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# LINACEAE AND CTENOLOPHONACEAE ESPECIALLY OF MALESIA, WITH NOTES ON THEIR DEMARCATION AND THE RELATIONSHIPS WITH IXONANTHACEAE

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## SUMMARY

Linaceae, Ctenolophonaceae and Ixonanthaceae are regarded as separate families. In Linaceae two subfamilies are recognized, only one of which occurs in Malesia, Hugonioideae, with three genera, *Hugonia, Indorouchera, Philbornea.* In *Hugonia* two sections are recognized, sect. *Hugonia* with *H. costata* Miq. and sect. *Durandea* with *H. jenkinsii* F.v.Muell. In *Indorouchera* two species are recognized, *I. contestiana* (Pierre) Hall.f. and *I. griffithiana* (Planch.) Hall.f. *Philbornea* has only one species, *P. magnifolia* (Stapf) Hall.f.

Ctenolophonaceae contains only the genus *Ctenolophon* with two species, of which one, *C. parvifolius* Oliv., in Malesia.

This is a precursor for the Flora Malesiana treatment. Delimitation and subdivision are discussed with chapters on anatomy, floral morphology, embryology, etc.

## DELIMITATION AND SUBDIVISION - A REVIEW OF THE LITERATURE

### General

Older authors often held a very wide view on the family Linaceae, see Winkler (1931), Scholz (1964). More recently several parts of Linaceae s.l. have been elevated to family level while other parts have been relegated to other families.

Winkler's Linoideae tribe Nectaropetaleae nowadays are always regarded as belonging to Erythroxylaceae. Hugonieae sensu Winkler and Scholz have sometimes been treated as Hugoniaceae (Exell & Mendonça, 1951; Takhtajan, 1969; Dahlgren, 1975; Cronquist, 1981; Rouleau, 1981; Van Welzen & Baas, 1984).

Ixonanthoideae have often been regarded, by the same authors and others, as a separate family Ixonanthaceae. If treated as a family often several genera, most of them formerly belonging to Simaroubaceae (or Irvingiaceae), have been included: *Allantospermum, Cyrillopsis, Desbordesia, Irvingia, Klainedoxa.*

Also Ctenolophonoideae have often been treated as a separate family, Ctenolophonaceae. Saad (1962a) and Takhtajan, however, have placed *Ctenolophon* in Malpighiaceae, Cronquist (1981) in Hugoniaceae. Oliver (1873) classified *Ctenolophon* as a *genus anomalum* in Olacineae (a combination of Olacaceae and Icacinaceae), an opinion shared by Masters (1875) and Ridley (1922). Beccari (1877) placed the genus under Icacinaceae, Engler and several other authors under Olacaceae. Sleumer (1935), however, stated that *Ctenolophon* is a 'von den Olacaceae mit Sicherheit auszuschliessende Gattung' and, referring to Winkler, that it belongs to Linaceae. This opinion was shared by Engler (1897) and many other authors. Hallier, after first placing *Ctenolophon* in Olacaceae again (1910), later transferred it to Celastraceae deriving this family via, among others, *Ctenolophon* from Linaceae. Later authors mostly regarded Ctenolophonaceae as a separate family, usually in Geraniales and related to Malpighiaceae.

Winkler's Humirioideae have recently only by Scholz (1964) and Thorne (1976) been regarded as a subfamily of Linaceae. Later Thorne treated them as a separate family. Winkler's 'Unsichere Gattung' *Umbellulanthus* belongs to Malpighiaceae, *Nesogordonia* to Sterculiaceae.

In the present paper Linaceae are divided into two subfamilies:

1. Linoideae (Winkler's and Scholz's Linoideae tribe Eulineae (Lineae) and Anisadenieae with the genera *Anisadenia, Hesperolinon, Linum, Radiola, Reinwardtia,* and *Tirpitzia*).
   Characters: Herbs or sometimes small shrubs. Stamens as many as petals, alternating with as many interposed staminodes. Fruit usually a capsule (of indehiscent mericarps in *Anisadenia*).
2. Hugonioideae (Winkler's and Scholz's Linoideae tribe Hugonieae with the genera *Hebepetalum, Hugonia, Indorouchera, Philbornea,* and *Roucheria*).
   Characters: Climbers or trees, rarely shrubs. Stamens twice as many as petals. Fruit a drupe.

The Ixonanthaceae, with the genera *Cyrillopsis, Ixonanthes, Ochthocosmus,* and *Phyllocosmus,* and the Ctenolophonaceae with only *Ctenolophon* are considered to be families distinct from Linaceae.

## Wood anatomy

The secondary xylem of Linaceae s.l. was studied by Heimsch (1942), Metcalfe & Chalk (1950), and Heimsch & Tschabold (1972). Heimsch and Metcalfe & Chalk found a considerable structural variability and Metcalfe & Chalk concluded that Linaceae s.l. is not a sound natural group. The xylem structure of *Ctenolophon* appeared to have a closer resemblance to Humiriaceae than to Linaceae s.l. A concise summary of the wood anatomy of Ctenolophonaceae runs as follows: The wood is relatively primitive. Vessels are exclusively solitary; perforation plates predominantly scalariform with usually 15–25 rather thick bars, but the bars more numerous and anastomosing in *C. englerianus* Mildbr. Pits to ray cells small and half-bordered. Mean vessel element length (1.3–)1.7–1.8 mm. Parenchyma of the abaxial paratracheal type from which vestiges of narrow bands extend tangentially and then connecting as many as 5 or more vessels. Wood rays heterogeneous (type I and II), multiseriate, up to 2 or 3 cells wide. Also numerous uniseriate rays are found, composed entirely of upright cells. Fibre tracheids with numerous conspicuously bordered pits, especially on tangential walls. Solitary crystals occur in chambered parenchyma and ray cells.

Heimsch considered Humiriaceae, in which all species possess scalariform vessel perforations, as a homogeneous group as regards their xylem structure and on the whole more primitive than Linaceae which generally possess scalariform to simple or only simple perforations. In wood anatomical literature Linoideae, Hugonioideae, and Ixonanthaceae as here defined were always treated as belonging to Linaceae. Linoideae possess, compared to Hugonioideae, more advanced characters with vestiges of primitive ones (vestiges of scalariform vessel perforation in *Linum* species) while *Indorouchera* of Hugonioideae has the most primitive xylem organisation within Linaceae s.s. Metcalfe & Chalk remarked for Ixonanthaceae that the rather unusual type of parenchyma bands, found in *Ixonanthes, Ochthocosmus*, and *Phyllocosmus*, together with the tendency to an oblique vessel pattern and vasicentric vessels is suggestive of affinity with the Calophylloideae group of Guttiferae and *Vismia* of Hypericaceae.

In wood anatomical papers *Ctenolophon* was treated in Linaceae, Olacaceae, or as a separate family.

### Leaf anatomy

On basis of leaf anatomy Ctenolophonaceae can be regarded as a separate family of which the alliance with the other families of the complex is not clear. The other suprageneric taxa of Winkler's Linaceae can be regarded as subfamilies as well as families. For details see Van Welzen & Baas (1984).

### Floral morphology

Narayana (1960, 1964a, b), Narayana & Rao (1966, 1969a, b, 1971, 1973a, b, c, 1974a, b, 1976a, b, c, d, 1977a, b, c, d, 1978a, b, c, d, e), Rao (1965, 1968a, b), and Rao & Narayana (1965a, b) performed an extensive floral morphological and embryological investigation on Linaceae s.l., Humiriaceae, and Erythroxylaceae. They came to the conclusion (1978e) that these families resemble one another with enough differences to retain them as separate families. They suggested that Humiriaceae are more primitive than Linaceae s.l. and that Erythroxylaceae have specialized along a different line. They came to the conclusion that their information did not warrant separating Ixonanthoideae and Ctenolophonoideae as families from Linaceae s.l. Tentatively they assigned *Lepidobotrys* to Linaceae s.l. and *Nectaropetalum* to Erythroxylaceae.

### Pollen morphology

Saad (1962b) concluded the Linaceae, as here defined, to represent a primitive family in the order Geraniales. The family is eurypalynous and 'with such a variety of pollen forms and apertures, and sporoderm stratification, could well be a stock from which other families, not only archichlamideous but also sympetalous, may have originated.' Palynology supports division in Linoideae and Hugonioideae, the pollen of Linoideae being regarded as generally more primitive although *Indorouchera*, like in its wood anatomy, has the most primitive pollen structure. Oltman (1971) argued that it is justified to treat them as two families.

Saad argues that pollen morphology supports the separation of the other subfamilies of Winkler, the Humiriaceae being more advanced than the Linaceae. This is supported by Oltman who concludes that Humiriaceae are more homogeneous in their pollen than in their flower and fruit morphology. They were placed between Hugonioideae and Erythroxylaceae.

Suryakanta (1974) placed Humiriaceae in the order Malpighiales next to Malpighiaceae and Erythroxylaceae while the genera closest to them are *Ixonanthes, Ochthocosmus* and *Ctenolophon*. Also according to Oltman Ixonanthaceae are closer related to Erythroxylaceae than to Linaceae. The pollen grains of *Ctenolophon* are of a unique type and exactly similar pollen grains are unknown in any other angiospermous family (Ramanujam & Rao, 1971).

### Seed anatomy

Corner (1976) described the seed structure of some species of *Hugonia, Indorouchera, Radiola, Reinwardtia*, and *Tirpitzia*. He concluded that the alliance of Linaceae is clearly with Malpighiaceae and, possibly, Oxalidaceae.

### Macromorphological differences between Ctenolophonaceae, Ixonanthaceae, and Linaceae

A summary of the main discriminating characters of these three families runs as follows:

1. Ctenolophonaceae. – Trees. Tufted hairs present. Stipules interpetiolar. Leaves opposite. Flowers hypogynous. Petals caducous, contorted. Disk extrastaminal. Filaments free, inserted halfway on inside of disk. Style 1, apically bifurcate, with 2 stigmas. Fruit a capsule. Seed persistent on the funicle after the valves have been shed, with hairy-papillose arilloid.
2. Ixonanthaceae. – Trees. Tufted hairs absent. Stipules lateral. Leaves spirally arranged. Flowers perigynous. Petals persistent in fruit, imbricate (extra-Mal. also contorted). Disk intrastaminal. Filaments free, inserted outside and against the disk. Style 1, simple. Fruit a capsule. Seed not persistent, with an obvious basal wing or supra-hilar arilliod.
3. Linaceae. – Lianas, trees, shrubs, or herbs. Tufted hairs absent. Stipules lateral. Leaves spirally or distichously arranged. Flowers hypogynous. Petals caducous, contorted. Disk absent (or traces of an extra staminal disk present, see the note under *Philbornea*). Filaments basally connate in a tube. Styles 3–5(–6), simple. Fruit a drupe or a capsule (sometimes with indehiscent mericarps). Seed (not seen in *Reinwardtia*) not persistent, with slightly or not developed arilloid.

## DISCUSSION

The Linaceae s.l. have always been a controversial group (see Hallier, 1923). The present state of knowledge is still incomplete, as is obvious from the survey given above.

*Ctenolophon*

Wood and, especially, leaf anatomical characters justify the exclusion from Linaceae s.s. and separation from *Ixonanthes* and related genera. This view is supported by pollen morphological evidence. Macromorphologically the differences are also obvious by the presence of tufted hairs, interpetiolar stipules, extrastaminal disk, free filaments inserted halfway the disk, bifurcate style, structure of the fruit, and seed with a persistent arilloid. The conclusions of Narayana & Rao (1978e), who included *Ctenolophon* in Linaceae, were rather negative because they were partly based on the fact that they did not know in which other family the genus could be placed.

Considering the above mentioned data we are of the opinion that Ctenolophonaceae deserve the family status. Their alliance, however, is not clear. According to Ding Hou (pers. comm.) the characters of *Ctenolophon*, except the number of stamens (10 in *Ctenolophon*, 5 or less in Celastraceae) and the tufted hairs, are also present in Celastraceae s.l., incl. Hippocrateaceae.

*Ixonanthes and related genera (Cyrillopsis, Ochthocosmus, Phyllocosmus)*

Kool (1980) made some remarks on their systematic position. He regarded them as a subfamily, Ixonanthoideae, of Linaceae. He proposed to unite *Phyllocosmus* Klotzsch and *Ochthocosmus* Benth. Oltman (1971) concluded on the basis of pollen morphology that they cannot be separated. Van Welzen & Baas (1984), however, come to the conclusion that on the basis of leaf anatomy these genera should not be united in accordance with Forman (1965).

*Cyrillopsis* Kuhlm., as demonstrated by Nooteboom (1967) has to be retained in Ixonanthaceae.

Although Oltman concluded that *Allantospermum* pollen morphologically could well be placed in Ixonanthoideae, Nooteboom (1967) concluded that this genus, on the basis of morphology and phytochemistry, belongs to Irvingioideae in Simaroubaceae; the latter is now of the opinion that Irvingiaceae deserve the status of family. Van Welzen & Baas (1984) find that *Allantospermum* has more leaf anatomical characters in common with Ixonanthaceae than with Irvingiaceae or Simaroubaceae.

Although as regards leaf anatomical characters *Ixonanthes* and related genera can be regarded as a subfamily of Linaceae, the same range of characters show that Erythroxylaceae, Humiriaceae, Irvingiaceae, Lepidobotryaceae and Simaroubaceae are much related to each other. The difference in pollen morphological characters [tegillate-tectate sexine and (*Ixonanthes*) suprategillar spinules] as well as in macromorphology brings us to treat Ixonanthaceae as a family of its own.

On the above mentioned arguments the alliance of *Allantospermum* remains unclear.

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## LINACEAE

*Linaceae* S.F. Gray, Nat. Arr. Brit. Pl. 2 (1821) 639 ('Lineae'); [DC., Théor. El. (1813) 241 ('Linées')]; Planch., Hook. Lond. J. Bot. 6 (1847) 588 ('Linées'); Benth. in Benth. & Hook., Gen. Pl. (1862) 241, p.p. ('Lineae'); Hall. f., Beih. Bot. Centralbl. 39, ii (1923) 1, p.p.; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 82, p.p.; Exell & Mendonça, Consp. Fl. Angol. 1, 2 (1951) 390; Hutch., Fam. Fl. Pl. 1 (1959) 256, 260; Scholz in Melchior, Engl. Syll. Pfl. Fam. 2 (1964) 253, p.p.; Hutch., Gen. Fl. Pl. 2 (1967) 595; v. Hooren & Nooteboom, Fl. Males. I, 10 (1985) in press. – *Disandraceae* Dulac, Fl. Hautes Pyrenées (1867) 226.

*Hugoniaceae* Arn. in W. & A., Prod. Fl. Ind. Or. 1 (1834) 71; Exell & Mendonça, Consp. Fl. Angol. 1 (1951) 391.

### KEY TO THE SUBFAMILIES

1a. Petals long clawed. Stamens 5, alternating with 5 staminodes. Ovary pseudo 6–10-loculed. Fruit a capsule. Subshrubs or herbs . . . . . . . . . . . . . . . **Linoideae**

b. Petals shortly or not clawed. Stamens 10, alternately longer and shorter. Ovary 3–5(–6)-loculed. Fruit a drupe, sometimes splitting in pyrenes. Lianas, sometimes shrubs or small trees . . . . . . . . . . . . . . . . . . . . . . . . . **Hugonioideae**

## HUGONIOIDEAE

*Hugonioideae* Planch., Hook. Lond. J. Bot. 6 (1847) 593 ('Hugonieae'); Takhtajan, Bot. Rev. 46 (1980) 285; v. Hooren & Nooteboom, Fl. Males. I, 10 (1985) in press. – *Hugoniaceae* Arn. in W. & A., Prod. Fl. Ind. Or. 1 (1834) 71; Miq., Fl. Ind. Bat. 1, 2 (1859) 135; Exell & Mendonça, Consp. Fl. Angol. 1 (1951) 391. – *Linaceae tribus Hugonieae* Benth. in Benth. & Hook., Gen. Pl. 1 (1862) 242; op. cit. (1867) 987; Reiche in E. & P., Nat. Pfl. Fam. 3, 4 (1897) 30, pro *Hugonia* L. and *Roucheria* Planch.; Hall. f., Extr. Arch. Néerl. III B, 1 (1912) 108, excl. *Ancistrocladus* W. & A.; Beih. Bot. Centralbl. 39, ii (1923) 1, excl. *Asteropeia* Thouars; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 107; Scholz in Melchior, Engl. Syll. Pfl. Fam. 2 (1964) 254; Hutch., Fam. Fl. Pl. 2 (1967) 259. – *Linaceae série des Hugonia* Baill., Hist. Pl. 5 (1874) 46, excl. *sect. Sarcotheca* (Bl.) Baill.

### KEY TO THE GENERA

1a. Indument present, at least on the calyx. Styles 5(–6). Ovary 5(–6)-celled, locules all distinct in the fruit. Drupe with 2–4(–5) developed seeds . **1. Hugonia**

b. All parts glabrous. Styles 3–4(–5). Ovary 3(–4)-celled, only one, rarely 2 locules distinct in the fruit. Drupe generally with one developed seed . . . . . . . 2

2a. Resin absent. Leaves spirally arranged. Inflorescence a rather lax raceme **2. Philbornea**

b. Buds and stipules often covered by resin. Leaves distichously arranged. Flowers in axillary fascicles, subtended by often densely packed, imbricate bracteoles **3. Indorouchera**

## 1. HUGONIA – Fig. 1.

*Hugonia* L., [Gen. Pl. ed. 1 (1737) 134] Sp. Pl. (1753) 675; Gen. Pl. ed. 5 (1754) 305; DC., Prod. 1 (1824) 522; Arn. in W. & A., Prod. Fl. Ind. Or. 1 (1824) 72; Endl., Gen. Pl. (1840) 1016; Wight, Ill. Ind. Bot. 1 (1840) 78; Planch., Hook. Lond. J. Bot. 6 (1847) 593; op. cit. 7 (1848) 524; Walp., Ann. 1 (1848) 96; Miq., Fl. Ind. Bat. 1, 2 (1859) 136; Benth. in Benth. & Hook., Gen. Pl. 1 (1862) 243; op. cit. (1867) 987; Reiche in E. & P., Nat. Pfl. Fam. 3, 4 (1897) 33; Hall. f., Beih. Bot. Centralbl. 39, ii (1923) 43; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 108; Guillaum.., Fl. Nouv.-Caléd. (1948) 161; Hutch., Gen. Fl. Pl. 2 (1967) 598; v. Hooren & Nooteboom, Fl. Males. I, 10 (1985) in press. – *Ugona* Adans., Fam. Pl. 2 (1763) 22. – *Hugonia sect. Mystax* (Ray) Baill., Hist. Pl. 5 (1874) 48, nom. ill. – *Hugonia sect. Genuinae* H. Perrier, Mem. Inst. Sci. Madag. ser. B, Biol. Veg. 2 (1949) 268, nom. ill. – Type: *Hugonia mystax* L. ('*myxtrax*').

*Durandea* Planch., Hook. Lond. J. Bot. 6 (1847) 594, nom. cons.; op. cit. 7 (1848) 527; Walp., Ann. 1 (1849) 97; op. cit. 2 (1851) 137; Benth. in Benth. & Hook., Gen. Pl. 1 (1862) 245; Stapf, Hook. Ic. Pl. (1906) t. 2822; Schltr., Bot. Jahrb. 39 (1906) 137; Hall. f., Extr. Arch. Néerl III B, 1 (1912) 104; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 108. – *Hugonia sect. Durandea* (Planch.) Baill., Hist. Pl. 5 (1874) 48. – Type: *Durandea serrata* Planch. (= *H. jenkinsii* F.v.Muell.).

*Penicillanthemum* Vieill., Bull. Soc. Linn. Norm. 10 (1866) 94; Baill., Hist. Pl. 5 (1874) 47. – Type: *Penicillanthemum racemosum* Vieill. (= *H. racemosa* (Vieill.) Schltr.).

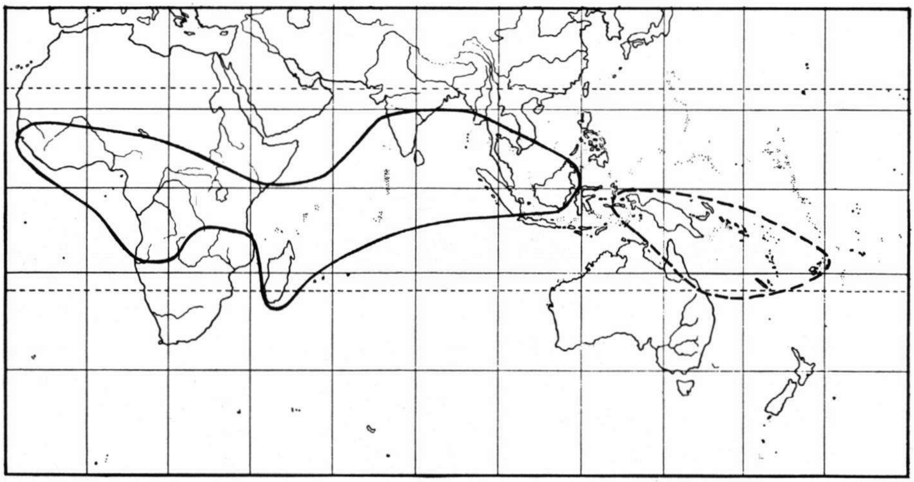

Fig. 1. World distribution of *Hugonia* L.; *Hugonia* sect. *Hugonia* (unbroken line) and *Hugonia* sect. *Durandea* (broken line).

Notes. 1. We agree with Baillon (1874) in recognizing *Durandea* as a section. There are two sections, *Hugonia* and *Durandea.*

2. Perrier's section *Hugoniopsis* from Madagascar contains two species. Both have entire stipules. One of them, however, was described on sterile material while the other species is a tree of 45 cm diam. with filiform stipules, anthers 'arrondies', and almost globular radicle. Although we have not been able to examine any material of both, we doubt whether these species belong to *Hugonia*. They may even not be Linaceae.

## KEY TO THE SECTIONS

1a. Young parts, stipules, petiole, nerves, and inflorescences densely tomentose. Stipules palmatifid, digitately laciniate or pinnatilobed, 3.5–20 mm long. Bracts, if present, similar in shape. Sepals 5–15 mm long. Petals 12–30 by 4–10 mm. Drupe generally indehiscent, sometimes finally septicidal . . . **a. Section Hugonia**

b. Young parts, stipules, petiole, and nerves glabrous or with some very small scattered hairs, inflorescence pubescent to glabrous. Stipules simple, entire or dentate, up to 1 mm long. Bracts differing in shape from stipules. Sepals up to 3.5 (–4) mm long. Petals 2.5–3.5 by 1.5–2.5 mm. Drupe splitting into 5 pyrenes **b. Section Durandea**

## a. Section Hugonia

*Hugonia* L., Sp. Pl. (1753) 675; v. Hooren & Nooteboom, Fl. Males. I, 10 (1985) in press. – *Ugonia* Adans.

Distribution. About 30 species in tropical Africa (Senegal to Kenya and Tanzania), Madagascar and Mauritius, and 4 species in India, Ceylon, Indochina, and Malesia. In Malesia 1 species (*H. costata* Miq.).

Uses. *Hugonia planchonii* Hook.f. is used medicinally in Liberia and Sierra Leone, *H. serrata* Lamk. in La Réunion. In India the bruised roots of *H. mystax* are employed externally in reducing inflammatory swellings and as an antidote to snake bites. In the form of a powder it is administered internally against intestinal worms and fever. The bark of the root is also employed as an antidote to poisons.

Notes. 1. Local African revisions complete the description of section *Hugonia*: Stipules palmatifid, digitately laciniate or pinnatilobed. Flowers in axile cymes, in terminal and lateral panicles, or solitary. Bracts and bracteoles present or not. Styles 2–5. Ovary 2–5 locular, often with fertile, biovulate loculi alternating with as many interlocular sterile cavities (false locules). Drupe whether with one 10-locular stone of which (3–)5 fertile locules alternate with as many interlocular cavities, or with 5 free stones (pyrenes), the interlocular cavities which are less well developed from centre to periphery serving as separation planes between the stone. Endosperm fleshy.

2. Staminal glands have never been described as such. An indication for the presence of these glands is given by Perrier de la Bâthie (1952) for *H. sphaerocarpa* Baill.: 'tube basally with 5 epipetalous swellings.' Wilczek (1958), however, mentioned the presence of (2–3–)5 glanduliformous thickenings between the filaments.

### 1. Hugonia costata Miq.

*H. costata* Miq., Ill. Fl. Arch. Ind. (1871) 67; Boerl., Handl. Fl. Ned. Ind. 1 (1890) 139: Hall. f., Beih. Bot. Centralbl. 39, ii (1923) 45; v. Hooren & Nooteboom, Fl. Males. I, 10 (1985) in press. – Type: *Korthals 978a* (L), Sumatra, Loeboekelangan.

Distribution. South Sumatra: Forbes 2814, 2978; Padang: Korthals 978a. – Borneo: Sabah: SAN 44657; Kutai: Leighton 1010.

Notes. 1. *Leighton 1010* and *SAN 44657* from Borneo differ from the collections of Sumatra by the lower density of the indumentum on the leaves. Besides, the hairs have smaller and more regular basal cells. However, as I have seen no mature flowers and as the fruits are equal in shape, size, and structure, no valid characters are available to separate them. It should be noted that several African species also show considerable variation in the amount of indumentum on the leaves and young twigs.

2. One of the fruits of *Leighton 1010* contains only 4 sterile cavities instead of 5(–6). Probably the number of styles and locules is the same. I only observed flowers with 5(–6) styles and locules.

## b. Section Durandea

*Hugonia sect. Durandea* (Planch.) Baill., Hist. Pl. 5 (1874) 48; v. Hooren & Nooteboom, Fl. Males. I, 10 (1984) in press. – *Durandea* Planch. – *Penicillanthemum* Vieill.

Distribution. Three or four species. In Malesia 1 species which also occurs in the Solomons, Queensland, Fiji and New Caledonia, two or three species endemic to New Caledonia.

### 2. Hugonia jenkinsii F.v.Muell.

*H. jenkinsii* F.v.Muell., Fragm. 5 (1865) 7; v. Hooren & Nooteboom, Fl. Males. I, 10 (1984) in press. – *Durandea jenkinsii* (F.v.Muell.) Stapf, Hook. Ic. Pl. (1906) t. 2822; Fedde, Repert. 5 (1908) 270. – Type: *Dallachy s.n.* (BM), Australia, Queensland, Rockingham Bay.

*Durandea serrata* Planch., Hook. Lond. J. Bot. 7 (1848) 528; Walp., Ann. 2 (1851) 137; Stapf, Hook. Ic. Pl. (1906) t. 2822; Kew Bull. (1908) 12, non *H. serrata* Lamk., 1789. – Type: *Webb s.n.* (K), New Caledonia, without precise locality.

*Penicillanthemum neo-caledonicum* Vieill., Bull. Soc. Linn. Norm. 10 (1866) 96. – *H. neo-caledonia* (Vieill.) Guillaum., Bull. Soc. Bot. Fr. 80 (1933) 36, 38; Fl. Nouv. Caléd. (1948) 162. – Lectotype: *Vieillard 934a* (P ex Caen; iso K, L), New Caledonia, 'ad montes prope Wagap'.

*Durandea pallida* K. Schum. in Schum. & Hollr., Fl. Kaiser Wilhelm Land (1889) 56. – Type: *Hollrung 760* (B, lost; iso BO, K, P, WRSL), Papua New Guinea, 'II Augusta Station, Lagerberg', IX-1887.

*Ancistrocladus pentagynus* Warb., Bot. Jahrb. 13 (1891) 383. – *H. pentagyna* (Warb.) K. Schum. in Schum. & Lauterb., Fl. Schutzgeb. (1900) 373. – *Durandea pentagyna* (Warb.) K. Schum. in Schum. & Lauterb., Nachtr. Fl. Schutzgeb. (1905) 278; Lauterb., Bot. Jahrb. 52 (1915) 117, f. 1; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 100, f. 48; Peekel, Ill. Fl. Bism. Arch. (1947) 887, fig. – Lectotype: *Warburg 20041* (A), Northern E. New Guinea, 3-IV-1889.

*Durandea rotundata* K. Schum. in Schum. & Lauterb., Nachtr. Fl. Schutzgeb. (1905) 278. – *Durandea pentagyna* var. *rotundata* (K. Schum.) Lauterb., Bot. Jahrb. 52 (1915) 117. – Type: *Hellwig 671* (non vidi), Northern E. New Guinea, Bussum, 12-IV-1889.

*Durandea lenormandii* Stapf, Hook. Ic. Pl. (1906) t. 2822; Fedde, Repert. 5 (1908) 269; Kew Bull. (1908) 12. – *H. lenormandii* (Stapf) Guillaum., Bull. Soc. Bot. Fr. 80 (1933) 37; Fl. Nouv. Caléd. (1948) 162. – Syntypes: *Vieillard 2224* (K, p.p.; iso L, P), New Caledonia, 'in montibus excelsis circa Wagap 1861–1869'; *Vieillard 934b* (P ex Caen), 'in montibus Novae Caledoniae prope Wagap'.

*Durandea vitiensis* Stapf, Hook. Ic. Pl. (1906) t. 2822; Fedde, Repert. 5 (1908) 270; Kew Bull. (1908) 12; A.C. Smith c.s., Sargentia 1, 1 (1942) 40. – Lectotype: *Storck 41*, here proposed (K; iso P), Fiji I., without precise locality, VIII-1881.

*Durandea parviflora* Stapf, Hook. Ic. Pl. (1906) t. 2822; Kew Bull. (1908) 14; Fedde, Repert. 5 (1908) 270. – Type: *Officers of H.M.S. 'Penguin' s.n.* (K), Solomon I., New Georgia, 1894–95.

*H. robinsonii* Merr., Philip. J. Sc. 11 (1916) Bot. 227. – *Durandea robinsonii* (Merr.) Hall. f., Beih. Bot. Centralbl. 39, ii (1923) 41. – Type: *Robinson 1783* (K; iso L), Moluccas, Ambon, 7-XI-1913.

*H. papillosa* Guillaum., Bull. Soc. Bot. Fr. 80 (1933) 37; Fl. Nouv. Caléd. (1948) 162. – Type: *Balansa 3526* (P), New Caledonia, forest near Mamari, superior part of Dothio Bassin, I-1872.

Distribution. Moluccas, Ambon: Robinson 1783; Ceram: Rutten 333; New Guinea: 85 collections; Solomons: 23 collections; Queensland: 15 collections; New Caledonia: 10 collection; Fiji, Naitasiri: Koroveibau 16619; without locality: Storck 41.

## 2. PHILBORNEA

*Philbornea* Hall. f., Extr. Arch. Néerl. III B, 1 (1912) 110; Fedde, Repert. 13 (1914) 415; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 109. – Type: *P. magnifolia* (Stapf) Hall. f.

Notes. Narayana & Rao (1973b, see References) showed the presence of an extrastaminal disk: 'at a level where the petals separate from the receptacle ten staminal traces arise in one whorl and after emerging arrange in the form of a ring near the periphery of the thalamus. The part of the thalamus external to the staminal traces represents the disk. At a higher level the staminal tube and the disk separate as one unit, so the prominent extra-staminal disk is completely adnate to the base of the staminal tube.' In gross morphology, however, this disk is hardly or not visible though the tube is lightly thickened at the base of the long stamens.

They also observed that: 'The bundles in the ovary wall fade away towards the top of the ovary while the dorsal carpellary bundles extend into the styles and terminate below the glandular haired stigma. The trilocular ovary becomes unilocular above.' Neither the glandular hairs nor the apically unilocular ovary were observed by us.

There is only one species.

### 1. Philbornea magnifolia (Stapf) Hall. f.

*P. magnifolia* (Stapf) Hall. f., Extr. Arch. Néerl. III B, 1 (1912) 110; Fedde, Repert. 13 (1914) 415. – *Durandea magnifolia* Stapf, Hook. Ic. Pl. (1906) t. 2822; Fedde, Repert. 5 (1908) 268. – Type: *Haviland's coll. 2834* (K; iso A, L, P), Sarawak, Rejang, Kapit, VIII-1893.

*P. palawanica* Hall.f., Extr. Arch. Néerl. III B, 1 (1912) 110; Fedde, Repert. 13 (1914) 415. – Type: *Elmer 12870* (L; iso A, BM, K, NY, P, U, US, WRSL), Philippines, Palawan, Puerto Princesa, Mt Pulgar, III-1911.

Distribution. Sumatra: Tapianuli, Rahmat si Boeea 5059, 5362, 5629. – Borneo: Sarawak, Haviland 2834; S (Jugah) 23784, S (Jugah & Sibat) 26203; Kalimantan Tengah: Veldkamp 8291; Kalimantan Timur: Kostermans 21142. – Philippines: Palawan, Elmer 12870.

## 3. INDOROUCHERA

*Indorouchera* Hall.f. [Meded. Rijksherb. 35 (1918) 16, nomen] Beih. Bot. Centralbl. 39, ii (1923) 50; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 109; Backer & Bakh.f., Fl. Java 1 (1963) 241. – Type: *Indorouchera griffithiana* (Planch.) Hall.f.

Distribution. Two species, from the Nicobars through ?Burma and Thailand to Indochina, in the Malay Peninsula and the Greater Sunda Islands.

### KEY TO THE SPECIES

1a. Leaves elliptic to obovate; reticulation densely parallel in about the whole leaf. Petals (5–)6.4–8.5 by 1.5–3 mm. Stigma knob-shaped. Drupe 4.5–6 by 3–4.5 mm . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **1. I. griffithiana**

b. Leaves often ovate, rarely elliptic; reticulation predominantly in the basal half laxly and (irregularly) parallel, in the apical half reticulated. Petals 4–5.5 by 1–1.8 mm. Stigma clavate, recurved. Drupe 4–4.5 by 2.5–3 mm **2. I. contestiana**

### 1. Indorouchera griffithiana (Planch.) Hall.f.

*I. griffithiana* (Planch.) Hall.f. [Meded. Rijksherb. 35 (1918) 16] Beih. Bot. Centralbl. 39, ii (1923) 50; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 109; Backer & Bakh.f., Fl. Java 1 (1963) 242; Cockb., Tree Flora Malaya (1972) 306. – *Roucheria griffithiana* Planch., Hook. Lond. J. Bot. 6 (1847) 132; op. cit. 7 (1848) 527; Walp., Ann. 1 (1849) 97; Hook.f., Fl. Brit. India 1, 2 (1874) 414; King, J. As. Soc. Beng. 62, ii (1893) 190; Boerl., Ic. Bog. 1, 1 (1897) 25, t. VII, f. 1–22. – Type: *Griffith s.n.* (K), Malacca.

*Flacourtia ? camptoceras* Miq., Fl. Ind. Bat. Suppl., Sumatra (1861) 288; Boerl., Ic. Bog. 1, 1 (1897) 27; Hall.f., Beih. Bot. Centralbl. 39, ii (1923) 50; Sleumer, Fl. Males. I, 5 (1954) 77. – Type: *Teysmann s.n.* (L, U), Sumatra Occ., prope Lubu-Alang.

*Hugonia sumatrana* Miq., Ill. Fl. Ind. Arch. (1871) 68; Boerl., Ic. Bog. 1, 1 (1897) 27. – Type: *Korthals s.n.* (L, no 908.126-974), Sumatra Occ.

[*Olax sp. auct.:* Treub, Ann. Jard. Bot. Buitenz. 3 (1883) 68–70, t. XII, f. 7–15; Massart, Ann. Jard. Bot. Buitenz. 8, 1 (1896) 132, t. XV, f. 12a, b; Boerl., Ic. Bog. 1, 1 (1897) 27.]

*Indorouchera griffithiana* var. *coriacea* Hall.f., Beih. Bot. Centralbl. 39, ii (1923) 52. – Type: *Hallier f. B 2163* (L), W. Borneo, Sungei Sekedouw, 'Xerophiler Myrtaceenwald', 21-I-1894.

Distribution. India: S. Nicobars, Balakrishnan 2963. – Thailand: Kantang, Haniff & Nur 4707; N. Sritamarat, Kerr 14320; Surat, Larsen c.s. 1472. – Sumatra: 40

collections. – Malay Peninsula: c. 40 collections. – Borneo: c. 60 collections. – Java: Depok, Bakhuizen van den Brink 5485; Beumée 6816, s.n.; van Hasselt s.n.; Koorders 30999.

Notes. 1. Planchon erroneously mentioned as type locality 'India Superioris, Prov. Khasya, inter 20° et 26° lat. bor., non procul a radicibus montum Himalaya.' On the type sheet 'Khasya' is changed into 'Malacca'.

2. As regards wood anatomy, Heimsch (1942: 95) concluded: 'The specimen of *Indorouchera griffithiana* which was available differs markedly from the other genera (of Linaceae incl. Ctenolophonaceae and Ixonanthaceae p.p.) with respect to rays, vessel perforations, and parenchyma distribution. In general, the xylem is more primitive than that of the other members of the family; but it can conceivably represent a type of basic xylem organisation of the family.' The main discriminating characters are:

1. All, or at least the majority, of the perforations are scalariform, with an average of 15 to 25 or more bars.
2. Rays in mature wood are heterogeneous type I.
3. Parenchyma typical abundant diffuse in aggregates with strong tendency to form narrow apotracheal bands.

3. Saad (1962a: 72) described the exine structure of pollen of *I. griffithiana* from a specimen collected in 1893 in Borneo (no collector mentioned). He concluded that *Indorouchera* represents the most primitive genus in the whole family. 'Pollen grains of *Indorouchera* are tritenuate, enveloped by a homogeneous, undifferentiated exine. In structure they recall those of Gymnosperms and the spores of Pteridophytes. The tenuitus represents a very primitive type of germinal furrow, probably the progenitor of the colpus.'

## 2. Indorouchera contestiana (Pierre) Hall. f.

*I. contestiana* (Pierre) Hall. f., Beih. Bot. Centralbl. 39, ii (1923) 52; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 110. – *Roucheria contestiana* Pierre, Fl. For. Cochinch. (1893) t. 281; Guillaum., Fl. Gén. Indo-Chine 1, 6 (1911) 586, f. 61-5 and 61-6. – Type: *Contest Lacour 290bis* (P), Cambodge, Ile de Phu Quoc, 15-V-1875.

*I. rhamnifolia* Hall. f., Beih. Bot. Centralbl. 39, ii (1923) 52; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 110. – Type: *Haviland 2840* (L 908.126-969; iso L, BM, GH, K), Sarawak, Muka, Kalong, IV-1893.

Distribution. Cambodia: Contest Lacour 290bis. – Indochina: Evrard 77. – Borneo: Sarawak, Haviland 2840; Brunei, van Niel 3607, 3976, 4034; Sabah, A 441 (Rahim), BNB For. Dep. 2113, Shah & Kadim 990.

### SPECIMENS EXAMINED

A series 441: 3.2 – Achmad 361, 890, 1235: 3.1 – Aet & Idjan 693: 1.2.

Bakhuizen van den Brink Sr 5485: 3.1 – Balakrishnan 2963: 3.1 – van Balgooy 2263, 2726: 3.1 – Balansa 3526: 2.1 (1) – Bartlett & La Rue 395: 3.1 – Bernardi 10216: 1.2 – Beumée

6816: 3.1 – BNB For. Dep. 2113: 3.2 – Boden Kloss 14532: 3.1 – Brass 1135, 3295, 5578, 7680, 8153, 8724, 8898: all 1.2 – Brooke 10581: 3.1 – BRUN series 5422: 3.1 – BS series 539: 3.1 – BSIP series 186, 961, 1763, 3837, 5268b, 5500, 5574, 5586, 5949, 8594, 8707, 8873, 8947, 9130, 10654, 11498, 11591, 13440, 17557: all 1.2 – Bünnemeijer 7587: 3.1 – H.M. Burkill 1116: 3.1 – I.H. Burkill 7643: 3.1 – BW series 2893, 3483, 3601, 6145, 9456, 11301, 15074: all 1.2.

Carr 11800, 12816, 12938, 14982: all 1.2 – Chin 2180, 2829: 3.1 – Clemens 21828, 27680: 3.1 – Contest Lacour 290bis: 3.2 – Craven & Schodde 200: 2.1 – Curtis 207: 3.1.

Darbyshire 891: 1.2 – Derry 519, 1209: 3.1 – Docters van Leeuwen 10630: 1.2.

Elmer 12870: 2; 21360: 3.1 – Endert 2548, 3104: 3.1.Forbes 2814, 2978: 1.1; 3053, 3083: 3.1.

Gibbs 6218: 1.2 – Gjellerup 309: 1.2 – Goudenough 1260: 3.1 – Griffith 61, 274: 3.1.

Hallier f. B1376, B1560, B2163, B2262, B3523: all 3.1 – Haniff & Nur 4707: 3.1 – Hardial 138: 3.1 – Hardial & Noor 104: 3.1 – Hardial & Sidek 376: 3.1 – Hartley 9820, 9888, 12267: all 1.2 – Haviland 874, 1473, 2834, 2840: all 3.2 – Haviland & Hose 1473E: 3.1 – Hellwig 460, 671: 1.2 – Hollrung 760: 1.2 – Hoogland 4578: 1.2 – Hoogland & Craven 10425, 10823: 1.2 – Hotta 12949, 13415: 3.1 – Hyland 6366, 6461: 1.2.

Iboet 219: 3.1.

Jacobs 9603: 1.2.

Kadim & Noor 132: 3.1 – Kanehira & Hatusima 11464, 12239: 1.2 – KEP/FRI series 4204, 23040, 29329: all 3.1 – Kerr 14320: 3.1 – King's coll. 293, 1079, 1499: all 3.1 – KL series 1586, 1690, 2854, 2975: all 3.1 – Koorders 30999: 3.1 – Korthals 978a: 1.1; 1178: 3.1 – Kostermans 10231, 12052: 3.1; 21142: 2; 22024: 3.1 – Kostermans & Soegeng 64, 96, 326, 343: all 1.2.

LAE series 53446, 73859: 1.2 – Lam 7721, 7799: 1.2 – Larsen, Smitinand & Warncke 1472: 3.1 – Leighton 1010: 1.1.

Native coll. D 198: 3.1 – NGF series 3854, 5291, 6237, 8098, 9996, 11966, 12328, 19215, 22476, 23539, 24470, 27932, 29963, 31666, 33031, 34044, 37891, 41822, 41997, 49863: all 1.2 – van Niel 3607, 3976, 4034: all 3.2.

Peekel 421: 1.2 – Pleyte 1092: 1.2 – Pullen 7652: 1.2 – Purseglove 5107, 5550: 3.1.

Rachmat 58: 3.1 – Rahmat si Boeea 4216, 4595, 4834, 4928: all 3.1; 5059, 5362, 5629: all 2.1 – Ridley 4204: 3.1 – Robinson 1783: 1.2 – van Royen 3420, 4029, 5407: all 1.2 – van Royen & Sleumer 5794: 1.2 – Rutten 333: 1.2.

S series 13784, 16214, 17291, 23491, 25111, 26203, 26922, 32733, 33178, 35948, 36846: all 3.1 – SAN series 17242, 18597, 26998, 28786, 28794, 31661, 39257, 41186, 41353: all 3.1; 44657: 1.1; 52756, 52925, 57270, 57470, 62080, 77645, 80348, 80401: all 3.1 – Schiefenhövel 134: 1.2 – Schlechter 15350, 18048, 20010: all 1.2 – Scortechini 2039: 3.1 – SF series 40699: 3.1 – Shah & Kadim 990: 3.2 – Sinclair 4909, 8494 (see SF 40699): 3.1 – L.S. Smith 12377, 12414: 1.2 – Soegeng 262, 459, 519: 1.2 – van Steenis 1099: 3.1 – Surbeck 445: 3.1.

Teysmann 785HB, 3462HB, 6663HB, 6663, 8541, 10875, 11395: all 3.1 – Thorel 768: 3.2.

Veldkamp 8291: 2.1 – Versteeg 1019: 1.2 – Vieillard 934, 2224, 2242: all 2.1 – de Voogd 194: 3.1.

Walker 178: 3.1 – Walter & Bangham 1274?: 3.1 – Warburg 20041: 1.2 – Weinland 176: 1.2 – de Wilde & de Wilde-Duyfjes 16540: 3.1 – Wray Jr 2741: 3.1.

Yates 1149, 2107, 2165: all 3.1.

## CTENOLOPHONACEAE

*Ctenolophonaceae* (H. Winkler) Exell & Mendonça, Consp. Fl. Angol. 1, 2 (1951) 248, 392; Hutch., Fam. Fl. Pl. 1 (1959) 265; Gen. Fl. Pl. 2 (1967) 608; Meijer, Bot. Bull. For. Dep. Sandakan 10 (1968) 149, 151. – *Linaceae subfam. Ctenolophonoideae* H. Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 106, 122; Scholz in Melchior, Engl. Syll. Pfl. Fam. 2 (1964) 254.

## 1. CTENOLOPHON

*Ctenolophon* Oliv., Trans. Linn. Soc. 28 (1873) 516; Masters in Hook. f., Fl. Brit. India 1 (1875) 577; Beccari, Malesia 1 (1877) 119; Engl. in E. & P., Nat. Pfl. Fam. 3, 1 (1889) 237: Baill., Hist. Pl. 11 (1892) 445; Pierre, Fl. For. Cochinch. (1893) t. 281; King, J. As. Soc. Beng. 64, ii (1895) 105; Hall. f., Extr. Arch. Néerl. III B, 1 (1912) 109; Ridley, Fl. Mal. Pen. 1 (1922) 423; Mildbr., Notizbl. Berl.-Dahl. 8 (1924) 705; Winkler in E. & P., Nat. Pfl. Fam. 19a (1931) 122; Exell & Mendonça, Consp. Fl. Angol. 1, 2 (1951) 392; Hutch., Fam. Fl. Pl. 1 (1959) 265; Bullock, Kew Bull. (1960) 41; Scholz in Melchior, Engl. Syll. Pfl. Fam. 2 (1964) 254; v. Hooren & Nooteboom, Fl. Males. I, 10 (1985) in press.

Distribution. Two species, one, *C. parvifolius* Oliv., in Malesia (Malaya, Sumatra, Borneo, Philippines, New Guinea) and one in Africa (Angola, Congo, Nigeria, and Gabon).

Note. The name *Ctenolophon* is derived from Greek *ctenos* = comb and *lophoros* = crested, referring to the aril.

Fossil distribution. The oldest known fossil pollen type of the family is the *C. englerianus* type, known as *Ctenolophonidites costatus* which occurs already in the Upper Cretaceous of Nigeria, is absent from the Lower Paleocene, but reappears and remains regularly present in younger sediments (Germeraad c.s., 1968). Ramanujam & Rao (1971) have recorded *Ctenolophonidites costatus*, as well as two related types (*C. keralensis* and *C. erdtmannii*) from SW. Indian deposits in the Upper Miocene. The recent area of *Ctenolophon englerianus* is Angola, Congo, Nigeria, and Gabon.

A similar pollen type, *Ctenolophon type A* (*Ctenolophonidites lisame*) has a sharply defined base occurrence in the Paleocene of the Caribbean area (Germeraad c.s., 1968), Colombia, and Venezuela but disappears at the Paleocene-Eocene transition. According to Muller (1981) it is also known from the Lower Eocene of Guyana. Ramanujan & Rao (1971) have recorded *Ctenolophonidites saadii*, identical to *Ctenolophon type A*, in SW. Indian deposits in Upper Miocene. According to Muller (1981) all types mentioned above are of the *Ctenolophon englerianus* type.

Another pollen type, the *Ctenolophon parvifolius* type and known as *Retistephanocolpites williamsi*, is first recorded in the Paleocene of Nigeria and disappears at the Eocene-Oligocene transition. Muller (1981) includes a complex of 13 comparable stephanocolpate pollen types in the *Ctenolophon parvifolius* type recorded in the Paleocene of India (Kutch and Assam), dominating in the Eocene and disappearing thereafter. In Borneo *Retistephanocolpites williamsi* is recorded as starting at the Lower Miocene (Morley, 1977). The recent area of distribution of *Ctenolophon parvifolius* is Sumatra, Malaya, Borneo, the Philippines, and New Guinea.

### 1. Ctenolophon parvifolius Oliv.

*C. parvifolius* Oliv., Trans. Linn. Soc. 28 (1873) 516, t. 43, f. 1–7; Masters in Hook. f., Fl. Brit. India 1 (1875) 577; Beccari, Malesia 1 (1877) 120; King, J. As. Soc. Beng. 62, ii (1895) 106; Ridley, Fl. Mal. Pen. 1 (1922) 423; Bullock, Kew Bull. 14 (1960) 41; Meijer, Bull. Herb. For. Dep. Sandakan 10 (1968) 151, fig.; Cockb., Gard. Bull. Sing. 24 (1969) 6; Sabah For. Rec. 10

(1976) 205; v. Hooren & Nooteboom, Fl. Males. I, 10 (1985) in press. – Type: *Maingay KD 382* (K, non vidi; iso L), Malaya.

*C. grandifolius* Oliv., Trans. Linn. Soc. 28 (1873) 517, t. 43, f. 8–10; Masters in Hook. f., Fl. Brit. India 1 (1875) 577; Beccari, Malesia 1 (1877) 119; King, J. As. Soc. Beng. 62, ii (1895) 106; Ridley, Fl. Mal. Pen. 1 (1922) 423. – Type: *Maingay KD 383* (L), Malaya.

*C. philippinensis* Hall. f. ex Schneider, Philip. Bur. For. Bull. 14 (1916) 217, nomen.

Distribution. Sumatra: 30 collections. – Malay Peninsula: 40 collections. – Borneo: 60 collections. – Philippines: 10 collections. – New Guinea: 28 collections.

## SPECIMENS EXAMINED

The collections cited all refer to *Ctenolophon parvifolius*. Unnumbered collections have not been included.

A series 4595 – Alvins 453, 2046.

van Balgooy 2464, 2534 – bb series 2691, 5772, 6622, 7085, 12890, 16780, 16902, 18830, 19620, 22319, 25056, 25232, 26454, 26466, 27659, 27684, 28173, 28410, 28651, 30638, 30639, 30646, 31783, 34208, 34436 – Beguin 307 – Brook 8861 – BRUN series 681 – Buwalda 7701 – BW series 3355, 4279, 4800, 6020, 8534, 10032, 10058, 10540, 13057.

CF series 887, 3222, 4006 – Curtis 721.

Derry 426, 477 – Dumas 1513.

Endert (all 36 E 1 P) 251, 365, 368, 369, 389, 415, 416, 417, 468, 474, 493.

FB series 20838, 21041, 23527, 23586, 24426, 26235, 26870 – FMS series 9765, 11635 – Forbes 2878, 2892, 3002.

Grashoff 665, 1013, 1058.

Hume 8284.

KEP/FRI series 177, 5759, 12637, 13925, 16976, 17573, 19295, 20580, 76056, 94376, 99679, 105195 – King's coll. 6028, 8116 – Kostermans 7744, 8150, 8666, 9127, 9560, 10071, 10334 – Kostermans & Anta 740.

LAE series 51770, 51866 – Lambach 1251, 1289.

Madulid c.s. 806 – Maingay KD 382, 383.

NGF series 31773, 31793, 31835, 31843, 33345, 42645, 48436.

PNH series 6146, 6385.

Rahim 5630 – Ridley 11433 – van Royen & Sleumer 6217, 6224, 6466.

S series 4969, 7655, 8527, 8567, 9040, 9245, 9718, 12099, 12260, 13969, 14206, 17869, 18432, 19964, 27783, 28177, 28553, 29917, 32712, 35209, 36921 – SAN series 17139, 17238, 17294, 20684, 21505, 22309, 28318, 28862, 28862a, 32272, 36826, 41084, 53339, 53880, 64384, 66925, 68398, 73241, 75358 – SF series 33951, 34096, 35154, 35979, 3660 36607 = 36647 = 36672, 36839 – Soegeng 367, 429.

Wray Jr 3791.

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