, acute, 3-4-flowered, usually maturing 2 nuts, 5-7 by 1½-2 mm. *Rachilla* anfractuose (as in *Schoenus*). *Glumes* 7-8, spiral, membranous, broadly ovate, mucicous or mucronulate, pale ferruginous, purplish lineolate. Flowers ♀, upper one(s) tabescent. *Bristles* absent. *Stamens* 2-3 (?); anthers 1½-2¼ mm. *Style* halfway bifid. *Style-base* much depressed, saddle-shaped, bilobed, almost as broad as the nut, c. ¼ mm high. *Nut* broadly obovoid, truncate at the apex, shortly stipitate, dorsiventrally compressed, biconvex, deeply transversely wavy-ridged, greyish white, 1¼-1½ mm long and wide; epidermal cells longitudinally linear.

*Distr.* Tropical Africa, Madagascar, SE. Asia (Ceylon, Khasia, Nicobars, Thailand, S. China), Australia (N. Queensland); in *Malesia*: Sumatra (Atjeh, Tapanuli, W. Coast Res.), Celebes (Res.

Menado), W. New Guinea (Dompta), NE. New Guinea (Sepik Distr.).

Ecol. In moist localities: on grassy hills, in secondary forests, 900–1000 m.

Note. The plants from continental Africa and Madagascar may be distinguished as *R. gracillima*

*ssp. subquadrata* (CHERM.) J. RAYNAL, *Adansonia* 7 (1967) 321. — *R. subquadrata* CHERM. Bull. Soc. Bot. Fr. 69 (1922) 720; KÜK. Bot. Jahrb. 75 (1951) 274. — *R. testui* CHERM. Arch. Bot. Caen 4, mém. 7 (1931) 42. — They differ from the Asian plants only by the number of transverse ridges on the nut.

## 26. SCLERIA

BERG. Kongl. Vet. Acad. Handl. Stockholm 26 (1765) 142, t. 4, 5; BOECK. *Linnaea* 38 (1874) 436–542; KERN, *Blumea* 11 (1961) 140. — *Diplacrum* R. BR. Prod. Fl. Nov. Holl. (1810) 240. — *Sphaeropus* BOECK. *Flora* 56 (1873) 89. — Fig. 103–116.

Monoecious (only the Australian *S. sphacelata* F.v.M. dioecious). Perennial, often stout herbs with short or creeping, often nodose rhizome, or annuals with fibrous, reddish roots. *Stems* solitary or more or less tufted, mostly erect, sometimes scrambling over bushes, trigonous or (in the Malesian *spp.*) triquetrous, leafy in the lower part or throughout, smooth or scabrid. *Leaves* 3-ranked, linear, sheathing the stem, smooth to very scabrous on the margins and the main nerves, the lower ones reduced to bladeless or almost bladeless sheaths; midrib prominent beneath, 2 lateral nerves prominent above; sheaths closed, not rarely 3-winged, eligulate, the apex on the ventral side truncate or produced into a tongue (*contraligula*). *Inflorescence* paniculate, consisting of a terminal partial panicle and usually some lateral ones, sometimes reduced to dense clusters, or glomerate-spiceiform with glume-like bracts. *Spikelets* all bisexual, or bisexual and ♂, or ♀ and ♂; bisexual spikelets composed of 1 terminal ♀ flower and 1 to several lateral ♂ ones; ♀ spikelets with 1 ♀ flower and not rarely 1–2 lateral empty glumes (the reduced ♂ part); ♂ spikelets with several to numerous flowers. *Glumes* (except for the upper ones of the ♂ spikelets and of the ♂ part of the bisexual spikelets) distichous, in the lateral spikelets at right angles to the pertinent bract and prophyll, the lower 2–4 empty. *Flowers* unisexual, achlamydeous, the ♂ ones consisting of 1–3 stamens; anthers oblong to linear, with more or less produced connective; ♀ flowers with a 3-carpellate pistil; style continuous with the ovary, caducous, the base often persistent on the nut; stigmas 3. *Nut* globose, ovoid, ellipsoid, or pyramidal, terete or trigonous, smooth or variously sculptured, glabrous or hairy, with crustaceous pericarp, white, more rarely bluish, ultimately often discoloured, borne on a gynophore (*cupula*), which is dilated at the apex into a more or less trilobate, but sometimes much reduced, disk adhering to the ripe nut; outer cells of nut very small, quadrate-hexagonal.

Distr. Large genus of about 200 *spp.*, mainly pantropical, but in N. America and Japan extending beyond the 40th N. parallel, and in S. America and S. Africa reaching the 35th S. parallel; see map in PIÉRTART, *Lejeunia*, Mém. 13 (1951) 18. In Malesia 34 *spp.* occur, of which only 5 are endemic (*no* 1, 2, 3, 5, and 32). Almost all others have a wide Asian or Australasian distribution, a few occur even also in Africa, and a single one, *S. lithosperma*, is pantropic in distribution. It is remarkable that of these some have only a very few stations in Malesia.

Ecol. As to altitude, the bulk of the species is found only in the tropical zone, below 1000 m, a few extend their area up to 1500 m, only one, *S. terrestris*, has been noted up to 2200 m; *S. benthamii* is only found at 1500 m.

Most species seem to be indifferent to climate, but some are restricted to regions subject to an annual dry season, e.g. 4. *S. brownii*, 11. *S. psilorrhiza*, 12. *S. junghuhniana*, 28. *S. tricuspidata*, 29. *S. laxa*, and 32. *S. pygmaeopsis*.

As to soil *Sclerias* are frequently found on sterile soils, and do not shun marshy lands, but on the whole they seem rather indifferent; *S. cyathophora* is, however, obviously silicicolous. Furthermore, *S. poaeformis* is a distinct swamp sedge, often forming tall, pure stands along lake shores.



Fig. 103. *Scleria densispicata* (CLARKE) KERN. a. Habit,  $\times \frac{1}{2}$ , b.  $\delta$  spikelet, c. spikelet, with one  $\delta$  and one  $\text{f}$  flower, both  $\times 5$ , d. stamen,  $\times 7\frac{1}{2}$ , e. style and stigmas,  $\times 5$ , f-g. nut, lateral and basal views,  $\times 7\frac{1}{2}$ , h-i. cupule, lateral and seen from above,  $\times 15$  (a-i RAMOS BS 44754).

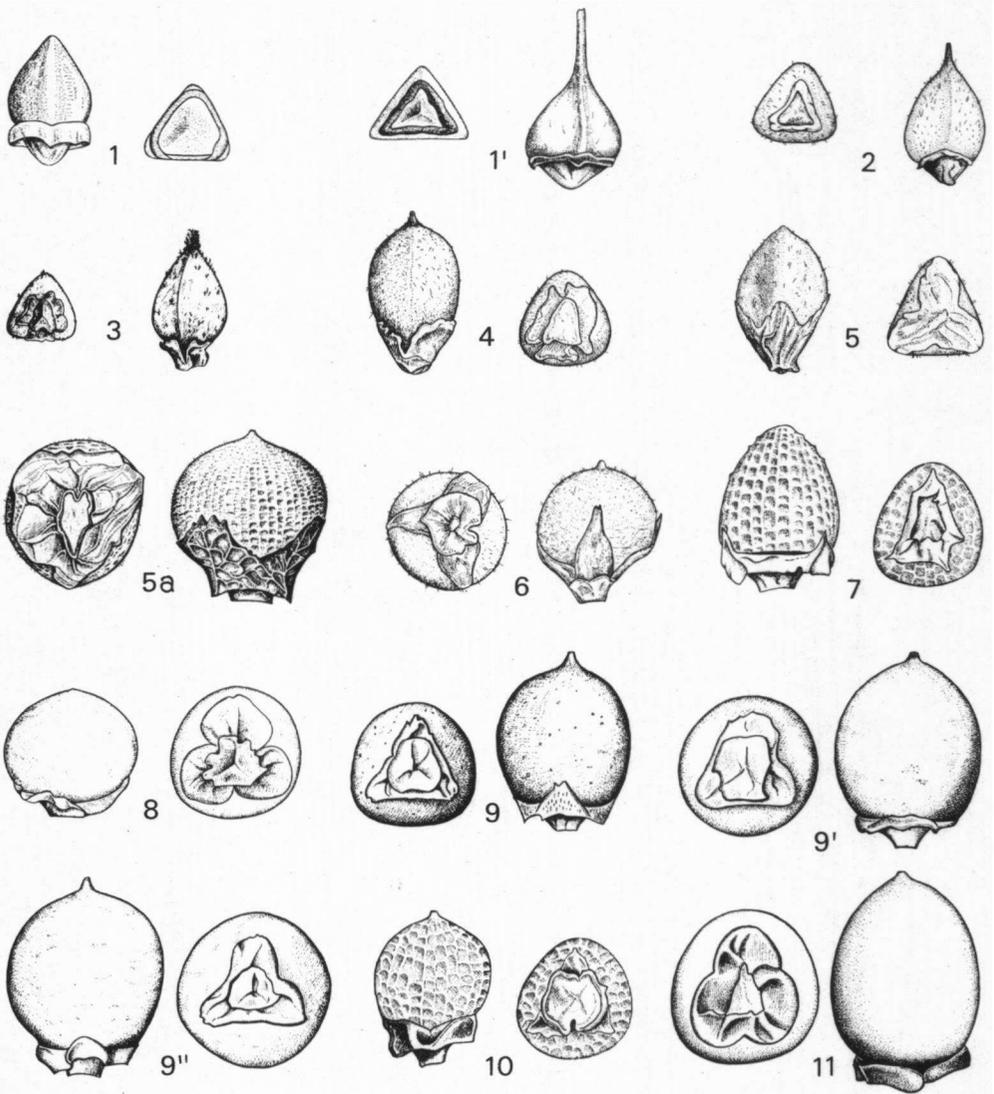


FIG. 104. Basal and lateral views of the nuts of Malesian species of *Scleria*, the numbers corresponding to those of the species in the text. All  $\times 7$ . 1. *S. motleyi* CLARKE — 1'. *S. motleyi* ssp. *rostrata* KERN — 2. *S. densispicata* (CLARKE) KERN — 3. *S. papuana* KERN — 4. *S. brownii* KUNTH — 5. *S. cyathophora* HOLTZ. — 5a. *S. alta* BOECK. (allied to no 5, but from Khasya in India) — 6. *S. levis* RETZ. — 7. *S. benthamii* CLARKE — 8. *S. oblata* S. T. BLAKE — 9. *S. terrestris* (L.) FASS. (facies of *S. radula* HANCE) — 9'. Ditto (facies of *S. haematostachys* BOECK.) — 9''. Ditto (facies of *S. exaltata* BOECK.) — 10. *S. ciliaris* NEES — 11. *S. psilorrhiza* CLARKE.

Though *Sclerias* occur in open places in the forest, they tend to be more common and gregarious in secondary growths and grasslands, along road-sides, on forest-edges, and in light forests. They have been frequently reported from *Melaleuca* woodland savannah. Almost invariably they take up a good portion of the stand, but we lack detailed figures; *S. sumatrensis* and *S. biflora* have been reported to be locally dominant.

**Taxon.** In nearly all *Scleria* spp. the glumes of the ♀ (or bisexual) spikelets are persistent on the peduncle after the falling out of the nut. In *S. caricina* (and in the closely related *S. reticulata*) they fall off with the ripe nut which they enclose like a sort of perigynium not unlike the utricle in *Carex*. On this character R. BROWN based his genus *Diplacrum*. After KUNTH had shown that the glumes in *Diplacrum* and the utricle in *Carex* are not homologous, BENTHAM merged *Diplacrum* with *Scleria*. Serious objections against their congenerity

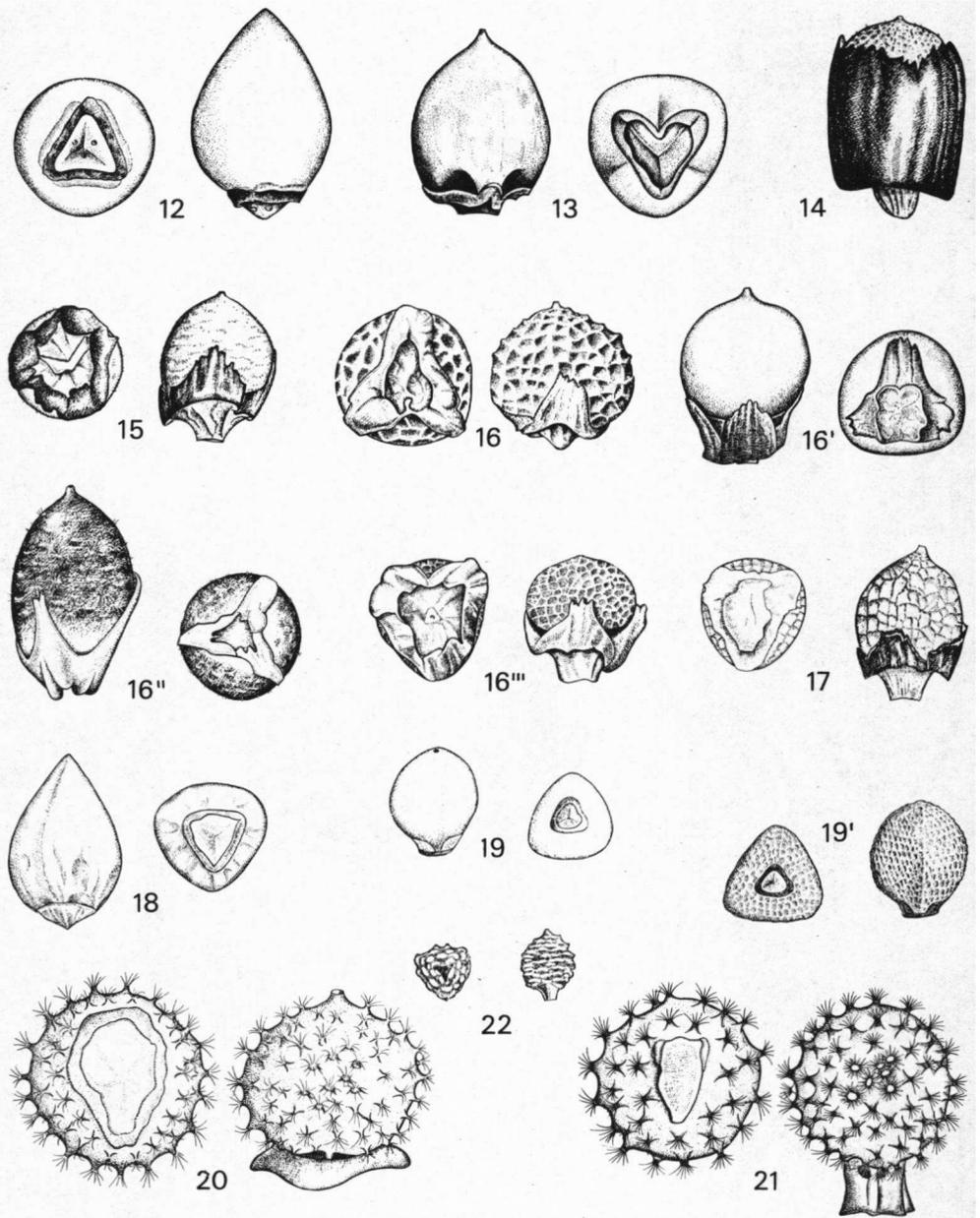


Fig. 105. Basal and lateral views of the nuts of Malesian species of *Scleria*, the numbers corresponding to those of the species in the text. All  $\times 7$ , except 20–21 which are  $\times 14$ . 12. *S. junghuhniana* BOECK. — 13. *S. poaeformis* RETZ. — 14. *S. sumatrensis* RETZ. (only lateral view) — 15. *S. polycarpa* BOECK. — 16. *S. scrobiculata* NEES & MEY. ex NEES — 16'. *Ditto* (HOOGLAND 3363) — 16''. *Ditto* (BRASS 27949) — 16'''. *S. scrobiculata* ssp. *discocarpa* KERN — 17. *S. purpurascens* STEUD. — 18. *S. corymbosa* ROXB. — 19. *S. lithosperma* (L.) Sw., typical — 19'. *S. lithosperma* var. *linearis* BENTH. — 20. *S. carphiformis* RIDL. ( $\times 14$ ) — 21. *S. neesii* KUNTH ( $\times 14$ ) — 22. *S. pergracilis* (NEES) KUNTH.

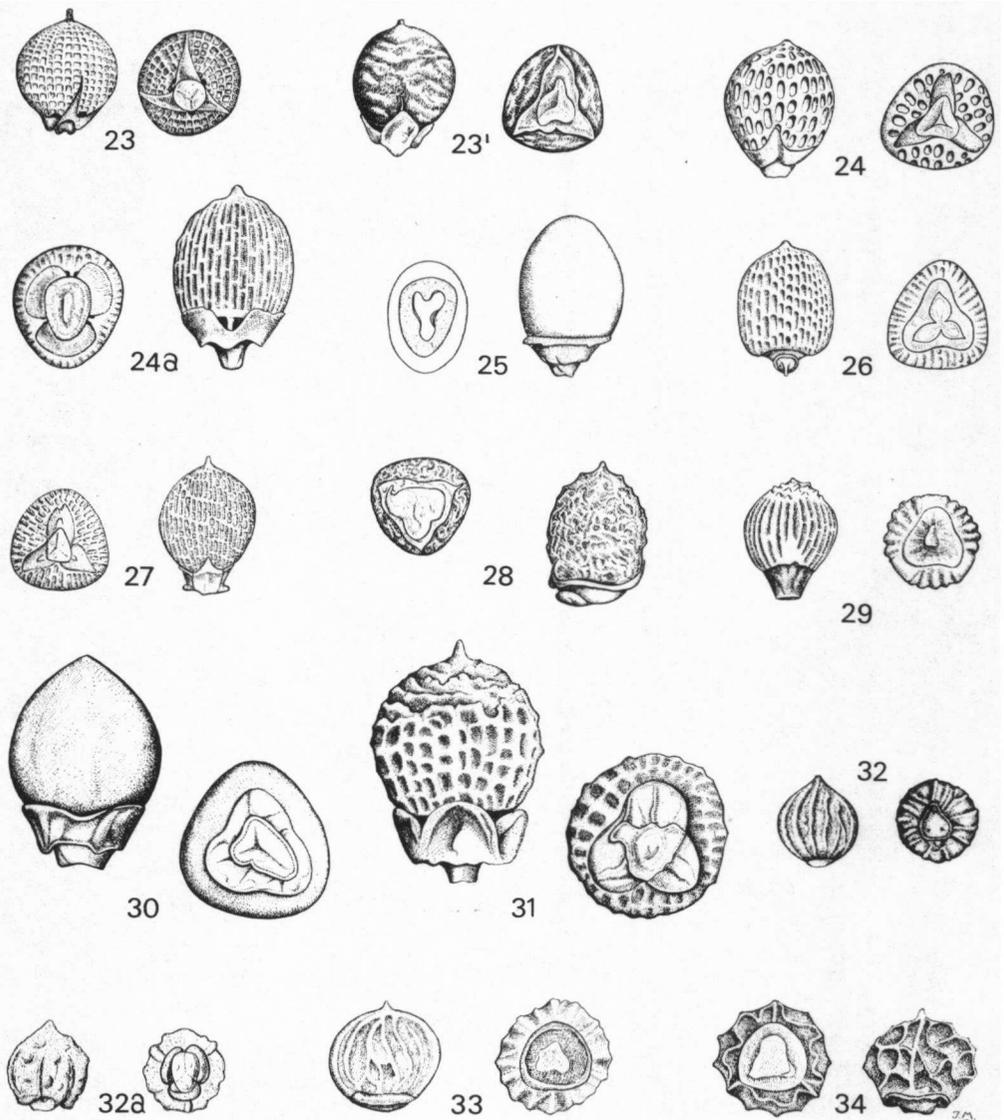


Fig. 106. Basal and lateral views of the nuts of Malesian species of *Scleria*, the numbers corresponding to those of the species in the text. All  $\times 7$ , except 30–34 which are  $\times 14$ . 23. *S. biflora* ROXB., typical — 23'. *S. biflora* ssp. *ferruginea* (OHWI) KERN — 24. *S. mikawana* MAKINO — 24a. *S. tessellata* WILLD., tropical Africa and India, not in Malesia, for comparison only — 25. *S. annularis* (KUNTH) NEES ex STEUD. — 26. *S. novae-hollandiae* BOECK. — 27. *S. parvula* STEUD. — 28. *S. tricuspida* S. T. BLAKE — 29. *S. laxa* R. BR. — 30. *S. thwaitesiana* BOECK. — 31. *S. rugosa* R. BR. — 32. *S. pygmaeopsis* KERN — 32a. *S. pygmaea* R. BR., from Australia, for comparison only — 33. *S. caricina* (R. BR.) BENTH. — 34. *S. reticulata* (HOLTT.) KERN.

were again raised by GOEBEL, who was of the opinion that the distribution of the sexes in the inflorescence and the structure of the nut-bearing spikelets in *Diplacrum* are essentially different from those in *Scleria*. According to me the inflorescence in *Diplacrum* represents but one of the numerous variations in type occurring in *Scleria*, and both in *Scleria* and *Diplacrum* the ♀ flower is terminal, so that there is no valid point of generic discrimination.

The Asiatic *Scleriae* (with the exception of *Diplacrum*) are generally subdivided into two subgenera, *Scleria* proper and *Hypoporium*, the former with none or few bisexual spikelets and usually a well-developed hypogynous

disk, the latter with many bisexual spikelets and a much reduced disk. As this subdivision is far from being natural, it has not been accepted here. See KERN, *Blumea* 11 (1961) 141-149.

Uses. The genus has hardly any economic value. The leaves of *S. poaeformis* are sometimes used for matting purposes, those of *S. pergracilis* as a medicine, and young plants of *S. biflora* are eaten with the rice as 'lalab'.

Note. A few species are aromatic, *S. pergracilis* is strongly lemon-scented; of *S. biflora* young plants are fragrant, its roots smelling of camphor or cajaput.

## KEY TO THE SECTIONS

1. Perennials.
  2. Glumes glabrous or minutely hairy. Spikelets not in globose clusters, at most 6 mm long.
    3. Hypogynous disk well developed.
      4. Nut-bearing spikelets bisexual (not always in *S. cyathophora*.) Nut usually trigonous. Glumes shortly hairy. *Spp.* 1-5 . . . . . 1. *Sect. Browniae*
      4. Nut-bearing spikelets usually unisexual, the ♂ part reduced to a sterile glume or sometimes to 1-2 flowers. Nut terete or obscurely trigonous. Glumes glabrous or minutely ciliate. *Spp.* 6-17.
        2. *Sect. Scleria*
        3. Hypogynous disk much reduced, obsolete. Nut-bearing (or all) spikelets bisexual. Nut trigonous, with 3 basal depressions. *Spp.* 18-19 . . . . . 3. *Sect. Corymbosae*
    2. Glumes long-hairy. Spikelets in a dense, globose, terminal cluster, 1-2 smaller lateral clusters whether or not added. Spikelets large, (6-)8-9 mm long. *Spp.* 20-21 . . . . . 4. *Sect. Carphiformes*
1. Annuals.
  5. Inflorescence linear, spiciform, unbranched, without leafy bracts. *Sp.* 22 . . . . . 5. *Sect. Hypoporum*
  5. Inflorescence otherwise, with leafy bracts.
    6. Nut bearing spikelets with at least 3 glumes. *Spp.* 23-31 . . . . . 6. *Sect. Tessellatae*
    6. Nut-bearing spikelets with 2 glumes.
      7. Ripe nuts falling out of the glumes which are persistent on the rachilla. *Sp.* 32 . . . . . 7. *Sect. Sphaeropus*
      7. Ripe nuts closely enveloped by the glumes and falling with them. *Spp.* 33-34 . . . . . 8. *Sect. Diplacrum*

## KEY TO THE SPECIES

1. Glumes beset with long, patent hairs.
  2. Nut-bearing spikelets 3-4 mm long. Nut smooth or more or less rugulose, often somewhat tuberculate at the top, glabrous. Spikelets in small, axillary clusters (one cluster terminal) . . . . . 31. *S. rugosa*
  2. Nut-bearing spikelets much larger, (6-)8-9 mm long. Nut densely tuberculate throughout, stellately hairy on the top of each tubercle. Spikelets in a dense, globose, terminal cluster 1-2 cm across, 1-2 smaller lateral clusters whether or not present.
    3. Besides the terminal cluster of spikelets 1-2 smaller clusters lower down on the stem in the axil of a leaf-like bract. Disk well developed, patelliform, almost as wide as the nut. . . . . 20. *S. carphiformis*
    3. No axillary clusters. Disk reduced to a columnar, triquetrous stipe much narrower than the nut. . . . . 21. *S. neesii*
1. Glumes glabrous, sometimes minutely appressed-hairy.
  4. Inflorescence linear, spiciform, unbranched, with several almost sessile clusters of spikelets, without leafy bracts. Spikelets all bisexual, 2½-3 mm long. Strongly lemon-scented annual. . . . . 22. *S. pergracilis*
  4. Inflorescence otherwise. Plant not lemon-scented.
    5. Nut-bearing spikelets with 2 glumes, 1½-3 mm long; ♂ spikelets 1-2 mm long. Spikelets strictly unisexual, in very small, axillary, head-like, almost sessile clusters. Disk obsolete.
      6. Glumes of the ♀ spikelets distinctly 3-lobed, prominently several-nerved. Ripe nut completely hidden by the connivent glumes and falling with them . . . . . 33. *S. caricina*
      6. Glumes of the ♀ spikelets entire, with only the midnerve more or less prominent.
        7. Ripe nut completely hidden by the connivent glumes and falling with them, depressed-globose, tuberculate-reticulate between the 3 longitudinal ribs, ¾ mm high, 1-1¼ mm broad. Peduncle of ♀ spikelet not or hardly swollen at the top . . . . . 34. *S. reticulata*
        7. Ripe nut visible between the more or less spreading glumes, falling out of them, globose, longitudinally costulate with 3 more prominent ribs, ½-¾ mm long and wide. Glumes persistent on the rachilla. Peduncle of ♀ spikelet bulbously swollen and spongy at the top . . . . . 32. *S. pygmaeopsis*
    5. Nut-bearing spikelets with at least 3 glumes. Other characters not united in that way.
      8. Middle leaves of the flowering stems clustered in groups of (2-)3(-5) forming pseudowhorls. Generally stout perennials with decomposed inflorescences consisting of several partial panicles.
        9. Disk cyathiform, covering at least the lower half of the nut, halfway or less 3-lobed, the lobes broadened upwards, contiguous or overlapping, truncate or very obtuse, crenulate at the top, at first yellow, ultimately dark red. Nut small, 2 mm ø, cancellate, olivaceous-brown to greyish black. . . . . 14. *S. sumatrensis*
        9. Disk much smaller, not cyathiform, its lobes narrowed upwards, separated from each other, entire or denticulate at the top.
          10. Nut strongly depressed, small, 1½ mm high, 2-2½ mm broad, not or hardly mucronate. . . . . 16. *S. scrobiculata ssp. discocarpa*
    10. Nut not depressed, ovoid or globose, 2-3 mm high.

11. Branches of the narrow partial panicles obliquely erect. Ultimate bractlets inconspicuous, much shorter than the branchlets in their axils. Nut-bearing spikelets rather evenly distributed throughout the partial panicles, rounded at the base. Nut slightly rugulose to smooth, hardly or not mucronate, often tinged with blue. Disk at first yellow, ultimately reddish. Stems and upper side of the leaves often asperous . . . . . 15. *S. polycarpa*
11. Branches of the broad partial panicles spreading. Ultimate bractlets conspicuous, about as long as to much longer than the branchlets in their axils. Nut-bearing spikelets chiefly restricted to the base of the branches of the partial panicles. Nut mucronate, white or discoloured, scrobiculate or cancellate, very rarely smooth.
12. Nut cancellate, at first whitish, soon discoloured (dingy purple to blackish), 2-2½ mm long. Nut-bearing spikelets cuneate at the base. Leaf-sheaths wingless. Undersurface of leaves often more or less pubescent with long, white hairs . . . . . 17. *S. purpurascens*
12. Nut scrobiculate (very rarely smooth), white, 2½-3 mm long. Nut-bearing spikelets rounded at the base. Leaf-sheaths wingless to broadly winged. Leaves usually glabrous. . . . . 16. *S. scrobiculata*
8. Leaves not in pseudo-whorls.
13. Disk-lobes mucronulate by a short (easily overlooked!) erect, stiff point.
14. Nut exactly globose or slightly depressed, strikingly cancellate, densely ferrugineous-pubescent on the ridges between the pits, with dark purplish to blackish beak and 2 basal, deep pits in each sinus of the disk-lobes . . . . . 23. *S. biflora* ssp. *ferruginea*
14. Nut ovoid, rugulose or obscurely cancellate, beakless or with white beak, sparsely pubescent or glabrous, without basal pits.
15. Nut distinctly beaked, somewhat tuberculate at the top. Annual . . . . . 28. *S. tricuspidata*
15. Nut not beaked, not tuberculate. Perennial . . . . . 7. *S. benthamii*
13. Disk-lobes not mucronulate, or disk obsolete.
16. Disk distinctly cup-shaped, reaching to about half the height of the nut, shortly 3-lobed, thin, yellowish or rufidulous. Nut obtusely but distinctly trigonous, hardly umbonulate, hirtellous with ferrugineous hairs . . . . . 5. *S. cyathophora*
16. Disk shorter, sometimes obsolete, when attaining half the height of the nut not cup-shaped.
17. Disk-lobes very broad (broader than long), membranous, white, truncate, erect or spreading upwards, the disk looking like a stand-up collar under the nut.
18. Leaves crowded at the base of the flowering stems and moreover 1-2 distant higher up, 5-10 mm wide. Stems 100-150 cm by 2-3 mm, the base clothed with the fibrous remains of decayed leaf-sheaths. Inflorescence 30-60 cm long. Spikelets 3-3½ mm long. Beak of nut white. . . . . 3. *S. papuana*
18. All the leaves about equally distributed along the stems, 2-3 mm wide. Stems 20-60 cm by 1-1½ mm; no fibrous remains of decayed leaf-sheaths. Inflorescence 3-12 cm long. Spikelets 4-6 mm long. Beak of nut brown or blackish . . . . . 4. *S. brownii*
17. Disk-lobes otherwise, or disk obsolete.
19. Nut with 3 basal depressions which are rugulose by transverse, wavy, ferrugineous ridges, trigonous. Disk reduced to a narrow, brown band concrete with the nut. Inflorescence very loose, with spiciform branches . . . . . 19. *S. lithosperma*
19. Nut without or with smooth basal depressions. Other characters not in that combination.
20. Annuals with fibrous, red roots; usually small plants.
21. Nut ferrugineous-pubescent on the walls between the lacunae of the deeply cancellate nut.
22. Nut exactly globose or somewhat depressed-globose, with purplish to blackish beak and 2 basal, deep pits clearly visible in each sinus of the disk-lobes, the lacunae on the surface of the nut at least for the greater part square to broader than long . . . . . 23. *S. biflora*
22. Nut ellipsoid, with white beak, not deeply pitted at the base, the lacunae mostly longitudinally elongate. Disk-lobes ovate, acute . . . . . 27. *S. parvula*
21. Nut glabrous.
23. Stems retrorsely scabrous on the angles. Nut very smooth and shining, ovoid, more or less laterally compressed, not apiculate. Disk not lobed . . . . . 25. *S. annularis*
23. Stems smooth (in *S. mikawana* rarely somewhat scabrid at the top). Nut not compressed.
24. Male spikelets at least partly much shorter than their peduncles, which are often reddish and recurved. Nut globose or ovoid-globose, minutely umbonulate, scrobiculate (the walls between the lacunae broad, forming a more or less continuous surface interrupted by the pits). Disk 3-lobed, with oblong lobes . . . . . 24. *S. mikawana*
24. Male spikelets longer than or as long as their peduncles. Nut variously sculptured or smooth.
25. Disk-lobes ovate, acute. Nut prominently cancellate . . . . . 27. *S. parvula*
25. Disk-lobes semi-orbicular, rounded, or disk hardly lobed.
26. Nut ellipsoid or oblong-ellipsoid, with nearly parallel sides, dull, white, 2¼-2¾ mm long. Disk hardly lobed, triangular with rounded angles. Cupula (and its scar in the centre of the disk) deeply 3-lobed . . . . . 26. *S. novae-hollandiae*
26. Nut globose, shining, 1⅓-1½ mm across. Cupula not lobed.
27. Disk densely cellular-glandular. Peduncles of the partial inflorescences relatively stout. . . . . 31. *S. rugosa*
27. Disk not cellular-glandular. Peduncles of the partial inflorescences slender, filiform.

28. Nut deeply longitudinally ribbed . . . . . 29. *S. laxa*  
 28. Nut smooth . . . . . 30. *S. thwaitesiana*
20. Perennials with distinct, woody, often nodose rhizomes; usually stout plants.
29. Inflorescence a single, terminal, much branched, long-peduncled panicle with a short, setaceous bract at the base, or ebracteate, very rarely a lateral panicle in the axil of a leafy bract added. Spikelets not clustered, solitary along the numerous spiciform branches of the panicle. . . . . 13. *S. poaeformis*
29. One or more lateral panicles in the axils of leafy bracts present. Spikelets in clusters of 2-4.
30. Disk-lobes lanceolate, thin, often bidentate at the apex. Leaf-sheaths at least partly winged. Nut globose or nearly so, pubescent if not too old . . . . . 6. *S. levis*
30. Disk-lobes broadly rounded, or disk obsolete.
31. Contraligule with a lanceolate or oblong, 1-1½ cm long, scarious appendage. Secondary bracts stiff, long-exserted from the panicle . . . . . 10. *S. ciliaris*
31. Contraligule short, either without a scarious appendage or with a band-like appendage much broader than long.
32. Nut depressed-globose, not or hardly umbonulate. Disk-lobes broadly ovate. Leaf-sheaths wingless . . . . . 8. *S. oblata*
32. Nut not depressed.
33. Nut 3-3½ mm long (beak, if any, included).
34. Nut rostrate by a cylindrical or narrowly conical beak up to 1½ mm long, prominently trigonous, covered with weak, brownish, long hairs. Spikelets all alike, bisexual (with several ♂ flowers besides the single ♀ one) . . . . . 1. *S. motleyi* ssp. *rostrata*
34. Nut erostrate, mucicous or shortly mucronate or umbonate. Besides the ♀ or bisexual spikelets strictly ♂ ones present.
35. Inflorescence ample, but very open, the ultimate branches spiciform, with distant, 1-2 cm spaced clusters of spikelets. Disk narrow, triangular, each side bordered by a low but distinct swelling of the pericarp. Nut much exserted from the glumes, very smooth and shining, mucicous . . . . . 12. *S. junghuhniana*
35. Branches of the more or less dense inflorescence not spiciform, the clusters of spikelets not so strikingly spaced. Pericarp not swollen around the disk.
36. Disk obsolete, reduced to a narrow, triangular, minutely glandular band concrete with the nut. Nut with 3 shallow depressions at the base, smooth, acute or minutely umbonulate. Nut-bearing spikelets bisexual, with some to several ♂ flowers besides the ♀ one. Inflorescence usually copious, with several corymbiform partial panicles. Leaf-sheaths wingless . . . . . 18. *S. corymbosa*
36. Disk well developed. Nut not depressed at the base. Nut-bearing spikelets as a rule strictly ♀, rarely with a single ♂ flower besides the ♀ one.
37. Nut large, usually more than 3 mm long, ovoid or broadly ovoid, obtuse, mucicous, very smooth and shining. Contraligule with cartilaginous, incrassate margin, not appendaged. Leaf-sheaths winged . . . . . 11. *S. psilorrhiza*
37. Nut at most 3 mm long, ovoid or subglobose, smooth or cancellate, umbonate or mucronate. Contraligule with scarious, brown, band-like appendage. Leaf-sheaths winged or wingless . . . . . 9. *S. terrestris*
33. Nut about 2 mm long.
38. Spikelets all bisexual, with some to several ♂ flowers besides the ♀ one. Nut prominently trigonous, conical with flat sides, covered with weak, appressed, long, brown hairs. Disk thick, reflexed, not lobed, about as wide as the base of the nut . . . . . 1. *S. motleyi*
38. Strictly ♂ spikelets present. Nut ovoid or globose, obtusely trigonous or terete, glabrous or shortly hairy.
39. Leaves crowded at the base of the flowering stem, moreover 1-3 distant higher up. Base of the stem clothed with the fibrous remains of decayed leaf-sheaths. Spikelets bisexual and ♂. Mouth of the leaf-sheaths truncate or emarginate, sometimes slightly convex. Nut obtusely trigonous, smooth, covered with stellately arranged, short, white hairs . . . . . 2. *S. densispicata*
39. Leaves about equally distributed along the flowering stems. No fibrous remains of decayed leaf-sheaths. Spikelets unisexual (♂ and ♀). Mouth of the leaf-sheaths with a short but distinct contraligule bordered by a brown, scarious appendage. Nut terete to obtusely trigonous, smooth to cancellate, often minutely hairy when young. . . . . 9. *S. terrestris*

### 1. Section *Browniae*

(CLARKE) KERN, *Blumea* 11 (1961) 156. — *Scleria* subg. *Browniae* ('*Browneae*')  
 CLARKE, *Kew Bull. add. ser.* 8 (1908) 132.

1. *Scleria motleyi* CLARKE, *Philip. J. Sc.* 2 (1907) Bot. 104; *Ill. Cyp.* (1909) t. 126, f. 1-7; MERR. *En. Born.*

(1921) 66; *En. Philip.* 1 (1923) 134, *excl. var. densispicata* CLARKE; ? OHWI, *Bot. Mag. Tokyo* 56 (1942)

213; KERN, *Blumea* 11 (1961) 156. — *S. trigonocarpa* RIDL. [J. Str. Br. R. As. Soc. n. 46 (1906) 228, *nom. nud.*] Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 110, *non* STEUD. 1855. — *S. gonocarpa* RIDL. Fl. Mal. Pen. 5 (1925) 177. — Fig. 104.

*ssp. motleyi*. — Synonymy as above.

Perennial. Stems rather stout, smooth, often quite or almost hidden by the overlapping leaf-sheaths, (30-)60-100 cm by 2-5 mm. Leaves cauline, very gradually narrowed to the very slender, scabrous tip, glabrous or shortly pubescent, sometimes asperous on the upper side, 5-15 mm wide; sheaths loose, not winged, stramineous or purplish at the base, glabrous or pubescent, the mouth emarginate on the ventral side, ciliate. Inflorescence narrow, elongate, 15-60 cm long, consisting of a terminal panicle and several (up to 10) distant fascicles of erect, decompound lateral panicles; lower primary bracts much exceeding their panicles, the upper ones gradually shorter; peduncles of lateral panicles single or binate at the nodes, smooth, hardly (rarely up to 5 cm) exerted from the sheaths. Spikelets all bisexual, lanceolate in flower, ovate in fruit, solitary or in clusters of 2-3, brown, 3-4 mm long; glumes ovate, acute, shortly pubescent in the upper part, the longest c. 3 mm; ♂ part of the spikelet c. 3 mm long; stamens 3; anthers linear, c. 2 mm long. Disk thick, reflexed, not lobed, about as wide as the base of the nut. Nut conical with flat sides, prominently trigonous, truncate at the base, acute, not or hardly beaked, smooth, shining, white or dingy purple, covered with erect, appressed, weak, ferruginous or cinnamomeous long hairs, finally more or less glabrescent,  $1\frac{1}{2}$ -2 by  $1\frac{1}{2}$ - $1\frac{2}{3}$  mm.

Distr. *Malesia*: Malay Peninsula, Banka, Borneo, Philippines, New Guinea; very local.

Ecol. Forests, sandy ridges, river-banks, at low and medium altitudes (up to 1200 m).

*ssp. rostrata* KERN, *Blumea* 11 (1961) 158. — *S. trigona* MERR. Philip. J. Sc. 8 (1913) Bot. 363, *ex descr.* — *S. sorsogonensis* ELM. Leaf. Philip. Bot. 10 (1938) 3541, *descr. angl.* — Fig. 104.

Spikelets lanceolate in fruit, 5-6 mm long; glumes lanceolate, acuminate, very acute or mucronate, sparsely pubescent or almost glabrous, purplish, up to  $4\frac{1}{2}$  mm long; ♂ part of the spikelet  $4\frac{1}{2}$  mm long. Nut distinctly beaked, the beak up to  $1\frac{1}{2}$  mm long. Inflorescence and leaf-sheaths often purplish.

Distr. *Malesia*: Philippines (Babuyan, Luzon, Catanduanes, Biliran I.). Fig. 107.

Notes. Typical specimens of this subspecies make the impression of a separate species. As especially the length of the beak of the nut varies considerably, I prefer to treat it as a geographical race of the much more widely distributed *S. motleyi*.

To judge from the description *S. trigona* MERR. represents a state of *ssp. rostrata* with less pronounced beak of the nut.

2. *Scleria densispicata* (CLARKE) KERN, *Blumea* 11 (1961) 159. — *S. motleyi* CLARKE *var. densi-spicata* CLARKE, Philip. J. Sc. 2 (1907) Bot. 104; MERR. En. Philip. 1 (1923) 134. — Fig. 103, 104.

Perennial. Stems slender, smooth, naked in the lower part, 30-100 cm by 1-3 mm, the base densely covered with the decayed, finally fibrous, dull brown remains of old leaf-sheaths. Leaves in a basal rosette and moreover 1-3 distant on the stem (their sheaths

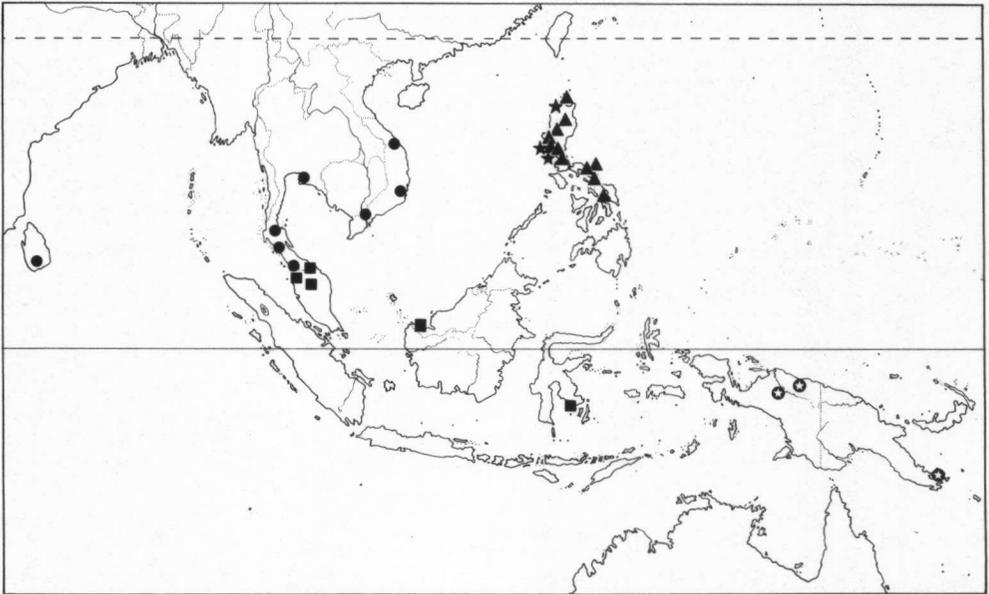


Fig. 107. Range of some species of *Scleria*: *S. motleyi* CLARKE *ssp. rostrata* KERN (triangles), *S. densispicata* (CLARKE) KERN (black stars), *S. papuana* KERN (white stars, in dots), *S. carphiformis* RIDL. (squares), *S. neesii* KUNTH (dots).

not overlapping), very gradually narrowed to the long, setaceous tip, glabrous or slightly pubescent, scabrid on the margins, 5–7 mm wide; sheaths of the stem-leaves and bracts narrow, not winged, stramineous, glabrous, the mouth truncate or emarginate, ciliate, sometimes somewhat convex. *Inflorescence* narrow, elongate, 15–40 cm long, consisting of a terminal panicle and several (up to 5) distant fascicles of erect, compound lateral panicles; lower primary bracts much exceeding their panicles, the upper ones gradually shorter; secondary bracts setaceous, long, standing out from the panicles; peduncles of lateral panicles solitary or binate at the nodes, scabrid, 0–5 cm exerted from the sheaths. *Spikelets* ♂ and bisexual, in dense clusters of (3–)5–7, brown, the ♂ ones lanceolate, 4–5 mm long, the bisexual ones ovate in fruit,  $3\frac{1}{2}$ – $4\frac{1}{2}$  mm long, the ♂ part 3–4 mm; glumes ovate, acute, sparsely hairy; stamens 3; anthers linear, c. 2 mm long. *Cupula* urceolate, with brown margin, thick, spongy. *Disk* thin, reflexed, not lobed, narrower than the base of the nut. *Nut* ovoid, with somewhat convex sides, obtusely trigonous, rounded at the base, acuminate, shortly beaked (beak c.  $\frac{1}{3}$  mm long), smooth, white or finally discoloured, covered with bundles of patent, stiff, whitish, short hairs, finally more or less glabrescent, c. 2 by  $1\frac{1}{3}$ – $1\frac{1}{2}$  mm.

Distr. *Malesia*: Philippines (Luzon). Fig. 107.

Ecol. Forests at low and medium altitudes, up to 800 m.

Note. CLARKE distinguished this taxon by the dense inflorescences with long, setaceous secondary bracts standing out from the panicles. In my opinion it certainly deserves specific rank, as the shape and the indument of the nut are also very different from those in *S. motleyi*.

3. *Scleria papuana* KERN, Blumea 11 (1961) 160, f. 4. — *S. motleyi* (non CLARKE) S. T. BLAKE, J. Arn. Arb. 35 (1954) 225. — Fig. 104.

Perennial. *Stems* rather stout, glabrous or sparsely pilose, smooth, 100–150 cm by 2–3 mm, the base densely covered with the decayed, finally fibrous, brown remains of old leaf-sheaths. *Leaves* in a basal rosette and moreover 1–2 distant on the stem, very gradually narrowed to the long, setaceous tip, glabrous or minutely pubescent beneath, scabrid on the margins, 5–10 mm wide; sheaths of the stem-leaves and bracts narrow, not winged, smooth, purplish, the mouth truncate, slightly convex, or concave, ciliate. *Inflorescence* narrow, elongate, 30–60 cm long, consisting of a terminal panicle and up to 6 distant lateral ones; lower primary bracts much exceeding their panicles, the upper ones gradually shorter; secondary bracts inconspicuous; peduncles of lateral panicles single or binate at the nodes, smooth or scabrid, hardly exerted from the sheaths. *Spikelets* mostly bisexual, some ♂ ones (always?) added, solitary or 2–3 together, ovate in fruit, brown, 3– $3\frac{1}{2}$  mm long; glumes ovate, acute, shortly pubescent or subglabrous; stamens 3; anthers linear, c.  $1\frac{1}{2}$  mm long. *Disk* membranous, erect, 3-lobed, narrower than the nut, the lobes very obtuse, undulate. *Nut* ovoid with slightly convex sides, obtusely trigonous, rounded at the base, apiculate, smooth, shining, white, finally discoloured, with sparse bundles of short, white or ferruginous hairs, finally glabrescent, 2 by  $1\frac{1}{3}$ – $1\frac{1}{2}$  mm.

Distr. *Malesia*: New Guinea (W. New Guinea: Hollandia, Rouffaer R., Humboldt Bay; East New Guinea: Fergusson I.; Morobe Distr., Leron R.). Fig. 107.

Ecol. In forests, on river-banks, at low altitude.

Note. This species and the preceding one are only known from a few collections. Apparently they are closely related, as they agree in habit (many leaves in a basal rosette, stems with a few distant leaves only, base of the plant covered with decayed leaf-sheaths), and in the shape and hairiness of the nut. They differ in the distribution of sexes (*S. densispicata* has many strictly ♂ spikelets), in the length of the secondary bracts, and in the very dissimilar disk under the nut, characters estimated as very important for specific delimitation in the genus. For this reason the two are treated here on the specific level; possibly additional collections may show the necessity to regard them as geographical races of one single species.

4. *Scleria brownii* KUNTH, En. 2 (1837) 349 ('*brownii*'); STEUD. Syn. 2 (1855) 173; BOECK. Linnaea 38 (1874) 453; F.v.M. Fragm. Phyt. Austr. 9 (1875) 21; BENTH. Fl. Austr. 7 (1878) 429; DOMIN, Bibl. Bot. Heft 85 (1915) 487, incl. var.; KÜK. Bot. Jahrb. 70 (1940) 464; KERN, Blumea 11 (1961) 162. — *S. distans* R. BR. Prod. (1810) 240, non POIR. 1806. — *S. pallidiflora* BOECK. Flora 58 (1875) 119. — Fig. 104.

Perennial, with short, nodose or corm-like rhizome. *Stems* slender, retrorsely hispid-scabrid on the angles to almost smooth, 20–60 cm by  $1\frac{1}{2}$  mm. *Leaves* narrowly linear, glabrous, more or less scabrid on the margins, 2–3 mm wide; sheaths narrow, not winged, often more or less pubescent; contraligule absent (mouth of the sheaths truncate or almost so, villous). *Inflorescence* narrow, consisting of 2–4 distant to approximate, small clusters, 3–12 cm long; peduncles single or binate at the nodes; primary bracts erect, as long as or overtopping the inflorescence, the upper ones gradually shorter; secondary bracts inconspicuous. *Spikelets* bisexual and ♂ (see note), 4–6 mm long; ♂ spikelets several-flowered; stamens 3; anthers linear, 2– $2\frac{1}{2}$  mm long; bisexual spikelets with several ♂ flowers; glumes ovate-lanceolate, acute or cuspidate, ferruginous with green keel. *Disk* 3-lobed, whitish; lobes membranous, broad, truncate, undulate. *Nut* small, much shorter than the glumes, fragile, globular to ovoid-ellipsoid, obtusely or obscurely trigonous, apiculate (the short beak conical, brown or blackish), more or less granular-tuberculate, at first pubescent, finally glabrescent, white, 2–3 by  $1\frac{1}{2}$  mm.

Distr. Tropical Australia, New Caledonia, Tonga; in *Malesia*: New Guinea (3 collections).

Ecol. Open savannah land, rocky slopes, *Eucalyptus* forests, at low altitude.

Note. The bisexual spikelets are mostly prevalent, but in one of the Australian specimens in the Leyden Herbarium I found only strictly ♂ spikelets. Is there a tendency to dioecism in this species?

5. *Scleria cyathophora* HOLTZ. Gard. Bull. Sing. 11 (1947) 294; KERN, Blumea 11 (1961) 163. — Fig. 104.

Perennial. *Stems* very slender, smooth, leafy throughout, up to 100 cm by 2–3 mm. *Leaves* very gradually narrowed to the acute tip, glabrous, smooth except for the retrorsely scaberulous tip,

3–4 mm wide; sheaths narrow, not winged, puberulous; contraligule very short, broader than long, rounded, hairy. *Inflorescence* narrow, 5–15 cm long, consisting of a terminal panicle and about 3 short, lateral ones, the latter single or binate at the nodes, 2–3 cm long, with very short branches; peduncles not or but slightly exerted from the sheaths; lowest primary bract overtopping the inflorescence; secondary bracts subulate. *Spikelets* bisexual or ♀, and ♂, reddish brown, 3–3½ mm long; ♂ spikelets lanceolate; stamens 3 (or in some flowers 2); anthers c. 2 mm long; nut-bearing spikelets ovoid, with a sterile or ♂ flower besides the terminal ♀ one; glumes ovate, acute, minutely pubescent. *Disk* cyathiform, thin, 3-lobed, about ½ the length of the nut, yellowish or rufidulous; lobes appressed, ovate-triangular, plicate, irregularly denticulate. *Nut* small, ovoid-conical, obtusely but distinctly trigonous, somewhat

acuminate, slightly rugulose, white, hirtellous with ferruginous hairs, c. 2 by 1½ mm.

*Distr. West Malesia:* Malay Peninsula (Pahang: Tasek Bera), S. Sumatra, Banka, W. Borneo; rare.

*Ecol.* Swampy places, shallow water, *Melaleuca* marsh, among *Sphagnum*, at low altitude.

*Note.* HOLTUM placed *S. cyathophora* next to *S. motleyi*, obviously because of its trigonous nuts, and I have followed him by placing the two species in the same section. Indeed, *S. cyathophora* has several characters in common with the group to which *S. motleyi* belongs, especially with *S. papuana*. However, in the other species of this group the spikelets are either all bisexual or the nut-bearing ones have a well-developed, several-flowered ♂ part, whereas in *S. cyathophora* this part is reduced to a single ♂ or frequently sterile flower. Also the resemblance in habit to the other species is rather slight.

## 2. Section Scleria

ENDL. *Gen. Plant.* (1836) 112, *p.p.* — *Scleria sect. Elatae* CLARKE in Hook. *f. Fl. Br. Ind.* 6 (1894) 689; CHERM. in Humbert, *Fl. Madag. fam.* 29 (1937) 257.

**6. *Scleria levis* RETZ.** Obs. 4 (1786) 13; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 226; KERN, *Blumea* 11 (1961) 164; in Back. & Bakh. *f. Fl. Java* 3 (1968) 486. — *S. zeylanica* POIR. *Enc. Méth.* 7 (1806) 3. — *S. hebecarpa* NEES in Wight, *Contr.* (1834) 117; KUNTH, *En.* 2 (1837) 357; STEUD. *Syn.* 2 (1855) 169; BOECK. *Linnaea* 38 (1874) 478; CLARKE, *Fl. Br. Ind.* 6 (1894) 689; J. Linn. Soc. Bot. 34 (1898) 99; Philip. *J. Sc.* 2 (1907) Bot. 105; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 113; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 166; MERR. *En. Born.* (1921) 66; *En. Philip.* 1 (1923) 133; RIDL. *Fl. Mal. Pen.* 5 (1925) 179; UITTEN in Backer, *Bekn. Fl. Java (em. ed.)* 10 (1949) *fam.* 246, *p.* 59. — *S. pubescens* STEUD. [ex ZOLL. *Syst. Verz.* 1 (1854) 61, *nom. nud.*] *Syn.* 2 (1855) 168; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 167; UITTEN in Backer, *Bekn. Fl. Java (em. ed.)* 10 (1949) *fam.* 246, *p.* 59. — *S. japonica* STEUD. *Syn.* 2 (1855) 169; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 168. — *S. sumatrensis* var. *pubescens* MIQ. *Fl. Ind. Bat.* 3 (1856) 344. — *S. wichuraj* BOECK. *Bot. Jahrb.* 5 (1884) 510, *ex descr.* — *S. hebecarpa* var. *pubescens* CLARKE, *Fl. Br. Ind.* 6 (1894) 689; J. Linn. Soc. Bot. 34 (1898) 99; MERR. *En. Philip.* 1 (1923) 133. — ? *S. hebecarpa f. pilosa* VALCK. *SUR. Nova Guinea* 8 (1912) 712. — Fig. 104.

Perennial. *Stems* slender, scabrid on the angles, glabrous to softly villous, 30–90 cm by 1–3 mm. *Leaves* equally distributed along the stem, gradually narrowed to the acutish tip, glabrous to densely pubescent with long, white hairs, scabrid on the margins in the upper part, 3–8 mm wide; sheaths narrow, narrowly to broadly winged (at least part of them), the wings retrorsely scabrous on the margin; contraligule short, semi-orbicular, densely hirsute, on the top (always?) with a short (sometimes up to 2 mm long), triangular or ovate scarious appendage. *Inflorescence* narrow, consisting of a terminal panicle and 1–2 smaller, lateral ones; terminal panicle oblong, 5–12 cm long, with obliquely erect branches; lateral panicles often almost spike-like, thin and loose, their peduncles exerted from the leaf-sheaths,

scabrid; primary bracts overtopping the inflorescence, secondary ones setaceous, longer than their branches. *Spikelets* unisexual, in clusters of 2–4; ♂ spikelets oblong-lanceolate, 3–4 mm long; stamens 3; anthers linear, c. 2 mm long; ♀ spikelets ovate, 4–6 mm long, a sterile glume (vestige of the ♂ part) usually present; glumes ovate, acute or mucronulate. *Disk* deeply 3-lobed; lobes thin, lanceolate, appressed to the nut, acute, often bidentate at the top, brown, 1–1½ mm long. *Nut* globose or ovoid-globose, terete or obscurely trigonous, not exerted from the glumes, apiculate, smooth or slightly transversely rugulose, pubescent, ultimately glabrescent, shining, white, 2–2½ mm long and wide.

*Distr.* Ceylon and India to S. China and Japan, Queensland, New Caledonia and W. Carolines; throughout *Malesia*.

*Ecol.* Open forests (often in teak-forests), brushwood, savannahs, fallow rice-fields, etc., at low and medium altitudes, up to 1500 m.

*Vern.* *Rumput belidang*, *M. djukut ilat*, *S. kërissan*, *J. sianit*, *C. Sum.*, *teteles*, *Gaju*, *pédugan*, *Bawean*, *tentaripa*, *Talaud*; *Philip.*: *dáat*, *Tag.*

*Note.* A small and slender species among its relatives and for this reason sometimes confused with *S. lithosperma*, but easily distinguishable by the presence of a well-developed hypogynous disk.

**7. *Scleria benthamii* CLARKE,** *Kew Bull. add. ser.* 8 (1908) 58; KERN, *Blumea* 11 (1961) 166. — *S. tessellata* (non WILLD.) BENTH. *Fl. Austr.* 7 (1878) 430, *excl. var. debilis.* — *S. khasiana* CLARKE, *Fl. Br. Ind.* 6 (1894) 692; J. Linn. Soc. Bot. 34 (1898) 102, *non* BOECK. 1890. — Fig. 104.

Perennial. *Stems* slender, smooth, (30–)45–120 cm by 1–3 mm. *Leaves* rather abruptly narrowed to the obtusish tip, glabrous to more or less villous by long white hairs, scabrid on the margins towards the apex, otherwise smooth, (2–)3–7 mm wide; sheaths narrow, wingless to rather broadly winged, smooth, villous by patent or retrorse hairs to glabrous except for the

very short, rounded or truncate contraligule, which is bordered by a narrow membranous band. *Inflorescence* narrow, consisting of a terminal, lanceolate panicle and 1-2 distant fascicles of lateral panicles, the terminal panicle  $1\frac{1}{2}$ -5 cm long, the lateral ones smaller, single or binate at the nodes, their peduncles short (or the lowest up to 10 cm exerted from the sheath), smooth; primary bracts erect, the uppermost as long as or slightly overtopping the inflorescence, secondary bracts setaceous, often slightly recurved. *Spikelets* unisexual; ♂ spikelets linear-lanceolate,  $3-4\frac{1}{2}$  mm long; stamens 3; anthers linear, c. 2 mm long; ♀ spikelets 4-5 mm long, the ♂ part reduced to a small empty glume or absent; glumes ovate, acute or mucronulate, stramineous with purplish or brownish sides, glabrous, smooth. *Disk* shallowly lobed, triangular, appressed to the nut and about as wide as it, thick, with c.  $\frac{1}{3}$  mm broad, reflexed margins, yellowish, the lobes with a short erect, subulate mucro. *Nut* somewhat shorter than to about as long as the glumes, ovoid, obtusely trigonous, not apiculate, rugulose or obscurely cancellate, sparsely pubescent, finally glabrescent, glossy, white,  $2\frac{1}{3}-2\frac{1}{2}$  by  $2-2\frac{1}{2}$  mm.

*Distr.* Khasia, Thailand, Indo-China, Queensland; in *Malesia*: Philippines (Luzon, Prov. of Benguet), E. New Guinea (Reai, MANNER & STREET 390), twice collected.

*Ecol.* Dry open grasslands, 1500 m.

*Note.* *S. benthamii* is especially characterized by the peculiar shape of the disk reminding one of a tricorn hat. This type of disk is also found in *S. tricuspadata*, but this is an annual with tuberculate, distinctly apiculate nut.

8. *Scleria oblata* S. T. BLAKE, *Blumea* 11 (1961) 219; KERN, *Blumea* 11 (1961) 169; in Back. & Bakh. *f. Fl. Java* 3 (1968) 486. — *S. levis* (non RETZ.) WILLD. *Sp. Pl.* 4 (1805) 314 ('*laevis*'); NEES in Wight, *Contr.* (1834) 117; KUNTH, *En. 2* (1837) 342; STEUD. *Syn.* 2 (1855) 169; MIQ. *Fl. Ind. Bat.* 3 (1856) 341, *incl. f. β*; BOECK. *Linnaea* 38 (1874) 512; CLARKE, *Fl. Br. Ind.* 6 (1894) 694; J. Linn. Soc. Bot. 34 (1898) 103; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 111; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 169; MERR. *En. Born.* (1921) 66; *En. Philip.* 1 (1923) 133; RIDL. *Fl. Mal. Pen.* 5 (1925) 177; UITTEN in Backer, *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 57. — *Fig.* 104.

Nearly glabrous and smooth perennial. *Stems* rather slender, smooth, 60-100 cm (in scrub sometimes sprawling and taller) by 2-3 mm. *Leaves* gradually narrowed to the acutish tip, somewhat puberulous on the upper side near the base, otherwise glabrous, minutely scabrid especially in the upper part, 4-9 mm wide, the upper ones distant, the middle ones more approximate (but not whorled); sheaths narrow, not winged, smooth, usually puberulous at the top; contraligule very short, much broader than long, obtuse, ciliate, with a narrow scarious margin. *Inflorescence* rather narrow, consisting of a terminal partial panicle and 2-5 lateral ones, 15-25 cm long, 3-5 cm wide; partial panicles dense, contiguous or the lower ones somewhat distant, compound, pyramidal; peduncles solitary or sometimes binate, shortly exerted from their sheaths; primary bracts overtopping the inflorescence, secondary ones small, setaceous. *Spikelets* unisexual, in clusters of 2-3, purplish brown; ♂

spikelets distinctly peduncled, slightly curved, oblong-lanceolate,  $3\frac{1}{2}-4$  mm long; stamens 3; anthers linear,  $1\frac{1}{2}-2$  mm long; ♀ spikelets ovate, 4-4 $\frac{1}{2}$  mm long, the ♂ part reduced to a single glume sometimes with vestigial stamens in its axil; glumes broadly ovate, acute or apiculate, minutely ciliolate. *Disk* deeply 3-lobed, lobes firm, broadly ovate, obtuse, appressed to the nut, entire or somewhat denticulate at the top, pale, greenish or reddish striolate,  $1-1\frac{1}{4}$  mm long, sinuses acute. *Nut* shorter than the glumes, depressed-globose, not or hardly umbonulate, glabrous and smooth, at first blackish, shining, white when mature, c. 2 mm by  $2\frac{1}{2}-2\frac{1}{4}$  mm.

*Distr.* Ceylon, Assam, Burma, Thailand, Indo-China, and S. China; in *Malesia*: Sumatra, Banka, Malay Peninsula, W. Java, Borneo, Philippines, SE. Celebes.

*Ecol.* Open wet places: road-sides, light forests, brushwood, at low altitudes, up to 700 m (according to MERRILL in the Philippines up to 1200 m).

*Vern.* Kērisan, Sum. E.C., *sialit dudok, sēranēk, sēsayok*, Mal. Pen., *badang, tali juru*, Born.

*Note.* CLARKE (1894) placed this species and *S. ciliaris* (*S. bancana*) in the group with pseudo-whorled leaves, along with *S. purpurascens* (*S. multifoliata*) and *S. sumatrensis*, which are certainly not their closest allies. The middle leaves in *S. oblata* and *S. ciliaris* are more or less approximated, but not whorled.

9. *Scleria terrestris* (L.) FASS. *Rhodora* 26 (1924) 159, *incl. var. latior* FASS. *et var. decolorans* FASS.; S. T. BLAKE, *Proc. R. Soc. Queensl.* 62 (1952) 89; J. Arn. Arb. 35 (1954) 228; KERN, *Blumea* 11 (1961) 170; in Back. & Bakh. *f. Fl. Java* 3 (1968) 487. — *Katu-Tsjolam* RHEEDE, *Hort. Mal.* 12 (1703) 113, t. 60. — *Zizania terrestris* LINNĒ, *Sp.-Pl.* 2 (1753) 991. — *Schoenus paniculatus* BURM. *f. Fl. Ind.* (1768) 19. — *Diaphora cochinchinensis* LOUR. *Fl. Cochinch.* (1790) 578; ed. Willd. (1793) 709. — *Olyra orientalis* LOUR. *Fl. Cochinch.* (1790) 552; ed. Willd. (1793) 674. — *S. radula* HANCE, *Ann. Sc. Nat. Bot.* 18 (1862) 232; CLARKE, *Fl. Br. Ind.* 6 (1894) 691; J. Linn. Soc. Bot. 34 (1898) 101; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 111; *Fl. Mal. Pen.* 5 (1925) 178. — *S. elata* THW. *En. Pl. Zeyl.* (1864) 353; BOECK. *Linnaea* 38 (1874) 487; CLARKE, *Fl. Br. Ind.* 6 (1894) 690, *incl. var. latior* CLARKE *et var. decolorans* CLARKE; J. Linn. Soc. Bot. 34 (1898) 100; RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 114; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 167; RIDL. *Fl. Mal. Pen.* 5 (1925) 179. — *S. melanostoma* NEES *ex Boeck.* *Linnaea* 38 (1874) 514; CLARKE, *Fl. Br. Ind.* 6 (1894) 692; J. Linn. Soc. Bot. 34 (1898) 102. — *S. hirsuta* BOECK. *Linnaea* 38 (1874) 489, *ex descr.*; UITTEN in Backer, *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 58. — *S. exaltata* BOECK. *Bot. Jahrb.* 5 (1884) 511. — *S. hasskarliana* BOECK. *l.c.* — *S. haematostachys* BOECK. *l.c.* 512, *ex descr.*; UITTEN in Backer, *Bekn. Fl. Java* (em. ed.) 10 (1949) fam. 246, p. 58. — *S. ploemii* BOECK. *Bot. Jahrb.* 5 (1884) 513. — *S. kuntzei* BOECK. *Cyp. Nov.* 1 (1888) 34. — *S. rinkiiana* BOECK. *ibid.* 2 (1890) 30; CLARKE, *Fl. Br. Ind.* 6 (1894) 694. — *S. chinensis* *var. biauriculata* CLARKE, *l.c.* 690; J. Linn. Soc. Bot. 34 (1898) 101. — *S. luzonensis* PALLA, *Allg. Bot. Z.* 13 (1907) 49; MERR. *En. Philip.* 1 (1923) 134. — *S. corymbosa* (non ROXB.) RIDL. *Mat. Fl. Mal. Pen.* (Monoc.) 3 (1907) 109, *p.p.*; *Fl. Mal.*

Pen. 5 (1925) 176, p.p. — *S. cochinchinensis* DRUCE, Rep. Bot. Exch. Club Br. Isl. 4 (1917) 646; H. PREIFF. in Fedde, Rep. 26 (1929) 263; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 57. — *S. hookeriana* (an BOECK.?) KÜK. Bot. Jahrb. 59 (1924) 59. — *S. chinensis* var. *luzonensis* UITT. Rec. Trav. Bot. Néerl. 32 (1935) 201. — *S. chinensis* var. *luzonensis* f. *pilosa* UITTEN, l.c. — Fig. 104 (3 ×).

Perennial. Stems slender to very robust, erect or scrambling over bushes and then up to a height of several meters, glabrous to pubescent, more or less scabrous, up to 12 mm thick in the lower part. Leaves all scattered, gradually narrowed into a very long tip, (2-)5-20(-40) mm wide, margins and not rarely the nerves scabrous; sheaths more or less widened upwards, glabrous or pubescent, scabrid, often 3-winged, the wings not rarely narrow or absent; contraligule short, rounded, with a brown, scarious margin, glabrous or ciliate. Inflorescence very variable in size, consisting of up to 4 distant partial panicles; peduncles single at the nodes, usually distinctly exerted from the sheaths, scabrid; primary bracts overtopping the inflorescence, secondary ones long, setaceous. Spikelets unisexual, solitary or 2-3 together; ♂ spikelets lanceolate, 3-4 mm long; stamens 3; anthers linear, 1-2 mm long; ♀ spikelets broadly ovate,  $3\frac{1}{2}$ -4 $\frac{1}{2}$  mm long, the ♂ part reduced to a sterile glume. Disk shortly 3-lobed; lobes appressed, short, rounded, sometimes slightly denticulate at the top, ferruginous or yellow, purplish striolate. Nut ovoid or subglobose, terete to rather distinctly trigonous in the upper part, umbonulate, smooth to cancellate, often minutely hairy when young, glabrescent, shining, white or finally purplish or blackish,  $2\frac{1}{2}$ -3 by 2-3 mm.

Distr. Ceylon and India to China, Formosa, the Ryu Kyu Is., and Australia; in Malesia: common everywhere.

Ecol. Primary and secondary forests, open scrub, swampy places, from sea-level up to 2200 m.

Vern. *ilat, ilat gobang*, Sund., *kérisan, rija-rija*, N. Sum., *patari*, Cel., *téntaripa*, Talaud, *jebbing*, Sibil valley; Philip.: *papan, agagedán, egegedán*, Bon., *mankot*, Ig.; New Guinea: *uruqu*, Kutubu lang.

Notes. Of the Asiatic species of *Scleria* this is the most difficult to deal with. All perennial *Scleriae* with scattered leaves, short contraligule bordered by a brown scarious band, unisexual spikelets, and a disk with short, rounded lobes are covered by the description given above. No wonder that the much varied facies of this widely distributed species has led to the distinction of numerous segregates, which, however, cannot be upheld on a specific level. They at most represent a series of races connected by numerous intermediates.

Typical *S. terrestris* has distinctly winged leaf-sheaths, and cancellate white nuts, often minutely hairy when young, glabrescent at maturity. It occurs throughout the area given above, but from Farther India and the Malay Peninsula it is represented by a few collections only.

*S. radula* HANCE is vegetatively scarcely different. It was characterized by CLARKE as a robust, very slightly hairy plant with very scabrous, broad leaves, long setaceous secondary bracts, and white, smooth nuts. Additional characters are the narrowly winged leaf-sheaths and the rather distinctly trigonous upper half of the nut (fig. 104-9). *S. radula*

extends from S. China through Indo-China and the Malay Peninsula to Sumatra, sometimes associated with the typical *S. terrestris*. Several Malesian collections perfectly agree with the type from Hongkong. In a large number of them, however, the nuts are more or less cancellate, and in some, smooth nuts and cancellate ones occur on the same inflorescence. In other specimens referred to *S. radula* the secondary bracts are not more conspicuous than in *S. terrestris*. There is also a considerable variation regarding hairiness, scabridity, and width of the leaves, the latter sometimes being smooth, densely villous, or unusually narrow. I can see no sharp demarcation between *S. radula* and stout forms of *S. terrestris*. The latter were distinguished by CLARKE as *S. elata* var. *latior*. HOLTUM (in sched. SING) reduced *S. radula* to a variety of *S. terrestris*.

*S. haematostachys* BOECK. is common in W. Java. It has also smooth or slightly cancellate nuts, and may be somewhat nearer to the typical *S. terrestris* than *S. radula* is (fig. 104-9). In general it has narrower, not very scabrous leaves, less conspicuous secondary bracts, and dark purplish inflorescences. Specimens with perfectly smooth nuts, but otherwise not differing from typical *S. terrestris*, occur in the Philippines.

Often the exposed part of the nut becomes purplish to blackish with age. *S. kuntzei* BOECK., *S. melanostoma* NEES ex BOECK., *S. rinkiana* BOECK., and *S. elata* var. *decolorans* CLARKE were mainly based on this phenomenon not deserving nomenclatural recognition.

In the *S. terrestris* complex also the character of the sheaths of the middle leaves being winged or wingless appears to be unfit for specific delimitation. When wings are present their tops may be produced beyond the mouth of the sheath or fall short of it.

The scarious brown band along the margin of the contraligule is one of the best characters to distinguish *S. terrestris* from its nearest allies.

In *S. ciliaris* the scarious appendage of the contraligule is drawn out into a lanceolate tongue. It must, however, be admitted that *S. ciliaris* and *S. terrestris* are very close to each other, and that their delimitation almost solely rests upon the different shape of the contraligule.

Very stout, broad-leaved hirsute specimens, answering BOECKELER's description of *S. hirsuta*, have been collected in Java (see UITTEN, 1949, p. 58). I cannot separate them satisfactorily from broad-leaved, more or less glabrous *S. terrestris*.

10. *Scleria ciliaris* NEES in Wight, Contr. (1834) 117; in Hook. & Arn. Bot. Beech. Voy. (1837) 229; S. T. BLAKE, J. Arn. Arb. 35 (1954) 227; KERN, Blumea 11 (1961) 174; in Back. & Bakh. f. Fl. Java 3 (1968) 486. — *S. chinensis* KUNTH, En. 2 (1837) 357; STEUD. Syn. 2 (1855) 179; BOECK. Linnaea 38 (1874) 486; CLARKE, Fl. Br. Ind. 6 (1894) 690, excl. var. *biauriculata* CLARKE; J. Linn. Soc. Bot. 34 (1898) 101; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 114; CAMUS, Fl. Gén. I.-C. 7 (1912) 167; RIDL. Fl. Mal. Pen. 5 (1925) 180. — *S. bracteata* (non CAV.) BRONGN. in Duperrey, Voy. Bot. (1834) 165. — *S. bancana* MIQ. Sum. (1861) 262, 602; CLARKE, Fl. Br. Ind. 6 (1894) 693; J. Linn. Soc. Bot. 34 (1898) 102; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 112; J. Str. Br. R. As. Soc. n. 59 (1911) 225, incl. var. *nana* RIDL.;

CAMUS, Fl. Gén. I.-C. 7 (1912) 168; MERR. En. Born. (1921) 66; En. Philip. 1 (1923) 133; RIDL. Fl. Mal. Pen. 5 (1925) 178; UITTIEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 56. — *S. malaccensis* BOECK. *Linnaea* 38 (1874) 507. — Fig. 104.

Perennial. Stems rather stout, smooth or retrorsely scabrid on the angles, (30-)70-100(-200) cm by up to 6 mm. Leaves rather abruptly narrowed to the obtusish tip, all scattered or the middle ones more or less approximate and the upper ones remote, scabrous on the margins and the main nerves in the upper part, glabrous or sparsely hairy,  $\frac{3}{4}$ -1 $\frac{1}{2}$  cm wide; sheaths narrowly to broadly winged, glabrous, smooth or scabrid; contraligule rounded, with a scarios, elongate, lanceolate or oblong, glabrous, purplish, 1-1 $\frac{1}{2}$  cm long appendage, usually 2-3 times as long as wide. Inflorescence very variable in shape, consisting of 2-3 lateral partial panicles and a terminal one, often confluent into a pyramidal, very dense, compound panicle, or the lateral partial panicles remote to very remote, ovoid to very long and narrow, spike-like; peduncles hardly to much exerted from the sheaths; primary bracts overtopping the inflorescence, secondary ones setaceous, rigid, long-exserted from the panicles. Spikelets unisexual, 2-3 together, 4-5 mm long; ♂ spikelets lanceolate; stamens 3; anthers linear, c. 2 mm long; ♀ spikelets ovate, with a sterile lateral glume (the vestigial ♂ part of the spikelet). Disk 3-lobed; lobes appressed, triangular, obtuse, sometimes denticulate at the top, pale ferruginous. Nut ovoid or subglobose, obsoletely trigonous, umbonulate, slightly reticulate to undulate-rugulose, hirtellous on the transverse netted lines, finally glabrescent, shining, white or pale grey,  $2\frac{1}{3}$ -2 $\frac{1}{2}$  mm  $\varnothing$ .

Distr. Burma, Thailand, and Indo-China to S. China, the Solomons, Carolines, and tropical Australia; widely distributed in *Malesia*, in Java only in the Western part, not known from the Lesser Sunda Is., and in the Philippines only in Palawan and Busuanga.

Ecol. Primary and secondary forests, savannahs, wet places on road-sides, beach-walls, etc., at low and medium altitudes, usually below 1000 m, in Celebes up to 1100 m (in Annam up to 1500 m).

Vern. *Rumpit sëndayan bukit*, M, *ilat*, S, *rija-rija korisan*, Sum. E. C., *gëgas*, Banka, *përidang*, Kutei, *babandang*, *tabinsuroh*, *wannensil*, N. Born.

Notes. Readily recognizable by the long, scarios appendage of the contraligule and the long-exserted, stiff secondary bracts, which give the inflorescence a somewhat prickly appearance. Otherwise very variable in habit and size, and closely related to *S. terrestris* (L.) FASS.

Typical *S. ciliaris* has open, often large, brown inflorescences with long and narrow, often spike-like lateral panicles, whereas *S. bancana* has more compact, often very dense, oblong, greenish inflorescences, in which the short lateral panicles are not rarely confluent with the terminal one. *S. ciliaris sensu stricto* occurs in S. China, Indo-China, and — less pronounced — in W. Java. *S. bancana* has a much wider distribution. The two do not exclude each other geographically. They are united here, as the characters for discrimination are feeble, and because there is a continuous series between the two extremes.

11. *Scleria psilorhiza* CLARKE, Fl. Br. Ind. 6 (1894)

691; J. Linn. Soc. Bot. 34 (1898) 101; CAMUS, Fl. Gén. I.-C. 7 (1912) 164; KERN, *Blumea* 11 (1961) 176; in Back. & Bakh. f. Fl. Java 3 (1968) 487. — *S. alta* (non BOECK.) CAMUS, Fl. Gén. I.-C. 7 (1912) 166. — Fig. 104.

Perennial, with creeping stolons. Stems slender, scabrid to almost smooth, leafy throughout, (60-)90-150 cm by 2-4 mm. Leaves rather gradually narrowed to the slender acute tip, or (when broad) premorse (see notes), glabrous, retrorsely scabrid on the margins, (6-)10-25 mm wide; sheaths loose, broadly winged, the wings retrorsely scabrid on the edge; contraligule short, ovate or triangular, glabrous, with narrow, cartilagineous, incrassate, yellowish margin, which is often scabrid on the edge. Inflorescence dense, narrow, consisting of a terminal panicle up to 10 cm long, and often 1-2 smaller lateral ones; panicles single at the nodes, oblong, narrow because of the very short branches; peduncles scabrid, the lowest sometimes up to 5 cm exerted from its sheath; clusters of spikelets close together; primary bracts erect, longer than the panicles in their axils but not or hardly overtopping the inflorescence; secondary bracts subulate, standing out from the panicle, often curved. Spikelets ♀ (or bisexual) and ♂, 2-3 together, reddish brown; ♂ spikelets lanceolate, 4-5 mm long; stamens 3; anthers linear, 1 $\frac{1}{2}$ -2 mm long; nut-bearing spikelets broadly ovoid, c. 5 mm long, with a sterile or ♂ flower besides the ♀ one. Disk triangular, reflexed, shallowly or hardly 3-lobed, lobes very obtuse. Nut large, ovoid or broadly ovoid, not or slightly overtopping the glumes, very obtusely trigonous, obtuse, not beaked, smooth, very shining, white, 3-3 $\frac{1}{2}$  by c. 3 mm.

Distr. Very local and scattered, India through Thailand, Cambodia to N. Australia; in *Malesia*: W. Java (Cheribon: For. Distr. Indramaju), Philippines (Luzon: Laguna and Rizal Prov.), New Guinea (Papua).

Ecol. Along ditches under seasonal climatic lowland conditions, moist places in grasslands.

Notes. Close to *S. junghuhnii*, but readily recognizable by the presence of stolons, the stems not spongy at the base, the broadly winged sheaths, the narrow, spike-like, dense panicles, the long, setaceous ultimate bracts, the disk not surrounded by an elevation of the pericarp, the non-tubercled scar of the cupula, and the obtuse nut not, or hardly, overtopping the glumes.

This is the only Asian species sometime clearly showing the curious character of 'pre-morse' leaves. In such leaves (occurring in several African and American species) the lower part is broadened by a continuation of the wings of the leaf-sheath and shows 5 principal nerves. Towards the apex there is a sudden narrowing (usually at not quite opposite points of the margin). The distal part of the leaf is therefore much narrower than the proximal part, and has only 3 principal nerves. On the morphology and anatomy of this interesting type of leaves see CHERMEZON, Rev. Gén. de Bot. 38 (1926) 337-353.

12. *Scleria junghuhniana* BOECK. *Linnaea* 38 (1874) 499; KERN, *Blumea* 11 (1961) 177; in Back. & Bakh. f. Fl. Java 3 (1968) 487. — Fig. 105.

Perennial (?). Stems stout, spongy towards the thickened base, leafy throughout, scabrid on the

angles, up to 100 cm by 7 mm. *Leaves* broadly linear, rather abruptly narrowed to the obtusish tip, glabrous, retrorsely scabrid on the margins, 7–13 mm wide; sheaths loose, not winged, scaberulous on the angles; contraligule short, broadly ovate, rounded, glabrous, with scarious, whitish margin. *Inflorescence* very loose, consisting of a terminal panicle and 2–3 distant lateral ones; panicles single at the nodes, compound, ovoid, c. 10 by 5–8 cm, branches obliquely patent, scabrid, spike-like, or with a few secondary branches 1–3 cm long; peduncles long-exserted from the sheaths, scabrid; clusters of spikelets distant (1–2 cm spaced); primary bracts much longer than the panicles in their axils, but not overtopping the inflorescence; ultimate bracts very short, scale-like, shorter than as long as the clusters of spikelets in their axils. *Spikelets* bisexual and ♂, 2–3 together, reddish brown; ♂ spikelets lanceolate, 3 mm long; stamens 3; anthers oblong-linear, c. 1 mm long; nut-bearing spikelets broadly ovoid, 4 mm long, with 1–2 ♂ flowers besides the ♀ one; largest glume c. 3 mm long. *Disk* thick, triangular, narrow, reflexed, not lobed, brown, each side bordered by a low swelling of the pericarp; scar of the cupula with 3 depressed-conical tubercles. *Nut* large, much exserted from the glumes, ovoid, terete or obsoletely trigonous, acutish, not beaked, smooth, very shining, white, sometimes slightly discoloured,  $3\frac{1}{3}$ – $3\frac{1}{2}$  by  $2\frac{2}{3}$  mm.

*Distr.* Cambodia, Cochinchina; in *Malesia*: W. Java (For. Distr. Indramaju), Central Java (in moist places near Awu-Awu, Kedu).

*Ecol.* Along a ditch under seasonal climatic lowland conditions.

*Note.* Closely related to *S. lacustris* WRIGHT ex SAUVALLE, Anal. Acad. Cienc. Habana 8 (1871) 152 (*S. aquatica* CHERM. Bull. Soc. Bot. Fr. 77, 1930, 279) from tropical Africa and America (Cuba, French Guiana), and possibly only racially distinct from it. *S. lacustris* is an aquatic plant rooting at the lower nodes of the stem, with very scabrous stems, leaf-margins and leaf-sheaths, and branches of the inflorescence. The contraligule is semi-orbicular and bordered by a firm, brown band with a membranous appendage. The bracts subtending the clusters of spikelets are definitely longer than those in *S. junghuhniana*, the glumes much darker, and the nuts do not exceed the glumes.

13. *Scleria poaeformis* RETZ. Obs. 4 (1786) 13; WILLD. Sp. Pl. 4 (1805) 316; NEES in Wight, Contr. (1834) 118; KUNTH, En. 2 (1837) 358; STEUD. Syn. 2 (1855) 179; FISCHER, Kew Bull. (1931) 265; S. T. BLAKE, J. Arn. Arb. 35 (1954) 231; KERN, Blumea 11 (1961) 178; in Back. & Bakh. f. Fl. Java 3 (1968) 485. — *S. oryzoides* PRESL, Rel. Haenk. 1 (1828) 201; NEES in Wight, Contr. (1834) 116; KUNTH, En. 2 (1837) 356; STEUD. Syn. 2 (1855) 169; MIQ. Fl. Ind. Bat. 3 (1856) 342; BOECK. Linnaea 38 (1874) 492 ('*oryzoides*'); BENTH. Fl. Austr. 7 (1878) 432; CLARKE, Fl. Br. Ind. 6 (1894) 691; J. Linn. Soc. Bot. 34 (1898) 101; Philip. J. Sc. 2 (1907) Bot. 105; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 110; CAMUS, Fl. Gén. I.-C. 7 (1912) 164; MERR. En. Born. (1921) 67; En. Philip. 1 (1923) 134; RIDL. Fl. Mal. Pen. 5 (1925) 177; STEEN. Bull. Jard. Bot. Btzg III, 17 (1948) 399; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 57. — Fig. 105, 108.

Glabrous perennial with thick, horizontally creeping rhizome. *Stems* robust, smooth or scabrid on the angles at the top, often rooting from the lower nodes, 1–2 m by up to 2 cm. *Leaves* mainly basal and subbasal (1–3 higher on the stem), rather abruptly narrowed to the obtusish, somewhat cucullate tip, septate-nodulose, smooth, or scabrid on the margins and the 3 prominent nerves, up to 25 mm wide; upper sheaths acutely triquetrous or narrowly winged, smooth or scabrid on the angles, mouth concave or truncate on the ventral side, with narrow scarious margin; lower sheaths spongy, purplish red. *Inflorescence* as a rule a single, compound, long-peduncled panicle with a small setaceous bract at the base, or ebracteate, ovate or elliptic in outline, 10–20 by 5–10 cm, very rarely a lateral panicle in the axil of a leafy bract added; ultimate branches obliquely erect, spiciform. *Spikelets* solitary, sessile, evenly distributed along the spiciform branches, usually unisexual; ♂ spikelets numerous, 4–5 mm long; stamens 3; anthers linear, c.  $1\frac{1}{2}$  mm long; nut-bearing spikelets few, mostly restricted to the base of the bracts, 4–5 mm long, their ♂ part reduced to a sterile glume or to 1–2 flowers (often with 2 stamens); glumes ovate, acute, mucous. *Disk* small, much narrower than the base of the nut, thick, triangular-cordate (emarginate on one side only), appressed to the nut. *Nut* about as long as the glumes, obtusely trigonous to almost terete, ovoid, ellipsoid, or subglobose, not or scarcely apiculate, with 3 depressions at the base, smooth and glabrous, very shining, white,  $2\frac{2}{3}$ –3 by  $2\frac{1}{2}$ –3 mm.

*Distr.* Africa (Zanzibar, Mozambique); Ceylon and SE. India through Thailand and Indo-China to Hainan, and through Malesia to tropical Australia; widely spread in *Malesia*, but very local: Sumatra (Atjeh, Palembang), Malay Peninsula (Perlis, Kedah, Perak, Trengganu, Malacca, Johore, Singapore), W. Java, Borneo, Philippines (Luzon, Palawan), SE. Celebes, New Guinea (Papua, NE. New Guinea), Aru Is.

*Ecol.* Fresh-water swamps, swampy savannah-forests, fallow rice-fields, along ditches, in grasslands, at low altitudes, in Atjeh up to c. 1000 m, often forming dense, pure stands.

*Use.* In W. Java the leaves are sometimes used for making mats.

*Vern. N. Sum.:* bènjen; *Mal. Pen.:* rumpit siku dana, purun tikus, pèrau; *W. Java:* wlingi, S; *Borneo:* kara, Dusun, bundung, Bajau; *Philip.:* agás, Bik.

14. *Scleria sumatrensis* RETZ. Obs. 5 (1789) 19, t. 2; WILLD. Sp. Pl. 4 (1805) 315; NEES in Wight, Contr. (1834) 116; KUNTH, En. 2 (1837) 357; STEUD. Syn. 2 (1855) 171; MIQ. Sum. (1861) 262, 602; BOECK. Linnaea 38 (1874) 513; CLARKE, Fl. Br. Ind. 6 (1894) 693; J. Linn. Soc. Bot. 34 (1898) 103; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 113; CLARKE, Philip. J. Sc. 2 (1907) Bot. 106; Ill. Cyp. (1909) t. 129, f. 1–2; CAMUS, Fl. Gén. I.-C. 7 (1912) 170, f. 21, 9; MERR. En. Born. (1921) 67; En. Philip. 1 (1923) 135; RIDL. Fl. Mal. Pen. 5 (1925) 179; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 54; KERN, Blumea 11 (1961) 182; in Back. & Bakh. f. Fl. Java 3 (1968) 485. — Fig. 105.

Perennial. *Stems* robust, smooth or slightly scabrid, up to 4 m tall by up to 8 mm thick. *Leaves* in the middle part of the stems (and lower bracts) clustered

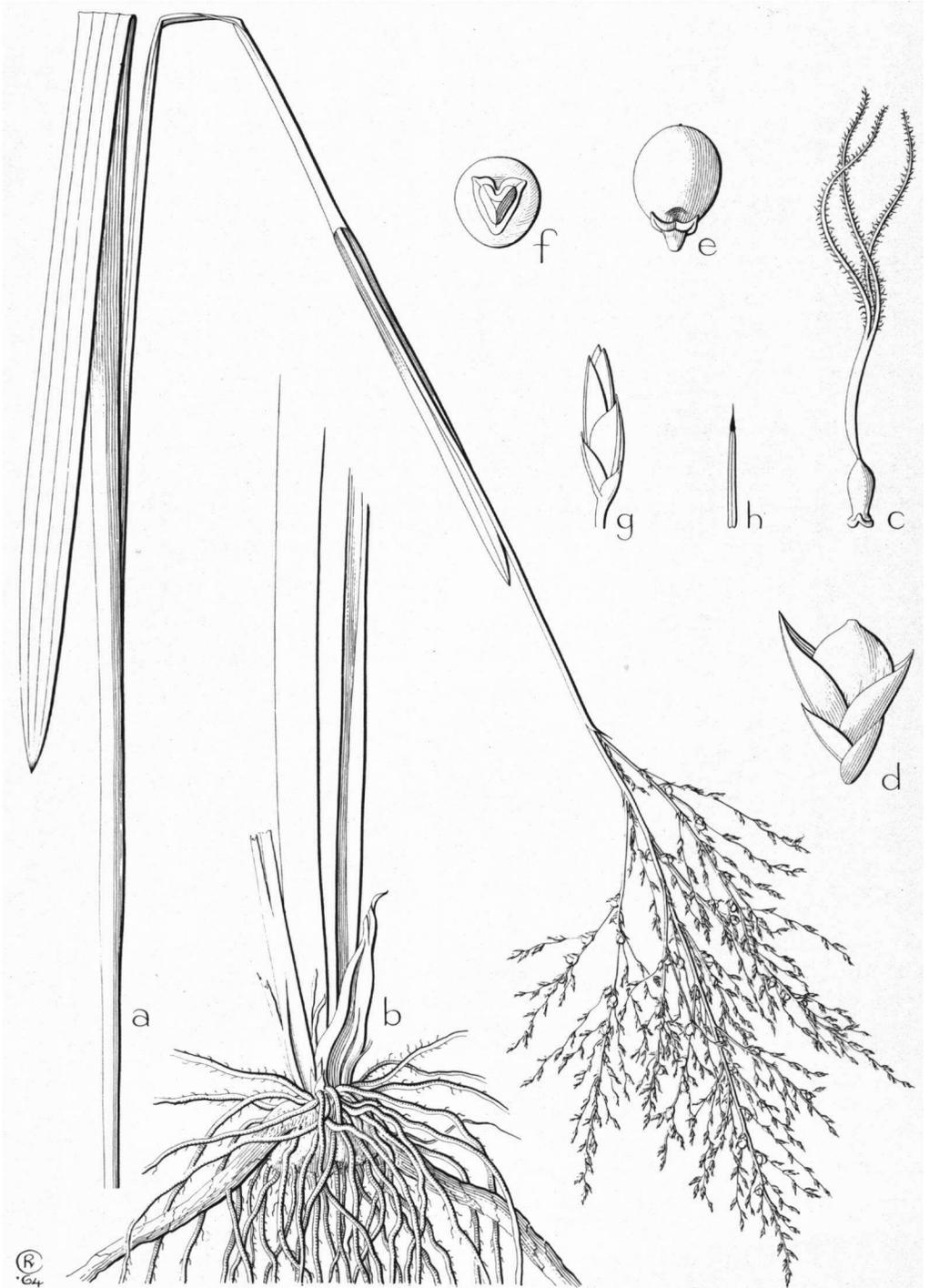


Fig. 108. *Scleria poaeformis* RETZ. a-b. Habit,  $\times \frac{1}{2}$ , c. pistil,  $\times 10$ , d. ♀ spikelet in fruit, e-f. nut, lateral and basal views, g. ♂ spikelet, all  $\times 5$ , h. anther,  $\times 10$ .

in pseudo-whorls of 3-5, gradually narrowed upwards, scabrous on the margins and the main nerves in the upper part, glabrous or puberulous at the base, up to 13 mm wide; sheaths narrow, glabrous or puberulous, wingless to rather broadly winged; contraligule very short, broadly rounded, ciliate. *Inflorescence* oblong, decompound, usually very dense, rarely rather loose, the terminal panicle up to 25 cm long, the lateral ones 2-3 together, on long peduncles; branches patent; primary bracts shorter than to about as long as the inflorescence, secondary ones setaceous. *Spikelets* in clusters of 2-3, unisexual, light or reddish brown, 4-5 mm long; ♂ spikelets lanceolate; stamens 3; anthers linear, c. 2 mm long; ♀ spikelets ovate, rounded at the base, the ♂ part reduced to a sterile glume; glumes ovate or broadly ovate, very acute, stramineous to purplish, with green keel. Cupula large and thick, c. 2 mm broad. *Disk* very large, cyathiform, coriaceous,  $\frac{1}{2}$ - $\frac{3}{4}$  as high as the nut (sometimes almost completely enveloping it),  $1\frac{1}{2}$ -2 mm high, strongly longitudinally plicate, half or less 3-lobed, at first yellowish, finally red; lobes broadened upwards, very obtuse, denticulate-crenulate, their margins contiguous or somewhat overlapping. *Nut* slightly shorter than the glumes, depressed-globose, terete, umbonulate, sparsely pilose, glabrescent, cancellate, shining, olivaceous-brown to greyish black, c. 2 mm ♂.

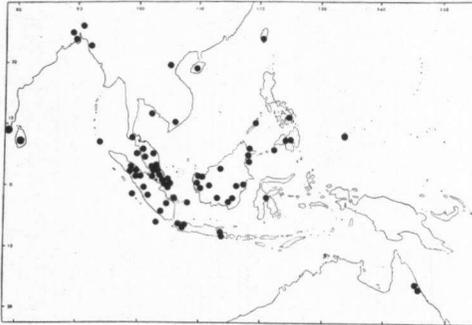


Fig. 109. Range of *Scleria sumatrensis* RETZ.

Distr. Ceylon and India to Formosa, Indo-China, and Queensland; W. Carolines; in *Malesia*: Sumatra and adjacent islands, Malay Peninsula, W. Java, E. Java (Djatitiro, Puger), Borneo, Celebes (Kolondale), Philippines (Palawan, Mindanao, Basilan, Leyte) Fig. 109.

Ecol. Dry open places, thickets, and forests, but also in swamps and swampy forests, at low altitudes (up to 500 m); often dominant.

Vern. *Rija-rija*, *si anit*, Sum., *rumpu kumba*, *r. sēsayah gajah*, *r. siamet*, *sēndayan*, Mal. Pen., *kares-kares*, *kēris-kēris*, *kērisan*, *pēredang*, *rambang*, *sampa hiering*, *tali juru*, Born.; Philip.: *balbalili*, Bon., *bulalo*, Sub., *pangpayung*, C. Bis.

15. *Scleria polycarpa* BOECK. *Linnaea* 38 (1874) 509; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 230; KERN, *Blumea* 11 (1961) 183; Pac. Pl. Areas 2 (1966) map 32. — *S. margaritifera* WILLD. *Sp. Pl.* 4 (1805) 312, non GAERTN. 1788; BOECK. *Linnaea* 38 (1874) 511;

BENTH. *Fl. Austr.* 7 (1878) 430; RENDLE in Gibbs, *Arfak* (1917) 200. — *S. graeffeana* BOECK. *Flora* 58 (1875) 121; BENTH. *Fl. Austr.* 7 (1878) 431, p.p.; K. SCH. *Bot. Jahrb.* 13 (1891) 266. — *S. levis f. villosa* VALCK. *SUR. Nova Guinea* 8 (1912) 712; KÜCK. *Bot. Jahrb.* 59 (1924) 58; ? OHWI, *Bot. Mag. Tokyo* 56 (1942) 212. — Fig. 105.

Perennial. *Stems* scabrid on the angles, glabrous or short-pubescent, often with asperous sides, up to 120 cm by 3-6 mm. *Leaves* in the middle part of the stem clustered, in pseudo-whorls of 2-5, gradually narrowed upwards, scabrid on the margins, more or less asperous above, glabrous or pubescent beneath, 5-10 mm wide; sheaths glabrous or pubescent, not winged; contraligule short, broadly rounded, hirsute-ciliate. *Inflorescence* narrow, dense or rather dense, 20-50 cm long, consisting of a terminal panicle and up to 7 lateral ones; panicles oblong, single or binate at the nodes, with obliquely erect, almost spiciform branches; primary bracts leafy, secondary ones inconspicuous, shorter than the branchlets in their axils. *Spikelets* 2-3 together, unisexual; ♂ spikelets narrowly lanceolate, c. 3 mm long; ♀ spikelets evenly distributed along the branchlets and throughout the panicles, numerous, suborbicular, rounded at the base, c. 4 mm long; stamens 3; anthers linear, c. 1 mm long. *Disk* large, coriaceous, less deeply 3-lobed than in *S. scrobiculata* and *S. purpurascens*, shining, bright yellow or reddish; lobes broadly triangular, very obtuse, prominently denticulate, appressed. *Nut* exerted from the glumes, globose, hardly or not umbonulate, almost smooth to slightly rugulose, hirtellous, white or (frequently) more or less tinged with blue, with purplish style-scar, 2-2½ mm long and wide.

Distr. Tropical Australia, through Melanesia to Fiji, Samoa, and Tonga Is.; in *Malesia*: Moluccas (Halmaheira, Ceram), New Guinea and adjacent islands. Fig. 110.

Ecol. Rain-forests, swamp-forests, forest-borders, banks of streams, also in coastal vegetation, at low altitudes, rarely up to 1200 m.

Vern. *Sāta*, Ceram, *simbora*, Orokawa lang., Mumuni.

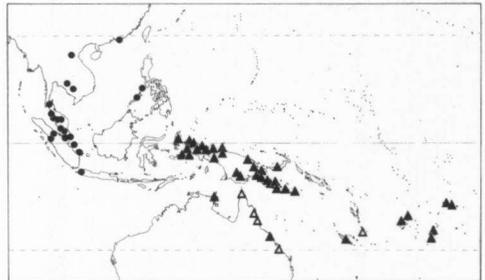


Fig. 110. Range of *Scleria polycarpa* BOECK. (triangles) and *S. corymbosa* ROXB. (dots) of which only few localities are indicated of its continental range from Ceylon to S. China.

16. *Scleria scrobiculata* NEES & MEY. ex NEES in Wight, *Contr.* (1834) 117; KUNTH, *En.* 2 (1837) 342; NEES, *Nov. Act. Ac. Caes. Leop.-Car.* 19, Suppl. 1 (1843) 119; STEUD. *Syn.* 2 (1855) 169; MIQ. *Fl. Ind.*

Bat. 3 (1856) 342, p. p.; BOECK. *Linnaea* 38 (1874) 508; CLARKE, Philip. J. Sc. 2 (1907) Bot. 106; MERR. Sp. Blanc. (1918) 83; En. Philip. 1 (1923) 135; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 55; S. T. BLAKE, J. Arn. Arb. 35 (1954) 229; KERN, *Blumea* 11 (1961) 184; in Back. & Bakh. f. Fl. Java 3 (1968) 485. — *S. trialata* (non POIR.) BRONGN. in Duperrey, Voy. Bot. (1834) 165. — *S. tessellata* (non WILLD.) DECNE, Nouv. Ann. Mus. Hist. Nat. 3 (1834) 362; Herb. Tim. Descr. (1835) 34. — *S. timorensis* NEES, *Linnaea* 9 (1835) 303, nom. nud. — *S. foveolata* (non CAV.) LLANOS, Fragm. Pl. Filip. (1851) 103; F.-VILL. & NAVES in Blanco, Fl. Filip. ed. 3, 4<sup>1</sup> (1880) 79. — *S. waigiouensis* STEUD. Syn. 2 (1855) 173; MIQ. Fl. Ind. Bat. 3 (1856) 345; cf. KERN, *Blumea* 11 (1961) 211. — *S. keyensis* K. SCH. in Warb. Bot. Jahrb. 13 (1890) 267, ex descr. — *S. purpureovaginata* (an BOECK.?) CLARKE, Philip. J. Sc. 2 (1907) Bot. 105; MERR. En. Born. (1921) 67. — Fig. 105 (3 ×).

*ssp. scrobiculata*. — Synonymy as above.

Perennial. *Stems* usually robust, scabrid on the angles, up to 2½ m tall and 4–10 mm thick. *Leaves* in the middle part of the stems clustered, in pseudo-whorls of 2–5, gradually narrowed upwards, scabrid on the margins and the main nerves, glabrous, rarely hairy, 4–20 mm wide; sheaths glabrous, wingless or winged (wings up to 1 cm wide, often protracted at the top into an up to 1 cm long auricle), green or purplish; contraligule short, broadly rounded, hirsute-ciliate. *Inflorescence* broad, up to 70 cm long, rather loose to dense, consisting of a large, broadly pyramidal terminal panicle and up to 7, single or binate lateral ones; branches patent; ultimate bracts conspicuous, more or less exerted from the panicle. *Spikelets* 2–3 together, unisexual; ♂ spikelets lanceolate, 3–4 mm long; ♀ ones at the base of the branchlets, ovoid, rounded at the base, 4 mm long; stamens 3; anthers 1–1½ mm long. *Disk* 3-lobed, triangular, thick, glabrous, yellowish; lobes triangular, obtuse, c. ⅓ as high as the nut, 1–1¼ mm long, denticulate at the top. *Nut* rather large, exerted from the glumes, ovoid or broadly ovoid, umbonate, scrobiculate, rarely smooth, hirtellous on the raised walls, glabrescent, white, 2½–3 by 2½–2½ mm.

Distr. Thailand, Indo-China, Andamans, through Malesia to Carolines, Palau Is. and Samoa; in Malesia: Malay Peninsula (Johore, once collected), Sumatra (very rare), Java, and Borneo; common in the Philippines and the Lesser Sunda Is., and probably not rare in Celebes, the Moluccas, and New Guinea.

Ecol. Damp shaded localities: thickets, forests, forest-borders, old clearings, etc., usually at low altitudes, rarely up to 1250 (1800?) m.

Vern. *Ilat*, *S. badingan*, *kërissan*, *J. kupuküë*, *Flores*, *tëntaripa*, *Talau*, *eri*, *Halmaheira*, *intarip*, *riap*, *rumpit piso*, *Minahassa*; Philip.: *agagidán*, *Bon.*, *aladán*, *amamgid*, *tangra*, *Ilk.*, *amgid*, *arat*, *daat*, *daut*, *katábán*, *ulat*, *Tag.*, *arat*, *dat*, *Pamp.*, *dáhat*, *Bik.*, *dat*, *haras*, *P. Bis.*, *gáat*, *mangked*, *Iv.*, *ulat*, *Pang.*, *telaíd*, Sub.: the Philippine names refer also to *S. purpurascens*; New Guinea: *nidiuk*, *Sempi*; Madang: *wurrah*, *Maprik*: *Sepik*.

*ssp. discocarpa* KERN, *Blumea* 11 (1961) 186. — Fig. 105c.

*Nut* small, strongly depressed, not or hardly

umbonate, smooth or slightly reticulate, white, 1½ by 2–2½ mm. *Disk* yellow, as wide as the nut. *Stems* smooth. *Leaf-sheaths* winged, smooth. *Inflorescence* loose, slender. ♀ *Spikelets* broadly ovate, 3 mm long and wide.

Distr. *Malesia*: New Guinea, probably also in the Moluccas (Halmaheira, Ceram).

Ecol. River-banks, lake-shores, etc., at low altitude.

Note. Connected with typical *S. scrobiculata* by intermediate forms.

17. *Scleria purpurascens* STEUD. Syn. 2 (1855) 169; MIQ. Fl. Ind. Bat. 3 (1856) 342; F.-VILL. Nov. App. (1882) 310; KERN, *Blumea* 11 (1961) 187; in Back. & Bakh. f. Fl. Java 3 (1968) 485. — *S. multifoliata* BOECK. *Linnaea* 38 (1874) 510; CLARKE, Fl. Br. Ind. 6 (1894) 693, incl. var. *pilosula* CLARKE; J. Linn. Soc. Bot. 34 (1898) 102; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 112; CLARKE, Ill. Cyp. (1909) t. 129 f. 3; CAMUS, Fl. Gén. I.-C. 7 (1912) 169; MERR. En. Born. (1921) 66; RIDL. Fl. Mal. Pen. 5 (1925) 178; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 55. — Fig. 105.

*var. purpurascens*. — Synonymy as above.

Perennial. *Stems* usually robust (but slender plants occur), pubescent or glabrous, smooth or scabrid on the angles, up to 2 m tall and 7 mm thick. *Leaves* in the middle part of the stems and lower bracts clustered, in pseudo-whorls of 2–5, gradually narrowed upwards, scabrous on the margins and the main nerves in the upper part, usually more or less pubescent especially beneath, rarely glabrous, 3–14 mm wide; sheaths usually pubescent, not winged, often purplish; contraligule short, broadly rounded, hirsute-ciliate. *Inflorescence* oblong, up to 50 cm long, consisting of a terminal panicle and up to 10 lateral ones, ultimately purple; lateral panicles solitary at the nodes or up to 4 together; primary bracts shorter than to about as long as the inflorescence, secondary ones long, setaceous. *Spikelets* 2–3 together, unisexual; ♂ spikelets lanceolate, 3–3½ mm long; stamens 3; anthers linear, 1½–2 mm long; ♀ spikelets at the base of the branchlets, obovoid when in fruit, cuneate at the base, 3½–4 mm long; ♂ part reduced to a sterile glume. *Cupula* much smaller and thinner than in *S. sumatrensis*. *Disk* 3-lobed, triangular when flattened out, thick, yellow-brown; lobes triangular, obtuse, c. ⅓–½ as high as the nut, denticulate-crenulate at the top. *Nut* small, not exerted from the glumes, ovoid, rather narrower than in the related spp., hirtellous at the top, glabrescent, finally dingy purplish to blackish, 2–2½ mm long, c. 2 mm wide.

Distr. Burma, Thailand, Indo-China; in Malesia: Sumatra and adjacent islands, Malay Peninsula, W. Java, very rare in Central Java, Borneo, Philippines (Palawan, Culion, Luzon, Samar, Leyte, Mindanao), Celebes (SE. Peninsula).

Ecol. Sunny and moderately shaded localities, secondary forests, brushwood, swampy grasslands, along roads, at low and medium altitudes, up to 1000 m.

Vern. *Daun kërisan*, (Mal. Pen.) *rumpit sasayang*, *r. sranit*, *M. sênayan*, *Lingga*, *rumpit béliđang*, *Enggano*, *pèrđang*, *Kutei*, *tali juru*, *N. Born.*

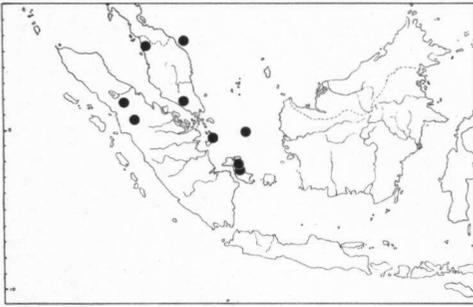


Fig. 111. Range of *Scleria purpurascens* STEUD. var. *ophirensis* (CLARKE) KERN.

var. *ophirensis* (CLARKE) KERN, Blumea 11 (1961) 188. — *S. multifoliata* BOECK. var. *ophirensis* CLARKE, Fl. Br. Ind. 6 (1894) 693; J. Linn. Soc. Bot. 34 (1898)

103; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 113; Fl. Mal. Pen. 5 (1925) 179.

Very coarse and rigid; leaves very densely aggregated in the middle of the stem, their sheaths much overlapping; lobes of the disk shorter than in the typical *S. purpurascens*.

Distr. *Malesia*: Sumatra, Banka, Riouw, Lingga, Malay Peninsula, and St. Barbe I. (S. China Sea). Fig. 111.

Ecol. Lowland and hills, in brushwood, obviously on poor soils, up to 1000 m (Kedah Peak).

Note. It is difficult to place this remarkable variety because of the absence of nuts in the rather numerous collections (except for a single fruit in the type). CLARKE treated it as a variety of *S. multifoliata* (= *S. purpurascens*), with the remark that perhaps it might represent a distinct species. As long as no complete fruiting material is available this seems the best solution of the question, although it is also possible that we are dealing with a systematically unimportant form from infertile soil with poor fructification and mostly vegetative propagation.

### 3. Section *Corymbosae*

BOECK. ex PAX in E. & P. Pfl. Fam. 2, 2 (1888) 121; CLARKE, Kew Bull. add. ser. 8 (1908) 132. — *Scleria C. Corymbosae* BOECK. Linnaea 38 (1874) 536. — *Scleria sect. Lithospermeae* CLARKE, Fl. Trop. Afr. 8 (1902) 493; Kew Bull. add. ser. 8 (1908) 132.

18. *Scleria corymbosa* ROXB. [Hort. Beng. (1814) 103, nom. nud.] Fl. Ind. ed. 2, 3 (1832) 574; CLARKE, Fl. Br. Ind. 6 (1894) 686; J. Linn. Soc. Bot. 34 (1898) 97; Philip. J. Sc. 2 (1907) Bot. 104; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 109, p.p.; CLARKE, Ill. Cyp. (1909) t. 124, f. 1–3; MERR. En. Philip. 1 (1923) 133; RIDL. Fl. Mal. Pen. 5 (1925) 176, p.p.; KERN, Blumea 11 (1961) 189. — *S. androgyna* NEES in Wight, Contr. (1834) 117; KUNTH, En. 2 (1837) 357; STEUD. Syn. 2 (1855) 168; BOECK. Linnaea 38 (1874) 536; RIDL. J. Str. Br. R. As. Soc. n. 23 (1891) 18. — *S. corymbifera* BOECK. Linnaea 38 (1874) 537. — *S. ridleyi* CLARKE, Fl. Br. Ind. 6 (1894) 686; J. Linn. Soc. Bot. 34 (1898) 97; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 109; CLARKE, Ill. Cyp. (1909) t. 124, f. 4; CAMUS, Fl. Gén. I.-C. 7 (1912) 160; RIDL. Fl. Mal. Pen. 5 (1925) 177. — Fig. 105.

Perennial. Stems often robust (but slender specimens not rarely occur), smooth or scaberulous in the upper part, up to 2 m by 1 cm. Leaves abruptly narrowed to the obtusish tip, glabrous, smooth or somewhat scaberulous on the margins near the top, 7–25 mm wide; sheaths loose, not winged, smooth or scaberulous on the angles, glabrous; contraligule broadly ovate-triangular, glabrous, with a broad, fuscous, scarios margin. Inflorescence often copious, up to 75 cm long, consisting of a few to several distant fascicles of panicles; lateral panicles 2–3 together at the nodes, rarely solitary, dense, decompound, corymbiform; peduncles very unequal, up to 10 cm exerted from the sheaths; lower primary bracts usually overtopping the inflorescence; secondary bracts subulate. Spikelets bisexual and ♂, stramineous to dark brown, 4–5 mm long; ♂ spikelets lanceolate; stamens 3; anthers c. 2 mm

long; bisexual spikelets broadly ovoid, with some ♂ flowers besides the ♀ one. Disk obsolete, reduced to a brown or reddish, narrow, triangular, minutely glandular band concrete with the nut. Nut ovoid, obtusely trigonous, with 3 shallow depressions at the base, acute, hardly or not umbonulate, shining, snowy white, rarely somewhat discoloured, 3–3½ by 2–2½ mm.

Distr. From India and Ceylon to S. China; in *Malesia*: Sumatra (also Banka and Lingga), Malay Peninsula, W. Java, Philippines (Palawan, Culion), everywhere very local. Fig. 110.

Ecol. Damp, shaded localities, swamp-forests, but also wet places in the open, at low altitudes, up to 300 m.

Vern. *Ilat badak*, *S. korisan*, *si anit tombak*, *si marpandanpandan*, Sum. E. C.

19. *Scleria lithosperma* (L.) Sw. Prod. (1788) 18; NEES in Wight, Contr. (1834) 117; KUNTH, En. 2 (1837) 349; STEUD. Syn. 2 (1855) 173; MIQ. Fl. Ind. Bat. 3 (1856) 344, incl. var. *β*; BOECK. Linnaea 38 (1874) 451; BENTH. Fl. Austr. 7 (1878) 429; CLARKE, Fl. Br. Ind. 6 (1894) 685; J. Linn. Soc. Bot. 34 (1898) 96; Philip. J. Sc. 2 (1907) Bot. 103; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 108; CLARKE, Ill. Cyp. (1909) t. 123, f. 1–4; MERR. Fl. Manila (1912) 120; CAMUS, Fl. Gén. I.-C. 7 (1912) 161, f. 21, 5; MERR. En. Born. (1921) 66; En. Philip. 1 (1923) 133; RIDL. Fl. Mal. Pen. 5 (1925) 176; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 54; S. T. BLAKE, J. Arn. Arb. 35 (1954) 224; KERN, Blumea 11 (1961) 191; in Back. & Bakh. f. Fl. Java 3 (1968) 485. — *Kaden Pullu* RHEEDE, Hort. Malab. 12 (1703) t. 48. — *Scirpus lithospermus* LINNÉ, Sp. Pl. 1 (1753)

51. — *Schoenus lithospermus* LINNÉ, *ibid.* ed. 2, 1 (1762) 65. — *S. tenuis* RETZ. Obs. 4 (1786) 13; ROXB. Fl. Ind. ed. 2, 3 (1832) 574. — *S. filiformis* Sw. Prod. (1788) 19; ZOLL. Syst. Verz. 1 (1854) 61. — *S. capillaris* R. BR. Prod. (1810) 240; KUNTH, En. 2 (1837) 349; STEUD. Syn. 2 (1855) 173. — *S. glaucescens* PRESL, Rel. Haenk. 1 (1828) 202; STEUD. Syn. 2 (1855) 174, *ex descr.* — *Hypoporum capillare* NEES, Linnaea 9 (1834) 303. — *Hypoporum lithospermum* NEES in Mart. Fl. Bras. 2, 1 (1842) 172. — *S. wightiana* STEUD. Syn. 2 (1855) 176. — Fig. 105.

*var. lithosperma.* — Synonymy as above.

Perennial. *Stems* slender, smooth, 40–60(–90) cm by 1–2 mm. *Leaves* often somewhat aggregated towards the middle of the stem, gradually narrowed to the obtusish tip, glabrous to sparsely pubescent, glaucescent, 1–4 mm wide; sheaths narrow, not winged, usually pubescent in the middle of the sides and glabrous on the angles, more rarely wholly glabrous; contraligule short, obtuse, ovate or triangular, hirsute or ciliate. *Inflorescence* narrow, very loose, up to 30 cm long, with a terminal panicle and 2–3 distant axillary ones; panicles almost spiciform or somewhat compound, with few spikelets; primary bracts usually much exceeding their panicles. *Spikelets* bisexual (or a few ♂ ones added?), solitary or in clusters of 2–3, with 1 ♀ flower and a few to several ♂ ones, 3–5 mm long; stamens 1(–2); anthers linear,  $\frac{3}{4}$ – $1\frac{1}{2}$  mm long; glumes ovate to lanceolate, acuminate, cuspidate or mucronulate, ferruginous. *Disk* reduced to a narrow, brown, minutely glandular ring concrete with the base of the nut. *Nut* ovoid or oblong-ovoid, obtusely trigonous, minutely umbonulate, about as long as the glumes, at the base

with 3 depressions which are rugulose by transverse, wavy, ferruginous, minutely glandular ridges, otherwise smooth and shining,  $2\frac{2}{3}$  by  $1\frac{1}{2}$ –2 mm.

*Distr.* Pantropical, the most widely distributed species of the genus; throughout *Malesia*.

*Ecol.* Open places, forest edges, rocky and sandy beaches, at low altitudes, up to 600 m (in New Guinea even up to 1000 m).

*Vern.* *Rumput kērisan*, *r. sangit*, *r. sianit darat*, *salit kēchil M*, *jaha tading*, Alor, *rumpul luwung*, Sumbawa, *tjaka ma gaolē*, Ternate, *ēri*, Halmahera; New Guinea: *momoab*, Wanigela, *widzi*, Onjob lang., *wammoam*, Miniafia lang.; Philip.: *daat*, *katābad*, Tag., *talaid*, Bag.

*var. linearis* BENTH. Fl. Austr. 7 (1878) 430; KERN, Blumea 11 (1961) 192. — *S. lithosperma var. roxburghii* CLARKE, Fl. Br. Ind. 6 (1894) 686; J. Linn. Soc. Bot. 34 (1898) 97; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 109; CLARKE, Philip. J. Sc. 2 (1907) Bot. 104; Ill. Cyp. (1909) t. 123, f. 5; MERR. En. Philip. 1 (1923) 133; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 54. — *S. roxburghii* DOMIN, Bibl. Bot. Heft 85 (1915) 487; S. T. BLAKE, J. Arn. Arb. 35 (1954) 224. — Fig. 105.

Entire surface of the nut rugulose by transverse wavy ridges, which are somewhat viscid on the upper margin.

*Distr.* Ceylon and India through Thailand and Indo-China to tropical Australia; according to BOECKELER also in Fiji; in *Malesia*: Malay Peninsula (Johore, Dindings), Philippines (Bawean, Luzon, Golo), Lesser Sunda Is. (Sumba, Wetar), New Guinea (Papua).

#### 4. Section Carphiformes

KERN, Blumea 11 (1961) 193.

20. *Scleria carphiformis* RIDL. J. Fed. Mal. St. Mus. 6 (1915) 194; Fl. Mal. Pen. 5 (1925) 180; KERN, Blumea 11 (1961) 193. — *S. neesii* (non KUNTH) RIDL. J. Str. Br. R. As. Soc. n. 46 (1906) 227; CLARKE *ex* RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 115, *pro var. borneensis* CLARKE *ex* RIDL.; MERR. En. Born. (1921) 66; CAMUS, Fl. Gén. I.-C. 7 (1912) 164, *pro var. hirsutissima* CAMUS. — Fig. 105, 112.

Probably perennial. *Stems* slender, smooth, retroversely hirsute especially on the middle of the sides, to glabrous, 10–40 cm by  $\frac{1}{2}$ –1 mm. *Leaves* aggregated towards the base of the stems, usually much overtopping the stem, with obtuse tip, smooth, pubescent with long, white or greyish, patent hairs, sometimes glabrescent, 3–5 mm wide; sheaths narrow, pubescent, not winged; mouth of sheaths truncate or emarginate, not appendaged. *Inflorescence* consisting of a very dense, globose or semiglobose, terminal cluster of spikelets 1–2 cm across, and 1–2 smaller clusters (sometimes reduced to a single spikelet) lower down on the stem, on capillary, more or less exerted peduncles in the axil of a leaf-like bract. *Spikelets* strictly unisexual, large, 8–9 mm long, ferruginous or rufescent; ♂ spikelets lanceolate, narrow, acute; stamens 3; anthers linear, 3 mm long; ♀ spikelets ovate-lanceolate; glumes

5–6, lanceolate, acute, mucinous, pubescent with long patent hairs especially near the margins and on the keel; style 3 mm. Cupula thick, large,  $1\frac{1}{2}$ –2 mm. *Disk* almost as wide as the nut, not or hardly lobed, pale. *Nut* globose, distinctly apiculate by the remainder of the style, with 6 pits at the base, densely tuberculate, stellately hairy on the top of the tubercles, dull, white or greyish brown,  $1\frac{1}{2}$ – $1\frac{2}{3}$  mm across.

*Distr.* Cochinchina; in *Malesia*: Malay Peninsula (Kedah: Kedah Peak; Trengganu: Padang Kandis; Pahang: G. Tahan), Borneo, SE. Celebes (Rumbia). Fig. 107.

*Ecol.* On Kedah Peak in grassy spots surrounded by forest, on G. Tahan abundant on slightly damp, exposed rocks and scree, in Padang Kandis in sandy *Melaleuca* forest, in Celebes in moist monsoon forest; at low altitudes, up to 900 m.

*Note.* The Kedah Peak plants are much less hairy than the others.

21. *Scleria neesii* KUNTH, En. 2 (1837) 358; STEUD. Syn. 2 (1855) 175; BOECK. Linnaea 38 (1874) 449; CLARKE, Fl. Br. Ind. 6 (1894) 688, *excl. specim. born.*; J. Linn. Soc. Bot. 34 (1898) 99, *excl. var.*; CAMUS, Fl. Gén. I.-C. 7 (1912) 164, f. 21, 6, *excl. var. hirsutissima*

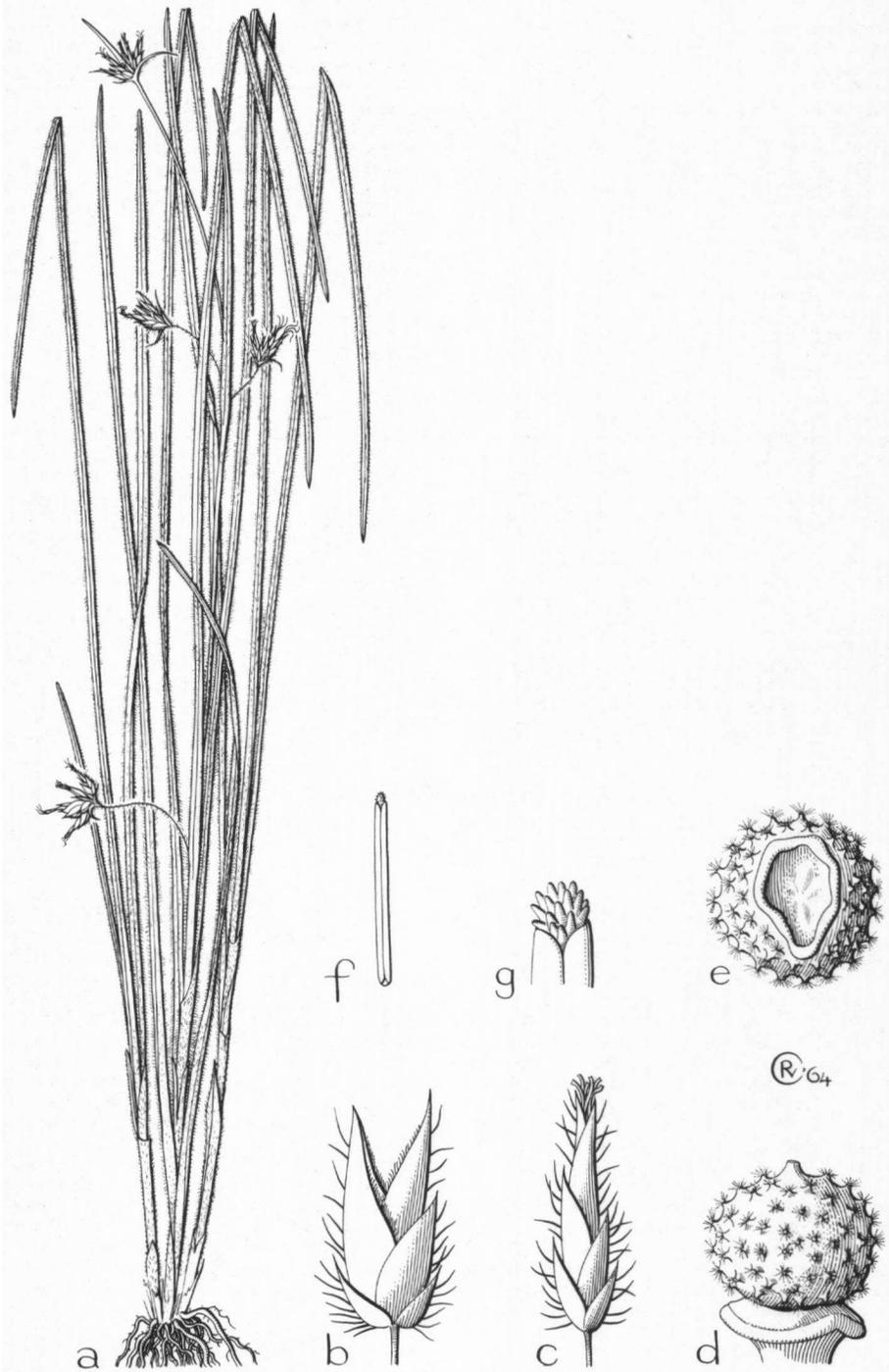


Fig. 112. *Scleria carphiformis* RIDL. a. Habit,  $\times \frac{2}{3}$ , b. ♀ spikelet, c. ♂ spikelet, both  $\times 4$ , d-e. nut, lateral and basal views,  $\times 12$ , f. anther,  $\times 10$ , g. anther tip, enlarged (a-g SINCLAIR & KIAH SF 40432).

CAMUS; KERN, *Blumea* 11 (1961) 194. — *Hypoporum capitatum* NEES, *Edinb. New Phil. J.* 17, n. 34 (1834) 267; in Wight, *Contr.* (1834) 118; *Linnaea* 9 (1835) 303. — Fig. 105.

Very similar in habit and closely related to *S. carphiformis* RIDL. Usually smaller (rarely up to 30 cm tall), with narrower leaves 2–3 mm wide, and copiously pubescent all over with long, white or greyish patent hairs. Leaves from much shorter than to about as long as the stems. *Inflorescence* consisting of a terminal cluster 1–1½ cm wide; no axillary clusters in the axil of the foliaceous bract, which therefore has become an ordinary leaf near the top of the stem. *Spikelets* usually slightly smaller, 6–8 mm

long; glumes of ♀ spikelets 4, distinctly mucronulate, hairy all over; anthers 1½ mm long; appendage of the connective smooth or nearly so. Style c. 2 mm long. Cupula small, c. 1 mm wide. *Disk* very small, much narrower than the nut, columnar, triquetrous, with a strong rib on each side, forming a stipe under the nut. *Nut* not or hardly apiculate (the remainder of the style not longer than the tubercles on the nut).

*Distr.* Ceylon, Thailand, Cochinchina, Tonkin, Laos, Annam; in *Malesia*: Malay Peninsula (Perlis: Bukit Ketri), once collected, together with *S. thwaitesiana*. Fig. 107.

*Ecol.* On Bukit Ketri in swampy places in 'heath', at low altitudes.

### 5. Section Hypoporum

(NEES) ENDL. *Gen. Plant.* (1836) 112. — *Hypoporum* NEES, *Edinb. New Phil. J.* 17, n. 34 (1834) 266. — *Scleria subg. Hypoporum* CLARKE in Hook *f. Fl. Br. Ind.* 6 (1894) 685; *Kew Bull. add. ser.* 8 (1908) 131.

22. *Scleria pergracilis* (NEES) KUNTH, *En.* 2 (1837) 354; STEUD. *Syn.* 2 (1855) 176; BOECK. *Linnaea* 38 (1874) 438; CLARKE, *Fl. Br. Ind.* 6 (1894) 685; *J. Linn. Soc. Bot.* 34 (1898) 96; *Ill. Cyp.* (1909) t. 121, f. 1–5; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 160, f. 21, 1–4; MERR. *En. Philip.* 1 (1923) 134; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 224; KERN, *Blumea* 11 (1961) 196. — *Hypoporum pergracile* NEES, *Edinb. New Phil. J.* 17, n. 34 (1834) 267; in Wight, *Contr.* (1834) 118. — Fig. 105.

Annual. *Stems* very slender, glabrous and smooth, 25–50 cm by ½–1 mm. *Leaves* narrowly linear, acutish, glabrous, scabrid towards the top, ½–2 mm wide; sheaths narrow, not winged, smooth, glabrous or sparsely pilose, truncate at the mouth or with a very short membranous appendage. *Inflorescence* linear, unbranched, spiciform, consisting of 5–25 clusters of spikelets; clusters almost sessile, small, with 2–5 spikelets, the lower ones 1–1½ cm distant, upper ones subcontiguous; bracts inconspicuous, not or hardly longer than the clusters of spikelets in their axils. *Spikelets* bisexual, small, obovate, 2½–3 mm long; glumes ovate-lanceolate, acute, mucicous, glabrous, densely beset with reddish glandular streaks, those of the ♂ flowers thinly membranous; stamens 2; anthers linear, c. 1 mm long. Cupula very small (c. ½ mm), triangular. *Disk* obsolete, concrete with the nut, forming a brown

triquetrous stipe ½–½ mm high. *Nut* much shorter than the glumes, obtusely trigonous, slightly depressed, apiculate, lacuno-rugose, and tuberculate especially towards the top, glabrous, shining, white, 1–1½ mm long and wide.

*Distr.* Tropical Africa; Ceylon, India, Thailand, Indo-China, Yunnan; in *Malesia* very rare: Sumatra (Karo Plateau), Philippines (Luzon: Bontoc; Mindanao: Cotabato), NE. New Guinea.

*Ecol.* Open slopes, edges of swamps, savannahs, at low and medium altitudes, up to c. 1500 m.

*Uses.* In Sumatra the strongly lemon-scented leaves are used as a remedy against fever and foot-and-mouth disease; in New Guinea they are eaten with salt.

*Vern.* *Sajat-sajat djëlma*, Sum., *kamiwa*, NE. New Guinea, Manki lang.; Philip.: *bangbangló*, Bon.

*Note.* The numerous spikelets I dissected were all bisexual, the ultimate one of each cluster frequently with much reduced androecium and gynoecium, not maturing a nut. CLARKE (*Fl. Trop. Afr.* 8, 1902, 495) described the African specimens as having also many ♂ spikelets, similar to the bisexual ones, except that they lack the third nut-bearing glume. Also PRÉART (*Lejeunia*, *Mém.* 13, 1951, 20) mentions the presence of strictly ♂ spikelets. They may have mistaken the reduced ultimate spikelets for ♂ ones.

### 6. Section Tessellatae

CLARKE in Hook *f. Fl. Br. Ind.* 6 (1894) 686. — *Scleria subg. Tessellatae* CLARKE, *Kew Bull. add. ser.* 8 (1908) 132.

23. *Scleria biflora* ROXB. *Fl. Ind. ed.* 2, 3 (1832) 573; CLARKE, *Fl. Br. Ind.* 6 (1894) 687; *J. Linn. Soc. Bot.* 34 (1898) 98; RIDL. *Mat. Fl. Mal. Pen. (Monoc.)* 3 (1907) 114; CLARKE, *Ill. Cyp.* (1909) t. 127, f. 1–2; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 163, f. 21, 7; RIDL. *Fl. Mal. Pen.* 5 (1925) 180; UITTEN in Backer, *Bekn. Fl. Java (em. ed.)* 10 (1949) fam. 246, p. 56; KERN, *Blumea* 11 (1961) 197; in Back. & Bakh. *f.*

*Fl. Java* 3 (1968) 486. — *S. tessellata* (non WILLD.) NEES in Wight, *Contr.* (1834) 118; KUNTH, *En.* 2 (1837) 343; STEUD. *Syn.* 2 (1855) 169; OCHSE & BAKH. *Ind. Groent.* (1931) 222; *Veg. D. E. I.* (1931) 221. — *S. propinqua* STEUD. *Syn.* 2 (1855) 169; MIQ. *Fl. Ind. Bat.* 3 (1856) 343. — *S. steudeliana* MIQ. *Fl. Ind. Bat.* 3 (1856) 344; Sum. (1861) 262; BOECK. *Linnaea* 38 (1874) 475. — Fig. 106, 113.

*ssp. biflora*. — Synonymy as above.

Annual. *Stems* slender, smooth, leafy, (15–)30–45(–75) cm by 1–2 mm. *Leaves* weak, abruptly narrowed to the obtusish tip, glabrous or sparsely pilose, scabrid on the margins in the upper part and on the midrib on the underside, 3–4(–8) mm wide; sheaths narrowly winged, retrorsely scaberulous on the angles or smooth; contraligule from much broader than long to as broad as long, rounded, with narrow, membranous, ciliate margin. *Inflorescence* narrow, elongate, consisting of 2–4 panicles; terminal panicle 2–4 cm long, somewhat longer than the lateral ones, these remote, single or binate at the nodes, on somewhat exserted, smooth peduncles; primary bracts erect, much longer than the panicles in their axil but usually not overtopping the inflorescence; secondary bracts subulate. *Spikelets* either ♂ and ♀, or ♂ and bisexual; ♂ spikelets lanceolate, 3–4 mm long; stamens 2–3; anthers c. 1 mm; nut-bearing spikelets obovoid, 4–4½ mm long, with 1(–2) ♂ or barren flowers at the base. *Disk* deeply 3-lobed; lobes appressed, lanceolate, acute, gradually narrowed upwards, ferruginous, reaching to ½ height of the nut. *Nut* globose or slightly depressed, regularly cancellate (the pits in vertical rows), beaked with the black or purplish persistent style-base, with 6 deep pits at the base (2 in each sinus of the disk-lobes), dull, white, ferruginous-pubescent on the walls between the lacunae, (1½–)2 mm across; lacunae deep, square to broader than long.

*Distr.* Ceylon and India through Farther India to S. China, Formosa and the Ryu Kyu Is.; in *Malesia* in the Western part, eastwards to the Philippines and Celebes, southwards to Java, Madura, and Kangean Is. Fig. 114.

*Ecol.* Grassy road-sides, brushwood, weed in rice-fields and tea-plantations, often gregarious, at low altitudes (up to 900 m).

*Use.* In Java the very young fragrant plants are eaten with the rice, as *lalab*, either raw or steamed.

*Vern.* *Ilat*, *i. huma*, *i. lalab*, *i. lètik*, *S. kèrisan*, *M. sèsalit*, *Alas landa*.

*Notes.* *S. biflora* is a well-marked species, readily recognizable by the globose, deeply cancellate, black-tipped nut deeply pitted between the long disk-lobes.

The roots strongly smell of camphor or cajaput.

*ssp. ferruginea* (OHWI) KERN, *Reinwardtia* 6 (1961) 76; *Blumea* 11 (1961) 199. — *S. ferruginea* OHWI, *Act. Phytotax. Geobot.* 7 (1938) 37. — Fig. 106.

Very slender, sometimes almost 1 m tall. *Leaves* rigid, 1–2 mm wide. *Disk-lobes* shorter, reaching to ½ height of the nut, suddenly caudate-mucronate from an ovate base. *Nut* at first often densely ferruginous-tomentose; lacunae less deep, often partly longer than broad; walls between the lacunae broader; beak shorter.

*Distr.* Ryu Kyu Is., Formosa, and Thailand; in *Malesia*: Malay Peninsula (Johore), once found.

24. *Scleria mikawana* MAKINO, *Bot. Mag. Tokyo* 27 (1913) 57; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18 (1944) 7; NELMES, *Kew Bull. n. 1* (1956) 107; KERN, *Blumea* 11 (1961) 199. — *S. tessellata* (non WILD.) BOECK. *Linnaea* 38 (1874) 470, *p.p.*; CLARKE, *Fl. Br. Ind.* 6 (1894) 686, *p.p.*; S. T. BLAKE, *J. Arn. Arb.* 35 (1954) 225, *excl. synon.* — *S. glabroreticulata*

DE WILD. *Pl. Bequaert.* 4 (1927) 230, f. 4; PRÉRART, *Lejeunia*, *Mém.* 13 (1953) 43, t. 2, f. 9, 10, 22. — Fig. 106.

Annual. *Stems* slender but firm, smooth or sometimes slightly scaberulous, 30–80(–120) cm by 2–3 mm. *Leaves* rather abruptly narrowed to the obtusish or acutish tip, glabrous, smooth or scaberulous on the margins and main nerves in the upper part, 2½–4(–7?) mm wide; sheaths narrow, not winged, smooth, glabrous or sparsely pubescent on the anterior side; contraligule membranous, short, semi-orbicular, ciliate. *Inflorescence* narrow, elongate, consisting of a terminal panicle and 1–2 lateral, remote, spike-like ones, with few spikelets, the terminal panicle somewhat longer than the lateral ones, these single at the nodes, on scarcely exserted, smooth peduncles; primary bracts erect, longer than the panicle in their axil, upper and secondary ones subulate. *Spikelets* unisexual; ♂ spikelets distinctly peduncled (peduncles ½–1½ cm long, the lowest often curved outwards, often reddish), lanceolate, pale or stramineous, 4–5 mm long; stamens 3; anthers linear, c. 1½ mm long; ♀ spikelets c. 5 mm long, the glumes oblong-ovate, acute or mucronulate, more or less reddish with green keel; often a sterile glume besides the ♀ flower. *Disk* thickish, deeply 3-lobed, yellowish or light green; lobes oblong, acute, sinuses obtuse. *Nut* globose or ovoid-globose, obscurely trigonous, minutely umbo-nulate, scrobiculate, 2–2¼ by c. 2 mm; lacunae rather deep, oblong to ovate, in longitudinal rows; walls between the lacunae broad, white, finally ferruginous, forming a more or less continuous surface interrupted by the lacunae.

*Distr.* Tropical Africa; Ceylon and India to Japan; in *Malesia*: a few times collected in New Guinea (Papua).

*Ecol.* Savannas, shores of lakes, by streams, in rain-forests, at low and medium altitudes, up to 1300 m.

25. *Scleria annularis* [KUNTH, *En.* 2 (1837) 359, *nom. nud.*] NEES ex STEUD. *Syn.* 2 (1855) 176, *ex descr.*; BOECK. *Linnaea* 38 (1874) 456; CLARKE, *Fl. Br. Ind.* 6 (1894) 687; *J. Linn. Soc. Bot.* 34 (1898) 98; KERN, *Blumea* 11 (1961) 200. — *Hypoporum annulare* NEES, *Linnaea* 9 (1835) 303, *nom. nud.* — Fig. 106.

Annual. *Stems* slender or medium, very sharply triquetrous, glabrous or sparsely pubescent, retrorsely scabrous on the angles, 2–3-noded below the inflorescence, 30–100 cm by 2–3 mm. *Leaves* gradually narrowed to the obtusish tip, glabrous or sparsely pubescent, antrorsely scabrous on the margins and the main nerves especially in the upper part, 3–6 mm wide; sheaths not winged, retrorsely scabrous, glabrous or pubescent on the anterior side; contraligule ovate or triangular, glabrous or ciliate, up to 3 mm long. *Inflorescence* narrow, elongate, consisting of a terminal panicle and 2–3 remote lateral ones, the terminal panicle 3–4 by 1–1½ cm, somewhat longer than the lateral ones, these single at the nodes, more rarely binate, their peduncles more or less (the lowest up to 10 cm) exserted from the sheaths, smooth or scabrid, 2-winged at the dilated top; primary bracts erect, much longer than the panicles in their axils, overtopping the inflorescence; secondary bracts subulate, much exserted from the panicles. *Spikelets* almost

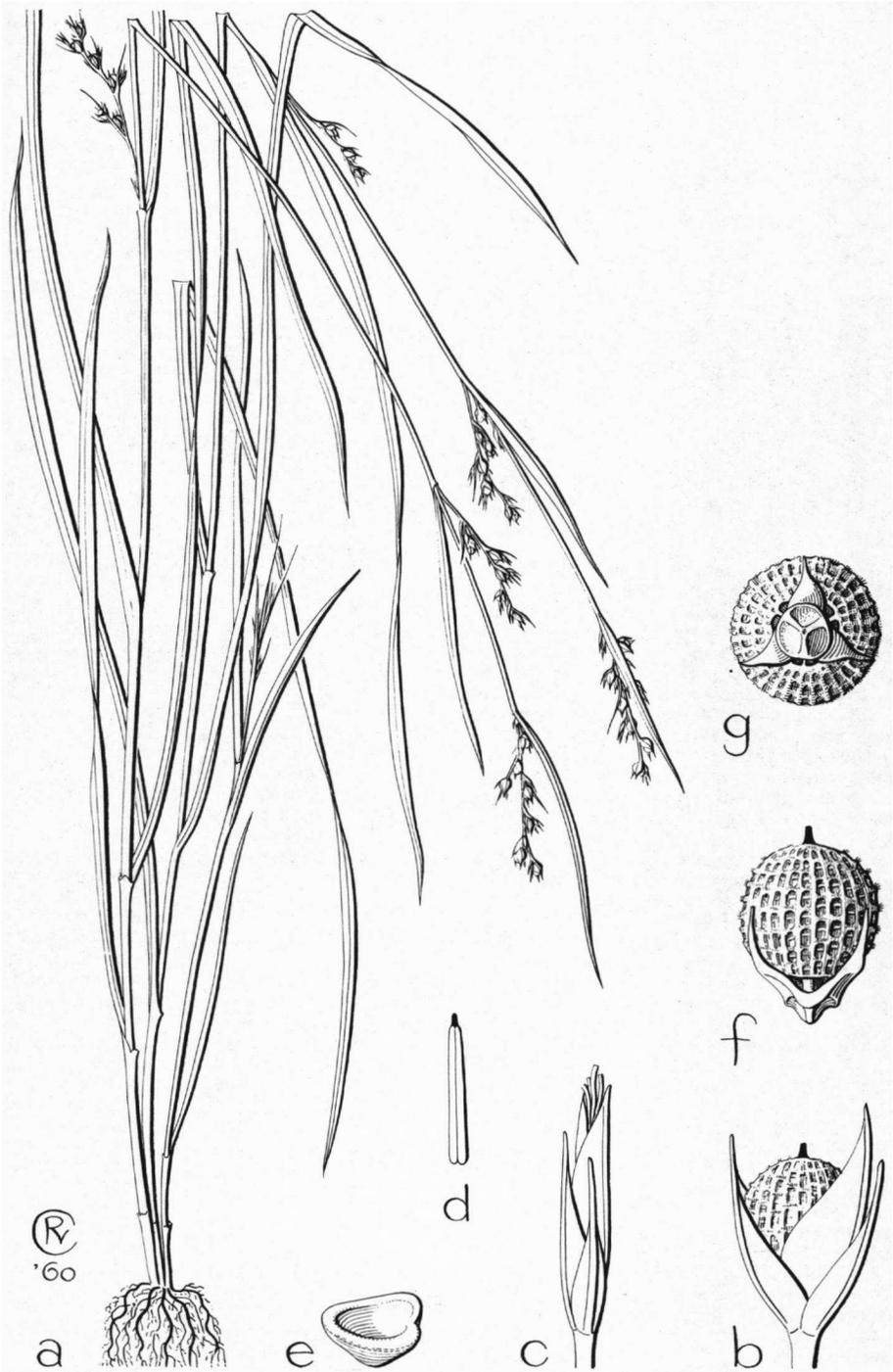


Fig. 113. *Scleria biflora* ROXB. *a.* Habit,  $\times \frac{1}{2}$ , *b.* ♀ fruiting spikelet, *c.* ♂ spikelet, both  $\times 7$ , *d.* anther,  $\times 20$ , *e.* cupule,  $\times 13$ , *f-g.* nut, lateral and basal views,  $\times 10$  (*a-g* VAN OOSTSTROOM 12948).

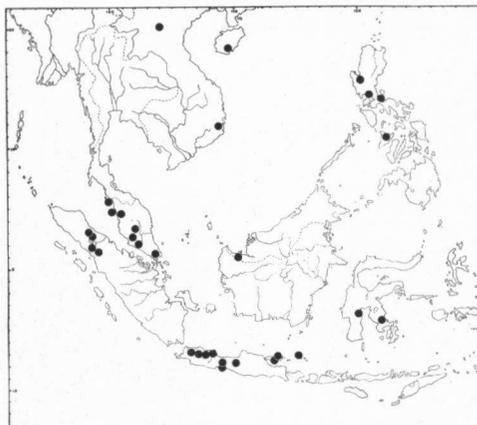


Fig. 114. Range of *Scleria biflora* ROXB. in Malesia; the localities in Ceylon, India, N. Burma and Thailand are omitted.

sessile (peduncle c. 1 mm long), glabrous, bisexual and ♂, or the ♂ part in the nut-bearing ones reduced to a sterile glume; ♂ spikelets lanceolate, c. 3 mm long; stamens 2-3; anthers linear, c. 1 mm long; nut-bearing spikelets 4 mm long; glumes broadly ovate-lanceolate, mucronulate, scabrid on the keel, pale, ferruginous-striolate. Cupula 3-lobed, 1 mm wide. *Disk* triangular with rounded angles, not lobed, purplish punctulate; scar of cupula 3-lobed. *Nut* shorter than the glumes, ovoid, obtusely trigonous, laterally compressed, truncate at the base, obtuse, not apiculate, glabrous, very smooth and shining, white, 2-2 $\frac{1}{3}$  mm long, c. 2 mm wide, 1 $\frac{1}{2}$ -1 $\frac{3}{5}$  mm thick.

Distr. Scattered throughout India, Central China; in *Malesia*: New Guinea (Vogelkop, Kebar Valley; Papua: Moi Biri Bay), twice collected.

Ecol. Grasslands, altitude c. 540 m.

Note. Very similar in habit to the closely related *S. novae-hollandiae*, but stouter, and clearly distinct by its scabridity, and the ovoid, not apiculate, compressed, very shining nut.

26. *Scleria novae-hollandiae* BOECK. *Flora* 58 (1875) 120; S. T. BLAKE, *Proc. R. Soc. Queensl.* 58 (1947) 48; *J. Arn. Arb.* 35 (1954) 225; KERN, *Blumea* 11 (1961) 201. — *S. annularis* (non STEUD.) CLARKE, *Philipp. J. Sc.* 2 (1907) Bot. 104; MERR. *En. Philip.* 1 (1923) 133. — *S. merrillii* PALLA, *Allg. Bot. Z.* 17 (1911) Beil. 8; MERR. *En. Philip.* 1 (1923) 134; KÜK. *Bot. Jahrb.* 59 (1924) 10; KANEHIRA, *J. Dept. Agr. Kyushu Imp. Un.* 4 (1935) 282. — Fig. 106, 115.

Annual. *Stems* slender, smooth, nodeless or 1-noded below the inflorescence, 25-45 cm by 1-2 mm. *Leaves* rather suddenly narrowed to the obtusish or acutish tip, glabrous, scabrid on the margins and main nerves in the upper part, 2-4 mm wide; sheaths not winged, smooth, shortly pubescent on the anterior side; contraligule short, rounded, with narrow, membranous, ciliate margin. *Inflorescence* narrow, elongate, consisting of a terminal panicle and (1-2-3 very remote lateral ones, the terminal

panicle somewhat longer than the lateral ones, these single at the nodes, their peduncles more or less exerted from the sheaths, smooth, 2-winged at the dilated top; primary bracts erect, much longer than the panicles in their axils, overtopping the inflorescence; secondary bracts subulate. *Spikelets* usually unisexual, ♂ and ♀, the nut-bearing ones sometimes bisexual, with 1 or 2 ♂ flowers; ♂ spikelets shortly peduncled (peduncle up to 3 mm long), narrowly lanceolate, c. 4 mm long; stamens 2-3; anthers linear, 1-1 $\frac{1}{2}$  mm long; nut-bearing spikelets 4 $\frac{1}{2}$ -5 mm long, with a barren or ♂ flower besides the ♀ one; glumes broadly ovate-lanceolate, mucronulate. Cupula deeply 3-lobed, 1 mm wide. *Disk* triangular with rounded angles, hardly lobed (sinuses very shallow, lobes broadly rounded), tightly appressed, greenish white; scar of cupula deeply 3-lobed. *Nut* ellipsoid or oblong-ellipsoid, with nearly parallel sides, very obtusely trigonous, truncate at the base, minutely umbonulate, smooth or slightly cancellate, glabrous, dull, white, finally often greyish, 2 $\frac{1}{4}$ -2 $\frac{3}{4}$  by 1 $\frac{1}{3}$ -2 mm.

Distr. N. and NE. Australia, Micronesia (Guam, Carolines); in *Malesia*: Philippines (Luzon), New Guinea (W. New Guinea; Papua).

Ecol. Savannahs and savannah-forests, fallow rice-fields, edges of swamps, at low altitudes.

27. *Scleria parvula* STEUD. *Syn.* 2 (1855) 174; NELMES, *Kew Bull. n.* 1 (1956) 105; KERN, *Blumea* 11 (1961) 202. — *S. tessellata* (non WILLD.) BOECK. *Linnaea* 38 (1874) 470, p.p.; CLARKE, *Fl. Br. Ind.* 6 (1894) 686, p.p.; *J. Linn. Soc. Bot.* 34 (1898) 97, p.p.; *Philipp. J. Sc.* 2 (1907) Bot. 104, p.p.; MERR. *Fl. Manila* (1912) 210; CAMUS, *Fl. Gén. I.-C.* 7 (1912) 162; MERR. *En. Philip.* 1 (1923) 135, p.p. — *S. uliginosa* HOCHST. ex BOECK. *Linnaea* 38 (1874) 471. — *S. fenestrata* FRANCH. & SAVAT. *En. Pl. Jap.* 2 (1879) 122, 549; OHWI, *Mem. Coll. Sc. Kyoto Imp. Un.* B 18 (1944) 8. — Fig. 106.

Annual. *Stems* slender, smooth, (10-)30-90 cm by 1-2 mm. *Leaves* rather suddenly narrowed to the obtusish tip, glabrous, scabrid on the margins in the upper part, 2-5 mm wide; sheaths rather loose, winged, glabrous or sparsely pubescent; edge of wings retrorsely scabrid; contraligule short, rounded or truncate, with narrow, membranous, ciliate margin. *Inflorescence* narrow, elongate, the terminal panicle oblong, 2-4 cm long, somewhat longer than the 1-3 distant lateral fascicles, these erect or the lower ones often pendulous, 1-3 at each node, on slender, smooth or scabrid peduncles more or less exerted from the sheaths; primary bracts erect, much longer than the panicles in their axils, as long as or overtopping the inflorescence. *Spikelets* unisexual; ♂ spikelets shortly peduncled (peduncles 1-3 mm long), lanceolate, 4-5 mm long; stamens 3; anthers linear, 1-1 $\frac{1}{2}$  mm long; ♀ spikelets 5 mm long, without a barren or ♂ flower besides the ♀ one; glumes ovate, acute or mucronulate, stramineous with purplish margins to wholly purplish. Cupula hardly lobed, 1 mm wide. *Disk* 3-lobed; lobes thickish, appressed, ovate, acuminate, sometimes faintly bidentate at the top, greenish or yellowish. *Nut* shorter than the glumes, ellipsoid or subglobose, obsoletely trigonous, deeply cancellate, glabrous or ferruginous-pubescent on the transverse raised lines, mucronate, shining, white, 2-2 $\frac{1}{3}$  by 1 $\frac{2}{3}$ -1 $\frac{1}{3}$

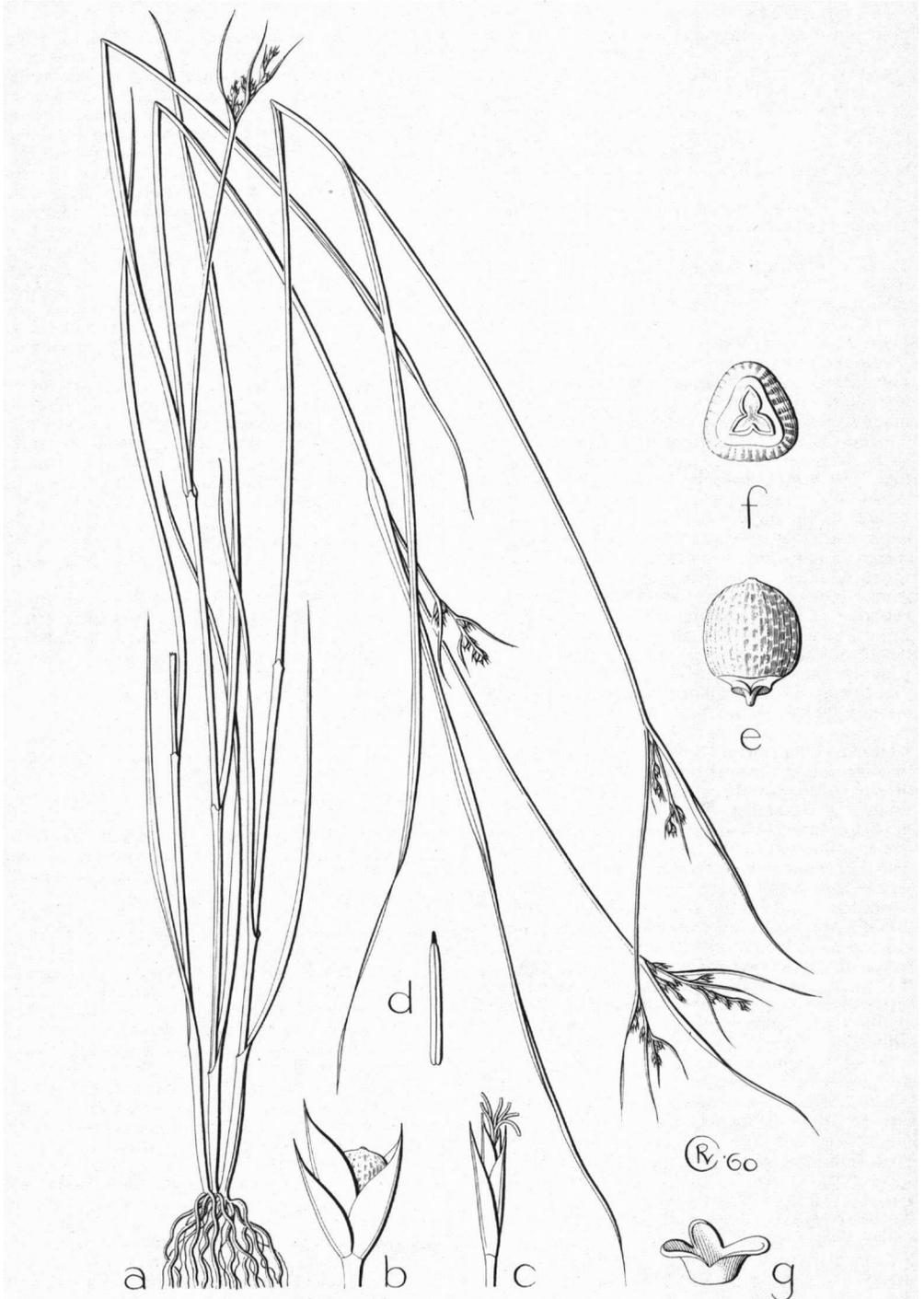


Fig. 115. *Scleria novae-hollandiae* BOECK. a. Habit,  $\times \frac{1}{2}$ , b. ♀ fruiting spikelet, c. ♂ spikelet, both  $\times 5$ , d. anther,  $\times 15$ , e-f. nut, lateral and basal views,  $\times 7\frac{1}{2}$ , g. cupule,  $\times 15$  (a-b, d-f BRASS 6427, c, g RAMOS BS 2029).

mm; lacunae rectangular, mostly longitudinally elongate, walls between the lacunae narrow.

Distr. Tropical Africa; Ceylon, India, Nepal, Thailand, Indo-China, S. China, Japan, Korea; in *Malesia* in the Philippines (Luzon) and NE. New Guinea.

Ecol. Swamps, wet open grasslands, in rainforests in semi-shade, at low and medium altitudes, up to 1900 m.

Vern. Philip.: *katábad*, Tag.; New Guinea: *drik*, *Togoba*, *kariandend*, Enga lang.

**28. *Scleria tricuspidata*** S. T. BLAKE, *Blumea* 11 (1961) 220; KERN, l.c. 203. — *S. tessellata* var. *debilis* BENTH. Fl. Austr. 7 (1878) 430. — *S. benthamii* (non CLARKE) S. T. BLAKE, Proc. R. Soc. Queensl. 8 (1947) 50. — Fig. 106.

Annual. *Stems* very slender, glabrous or somewhat pubescent, usually retrorsely scabrid, sometimes almost smooth, nodeless or 1-noded below the inflorescence, (10–)30–80 cm by 1–2 mm. *Leaves* (i.e. those not subtending a panicle) often all reduced to bladeless or shortly bladed sheaths, sometimes (like the lower primary bracts) well developed, rather suddenly narrowed to the obtusish tip, scabrid on the margins and the main nerves in the upper part, 2–5 mm wide; sheaths narrow, wingless, sparsely pubescent; contraligule short, broadly rounded, ciliate. *Inflorescence* occupying by far the greater part of the stem, narrow, consisting of 3–5 very remote, dense partial panicles; terminal panicle 2–3 cm long, lateral ones somewhat smaller, usually binate at the nodes, more or less nodding, their peduncles much exerted from the sheaths, filiform (but 2-winged at the dilated apex), often purplish; primary bracts longer than the panicles in their

setaceous, often curved. *Spikelets* shortly peduncled (peduncles 1–2 mm long), either ♂ and ♀ or ♂ and bisexual; ♂ spikelets linear-lanceolate, 3–4 mm long; stamens 2(–3); anthers linear, 1–1½ mm long; nut-bearing spikelets 4½–5 mm long, unisexual or with some ♂ flowers besides the ♀ one; glumes ovate, acute or mucronulate, scabrid on the keel, pale ferruginous with green keel. Cupula shallowly 3-lobed, c. 1 mm wide. *Disk* triangular, shallowly 3-lobed, appressed; lobes obtuse, with very narrow, reflexed margins, abruptly ending in a short, stiff, erect, subulate mucro, pale ferruginous. *Nut* shorter than the glumes, elliptic-oblong, obscurely to obtusely trigonous, rugulose, somewhat tuberculate at the top, sparsely pubescent, apiculate, dull, white, 2½–2¾ by 1¼–2 mm.

Distr. Tropical Australia; in *Malesia*: SE. Moluccas (Aru Is.), once collected.

Ecol. Moist places, swampy ground, open forests, often in *Melaleuca* stands, at low altitude.

**29. *Scleria laxa*** R.Br. Prod. (1810) 240; BENTH. Fl. Austr. 7 (1878) 428, p.p.; S. T. BLAKE, Proc. R. Soc. Queensl. 60 (1949) 52; KERN, *Blumea* 11 (1961) 205. — *S. filipendula* S. T. BLAKE, Proc. R. Soc. Queensl. 58 (1947) 49. — Fig. 106.

Annual. *Stems* very slender, more or less nodding at the top, smooth, 1–2-noded below the inflorescence, 20–45 cm by 1–1½ mm. *Leaves* narrowly linear, rather abruptly narrowed to the obtusish tip, glabrous, smooth or scabrid on the margins

and the main nerves near the apex, 1–3 mm wide; sheaths narrow, wingless, upper ones glabrous, lower ones often reduced to the sheaths, pubescent, purplish; contraligule short, broadly rounded, ciliate. *Inflorescence* occupying by far the greater part of the stem, narrow, very loose, consisting of about 3 very remote fascicles of partial panicles, the terminal panicle not larger than the lateral ones, 1–2 cm long; peduncles 3–4 together at the nodes, exerted from the sheaths, more or less nodding, filiform, slightly incrassate at the apex, 2–4 cm long; primary bracts erect, as long as or overtopping the inflorescence. *Spikelets* unisexual; ♂ spikelets about as long as their peduncles, linear-lanceolate, 1½–2½ mm long; stamen 1; anther oblong-linear, ¾–1 mm long; ♀ spikelets 3½–4 mm long, without a trace of a ♂ part; glumes ovate, acute or mucronulate. Cupula very small, ⅔ mm wide, hardly lobed. *Disk* small, shortly 3-lobed; lobes obtuse, semi-orbicular. *Nut* globose, deeply longitudinally ribbed, with 3 of the ribs more prominent, more or less trabeculate between the ribs, slightly tuberculate at the top, umbonulate, glabrous, shining, white, c. 1½ mm across, the ribs not all reaching the base of the nut, but leaving a smooth triangular area above each disk-lobe.

Distr. Queensland; in *Malesia*: Thursday I. in Torres Strait, S. New Guinea (Kurik near Merauke), Philippines (Luzon).

Note. Closely related to *S. thwaitesiana*, from which it can be distinguished by the weaker stems and leaves, the much longer, nodding peduncles of the lateral panicles, the number of panicles arising from each node (3–4 in *S. laxa*, 1–2 in *S. thwaitesiana*), and the strongly ribbed or scrobiculate, apiculate nut.

**30. *Scleria thwaitesiana*** BOECK. *Linnaea* 38 (1874) 454; KERN, *Blumea* 11 (1961) 205. — Fig. 106.

Annual (?). *Stems* very slender, strictly erect, smooth, 15–50 cm by 1–2 mm. *Leaves* narrowly linear, rather abruptly narrowed to the obtusish tip, glabrous, smooth or minutely scabrid at the top, 1–2(–3) mm wide; sheaths narrow, wingless, glabrous; contraligule very short, glabrous or minutely scabrid-ciliolate. *Inflorescence* narrow, elongate, consisting of a terminal panicle 1–2 cm long, and 2–3 remote lateral fascicles; terminal panicle not pseudo-lateral, its bract not or but slightly overtopping the inflorescence; peduncles of lateral panicles single or binate at the nodes, setaceous, more or less exerted from the sheaths, smooth or slightly scabrid, often purplish; primary bracts erect, not overtopping the inflorescence. *Spikelets* unisexual; ♂ spikelets about as long as their peduncles, linear-lanceolate, 2 mm long; stamen 1; anther oblong, ¾ mm long; ♀ spikelets 4 mm long; glumes ovate, acute or mucronulate. *Disk* thin, appressed, triangular with rounded angles, hardly lobed, not cellular-glandular. *Nut* shorter than the glumes, subglobose, obtusely trigonous, not or hardly apiculate, smooth or nearly so, very shining, 1½–1¾ mm across.

Distr. Insufficiently known because of confusion with *S. rugosa*; Ceylon, Thailand; in *Malesia*: Malay Peninsula (Perlis: Bukit Ketri), once collected, together with *S. neesii*.

Ecol. Wet localities, open grassy ground, at low and medium altitudes, in Thailand up to 1300 m.

Note. Clearly distinct from *S. rugosa* by the stiffly erect stems, the rigid, narrow leaves, the very short contraligule, the setaceous peduncles of the lateral panicles, the obtusely trigonous, mucinous nut, and the hardly lobed disk, which is not cellular-glandular.

31. *Scleria rugosa* R. BR. Prod. (1810) 240; KUNTH, En. 2 (1837) 358; STEUD. Syn. 2 (1855) 179; S. T. BLAKE, J. Arn. Arb. 35 (1954) 226; KERN, Blumea 11 (1961) 206. — *S. lateriflora* BOECK. Linnæa 38 (1874) 455; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 55. — *S. onoei* FRANCH. & SAVAT. En. Pl. Jap. 2 (1879) 122 & 549; OHWI, Mem. Coll. Sc. Kyoto Imp. Un. B 18 (1944) 9, incl. var. *pubigera*. — *S. flaccida* CLARKE, Fl. Br. Ind. 6 (1894) 688, non STEUD. 1855; J. Linn. Soc. Bot. 34 (1898) 98; Ill. Cyp. (1909) t. 127, f. 3-5. — *S. zeylanica* (non POIR.) CLARKE, Fl. Br. Ind. 6 (1894) 687, excl. syn. *S. thwaitesiana*; J. Linn. Soc. Bot. 34 (1898) 98; RIDL. Mat. Fl. Mal. Pen. (Monoc.) 3 (1907) 110; CLARKE, Philip. J. Sc. 2 (1907) Bot. 104, p. p.; MERR. Fl. Manila (1912) 120; CAMUS, Fl. Gén. I.-C. 7 (1912) 163; MERR. En. Born. (1921) 67; En. Philip. 1 (1923) 136; RIDL. Fl. Mal. Pen. 5 (1925) 177. — *S. pubigera* MAKINO, Bot. Mag. Tokyo 27 (1913) 55. — Fig. 106.

Annual. Stems slender, obliquely erect or decumbent, smooth, (5-)10-30(-40) cm by  $\frac{1}{2}$ -1 $\frac{1}{2}$  mm. Leaves rather abruptly narrowed to the obtusish tip, from glabrous to densely pubescent with pale, patent hairs, smooth, 2-4 mm wide; sheaths loose, from sharply triquetrous to distinctly winged; contraligule short, semi-orbicular, ciliate. Inflorescence narrow, elongate, consisting of a terminal (but

pseudo-lateral) panicle and 1-2 lateral, remote fascicles of panicles not markedly different from the terminal one; panicles single or binate at the nodes, on stout, often recurved peduncles; primary bracts erect, the upper one as though continuing the stem, distinctly overtopping the inflorescence. Spikelets unisexual; ♂ spikelets shortly peduncled, lanceolate, c. 2 mm long; stamen 1; anther oblong,  $\frac{1}{2}$ - $\frac{2}{3}$  mm long; ♀ spikelets 3-4 mm long; glumes ovate, acute or mucronulate, usually long-ciliate on the keel, rarely glabrous; a sterile glume besides the ♀ flower sometimes present. Cupula hardly lobed,  $\frac{2}{3}$  mm wide. Disk thick, appressed, shallowly 3-lobed, densely cellular-glandular; lobes obtuse, semi-orbicular. Nut shorter than the glumes, globose or slightly depressed, terete, apiculate, smooth or more or less rugulose to lacunose especially in the upper half, often somewhat tuberculate at the top, shining, white or finally greyish,  $1\frac{1}{3}$ -1 $\frac{1}{2}$  across.

Distr. Ceylon and India to S. China, Formosa, Japan, N. and NE. Australia, W. Carolines, Solomon Is., and New Caledonia; in *Malesia*: Malay Peninsula, W. Java, Madura, Kangean, Borneo, Philippines (Luzon), Moluccas (Ambon and Tanimbar), and New Guinea (Papua).

Ecol. Open swampy places, savannahs, fallow rice-fields, rice-field dikelets, damp road-sides, at low altitudes, up to 500 m.

Vern. *Rumput panjang*, M, *ilat bogo*, i. *lalab*, ;; Philip.: *dâat-parang*, *dât-babâe*, *pûgad-pûgad*, Tag.

Note. A very variable species. The plants may be almost glabrous or softly pilose all over, the nuts smooth or tuberculate-rugulose, the leaf-sheaths wingless or broadly winged, but I cannot find any correlation in these characters.

### 7. Section *Sphaeropus*

(BOECK.) KERN, Blumea 11 (1961) 208. — *Sphaeropus* BOECK. Flora 56 (1873) 89.

32. *Scleria pygmaeopsis* KERN, Blumea 11 (1961) 208, f. 9. — *Diplacrum pygmaeopsis* KOYAMA, Mem. N.Y. Bot. Gard. 17 (1967) 33. — Fig. 106, 116.

Very slender, glabrous annual. Stems filiform, smooth, 5-15 cm by  $\frac{1}{3}$ - $\frac{1}{2}$  mm. Leaves very acute, scaberulous on the margins near the top, otherwise smooth, 3-5 cm by  $1\frac{1}{2}$ -2 mm; sheaths not winged. Inflorescence occupying by far the greater part of the stem, composed of 3-8 small axillary clusters 1-2 cm remote; primary bracts leaf-like; sheaths very narrowly winged, the mouth truncate or emarginate; peduncles not or hardly exerted from the sheaths; terminal spikelet of each cluster ♀. ♂ Spikelets 1-1 $\frac{1}{2}$  mm long, c. 3-flowered; stamen 1; anther oblong,  $\frac{1}{3}$  mm long; ♀ spikelets without a trace of ♂ flowers, 1 $\frac{1}{2}$ -2 mm long, the peduncle bulbously swollen at the apex; glumes 2, oblong-ovate, acute, apiculate or mucronulate, entire, spreading, faintly

3-5-nerved. Disk obsolete, trigonous, adnate to the nut. Nut very small, globose, truncate at the base, very shortly acuminate, longitudinally ribbed (3 ribs prominent), white, finally fuscous to blackish,  $\frac{1}{2}$ - $\frac{3}{5}$  mm long and wide, when ripe falling out of the persistent glumes.

Distr. *Malesia*: Lesser Sunda Is. (East Sumba), once collected.

Ecol. Swamp, 500 m.

Note. Closely related to the Australian *S. pygmaea* R. Br. (fig. 106-32a) from which it differs by the slender habit, the quite entire glumes, and especially by the somewhat smaller, etuberculate nut with obsolete triangular disk. In *S. pygmaea* the glumes are often slightly 3-lobed (side-lobes small, obtuse, more rarely absent), and the nut is about  $\frac{1}{2}$  mm long and wide, tuberculate, with 3 crescent-shaped swellings at the base which surround the disk.

### 8. Section *Diplacrum*

(R. BR.) KERN, Blumea 11 (1961) 208. — *Diplacrum* R. BR. Prod. Fl. Nov. Holl. (1810) 240.

33. *Scleria caricina* (R. BR.) BENTH. Fl. Austr. 7 (1878) 426; CLARKE, Fl. Br. Ind. 6 (1894) 688; J. Linn. Soc. Bot. 34 (1898) 98; RIDL. Mat. Fl. Mal.

Pen. (Monoc.) 3 (1907) 111; Fl. Mal. Pen. 5 (1925) 178; KERN, Blumea 11 (1961) 208; in Back. & Bakh. f. Fl. Java 3 (1968) 485. — *Diplacrum caricinum*

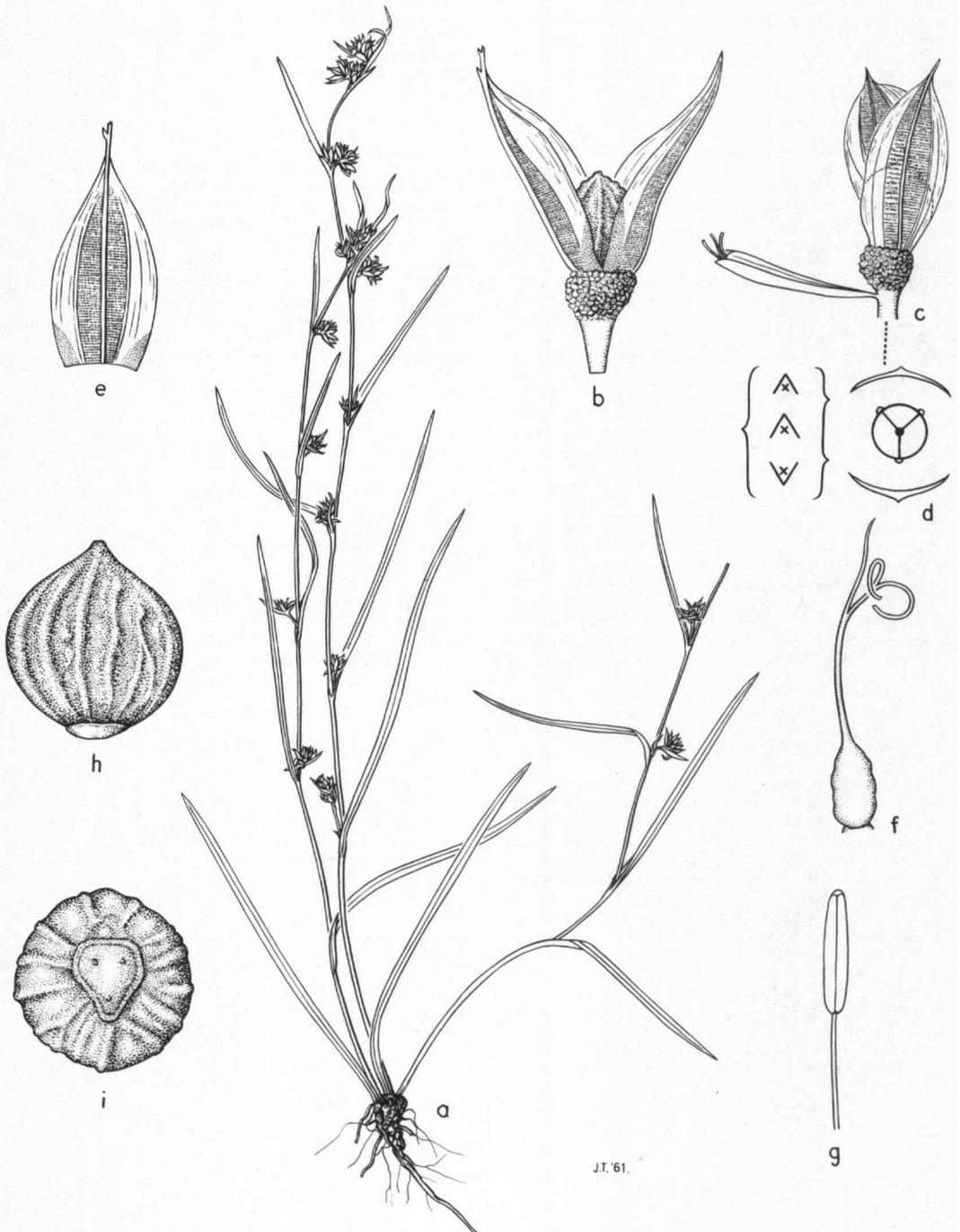


Fig. 116. *Scleria pygmaeopsis* KERN. a. Habit,  $\times \frac{1}{2}$ , b. ♀ spikelet, c. ♀ and ♂ spikelet, d. floral diagram of the latter, e. glume of ♀ spikelet, all  $\times 15$ , f. pistil,  $\times 30$ , g. stamen, h-i. nut, lateral and basal views, both  $\times 45$  (a-i DE VOOGD 2513).

R. BR. Prod. (1810) 241; BRONGN. in Duperrey, Voy. Bot. 2 (1834) 160; KUNTH, En. 2 (1837) 360; ENDL. Iconogr. (1838) t. 25; STEUD. Syn. 2 (1855) 180; MIQ. Fl. Ind. Bat. 3 (1856) 345; Sum. (1861) 262, 602, *incl. var. sumatranum* MIQ.; BOECK. Linnaea 38 (1874) 434; GOEBEL, Ann. Jard. Bot. Btzg 7 (1888) 132, t. 15, f. 21-29; CLARKE, Philip. J. Sc. 2 (1907) Bot. 106; Ill. Cyp. (1909) t. 134, f. 3; CAMUS, Fl. Gén. I.-C. 7 (1912) 157; MERR. En. Born. (1921) 67; En. Philip. 1 (1923) 136; UITTEN in Backer, Bekn. Fl. Java (em. ed.) 10 (1949) fam. 246, p. 53; S. T. BLAKE, J. Arn. Arb. 35 (1954) 233. — *Olyra malaccensis* WALL. Cat. (1831) 3540 A, B, *nom. nud.* — *Diplacrum tridentatum* BRONGN. in Duperrey, Voy. Bot. (1834) t. 26. — *Diplacrum zeylanicum* NEES in Wight, Contr. (1834) 119. — Fig. 106.

Very slender, nearly smooth and glabrous annual. Stems diffuse or procumbent, smooth, (2-)-5-35 cm by  $\frac{1}{2}$ -1 mm. Leaves rather abruptly narrowed to the acute tip, scaberulous on the margins in the upper part, 1-5 cm by ( $1\frac{1}{2}$ -)3-5 mm; sheaths not winged, widened upwards, truncate at the top. Inflorescence occupying by far the greater part of the stem, composed of several to numerous (up to c. 20) remote, small, axillary clusters; primary bracts leaf-like; peduncles usually just exerted from their sheaths; terminal spikelet of each cluster ♀. ♂ Spikelets 1-2 mm long, few-flowered; stamen 1; anther oblong, c.  $\frac{1}{2}$  mm long; ♀ spikelets without a trace of ♂ flowers, finally almost cylindrical, 2-3 mm long; glumes 2, ovate-lanceolate, several-nerved, 3-lobed, central lobe herbaceous, cellular-reticulate above, cuspidate, lateral lobes shorter, membranous. Disk obsolete, adnate to the nut, with a scarcely prominent 3-angled margin. Nut hidden by the connivent glumes and falling with them, depressed-globular to ovoid-globular, irregularly ribbed (the longitudinal ribs more pronounced than the transverse ones and 3 of them prominent), slightly hispid at the top, white, finally more or less discoloured,  $\frac{3}{4}$ -1 mm across.

Distr. Ceylon and India to S. China, Japan, Micronesia, and Queensland; almost throughout Malesia, but everywhere scattered.

Ecol. Damp open places, grassy sunny roadsides, river-banks, locally sometimes abundant, at low and medium altitudes, up to 1200 m.

Vern. *llat*, S.

Note. In this species and the next one the epidermal cells on the upper side of the glumes of the ♀ spikelets are much inflated. Though less pronounced, such cells are also found in the species of *sect. Sphaeropus* and in *S. rugosa*.

34. *Scleria reticulata* (HOLTT.) KERN, Reinwardtia 6 (1961) 71; Blumea 11 (1961) 211. — *Diplacrum reticulatum* HOLTT. Gard. Bull. Sing. 11 (1947) 295, f. 6. — Fig. 106.

Closely related to *S. caricina* and very similar in habit to it. ♀ Spikelets turbinate (not cylindrical),  $1\frac{1}{2}$ -2 mm by  $1\frac{1}{4}$ - $1\frac{1}{2}$  mm; glumes ovate, acute, entire (not 3-lobed), purplish punctulate, with only the midnerve prominent, the sides faintly nerved. Nut depressed-globose, tuberculate-reticulate between the 3 longitudinal ribs,  $\frac{3}{4}$  by  $1-1\frac{1}{4}$  mm.

Distr. East Bengal, Burma, Peninsular Thailand; in Malesia: Malay Peninsula (Pahang: Gua Tipus).

Ecol. Damp spots in *lalang* (= *Imperata*) fields.

#### Doubtful

*Scleria approximata* HASSK. Tijd. Nat. Gesch. Phys. 10 (1843) 118; Cat. Bog. (1844) 22. "Late major RUMPH. amb. VI p. 20, t. 8. 2. Ielat." — No description; in Ind. Kew. referred to the synonymy of *S. sumatrensis* RETZ. RUMPHIUS's figure represents a *Scleria* of the group with pseudo-whorled leaves, probably *S. scrobiculata* NEES or *S. polycarpa* BOECK.; cf. MERR. Int. Rumph. (1917) 108.

#### Excluded

*Scleria macrophylla* PRESL, Rel. Haenk. 1 (1828) 200, t. 3, f. 25 ["*in insula Luzon*"]; NEES in Wight, Contr. (1834) 116; KUNTH, En. 2 (1837) 356; STEUD. Syn. 2 (1855) 170; MIQ. Fl. Ind. Bat. 3 (1856) 343; F.-VILL. Nov. App. (1882) 310.

The type is certainly not from Luzon, but from tropical S. America or Mexico. CLARKE (Fl. Br. Ind. 6, 1894, 693) wrongly reduced it to *S. bancana* MIQ.; cf. MERR. En. Philip. 1 (1923) 136; H. PFEIFFER, Mitt. Inst. Allg. Bot. Hamb. 7 (1928) 175; CORE, Brittonia 2 (1936) 38.

### 27. KOBRESIA

WILLD. Sp. Pl. 4 (1805) 205; BOECK. Linnaea 39 (1875) 2; CLARKE, J. Linn. Soc. Bot. 20 (1883) 376; BENTH. in B. & H. Gen. Pl. 3 (1883) 1071; CLARKE, Fl. Br. Ind. 6 (1894) 694; KÜK. Pfl. R. Heft 38 (1909) 33 ('*Cobresia*'); KERN, Act. Bot. Neerl. 7 (1958) 786-800, f. 1-3. — *Elyna* SCHRAD. Fl. Germ. 1 (1806) 155; KUNTH, En. 2 (1837) 532. — *Schoenoxiphium* NEES, Linnaea 7 (1832) 531; KUNTH, En. 2 (1837) 528; BOECK. Linnaea 41 (1877) 352; BENTH. in B. & H. Gen. Pl. 3 (1883) 1072; KÜK. Pfl. R. Heft 38 (1909) 28. — *Hemicarex* BENTH. J. Linn. Soc. Bot. 18 (1881) 367; in B. & H. Gen. Pl. 3 (1883) 1072; CLARKE, J. Linn. Soc. Bot. 20 (1883) 382. — Fig. 117.

Perennial herbs with short rhizome, monoecious, rarely dioecious. Stems tufted, arising from the centre of the basal leaves, trigonous, solid, smooth, or scaberulous at the apex. Leaves tristichous, narrowly linear, often convolute,

crowded near the base of the stems or also cauline; margins scabrous at least towards the apex; lower sheaths bladeless. *Inflorescence* consisting of a single terminal spike or of several paniced spikes; spikes usually androgynaeceous, *i.e.* ♂ above, ♀ below (rarely wholly male or female?). *Flowers* unisexual, achlamydeous (destitute of perianth or hypogynous bristles); each male flower consisting of 3 stamens only, subtended by a glume; filaments free; anthers linear; each female flower a naked pistil inserted on an axis of next lower rank (rachilla) and subtended by a 2-keeled adaxial prophyll ('adossiertes Vorblatt') with free or more or less connate margins; rachilla subtended by a glume (bract) and often bearing one to several male flowers above the female one, but not rarely reduced to a setiform or flat (very rarely vestigial) rudiment. *Stigmas* 3 (2 in a single extra-Malesian *sp.*). *Nut* trigonous (biconvex in the digynous *sp.*), oblong or narrowly obovoid, free (when the prophyll is open or almost so), or enclosed in the more or less sac-like prophyll.

*Distr.* In its usually accepted circumscription the genus comprises *c.* 40 *spp.* all occurring in the northern hemisphere. A few arctic-alpine species are known from Europe and N. America; the centre of development is in Asia, especially the Himalaya, Tibet, Yunnan, and Szechuan. In *Malesia* 1 *sp.*, originally referred to the African genus *Schoenoxiphium* (*c.* 10 *spp.*, 2 in Madagascar). It seems impossible to separate *Schoenoxiphium* from *Kobresia* on morphological grounds.

*Notes.* Phylogenetically *Kobresia* is undoubtedly to be considered the prototype of *Carex*, from which genus it is difficult to separate in morphological terms. In *Carex* the margins of the prophyll subtending the female flower have become completely connate, leaving only a small orifice at the apex through which the style protrudes; the prophyll has become a bottle- or sac-like organ called a utricle or perigynium. In *Kobresia* the margins of the prophyll may be free (as in the Malesian *sp.*) or more or less connate (rarely almost to the top). In *Carex* the lateral spikelets are reduced to a single female flower; their axes are vestigial and bear only the female flower surrounded by its utricle; very rarely the axis is still present as a setiform rudiment enclosed in the utricle. In the lateral spikelets of *Kobresia* the axis is well developed as a rule, bearing a basal female flower and 1-several superposed male flowers. The terminal flowers of each spike are male. The number of male flowers in the lateral spikelets may vary in one inflorescence: from several in the lower spikelets of each spike to none in the upper ones; also in the latter case the rachilla is usually present as a setiform or flat rudiment. In the *Kobresias* with compound inflorescence the base of each lateral spike bears also a prophyll (here called cladoprophyll), which may or may not contain a female flower.

**1. *Kobresia kobresioidea*** (KÜK.) KERN, Act. Bot. Neerl. 7 (1958) 795, f. 3. — *Schoenoxiphium kobresioideum* KÜK. Bull. Jard. Bot. Btzg III, 16 (1940) 312; in Fedde, Rep. 53 (1944) 102 ('*cobresioideum*'). — Fig. 117.

*Stems* numerous, slender, triquetrous, leafy up to the middle, scaberulous at the top, 30–80 cm by 1–1½ mm. *Leaves* longer than the stems, flat or canaliculate, shortly acuminate, 1½–3 mm wide; ligule short, rounded; basal sheaths bladeless, stramineous, with broad scarious cinnamomeous margins. *Inflorescence* paniculate, decompound and rather lax below, compound and dense above, narrowly oblong, 6–8(–12) cm long. Lower bracts excurrent into a short setaceous blade, upper ones glume-like. Spikes numerous, erect or slightly incurved, sessile, androgynaeceous, 6–10 mm long; cladoprophyll containing a ♀ flower. *Spikelets* with a single basal ♀ flower, the lower ones of each spike with 3–4 superposed ♂ flowers, the upper ones with a single ♂ flower, or with a rudiment of the latter at the top of the rachilla. *Rachilla* flattened, often slightly dilated towards the apex, ciliate on the margins, 2-nerved, green. *Glumes* membranous, lanceolate, ferrugineous, with green keel. *Prophyll* membranous, oblong, emarginate at the top, 2-keeled, ferrugineous, 4–5 mm long, the margins free or connate at the very base only. *Anthers* *c.* 2 mm long. *Style* fimbriate, incassate at the persistent base, trifid. *Nut* oblong or subobovoid-oblong,

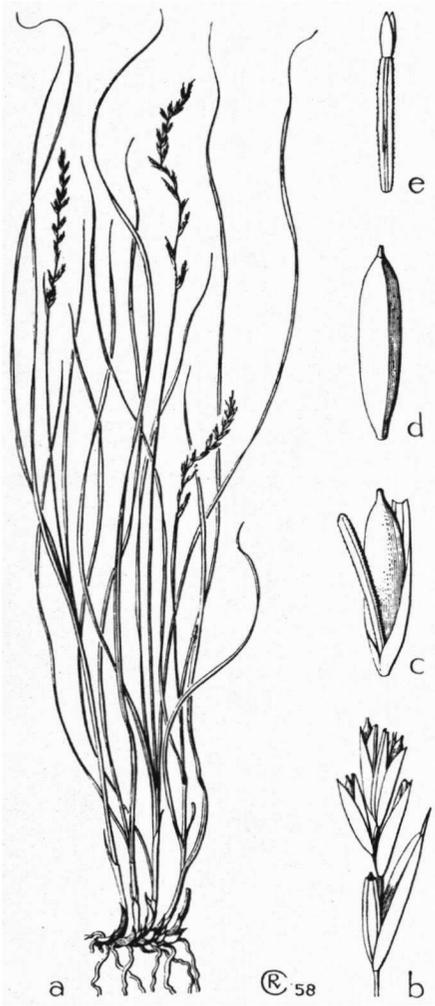
apiculate, brown, purplish punctulate, 4–5 by 0.9 mm.

*Distr. Malesia:* N. Sumatra (Atjeh, Gajo Lands: Mts Losir, Kemiri, and Goh Lembuh).

*Ecol.* In moist grasslands, mountain heathlands, peaty banks of brooks, locally gregarious, 2900–3400 m.

*Note.* When describing this remarkable species discovered by VAN STEENIS in 1937, KÜKENTHAL, although stating that to him it represents the last 'missing link' between *Kobresia* and *Schoenoxiphium*, referred it to the latter genus. In his monograph of the *Caricoideae* (1909) these two genera were kept apart for geographical and supposed phylogenetical reasons; the only definitely stated morphological difference (rachilla elongated and flattened in *Schoenoxiphium*, inconspicuous in *Kobresia*) is illusory. In referring the Sumatran plant to the African genus, KÜKENTHAL made the geographical reason for separation also ineffective. The nearest allies of the plant in question are undoubtedly some *Kobresia* *spp.* with paniculate inflorescence from Central Asia, *e.g.* *K. laxa* NEES, and there is no reason whatever for generic separation. All *Schoenoxiphium* *spp.* of the African continent are much more remote; the Madagascan *S. gracile* CHERM. may be rather closely allied.

In my opinion the numerous attempts to distinguish between *Schoenoxiphium* and *Kobresia* in morphological terms have completely failed.



BENTHAM (1881, 1883) restricted *Schoenoxiphium* to a single species and accommodated the other ones together with some Indian *Kobresias* into a new genus, *Hemicarex*, with all the characters of *Carex* except that the prophyll is open to below the middle or even quite to the base, the rachilla present but not exceeding the glume. As he included the type-species of *Schoenoxiphium* in *Hemicarex*, the latter name is nomenclaturally a later synonym of the former. In doing so BENTHAM had to place two forms of *Kobresia laxa* with different distribution of sexes into two genera (*Hemicarex laxa* and *Kobresia pseudolaxa*), and even in two different tribes (*Cariceae* and *Sclerieae*), obviously not recognizing either the homology of the open prophyll and the closed utricle, or of the spikes with several female spikelets and those in which only the female flower in the cladoprophyll is present.

Fig. 117. *Kobresia kobresioidea* (KÜK.) KERN. a. Habit,  $\times \frac{2}{5}$ , b. part of spike,  $\times 4$ , c. ♀ spikelet, d. nut, both  $\times 8$ , e. rachilla with vestigial ♂ flower on top,  $\times 12$  (a-e VAN STEENIS 8542).