

A TAXONOMIC REVISION OF HARPULLIA (SAPINDACEAE)

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INTRODUCTION

The present taxonomic revision of *Harpullia* was started by the second author as the main part of her work for a M. Sc. in biology at Leiden University. She concentrated on a revision of the species occurring in New Guinea, paid only a more superficial attention to the rest of the genus. The first author supervised her work, completed it, and worked it up for publication.

It is hoped that this taxonomic revision will be followed by two more papers, one on the pollen-morphology by Dr. J. Muller, secondly one on the systematics of the genus by the first author of the present paper. The system that will probably emanate from the last named paper is already used in the present one and, accordingly, will be sketched here. The genus is, as with Radlkofer (1933–1934), divided into two subgenera, namely a supposedly more primitive one, *Otonychium*, with only two species, *H. pendula* (1) and *H. arborea* (2), and the other one, *Harpullia*, with the further 24 species. Contrary to Radlkofer, however, we refrained from a further subdivision into sections, but grouped the species of the latter subgenus in a more informal way. The first rather loose group of supposedly relatively primitive species encompasses *H. austro-caledonica* (3), *H. giganteacapsula* (4), *H. longipetala* (5), and *H. species nova* (26). Next comes a mainly Australian group of species characterized by winged petioles and leaf rachises, viz. *H. frutescens* (6), *H. alata* (7), *H. rhyticarpa* (8), and probably the New Guinea *H. rhachiptera* (9). The likewise Australian species *H. hillii* (10) seems to take a position in between some groups, as explained in the note under that species. Included in the third group are *H. cupanioides* (11), *H. vaga* (12), *H. crustacea* (13), *H. camptoneura* (14), and *H. hirsuta* (15). To the fourth group belong three New Guinea species characterized by deeply lobed fruits, viz. *H. leptococca* (16), *H. carrii* (17), and *H. oococca* (18). The fifth and last group, considered to be the most derived one, is characterized by rami- or cauliflory. This group encompasses 6 or 7 mutually closely allied species, viz. *H. solomonensis* (19), *H. ramiflora* (20), *H. myrmecophila* (21), *H. cauliflora* (22), *H. petiolaris* (23), *H. largifolia* (24), and probably *H. peekeliana* (25).

HARPULLIA

Harpullia Roxb. [Hort. Beng. (1814) 86, *nom. nud.*] Fl. Ind. 2 (1824) 441; Radlk., Engl. Pflanzenr. 98 (1933–1934) 1433–1462. — Type: *H. cupanioides* Roxb.
[*Donatophorus* Zipp. ex Macklot, Bijdr. Natuurk. Wetensch. 5 (1830) 181, *nom. nud.* — *Thanatophorus* Zipp. ex Walp., Ann. Bot. Syst. 2 (1851–1852) 213, *nom. inval.* in synon. —

T y p e: *D. erythrospermus* Zipp. ex Macklot (= *H. cupanioides*).]
Otonychium Bl., Rumphia 3 (1847) 179. — T y p e: *O. imbricatum* Bl. (= *H. arborea*).
Blancoa Bl., Rumphia 3 (1847) 181, *nom. illeg., non* Lindl. (1840). — T y p e: *B. arborea* (Blanco)
 Bl. (= *H. arborea*).
Streptosugma Thwaites, Hooker's J. Bot. Kew Gard. Misc. 6 (1854) 298. — T y p e: *S. viridiflorum*
 Thwaites (= *H. arborea*).
 ? *Apiocarpus* Montrouz., Mém. Acad. Roy. Sci. Lyon, Sect. Sci., sér. 2, 10 (1860) 190. — T y p e:
A. moguinii Montrouz. (= ? *H. austro-caledonica*).

Shrubs to medium-sized trees. *Indumentum* consisting of stellate tufts of simple hairs, in some parts also of solitary simple hairs, sometimes intermingled with glandular-capitate hairs; no glandular scales. *Leaves* nearly always spirally arranged, paripinnate, with 1–9 leaflets on either side, without stipules; petiole and rachis winged or not; petiolules above flattened to often hollowed. *Leaflets* alternate or rarely opposite, not papillose beneath, variably hairy to glabrous; base equal-sided to oblique; margin entire except in *H. alata* (coarsely undulate to lobed). *Inflorescences* axillary, together sometimes pseudoterminal, to truly terminal, or rami- and/or cauliflorous, solitary or, especially in the latter case, often tufted; bracts and bracteoles mostly caducous. *Flowers* unisexual, dioecious, actinomorphic. *Calyx* 5-merous, sepals free, imbricate, equal or the outer two sometimes slightly smaller, not petaloid, on both sides variably hairy, not ciliate, sometimes with glandular-capitate hairs mainly along the margin, entire. *Petals* 5, longer than the calyx, either distinctly clawed and with a pair of auricles above the claw (subg. *Otonychium*; fig. 1 a¹), or sessile with a broad or narrow base and without either auricles or a scale (subg. *Harpullia*; fig. 1 b¹), either glabrous, or ciliate at the base, or out- and/or inside partly hairy, mainly near the base, entire. *Disk* annular or exceptionally divided into 5 lobes, without an appendage, variably hairy or glabrous. *Stamens* 5–8, in ♂ bud in some species S-wise bent, in ♂ flowers exerted, glabrous; anther basally attached, base cleft for up to 20%, dehiscence latero-introrse. *Pistil* 2- or 3- (exceptionally 4-)merous, sessile or short-stalked, the ovary hairy, 2- or 3- (4-)celled, with 1 or 2 ovules per locule; style apical, shorter to much longer than the ovary, slender, often hooked and the upper part twisted, lower part hairy, with sigmatic lines usually till slightly above the base (fig. 1 a & b). *Ovules* attached apically to about halfway, descendent, epitropous, anatropous. *Fruits* usually short-stipitate, 2- or 3-lobed, the lobes erect to spreading (fig. 2), inflated, rounded, loculicidally dehiscent, the wall pergamentaceous to woody, outside smooth to pustular, nearly glabrous or variably hairy, inside smooth, glabrous or sparsely, rarely densely hairy. *Seeds* with a thin-crustaceous testa; aril either restricted to a narrow annular sarcotesta around the hilum (subg. *Otonychium*; fig. 1 c) or composed of a sarcotesta covering up to half the seed and a free arilloid reaching till near the apex (subg. *Harpullia*; fig. 1 d), the aril entire and without appendage; embryo straight, cotyledons superposed, about equal (fig. 1 c¹).

D i s t r i b u t i o n: 26 species, occurring in SE. China, Bangladesh, India (Assam, the Deccan Peninsula, and the Andaman I.), Ceylon, Burma, Thailand, Vietnam, throughout Malesia, Australia (Northern Territory, Queensland, and New South Wales to 32° 30' S), from the Solomon I. to Samoa and Tonga, and New Caledonia.

E c o l o g y: Mainly substage or lower storey trees of primary and sometimes secondary rain forests; sometimes growing in low or open forest or savannas and in shrubberies

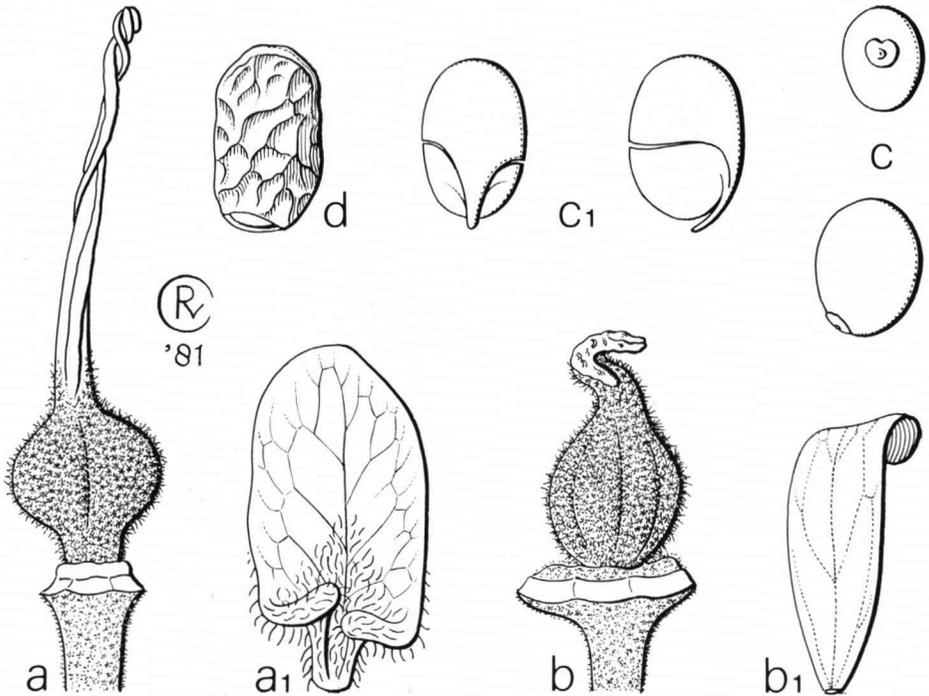


Fig. 1. *Harpullia* subg. *Otonychium*. a: pistil with long twisted style; a¹: petal from inside with claw and auricles (both *H. pendula*; Moore s.n. in A; $\times 7.5$); c: seed, basal and side view, with annular sarcotesta around the hilum (*H. arborea*; Merrill 2843; $\times 1.5$); c¹: embryo, showing the rootlet and two thick cotyledons (*H. arborea*; Waterhouse 36-B; $\times 1.5$). — subg. *Harpullia*. b: pistil, with short hooked style; b¹: petal, without claw and auricles (both *H. cupanioides*; SAN 31225; $\times 7.5$); d: dried seed fully enveloped by the arilloid (*H. cauliflora*; Brass 13802; $\times 1.5$).

on coastal dunes; altitude from sea level up to c. 2000 m. The seeds are probably mainly dispersed by birds, possibly also by mammals and lizards.

U s e s. Economically the genus is not very important. Two Australian species, *H. pendula*, the Tulip Wood, and *H. hillii* provide good timber; of several other species the wood is recorded as being soft and white. Containing saponin, the bark is locally used as a soap substitute and as a fish poison, like that of many Sapindaceae.

N o t e s. 1. *Monoecism and dioecism.* In *Harpullia*, like in most Sapindaceae, dioecism is probably the normal situation. In most species the pistillode in ♂ flowers and the staminodes in ♀ ones are rather strongly reduced, hence the flowers are distinctly unisexual. As far as can be seen in the herbarium all flowers in the same inflorescence and on the same specimen are of the same sex, moreover. However, in a few species, viz. *H. austro-caledonica* and the Australian species of the *H. frutescens* group, the pistil, resp. the stamens, are less strongly reduced. *H. austro-caledonica* and *H. frutescens* especially are sometimes said to be monoecious. In the herbarium material available to us we could not find any indication that this is true, but especially in *H. austro-caledonica*

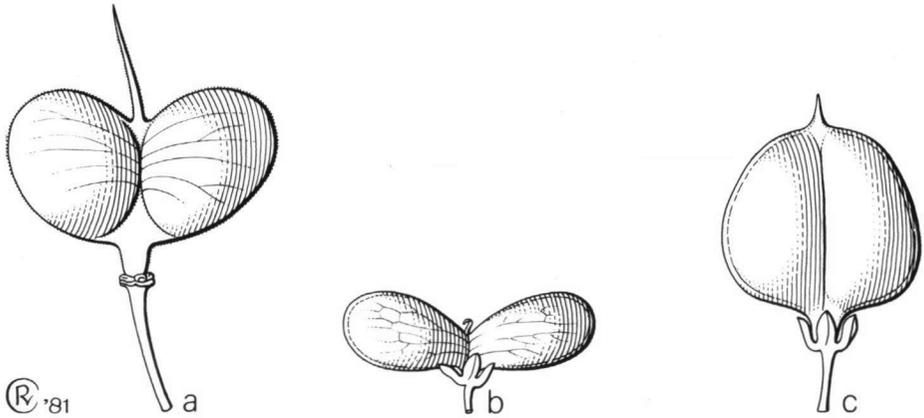


Fig. 2. Fruits of *Harpullia*. a. subg. *Otonychium*, showing the absence of the calyx and the relatively long style remnant; *H. arborea* (NGF 39454). — b & c. subg. *Harpullia*, showing the presence of the calyx and the short style remnant. b. *H. leptococca* (NGF 12367); c. *H. ? cauliflora* (Hoogland & Craven 10551). All natural size.

the degree of reduction is very variable and hence it is possible that this species is at least partly monoecious. This problem should be studied in the field. For a further discussion see Leenhouts, *Blumea* 21 (1973) 92.

2. *Inflorescences*. The inflorescences may be terminal, axillary, rami- or cauliflorous. Truly terminal inflorescences are only known, more or less as an exception, from *H. hillii*, *H. cupanioides*, and *H. leptococca*, three species considered to be rather closely allied mutually. Most species either bear truly axillary inflorescences, or are rami- and/or cauliflorous. True axillary inflorescences drop after one flowering and eventually fruiting period. If the upper leaves remain rather small, the inflorescences together may give the impression of a large terminal one, but with a terminal vegetative bud. This situation is called pseudo-terminal. In rami- or cauliflorous species the inflorescences often start also in the axils of leaves, but will go on flowering for several seasons after the leaf is fallen. Probably, especially in the few cauliflorous species, the inflorescences may sometimes start developing only after the leaves are fallen; in a few cases it looked even as if the inflorescences developed much later from adventitious buds. This should be studied on the living tree, however.

The number of buds per leaf axil is sometimes 1 (exclusively so in *H. austro-caledonica*, *H. petiolaris*, and *H. largifolia*), mostly 2, and in *H. pendula* and *H. ramiflora* sometimes even 3, and serial. If the inflorescences are exclusively axillary there is mostly only one inflorescence per axil. If in that case there is more than one axillary bud the inflorescence nearly always develops from the upper one; in *H. alata* and *H. frutescens*, however, it is the lower bud that gives rise to the inflorescence. Sometimes with axillary inflorescences, and mostly so with ramiflorous ones, a 2nd feebler inflorescence develops from the lower axillary bud.

In principle, the inflorescence is a thyrus, which sometimes may be subspicate. Next to the main rachis often two strong branches develop from the axils of the lowermost bracts.

In species which are principally ramiflorous the inflorescence is often a tuft of several short rachises, the number of which grows with the age of the inflorescence; moreover, two serial tufts in the same leaf axil may in the course of time merge together and form one big tuft.

3. According to the description, *Apiocarpus* Montrouz. could be identical with *Harpullia* and *A. moguinii*, the only species, with *H. austro-caledonica*. However, the description is not sufficiently complete to be sure. The original material seems to be lost, as according to Guillaumin & Beauvis., Ann. Soc. Bot. Lyon 38 (1914) 120, it is neither present in P, nor in LY, MPU, the herbaria where part of Montrousier's collections are kept.

4. The present revision is based upon material from the following herbaria: A, B, BISH, BKF, BM, BO, BRI, C, CANB, FI, K, L, LAE, M, MEL, NOU, NSW, P, PNH, S, SING, TNS, U, US, W, WRSL. Our thanks are due to the directors of these institutes. The second author wishes to express her gratitude especially to the directors of BM and K for their hospitality during her visit to these institutes, to the fund Fonds Mr. Vollenhoven of Leiden University, which financed these visits, and to the staff of the Rijksherbarium, Leiden, for their cooperation and guidance during her stay there.

GENERAL KEY TO THE SPECIES

- 1a. Leaf rachis (and mostly also petiole) winged. 2
- b. Leaf rachis and petiole not winged 5
- 2a. Margin of leaflets coarsely undulate, dentate, or lobed **7. *H. alata***
- b. Margin of leaflets entire 3
- 3a. Ovules 1 per locule. New Guinea **9. *H. rhachiptera***
- b. Ovules 2 per locule. Australia 4
- 4a. Stamens 7 or 8. **6. *H. frutescens***
- b. Stamens 5 (exceptionally 6) **8. *H. rhyticarpa***
- 5a. Petals clawed and auricled, membranous. (fig. 1 a¹). Aril restricted to a ring around the hilum (fig. 1c) 6
- b. Petals neither clawed, nor auricled, thin-fleshy (fig. 1 b¹). Aril (nearly) completely enveloping the seed (fig. 1 d) 7
- 6a. Leaflets above glabrous or at most very sparsely hairy on the base of the midrib. Sepals up to 4 mm long; petals up to 8 mm long. Pedicels in fruit c. 10 mm long **1. *H. pendula***
- b. Leaflets above hairy all along the midrib. Sepals 5–10 mm long; petals 10–25 mm long. Pedicels in fruit 12–30 mm long **2. *H. arborea***
- 7a. Stamens 8 (sometimes 7) 8
- b. Stamens 5 (sometimes 6, exceptionally 7) 12
- 8a. Pistil and fruit 3-merous 9
- b. Pistil and fruit 2-merous 10
- 9a. Leaves with 4–7 leaflets per side, these glabrous or nearly so. New Caledonia **3. *H. austro-caledonica***
- b. Leaves with 1 or 2 leaflets per side, these distinctly hairy. New Guinea **26. *H. sp. nov.***

- hairy on axes, midrib, and nerves **11. *H. cupanioides***
- b. Vegetative parts, at least when young, distinctly and \pm densely hairy 27
- 27a. Twigs rather stout (9–15 mm thick). Leaves 5–9-jugate. Leaflets sessile, the nerves slightly sunken above **13. *H. crustacea***
- b. Twigs rather slender (3–10 mm thick). Leaves up to 5-jugate. Leaflets distinctly stalked, nerves above \pm raised 28
- 28a. Inflorescences pendulous, up to 70 cm long. Solomon I. **12. *H. vaga***
- b. Inflorescences erect, 1.5–15 cm long. New Guinea 29
- 29a. Leaflets at most above and beneath on midrib and nerves thin puberulous **14. *H. camptoneura***
- b. Leaflets hirsute on both sides, most densely so on both sides of the midrib and on the upper side of the nerves **15. *H. hirsuta***

KEY TO THE SPECIES OF CONTINENTAL ASIA, SUMATRA, JAVA, AND THE LESSER SUNDA ISLANDS

- 1a. Vegetative parts, including the upper side of the midrib, rather densely hairy. Petals distinctly clawed and auricled, up to 2.5 cm long, membranous (fig. 1 a¹). Pedicels in fruit 1.25–3 cm long. Sepals nearly always caducous. Ovules and seeds nearly always 2 per locule. Seeds with a small annular aril (fig. 1 c) **2. *H. arborea***
- b. Vegetative parts (sub)glabrous, except the terminal buds. Petals neither clawed, nor auricled, up to c. 1 cm long, thin-fleshy (fig. 1 b¹). Pedicels in fruit up to 1 cm long. Sepals persistent. Ovules and seeds 1 per locule. Seeds nearly completely enveloped by the aril (fig. 1 d) **11. *H. cupanioides***

KEY TO THE SPECIES OF BORNEO, THE PHILIPPINES, CELEBES, AND THE MOLUCCAS

- 1a. Vegetative parts (sub)glabrous, except the terminal buds. Inflorescences axillary to exceptionally terminal **11. *H. cupanioides***
- b. Vegetative parts, including the upper side of the midrib fairly densely hairy. Inflorescences axillary to rami- or cauliflorous 2
- 2a. Inflorescences short (c. 3 cm) **20. *H. ramiflora***
- b. Inflorescences long (c. 15–60 cm) 3
- 3a. Petals distinctly clawed and auricled, up to 2.5 cm long, membranous (fig. 1 a¹). Filaments of stamens 10–17 mm long. Style 14–17 mm long, partly persistent on the fruit (fig. 2 a). Pedicels in fruit 1.25–3 cm long. Fruits 2.7–6.5 cm wide. Seeds with a small annular aril (fig. 1 c) **2. *H. arborea***
- b. Petals neither clawed, nor auricled, up to 1.25 cm long, thin-fleshy (fig. 1 b¹). Filaments of stamens up to 5.5 mm long. Style c. 6 mm long, deciduous. Pedicels in fruit 5–8 mm long. Fruits c. 2.5–2.8 cm wide. Seeds fully enveloped by the aril (fig. 1 d) **23. *H. petiolaris* subsp. *moluccana***

NEW GUINEA

For New Guinea may be referred to the General Key, as 19 out of a total of 26 species are known to occur in that area.

KEY TO THE SPECIES OF THE SOLOMON ISLANDS

- 1a. Sepals deciduous. Fruits outside smooth or veined 2
 b. Sepals persistent under the fruit. Fruits outside granulate to pustular 3
 2a. Pedicels in fruit 1.25–3 cm long. Style 14–17 mm long, often partly persistent on the fruit (fig. 2 a). Seeds with a small annular aril (fig. 1 c). **2. H. arborea**
 b. Pedicels in fruit up to 0.75 cm long. Style c. 3 mm long, only the base persistent in fruit (fig. 2 c). Seeds fully enveloped by the aril (fig. 1 d). **24. H. largifolia**
 3a. Twigs mostly, leaf axes always at first densely hairy. Fruits up to 4.5 cm wide, the wall 1–1.5 mm thick, woody. Ovules 1 or 2 per locule **12. H. vaga**
 b. Twigs and leaf axes about glabrous. Fruits up to 3.4 cm wide, the wall thin-woody. Ovules 1 per locule **19. H. solomonensis**

KEY TO THE SPECIES OF AUSTRALIA

- 1a. Leaf rachis (and mostly also petiole) winged 2
 b. Leaf rachis and petiole not winged 4
 2a. Leaflets undulate, dentate, or lobed **7. H. alata**
 b. Leaflets entire 3
 3a. Stamens 7 or 8 **6. H. frutescens**
 b. Stamens 5 (exceptionally 6) **8. H. rhyticarpa**
 4a. Petals long-unguiculate, auricled, membranous (fig. 1 a¹). Sepals caducous in fruit. Seeds with an annular sarcotesta around the hilum (fig. 1 c) 5
 b. Petals not or slightly unguiculate, not auricled, thin-fleshy (fig. 1 b¹). Sepals persistent in fruit. Seeds enveloped by a mainly free aril (fig. 1 d) 6
 5a. Leaflets above glabrous or at most very sparsely hairy on the base of the midrib. Sepals up to 4 mm long; petals up to 8 mm long. Pedicels in fruit c. 10 mm long **1. H. pendula**
 b. Leaflets above hairy all along the midrib. Sepals 5–10 mm long; petals 10–25 mm long. Pedicels in fruit 12–30 mm long. **2. H. arborea**
 6a. Inflorescences, though at first axillary, finally rami- or cauliflorous **20. H. ramiflora**
 b. Inflorescences axillary to sometimes terminal 7
 7a. Fruits rather big, up to 3 cm high by 4.5 cm wide, the wall 1–1.5 mm thick woody, inside glabrous **12. H. vaga**
 b. Fruits smaller, the wall leathery to thin-woody, inside mostly hairy 8
 8a. Twigs and leaf axes at first densely puberulous, though mostly early glabrescent. Leaflets mostly nearly parallel-sided and not acuminate; nervation rather dense. Pistil and fruit inside densely woolly, the fruit lobes either spreading and only slightly connate, or erect and high up connate. Queensland, New South Wales . **10. H. hillii**
 b. Twigs and leaf axes mostly nearly glabrous from the beginning. Leaflets not parallel-sided, mostly distinctly acuminate; nervation rather lax. Pistil and fruit inside glabrous or very sparsely hairy, the fruit lobes never spreading. Northern Territory. **11. H. cupanioides**

REGIONS FROM WHERE ONLY ONE SPECIES IS KNOWN

Ceylon: **H. arborea**New Hebrides: **H. arborea**Fiji, Samoa, and Tonga: **H. arborea**New Caledonia: **H. austro-caledonica**

subg. OTONYCHIUM

Otonychium Bl., 1847. — *Harpullia* subg. *Otonychium* Radlk., Sapind. Holl.-Ind. (1879) 52; Engl. Pflanzenr. 98 (1934) 1438. — *Harpullia* sect. *Euotonychium* Radlk., Sapind. Holl.-Ind. (1879) 52, nom. inval. (I.C.B.N. ed. 1978, art. 21.3 & 32.1); Engl. Pflanzenr. 98 (1934) 1439. — T y p e: *O. imbricatum* Bl. (= *H. arborea*).
Blancoa Bl., 1847. — T y p e: *B. arborea* (Blanco) Bl. (= *H. arborea*).
Streptostigma Thwaites, 1854. — T y p e: *S. viridiflorum* Thwaites (= *H. arborea*).
Harpullia sect. *Otonychidium* Radlk., Sapind. Holl.-Ind. (1879) 53; Engl. Pflanzenr. 98 (1934) 1438. — T y p e: *H. pendula* Planch.

Petiole and rachis never winged. Sepals deciduous. Petals distinctly clawed and with a pair of infolded auricles just above the claw, membranous. Style straight. Aril restricted to a narrow sarcotestal ring around the hilum. — Fig. 1 a & c; fig. 2 a.

1. *Harpullia pendula* Planch. ex F. Muell. — Fig. 1 a, a¹.

H. pendula Planch. ex F. Muell., Trans. Phil. Inst. Victoria 3 (1859) 26; Fragm. 2 (1860) 104; Benth., Fl. Austr. 1 (1863) 471; Reichb. f., Neuholl. Pfl. Am. Dietr. (1866) 11; F. Muell., Fragm. 9 (1875) 100, 197; F. M. Bailey, Queensl. Fl. 1 (1899) 309; J. H. Maid., Commerc. Timb. N.S.W. ed. 2 (1904) 28; W. Dallimore, Kew Bull. (1912) 241; Le Renard, Ann. Sci. Nat. Bot. IX, 17 (1913) 370, fig. 9 (anatomy); E. H. F. Swain, Timbers and Forest Products of Queensland (1928) 291; Francis, Queensl. Agric. J., N. Ser. 31 (1929) 161, 162; Anderson, Agric. Gaz. N.S.W. 41 (1930) 901; Trees N.S.W. (1932) 146; Radlk., Engl. Pflanzenr. 98 (1934) 1455; Dadswell & Eckersley, Bull. Counc. Sci. Industr. Res. Commonw. Austral. 90 (1935) 53; Francis, Austr. Rain-For. Trees ed. 2 (1951) 261, fig. 154, 155; Holliday & Hill, Field Guide Austral. Trees (1969) 164, 165; Hyland, Card Key For. Trees N. Queensl. (1971) nr. 371; Audas, Native Trees Austr. (no date) 223, fig. opp. p. 236; S. T. Reynolds, Austrobaileya 1 (1981) 418, fig. 29 A. — L e c t o t y p e (present authors): *Cunningham 125*, Queensland, Brisbane R., -ix-1828, fr. (K; iso in MEL).

Tree, sometimes shrublike, up to 30 m high and 90 cm d.b.h., but usually much smaller. Twigs and leaf axes densely yellowish- to reddishbrown puberulous, mostly early glabrescent. Twigs 1.5–5 mm thick. Leaves sometimes opposite, with (1–) 3–5 leaflets per side; petiole 2.5–4 (–9) cm long; petiolules (1.5–) 2–3 (–4.5) mm long. Leaflets (2.25–) 4–12 (–17.5) × (1–) 1.5–3.5 (–7.5) cm, (1.75–) 2.5–3.5 (–4) times as long as wide, widest in or exceptionally below the middle, curved backwards and not rarely slightly falcate, thin-pergamentaceous or sometimes papyraceous, above glabrous or very sparsely hairy on the base of the midrib, beneath sparsely hairy on the midrib to nearly glabrous; base equalsided to oblique (especially in upper leaflets), acute and not decurrent to sometimes rounded and then often slightly attenuate; apex acute, blunt, rounded, emarginate, or slightly acuminate, in the latter case the acumen short, broad, and rounded to slightly emarginate, always mucronate; midrib above slightly raised over the whole length, or flat and slightly sunken to the base, or rarely completely sunken; nerves 1–1.75 cm apart, above hardly prominent to slightly sunken; intercalated veins often present, but feeble to

hardly conspicuous. *Inflorescences* axillary, together mostly pseudo-terminal, developing mostly from the upper or sometimes from the lower of two axillary buds, hence solitary, sometimes a 2nd and exceptionally a 3rd feebler one from the lower bud, exceptionally tufted, (2.5–) 10– c. 30 cm long, with few erecto-patent up to 8 cm long branches and sometimes a strong patent branch at the base; the rachis and main branches usually sparsely, the ultimate branches densely puberulous; pedicels in fruit c. 1 cm long. *Sepals*: outer 2 smaller (outermost one often much smaller) and relatively narrower than the inner three, outer ovate to oblong, 2.2–3.6 × 1–2.5 mm, inner broad-ovate to suborbicular, 3–4 × 2.5–3 mm, with a few marginal glands. *Petals*: claw 1–2 mm long, plate 4–6 × 2–3 mm, ovate to oblong, nearly parallel-sided, rounded at the top, outside sparsely appressedly reflexed-hairy, lower part of plate and claw sparsely woolly ciliate, inside lower half of plate and auricles thin-woolly. *Disk* annular, glabrous. *Stamens* (7 or) 8 (or 9); filament 2.5–6 mm long; anther 1.3–1.75 mm long. *Pistil* 2- (exceptionally 3-) merous; style 6–10 mm long; ovules 1 per locule (acc. to Radlk., 1934, rarely 2 in one of the locules). *Fruits* with a stipe 0.5–3 mm high, the lobes spreading and ellipsoid, 15–17.5 mm long and 12.5–15 mm high, making an angle of 130–190°, to erect and subglobular, 17.5–20 mm high, 22.5 mm broad, deeply cordate at apex; fruit wall thin-woody, outside coarsely reticulate, very sparsely stellate-hairy, finally subglabrous, inside thin-hairy. *Seeds* 1 per locule, globular, 10–11.5 mm \varnothing , to ellipsoid, up to 14 × 11 × 9 mm, with a c. 1 mm broad aril ring around the hilum; embryo with suture varying from transverse to longitudinal.

Field notes. Bole fluted; wood hard, sapwood thick, pale, yellowish, heartwood red to darkbrown; bark smooth or sometimes rough or irregularly flaked, light grey, sometimes cream or mottled, bitter. Young shoots reddish brown; leaflets light to dark glossy green above, paler beneath. Flowers pale yellow to pale green, faintly scented. Inflorescences pendulous; fruits orange to red, the seeds black and shiny with a yellow aril.

Distribution: Coastal NE. Australia, from Black Mt., Queensland (15°31' S) to Bellingen R., N.S.W. (30°30' S).

AUSTRALIA. Queensland: 64 collections. — New South Wales: 27 collections.

Cultivated at Bogor (Indonesia, Java: Bot. Garden, III-H-14, III-J-54), Brisbane (Australia, Queensland: Bot. Gardens, Helms 210, C.T. White 8801; Brookfield, BRI 76600), Sydney (Australia, New South Wales: Bot. Gardens, NSW 27309, 130519), Honolulu (Hawaii, Oahu: Govt. Nursery, College of Hawaii Herb. 12553; roadside tree, Degener 21414), Eala (Zaire: Baland 1324), Miami (U.S.A., Florida: Plant Introduction Station, Gillis 10831), Fort Myers (U.S.A., Florida, Lee County: The Sanders Garden, Brumbach 7359).

Ecology: An element of rain forest, often along rivers or near the coast, as well as of dry forest on hill slopes; on different soils: basalt, deep sand, loamy clay, basic soil. Flowering mainly in Febr. and March, fruiting apparently throughout the year. Up to 800 m a.s.l.

Uses: Planted along streets and as a solitary ornamental tree. Provides excellent timber. See Dadswell & Eckersley (1935), Francis (1951), and Audas (no date; plate opp. p. 236).

Vernaculars: The common English name is *Tulip-wood tree*; an aboriginal name from N.S.W. *Mogum-mogum*.

Notes: 1. The number of stamens was given by Bentham (1863) as 5–7; in this he was followed by F. M. Bailey (1899) and Francis (1951), the latter 5–8. The normal number is 8; I counted never less than 7.

2. *H. pendula* is distinctly nearest to *H. arborea*; the latter differs in its more tender leaflets, its bigger, longer pedicelled flowers, and its hairy disk.

2. *Harpullia arborea* (Blanco) Radlk. — Fig. 1 c, c¹; 2 a.

Ptelea arborea Blanco, Fl. Filip. (1837) 63. — *Seringia lanceolata* Blanco, Fl. Filip. ed. 2 (1845) 45, *nom. illeg.* (I.C.B.N. ed. 1978, art. 67.1, being contrary to art. 55.1), *non* Steetz, (1848); ed. 3, 1 (1877) 85. — *Blancoa arborea* Bl., Rumphia 3 (1847) 181, *comb. illeg.* — *H. arborea* Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 16 (1887) 404; Lecomte, Fl. Indo-Chine 1 (1912) 1022; Le Renard, Ann. Sci. Nat. Bot. sér. 9, 17 (1913) 373 (anatomy); Merr., Sp. Blanc. (1918) 243; En. Philip. 2 (1923) 515; Craib, Fl. Siam. 1 (1926) 335; Radlk., Engl. Pflanzenz. 98 (1934) 1456; Gagnepain, Fl. Indo-Chine Suppl. 1 (1950) 954, fig. 119: 18–21; Backer & Bakh. f., Fl. Java 2 (1965) 142; Gandhi in Saldanha & Nicolson, Fl. Hassan Dist. (1976) 367; S. T. Reynolds, Austrobaileya 1 (1981) 419, fig. 29 F. — **N e o t y p e** (present authors): *Merrill Sp. Blancoanae* 339, Philippines, Luzon, Bulacan Prov., Angat, -ix-1913, fl. (A; iso in BM, BO, K, L, NSW, P, US, W).

Otonychium imbricatum Bl., Rumphia 3 (1847) 180. — *H. imbricata* Thwaites, En. Pl. Zeyl. (1858) 56; Bedd., Fl. Sylv. (1871) pl. 158; Trimen, Fl. Ceyl. 1 (1893) 311; Cooke, Fl. Bombay 1 (1902) 268; Koord. & Valetton, Bijdr. Boomsoort. Java 9 (1903) 236; Talbot, For. Fl. Bombay 1 (1909) 340, fig. 201; Koord. & Valetton, Atlas Baumart. Java 1 (1913) pl. 142: F–N; Gamble, Fl. Madras 1 (1918) 253. — **S y n t y p e s**: *Korthals s.n.*, Central Sumatra, ♀ (L sh. nrs. 908.268–924, 936, 937); Kühl & Van Hasselt s.n., Java, fr. (L sh. nr. 908.268–924).

Streptostigma viridiflorum Thwaites, Hooker's J. Bot. Kew Gard. Misc. 6 (1854) 298, pl. 9A. — **T y p e**: *Thwaites C.P. 605*, Ceylon, Central Prov., ♀ and fr. (PDA; iso in A, BM, BO, K, MEL, P, W).

? *H. blancoi* F.-Vill. in Mercado, Libro Medic. (1880) 4. — **T y p e**: unknown.

H. divaricata Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Akad. Wiss. München 20 (1890) 279; Engl. Pflanzenz. 98 (1934) 1454. — **T y p e**: *E. Bauer s.n.*, Queensland, Bloomfield R., 1884, fr. (M; iso in MEL).

H. pedicellaris Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20 (1890) 279; Engl. Pflanzenz. 98 (1934) 1454. — **T y p e**: *C. Hartmann s.n.*, SE. New Guinea, 1887, fr. (M; iso in MEL sh. nr. 71705).

H. condorensis Pierre, Fl. Cochinchine (1895) pl. 332 fig. B. — **T y p e**: *Harmand 692 = herb. L. Pierre 5671*, Vietnam, P. Condor, -viii-1876, fr. (P; iso in L).

H. mellea Lauterb., Bot. Jahrb. Syst. 41 (1908) 229; Radlk., Engl. Pflanzenz. 98 (1934) 1453; Christoph., Bernice P. Bishop Mus. Bull. 128 (1935) 133; A. C. Smith, Sargentia 1 (1942) 55; Yuncker, Bernice P. Bishop Mus. Bull. 220 (1959) 176. — **T y p e**: *Vaupel 459*, Samoa I., Savaii, between Aopo and Asau, 6-x-1906, ♀ and fr. (B, lost, photo in BISH; iso in WRSL).

H. glanduligera Radlk., Feddes Repert. Spec. Nov. Regni Veg. 20 (1924) 41; Engl. Pflanzenz. 98 (1934) 1459. — **T y p e**: *Ledermann 6760*, NE. New Guinea, near Sepik R., 1912–1913, fl. (B, lost; iso in M).

? *H. arborea* var. *megalocarpa* Merr., Philipp. J. Sci. 27 (1925) 35. — **T y p e**: *Loher 13273*, Philippine I., Luzon, Rizal Prov., Mt. Sumag, Montalban, -iv-1912, fr. (PNH, lost).

H. tomentosa Ridley, Kew Bull. (1933) 192; Radlk. in Engl. Pflanzenz. 98 (1934) 1462. — **T y p e**: *G. D. Haviland 2232*, Borneo, Sarawak, Mt. Braang, bud (K).

H. sphaeroloba Radlk., Engl. Pflanzenz. 98 (1934) 1454. — **T y p e**: *Bogor Hort. Bot. III. K.19a*, Moluccas, Ceram, Amahai, fr. (M; iso in BO, BRI, U).

H. cupanioides auct. *non* Roxb.: Hiern in J. D. Hook., Fl. Brit. India 1 (1875) 692 p.p.; F.-Vill. in Blanco, Fl. Filip. ed. 3, Nov. App. (1880) 53 p.p.; Brandis, Indian Trees (1906) 187 p.p.; Le Renard, Ann. Sci. Nat. Bot. sér. 9, 17 (1913) 365 p.p.; Radlk., Meded. Rijks-Herb. 22 (1914) 20 as for *Elbert 3261*; Engl. Pflanzenz. 98 (1934) 1444 as for Celebes; U. N. & P. C. Kanj., Das & Purkay., Fl. Assam 1 (1936) 318; K. R. Rao, Indian Woods 2 (1963) 220 p.p.; Foreman, Check List Bougainville (1971) 58 p.p.

Harpullia sp.: Ceron, Cat. Pl. Herb. Manila (1892) 55 as for Vidal 2524 & 2526.

Harpullia sp. A: Koord., Meded. Lands Plantentuin 12 (1894) 33.

Arytera litoralis auct. non Bl.: Koord., Versl. Minahassa (1898) 402.

Tree or sometimes shrub, up to 33 m high \times 60 cm d.b.h., but usually much smaller. Young parts \pm densely hairy, the hairs patent, rather long, on lower side of midrib, in inflorescences and on sepals sometimes intermingled with longer glandular hairs. *Twigs* 3.5–9 mm thick. *Leaves* with 2–6 leaflets per side; petiole 4.5–15 cm long; petiolules 3–8 mm long; all axes hairy, glabrescent. *Leaflets* 5.5–30 \times 2–10 cm, 1.5–3.5 times as long as wide, widest above to below the middle, herbaceous, above glabrous except for the midrib, beneath glabrous or sparsely hairy on midrib and very sparsely so on the nerves; base oblique with either the upper half cordate or both sides acute, or equal-sided and acute to rounded; apex acute to rounded, sometimes acuminate, acumen mostly short, acute; midrib above flat to slightly raised; nerves 0.75–2.25 cm apart, above flat; intercalated veins sometimes present but inconspicuous. *Inflorescences* axillary or ramior cauliflorous, developing either from the single axillary bud, or from the upper one of two axillary buds, either ramified only near the base into several axes of about the same length, up to 17 cm long, or with a distinct, up to 35 cm (in fruit up to 60 cm) long main axis bearing short side axes; all axes hairy; pedicels in fruit 12–30 mm long. *Sepals* all equal, ovate to obovate, 5–10.5 \times 3–5 mm, sometimes, especially along the margin, with some scattered glandular hairs; exceptionally some sepals persistent under the fruit. *Petals*: claw 3–7 mm long, plate 8–17 \times 3–10 mm, obovate-oblong, outside glabrous or claw and lower half of plate mainly in the centre sparsely hairy, margin often ciliate mainly in the basal part, inside often sparsely hairy. *Disk* sparsely to densely hairy. *Stamens* 5 (exceptionally up to 7); filament 10–17 mm long; anther 2–2.5 mm long. *Pistil* 2 (–4)-merous; style 14–17 mm long; ovules 1 or 2 per cell. *Fruits* with a stipe up to 4.5 (–7) mm high, 9–31 mm high, 27–65 mm wide, the lobes spreading, slender ellipsoid to globular; outside prominently veined to smooth, fairly densely to sparsely hairy; fruit wall thin, chartaceous to woody; inside sparsely hairy to glabrous. *Seeds* 1 or 2 per cell; the aril up to 2.5 mm wide. *Seedling* from the beginning with paripinnate leaves, the first ones 2-jugate.

F i e l d n o t e s. Bole straight or often crooked, sometimes with buttresses up to 1.5 m high, 1 m spreading, and 4–10 cm thick. Bark mostly greyish, brownish, or greenish, smooth but often with long horizontal lenticels, corky, peeling off in irregular flakes or not; sapwood hard or sometimes soft, white or creamy to light brown, heavy; heartwood, if differentiated, brown. Leaves above dark green and mostly shiny, beneath lighter green and often dull, sometimes with yellowish nerves, young leaves light brownish- or greyish-green to silvery white, or brown red. Sepals light greenish with brown hairs. Petals mostly yellowish-green, often with reddish margins, sometimes completely flushed reddish, or pink to red. Filaments light yellow; anthers orange or brown to light yellow. Style yellowish, green towards apex. Flowers without or with a faint smell. Fruits red, inside reddish. Seeds black, mahoganybrown, or dark purple with an orange aril.

D i s t r i b u t i o n: Ceylon, the Deccan Peninsula from Maharashtra to the South, Assam, Thailand, South Vietnam, throughout Malesia, from the Solomon I. to Samoa and Tonga, and N. Queensland.

INDIA. Assam: *Chand 4619*, Laikul (L); *Koelz 27864*, Laikul, Cachar (L). — Maharashtra: *Gibson s.n.*, Bombay Presidency (BO, MEL sh. nr. 71688, M); *Law s.n.*, Bombay (K); *Stocks & Law s.n.*, Konkan (A, C, FI, K, L, M, P, W). — Mysore: 4 collections from the North Kanara (*Bor 9669*, *Gamble 2732*, *Raghavan 86283*) and Hassan Dist. (*Saldanha 12070*). — Tamil Nadu: *Beddome s.n.*, Madras, Anamallays (MEL sh. nr. 71701); *Kostermans 26120*, Central Kerala, road between Thekadi and Devicolam (L).

CEYLON. *Jayasuriya 1981*, Monaragala Dist., Kotabowe off Medagama (L); *Meijer 89*, Central Prov., Kandy, margin of Udawattakella For. Res. near St. Paul's Church (L, US); *Thwaites C.P. 605*; *Worthington 5151*.

THAILAND. 17 collections.

INDO-CHINA. Vietnam: *Harmand 692* = herb. *L. Pierre 5671*, P. Condor, type of *H. condorensis*.

MALAY PENINSULA. Pahang: *Burkill & Haniff S. F. 17547*, Beserah, — without locality: *S. F. 17225*; *T. & P. 39* = *K. L. 2639*, Tanjong Hantu For. Res.

SUMATRA. West Coast: *Meijer 5049*, Mt. Sago, Kebun Bantjah (L, PNH); *NIFS bb 18072*, Kerintji. — Benkoelen: *NIFS bb 15444*, Redjang, Konak, 2 km from Kepahiang.

JAVA. West: 8 collections. — Central: *Koorders 7408 & 7409*, Res. Banjumas, Dist. Singomerto, Pringombo For. Res. — East: 25 collections, all from Res. Besuki.

LESSER SUNDA ISLANDS. Flores: *Schmutz 3275*, Rangu, Mt. Kuwu (L); *Verheijen 3199* (L). — Tanimbar I.: *P. Buwalda 4579*, P. Jamdena, c. 25 km ENE of Otimmer; *NIFS bb 24372*, Otimmer; *NIFS bb 24420*, Arkilo.

BORNEO. Sarawak: 14 collections. — West Kalimantan: *Hallier 2788*, Mt. Liang Gagang (L). — East and Northeast Kalimantan: 5 collections. — Sabah: 43 collections.

PHILIPPINES. 139 collections.

CELEBES. North Peninsula: *Fairchild 251*, near Gorontalo (A); *Koorders 18842*, Totok near Ratatotok; *Riedel s.n.*, Gorontalo (BO). — Central: *Kjellberg 2242*, Dist. Nuha, Tabarano (BO, S), *Waturandang Cell/V-154*, Malili, near Kawata. — Southeast Peninsula: *Kjellberg 1201*, Wavotobi (BO, S); *3156*, Wavotobi Dist., Pungalaka (BO, S). — Kababënan: *Elbert 3261*, Balo, Eempuhu. — P. Muna: *NIFS bb 21706*, Boné.

MOLUCCAS. Sula Islands: *Atjè 338*, Sulabesi, Waegoica (L). — Buru: *Toxopeus 447*, Fakal (BO). — Ceram: *Bogor Bot. Gdns. III. K.19 & 19a*, Amahai, the latter type of *H. sphaeroloba*. — Ambon: *C. B. Robinson 1601* (BO, L, M, US); *Pl. Rumph. 4*, Hitu Lama (BO, L, M, SING). — Kai Islands: *Jaheri 442* (L).

NEW GUINEA. 44 collections from all but the southwestern part, and including New Britain and the Misoöl I.

AUSTRALIA. Queensland: *Brass 2018*, Mowbray R.; *E. Bauer s.n.*, Bloomfield R., type of *H. divaricata*; *Hyland 5968*, Cape Tribulation Rd. near Hoah Head, 16°10' S 145°10' E (L).

SOLOMON ISLANDS. 38 collections.

NEW HEBRIDES. Efate: *Gillison & Beveridge RSNH 3507*, Rentapao. — Tanna: *Kajewski 138*, Lenakel. — Aneityum: *S. F. Kajewski 939*, Anelgauhat Bay.

FIJI ISLANDS. Kambara: *A. C. Smith 1267*. — Fulanga: *A. C. Smith 1153*.

SAMOA ISLANDS. 6 collections, at least 5 of which from Savaii.

TONGA ISLANDS. Eua: *Hotta 5301*, E. of Pangai (L); *Parks 16356* (A, US); *Yuncker 15627*, NE of Ohonua on the western side of the island.

Ecology: On ridges, slopes, and plains, in ravines and sometimes along or in swamps, on riverbanks or along the seacoast; on fertile soil, clay, loam or sand, in limestone areas or on volcanic soils. Mainly in well-drained primary rain forest, but also in secondary forests, in lowland, hill, lower and middle montane forest, also in Araucaria forest; mostly a lower stage tree, sometimes in lower forest an element of the canopy; exceptionally in open vegetations. Alt. up to 1200 m. Fl. and fr. throughout the year.

Uses: The bark is used as fish poison. A watery exudate of the bark and sometimes the fruits is used for laundering, for hair washing, to keep away leeches, and is drunk to allay pain. The timber is good. The oil pressed out of the seeds is used as an anti-rheumatic. See Brown, Useful Pl. Philip. 2 (1950) 363; Desch, Malayan Forest Rec. 15 (1954) 528 (timber).

Notes. 1. *Variability and taxonomy.* *H. arborea* is among the most variable species of its genus. Like usually, this results partly in a mosaic of \pm recognizable local races, some of the more extreme of which have been named. We are of the opinion, however, that any sharp division is impossible: the variability is always gradual and the same more or less extreme character may be found in very different areas. The main difference is between the populations West and East of the Wallace line, with the Philippines in an intermediate position. The western populations are as a whole less variable and show more often 2 ovules, and also 2 seeds, per locule, a character which is considered to be more primitive. The eastern populations are, accordingly, more variable; they have usually only 1 ovule and nearly always only 1 seed per locule. The difference is not sharp enough, however, to warrant the recognition of subspecies.

Indumentum. In several areas (India, Thailand, Indo-China, Java, Borneo, the Philippines, New Guinea, and Guadalcanal) the axes of the leaves and of the inflorescences are rather often to sometimes velvety. An extreme form, with the lower side of the leaflets completely velvety, was described by Ridley from Sarawak as *H. tomentosa*. Apart from the type, *Haviland 2232*, we saw two more specimens, *S. 27443* and *33453*. Gland hairs we found only in New Guinea and New Britain. This and the membranous leaflets characterized Radlkofer's *H. glanduligera*. It seems likely that the abundance of gland hairs and the texture of the leaflets are due to the young state of the material; when older at least the heads of many gland hairs are broken off and the leaflets will be thicker, hence the material will be hardly distinguishable from normal *H. arborea*.

Leaflets. Out of the wide variation in shape and size the following tendencies are worth mentioning. Broad and distinctly oblique leaflets do only occur in the Moluccas, New Guinea, New Britain, and the Solomon Islands; other shapes are also possible in these areas. The leaves are mostly 3–5-jugate. On Samoa and Tonga the leaves are 1–3-jugate and the leaflets are often broad with an almost rounded base and a short acumen with rounded top. The smallest and narrowest leaflets occur in India and the Philippines, where the leaves are mostly 4- or 5-jugate.

Flower buds. The flower buds have a characteristic subangular base.

Deformed flowers and fruits. *H. arborea* is one of the few species which sometimes shows deformed flowers and fruits. This may regard: stamen partly petaloid, ovary coalescent with stamen, or fruit with basal outgrowth.

Stamens. On New Guinea the number of stamens can vary from 5 to 7, even between flowers of the same specimen; specimens with apparently constantly 5 stamens per flower occur as well. From outside New Guinea less flowers were analyzed; here we found always 5 stamens.

Ovules. Pistils with either 1 ovule in both locules or 2 ovules in one locule and 1 in the other were found in New Guinea, New Britain, and the Solomon Islands; in the latter area 2 ovules per locule occurred also, but rarely. Both 1 and 2, and 2 and 2 (the latter more often) was observed in Thailand. In the Philippines about 10% of the material had 2 ovules per locule, the rest mostly 1 per locule. As a whole the western populations up to and including Java and Borneo have 2 ovules per locule, the eastern ones have 1 in both locules.

Fruits. The dimensions are rather variable. We found the biggest fruits in India and Thailand as well as in Samoa, the smallest in the Philippines (see, however, note 3 on var.

megalocarpa). A few 3-merous fruits are known from Thailand, Borneo, and New Guinea. One specimen from New Britain, *NGF 1853*, showed incidentally 4-merous pistils and fruits, while the rest was 2-merous. This specimen had also some deformed flowers.

2. It is surprising that so few collections of *H. arborea* are known from Indo-China, the Malay Peninsula, Sumatra, West and Central Java, and the greater part of Borneo. This is in contrast with its occurrence in the eastern half of its area, where it seems to be common. It also contrasts with the clearly more common occurrence of *H. cupanioides* in the western part of its area. Still, *H. arborea* must be more conspicuous than *H. cupanioides*: both are mostly small trees, but the former has bigger flowers and much bigger orange fruits than the latter.

3. The very brief description of *H. blancoi* F. Vill. is absolutely insufficient for identification, but the vernacular cited ('puas') as well as the note on the uses agree with the present species. Accordingly, the reduction to *H. cupanioides* by F. Vill. himself (Nov. App., 1880: 53) seems to be wrong.

H. arborea var. *megalocarpa* Merr. may belong here as *H. arborea* is the species with the biggest fruits in the Philippines. The fruits, however, are said to be 5 × 9 cm, which is nearly twice as big as the biggest fruits of true *arborea* (and the Philippine ones are mostly rather small!). As long as the type is not available and as no more material is known, the identity of this taxon remains doubtful.

subg. HARPULLIA

Harpullia Roxb., 1824. — *Harpullia* subg. *Euharpullia* Radlk., Sapind. Holl.-Ind. (1879) 52, *nom. inval.* (I.C.B.N. ed. 1978, art. 21.3 & 32.1); Engl. Pflanzenz. 98 (1934) 1435. — T y p e: *H. cupanioides* Roxb.

Donatophorus Zipp. ex Macklot, 1830. — *Harpullia* sect. *Thanatophorus* Radlk., Sapind. Holl.-Ind. (1879) 52, *nom. inval.* (I.C.B.N. ed. 1978, art. 22.1 & 32.1; type of genus included); Engl. Pflanzenz. 98 (1934) 1436. — T y p e: *D. erythrospermus* Zipp. ex Macklot (= *H. cupanioides*).

? *Apiocarpus* Montrouz., 1860. — T y p e: *A. moguinii* Montrouz. (= *H. austro-caledonica* ?). *Harpullia* sect. *Harpulliastrum* Baillon, *Adansonia* 11 (1874) 242; Radlk., Engl. Pflanzenz. 98 (1934) 1438. — T y p e: *H. austro-caledonica* Baillon.

Petiole and rachis in some species winged. Sepals nearly always persistent in fruit. Petals sessile with a broad or narrowed base, without auricles, thin-fleshy to rarely membranous. Style bent or hooked once to twice. Seeds with a complex aril composed of a sarcotestal part and a free arilloid. — Fig. 1 b & d; 2 b & c.

3. *Harpullia austro-caledonica* Baillon

? *Apiocarpus moguinii* Montrouz., Mém. Acad. Roy. Sci. Lyon, Sect. Sci., sér. 2, 10 (1860) 190. — T y p e: *Montrousier s.n.*, Ile d'Art (apparently lost).

H. austro-caledonica Baillon, *Adansonia* 11 (1874) 242; Schlechter, Bot. Jahrb. Syst. 39 (1906) 177; Radlk., Engl. Pflanzenz. 98 (1934) 1452. — L e c t o t y p e (present authors): *Balansa 149*, New Caledonia, E. of Pont des Français near Nouméa, 30-viii-1868, fr. (P; iso in M).

[*H. neo-caledonica* Guillaumin, Fl. Nouv. Caléd. (1948) 201, *nom. nud.* (probably a name change, either by mistake or intentionally, of *H. austro-caledonica*).]

Tree or sometimes shrub, up to 15 m high and 25 cm d.b.h., but often much smaller. Young parts short-velvety. Twigs 3–8 mm thick. Leaves with (4–) 6 (–7) leaflets per side;

petiole 5.5–20 cm long, not winged; rachis not winged; petiolules 3–10 mm long; axes soon glabrous. *Leaflets* 3–18 × 1.5–5 cm, 1.7–3.6 times as long as wide, about parallel-sided to widest slightly above the base, ± falcate and sometimes dorsiventrally curved, pergamentaceous to chartaceous, glabrous or rarely beneath on the midrib slightly hairy; base slightly to strongly oblique, rounded to acute and mostly abruptly short- to long-decurrent; apex rounded or sometimes acuminate, the acumen short, broad, straight, with a rounded top; midrib above slightly raised to slightly sunken; nerves 0.75–2.5 cm apart, above slightly raised; intercalated veins common and strongly developed. *In-florescences* axillary, together often pseudoterminal, or sometimes ramiflorous, developing from the single axillary bud, 4–12 cm long, slightly branched, the few lowermost branches often patent and relatively long, densely hairy; pedicels 10–22.5 mm long. *Sepals* from ovate to obovate to suborbicular, 5.5–9 × 4.5–9 mm, the outer slightly narrower than the inner ones, along the margin without or with some to several glandular hairs; sepals persistent under the fruit. *Petals* obovate, 10–18 × 4–10 mm, glabrous or sometimes outside in the lower half and along the margin with some hairs. *Disk* varying from a high and irregular to a low ± lobed ring, velvety to glabrous. *Stamens* 8; filament 12.5–17 mm long; anther 3–3.2 mm long. *Pistil* 3-merous (acc. to Radlkofer sometimes 4-merous); style 10–12 mm long; ovules 2 per locule. *Fruits* transversely ellipsoid to subglobular, in cross-section rounded- to sharp-triangular, c. 25–30 mm high × 25–35 mm wide, base and apex broadly rounded, the base up to 5 mm long stalked, the apex with a conical up to 5 mm long point; fruit wall woody, outside pustular, fairly densely tomentose to nearly glabrous, inside thin-puberulous. Some fruits are subglobular, stalked or not, the wall horny, very thin, outside fairly densely short-puberulous, inside without dissepiments; these fruits are sterile but may reach about the size of fertile ones, are found on the same tree with normal fruits, and are rather characteristic. *Seeds* 1 or sometimes 2 per locule.

F i e l d n o t e s. Bark smooth or nearly so, brown, light brown, brown spotted with grey, or light yellowish grey. Leaflets above dark green, below light green, at least above shining. Sepals brown, yellowish green, or yellow. Petals yellow, sometimes greenish white. Anthers pink. Fruits green to yellow (all young?). Seeds dark brown with a yellow to orange aril.

D i s t r i b u t i o n: New Caledonia.

N E W C A L E D O N I A. 45 collections, also from I. des Pins and Lifu.

E c o l o g y. Wet forests on slopes or ridges, rarely on plains; on sediments, sand, gravel, or raised coral limestone, usually over schistes, sometimes over grau acke or limestone; alt. up to 1000 m. Fl. Jan., Febr., April, June to Sept.; fr. April and Aug. to Oct.

N o t e s. 1. If *Apiocarpos* Montrouz. should be identical with *Harpullia* there could be hardly any doubt that *A. moguinii* represents *H. austro-caledonica*. The type seems to be lost, however; at least it is not represented in LY, MPU, or P (see Guillaumin & Beauvis., Ann. Soc. Bot. Lyon 38: 120. 1914).

2. The flowers of *H. austro-caledonica* show an unusually wide range of variability.

This regards the size and shape of the sepals, presence or absence of marginal glands, size and shape of petals, and shape and hairiness of disk. The fruits and the leaves are less variable; in the latter a small sclerophyllous kind is the most conspicuous extreme. There seems to be some correlation between leaf type and locality and/or habitat. We couldn't find any clear correlation between leaf type and other characters, however. Hence, a taxonomic subdivision seems impossible.

3. Systematically, *H. austro-caledonica* is a rather isolated, relatively primitive species, the most primitive one in subg. *Harpullia*. Its closest connection may be with the three most primitive New Guinea species, *H. giganteacapsula*, *H. longipetala*, and *H. nov. sp. nr. 26*; these species share some primitive character states, and they may be all derived from the same old stock.

4. *Harpullia giganteacapsula* M. Vente, *nov. sp.*

Descriptio typi: Arbor parva, indumento partium iuvenum longo moderate dense fusco-tomentoso. *Ramuli* subteretes, 21 mm crassi vel magis, canaliculati, dense lenticellati. *Folia* 5-jugata; petioluli 15,5–35 cm × 4,5–6,5 mm, canaliculatus, sparse lenticellatus, non alatus; rhachis non alata; petioluli 7–10 × 1,5–2,5 mm, supra applanati, interdum tenuiter canaliculati. *Foliola* elliptica ad oblonga, 12–26 × 5,5–11 cm, ratione 2,2–3, herbacea; basis equilateralis, acuta et breve decurrens; margo integrum; apex abrupte acuminatus, acumine brevi angusto rotundato; costa supra subimmersa, subtus perprominens, utrinque moderate dense tomentosa; nervi laterales a costa angulo ca. 60° abientes, per 10–28 mm distantes, supra plani aut immersi, subtus prominentes; venae intercalares paucae, venae venulaeque reticulatae, utrinque planae vel paulum prominulae. *Infructescentiae* axillares, binae, 10,5–33 cm longae, ramis lateralibus paucis, usque ad 6 cm longis; pedicelli usque ad 18 mm longi. *Sepala* sub fructu persistentes. *Stamina* 7 vel 8 (ciccatrices). *Fructus* 3,5 cm alti, 5,8 cm lati, lobis erectis multo inflatis, apice basique submarginato, externi initio dense breviter aureo-fusco tomentosi, denique fere glabrati, tenuiter pustulati et sulcati, interni sparse puberuli; pericarpium sublignosum; stipes ca. 1 mm altus × 4 mm latus; loculi biovulati, alter ovulo caduco, alter non evoluto; sarcotesta et arilloidium presentes.

T y p u s: *H. Streimann* & *A. Kairo* NGF 27614, NE. New Guinea, Morobe Dist., Menyamya Subdist., Tawa village near Aseki, 7°24' S 146°07' E, 15-v-1968, fr. (L; iso in BRI, K).

Tree (once reported as a climber, which may be wrong), up to 20 m high and 80 cm d.b.h. Young parts with a short, dense, brown indumentum, gradually glabrescent. *Twigs* 6–21 mm thick. *Leaves* with (2–) 4–5 leaflets per side; petiole 7.5–35 cm long, not winged; rachis not winged; petiolules 2–10 mm long; axes hairy, glabrescent. *Leaflets* 7.5–26 × 4–11 cm, 1.7–3 times as long as wide, widest in or (upper leaflets) somewhat above the middle, herbaceous to thin-pergamentaceous, above slightly hairy on midrib and sometimes nerves, beneath sparsely to densely hairy on midrib and nerves; base equal-sided to slightly oblique, acute to rounded and short-decurrent; apex rather abruptly or sometimes gradually acuminate, acumen short to moderately long, slender, acute to rounded; midrib above sunken; nerves 1.2–4.3 cm apart, above flat or sunken; intercalated veins few, mostly feeble. *Infructescences* axillary, primarily developed from the upper of two serial buds, sometimes moreover a feebler one from the lower bud, 10–33 cm long, with few up to 6 cm long branches, hairy; bracts lanceolate, up to 2.5 cm long; pedicels in fruit up to 18 mm long. *Flowers* only known from remnants under the fruit. *Sepals* broad-elliptic to suborbicular, 6–8 × 4.5–7 mm, persistent or caducous. *Stamens* 7 or 8 (scars). *Disk* annular, hairy. *Pistil* 2-merous; style c. 4.5 mm long; ovules 2 per cell, the lower one with a long thin funicle, probably abortive. *Fruits* transversely broad-ellipsoid, 35 mm high × 58 mm wide, the base emarginate, 1–2 mm long stalked, the apex emarginate to

truncate, the lobes erect, strongly inflated; fruit wall thin-woody, outside minutely pustulate and sulcate, densely hairy, glabrescent, inside very sparsely hairy. *Seeds* 1 per cell.

Field notes: Bole straight. Bark with horizontal pustules or slightly peeling off, dark grey or dark brown, middle bark reddish to creamish, inner bark yellowish to brown. Sapwood straw coloured or cream, rather hard and heavy; heartwood brown. Leaflets dark green and mostly shiny above, pale green beneath. Fruits brownish (ripe?).

Distribution: East New Guinea.

NEW GUINEA. Southeast: *C. E. Carr 14504*, Central Dist., Boridi. — Northeast, Morobe Dist.: *LAE 62090*, Wau Subdist., Eraulu logging area, 7°20' S 146°40' E; *NGF 27614*, Menyamy Subdist., Tawa village near Aseki, 7°24' S 146°7' E; *NGF 47662*, Wau Subdist., Bulolo-Watut Divide, 7°15' S 146°37' E.

Ecology: In forests on ridges and slopes; limestone; alt. 1350–1850 m. Fr. April–June, Oct.

5. *Harpullia longipetala* Leenh., *nov. sp.*

Harpullia sp.: Hartley *et al.*, *Lloydia* 36 (1973) 270.

Description type: Arbor ca. 18 m alta, glabra praeter gemmas inflorescentiasque fulvo-velutinas. *Ramuli* 5 mm crassi. *Folia* 2–3-jugata; petiolus 5–8 cm longus rhachisque nudus; petioluli 5–8 mm longi. *Foliola* elliptica, 13–22 cm longa, 5–8 cm lata, chartacea, glabra; basis equilateralis, acuta, paulum decurrentia; margo integrum; apex gradatim acuminatus, acumine brevi lato anguste rotundato; costa supra subprominentis. *Inflorescentiae* axillares et in ramis defoliatis, dense caespitosae, 2–2,5 cm longae; pedicelli ca. 5 mm longi. *Sepala* externa rotundata, 6 mm longa, interna late elliptica, 7 mm longa, omnia 5 mm lata. *Petala* oblanceolata, 15 mm longa, 4 mm lata, exunguiculata, exauriculata, tenue carnosa, alba, glabra. *Discus* velutinus. *Stamina* 8, filamentum ad 9 mm longo, anthera 2.5 mm longa. *Pistillodium* biloculare, loculis biovulatis.

Type: *C. E. Carr 11498*, SE. New Guinea, Central Dist., Lolorua, 24-ii-1935, ♂ fl. (L; iso in K, SING).

Tree or shrub, up to 18 m high and 20 cm d.b.h., but often much smaller, Glabrous except for buds and inflorescences which are shortly dark- to orangebrown velvety. *Twigs* 3–14 mm thick. *Leaves* with 2–4 leaflets per side; petiole 4–15 cm long, not winged; rachis not winged; petiolules 5–10 mm long. *Leaflets* 12.5–27 × 4–11 cm, ratio 2–4, widest in, lower ones often slightly below, upper ones slightly above the middle, thin- to stiff-pergamentaceous, chartaceous, or coriaceous; base equal-sided to sometimes oblique, acute to (lower sometimes) rounded, usually slightly decurrent; apex acute to rounded, (not or) tapering to abruptly acuminate, acumen short (to long), broad (to slender), the very apex rounded to acute; midrib above raised, mostly only slightly so; nerves 1–4 cm apart, above slightly to hardly raised; intercalated veins rarely well developed, usually absent. *Inflorescences* axillary, rami-, and cauliflorous, developing from both axillary buds, densely tufted, c. 2–2.5 cm long, the axes racemoid, few-flowered; pedicels in fruit 1 cm long. *Sepals* outer roundish, 6 × 5 mm, inner broad-elliptic, 7 × 5 mm; persistent under the fruit. *Petals* oblanceolate, 15 × 4 mm, glabrous. *Disk* velvety. *Stamens* 8, filament up to 9 mm long, anther 2.5 mm long. *Pistil* 2-merous; style c. 4.5 mm long; ovules 2 per cell, rarely 2 in one cell and 1 in the other. *Fruits* broad-cordate, 18 mm high × 22–25 mm wide, widest in or above the middle, base ± truncate to broadly rounded, 2

mm long stalked; fruit wall leathery, outside densely short-velvety, \pm glabrescent, inside very sparsely hairy to glabrous. *Seeds* mostly only 1 per cell.

Field notes. Bark smooth, with few lenticels, sometimes with short, shallow, longitudinal fissures, greyish to brownish, inside greenish to strawcoloured; wood creamy to white. Leaves above glossy mid to dark green, below \pm glossy light to mid green, nerves yellowish. Flowers fragrant. Sepals brown or yellow to green. Petals white, sometimes cream or very pale mauve. Stamens white. Fruits orange to red, aril bright red.

Distribution: East New Guinea.

NEW GUINEA. Southeast: 7 collections. — Northeast: 19 collections from the Madang and mainly Morobe Dists.

Ecology: Rain forest, sometimes dry monsoon forest, swamp forest, or secondary forests; on river banks, on hill sides, in gullies, also in coastal savannas; mostly below 100 m, exceptionally up to 1650 m a.s.l. Fl. mainly Nov.–Febr. (to April, June, July, Sept.); fr. mainly July–Sept. (Nov., March).

6. *Harpullia frutescens* F. M. Bailey

H. frutescens F. M. Bailey, Rep. Bellenden Ker Exp. (1889) 36; Syn. Queensl. Fl. 3rd Suppl. (1890) 17; Queensl. Fl. 1 (1899) 308; non C. T. White, Queensland Naturalist 1 (1911) 204 (= *H. alata*); C. T. White & Francis, Queensland Dept. Agric. Bot. Bull. 22 (1920) 10; Domin, Biblioth. Bot. 22 (1927) 914, fig. 155; Radlk., Engl. Pflanzenr. 98 (1934) 1451 (*p.p.* = *H. rhyticarpa*); S. T. Reynolds, Austrobaileya 1 (1981) 415, fig. 29 D. — *H. marginata* Radlk. in E. & P., Nat. Pflanzenfam. 3, 5 (1895) 362, *nom. illeg.* (I.C.B.N. ed. 1978, art. 63.1). — **Syn type s:** (*F. M. Bailey* ?) *s.n.*, Bellenden Ker Ra., fr. (BRI sh.nr. 14413); *F. M. Bailey s.n.*, Mulgrave R., 1889, fr. (BRI sh. nr. 72386); *Unknown coll. s.n.*, Tringitburra Creek, fr. (MEL sh. nr. 71573); *F. M. Bailey s.n.*, Bellenden Ker Ra., Behana Creek, 1889, y fr. (BRI sh. nr. 72382); *F. M. Bailey s.n.*, Bellenden Ker Ra., 1889, sterile (BRI sh. nr. 8527).
H. holoptera Radlk., Feddes Repert. Spec. Nov. Regni Veg. 20 (1924) 40; Engl. Pflanzenr. 98 (1934) 1451. — **Type:** *Diels 8306 b*, NE. Queensland, Mulgrave, -v-1907, ♀ (B, lost; iso in M).

Shrub or treelet, up to 4 m high but often much smaller. Twigs and leaf axes sparsely puberulous (the latter often subglabrous), inflorescences and infructescences (especially the branches) densely puberulous. *Twigs* 2–5 mm thick. *Leaves* with 2–5 leaflets per side; petiole 4–10 cm long, completely (exceptionally only in the upper part) winged like the rachis, wings strongest developed towards the apex, up to 9 mm wide, entire; leaflets sessile or petiolule up to 0.5 mm long. *Leaflets* 5–22 \times 2–6.5 cm, 2–4 times as long as wide, widest in or sometimes slightly above the middle, pergamentaceous to chartaceous or rarely herbaceous, glabrous or both sides on midrib very sparsely hairy; base equal-sided to slightly oblique, narrowly subcordate; apex mostly tapering acuminate, acumen mostly long and often broad, exceptionally short and slender, acute to blunt; midrib raised above; nerves 0.75–2.5 cm apart, above slightly raised; intercalated veins variably developed. *Inflorescences* axillary, solitary, developing from the lower of 2 serial buds, often some together pseudoterminal, 1–17 cm long, nearly always with some strong branches from the base, in the more common short ones as strongly developed as the rachis; pedicels in fruit 3–8 mm long. *Sepals* elliptic to obovate, 6.5–7.5 \times 3.5–4.5 mm,

along the margin sometimes with several gland-hairs; persistent under the fruit. *Petals* oblanceolate or sometimes obovate-oblong, 10–17 × 3–5.5 mm, thin-fleshy to membranous, glabrous or nearly so. *Disk* divided into 5 alternipetalous glabrous lobes. *Stamens* 7 or 8, filament 4–8 mm long, anther 2–3 mm long. *Pistil* 2-merous; style 7–10 mm long; ovules 2 per locule. *Fruits* transversely broad-ellipsoid, 15–17.5 mm high × 20–27 mm wide, widest above the middle, slightly cordate and 1–3 mm long stalked at base, truncate at apex; fruit wall thin-woody, outside rugulose to rather smooth, fairly densely puberulous, inside very sparsely puberulous or sometimes glabrous. *Seeds* 2 per locule.

Field notes. Leaves glossy green above, paler beneath. Flowers sweet smelling. Petals white. Fruits out- and inside reddish. Seeds dark brown to black, glossy; arial yellow.

Distribution: NE. Australia, in the area of Trinity Bay, Rockingham Bay, and Atherton; a single collection (*NN 17 in MEL sh. nr. 71585*) from Fraser Island.

AUSTRALIA. Queensland: 39 collections.

Ecology: Understorey of rain forest, sometimes in light forest; on slopes; soil loam over basalt; alt. up to 1050 m. Fl. May-June; fr. Aug.

Notes. 1. Radlkofer (1934) distinguished between *H. frutescens* and *H. holoptera*, for which he gave two differences, viz. petiole not winged and capsule inside hairy, versus petiole winged and capsule inside glabrous. As to the first character it should be noted that Radlkofer did not distinguish between *H. frutescens* and *H. rhyticarpa* (the latter species was still unknown to him). *H. frutescens*, as circumscribed by the present authors, shows a gradual variation from a marginate to a broadly winged petiole, with the greatest concentration somewhat to the winged side. As to the second character, the fruit is more often inside hairy, varying from very thinly so to laxly but distinctly, than fully glabrous. We did not find any correlation between the development of the petiolar wings and the hairiness of the inside of the fruit, neither of the two characters appeared to be geographically restricted, both could vary between specimens from about the same locality. The species as a whole is bound to a rather restricted area, with the exception of the one collection from Fraser I., which has no deviating characters.

2. Within the rather wide range of variability we found clear correlations of characters only in the leaflets: a variation between on the one hand large, relatively broad, thin leaflets with a broad blunt acumen, on the other hand small, relatively narrow, stiff leaflets with a narrow and acute acumen and with, moreover, the nervature strongly prominent. This variation makes the impression of being caused by differences in habitat or climate.

3. The specimen *Gresty BRI 72401* consists of 2 seedling leaves, the one simple, oblong-obovate, long-cuneate to the base, measuring 30 × 9 cm, the other one imparipinnate with two pairs of lateral leaflets and a terminal one slightly bigger than the upper laterals.

4. Radlkofer's statement '*Semina abortu solitaria*' (1934: 1451) is probably based upon *Mrs. Gribble s.n.* in M, which is *H. rhyticarpa*.

F. M. Bailey (1889, same text 1890 and 1899) gives several dubious characters: inflorescences terminal, monoecious, sepals 4 or 5, petals 4, capsule 2- or 3-celled with

spreading lobes. Possibly, what he described was a mixture of different species (or even genera?), but his material under the present name clearly belongs here.

5. The nearest allies of the present species are *H. alata* and *H. rhyticarpa*.

7. *Harpullia alata* F. Mueller

H. alata F. Mueller, *Fragm. Phytogr. Austral.* 2 (1860) 103; Benth., *Fl. Austral.* 1 (1863) 470; Walp., *Ann. Bot. Syst.* 7 (1869) 631; *non* F. Mueller, *Fragm. Phytogr. Austral.* 9 (1875) 89, *Addit.* 198 (= *H. rhyticarpa*); F. M. Bailey, *Queensl. Fl.* 1 (1899) 308; Le Renard, *Ann. Sci. Nat. Bot. sér.* 9, 17 (1913) 368, fig. 8 (anatomy); C. T. White & Francis, *Queensland Dept. Agric. Bot. Bull.* 22 (1920) 10; Radlk., *Engl. Pflanzenz.* 98 (1934) 1452; Francis, *Austral. Rain-For. Trees ed.* 2 (1951) 261; Audas, *Native Trees Austral.* (no date) 222; Beadle, *Stud. Fl. NE. N.S.W.* 4 (1980) 581, fig. 257 A; S. T. Reynolds, *Austrobaileya* 1 (1981) 414, fig. 29 E. — *Type*: *Beckler s.n.*, New South Wales, Clarence R., st. (MEL sh. nr. 71559, 71569).

H. frutescens auct. non F. M. Bailey: C. T. White, *Queensland Naturalist* 1 (1911) 204.

Tree or rarely shrub, up to 6 m high. All parts sparsely pubescent. *Twigs* 3–6 mm thick. *Leaves* with 3–6 leaflets per side; petiole 4.5–10 cm long, mostly winged, rachis always winged, wings strongest developed towards the apex, up to 7 mm wide, variably, often very sparsely or irregularly dentate; petiolules up to 2.5 mm long. *Leaflets* 2.5–19 × 1.75–5.5 cm, 2–4.3 times as long as wide, widest in, or in lower leaflets slightly below the middle, in upper leaflets often above the middle to exceptionally near the apex, pergamentaceous to chartaceous, above glabrous, beneath glabrous to sparsely hairy on midrib and nerves; base equal-sided to slightly oblique with the basiscopic side broadest, narrowly subcordate; margin coarsely undulate, dentate, or lobed, with mucronate to aristulate teeth; apex tapering to fairly abruptly acuminate, acumen long, ± broad, straight to sometimes falcate, acute; midrib raised above; nerves 1.25–2.5 cm apart, usually (if leaflet dentate or lobed) the one ending in a tooth, the other one looped and joined at some distance from the margin, sometimes all ending in teeth, sometimes (if leaflet only undulate) all looped and joined, above slightly raised; intercalated veins common, variably developed. *Inflorescences* axillary, solitary, developing from the lower of two serial buds, c. 4–27 cm long, with few scattered erecto-patent few-flowered branches; pedicels in fruit 5–7 mm long. *Sepals* elliptic, 5.5–7 × 3.5–4.5 mm, along the margin sometimes with several gland hairs; sepals persistent under the fruit. *Petals* oblanceolate, 10–11 × 3 mm, thin-fleshy to membranous, glabrous. *Disk* in ♂ flowers annular, in ♀ flowers divided into lobes protruding between the staminodes and ± confluent with the base of the ovary, both short-velvety. *Stamens* 8, 4 long and 4 short ones, filament 6 and 3.5 mm long resp., anther 2.25 and 2 mm long resp.; staminodes strongly reduced. *Pistil* 2-merous; style 5–7 mm long; ovules 2 per cell. *Fruits* transversely broad-ellipsoid, 20–23 mm high × 25–33 mm wide, widest above the middle, slightly cordate and 1–2 mm long stalked at base, slightly emarginate at apex; fruit wall thin woody, outside rugulose, thin-puberulous, inside fairly densely puberulous. *Seeds* 2 per cell (in literature often mentioned 2 in one cell, 1 in the other).

Field notes. Leaves glossy dark green. Petals creamy to white. Fruits yellow (ripe?). Seeds shiny chestnut brown with a rather thin red aril.

Distribution: Australia, in the coastal parts of southern most Queensland and the northern part of New South Wales, between about Logan R. at c. 27°40' S and Stroud at c. 32°30' S.

AUSTRALIA. Queensland: 12 collections. — New South Wales: 20 collections.

E c o l o g y: Understorey of rain forest on hills and in valleys; alt. 600-900 m. Fl. April–May, fr. March, May, and Sept.–Oct.

N o t e. *H. alata* is nearest related to *H. frutescens* and *H. rhyticarpa*. It is the only species in the genus with the leaflets not entire.

8. *Harpullia rhyticarpa* C. T. White & Francis

H. rhyticarpa C. T. White & Francis, Queensland Dept. Agric. Bot. Bull. 22 (1920) 10 with plate; Radlk., Engl. Pflanzenr. 98 (1934) 1460; S. T. Reynolds, Austrobaileya 1 (1981) 413, fig. 29 C. — T y p e: *F. M. Bailey s.n.*, Queensland, Bellenden Ker Ra., Barnards Spur, young fr. (BRI sh. nr. 10376).

H. angustialata C. T. White & Francis, Queensland Dept. Agric. Bot. Bull. 22 (1920) 12 with plate; Radlk., Engl. Pflanzenr. 98 (1934) 1460. — T y p e: *N. Michael 468*, North Queensland, Yarrabah, ♂ bud (BRI; iso in BO).

H. alata auct. non F. Muell.: F. Muell., Fragm. Phytogr. Austral. 9 (1875) 89, Addit. 198.

H. frutescens auct. non F. M. Bailey: Radlk., Engl. Pflanzenr. 98 (1934) 1451 p.p.

Tree, up to 7 m high and 10 cm d.b.h., often unbranched. Youngest parts of twigs and inflorescences fairly densely puberulous, branches of inflorescences and of infructescences velvety, leaf axes glabrous or nearly so. Twigs 3.5–7.5 mm thick. Leaves with (3–) 5 (–7) leaflets per side; petiole 5–13 cm long, usually \pm marginate towards the apex, sometimes either not winged at all or narrowly winged in the apical part only; rachis winged except near the base, widest near the apex, the wings up to 4.5 mm wide, exceptionally narrowly winged to marginate only; petiolules 0–1 (–2.5) mm long. Leaflets 3.75–26 \times 1.25–6 cm, 2.5–5 times as long as wide, widest about the middle, in lowermost leaflets to slightly below the middle, in uppermost ones sometimes far above the middle, pergamentaceous (herbaceous to chartaceous), above glabrous, beneath very sparsely hairy in lower part of midrib and on basal nerves; base equal-sided to oblique (basiscopic side more developed), mostly narrowed and rounded, rarely either subcordate or acute, not, or if acute sometimes slightly, decurrent; apex mostly tapering acuminate (in obovate leaflets rather abruptly acuminate, in very narrow ones not acuminate at all, but narrowly rounded to acute, rarely broadly rounded and slightly emarginate), acumen straight or rarely falcate, long or rarely short, broad to slender, narrowly rounded to acute at tip; midrib above slightly (rarely distinctly) raised to flat, slightly sunken at the base; nerves 1–2.75 cm apart, above slightly raised; intercalated veins rare, mostly feeble. Inflorescences axillary, possibly sometimes cauliflorous, either developing from the upper one of two serial buds only, or from both, (5–) 20–70 cm long, either simple, mainly in the upper part with distant sessile or short-stalked few-flowered cymules, or with scattered short branches; pedicels in fruit 6–9 mm long. Sepals ♂ (elliptic-)ovate, 4–5.5 \times 3 mm, ♀ elliptic, 7 \times 4 mm, marginal gland hairs mostly present; sepals persistent under the fruit. Petals oblong-obovate to oblanceolate, 8–13 \times 3–5.5 mm, glabrous. Disk annular, ♂ glabrous or puberulous, ♀ densely short-hairy. Stamens 5 (acc. to several authors also 6); filament 3.5 mm long; anther 2 mm long. Pistil 2-merous; style c. 10 mm long; ovules 2 per cell. Fruits broadly cordate with erect to slightly spreading lobes (exceptionally widely spreading if only 1 seed per cell developed), 15–20 mm high \times 20–38 mm wide, broadest near the apex, the base truncate, 2 mm long stalked; fruit wall crustaceous or

thin-woody, outside slightly wrinkled, velvety, inside thin-hairy. *Seeds* 2 (exceptionally 1) per cell.

Field notes. Leaves dark green and glossy above, the same or lighter beneath. Flowers with a sweet smell. Calyx light or yellowish brown. Petals pale yellow to white or pink. Fruits red. Seeds black and shiny with a yellow to orange aril.

Distribution: Australia, northeastern Queensland, about between Mossman (c. 16°30' S) in the north and Herberton (c. 17°20' S) in the south.

AUSTRALIA. Queensland: 56 collections.

Ecology. Rain forest (complex mesophyll vine, mixed notophyll vine, simple mesophyll vine, simple notophyll vine, mesophyll palm, and Araucarian notophyll vine forest), mainly on slopes, ridges, crests, banks, road sides, sometimes on flats; soils alluvial, over or derived from granites, basalt, granodiorite, basic rocks; alt. mostly above 400 and up to 1200 m. Fl. April and June to Aug., fr. July–Nov.

Note. Systematically, *H. rhyticarpa* seems to take a position in between *H. frutescens* and *H. hillii*, with some overlap to both sides. The main difference with the former species is in the number of stamens, 5 in *H. rhyticarpa*, 7 or 8 in *H. frutescens*. From *H. hillii* the present species differs most clearly in the following points: rachis and mostly also petiole marginate to winged (versus not at all winged in *hillii*), leaflets sessile or nearly so (versus distinctly stalked), beneath slightly hairy (versus fully glabrous), the apex mostly acuminate (versus mostly rounded), intercalated veins few and feeble (versus many and strong), cymules few-flowered (versus several-flowered), ovary sessile, inside glabrous (versus distinctly stalked and inside woolly), fruit inside sparsely hairy with stellate hairs (versus woolly with tufts of simple hairs), 2 seeds per locule (versus 1 seed per locule).

9. *Harpullia rhachiptera* Radlk.

H. rhachiptera Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20 (1890) 278; Engl. Pflanzenr. 98 (1934) 1440; Verdc., Kew Bull. 32 (1977) 223. — **Type:** *Bauerlen 191 = Capt. Everett's Exp.*, SE. New Guinea, Western Dist., Strickland R., -viii-1885, fr. (M; iso in MEL).

[*Affonsea pteropoda* Kosterm., *Adansonia* n.s., 6 (1966) 371, pl. 5, *nom. inval.* (I.C.B.N. ed. 1978, art. 37). — **LECTOTYPE** (Verdcourt, 1977): *d'Albertis herb. 3544 & 3544 A*, SE. New Guinea, Western Dist., Fly R., 1877 (F).]

Shrub, less than 1 m, to treelet up to 3 m high. Young parts, inflorescences, and infructescences densely appressedly shortly brown hairy. *Twigs* 4–6 mm thick. *Leaves* with 3 or 4 leaflets per side; petiole 8–11 cm long, winged except for the basal 25–50%, wings 2–3.5 mm wide; rachis winged, wings 4.5–6 mm wide, widest just beneath a leaflet, ending at some distance above the next lower one; petiolules 0–3 mm long; axes hairy. *Leaflets* 7.5–25 × 2.5–10 cm, 2–3.75 times as long as wide, widest in or below the middle, herbaceous, midrib and nerves at both sides very sparsely to densely minutely hairy, below intermingled with glandular capitate hairs; base equal-sided, narrowly rounded to subcordate; apex tapering to rather abruptly acuminate, acumen short to rather long,

slender, straight, with rounded top; midrib above slightly raised; nerves 1.5–2.5 cm apart, slightly raised above; intercalated veins few, faint. *Inflorescences* axillary, developing either from the upper, or from the lower, or from both axillary bud(s), simple or slightly branched, up to 3.5 cm long, few-flowered; pedicels in fruit 3–4 mm long. ♀ *Flowers* unknown. *Sepals* elliptic or (outer) ovate, 4.5–5.5 × 2.5–3 mm, in fruit semipersistent. *Petals* oblanceolate, 9 × 2 mm, glabrous. *Disk* annular, puberulous. *Stamens* 5 or 6; filament 8 mm long; anther 2.3–2.5 mm long. *Pistil* 2-merous; style c. 3.5 mm long; ovules 1 per cell. *Fruits* broad-ellipsoid to subglobular, 14–22 mm high × 18–20 mm wide, base obtuse to truncate, short-stalked, apex (sub)emarginate; fruit wall thin coriaceous, outside prominently coarsely reticulate and pustulate, pubescent, inside glabrous.

Field notes. Leaves dark green and dull above, somewhat lighter beneath. Petals white. Fruits red. Seeds black with a yellow to orange aril.

Distribution: New Guinea.

NEW GUINEA. Vogelkop Peninsula: *Ijiri & Niimura 695*, Napan Dist., Wati (TNS). — Southeast: Western Dist., 4 collections.

Ecology: In undergrowth of forest, also swamp forest, on ridges and river banks; alt. 45–90 m. Fl. Aug.; fr. April–June and Aug.

Note. The present species seems on the one hand allied with the Australian *H. fruticosa* group, especially with *H. rhyticarpa*, but is still more derived in some characters. On the other hand there may be some connection with *H. cupanioides*.

10. *Harpullia hillii* F. Muell.

H. hillii F. Muell., Trans. Philos. Inst. Victoria 3 (1859) 26; Fragm. Phytogr. Austral. 2 (1860) 104; Benth., Fl. Austral. 1 (1863) 470; F. Muell., Fragm. Phytogr. Austral. 9 (1875) 197; F. M. Bailey, Queensl. Fl. 1 (1899) 308; C. T. White & Francis, Queensland Dept. Agric. Bot. Bull. 22 (1920) 12; Domin, Biblioth. Bot. 22 (1927) 915, fig. 156; Radlk., Engl. Pflanzenr. 98 (1934) 1447; Francis, Austral. Rain-For. Trees ed. 2 (1951) 261; S. T. Reynolds, Austrobaileya 1 (1981) 417, fig. 29 B. — Type: *W. Hill*, 'in the virgin forests of Durando' (not seen).

Tree, up to 27 m high and 30 cm d.b.h. Inflorescences and infructescences densely ferruginously pubescent, twigs and leaf axes mostly early glabrescent. *Twigs* 3–11.5 mm thick. *Leaves* with 1–7 leaflets per side, the few-jugate ones near the inflorescence very exceptionally with a true terminal leaflet; petiole 2.5–8 cm long, not winged; rachis not winged; petiolules 1–7 mm long. *Leaflets* 2.5–18.5 (–20) × 1–6.5 cm (basal leaflets sometimes much smaller than the other ones), 1.5–4 times as long as wide, broadest in the middle, mostly ± parallel-sided, chartaceous to pergamentaceous, glabrous; base equal-sided in the lower, slightly oblique in the upper leaflets, acute or (in relatively broad leaflets) blunt to truncate, slightly decurrent; apex rounded and mostly slightly emarginate, rarely angular; midrib above mostly slightly sunken, rarely slightly raised; nerves 0.5–1.5 cm apart, slightly raised above; intercalated veins frequent, often rather well developed. *Inflorescences* axillary, together pseudoterminal, to terminal, if axillary developing from the upper one of two serial buds, sometimes a 2nd feebler one from the lower bud, up to c. 20 cm long, bearing few obliquely patent to patent short branches, terminal inflorescences up to 36 cm (or probably more) long, in the basal part with

several long obliquely erect branches from the axils of caducous bracts; pedicels in fruit 5–20 mm long. *Sepals* broad-ovate or -elliptic to suborbicular, 4–7 × 3–6 mm, with or without marginal gland hairs; sepals persistent under the fruit. *Petals* oblanceolate or obovate- to ovate-oblong, 6–12 × 1.5–4 mm, glabrous or near the base out- or inside or at one margin with a densely short-hairy strip. *Disk* annular, mostly minute, densely short-hairy. *Stamens* 5; filament 3–5 mm long; anther 2.25–3 mm long. *Pistil* 2- or exceptionally 3-merous; style c. 5 mm long; ovules 1, 1 and 2, or 2 per cell; wall of ovary very thick and hard, inside woolly. *Fruits* 9–17.5 mm high × 22.5–42.5 mm wide, at base hardly stalked, the 2 (rarely 3) lobes either spreading and ellipsoid, or erect and subglobular to ovoid; fruit wall thin-woody, outside slightly longitudinally reticulately nerved, and fairly densely to sparsely minutely hairy, inside fairly densely woolly. *Seeds* 1 per cell (Francis, 1951, mentions sometimes 2, which may be wrong).

F i e l d n o t e s. A sparsely branched slender tree with a straight bole. Bark rather smooth or with fine horizontal lenticels and many longitudinal short cracks, light grey; inner bark light brown to creamy inwards; wood hard, close-grained, heavy, with very strong dark brown markings on light ground. Leaves glossy, dark green above, lighter beneath. Calyx light brown; petals white. Fruits yellow to orange (ripe?). Seeds black, shining, with a yellow sourish aril.

D i s t r i b u t i o n: Australia, in the eastern parts of southern Queensland and northernmost New South Wales, about between Davies Creek (c. 17° S) and Clarence R. (c. 29°30' S).

AUSTRALIA. Q u e e n s l a n d: 34 collections. — N e w S o u t h W a l e s: 13 collections. Cultivated at Sydney (Australia, New South Wales: Botanic Gardens, J. H. Camfield NSW 22442, 136093, 136094).

E c o l o g y: Rain forest, wett sclerophyll forest, mixed notophyll vine for.; soil derived from mixture of basic igneous and metamorphic rocks; alt. 250–660 m. Fl. May–June and Sept.–Oct.; fr. Oct.–Jan. and May–June.

U s e s: A good timber (F. M. Bailey, Queensland Woods, 1893, p. 42; Audas, Native trees Austr. new ed. p. 222). The aril is eaten by the aborigines.

N o t e. Systematically, *H. hillii* seems to take a kind of a key position in sect. *Harpullia*. In the first place it is only vaguely demarcated against *H. rhyticarpa*, as discussed under that species. In the second place it seems closely allied to *H. cupanioides*, from which it mainly differs in the following characters: apex of leaflets never (versus in *H. cupanioides* nearly always) acuminate, suture of fruit prominent (versus nearly always flat), fruit outside coarsely veined (versus pustular), inside fairly densely woolly (versus glabrous to very sparsely minutely hairy), funicle attached at about 25% from the top (versus nearly apical to rarely up to 15% from the top). Finally, the fruits with often spreading lobes connect *H. hillii* with the *H. leptococca*-group. Geographically, *H. rhyticarpa* occurs on the whole somewhat more northern in Queensland, *H. cupanioides* and its further alliance is primarily non-Australian, and the *H. leptococca*-group is restricted to SE. New Guinea. It was mainly this key position of *H. hillii* that hampered the obvious subdivision of subg. *Harpullia* into sections.

11. *Harpullia cupanioides* Roxb. — Fig. 1 b & b¹.

[*Ay-Assa* Rumph., *Herb. Amb. Auct.* (1755) 20; see Hassk., *Abh. Naturf. Ges. Halle* 9, 2 (1866) 329; Merr., *Int. Rumph.* (1917) 509.]

H. cupanioides Roxb., [*Hort. Beng.* (1814) 86, *nom. nud.* ('cupanioides')] *Fl. Ind.* 2 (1824) 442; ed. 2, 1 (1832) 645; Miq., *Fl. Ind. Bat.* 1, 2 (1859) 570; Kurz, *Rep. Veg. Andaman I.* (1870) 34; Hiern in *J. D. Hook., Fl. Brit. India* 1 (1875) 692 (*p.p.* = *H. arborea*); Kurz, *Forest Fl. Burma* 1 (1877) 287; Radlk., *Sapind. Holl.-Ind.* (1879) 94; F.-Vill. in Blanco, *Fl. Filip.* ed. 3, Nov. App. (1880) 53 (*p.p.* = *H. arborea*); King, *J. Asiat. Soc. Bengal Pt. II Nat. Hist.* 65 (1896) 451; Koord. & Valetton, *Bijdr. Boomsoort. Java* 9 (1903) 239; Brandis, *Indian Trees* (1906) 187 (*p.p.* = *H. arborea*); *non* Koord., *Nova Guinea* 8 (1909) 171 (= *H. ramiflora*); Lecomte, *Fl. Indo-Chine* 1 (1912) 1022, fig. 126: 6-8; Koord. & Valetton, *Atlas Baumart. Java* 1 (1913) pl. 142: A-E; Le Renard, *Ann. Sci. Nat. Bot. sér.* 9, 17 (1913) 365, fig. 7 (anatomy; *p.p.* = *H. arborea*); Radlk., *Meded. Rijks-Herb.* 22 (1914) 20 (*Elbert 3261* = *H. arborea*); *Bot. Jahrb. Syst.* 56 (1920) 313 (material from W. New Guinea = *H. ramiflora*); Merr., *En. Philip.* 2 (1923) 516 (*Ramos 30150* = *H. ramiflora*); Craib, *Fl. Siam.* 1 (1926) 335; *Doct. v. Leeuwen, Zoocecidia* (1926) 337, fig. 609 & 610; *non* Rehder, *J. Arnold Arbor.* 14 (1933) 64 (= *H. ramiflora*); Radlk., *Engl. Pflanzenz.* 98 (1934) 1444 (material from Celebes = *H. arborea*); *non* U. N. & P. C. Kanj., *Das & Purkay., Fl. Assam* 1 (1936) 318 (= *H. arborea*); *non* Holth. & H. J. Lam, *Blumea* 5 (1942) 208 (= *H. petiolaris* subsp. *moluccana*); Gagnepain, *Fl. Indo-Chine Suppl.* 1 (1950) 954; How & Ho, *Acta Phytotax. Sin.* 3 (1955) 412; Rao, *Indian Woods* 2 (1963) 220, pl. 54 fig. 323 (*p.p.* = *H. arborea*); Backer & Bakh. f., *Fl. Java* 2 (1965) 142; *Icones Roxb.* 1, 3 (1969) pl. 13; *non* Foreman, *Check List Bougainville* (1971) 58 (= *H. crustacea* and *arborea*); Hartley & al., *Lloydia* 36 (1973) 270 (*p.p.* = *H. crustacea*); H. S. Lo in Anon., *Fl. Hainan.* 3 (1974) 90, fig. 588; Ming in Wu, *Fl. Yunnan.* 1 (1977) 288, pl. 67 fig. 10-13. — *T y p e*: *Roxburgh s.n.*, Bangladesh, 'hilly parts near Chittagong', 1813 (holotype not seen; iso (?) in A, BO).

Tina rupestris Blume, *Bijdr.* (1825) 235; Span., *Linnaea* 15 (1841) 181. — *Cupania rupestris* Cambess., *Mém. Mus. Hist. Nat.* 18 (1829) 29. — *Cupania blumei* Steudel, *Nomencl. ed.* 2, 1 (1840) 453, *nom. illeg.* (I.C.B.N. ed. 1978, art. 63.1). — *H. rupestris* Blume, *Rumphia* 3 (1847) 175; Miq., *Fl. Ind. Bat.* 1, 2 (1859) 570; Radlk., *Sapind. Holl.-Ind.* (1879) 50, 94. — *L e c t o t y p e* (Blume, 1847): *Blume 1625*, Java, Nusa Kambangan, bud (L).

[*Donatophorus erythrospermus* Zipp. ex Macklot, *Bijdr. Natuurk. Wetensch.* 5 (1830) 181, *nom. nud.*]

H. confusa Blume, *Rumphia* 3 (1847) 176; Ridley, *Fl. Mal. Pen.* 1 (1922) 510; Burkill, *Dict.* (1935) 1128. — *S y n t y p e s*: *Blume s.n.*, West Java (L sh. nrs. 908.268-882 & 917); *Reinwardt s.n.*, East Java, Juti Kalangan, July, fl. (L sh. nr. 908.268-901).

H. fraxinifolia Blume, *Rumphia* 3 (1847) 177; Radlk., *Engl. Pflanzenz.* 98 (1934) 1442. — *T y p e*: *Spanoghe s.n.*, Timor (L sh. nrs. 908.270-23, 37, 72, 82 & 92; iso in M, P).

H. fruticosa Blume, *Rumphia* 3 (1847) 179; Radlk., *Engl. Pflanzenz.* 98 (1934) 1443. — *T y p e*: *Zippelius 168*, West New Guinea, fr. (L).

H. juglandifolia Blume, *Rumphia* 3 (1847) 177. — *S y n t y p e s*: *Korthals s.n.*, Borneo, ♂ (L sh. nrs. 908.268-884, 904 & 905); *Korthals s.n.*, SE. Borneo, Dusun (L sh. nr. 908-268-919); *Muller s.n.*, Borneo, ♂ (L sh. nr. 908-268-883); *Anonymous coll. s.n.*, Borneo (L sh. nr. 908-268-930).

H. juglandifolia Blume var. *multiflora* Blume, *Rumphia* 3 (1847) 177. — *T y p e*: *Junghuhn s.n.*, Sumatra, Tapanuli, 'Hochankola' (L sh. nrs. 908.268-912, 908.270-36 & 90, 909.90-813).

H. thanatophora Blume, *Rumphia* 3 (1847) 178; Gresh., *Meded. Lands Plantentuin* 10 (1893) 44; Le Renard, *Ann. Sci. Nat. Bot. sér.* 9, 17 (1913) 362, fig. 5 & 6 (anatomy); Radlk., *Engl. Pflanzenz.* 98 (1934) 1440; S. T. Reynolds, *Austrobaileya* 1 (1981) 418. — *H. cupanioides* Roxb. var. *latifolia* Miq., *Fl. Ind. Bat.* 2 (1859) 571. — *S y n t y p e s*: *Zippelius 134 a*, West New Guinea, bud (L; iso in A, S); *185 b*, West New Guinea, bud (L).

H. leichhardtii F. Muell. ex Benth., *Fl. Austral.* 1 (1863) 470; Radlk., *Engl. Pflanzenz.* 98 (1934) 1447. — *T y p e*: *Leichhardt s.n.*, Australia, Northern Territory, Entrance Is., Port Essington, ♀ (MEL sh. nr. 71610; iso in M).

H. cochinchinensis Pierre, *Fl. Cochinchine* (1895) pl. 332 fig. A. — *S y n t y p e s*: *L. Pierre 4123* (erroneously cited 4183), Vietnam, Cochinchina, Mt. Dinh near Baria, -ix-1866 and 1867 resp., bud and young fr. (A, L, M), resp. (M, P).

H. macrocalyx Radlk., *Philipp. J. Sci.* 8, Bot. (1914) 473; Merr., *En. Philipp.* 2 (1923) 516; Radlk., *Engl. Pflanzenz.* 98 (1934) 1441. — *T y p e*: *A. Loher 5891*, Philippines, Luzon, Rizal Prov., Montalban, -viii-1905, fr. (M).

H. obscura Radlk., *Bot. Jahrb. Syst.* 56 (1920) 314; *Engl. Pflanzenz.* 98 (1934) 1448. — *S y n*

t y p e s: *Ledermann 12494*, NE. New Guinea, Felsspitze, -viii-1913, fl. (B, lost; iso in M); *12968*, same loc., fr. (B, lost; iso in M).

H. longithyrsofera Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 78, fig. 12. — T y p e: *Kanehira & Hatusima 14234*, New Guinea, Vogelkop Pen., Waren 60 miles S. of Manokwari, 19-iv-1940, bud (holotype not seen; iso in A, BO).

Harpullia sp. Ceron, Cat. Pl. Herb. Manila (1892) 55 as for *Vidal 2525 & 2527*.

Walsura villosa auct. non Wall.: Ridley, Fl. Mal. Pen. 1 (1922) 412, as for coll. *Burn-Murdoch* from Gombak, Selangor.

H. reticulata auct. non Radlk.: Radlk., Nova Guinea 14 (1926) 185; Engl. Pflanzenr. 98 (1934) 1443 as for both *Feuilleateau de Bruyn* colls.

Usually a tree, not rarely a shrub, twice reported as a climber, which may be wrong; usually up to 20 m high and 40 cm d.b.h., exceptionally up to 40 m high and 1 m d.b.h. Twigs 2–10 mm thick, usually glabrous except for the terminal bud, exceptionally all young parts, including the branches of the infructescences densely appressedly short-hairy, then mostly early glabrescent. *Leaves* with (1–) 3–6 (7) leaflets per side; petiole up to 20 cm long, not winged; rachis not winged; petiolules 2–12 mm long; axes glabrous or rarely sparsely puberulous. *Leaflets* 2.5–36 × 2–15 cm, 1.5–5 times as long as wide, widest about to (lower leaflets) below or (upper leaflets) above the middle, (herbaceous to) pergamentaceous (to chartaceous), glabrous or above on midrib, beneath on midrib and nerves very sparsely hairy; base equal-sided to oblique, acute or the broader apical half (rarely both halves) rounded, not or mostly only slightly decurrent; apex acute to rounded, (not or) mostly tapering to abruptly acuminate, acumen short to rather long, slender to broad, rounded or retuse to rarely acute; midrib mostly above slightly raised, sunken to the base, sometimes either raised or sunken over its whole length; nerves 1–2.5 (–4.5) cm apart, above slightly raised to slightly sunken; intercalated veins mostly feeble or absent, rarely many and conspicuous. *Inflorescences* axillary, sometimes together pseudo-terminal (very rarely apparently truly terminal), erect or pendulous, infructescences more often ± pendulous, solitary, developing from the single, or the upper of two, axillary bud(s), up to 35 (rarely to 85) cm long, simple or exceptionally with a strong branch near the base, mostly sparsely and ± widely branched, often rather few-flowered, the upper parts mostly remaining hairy, for the rest glabrescent; pedicels in fruit 3–10 mm long; bracts often small simple or rarely ternate leaves. *Sepals* elliptic to nearly orbicular or broad-ovate, 3–7 × 2.5–4.5 mm, persistent in fruit. *Petals* oblong-ovate to oblanceolate, 5–11 × 1.5–3.5 mm, glabrous. *Disk* low-annular, short-velutinous. *Stamens* 5 (4–6); filament 2.5–4.5 mm long; anther 1.5–3.5 mm long. *Pistil* 2-(rarely 3-) merous; style 1.75–6.5 mm long; ovules 1 per cell (exceptionally 1 and 2). *Fruits* slightly kidney-shaped, transversely ellipsoid, ellipsoid, broadly ovoid, obovoid, or globular, 12–25 mm high × 12–35 mm wide, base rounded to truncate or sometimes slightly hollowed, c. 1–3.5 mm long stalked, the apex slightly hollowed to blunt-angular, apiculate; fruit wall leathery to woody, outside variably hairy, early to late glabrescent, inside glabrous to very laxly rather long hairy or glandular hairy.

F i e l d n o t e s. Bole straight, cylindrical; sometimes with buttresses up to 2 m high and 2 m spreading. Bark smooth or sometimes peeling off in thin sheetlets, lenticellate, rough, or finely fissured, greyish or sometimes yellowish, greenish, or brownish, hard or soft, corky, rather brittle, with some watery exudate; inner bark brownish or reddish outside, yellow to white inside, hard and fibrous, up to 1 cm thick; cambium yellow, sometimes greyish or white; sapwood white or sometimes yellow, soft or sometimes hard.

Young parts pale glaucous green, a little furfuraceous. Leaflets dark green and glossy above, light to deep green and dull below, aromatic. Flowers fragrant; sepals green, sometimes more yellowish or brownish; petals white to creamy, sometimes yellow or greenish, exceptionally pink; filaments white, anthers yellowish white, greyish yellow, or dark mauve; ovary pale light green, yellow, or reddish brown, style light green, stigma whitish. Fruits out- and inside red; seeds shining brown to black with a bright glossy red aril.

Distribution: China (Yunnan, Kwantung, Hainan), India (Assam, the Andaman I.), Bangladesh, Burma, Thailand, Indo-China, Malesia, and Australia (the North Territory).

CHINA. Y u n n a n: *Henry 12140*, Szemao (A, US); *12144*, Szemao (A, K); *C. W. Wang 75591*, Sheau-meng-yeang, Che-li Hsien (A). — K w a n t u n g: acc. to How & Ho (1955). — H a i n a n: 23 collections.

BANGLADESH. 11 collections.

INDIA. A s s a m: 11 collections.

BURMA. T e n a s s e r i m: *Meebold 15198*, Tavoy, Wagon (S).

ANDAMAN ISLANDS. 4 collections, at least 2 from South Andaman

THAILAND. 20 collections, mainly from the Northern, Southwestern, and Southeastern Provinces.

INDO-CHINA. L a o s: *A. F. G. Kerr 20862*, Tatom, Chiengkwang; *Poilane 13463*, between La Mui and A Pril Port; *26390*, Prov. de Haut Mekhong, between Vien Poukha and Taffa. — V i e t n a m: from Quang Tri southwards, 7 collections. — unlocalized: *Harmand s.n.*, Mt. Bassin (P).

MALAY PENINSULA. P e n i n s u l a r T h a i l a n d: 7 collections. — P e r a k: *Anonymous 4795*, Ipoh, Kroh, near Gunong, 26-viii-1962 (SING); *King's coll. 1015*, Kinta R.; *7074*. — K e l a n t a n: *M. Haniff & Nur SF 10116*, Kuala Kiai. — P a h a n g: 6 collections. — S e l a n g o r: 5 collections, 3 of which from Bt. Lagong. — M a l a c c a: *Goodenough 1913*, Bt. Tampin.

SUMATRA. A t j e h: G. Leuser Nature Reserve, 4 collections. — T a p a n u l i: 8 collections. — W e s t C o a s t: *Icalas 61*, Mt. Sago near Pajakumbuh (L); *Jacobson 2281*, Padangse Bovenlanden, Aur, Kumanis (L); *Teijsmann 606 HB*, Sidjongdjong, — E a s t C o a s t: 8 collections. — P. S i m a l u r: *Achmad 1676*, Tapa.

JAVA. 50 collections.

LESSER SUNDA ISLANDS. L o m b o k: *Elbert 1711*, Mt. Rindjani, East side, Pussuk Berg; *2246*, ditto, Sangkareang. — F l o r e s: 9 collections. — T i m o r: *Spanoghe s.n.*, type of *H. fraxinifolia*. — T a n i m b a r I s l a n d s: v. d. *Kolk 5 & 15*, Jamdena I., Ollilit (L).

BORNEO. S a r a w a k: *Anderson & al. S. 26093*, 4th Div., Miri Dist., Niah, on southern slopes of G. Subis on the Sekaloh R.; *Beccari P.B. 2883*, S'bungo; *Murthy & Chai S. 24685*, Kuching, 21st mile Kuching-Seriah Rd. — W e s t K a l i m a n t a n: *Hallier 917*, Sanggouw (BO, L, M); *1089*, Sungai Tanggi (BO, L). — S o u t h e a s t K a l i m a n t a n: *Korthals s.n.*, Dusun (L sh. nr. 908.268-919); *Hubert Winkler 2179a*, Kayup (BM, L). — E a s t K a l i m a n t a n: *Amdjah 9*, Bt. Millie (L); *Kostermans 9659*, Kelindjau R. near Melan; *Meijer 487*, Dist. Muara Muntai, Tegumbit above Pringtali, R. Bongan. — S a b a h: 24 collections.

PHILIPPINES. P a l a w a n: *Cenabre FB 29166*, Puerto Princesa (L, US). — L u z o n: *Loher 5891*, Rizal Prov., Montalban (M); *Sandkuhl 216*, Benguet Subprov., Baguio (A); *Vidal 2525*, Isabela Prov., San Antonio (A, M). — M a s a t e: *Vidal 2530*. — S i q u i j o r I s l a n d: acc. to Merrill (1923). — P a n a y: *Martelino & Edaño BS 35569*, Mt. Salibongbong (A, US); *Vidal 2529*, Prov. Iloilo, Miagao. — S u l u I s l a n d s: *Ramos & Edaño BS 44075*, Tawitawi (BRI, L, MEL); *Vidal 2527*, Bengao I.; *Yaes BS 36326*, ditto (A). — M i n d a n a o: *Ramos & Edaño BS 49625*, Davao Prov., Mati (A, BO, SING, US); *Ramos & Pascasio BS 35267*, Dinagat I. (A, BRI, NSW).

CELEBES. N o r t h P e n i n s u l a: *Meijer 9248*, between Palu and Parigi, c. 0°53' S 120° E (L). — C e n t r a l: *van Balgooy 3539*, Sopa Valley, c. 80 km SSE. of Palu (L). — S o u t h w e s t P e n i n s u l a: *NIFS Cell-69*, Ond.afd. Bonthain; *Teijsmann 12417 HB*, Tjamba.

MOLUCCAS. P. B a t j a n: *Curran 344*, Mandioli I. (A, US). — S u l a I s l a n d s: *Atjè 115*, Taliabu I., Tdj. Salu (L); *Teijsmann 14252 HB & 14253 HB*, Sula Besi. — B u r u: *Toxopeus 43*, Leksula (BO). — C e r a m: *Rutten 1799*, NW., W. of Riring (L). — A m b o n: *Teijsmann 5529*. — K a i I s l a n d s: 5 collections.

NEW GUINEA. Vogelkop Peninsula: 5 collections — Northwest: Schram BW 2804, Hamadi near Hollandia. — Southeast: 5 collections, from Central and Milne Bay Dist. — Northeast: 14 collections, mainly from the Morobe Dist. — New Britain: Croft & al. NGF 41434, West Dist., Kakolan I., off Nantamby For. Station. — Schouten Island: Feuilleateau de Bruijn 419, Wari (L); 443, Korim (L); J. J. F. E. de Wilde 1199, Biak, near Kampong Saba (L). — P. J a p e n: Aet & Idjan 770, Mariadai near Seroei; Barclay 4020 (BM, US); Beccari herb. 2820, Ansum. — B a t a n t a: Beccari herb. 2821; van Roijen 3254, Marchesa Bay, beach E. of Amdoi Village (K, L). — M i s o ö l: Pleyte 824, Waigana (B, K, L, SING). — A r u I s l a n d s: Treub s.n. (BO).

AUSTRALIA. Northern Territory: *Leichhardt s.n.*, Entrance I., Port Essington, type of *H. leichhardtii*. — unlocalized: *R. Brown s.n.* (MEL sh. nr. 71592, P).

Cultivated at Bogor (Indonesia, Java: Botanic Garden, III.J.28, XV.J.A.XXVII.6) and Calcutta (India, West Bengal: Botanic Gardens, HB 14279, 14280, 14321, 14588, Lindley 8078, L. Pierre 4123).

E c o l o g y: In Malesia mainly in primary and secondary rain forest, in continental Asia in mixed deciduous forest, more rarely in light forest, teak forest, tidal forest, scrub, or on open places; often on slopes and ridges, on riverbanks and along ravines, also on flats and along the beach, mostly on a dry, rarely on swampy soil; soil rocky, sand, clay, or loam, mostly over limestone, sometimes on fertile volcanic soils; alt. 0–1200 (–1800) m. Fl. and fr. the year round, but mainly in April–July and April–Oct., resp.

U s e s: The wood is useless as a timber, but is good for charcoal and as firewood; the bark is used as a fish poison; the saponin containing fruits are in Ceylon used for washing.

N o t e s. Systematically, *H. cupanioides* seems on the one side allied with *H. hillii*; on the other side it is more or less the basis of a group of species to which further belong *H. vagans*, *H. crustacea*, *H. camptoneura*, and probably *H. hirsuta*. This group seems connected with the more derived *H. ramiflora*-group. Among the surrounding species or groups, *H. cupanioides* is best characterized by the combination of vegetative parts glabrous except for the terminal buds, and exclusively axillary inflorescences. In the *H. ramiflora*-group the inflorescences are at first also axillary, but these are usually clustered and branched whereas in *H. cupanioides* they are solitary and hardly branched.

Notwithstanding its rather wide distribution, the present species is not very variable. As a whole there is a gradual shift in flower size from large in the west to small in the east. Locally, there may be some more variation. The form formerly known as *H. cochinchinensis* occurs from India to southernmost Vietnam and is mainly characterized by an obovoid fruit measuring c. 2 cm high × 1.5 cm broad, with the apex broadly rounded to truncate and the base tapering to the stipe. Especially in Thailand, this form is connected by intergrades with the normal one.

In Borneo there is a fairly clear differentiation between a mainly western '*cupanioides*' type and a mainly eastern '*thanatophora*' type. The latter is restricted to Sabah and is characterized by leaves with few large and relatively broad leaflets with the nerves rather distant, by less hairy inflorescences and smaller flowers, and by relatively big (up to 3.5 cm wide against up to 2 cm wide) early glabrescent fruits.

The type of *H. fruticosa*, from West New Guinea, is the only specimen with the leaflets fairly densely hairy all along the midrib above; the lower side of the leaflets is glabrous as is the normal case.

The two Feuilleateau de Bruyn collections from Schouten I., in our opinion incorrectly cited by Radlkofer (1926, 1934) under *H. reticulata*, are deviating in their thick hard leaflets with a very pronounced dense network of veinlets.

Further rare exceptions are truly terminal inflorescences (only known from *Verheijen 3241* from Flores) and a 3-merous pistil (a rare exception in *H. cochinchinensis*).

A somewhat doubtful collection is *Sulit PNH 10113* from Mindanao (Bukidnon Prov., Mt. Katanglad, south slope of middle peak, source of Alanib R., near Bo. Songcô, at 1800 m alt.); the main difference is the unusually big fruit, which measures up to 25 mm high \times 45 mm wide. This could represent a separate species, though from the alliance of *H. cupanioides*.

12. *Harpullia vaga* Merr. & Perry

H. vaga Merr. & Perry, J. Arnold Arbor. 21 (1940) 526. — Type: *Kajewski 2544*, Solomon I., Guadalcanal, Vulolo, Mt. Tutuwe (A; iso in BISH, BM, BO, BRI, L, P. SING).
Harpullia spp. Foreman, Check List Bougainville (1971) 58, as for the Craven & Schodde colls.

Tree up to 18 m high and 48 cm d.b.h., but often much smaller. *Indumentum* dense, patent, short, yellowish brown, and hirsute. *Twigs* 4–10 mm thick, sometimes hardly more than the terminal bud hairy. *Leaves* with (2) 3–5 leaflets per side; petiole 4–14 cm long, not winged; rachis not winged; petiolules 3–8 (–10) mm long; axes fairly densely hairy, glabrescent. *Leaflets* 4.75–27 \times 2.5–8.5 cm, 2–4.5 times as long as wide, widest in to below the middle, chartaceous to papyraceous, above sparsely hairy on midrib and sometimes nerves to rarely glabrous, beneath thinly hairy (exceptionally densely tomentellous) all over, most densely so on midrib and nerves, to glabrous except for some scattered hairs on midrib and nerves; base oblique to equalsided, acute to (lower) blunt to rounded, attenuate; apex tapering acuminate, acumen long, slender, and acute, or sometimes short, broad, and rounded; midrib above slightly raised to slightly sunken; nerves 1–2.5 cm apart, slightly raised above; intercalated veins few and mostly feeble. *Inflorescences* axillary, solitary, developing from the upper of two axillary buds, pendulous, 10–37 (–70) cm long, subspicate to thyrsoid; pedicels in fruit 5–10 mm long. *Sepals* ovate, 6–8 \times 5–6 mm, persistent in fruit. *Petals* glabrous. *Disk* annular, densely puberulous. *Stamens* 5. *Pistil* 2-merous; ovules 1 in one locule, 2 in the other. *Fruits* transversely broad-ellipsoid, kidney-shaped, broad-ovoid, or subglobular, up to 3 cm high \times 4.5 cm wide, base obtuse or rounded, c. 2.5 mm long stalked, the apex rounded or submarginate; fruit wall woody, 1–1.5 mm thick, outside coarsely granulate, sometimes with rather big pustules, almost glabrous, inside glabrous.

Field notes. Bole crooked to straight; no buttresses. Bark smooth, rarely rough or slightly fissured, light brown, grey, or white, rarely blackish brown; slash soft or sometimes hard, brown to white, often flecked, inside creamy brown to creamy white; wood hard to soft, white or sometimes brownish or yellowish. Leaves dark green. Flowers without smell; sepals pale green, brown yellow, or brown; petals yellow, greenish white, or white. Fruits orange.

Distribution: Queensland, the Solomon Islands, and a doubtful collection from New Ireland.

AUSTRALIA. Queensland: *Webb & Tracey 10903*, Cape Tribulation area, Oliver Creek, 16°6' S 145°27' E (BRI).

SOLOMON ISLANDS. 22 collections.

Doubtful:

NEW GUINEA. New Ireland: Coode & Lelean NGF 46042, Namatanai Subdist., 8 miles up Danfu R. near Manga, 153° E 4°13' S.

E c o l o g y: In well drained primary, rarely secondary rain forest on slopes or ridges; alt. 0–200 (–1200) m. Fl. May, July–Sept., Dec.; fr. Febr.–March, June–July, and Dec.

N o t e s. 1. *H. vaga* belongs with the *H. cupanioides*-group. It appears to be nearest to *H. cupanioides* itself, from which it mainly differs in the big thick-walled fruits and in the nearly always \pm hairy leaves.

2. As a whole, *H. vaga* is very uniform. The only somewhat deviating specimen is Corner R.S.S. 180 from Guadalcanal I., the leaflets of which are densely tomentellous all over the lower surface.

3. In comparison with the uniform material from the Solomon I., the one collection from New Ireland mentioned above makes a somewhat different impression: the leaflets are relatively broad (up to 20 \times 9 cm) with widely spaced (up to 3.5 cm) nerves and the old ♀ flowers have rather big calyces (sepals 8 \times 5 mm). As, moreover, the fruits are still unknown, we prefer to keep this specimen separate as doubtful.

13. *Harpullia crustacea* Radlk.

H. crustacea Radlk. in K. Schum. & Hollr., Fl. Kais. Wilh. Land (1889) 67; Engl. Pflanzenr. 98 (1934) 1442; *non* Ridsdale, Trans. Papua N. G. Sci. Soc. 9 (1968) 20 (= *Guioa* sp.). — **T y p e:** *Hollrung* 549, NE. New Guinea, Constantinhafen, 1887, fr. (M; iso in BO, K, MEL).
H. cupanioides auct. *non* Roxb.: Foreman, Check List Bougainville (1971) 58 p.p.; Hartley et al., Lloydia 36 (1973) 270 p.p.

Tree, up to 24 m high and 22.5 cm d.b.h., but often much smaller. Young parts, leaf axes, inflorescences, and infructescences sparsely to moderately densely patently short-hairy. Twigs 9–15 mm thick. Leaves with 5–9 leaflets per side; petiole 4–23 cm long, not winged; rachis not winged; petiolules 0–3 mm long. Leaflets 6–31 \times 3–13 cm, 1.8–3.4 times as long as wide, widest in the middle, papyraceous to thin-pergamentaceous, above densely puberulous on the midrib, more sparsely so on the nerves and sometimes very sparsely all over, beneath thin-puberulous on midrib and nerves and sometimes on veins and veinlets, hairs beneath sometimes longer than above; base equal-sided or sometimes \pm oblique, acute to rounded, sometimes subcordate; apex tapering acuminate, the acumen short to long, broad, acute to rounded, sometimes the leaflet rounded and hardly apiculate; midrib above slightly raised; nerves 0.5–2.3 cm apart, sunken above; intercalated veins rather many and often strongly developed, making the nervation sometimes irregular; veins and veinlets hardly raised at both sides. Inflorescences axillary, developing from the upper one of two serial buds, sometimes a second much smaller one developing from the lower bud, pendulous, 30–60 cm long, simple; pedicels in fruit 4–6 mm long. Sepals broad-ovate, 4.5–6.5 \times 4.2–4.5 mm, persistent. Petals oblanceolate, 7–9 \times 2.5–3.5 mm, sometimes slightly hairy outside in the basal part. Disk annular, 5-lobed, velvety. Stamens 5; filament 3–5.5 mm long; anther 2.5–3 mm long. Pistil 2-merous; style 3.5–4 mm long; ovules 1 per cell. Fruits transversely flattened broad-ellipsoid, c. 2 cm high \times 3–3.5 cm wide, base slightly cordate to truncate, abruptly narrowed into a 1–2 mm long stalk, apex (slightly) emarginate; fruit wall woody, outside prominently reticulate or pustulate, sparsely to moderately densely hairy, inside with a rather dense indumentum of longer, tufted hairs.

Field notes. Sparsely branched tree; bole irregular. Bark fairly smooth or with numerous very tiny pustules, greyish white to light brown, in section very light brown, inside pinkish brown or straw; sapwood creamy. Twigs hollow, inhabited by ants. Leaves clustered at the end of the twigs, up to 1 m long, the leaflets dull dark green above, lighter beneath. Flowers fragrant; sepals yellow green to brown; petals white, sometimes cream or yellowish green. Fruits orange red; the young aril white.

Distribution: East New Guinea.

NEW GUINEA. East: 15 collections.

Ecology: Lower stage of rain forest, also in forest edges; on slopes, river banks, banks of mangrove creeks, also in swamps; on clay over volcanic rocks; alt. 0–480 m. Fl. Febr.–March, July, Sept., and Nov.–Dec.; fr. April and Dec.

Note. *H. crustacea* belongs with the *H. cupanioides*-group. Within this group, its nearest allies appear to be *H. cupanioides* and *H. vaga*. It is easily distinguished from the former by the always hairy leaflets. From the latter it is mainly different by the inside fairly densely hairy fruits (in *H. vaga* these are glabrous); for the rest there are several differences that show a slight overlap. Actually, *H. crustacea* and *H. vaga* could as well form a pair of subspecies, the one in E. New Guinea, the other one in the Solomon I. This combination would have had its consequences for the subdivision of the whole alliance, however, and therefore we considered it better to keep the two separate as species.

14. *Harpullia camptoneura* Radlk.

H. camptoneura Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Akad. Wiss. München 20 (1890) 360; non Rehder, J. Arnold Arbor. 14 (1933) 64 (= *H. leptococca*); Radlk., Engl. Pflanzenr. 98 (1934) 1446; non Hartley et al., Lloydia 36 (1973) 270 (= *H. ramiflora*). — Type: O. Warburg s.n., NE. New Guinea, Morobe Dist., Sattelberg near Finschhafen, 1881, fl. (B, lost; iso in M). *H. crustacea* auct. non Radlk.: K. Schum. & Lauterb., Fl. Schutzgeb. (1900) 424 as for *Lauterbach 601*.

Shrub or treelet, up to 4.50 m high. Twigs, leaf axes and inflorescences densely shortly brownish puberulous, apart from the inflorescences mostly early glabrescent. Twigs 3.5–6 mm thick. Leaves with 2–4 leaflets per side; petiole 4–8 cm long, not winged; rachis not winged; petiolules 2–8 mm long. Leaflets 7–21 × 3.5–8 cm, 1.75–3.25 times as long as wide, widest in, or in lowermost leaflets below the middle, stiff-pergamentaceous, above (glabrous to) thin-puberulous on midrib and nerves, beneath with only some scattered hair tufts on base of midrib to rarely thin-puberulous on midrib and nerves; base equal-sided to sometimes slightly oblique, acute to rounded, not or slightly decurrent; apex acute, fairly abruptly to sometimes hardly acuminate, acumen fairly short, broad to slender, rounded to acute; midrib above slightly raised to near the base nearly flat; nerves 1.25–3 cm apart, above slightly raised; intercalated veins variably developed. Inflorescences axillary, together sometimes pseudoterminal, solitary, developing from the single axillary bud or from the upper of two, 1.5–15 cm long, sparsely and laxly branched, few-, exceptionally even only 1-flowered; pedicels in flower 4 mm long. Only ♂ flowers known. Sepals elliptic, 6 × 4 mm, persistent. Petals linear-lanceolate, 8 × 1.5 mm,

glabrous. *Disk* annular, velvety. *Stamens* 5; filament 5 mm long; anther 2 mm long. *Pistil* 2-merous; ovules 1 per cell. *Fruits* transverse-ellipsoid, 20–25 × 25–30 mm, to subglobular, c. 2 cm in diam., the lobes erect, strongly bulging, the base slightly hollowed, c. 1.5 mm long stalked, the apex blunt; fruit wall thin, hard, outside granulate and in old fruits coarsely reticulately veined, glabrous, inside glabrous or with scattered tufts of few hairs.

Field notes. Bark dark brown; wood straw, hard. Leaves above shiny dark- or midgreen, beneath dull olive to lightgreen. Petals white. Fruits bright red. Seeds black, aril bright red or pink.

Distribution: NE. New Guinea.

NEW GUINEA. Northeast: 9 collections.

Ecology: Undergrowth of primary and secondary rain forest, also Castanopsis-oak forest; alt. 300–1500 m. Fl. Jan. and Oct.; fr. Jan., March, and July. The fruits are said to be eaten by birds.

Note. This species clearly belongs with the *H. cupanioides*-group.

15. *Harpullia hirsuta* Radlk.

H. hirsuta Radlk., Nova Guinea 8 (1912) 618; Engl. Pflanzenr. 98 (1934) 1450; non Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 77 (= ? *H. oococca*). — *Type:* von Römer 980, SW. New Guinea, near Lorentz R. and Wilhelmina Top, c. 4°30' S 138°40' E, 8-xi-1909, ♀ buds (L; iso in M).

Tree. Twigs and leaf axes brownish hirsute. *Twigs* 3 mm thick. *Leaves* with 2 or 3 leaflets per side; petiole 5–7 cm long, not winged; rachis not winged; petiolules 4–6 mm long. *Leaflets* 11–20 × 5–6.5 cm, 2.1–2.9 times as long as wide, widest in the middle, pergamentaceous, above densely hirsute on midrib and nerves, more sparsely so all over, beneath densely hairy on midrib, sparsely so all over; base equal-sided or slightly oblique, acute and decurrent; apex acuminate, acumen long, slender, falcate, with acute top; midrib and nerves slightly raised above, the latter at 1.5–2.5 cm apart; intercalated veins few. *Inflorescences* axillary, solitary, probably unbranched, 1.5 cm long (or slightly more?). *Flowers* known from ♀ buds only. *Sepals* elliptic. *Petals* thin, not (yet?) clawed, not auricled, glabrous. *Disk* densely long-hairy. *Stamens* 5. *Pistil* 2-merous; ovary densely hairy; ovules 1 per cell. *Fruit* unknown.

Distribution: West New Guinea. Known from the type only.

Doubtful:

NEW GUINEA. Vogelkop Peninsula: T. Tuyama s.n., 1943, st. (TI).

Notes. 1. The present species seems to belong with the *H. cupanioides*-group, where it resembles most *H. camptoneura*.

2. The Tuyama collection from the Vogelkop Peninsula is sterile, comparison is hence difficult, but it resembles the type reasonably well.

16. *Harpullia leptococca* Radlk. — Fig. 2 b.

H. leptococca Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20 (1890) 278; Engl. Pflanzenr. 98 (1934) 1450. — Type: *Chalmers s.n.*, SE. New Guinea, 1880, fr. (M; iso in MEL sh. nr. 71699).

H. camptoneura auct. non Radlk.: Rehder, J. Arnold Arbor. 14 (1933) 64.

Trees, up to 9 m high. Young parts, leaf axes, inflorescences, and infructescences densely, appressedly, minutely hairy. Twigs 3.5–7 mm thick. Leaves with 2 or 3 (rarely up to 5) leaflets per side; petiole 2.5–8 cm long, not winged; rachis not winged; petiolules 2–5 (–7) mm long. Leaflets 4.5–15 × 2.5–8 cm, 1.5–3 times as long as wide, widest in or above the middle, chartaceous, glabrous or below on the midrib very sparsely hairy; base equal-sided to slightly oblique, rounded to acute and mostly (abruptly) short-decurrent; apex rounded to obtuse, sometimes slightly emarginate; midrib above slightly sunken to slightly raised; nerves 0.9–2 (–2.6) cm apart, above and beneath about equally strongly prominent; intercalated veins rather many, mostly rather feeble. Inflorescences either axillary or pseudoterminal, developing from the single, or from the upper of two axillary bud(s), or terminal, 8.5–30 cm long, solitary and simple or ramified, mostly with 2 equally strong basal branches, sometimes with some more higher up; pedicels as well in flower as in fruit 2–4 mm long. Sepals obovate to elliptic to orbicular, 4–5.5 × 3–4 mm, persistent. Petals oblong, lanceolate, or oblanceolate, 6–7.5 × 2–2.5 mm, mostly glabrous (in one and the same flower 4 glabrous, the 5th one inside in the basal half centrally with a densely puberulous line). Disk annular, short-velvety. Stamens 5 (ones 7). Pistil 2-merous; style 2.5–5 mm long; ovules 1 (rarely 1 and 2) per cell. Fruits with widely spreading, obovoid to ellipsoid lobes, 5–6 mm high × 27–34 mm wide, the base cordate to obtuse, up to 2 mm long stalked; fruit wall pergamentaceous, outside smooth with faint longitudinal nerves, sparsely short-hairy, inside very sparsely short-hairy.

Field notes. Erect bushy tree. Bark moderately smooth, brown or patchy grey and fawn, blaze straw, inside yellow or green; wood cream to straw. Leaves dark green and dull above, slightly paler beneath. Sepals green or dull yellow to golden brown; petals creamy green to creamy white. Fruits orange to red; seeds black with a red aril.

Distribution: SE. New Guinea (Central Dist.).

NEW GUINEA. Southeast: Central Dist., mainly around Port Moresby and on Yule I., 15 collections.

Ecology: In and along coastal scrub, between strand vegetation and grasslands, on savannas and grasslands, also in the undergrowth of semi-deciduous forest; along the shore, behind the mangrove, on tidal flats, also on sand hills and ridges; alt. 0–60 m. Fl. April and Aug.; fr. April, July–Sept., and Nov.

Note. The present species is on the one hand allied with *H. hillii*, which is more primitive in some characters, however. On the other hand it forms a group with *H. carrii* and *H. oococca*, all three characterized by the fruits with a short axis and widely spreading lobes. This kind of fruit is furthermore only known from *H. hillii* where it occurs together with normal fruits with erect connate lobes.

17. *Harpullia carrii* Leenh., nov. sp.

Descriptio typi: Frutex ca. 2,40 m altus. *Ramuli* 4,5–5 mm crassi, sparse puberuli, glabrescentes. *Folia* 4-jugata; petiolus 7–10 cm longus, rhachisque nudus; petioluli 6–7 mm longi; axes sparse puberuli. *Foliola* oblonga, 8–18 cm longa, 4,5–8 cm lata, pergamentacea, glabra; basis equilateralis, rotundata; margo integrum; apex gradatim acuminatus, acumine brevi lato rotundato; costa supra plana. *Infructescentiae* axillares, solitariae, 4,5–12 cm longae, sparse ramosae, puberulae; pedicelli 3 mm longi. *Sepala* elliptica, 5 mm longa, 2 mm lata, sub fructu persistentes. *Discus* pilosus. *Fructus* bi- vel trilocolati, lobis ellipsoideis patentissimis, 6–7 mm alti, 3 cm lati, ad basem 3 mm stipitati; pericarpium tenue lignosum, extus pustulatum, glabrescens, intus glaber; loculi uniovatuli. *Semina* ellipsoidea, 1,5 cm longa, 0,8 cm lata, pro majore parte arillo obtectata.

T y p u s. C. E. Carr 12443, SE. New Guinea, Central Dist., Rouna, 30-v-1935, fr. (L; iso in K, SING).

Shrub or treelet, 1.80–2.40 m high. Twigs and leaf axes thin-puberulous, glabrescent, inflorescences and infructescences short-velvety. *Twigs* 3–5 mm thick. *Leaves* with 1–5 leaflets per side; petiole 4–10 cm long, not winged; rachis not winged; petiolules 3–9 mm long. *Leaflets* 5.5–23 × 2.5–9.5 cm, 1.75–3 times as long as wide, widest in the middle, thin- to stiff-pergamentaceous, glabrous to sparsely hairy above and beneath on midrib and sometimes nerves; base equal-sided or sometimes slightly oblique, acute to rounded, only slightly decurrent; apex acuminate, acumen short to long, slender to broad, rounded; midrib above slightly raised to flat; nerves 1.25–3 cm apart, slightly raised above; intercalated veins frequent, variably developed. *Inflorescences* restricted to the uppermost leaf axil (rarely the upper two axils), developing from the upper one of two serial buds (rarely from both), solitary or few together, 4.5–12 cm long, hardly to repeatedly branched from the base onwards; pedicels in fruit 3 mm long. *Sepals* elliptic to broad-ovate, 3.5–5 × 2–3 mm, persistent under the fruit. *Petals* glabrous (known in bud only). *Disk* annular, velvety. *Stamens* 5; anther 1.2 mm long. *Pistil* 2- or 3-merous; style 2.5–3 mm long; ovules 1 per cell. *Fruits* with widely spreading ellipsoid lobes 1.5 cm long and 1.25 cm wide, the central axis 6–7 mm high with a stipe 3 mm high; fruit wall thin-woody, outside pustular or coarsely veined, glabrous, inside glabrous.

Field notes. Leaves dark green. Calyx green. Fruits orange.

Distribution: SE. New Guinea (Central Dist., near Port Moresby).

NEW GUINEA. S o u t h e a s t: 4 collections, 3 of which from Rouna, one from Boridi.

Ecology: In primary and secondary forest; on ridges and steep rocky hillsides, in the savanna in gallery forests; alt. 300–400 (–1200) m. Fl. and fr. in May.

Note. *H. carrii* is closely allied to *H. leptococca* and comes from the same restricted area. However, it has a distinctly different ecology and occurs at a higher altitude.

18. *Harpullia oococca* Radlk.

H. oococca Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20 (1890) 278; Engl. Pflanzenz. 98 (1934) 1449. — T y p e: Sayer s.n., SE. New Guinea, Central Dist., between Senamagove and Bouvauarri, 1887, fr. (M; iso in MEL sh. nr. 71704).

H. hirsuta auct. non Radlk.: Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 77 (prob.).

Straggling tree, 6 m high. Twigs and leaf axes sparsely puberulous, infructescences short-velvety. *Twigs* 2 mm thick (or more?). *Leaves* with 3 (or sometimes more?) leaflets per side; petiole at least 2.5 cm long, not winged; rachis not winged; petiolules 7–10 mm long. *Leaflets* 10–30 × 5.5–11 cm, 2–3 times as long as wide, widest in the middle, pergamentaceous, above and beneath on midrib and nerves densely puberulous, beneath moreover sparsely so on veins and veinlets; base equal-sided to slightly oblique, acute and slightly decurrent; apex rather abruptly acuminate, acumen short, slender, and acute; midrib slightly raised above; nerves 1.5–4 cm apart, hardly raised above; some intercalated veins strongly developed. *Infructescences* (position unknown) probably solitary, probably no more than 5–6 cm long, with some strong patent branches near the base; pedicels c. 7.5 mm long. *Sepals* elliptic, c. 5 × 3 mm, persistent. *Disk* velvety. *Fruits* with 2 widely spreading ellipsoid lobes measuring 1.5 × 1 cm, the central axis 4–7 mm high with a stipe 3 mm high and crowned by a style c. 5 mm long; fruit wall thin-woody, outside pustular, thinly puberulous, probably ± glabrescent, inside glabrous; 1 seed per locule.

Field notes. Fruits orange; seeds black with a deep carmine aril.

Distribution: New Guinea. With certainty known from the type only.

Doubtful:

NEW GUINEA. West: *Docters van Leeuwen 10595*, Nassau Mts., Explorers bivouac (L); *Kanehira & S. Hatusima 12597*, Sennen, 40 km inward of Nabire (BO).

Ecology: Alt. 600 m.

Note. The fruits of *H. oococca* point to a relationship with *H. carrii* and *H. leptococca*. It comes also from the same restricted area. The poor condition of the type makes a further interpretation very difficult, however. Accordingly, it is still impossible to tell whether the two West New Guinea specimens mentioned above, both flowering, which show a superficial resemblance with *H. oococca*, really belong here.

19. *Harpullia solomonensis* M. Vente, *nov. sp.*

H. peekeliana auct. non Melch.: F. S. Walker, For. Brit. Solomon I. (1948) 167.

H. largifolia auct. non Radlk.: Foreman, Check List Bougainville (1971) 58.

Harpullia spp. Foreman, Check List Bougainville (1971) 58, as for Waterhouse coll.

Descriptio typi: Arbor usque ad 10 m alta, indumento partium iuveniliū sparse puberulo. *Ramuli* 10 mm crassi, substriati, lenticellati. *Folia* 3-jugata. *Petioli* 10,5–16 cm × 3–4 mm, striatus, haud alatus; rhachis non alata; petioluli (6–)10 mm longi, supra sulcatuli, basi valde incrassato, 3–4 mm lato. *Foliola* 21–42 × 10,5–15,5 cm, ratiōne 2–2,7, medio vel infra medium latissima, herbacea; costa nervique supra sparse puberuli, plani vel prominuli, subtus glabri prominentes; basi acuta vel rotundata semperque breve decurrens; margo integrum; apex (sensim) attenuatus, ipso acumine brevi, obtusato; nervi laterales a costa angulo 50–70° abeuntes, per 20–35 mm distantes; venae intercalares paucae, cum venulis (transverse) reticulatae. *Inflorescentia* fascicula densa axillaris rhachidum usque ad 4,5 cm longarum. *Flores* cogniti reliquiis solum fructus. *Sepala* (sub)orbicularia usque elliptica, 5–6 × 3–4 mm, rigida, coacta laeviaque, haud reflexa in fructu. *Stamina* 5. *Fructus* 1,7 cm longi, 2,5 cm lati, applanati, apice (leviter) emerginato, basi rotundata; lobi erecto-ellipsoideis, extus granulis indumento dense vel sparse brevissimo instructi, intus glabri; pericarpium lignescens; dissepimentum lanceolatum; sutura plana; stipes 3 mm longus, 1,5 mm latus; semina ignota, funiculi prope apicem dissepimenti inserti; sarcotesta arilloideoque obvis.

T y p u s: *S. F. Kajewski 1968*, Solomon I., Bougainville I., Kugumaru, Buin, 29-vii-1930, fr. (BRI; iso in A, BISH, BO, P).

Tree, up to 18 m high \times 25 cm d.b.h. Twigs and leaf axes about glabrous, infructescences thin-puberulous. *Twigs* 9–11 mm thick. *Leaves* with 3 leaflets per side; petiole 9.5–18 cm long, not winged; rachis not winged; petiolules (6–) 9–12 mm long. *Leaflets* 11–42 \times 6–15.5 cm, 1.8–2.7 times as long as wide, widest in or below the middle, herbaceous to pergamentaceous, above sparsely puberulous on midrib and sometimes nerves, beneath glabrous; base equal-sided, acute or rounded, short-decurrent; apex tapering-acuminate, acumen long, broad; midrib and nerves above flat to slightly raised, nerves 2–3.5 cm apart; intercalated veins few. *Inflorescences* axillary to cauliflorous, developing from the single or the upper of two axillary bud(s), densely clustered, the rachises branched at base, the axillary ones up to 4.5 cm long, those on the trunk up to 22 cm long; pedicels 8–12 mm long. *Flowers* known only from remnants under the fruit. *Sepals* (sub)orbicular to elliptic, (3–) 4–6 \times 3–5 mm, persistent. *Disk* short-velvety. *Stamens* 5. *Pistil* 2-merous; style c. 6 mm long; ovules 1 per cell. *Fruits* with erect ellipsoid lobes, (17–) 23–24 (–30) mm high \times (25–) 28–34 mm wide, base broadly rounded, 3 mm stalked, apex slightly emarginate; fruit wall slightly woody, outside granulate and variably minutely hairy, inside glabrous.

Field notes. Not or hardly branched tree; bole straight or crooked; no buttresses. Bark smooth, soft, light brown; wood soft, white. Leaves up to 75 cm long. Flowers without or with a strong smell, greenish- to golden yellow. Fruits yellow to orange.

Distribution: the Solomon I.; possibly also on New Britain and New Ireland.

SOLOMON ISLANDS. 6 collections, from Bougainville, Fauro, Ranongga, and Guadalcanal.

Doubtful:

NEW GUINEA. New Britain: Foreman NGF 45722, Nantambo Harbour, 4°53' S 151°25' E.
— New Ireland: Coode & Katik NGF 29839, Kaut Harbour, 2°45' S 150°55' E.

Ecology: Well drained primary rain forest on ridge tops, hill sides, and in deep valleys; alt. 150–250(–900) m. Fl. April, June, and Nov.; fr. March–April and June–July.

Notes. 1. *H. solomonensis*, together with *H. ramiflora*, *H. myrmecophila*, *H. cauliflora*, *H. petiolaris*, *H. largifolia*, and probably *H. peekeliana*, forms a group of mutually closely connected species. The most important common character is that they are all finally rami- or cauliflorous. From the nearest related species, *H. ramiflora*, *H. solomonensis* differs especially in the inflorescences, which, when still axillary, are short dense clusters developing from both axillary buds, in the as a whole longer pedicels, and in the bigger fruits with a thicker rather woody wall.

2. The two collections cited from the Bismarck Archipelago strongly resemble the present species and may very well belong here. However, within a group of several mutually closely allied species it is difficult to place a few geographically separated and accordingly morphologically somewhat deviating specimens with reasonable certainty. An extra difficulty in the present case is that the nearly unknown *H. peekeliana* is described from New Ireland and that that species seems nearest allied to *H. solomonensis*. This problem can only be solved when more material from the Bismarck Archipelago becomes available.

20. Harpullia ramiflora Radlk.

- H. ramiflora* Radlk., Sapind. Holl.-Ind. (1879) 15, 54; Engl. Pflanzenr. 98 (1934) 1439; non Foreman, Check List Bougainville (1971) 58 (= *H. largifolia* ?); S. T. Reynolds, Austrobaileya 1 (1981) 415, fig. 29 G. — T y p e: *Beccari herb.* 2822, Indonesia, Aru I., Vokan, -iii-1873, fr. (FI).
H. angustifolia Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9 (1879) 599; Engl. Pflanzenr. 98 (1934) 1439. — T y p e: *d' Albertis s.n. in herb. Beccari 2892*, SE. New Guinea, Fly R., 1876, fr. (FI).
H. aeruginosa Radlk., Sitzungsber. Math. Phys. Cl. Königl. Bayer. Akad. Wiss. München 20 (1890) 278; Engl. Pflanzenr. 98 (1934) 1448. — T y p e: *Chalmers s.n.*, SE. New Guinea, 1885, fr. (M).
H. weinlandii K. Schum. in K. Schum. & Lauterb., Nachtr. (1905) 310; Radlk., Engl. Pflanzenr. 98 (1934) 1449. — T y p e: *Weinland 258*, NE. New Guinea, 'am mittleren Bumifluss', -vi-1890, young fr. (B, lost; iso in BRI, L, M, SING, US, WRSL).
H. reticulata Radlk., Bot. Jahrb. Syst. 56 (1920) 313; non Nova Guinea 14 (1926) 185 (= *H. cupanioides*); Engl. Pflanzenr. 98 (1934) 1443 (type only; further collections = *H. cupanioides*). — T y p e: *Branderhorst 439*, SW. New Guinea, Oetoemboewe R., 11-vi-1908, fr. (M; iso in BO).
H. cupanioides auct. non Roxb.: Koord., Nova Guinea 8 (1909) 171; Radlk., Bot. Jahrb. Syst. 56 (1920) 313 as for West New Guinea material; Merr., Enum. Philipp. 2 (1923) 516 as for *Ramos 30150*; Rehder, J. Arnold Arbor. 14 (1933) 64.
H. cauliflora auct. non K. Schum. & Lauterb.: Radlk., Nova Guinea 8 (1912) 618; Bot. Jahrb. Syst. 56 (1920) 312 as for West New Guinea; Engl. Pflanzenr. 98 (1934) 1440, ditto.
H. camptoneura auct. non Radlk.: Hartley et al., Lloydia 36 (1973) 270.

Tree or shrub, up to 15 m high and 15 cm d.b.h., but often much smaller. Either twigs and leaf axes, or only buds, inflorescences, and infructescences sparsely to densely variably hairy, \pm glabrescent. Twigs 3–11 mm thick. Leaves with (1–) 3 or 4 (–) leaflets per side; petiole (2–) 5–14 (–18) cm long, not winged; rachis not winged; petiolules (2–) 4–8 (–11) mm long. Leaflets (4–) 8–20 (–31) \times (1.5–) 3.5–8 (–15) cm, (1.5–) 2–4 times as long as wide, widest in or below the middle, sometimes \pm falcate, herbaceous to chartaceous, if thin \pm bullate, above glabrous to densely hairy on midrib, sparsely so on nerves, beneath densely hairy on midrib and nerves, more sparsely so in between, to glabrous; base equal-sided to sometimes oblique, acute to (especially in the relatively broad lower leaflets) rounded, not or variably decurrent; apex acute to (in obovate leaflets) rounded to gradually to abruptly acuminate, the acumen short to long, slender to broad, straight to (slender ones) strongly curved, acute to rounded, sometimes mucronulate; midrib from slightly sunken near the base via flat to slightly raised in the upper part, or completely raised; nerves 0.5–6 cm apart, above flat to raised; intercalated veins hardly to fairly strongly developed. Inflorescences at first axillary, developed from the upper 1 or 2 of the 2 or 3 clearly separated serial buds, later rami- to cauliflorous, at first solitary or sometimes already some together, later on clustered, in fruit sometimes pendent, 1–20 (–40) cm long, simple or sparsely branched mainly in the lower part, few-flowered; pedicels in fruit 4–10 mm long. Sepals ovate (outer) to elliptic or sometimes suborbicular (inner), 3.5–6 \times 2.5–4.5 mm, persistent. Petals (lanceolate or) oblanceolate to oblong-obovate, 6–13.5 \times (1.5–) 2–3 mm, glabrous. Disk low-annular, short-velvety or sometimes thin-puberulous. Stamens 5; filament 5–6.5 mm long; anther 2.25–3.5 mm long. Pistil 2-merous; style (2–) 4.5–7 mm long; ovules 1 per cell. Fruits transversely ellipsoid to broadly heart-shaped or sometimes obtriangular, 11–16 (–22) mm high \times 16–25 mm wide, base truncate to rounded or sometimes angular, 1–2 (–3) mm stalked, apex emarginate or sometimes truncate to rounded; fruit wall pergamentaceous to

leathery, outside minutely warty or coarsely reticulately veined or sometimes smooth, fairly densely puberulous to short-velvety, inside glabrous or very sparsely hairy.

Field notes. Bushy to sparsely branched shrub or tree. Bark smooth or with shallow, short, longitudinal fissures, dark brown to greyish, inner bark yellowish brown, creamy, or yellowish green, wood white or cream, soft to hard. Twigs inhabited by ants. Leaflets dark green and glossy or dull above, light green beneath. Flowers fragrant. Sepals green, sometimes yellowish or brownish; petals white to creamy. Fruits orange to bright red, inside orange; seeds black with a shining orange aril.

Distribution: Philippines (Catanduanes), Moluccas (Halmahera), New Guinea, and Queensland (Cook Dist.: Claudie R. and Iron Ra.).

PHILIPPINES. *Catanduanes:* Ramos BS 30150 (K, US); M. Ramos & G. Edaña BS 75366 (BO, SING).

MOLUCCAS. *Halmahera:* Anang 649, S. Peninsula, Weda (L).

NEW GUINEA. 124 collections, also from the Aru I.

AUSTRALIA. *Queensland:* 5 collections, all from c. 12° 44/50' S 143° 15/20' E.

Ecology: Mainly in the undergrowth of primary rain forest and in young secondary forest, furthermore in gallery forests, coastal scrub, semi-evergreen vine forest, monsoon forest, periodically flooded forest, and sago swamp; on river banks, in gully's, on steep slopes and ridges; soil basic or acid loam, or clay, or stony; alt. 0–200 (–1950) m. Fl. Febr.–Sept.(–Nov.); fr. ditto.

Note. In the circumscription accepted here, *H. ramiflora* is a rather variable species, consisting of a mosaic of geographical and ecological races. It is difficult to find a clear pattern in this mosaic, however. Moreover, *H. ramiflora* forms the centre of the group of species mentioned under *H. solomonensis* Note 1. That group makes the impression of being young and the species not yet sharply defined. Accordingly, the delimitation of *H. ramiflora* as a whole cannot be but vague. Still we are of the opinion that the present subdivision of the group into species, some of which divided further, gives a better insight in the group than a combination into one species with a number (in that case about twelve) of subspecies.

21. *Harpullia myrmecophila* Merr. & Perry

H. myrmecophila Merr. & Perry, J. Arnold Arbor. 21 (1940) 526. — **Type:** Brass 13414, NW. New Guinea, Idenburg R., 4 km SW. of Bernhard Camp, -iii-1939, fr. (A; iso in BO, L).

Treelet, up to 4 m high. All young parts, including the twigs, leaf axes, and infructescences, moderately to (the latter) densely puberulous, glabrescent. Twigs 6–7 mm thick. Leaves with 3 or 4 leaflets per side; petiole 8.5–11.5 cm long, not winged; rachis not winged; petiolules 5–7 mm long. Leaflets 14.5–24.5 × 7.5–9 cm, 1.9–2.8 times as long as wide, widest in the middle, chartaceous, midrib and nerves above fairly densely, beneath sparsely puberulous; base equal-sided or in upper leaflets oblique, acute and gradually to (lowermost leaflets) rounded and abruptly decurrent; apex (rather) abruptly acuminate, acumen rather long, mostly slender and straight, sometimes either broad, or falcate, the top rounded; midrib and nerves above slightly raised, nerves 2.2–3.5 cm apart; interca-

lated veins few, short. *Inflorescences* axillary and solitary or ramiflorous and in clusters of c. 3, not to sparsely branched, 6–15 cm long; pedicels in flower as well as in fruit 4–9 mm long. *Sepals* ovate to elliptic, 4.5–5 × 3–4 mm, persistent. *Petals* oblanceolate, 10 × 3.2 mm, glabrous. *Disk* annular, short-velvety. *Stamens* 5; filament 2.5 mm long; anther 3.5–4 mm long. *Pistil* 2-merous; ovules 1 per cell. *Fruits* broad-ellipsoid, 24–26 mm high × 22–25 mm wide, rounded at base and apex, 0.5 mm long stalked; fruit wall thin, woody, outside granulate and irregularly pustulate, very sparsely minutely hairy, inside glabrous.

Field notes. Branches often hollow, inhabited by ants. Petals greenish white. Fruits red; aril yellow.

Distribution: NW. New Guinea.

NEW GUINEA. Northwest: *Brass 13285 & 13414*, Idenburg R., 4 km SW of Bernhard Camp.

Ecology: Rain forest, on stream bank; alt. 850 m. Fl. and fr. March.

Notes. 1. The present species is still only based on the two original specimens, originating from the same locality and mutually identical. It is doubtless closely allied to *H. ramiflora*, differs from that species in several points, however (leaflets more hairy and more abruptly acuminate, filaments shorter and anthers longer and more deeply cleft at base, fruits bigger and higher, very shortly stalked, rounded at apex, wall thicker, suture flat). For the time being it seems reasonable to accept this as a separate species; see Note under *H. ramiflora*.

2. The collection *Hoogland & Craven 10551* from the West Sepik Dist., identified by us as nearest to *H. cauliflora*, also resembles the present species. It differs mainly in the following characters: twigs at least 15 mm thick, inflorescences no more than 3.5 cm long, sepals up to 7 mm long, filaments at least 4 mm long, anthers 3 mm long, fruits 3–3.5 mm long stalked, widest near the base, inside sparsely hairy (fig. 2 c).

22. *Harpullia cauliflora* K. Schum. & Lauterb. — Fig. 1 d; 2 c.

H. cauliflora K. Schum. & Lauterb., Fl. Schutzgeb. Südsee (1900) 424; *non* Radlk., Nova Guinea 8 (1912) 618 (= *H. ramiflora*); Bot. Jahrb. Syst. 56 (1920) 312 p.p. (West New Guinea collections are *H. ramiflora*); Engl. Pflanzenz. 98 (1934) 1440 p.p. (ditto); Merr. & Perry, J. Arnold Arbor. 21 (1940) 525. — **Type:** *Kersting s.n. in herb. Lauterbach 2411*, NE. New Guinea, Madang Dist., 'Ssigau Hochland, Lager II Flut', fr. (B, lost; iso in M, WRSL).
H. peekeliana auct. non Melch.: Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 79.

Tree or rarely shrub, up to 20 m high and 20 cm d.b.h., but usually much smaller. Twigs, leaf axes, inflorescences, and infructescences rather densely to sparsely puberulous and glabrescent to glabrous. *Twigs* 6–15 mm thick. *Leaves* with 3–5 leaflets per side; petiole 8–17 cm long, not winged; rachis not winged; petiolules 4–12 mm long. *Leaflets* 12.5–33.5 × 5–13 cm, 1.6–3 times as long as wide, widest in or sometimes above or below the middle, pergamentaceous to chartaceous, above and beneath midrib and often nerves densely to sparsely puberulous, especially beneath glabrescent; base equal-sided, acute, and gradually long-decurrent (especially upper leaflets) to oblique, rounded, and abruptly shortly attenuate (lower ones); apex tapering to abruptly acuminate, acumen straight to slightly falcate, short to long, rather broad, with rounded top; midrib above slightly

raised; nerves 1.5–5.5 cm apart, slightly raised above; intercalated veins few to many, mostly short and inconspicuous. *Inflorescences* axillary, rami-, and cauliflorous, 1 or 2 serial tufts of not or hardly branched up to 3.5 cm long rachises; pedicels in fruit 6–13 mm long. *Sepals* oblong-obovate to elliptic, 5–7 × 2.5–4.5 mm, outer 2 sometimes slightly smaller, persistent. *Petals* oblong, 7 × 3 mm or more, glabrous. *Disk* short-velvety. *Stamens* 5; filament 4 mm long or more; anther 3 mm long. *Pistil* 2-merous; ovules 1 per cell. *Fruits* transversely broad-ellipsoid to subglobular or sometimes almost trapezoid, 15–25 mm high × 18–32 mm wide, base obtuse or rounded to sometimes nearly truncate, up to 3.5 mm long stalked, apex rounded to emarginate; fruit wall up to 1 mm thick, woody, outside granulate with scattered prominent pustules and prominulous irregular ridges, glabrous or sparsely puberulous, inside glabrous to moderately, densely, shortly tufted-hairy.

Field notes. Tree with few upright branches; stem and branches inhabited by small black ants. Bark brown; wood white. Leaflets dark green and dull above, lighter green beneath. Petals white. Fruits red; seeds black or dark brown, with an orange to red aril.

Distribution: New Guinea.

NEW GUINEA. Vogelkop Peninsula: 5 collections. — Northwest: *Brass 13802*, Idenburg R., Bernhard Camp; *G. Iwanggin BW 9049*, Sidoarsi Mts., c. 200 km W. of Hollandia. — Southeast: *Jacobs 9111, 9311*, Mt. Bosavi, 6°26' S 142°50' E (L). — Northeast: *Foreman & Kumul NGF 48337*, West Sepik Dist., Amanab Subdist., W. of Kilifas; *Kersting in herb. Lauterbach 2411*, Ssigau Hochland, Lager II Flut; *Streimann & Martin LAE 52913*, West Sepik Dist., Lumi Subdist., Lumi - Aitape Rd. — Papua: *Aet & Idjan 653*, Kamioraro near Seroei (L).

Cultivated at Bogor (Indonesia, Java: Botanic Garden, *III.1.12a*).

Ecology: Understorey of primary rain forest on alluvial plains; soil rocky clay or a mixture of sand, clay, and peat; alt. 50–700 m. Fl. March–April and July; fr. March, June, Oct., Nov.

Notes. 1. A member of the *H. ramiflora*-group; see Note under that species.

2. For *Hoogland & Craven 10551* from West Sepik Dist., which may belong to the present species, see *H. myrmecophila* Note 2.

23. *Harpullia petiolaris* Radlk.

H. petiolaris Radlk., Bot. Jahrb. Syst. 56 (1920) 315; Engl. Pflanzenr. 98 (1934) 1450. — Lectotype (present authors): *Ledermann 8814*, NE. New Guinea, 'Aprilfluss', -ix-1912, fl. (B, lost; iso in M).

H. cupanioides auct. non Roxb.: Holth. & Lam, Blumea 5 (1942) 208.

Tree, up to 20 m, but usually no more than 6 m high and 4 cm d.b.h. Twigs, leaf axes, inflorescences, and infructescences (very) densely set with patent short or long brown hairs, or minutely tomentose, ± early glabrescent. Twigs (5–) 10–13 mm thick. Leaves with 4–6 (7) leaflets per side; petiole 10–27 (–33) cm long, not winged; rachis not winged; petiolules 0–4 mm long. Leaflets 9–44 × 3.5–15 cm, 2.1–3.6 times as long as wide, widest in or below the middle, herbaceous to thin-pergamentaceous, above densely or sparsely hairy on midrib and nerves, below varying from densely hairy on midrib and nerves to

sparingly on the veinlets, or whole leaflet glabrous; base mostly equal-sided, subcordate to rounded, rarely oblique with one half acute, the other rounded; apex tapering or sometimes fairly abruptly acuminate, acumen short to rather long with acute top; midrib above \pm raised; nerves 1–3.3 cm apart, above slightly sunken to sometimes slightly raised; intercalated veins often strongly developed. *Inflorescences* cauliflorous, composed of 1–c.5 rachises, 22–50 cm long, simple or with few widely spaced erecto-patent up to 7 cm long branches mainly in the basal half, lax, cymes scattered along rachis and branches; pedicels in fruit 5–8 mm long. *Sepals* broad-elliptic, 4–6.5 \times 3.2–4.5 mm; in fruit persistent or caducous. *Petals* oblanceolate, (7–) 11–12.5 \times 2.5–4 mm, sometimes ciliate at base but furthermore glabrous. *Disk* low, 5-angular, short-velvety. *Stamens* 5; filament 2–5.5 mm long; anther 3–4.75 mm long. *Pistil* 2-merous; style c. 6 mm long; ovules 1 per cell. *Fruits* transversely ellipsoid, 16–20 mm high \times 26–28 mm wide, base slightly cordate to rounded, 1–2 mm long stalked, apex slightly emarginate or obtuse; fruit wall woody, outside irregularly pustulate, puberulous to pubescent, glabrescent, inside glabrous.

D i s t r i b u t i o n: Borneo, the Moluccas, and New Guinea.

KEY TO SUBSPECIES AND VARIETIES

- 1a. Twigs, leaf axes, midrib and nerves on lower side of leaflets, and inflorescences ferruginous-velvety. Nervation rather dense. *New Guinea* subsp. **petiolaris**
- 1b. Twigs, leaves, inflorescences, and infructescences thin-puberulous. Nerves spaced. *Borneo and the Moluccas* subsp. **moluccana**
- 2a. Sepals persistent in fruit var. **moluccana**
- 2b. Sepals caducous shortly after fertilization var. **decidens**

a. subsp. petiolaris

F i e l d n o t e s. Tree, up to 20 m high but usually no more than 6 m and 4 cm d.b.h., either unbranched with leaves at the apex only, or with branches bare but for the tips; bole straight. Bark with deep longitudinal fissures, grey or brown; wood cream. Leaflets light green. Sepals green; petals white. Fruits bright red; seeds black with yellow aril.

D i s t r i b u t i o n: New Guinea.

NEW GUINEA. **N o r t h w e s t:** *Docters van Leeuwen 9139*, Albatros Bivouac. — **S o u t h e a s t:** *Schodde 2272*, Southern Highlands Dist., Lake Kutubu, near Tage. — **N o r t h e a s t:** 5 collections from the Sepik and Western Highlands Dists.

E c o l o g y: Primary and secondary forests, Fagaceous and marsh forest, at up to 1400 m alt. Fl. March, May, Sept., and Nov.; fr. Oct.

b. subsp. moluccana Leenh., *nov. subsp.*

Ramuli, folia, inflorescentiae infructescentiaeque sparse puberuli. Venae foliorum distantes.

T y p u s: *de Vogel 4102*, Moluccas, Obi I., Anggai, G. Batu Putih, 1°24' S 127°48' E, 16-xi-1974 (L).

Field notes. Tree, up to 5 m high and 4 cm d.b.h. Leaflets above dark green, beneath light green. Flowers without smell; sepals brown; petals white; anthers cream. Fruits red; seeds darkbrown with a red aril.

Distribution: Borneo and the Moluccas.

c. var. moluccana

Ecology: Rather dense primary forest with little undergrowth on dry soil, clay with limestone boulders; alt. up to 500 m. Fr. May.

d. var. decidens M. Vente, *nov. var.*

Sepala sub fructu caduca.

Type: *de Vogel 3077*, Moluccas, Halmaheira, Ekor, Kali Doworo Ino, 0°49' N 127°52' E, 24-ix-1974 (L).

Ecology: Rather dense primary forest with very little undergrowth on plane or slight slope; soil clay; alt. 10–20 m. Fl. and fr. Oct.

BORNEO. South Kalimantan: *Kostermans 4660*, near Sampit (*subsp.*).

MOLUCCAS. Morotai: *Kostermans 631*, Totodoku (*subsp.*); *Lam 3656*, Marilako E. of Pilawo (*subsp.*). — **Halmaheira:** *Beguín 2041*, Soa Tobaru (*subsp.*); *de Vogel 3077*, type of var. *decidens*; *3267*, near Ekor, 0°49' N 127°52' E (*var. decidens*); *4495*, Central part, Akeloma Oba, 0°34' N 127°36' E (*subsp.*). — **Batjan:** *Fairchild 358*, Kasiruta, Mandiole I. (*var. moluccana*). — **OBI:** *de Vogel 4102*, type of *subsp. moluccana*.; *4302*, Jikodolong (*subsp.*).

Note 1. A representative of the *H. ramiflora* alliance; see Note under that species.

2. *Kostermans 4669* from Borneo shows a surprising resemblance to *Kostermans 631* from Morotai I.; this disjunction is phytogeographically of interest.

24. Harpullia largifolia Radlk.

H. largifolia Radlk. Bot. Jahrb. Syst. 56 (1920) 314; Engl. Pflanzenz. 98 (1934) 1447; *non* Foreman, Check List Bougainville (1971) 58 (= *H. solomonensis*). — **Type:** *H. B. Guppy 212*, Solomon Is., Faro I., -vii-1884, fr. (K; iso in M).

Sapindacea an aff. Harpulliae? Oliver in Guppy, Solomon Islands (1887) 296.

Harpullia sp. perhaps H. peekeliana Melch.: Foreman, Check List Bougainville (1971) 58.

? *H. ramiflora auct. non* Radlk.: Foreman, Check List Bougainville (1971) 58.

Tree or sometimes shrub, up to 6 m high and 7 cm d.b.h. Young parts and inflorescences sparsely puberulous, twigs early glabrescent. *Twigs* 3.5–7 mm thick. *Leaves* with 2 or 3 leaflets per side; petiole 7–16.5 cm long, not winged; rachis not winged; petiolules 4–8 mm long. *Leaflets* 14.5–39 × 6.5–15 cm, 2.1–3.2 times as long as wide, widest in or below the middle, herbaceous to chartaceous, glabrous or above puberulous on midrib and nerves; base equal-sided or sometimes slightly oblique, acute or rounded, always ± abruptly short-decurrent; apex tapering acuminate, acumen long, broad, and acute; midrib and nerves above slightly raised to sunken, nerves 1.5–3.6 cm apart; intercalated veins exceptional and feeble. *Inflorescences* cauliflorous (also on lower part of trunk) and sometimes ramiflorous, in clusters of a few axes, 6–19 (–33) cm long, branched from just above the base upwards; pedicels in fruit 6–7 mm long. *Flowers* known in bud only. *Sepals* elliptic, 4–4.5 × 3–4 mm, caducous in fruit. *Petals* glabrous. *Disk* stellate, the 5

arms between the petals, prominulous, densely minutely pubescent. *Stamens* 5; anther 2.7 mm long. *Pistil* 2-merous; style c. 3 mm long; ovules 1 per cell. *Fruits* (young only) transversely ellipsoid, 12 mm high × 22 mm wide, base slightly cordate, obtuse, or rounded, 1.5 mm stalked, apex emerginate; fruit wall chartaceous, outside smooth, rather densely puberulous, inside glabrous.

F i e l d n o t e s. Bole straight or crooked. Bark smooth or slightly rough by small horizontal ridges, grey, light or dark brown, soft; wood white or straw, hard or soft. Leaflets dark green above, paler below. Flowers with a faint smell; buds green to dull yellow. Petals white. Fruits red.

D i s t r i b u t i o n. Solomon I.

SOLOMON ISLANDS. 9 collections.

E c o l o g y: Well drained to swampy primary and secondary rain forest, mainly on ridges and steep slopes, sometimes on flat plains; alt. up to 450 m. Fl. March and Nov.; fr. July and Nov.

N o t e. A member of the *H. ramiflora*-group mentioned under that species.

25. *Harpullia peekeliana* Melch.

H. peekeliana Melch., Notizbl. Bot. Gart. Berlin-Dahlem 10 (1928) 279; Radlk., Engl. Pflanzenr. 98 (1934) 1461; non Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 79 (= *H. cauliflora*); non F. S. Walker, For. Brit. Solomon I. (1948) 167 ('*Peekelii*') (= *H. solomonensis*); non Foreman, Check List Bougainville (1971) 58 (= *H. largifolia*). — **T y p e:** *Peekel* 987, Papua New Guinea, New Ireland, Lamekot to Panamangaf, 19-v-1925, fl. (B, lost).

Tree, 12 m high. Vegetative parts glabrous, inflorescences olive-brown tomentellous. *Leaves* with 2–4 leaflets per side, 42–50 cm long; neither petiole nor rachis winged; petiolules 5–15 mm long. *Leaflets* elliptic or oblong-elliptic, 18–40 × 11–16 cm, coriaceous, glabrous; base equilateral, shortly attenuate; margin entire; apex acuminate; midrib and nerves above not or hardly raised. *Inflorescences* rami- and cauliflorous, 2–10 cm long, paniculate; pedicels in flower 10–12 mm long. Only ♂ *flowers* known. *Sepals* broad-elliptic, 7–8 × 5 mm. *Petals* 12 × 3.5 mm, narrowed at base, not auricled, fleshy, glabrous. *Disk* low, tomentellous. *Stamens* 5, 9 mm long, filament and anther of about the same length. *Pistil* and *fruits* unknown.

D i s t r i b u t i o n: New Ireland. Known from the type only.

E c o l o g y: Alt. 200 m. Fl. May.

N o t e. This species is only known from the rather extensive original description by Melchior, on which the above description has been based. Peekel himself, in his MS: 'Illustrierte Flora des Bismarck Archipels für Naturfreunde', does not make mention of it. The type was lost in the Berlin fire and no duplicates are known. There is hardly any doubt that it belongs to the *H. ramiflora*-group, where it seems nearest to *H. solomonensis* (see Note 2 under that species). Comparison is difficult as from *H. peekeliana* only ♂ flowers were known, whereas from *H. solomonensis* we know only the fruits and the remains from the flowers under these. The two specimens from the Bismarck Archipelago referred to under *H. solomonensis* are both in fruit, too; vegetatively, they

seem to agree fairly well with *H. peekeliana*, but the infructescences are axillary, in one specimen very short, in the other one long and slender. Moreover, the two collections stem from coastal forest, whereas Peekel had his collection from 200 m alt. For the time being it would be highly speculative to refer all *H. solomonensis* material to *H. peekeliana*, that being the older name.

No other specimens from the *H. ramiflora* alliance are known from the Bismarck Archipelago.

26. *Harpullia* species nova

Shrub c. 1.80 m high. Twigs and leaf axes puberulous, slowly glabrescent. *Twigs* 4 mm thick. *Leaves* with 1 or 2 leaflets per side; petiole 2–3 cm long, not winged; rachis not winged; petiolules 5 mm long. *Leaflets* 5–12 × 2.5–5.5 cm, 2–3 times as long as wide, widest in the middle, stiff-pergamentaceous, above puberulous on the midrib and with some hairs on the nerves, glabrescent, beneath all over fairly densely hairy, gradually glabrescent except for midrib, nerves, and veins; base equal-sided, acute, rarely up to c. 90°, slightly attenuate; margin entire; apex tapering acuminate, acumen short, broad, and acute; midrib and nerves slightly raised above, the latter c. 1.5–2 cm apart; intercalated veins rather strongly developed; veins and veinlets slightly raised on both sides. *Inflorescences* axillary, solitary, c. 7–15 cm long, usually with a strong basal branch and with some scattered short branches; pedicels in flower 7–8 mm long. *Sepals* elliptic, 5.5–6.5 × 4 mm. *Petals* narrowed at base (not clawed), obovate, 8 × 4 mm, fleshy, glabrous. *Disk* velvety. *Staminodes* (in ♀ flower) 7. *Pistil* 3-merous; ovary not stipitate, outside and inside velvety; style curved, not twisted, 2 mm long, velvety; ovules 1 per cell. ♂ *Flowers* and *fruits* unknown.

Field notes. Sepals green; petals white.

Distribution: NE. New Guinea.

NEW GUINEA. *N o r t h e a s t:* *Hays 167*, Eastern Highlands Dist., Kainantu Subdist., 10 miles SE. of Obura, 6°40' S 146° E (LAE).

E c o l o g y: Undergrowth of dense primary forest on flat soil; soil humic brown clay; alt. 2000 m. Fl. Febr.

N o t e. This single specimen represents an interesting new species. The combination of at least three primitive character states, viz. axillary inflorescences, 7 stamens, and a 3-merous pistil, places it near the basis of subgenus *Harpullia*. Its most probable position seems to be in the alliance of *H. austro-caledonica*, possibly nearest to *H. longipetala* (also in E. New Guinea!); a position nearer to the basis of the *H. leptococca*-group seems also possible, however.

EXCLUDED TAXA

Harpullia sect. *Dysotonychium* Radlk., Engl. Pflanzenr. 98 (1934) 1439. — *Boniოდendron* Gagnepain, Notul. Syst. (Paris) 12 (1946) 246, *nom. inval.* — *T y p e:* *H. parviflora* Lecomte.

= *Sinoradlkofera* F. G. Meyer, J. Arnold Arbor. 58 (1977) 183.

Boniodendron was published as a monotypic new genus based upon *H. parviflora* Lecomte. It was accompanied by a lengthy Latin description of the species, which was not new, however, and by some notes in French concerning the differences with *Arfeuillea*. No mention was made of the legitimate sectional name under *Harpullia*. Hence, according to I.C.B.N. ed. 1978, arts. 36 and 42.3 the name can't be considered but invalid. Validation has no use as in the mean time the synonymous genus *Sinoradlkofera* has been published.

Harpullia subg. *Majidea* (Oliver) Radlk., Sapind. Holl.-Ind. (1879) 53. — **Majidea** J. Kirk ex Oliver, Hooker's Icon. Pl. 11 (1871) 78, pl. 1097. — T y p e: *Majidea zanguebarica* Oliver.

Harpullia madagascariensis (Baillon) Radlk., Sapind. Holl.-Ind. (1879) 53. — *Cossinia madagascariensis* Baillon, Adansonia 11 (1874) 247. — *Majidea madagascariensis* Radlk., Bot. Jahrb. Syst. 56 (1920) 256. — **Majidea zanguebarica** Oliver subsp. **madagascariensis** Capuron, Mém. Mus. Natl. Hist. Nat. Sér. B, Bot. 19 (1969) 44, pl. 8: fig. 1–13.

The original spelling *Cossinia*, as published by Commerson ex Lam., Encycl. 2 (1786) 132, has been reinstated here. *Cossinia* was named after De Cossigny, and therefore Jussieu, Gen. (1789) 248, 'corrected' it to *Cossignia*, a spelling unanimously adopted since. However, Lamarck, who mentioned De Cossigny, yet consistently used the spelling *Cossinia*. I am convinced that this spelling was intentional, being adapted to the right pronunciation (for a comparable case see my paper on *Glennia*, Blumea 22, 1975: 412).

Harpullia parviflora Lecomte, Fl. Indo-Chine 1 (1912) 1023; Radlk., Engl. Pflanzenr. 98 (1934) 1459. — *Boniodendron parviflorum* Gagnepain, Notul. Syst. (Paris) 12 (1946) 246, *nom. inval.* (see under *Harpullia* sect. *Dysotonychium*); Fl. Indo-Chine Suppl. 1 (1950) 937, fig. 117.

= *Sinoradlkofera* prob. **minor** (Hemsley) F. G. Meyer, J. Arnold Arbor. 58 (1977) 183. — *Koelreuteria minor* Hemsley, Hooker's Icon. Pl. 27 (1900) pl. 2642. — *Boniodendron minus* T. Chen in Lo & Chen, Acta Phytotax. Sin. 17 (2) (1979) 38, *nom. inval.*

Harpullia wadsworthii F. Muell., Fragm. Phytogr. Austral. 4 (1863) 1, pl. 26. — **Cupaniopsis wadsworthii** Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9 (1879) 534; Engl. Pflanzenr. 98 (1933) 1188. — *Cupania wadsworthii* F. Muell., Census Austral. Pl. (1882) 24.

Harpullia zanguebarica (Oliver) Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20 (1890) 279. — **Majidea zanguebarica** J. Kirk ex Oliver, Hooker's Icon. Pl. 11 (1871) 78, pl. 1097; Radlk., Engl. Pflanzenr. 98 (1934) 1466.

Otonychium retusum Miq., Fl. Ind. Bat. 1, 2 (1859) 572.

= **Rhus taitensis** Guillemin, Ann. Sci. Nat. Bot. sér. 2, 7 (1837) 361; cf. Ding Hou, Fl. Males. I, 8 (1978) 537–538.

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