

## RESTIONACEAE (K. Bäkker, Leyden)

The delimitation of the family as it is now generally accepted has been liable to changes. Moreover, representatives of other families have occasionally been confused with *Restionaceae*.

In habit *Restionaceae* are very like *Cyperaceae*, specially *Rhynchosporoideae*, and grow in similar habitats. They can be distinguished from the latter by open leaf-sheaths, the pendent, apically inserted ovules, and the absence of peculiar 'cone-cells' in the epidermis ('Kegel-Zellen', cf. KÜKENTHAL in Fedde, Rep. 53, 1944, 89).

According to ERDTMAN (Pollen-morph. & Plant Taxon. p. 377) the pollen grains are  $\pm$  similar to those found in *Centrolepidaceae* and *Gramineae*. They are  $\pm$  different from those of the *Cyperaceae*, *Eriocaulonaceae*, and *Juncaceae*.

HUTCHINSON (Fam. Fl. Pl. 2: 185, 192) refers the *Restionaceae* to *Juncales* along with *Juncaceae* (ubiquist), *Centrolepidaceae* (Antarctopacific), and *Thurniaceae* (Africa).

They differ from *Juncaceae* by their pendulous ovule, dorsifixed anthers, and often unisexual, mostly dioecious flowers.

*Centrolepidaceae* are different by the absence of a perianth and mostly present leaf-blades.

As BENTHAM already remarked (Fl. Austr. 7: 209) *Restionaceae* show a remarkable diversity in flowers and sometimes in sexual forms when dioecy prevails. He says: 'The great dissimilarity in habit and inflorescence between the males and females of some species often renders even their generic determination very difficult or uncertain from dried specimens where only one sex is present or the sexes are mismatched. In some cases indeed the males of species belonging to different genera are more like each other than those of congeneric species, and, notwithstanding the copious materials before me, there are still some species in which I may not have correctly matched the two sexes, and in several others one sex is still unknown'.

Several species are inadequately known in this respect, as is illustrated by *L. elatior* of which  $\sigma$  flowers are described here for the first time.

Geographically *Restionaceae* are almost restricted to the southern hemisphere and are specially frequent both in numbers and species in the savannahs and other open areas of arid countries. In certain areas they may be gregarious and take the place of grasses in the vegetation. They are specially centred in extratropical S. Africa and Australia, a few occur in Tasmania and New Zealand, 1 in Chile, 1 in SE. Asia, 1 in Madagascar, and 1 in Nyasaland. About 30 genera and c. 300 species have been recognized. Two genera are bicontinental, viz *Restio* and *Leptocarpus* (if its African species are not segregated as a separate genus *Calopsis* KUNTH as is done by GILG (Bot. Jahrb. 13, 1891, 524), UEBERFELD (*op. cit.* 60, 1926, 175), and GILG-BENEDICT (in E. & P. Pfl. Fam. ed. 2, 15a, 1930, 22)).

The Malaysian area is extremely poor in representatives though ecologically suitable habitats should not be rare.

The family is subdivided into 2 tribes, *Haplantherae* and *Diplantherae*, characterized respectively by anthers containing one or two cells. The more primitive *Diplantherae* are restricted to Australia.

### 1. LEPTOCARPUS

R.BR. Prod. (1810) 250, *nom. cons.*; MAST. in DC. Mon. Phan. 1 (1878) 329; BENTH. Fl. Austr. 7 (1878) 230.—Fig. 1.

Perennial herbs; rhizome covered by often partly caducous, imbricate scales, (in Mal. *spp.*) covering a dense woolly pubescence. *Stem* simple or branched, terete, hollow except at the nodes. *Leaves* almost always consisting of open, stem-clasping bladeless sheaths, without ligule, distichous, firm, closely appressed to the stem, with overlapping basal margins, persistent, sometimes with a scarious margin and an elongated apex. Male and female inflorescences nearly similar or very different, in some species the spikelets of both sexes very small and clustered along the branches of a long panicle (§ *Homoeanthesis*), in others the males pedicellate and paniculate or clustered, the females sessile and clustered or spicate (§ *Diplanthesis*). *Flowers* mostly dioecious, rarely monoecious or even bisexual. Both sexes in spikelets with imbricate glumes, often densely clustered in fascicles. *Tepals* 4–6 or sometimes rather indefinite (partly barren bracts?), variously shaped.— $\sigma$  *Flowers*: stamens 2 or 3, rarely 1; filaments ligulate to filiform, free, delicate; anthers 1-celled, dorsifix, introrse, apiculate; rudimentary ovary, when present, very

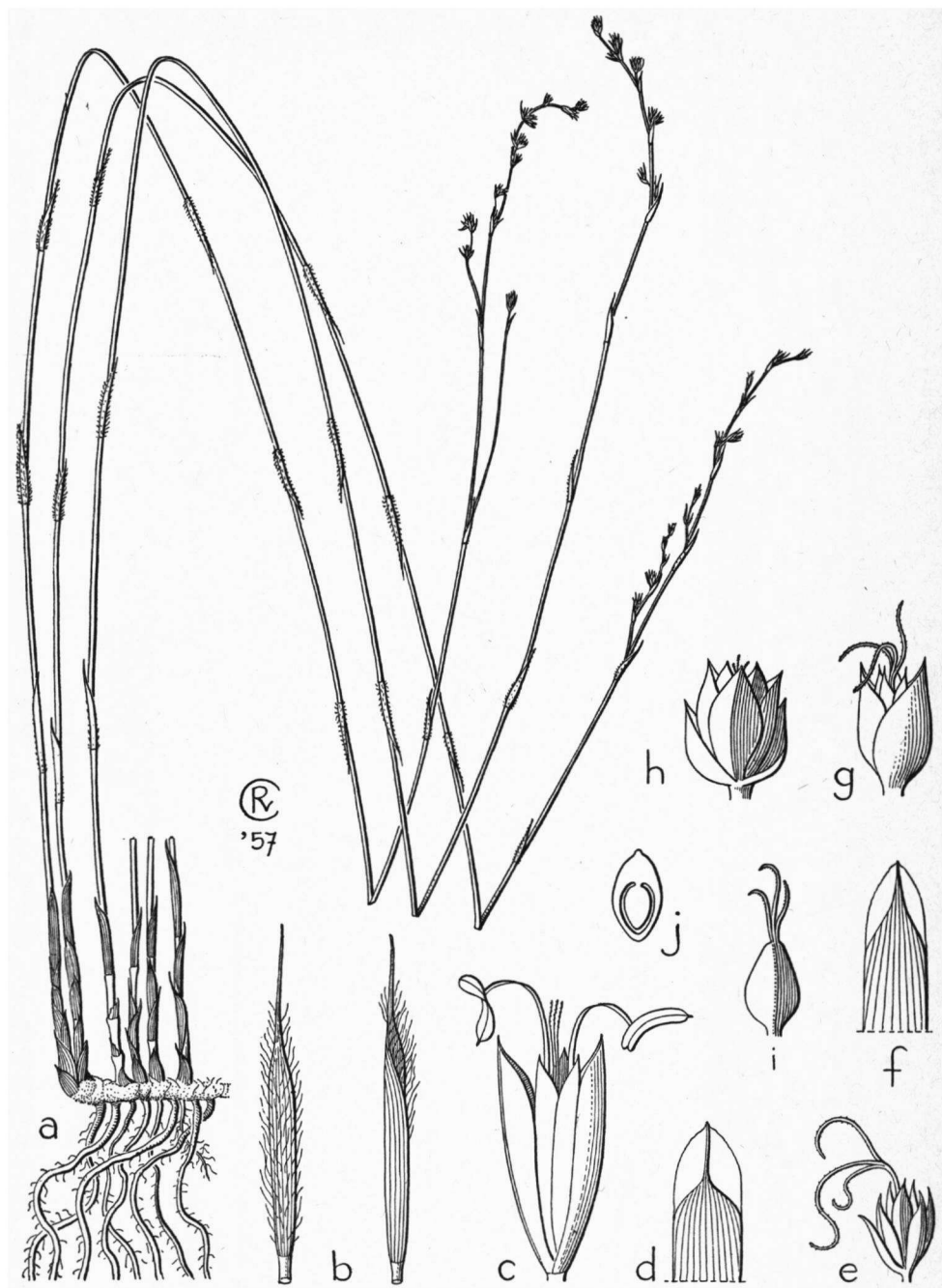


Fig. 1. Habit and details of Malaysian *Leptocarpus*.—*L. barbatus* BAKKER. a. habit,  $\times \frac{2}{3}$ , b. two sheaths, one nearly glabrous by caducous hairs,  $\times 3$ , c.  $\sigma$  flower,  $\times 13$ .—*L. elatior* R.Br. d. apex of sheath (scarios margin sometimes partly disappearing),  $\times 3$ , e.  $\phi$  flower,  $\times 13$ .—*L. disjunctus* MAST. f. apex of sheath,  $\times 3$ , g. young  $\phi$  flower,  $\times 13$ , h.  $\phi$  flower with fruit,  $\times 13$ , i. fruit,  $\times 13$ , j. ditto, in longitudinal section (a-c BUWALDA 5531, d-e VAN ROYEN 4885, f-g GWYNNE VAUGHAN, h-j SINCLAIR S.F. 39983).

small.—♀ *Flowers*: staminodes 3 or none, ovary superior, 1-celled with 1 pendulous orthotropous ovule; styles 3 (or sometimes 2?), filiform, delicate, free or united at the base, the free parts entirely stigmatic. *Fruit* narrow oblong-elliptic, ovoid or obovoid, with a thin pericarp opening on one side, or with a thicker pericarp splitting at the angles. *Bisexual flowers* with an ovary and a varying number of stamens (1–3).

Distr. About 40 *spp.*, distributed mainly in South Africa (*c.* 25), Australia and New Zealand (*c.* 12), Chile (1), in *Malaysia* 3 *spp.*, one of which also in Indo-China & Hainan and another also in Queensland. Fig. 2.

Notes. The concept 'floral bract' is used here for the mostly rather small glume just below the flower or, in the case of several-flowered spikelets where such glumes are not to be recognized, the glume from the axil of which the spikelet springs. This glume is often appressed to the flower and may be confused with a 7th perianth-segment (in ♀ flowers of *L. elatior*), but it may be distinguished from the perianth-segments (tepals) by its size and lower insertion. BENTHAM (*Fl. Austr.* 7: 209) has used the term 'floral bracts' in a slightly other sense, *viz* for the upper sheaths under the inflorescence and its branches which are usually shorter, broader and sometimes spathe-like and more open than the sheaths of the stem. BENTHAM (*op. cit.* 231) remarks: 'The males of some species are scarcely to be distinguished from those of some species of *Restio*, but the females are readily recognized'.

In a number of specimens the ovaries or fruits are swollen and appear to contain a mass of blackish granules, apparently due to a fungus. This disease is, according to BENTHAM (*op. cit.* 236), observed in several *Restionaceae*.

KEY TO THE SPECIES

- 1. Sheaths with a beard-like but detersile pubescence, specially along the non-scarious margin; top acuminate, ending in a long needle up to 7 mm. Flowers 2–2½ mm long . . . . . 2. *L. barbatus*
- 1. Sheaths glabrous, with a scarious margin. Flowers smaller, seldom up to 2 mm.
- 2. Firmer central part of each sheath with an acute, acuminate top across the scarious margin. Tepals of ♀ flowers *c.* 2/3–¾ mm broad. Anthers *c.* ¾–1 mm long . . . . . 3. *L. disjunctus*
- 2. Firmer central part of each sheath with a blunt, mucronate top; dark mucro across the apical scarious margin. Tepals of ♀ flowers *c.* 1/5–¼ mm broad. Anthers *c.* 1/2–¾ mm long . . . . . 1. *L. elatior*

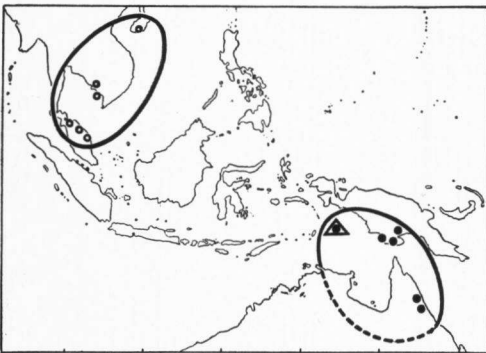


Fig. 2. Distribution of Malaysian *Leptocarpus* species: *L. disjunctus* MAST. (SE. Asia, localities indicated), *L. elatior* R.BR. (Queensland & Papua, localities dotted), *L. barbatus* BAKKER (triangle).

1. *Leptocarpus elatior* R.BR. *Prod.* (1810) 250; *STEUD. Syn.* 2 (1855) 260; *MAST. in DC. Mon. Phan.* 1 (1878) 343; *BENTH. Fl. Austr.* 7 (1878) 236; *BAILEY, Queensl. Fl.* (1902) 1724.—Fig. 1d–e.

Mostly dioecious, sometimes monoecious with some bisexual flowers. *Stems* *c.* 1–1½ m high, up to *c.* 3 mm diam., with few branches, with very fine reddish ribs; internodes apically increasing in length, up to *c.* 12 cm, generally glabrous but

sometimes with a short detersile pubescence. *Sheaths* brownish, *c.* 1–1½ cm, lengthwise ribbed, with a *c.* 1–3 mm broad scarious margin, ribs on the central firm part accurately converging towards the blunt, mucronate, 2–3 mm long apex extending through the scarious margin; both the dark mucro and the apical portion of the scarious margin may partly or wholly disappear through withering. *Panicle* lax, *c.* 6–20 cm long. Flowers in small clusters along the 1–4 cm long branches; axis 1 mm diam., or thinner, terete but near the nodes sometimes triangular-flattened or subsulcate; internodes ½–3 cm.—♂ *Flowers* in chestnut-coloured clusters, *c.* 2–5 mm diam. Floral bract broadly-elliptic or slightly obovate, towards the acuminate apex somewhat irregularly erose, brownish striate with darker midrib, *c.* 1–2 by ¾–1 mm. Tepals 4(–5); 2 outer ones opposite, folded, slightly keeled and boat-shaped, dark-brown; when flattened obovate-spathulate, apex short-acuminate, *c.* 1–1½ mm by 2/5–½ mm; 2(–3) inner ones opposite, flatter, elliptic, not keeled, apex blunt or broad-acute, lighter brown, midrib less discernable, *c.* 1–1⅓ by ⅓ mm. Stamens 2, opposite the inner tepals, connate at the base; filaments 1–2 mm, strap-shaped, in young flowers very short; anthers 1-celled, the cell curling over the top of the filaments to the outside, elliptic, rather dark in the upper part of the back in the median line, top short-apiculate; *c.* ½–¾ by ¼ mm.—♀ *Flowers* in chestnut-coloured clusters *c.* 2–5 mm diam.,

densely branched. Glumes of different order all narrowly ovate, acuminate, brownish-striate, margin somewhat scariosus. Floral bract c. 1 mm long, somewhat smaller or larger than the tepals, appressed to the flower. Tepals 6, free, very narrowly elliptic or lanceolate, acute or acuminate, chestnut-coloured, c.  $1-1\frac{1}{4}$  by  $\frac{1}{5}-\frac{1}{4}$  mm. Ovary narrowly ellipsoid, c.  $\frac{1}{2}$  by  $\frac{1}{6}$  mm. Styles 3, free or sometimes connate at the base, c.  $\frac{3}{4}-1$  mm, sometimes (BRASS 8730) longer ( $1\frac{1}{2}-2\frac{1}{2}$  mm). *Fruit* reddish-brown, ovate-oblong, triquetrous, acute, c.  $\frac{3}{4}$  mm, sometimes (BRASS 8730) 1 mm long and more elliptic.—♂ *Flowers* (found in the type specimen BROWN 5875, BRASS 1915, and in BRASS 8730 beside ♀ flowers) provided with an ovary with rather long styles and 1(-3 in BRASS 1915 from N. Queensland) stamen(s).

Distr. N. Australia, round the Gulf of Carpentaria and NE. Queensland, in *Malaysia*: South New Guinea (Wassi Kussa River near Tarara: BRASS 8702, 8730; Lower Fly River near Gaima: BRASS 8354; Merauke: ANTA (exp. Wentholt) 31, VAN ROYEN 4885), and S. Moluccas (P. Trangan, near Cape Popjetu: BUWALDA 75499, 5501). Fig. 2.

Ecol. In grass fields (BUWALDA 5499, 5501), under trees among moderate high grasses (VAN ROYEN 4885), common in *Melaleuca* swamp-forests (BRASS 8730), occasional in wet soil of savannah-forest (BRASS 8702) and associated with sedges in extensive open marshes in savannah-forest (BRASS 8354).

Vern. *Tanu*, Merauke.

Note. In the type specimen (BROWN 5875) some ♂ flowers have been detected, which were apparently overlooked by BROWN, MASTERS, and BENTHAM.

The collection BUWALDA 5499 differs slightly by the hairy stems but the material is insufficient for further critical examination.

## 2. *Leptocarpus barbatus*, nov. sp.—Fig. 1a-c.

*Vaginae* 1-2 cm longae, nervosae, nervis apicem versus prominulis convergentibus, in acumen subulatum usque ad 7 mm longum marginibus non scariosum sensim angustatae, per totam superficiem praesertim secus margines pilis longis barbiformibus evanescentibus indutae. Bracteae prope apicem scariosae pilosae. Flores 2-2½ mm longae.

Monoecious or also with bisexual flowers. *Stems* c. 80 cm high, up to 2 mm diam., little-branched, brownish-green through reddish grooves on green background; internodes increasing in length from the base to the top. *Sheaths* 1-2 cm, light brown, somewhat darker at the base, caused by reddish-brown spots on green background, with apically converging prominent ribs; apex acute and up to 7 mm aciculate; entire surface, specially along the margins, beard-like, rather detersile pubescent; sheath axils provided with a dense tuft of long, soft hairs. *Panicle* very loose, c. 10 cm long. *Flowers* in small clusters up to 3 mm, in the sheath axils and along the branches; axis less than 1 mm diam.; internodes  $\frac{1}{2}-5$  cm.—♂ *Flowers* with 2-3 stamens or with 2 stamens and a rudimentary ovary.—♀ *Flowers* with 1-2 stamens and an ovary.

—♀ *Flowers* with an ovary. Stamens occasionally reduced. All flowers with 4-6 tepals. Some flowers reduced and not developing. *Floral bracts* of different shape and size, mostly elliptic and somewhat boat-shaped; top often long-acuminate and aciculate; margin specially near the top rather scariosus and fimbriate; surface often covered with a detersile, beard-like pubescence. *Tepals* in all flowers very variable: 2 outer ones keeled, spatulate, brownish-striate, c.  $2-2\frac{1}{2}$  mm; 2-4 inner ones flatter, oblong-elliptic, acute, brownish striate, c. 2 mm. *Filaments* strap-shaped, c.  $2\frac{1}{2}-3$  mm; in young flowers very short; anthers 1-celled; cell oblong-elliptic, up to 1 mm long, rather dark in the upper part of the back in the median line, apex shortly dark-apiculate, in anthesis curling over the top of the filaments with the apiculate apex pointing downwards. Older ovaries: 1-celled, triquetrous, oblong-rectangular, light-brown, with a somewhat darker apex, c. 1 by  $\frac{1}{3}$  mm; styles 3, c.  $1\frac{1}{2}$  mm, delicate. *Capsule* obovate, c. 1 mm.

Distr. *Malaysia*: S. Moluccas (Aru Islands: P. Trangan, Cape Meroor: BUWALDA 5531, A, Bo, K, L, type). Fig. 2.

Ecol. Sandy lowland savannahs.

3. *Leptocarpus disjunctus* MAST. J. Linn. Soc. Bot. 17 (1879) 344; RIDL. Fl. Mal. Pen. 5 (1925) 136.—*Cladium vaginale* (non BENTH.) CAMUS, Fl. Gén. I.-C. 7 (1912) 153.—*L. sanaensis* MASAMUNE, Trans. Nat. Hist. Soc. Taiwan 33, no 232 (1943) 14, ex descr.; Fl. Kainant. (1943) 394.—Fig. 1f-j.

Dioecious or monoecious with some bisexual flowers. *Stems* c.  $\frac{1}{2}-1$  m high, up to c. 3 mm diam., sparsely branched, with very fine reddish ribs; internodes only slightly increasing in length towards the apex, up to c. 7 cm. *Sheaths* brownish, c.  $1\frac{1}{2}-2\frac{1}{4}$  cm long, lengthwise ribbed, with a c. 1-3 mm broad, partly or wholly caducous scariosus margin; ribs on the central firm part straightly converging towards the acute-acuminate, up to c. 5 mm long apex, extending through the scariosus margin. *Panicle* lax, c. 5-15 cm long. *Flowers* ♂, ♀ or ♂, in small chestnut-coloured clusters along the c. 1-4 cm long branches; internodes c.  $\frac{1}{2}-3$  cm.—♂ *Flowers* c. 2 mm long. *Floral bract* narrowly ovate, c.  $2-2\frac{1}{2}$  by 1 mm. Tepals 4-6, 2 outer ones opposite, folded, slightly boat-shaped, dark-brown, c.  $1\frac{3}{4}-2$  mm long; 2-4 inner ones narrowly elliptic, somewhat shorter and flatter than the outer ones, lighter brown, c.  $1\frac{1}{2}$  mm long. *Stamens* 3, filaments strap-shaped, up to 2 mm, anthers 1-celled, c.  $\frac{3}{4}-1$  by  $\frac{1}{3}$  mm, top distinctly brownish apiculate, upper part of the back in the median line reddish-brown. Rudimentary ovary sometimes present.—♀ *Flowers* c.  $1-1\frac{1}{2}$  mm long. Tepals 6-7, elliptic, narrowed towards the base, top acute, margin slightly fimbriate, c.  $1-1\frac{1}{2}$  by  $\frac{2}{3}-1$  mm, in young flowers all folded, enclosing the small, triquetrous, ellipsoid, c.  $\frac{1}{3}$  mm long ovary; styles 3 or less by abortion, connate in their lower half, c. 1-2 mm long. *Fruit* ellipsoid, c. 1 by  $\frac{1}{2}$  mm, enclosed by the flattened tepals. *Seed* c.  $\frac{1}{2}$  by  $\frac{2}{3}$  mm.

Distr. Hainan (Sana, Yurin, cf. MASAMUNE), Cochin-China (Phu Quoc Isl.: GODEFROY-LEBEUF

908, 928 type), Cambodia (Mt de l'Eléphant: POILANE 23177), Lower Siam (Songkhla = Singora: ANNANDALE *s.n.*, GWYNNE VAUGHAN *s.n.*, KINGDON WARD S.F. 37516), and *Malaysia*: Malay Peninsula (Kuala Trengganu: HOLTUM S.F. 17372; between Kuala Dungun and Kuala Marang: SINCLAIR S.F. 39983; Kresag: VESTERDAL *s.n.*). Fig. 2.

*Ecol.* Locally common on sandy places, specially along the seashore.

*Uses.* According to PIERRE natives of the isle of Phu Quoc use the stems for making mats, *etc.*

#### Excluded

*Restio pilisepalus* STEUD. Syn. 2 (1855) 256; F.v.M. Descr. Not. 2 (1885) 18, based on a plant of

D'URVILLE collected in Waigeou Island (S. Moluccas, near New Guinea) is, according to MASTERS (in DC. Mon. Phan. 1, 1878, 301) and Ind. Kew. a *Cyperacea*. It could be traced at Paris and = *Costularia pilisepala* (STEUD.) KERN.— J. H. KERN.

'Twee fraaije Restiaceën, welke op den G.-Diëng voorkomen, zijn in mijn herbarium nog niet bestemd' says JUNGHUHN (Java, 2nd Dutch ed., 1, 1853, 542); *cf.* also KOORDERS (Exk. Fl. Java 1, 1911, 270). According to BACKER (Handb. Fl. Java 3, 1925, 6) JUNGHUHN merely had in mind some *Eriocaulons*.

*Restio articulatus* RETZ. Obs. 4 (1786) 14 = *Leptonia articulata* (RETZ.) DOMIN.