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A REVISION OF MISCHOCARPUS (SAPINDACEAE)

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MISCHOCARPUS

Mischocarpus Blume, Bijdr. (1825) 238, *nom. cons.*; Rumphia 3 (1849) 166; Radlk., Pfl. R. Heft 98 (1933) 1288—1310. — *Cupania* § *Mischocarpus* Miq., Fl. Ind. Bat. 1, 2 (1859) 566. — T y p e: *M. sundaicus* Bl.
Pedicellia Lour., Fl. Coch. (1790) 655, *nom. rejic.* (see under dubious names). — T y p e: *P. oppositifolia* Lour.
Mischocodon Radlk., Bot. Jahrb. 50 (1913) 79; Pfl. R. Heft 98 (1933) 1327—1328. — T y p e: *M. reticulatus* Radlk.

Shrubs or, sometimes large, trees, sometimes with a slender unbranched stem. Buttresses sometimes present (*M. largifolius*). *Indumentum* rather dense to sometimes very sparse, consisting of mostly appressed, short to long, brownish to ferruginous hairs; no glandular scales. *Twigs* brownish to reddish-brown to greyish. Axillary buds just above or, mostly in ramiflorous species, up to 6 mm above the base of the petiole. *Leaves* spirally arranged, paripinnate, the leaflets accrescent in size towards the top, 1—6-jugate, without stipules; petiole ± semi-terete, sometimes dorsiventrally flattened. *Leaflets* alternate to subopposite, petioluled, ratio 1.5—5(—8), widest below, in, or above the middle, sometimes curved downwards (in the herbarium showing a folded base and apex and sometimes an undulate or folded margin), sometimes bullate, pergamentaceous to coriaceous, when dry above mostly greyish-green, sometimes smooth and shiny, beneath mostly brownish-green, not papillose, above glabrous or hairy on midrib and nerves, beneath glabrous or hairy mainly on midrib, nerves and along the margin, between the nerves very sparsely appressedly short-hairy, often glabrescent; domatia often present in axils of main nerves; base equalsided, rarely slightly oblique, rounded or acute to blunt, decurrent; margin entire, flat or sometimes revolute; apex rounded or acute to blunt, mostly shortly mucronate, or ± acuminate or retuse or rarely emarginate; acumen rounded or acute, mostly slightly retuse; midrib above prominent to sunken, rounded or angular, sometimes carinate, beneath prominent, in cross-section about semi-circular, sometimes nearly completely circular (*M. grandissimus*), slightly angular to the base; nerves not or sometimes indistinctly connected in the lower 0.5—0.75, in the upper part connected, about straight to rather strongly curved; intercalated veins present, sometimes indistinct; veins and veinlets nearly always forming a very regular reticulate pattern, dense; nerves, veins, and veinlets ± prominent on both faces, beneath stronger so than above, veinlets inconspicuous beneath. *Inflorescences* pseudoterminal, axillary, and ramiflorous (probably also cauliflorous in a few species), composed of one or more thyrsoid axes, these nearly always branched, erect to spreading, mostly slightly grooved, with stalked or sometimes sessile cymules, glabrous to densely hairy; cymules 1—7(—10)-flowered; pedicels 1—3(—5) mm; bracts triangular to lanceolate, sometimes subulate, outside glabrous or hairy, inside mostly glabrous. *Flowers* unisexual, probably mostly monoecious (dioecious in *M. reticulatus*?). *Calyx* spreading or cup-shaped, early expanding, 5 (rarely 6)-merous, connate for up to 65%, membranaceous to subcoriaceous, sometimes somewhat fleshy; lobes subequal,

sometimes slightly imbricate at the base, triangular to ovate, outside variably hairy, inside glabrous or hairy, often only a row of hairs near the base sometimes hidden by the disk; apex acute, sometimes acuminate. *Petals* 0—5, from minute up to slightly longer than the calyx, apert, unguiculate or not, variably hairy, mostly on claw, base of plate, and auricles; plate elliptic to ovate, sometimes triangular or rhomboid; apex sometimes lobed; 2 auricles or scales mostly present, without crest. *Disk* complete or sometimes interrupted, annular or cup-shaped, sometimes surrounding base of stamens and confluent with pistil, glabrous or short-hairy. *Stamens* (5—)8(—9), exserted (sometimes rather long); filament thread-like, glabrous or appressedly to patent-hairy, more densely so to the base; anther basifixed, base and apex emarginate; connective sometimes with a lighter coloured wart at the top; thecae about ellipsoid, glabrous or sparsely hairy, smooth or papillose (most distinct when not yet exserted), dehiscence lateral or latero-introrse. *Pistil* 3-(rarely 2- or 4-) celled, glabrous or appressedly short-hairy; ovary stiped or almost sessile, about ellipsoid- to obovoid-triangular; style apical, shorter to slightly longer than ovary, the upper part either split in 3 ± recurved stigmatic lobes or almost undivided, bearing 3 stigmatic lines (*M. exangulatus*); ovules 1 per cell, apotropous, anatropous, ascending, base collar-like, surrounding micropyle and funiculus. *Pistillode* small, densely hairy to subglabrous. *Infructescences* sometimes with accrescent axes and pedicels; calyx present, sometimes accrescent, mostly glabrescent; disk present, not accrescent. *Fruit* nearly always distinctly stiped (in *M. paradoxus* only up to 1 mm), not lobed, the cells about equally developed but the ovules abortive in (1) 2 cells, loculicidal, up to 3.5 cm long, reddish when ripe, glabrous or hairy; stipe empty, 3-celled, cylindrical near the base, distally becoming triangular; seed bearing part triangular to rounded in cross-section, with elliptic to obovate valves, apiculate; valves thin to almost woody, mostly shrivelled after dehiscence; pericarp slightly fleshy; endocarp sclerenchymatic, either complete, lining valves (except for *M. exangulatus* also lining stipe) and distal parts of the septa, or incomplete, only along the sutures (see fig. 1g and 1h); septa membranaceous, at least in the proximal half; endocarp and septa glabrous or variably hairy. *Seed* sometimes pendulous by the appendix of the arillode, globose to ellipsoid; hilum adaxial, basal; testa shining, chestnut-brown, finally (nearly) completely covered by a thin-fleshy, translucent, bluish or yellow to orange arillode which is attached around hilum and micropyle; arillode nearly always (except *M. paradoxus*) with an appendix abaxial of the hilum and micropyle, descending into the stipe; cotyledons equal or not, folded or not; suture between cotyledons either transverse and straight, or curved (see fig. 1e and 1f). *Plumule* glabrous or variably hairy (not constant within one species).

Distribution: 11 species from SE. Asia to Australia.

Ecology: Shrubs and substage or understorey trees of primary and sometimes secondary (rain) forests, from sea-level (rocky sea-coasts; salt water creeks) up to 3000 m. The fruits may be searched for by animals because of the showy, slightly fleshy arillode.

Note: For the present revision I studied the material from the following herbaria: A, B, BKF, BM, BO, BRI, CAL, CANB, FI, K, KEP, L, LAE, M, MEL, NSW, NY, P, SING, U, UC, US, WAG. Thanks are due to the directors of these institutes for enabling me to study these materials. Special thanks are due to the directors of BM and K, and the Fund of Mr. H. Vollenhoven of the Leiden University for enabling me to visit these institutes.

Further I want to thank the staff of the Rijksherbarium, Leiden, and especially Dr. P. W. Leenhouts for his kind and accurate guidance of my work, and Prof. Dr. C. Kalkman for his critical remarks after having read the manuscript. The drawings are made by Mr. J. H. van Os.

NOTES ON MORPHOLOGY

Domatia

Domatia are common in some species of *Mischocarpus*, lacking in others. Mostly they are pocket domatia (*M. exangulatus*, *M. pyriformis*, *M. anodontus*, fig. 1c and 1d), but in a few species (*M. sundaicus*, fig. 1a and 1b, *M. pentapetalus*) they are rather variable: from small and pocket-shaped to dome-shaped with an abaxial (that is away from the angle of the axil) opening. The domatia can be glabrous or hairy but there is no indumentum of

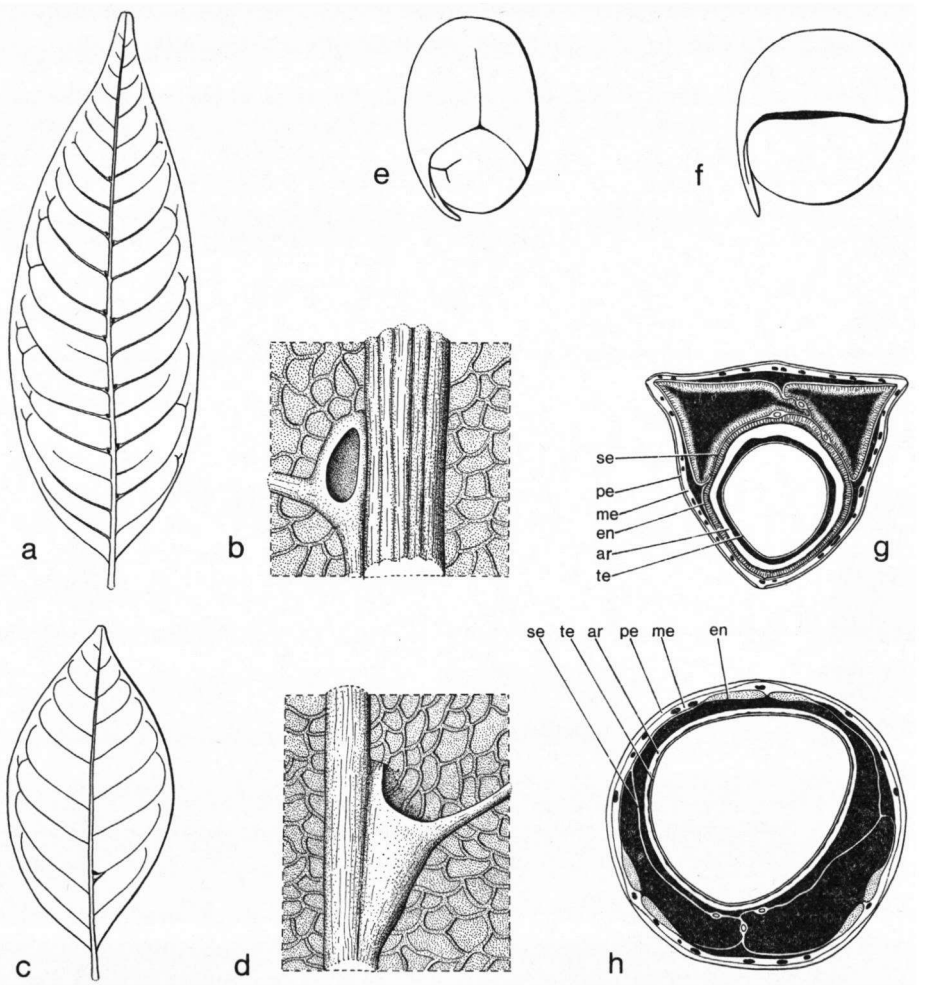


Fig. 1. *Mischocarpus*. — a—d: domatia. a and b: *M. sundaicus*; c and d: *M. anodontus*; a and c: ×½, b: ×15, d: ×7. — e—f: embryos. e: *M. triqueter* (*Mc Gregor 271*), ×2½; the cotyledons are folded and the suture is curved. f: *M. lachnocarpus* (*Dallachy s.n.*), ×4; the cotyledons are not folded and the suture is about straight. g: cross-section through fruit with complete endocarp of *M. largifolius* (*BSIP 1974*), ×3. h: cross-section through fruit with incomplete endocarp, only along the sutures, of *M. paradoxus* (*Carr 14992*), ×4. — pe: pericarp; me: mesocarp; en: endocarp; se: septum; ar: arillode; te: testa of the seed.

special shape or in a special position. Several kinds of mites and small insects were found in the holes of the domatia.

Inflorescences

Terminal inflorescences do not occur in *Mischocarpus*; twigs always end with a vegetative bud. The only possible position is the axillary one. This can be differentiated in: (1) inflorescences in the axils of leaves, or (2) ramiflorous (possibly sometimes cauliflorous?). Pseudoramiflorous and ramifructous situations can arise when leaves are caducous.

The inflorescence consists of an axillary short shoot (2nd order), bearing in the axils of scaly bracts, which may be caducous or not, one or more thyrses (3rd order). Each short shoot bears a, probably terminal, vegetative bud; sprouting of this bud can lead to the development of the short shoot into a normal side branch. Apart from *M. triqueter*, these thyrses are branched.

It often occurs that the axillary inflorescences are partly crowded at the apex of a twig and that the uppermost leaves are absent. This situation is called: pseudoterminal.

Sometimes when an inflorescence bears only one thyrse (the vegetative bud is often obscure), it seems as if the thyrse is directly placed on the twig (2nd order). Whether this is real or not can only be ascertained from living material.

Pollen

See Van der Ham 1977 c. Pollen morphology of the genus *Mischocarpus*. Blumea 23 : p. 301.

Hairiness of endocarp and septa

The value of the indumentum of endocarp and septa as a character was much overrated by Radlkofer. On this character he distinguished species which appeared to be only variants (*M. brachyphyllus*, *M. endotrichus*). Species described by Radlkofer as having a glabrous endocarp and glabrous septa appeared to include collections with a more or less densely hairy endocarp (*e.g.* some Philippine and most Australian collections of *M. sundaicus*, the type specimen of *M. sumatranus*). Within some species the endocarp and the septa can be glabrous, or sparsely hairy (mainly along the sutures), or very densely hairy. There is much variation even within the species, not only in density but also in kind of hairs. Hairs may be long or short, patent or appressed, straight or curled, and of different colour (when dry). Hence, the hairiness of endocarp and septa is hardly of any value in the delimitation of species in *Mischocarpus*.

Seedcover

The seed in *Mischocarpus* is finally (nearly) completely enveloped by an arillode, arising from a narrow ring of sarcotesta around hilum and micropyle (fig. 1n). The arillode is not lobed or folded on the inner surface, as it is in several species of *Arytera* (see: Van der Ham, 1977b). It is membranaceous, usually somewhat fleshy near the base, not differentiated in more layers (as it can be in *Arytera*), yellowish when dried; in fresh state it is according to fieldnotes bluish or more or less bright orange. In combination with the dehiscent reddish fruit (from which the seed is sometimes pendulous by the appendix of the arillode) and against the green background of the leaves, this will probably make a conspicuous contrast, supposed to be important for dispersal by animals.

A flap of tissue, originating from the testa at the abaxial side of the micropyle, is lengthened to an appendix of the arillode, descending, often sinuate, into the hollow stipe of the fruit. When the appendix starts to grow, it is a small, 2-topped lobe. In other genera, this flap of the arillode is not lengthened and is mostly overlying the micropylar region.

The tissue originating from the testa between micropyle and hilum can either form a separate, small lobe (fig. 2l) or can be part of the arillode (fig. 2m). In the latter case this results in a tube-like beginning of the appendix, at the base of which the micropyle lies.

Plumula

Many times, in nearly all species, it was noticed that there were hairs present on the plumula of the embryo: from 1 or 2 to rather many hairs. On other parts (hypocotyl or cotyledons) hairs were never found.

NOTES ON SYSTEMATICS

Mischocarpus and Mischocodon combined

I have combined the genera *Mischocarpus* and *Mischocodon* as distinguished by Radlkofer (1933). *Mischocodon* was not included by him in the key to the genera but characterized as a genus of unknown position within the subfamily *Eusapindaceae*. Radlkofer had two reasons for this: 1. the material on which he based his description consisted only of male flowers, while his subdivision of *Eusapindaceae* in tribes is based on fruit characters; 2. the flowers are not easy to interpret, as they lack petals and are considered highly derived. Radlkofer distinguished a single species of *Mischocodon: M. reticulatus*. When fruiting material (*Clemens 8619*) and collections with female flowers became available to me, it was not difficult to determine this species as belonging in *Mischocarpus*. *M. reticulatus* links up very well with a group of species in *Mischocarpus*, the 'pentapetalus-group' (see infrageneric structure). *M. reticulatus* is a logical extension of a morphological series demonstrated in that group.

Delimitation and relationships of Mischocarpus

In Muller & Leenhouts (1976), the second author discussed the mutual relationships of genera within the tribes. He placed *Mischocarpus* in the group within the *Cupanieae* with one derived character in the flower. *Mischocarpus* is thought to take a rather basic position among the genera of the Asian-Australian-Pacific region.

In the paper mentioned, *Gongrodiscus* from New Caledonia is considered closely related and slightly more derived. In a more detailed study of that genus, especially of the fruit, many differences were found. The disk is deeply 5-lobed; the pistil has very small stigmatic lobes; there is a 3-merous, 1-locular fruit (septa reduced); the embryo has a strongly folded lower cotyledon and a hairy hypocotyl; the arillode has no appendix. Some of these characters are shared by other species in the *Cupanieae*: a 3-merous, 1-locular fruit with reduced septa is also found in *Cupaniopsis concolor*; the hairy hypocotyl also occurs in *Cupaniopsis fruticosa* and *Arytera collina*, both also from New Caledonia.

Most of the species which were either problematic in or to be excluded from *Mischocarpus* appeared to have relations with species of *Arytera*. Especially the position of *M. exangulatus* offered problems. Therefore, a detailed study has been made of various characters in *Arytera*. This showed a great heterogeneity within that genus. All resemblances between *Mischocarpus* and *Arytera* appeared to be superficial and finally it was no longer difficult to separate the two genera. Another paper (Van der Ham, 1977 b) deals in a precursory form with the genus *Arytera*, and several new combinations, some of them already used here, are formally proposed there.

In a more progressed stage of study in the *Cupanieae* we may be able to say more about the nearest relationships of *Mischocarpus*.

GEOGRAPHICAL PATTERNS

Mischocarpus is distributed over SE. Asia, Malesia, and E. Australia. This area can be divided into three parts (see fig. 3, map).The western part is occupied by *M. pentapetalus* and *M. triqueter*. The first is distributed over the whole western part, with an eastern boundary east of Java, Borneo, and the Philippines, the latter species is limited to a few islands of the Philippines (not on Palawan !).

The eastern part of the area is inhabited by 8 species which are distributed as follows. Three species, *M. exangulatus*, *M. anodontus*, and *M. grandissimus*, are endemics of the Australian mainland. A further three species, *M. paradoxus*, *M. reticulatus*, and *M. largifolius*, are restricted to New Guinea and the Solomon Islands. Two more species, *M. pyriformis* and *M. lachnocarpus*, occur in Australia as well as in New Guinea and the Solomon Islands (the latter also on the Aru Islands). *M. pyriformis* is differentiated in subspecies in this region. Finally, *M. sundaicus* covers nearly the whole area of the genus, and is the only species in the region between the western and the eastern part, viz. the Lesser Sunda Islands, Celebes, and the Moluccas. Concluding, there is a western part with 2 out of 3 species exclusive, a central part with one widespread species, and an eastern part with 8 out of 9 species exclusive.

Comparison with zoogeographical data.

There is much similarity when we compare the pattern of *Mischocarpus* with data from zoogeographical literature. In studies of Rensch (1936) and Mayr (1944) several boundaries were drawn to characterize the region between Asia and Australia. The best known of these are the Wallace-line, which is the westernmost boundary of Australian elements and the Lydekker-line, the easternmost boundary of Asian elements, with their variants.

In *Mischocarpus* the eastern boundary of the western part agrees with the Wallace-line (following Mayr). The difference of opinion between Mayr and Huxley concerning the position of the Wallace-line regards the question whether the Philippines are mainly Asian or Australian. Between these two variants of the Wallace-line lies the area of distribution of *M. triqueter* and the region where *M. pentapetalus* is most complex and variable.

The western boundary of the eastern part agrees with the Lydekker-line. There is one difference between zoogeographical and our phytogeographical data. In zoogeography, the Lydekker-line represents the easternmost boundary of Asian elements but here, in *Mischocarpus*, it is the westernmost boundary of Australian-New Guinea species. The same holds true for the Wallace-line.

Of coarse we should see the biogeographical patterns of today at least partly as a result of the geological history of the region. The archipelago between the Wallace-line and the Lydekker-line, called Wallacea, is a very unstable region between the continental blocks of Asia and Australia, already since the Tertiary. These blocks, limited by the continental slope, have been relatively stable since early Tertiary times. Seas on the continental shelfs are not very deep, 200 m at most. During Pleistocene glaciations, with a worldwide lowering of the sealevel, there was a possibility of exchange of floras between regions which are nowadays islands, resulting in close relationships between the various parts of a continental block. Because of the dynamical history of Wallacea, relations between the two continental blocks are much less close. Land-bridges here are unstable and will have been a series of stepping stones rather than continuous land-masses.

Different mechanisms of dispersal in plants and animals could be a reason for the difference in functioning of the boundaries of Wallacea noticed above. In general animals are

more mobile than plants. However, in the plant kingdom there are many different means of dispersal and plants too can be very mobile, for instance by floating waterproof fruits or seeds.

Lowland species were doubtlessly the first to migrate during the pleistocene lowerings of the sea-level, for the sea is their most important obstacle in dispersal. May be *M. sundaicus* is such a species, being widespread and inhabiting lowland forests and coastal regions.

INFRAGENERIC STRUCTURE

I. Groups

The 11 species of *Mischocarpus* can be arranged in 5 groups as follows:

group 1.	'*sundaicus*-group':	*M. sundaicus*
		M. lachnocarpus
group 2.	'*pentapetalus*-group':	*M. pentapetalus*
		M. triqueter
		M. largifolius
		M. paradoxus
		M. reticulatus
		M. grandissimus
group 3:		*M. pyriformis*
group 4:		*M. anodontus*
group 5:		*M. exangulatus*

The groups show the following (nearly) exclusive characters. The first two groups form the majority of the genus. The petals in both groups, if present, are not unguiculate and may be auricled. The species of the 'pentapetalus-group' nearly always have petals; those of the 'sundaicus-group' only in very rare cases, viz. in a few collections of *M. sundaicus* where flowers with 1 to 3 petals were found. Differences between these groups are the following:

	group 1	group 2
midrib above:	mostly rounded	mostly angular
suture between cotyledons:	transverse and straight	curved

The last three monotypic groups can not easily be connected with other species. They are characterized as follows:

group 3: *M. pyriformis* with very compact flowers: calyx small, highly connate, cup-shaped; petals unguiculate, auricled or scaled; disk annular to cup-shaped, often irregular and once or several times interrupted (sometimes also in *M. paradoxus*); pistil clearly stiped. These characters are probably all correlated. *M. pyriformis* has long petiolules as compared with other groups.

group 4: *M. anodontus* with an almost woody fruit; midrib above carinate, with decurrent nerves. This species lacks petals, as is the case with the species of the '*sundaicus*-group', but is different from these in many characters.

group 5: *M. exangulatus* with a pistil with stigmatic lines and stamens with a wart on the top of the connective. The petals are unguiculate, and auricled or scaled.

II. Characters

In 1976 Muller & Leenhouts published a paper on *Sapindaceae* in which Leenhouts rearranged tribes and genera into a phylogenetic system by means of characters which can be arranged in a logical series probably reflecting evolutionary specialisation. In each tribe he indicated a genus with the greatest number of primitive states of the characters used, as standing nearest to the typological type of the tribe. The typological type of a group is a hypothetical plant showing a combination of all primitive states of characters in a group, from which all taxa in the group can be derived.

The same methodology is followed here for *Mischocarpus*. Many of the phylogenetic series proposed by Leenhouts occur at least partly in *Mischocarpus*.

The trends used in *Mischocarpus* are as follows:

inflorescence: axillary to rami- or cauliflorous.

sepals: free to connate;
tendency to become petaloid.

petals: reduction in number, 5 to 0, and in size;
without scale via auricled to with a scale to secondary without scale.

disk: complete to interrupted;
annular to with lobes surrounding the base of the stamens and confluent with pistil or fruit.

stamens: 8 to constantly less.

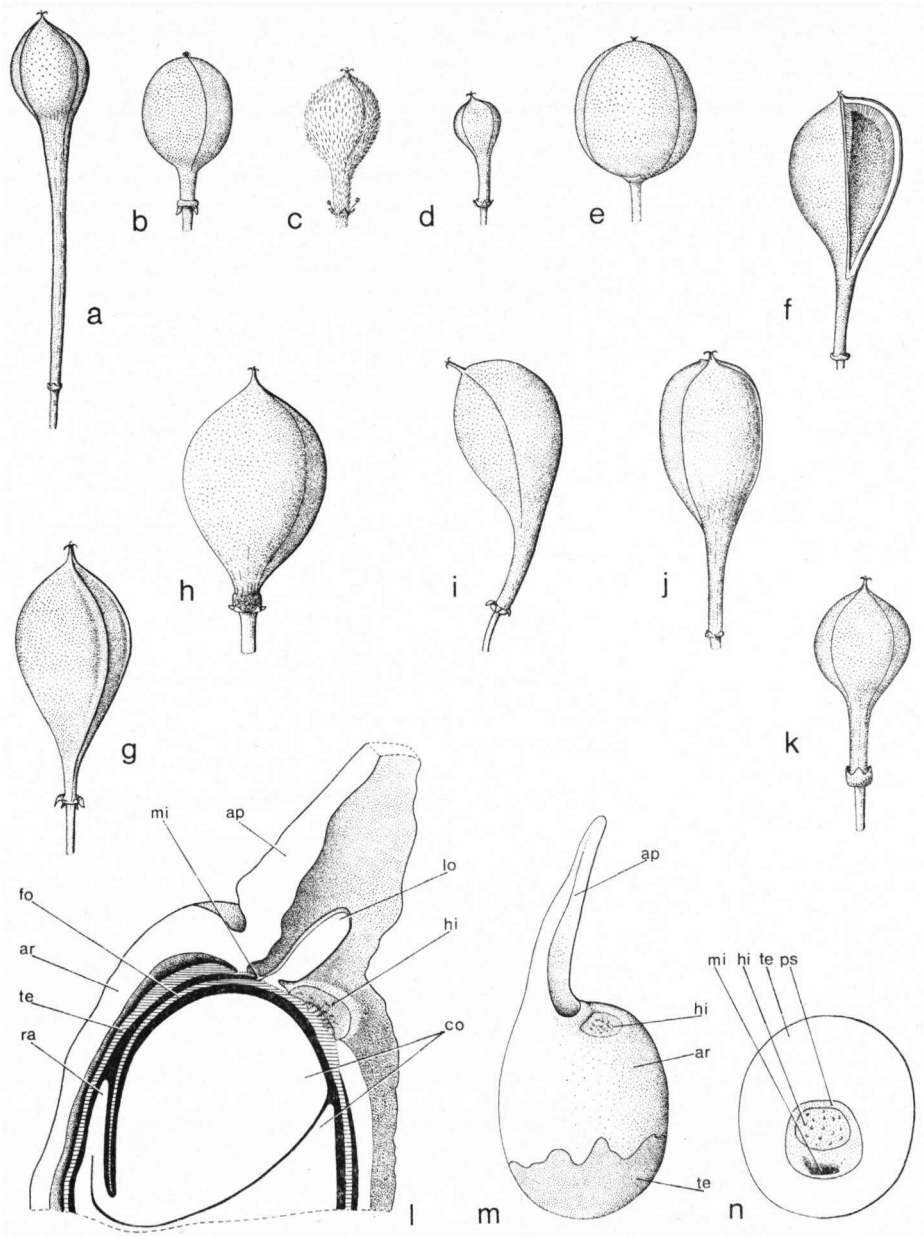
stigma: lobes to lines (by coalescence of the lobes; the lobes correspond with the locules, the lines alternate with them).

fruit: endocarp completely to incompletely sclerified.

Whether a character is more derived or more primitive is often difficult to say. As in the paper mentioned, a working hypothesis is that apparent specializations and reductions may be regarded as derived. Complications can arise when both processes occur in the development of the same organ, viz. the specialization and reduction of petals. When a petal lacks scales it is not clear whether this is a reduced or an unspecialized state. The same holds for the sessile fruit and correlated with this the absence of the appendix of the arillode in *M. paradoxus*. Whether this fruit is primarily or secondarily stipe less is not clear. In most genera allied with *Mischocarpus* a stipe is absent. In a few, a short stipe is present but never as strongly developed as in *Mischocarpus*. The appendix of the arillode is exclusive for *Mischocarpus*. The species nearest to *M. paradoxus* have a well-developed stipe and appendix. The stalk and the appendix develop rather late. May be the situation in *M. paradoxus* is neotenic.

Using the characters mentioned above we can discuss the relationships, in the sense of more or less derived, in and between the groups as mentioned before under I.

Fig. 2. *Mischocarpus*. — a—k: fruits, all × 3. a: *M. pyriformis* subsp. *papuanus* (*Chalmers s.n.*); b: *M. pentapetalus* (*PNH 34128*); c: *M. lachnocarpus* (*MEL 56004*); d: *M. sundaicus* (*FB 24765*); e: *M. paradoxus* (*Forbes 309*); f: *M. anodontus* (*MEL 55972*); g: *M. triqueter* (*BS 42010*); h: *M. largifolius* (*Schodde & Craven 3963*); i: *M. exangulatus* (*MEL 55990*), Rockingham Bay; j: *M. grandissimus* (*MEL 55998*); k: *M. reticulatus* (*Clemens 8619.*) — l—m: seeds. l: section through base of seed with arillode, × 5; the arillode forms a small lobe between micropyle and hilum. te: testa of the seed; fo: internal fold of the testa; co: cotyledons of the embryo; ra: radicula of the embryo; hi: hilum; ar: arillode; ap: appendix of arillode; lo: lobe of arillode attached between micropyle and hilum; mi: micropyle; m: the arillode between hilum and micropyle is continuous with the appendix, see l for abbreviations; n: aspect of the hilar region of the seed, schematically. ps: part of the testa to which the arillode is attached (pseudohilum), see l for other abbreviations.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III. Relationships within the groups

With the help of the phylogenetic series of characters, mentioned above, we can indicate in each of the first two groups one species which is the least derived one and comes nearest to the typological type of that group.

Group 1. The two species *M. sundaicus* and *M. lachnocarpus*, are closely allied. *M. lachnocarpus* has a ferruginous indumentum, sessile cymules, and lacks petals. *M. sundaicus* is sparsely puberulous, has stalked cymules, and has rarely petals. *M. sundaicus* is slightly less derived, as far as the rare petals are concerned and is nearest to the typological type of group 1.

M. sundaicus covers about the area of distribution of the genus. *M. lachnocarpus* occurs in the eastern part of this area. A different form of *M. sundaicus*, with a dense indumentum inside the fruit, is restricted to E. Australia.

Group 2. There are six species and there is a great deal of variation in this group. The affinities between the extremes seem dubious but in various phylogenetic series, these species are bound together. The main variations are:

Calyx. The sepals are free to connate. Sepals (nearly) constantly hardly connate: *M. pentapetalus*, *M. triqueter*; varying from 0% to 35% connate: *M. largifolius*, *M. paradoxus*; varying from 35% to 50% connate: *M. grandissimus*; varying from 50% to 75% connate: *M. reticulatus*.

In *M. triqueter* and *M. reticulatus* the calyx is petaloid, being membranaceous with visible nerves (and coloured?), and bigger than in other species (respectively up to 2.5 and up to 5 mm against up to 2 mm for the other species). This seems clearly to be a specialization and is probably correlated with the small size of the inflorescence and its ramiflorous position (see: Inflorescence).

Petals. The number is variable. There are 5—3 petals in *M. paradoxus*; 5—2 in *M. triqueter*, 5—0 in *M. pentapetalus*, 3—0 in *M. grandissimus*, 2—0 in *M. largifolius*, and 0 in *M. reticulatus*.

Sometimes also the size of the petals is reduced: sometimes in *M. pentapetalus* and *M. largifolius*; nearly always in *M. paradoxus* and *M. grandissimus*.

Disk. Sometimes the disk has lobes protruding between the stamens, to, in some species, completely surrounding their base; in the latter case the disk may be confluent with the pistil or the fruit. There are the following possibilities: lobes absent in *M. paradoxus*, *M. largifolius*; lobes rare in *M. pentapetalus*; lobes mostly present in *M. grandissimus*; lobes mostly present, confluent with the fruit in *M. triqueter*; the disk surrounds the base of the stamens completely and is confluent with the pistil in *M. reticulatus*.

A lobed disk can be seen as specialized. Again *M. reticulatus* is most derived.

Stamens. In *M. reticulatus* the number of stamens is constantly less than 8.

Inflorescence. A description of the inflorescences in *Mischocarpus* is found in the notes on the morphology on page 254. Characters which can be used here are its position and size.

Of the possible positions in the *Sapindaceae*, *i.e.* terminal, axillary, and rami- and cauliflorous, Leenhouts argues that the latter is the most derived one. It is not clear, however, whether the terminal or the axillary condition is more primitive. In *Mischocarpus* only axillary and rami-, and possibly cauliflorous inflorescences occur. The pseudoterminal inflorescence is probably a specialized condition of the axillary inflorescence arisen by crowding of (one or) several axillary inflorescences at the apex of a twig. Pseudoterminal and axillary inflorescences do not occur separately in species of *Mischocarpus*. Accepting the ramiflorous condition as more derived than the axillary one (incl. also pseudoterminal), we can make the following series.

Species with only axillary inflorescences: *M. pentapetalus*, *M. grandissimus*. Ramifructous situations can arise when the lowermost leaves bearing inflorescences in the axils are caducous. The infructescences of *M. grandissimus* are said to grow on the stem. Possibly the situation here is a slender, usually unbranched main stem, with the ripe fruits in the axils of the lowermost leaves or just below these ('Schopfbaum').

Inflorescences either axillary or ramiflorous: *M. largifolius*.

Inflorescences ramiflorous (rarely partly axillary): *M. paradoxus*.

Inflorescences ramiflorous (and cauliflorous?): *M. triqueter* and *M. reticulatus* (in the latter species, moreover, once an axillary inflorescence was found).

Correlated with this is the gradual shortening of the axes of the inflorescence: up to 40 cm in *M. pentapetalus*, up to 32 cm in *M. largifolius*, up to 25 cm in *M. paradoxus*, up to 12 cm in *M. grandissimus*, up to 10 cm in *M. triqueter*, and up to 5 cm in *M. reticulatus*.

Summarizing, we can say that there is a morphological trend regarding the inflorescences and flowers in which are correlated: the shift of the inflorescence from axillary to ramiflorous, the shortening of the inflorescence axes, the sepals from free to highly connate, the sepals becoming big and petaloid, the reduction of petals in number and size.

M. pentapetalus has the greatest number of primitive states of all characters mentioned above and *M. reticulatus* is clearly the most derived species. This development leads to a more showy offering of the flowers to a pollinator and probably the shift to some other pollinator.

Correlated with the reduction in size of the inflorescence and consequently of the number of flowers, which themselves are bigger, the disk is larger in *M. triqueter* and *M. reticulatus*, the most derived species. This may lead to a relatively higher production of nectar and a stronger smell, which may be important for pollination.

F r u i t. Fruit characters are not used by Leenhouts in making his phylogenetic series, since one of his intentions was to test the system of Radlkofer, which is largely based on the fruit. Fruit characters could be used as one of the possibilities to check the new system.

A character which at first sight could be of phylogenetic value in *Mischocarpus* is the extension of the sclerenchyma in the endocarp and the septa. The maximum extension of the sclerenchyma is from the suture until about halfway in the septa, so the proximal parts of the septa are always more or less membranaceous. The minimum extension consists of a strip at both sides of the suture. The sclerenchymatic layer is always thickest along the suture. This structure may play a role in the dehiscence of the fruit.

In *M. pentapetalus* the sclerenchyma in the wall of the fertile locule does sometimes not reach the septa, while in the (smaller) sterile locules it extends into the distal parts of the septa. Ontogenetically this seems to be due to inequal growth of the locules. In the fertile locule the differentiation of the sclerenchyma stays behind as compared with the rest of the fruitwall.

The three situations in group 2 are:

sclerenchyma extending into the septa as in *M. pentapetalus*, *M. triqueter*, *M. largifolius*;

sclerenchyma almost reaching the septa as in *M. grandissimus*, *M. reticulatus* (sometimes *M. pentapetalus*);

sclerenchyma limited to narrow plates along the suture as in *M. paradoxus*.

If we compare this series with the phylogenetic series of flower characters we find no clear correlation. Hence a phylogenetic interpretation of this character seems unwarranted.

C o n c l u s i o n. From the series of morphological characters we can deduce that *M. pentapetalus* has the greatest number of primitive character states. So this species is nearest to the typolocigal type of the group from which all others in the group can be derived. *M. reticulatus* is in all characters the most derived species. The other four species have a mixture of primitive and derived states, each with a different combination.

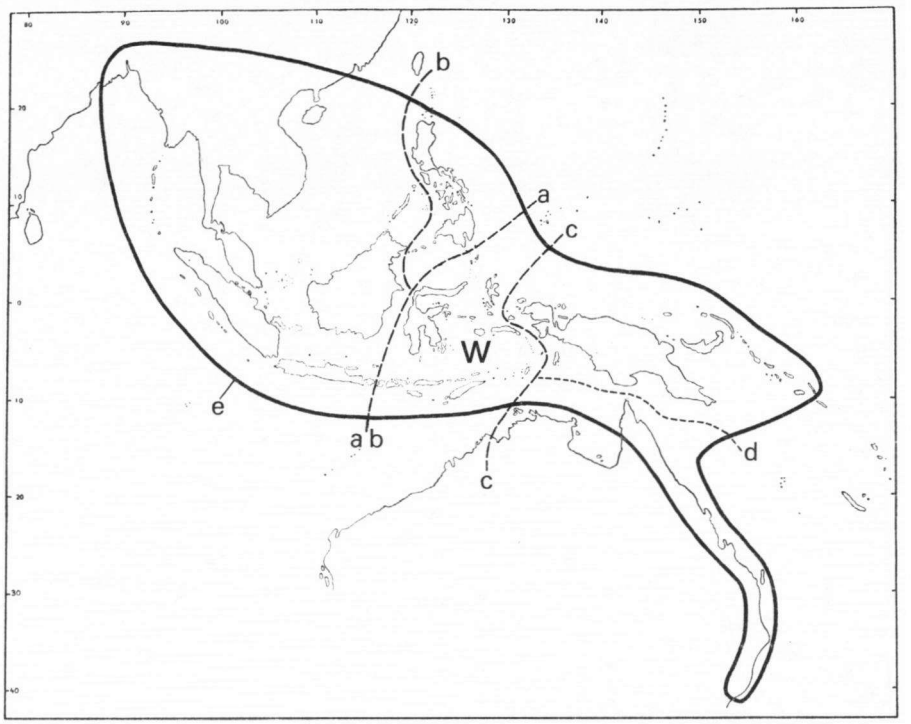

Fig. 3. Distribution map of *Mischocarpus*. — a: Wallace-line (following Mayr): eastern boundary of the western part of the area of *Mischocarpus*; b: Wallace-line (following Huxley); c: Lydekker-line: western boundary of the eastern part of the area of *Mischocarpus*; d: Torres Strait; e: area of distribution of *Mischocarpus*; W: Wallacea.

G e o g r a p h y. A clearly directed development as shown by inflorescence and flower characters, is also demonstrated in geography. The area of distribution of the group as a whole includes continental SE. Asia, the islands on the Sunda Shelf, the Philippines, New Guinea, the Solomon Islands, and N. Queensland. *M. pentapetalus*, the most primitive species, occurs in continental SE. Asia, the islands on the Sunda Shelf, and the Philippines. *M. triqueter*, more derived, is restricted to the northwestern islands of the Philippines: S. Luzon, Mindoro, Panay, Negros, but is not known from Palawan (Mindoro Strait, separating Palawan from the remainder of the Philippine Islands, is the boundary of the Asian continental flat). *M. largifolius*, slightly more derived, is distributed over New Guinea and the Solomon Islands. *M. paradoxus*, about as much derived as *M. largifolius* and unique in its fruit, is restricted to the Sogeri region, a small part of SE. New Guinea. *M. grandissimus* occurs in a small region of N. Queensland: the eastern parts of the Atherton Tablelands. The most derived species, *M. reticulatus*, has its area of distribution in E. New Guinea, concentrated in the Morobe District.

Finally, I received a collection from the Sogeri region, SE. New Guinea, which may represent a new species. As far as can be judged from the fruiting material, it stands evolutionary on a level between *M. largifolius* and *M. paradoxus* (see: *Mischocarpus prob. nov. spec.*).

Concluding we may say that there is a correlation between the level of morphological development and geography. *M. pentapetalus*, the most primitive species, is also the most western. The higher evolved morphologically, the more southeastern the distribution and the more restricted the area.

IV. Relationships between the groups

When we take from each group the species which is nearest to the typological type of that group we can, by determining primitive and derived states, set up relations between the groups. The following species represent their groups. *M. sundaicus:* group 1, *M. pentapetalus:* group 2, *M. pyriformis:* group 3, *M. anodontus:* group 4, *M. exangulatus:* group 5.

None of the last three species can easily be connected with species of other groups; they form three monotypic groups, all with an exclusively eastern distribution.

M. pyriformis stands on about the same specialisation level as *M. pentapetalus* but differs in the following derived states: calyx highly connate; disk mostly interrupted once or several times. The unguiculate petals with auricles or scale(s) are at least somewhat derived (see II: Characters) but together with the characters mentioned above, they make up a flower which is more derived than that of *M. pentapetalus*. The variation in the rate of extension of the sclerenchyma in the endocarp and the septa is the same as in *M. pentapetalus*. Of the three monotypic groups, *M. pyriformis* has the widest range of variability, probably reflecting a wider ecological amplitude. It has also the widest distribution: it occurs in New Guinea and easternmost Australia, from 0 to 3000 m, and can be subdivided into three subspecies.

Little can be said of *M. anodontus*. As this species lacks petals and as the rate of extension of the sclerenchyma is until halfway in the septa, it is on the specialisation level of the '*sundaicus*-group'. Still there are many differences but none of them is of a clear phylogenetic value. *M. anodontus* occurs in easternmost tropical Australia.

M. exangulatus is the most isolated species in *Mischocarpus* having characters unique for this genus. The style with stigmatic lines is considered derived and is unique in *Mischocarpus*. Probably derived are the unguiculate, auricled or scaled petals and the rate of extension of the sclerenchyma in the endocarp (only narrow plates are present along the sutures). The axial parts of the septa are almost separated or at least easy to separate. This may be a first step towards reduction of the septa, a situation which is fully realized in *Gongrodiscus* and *Cupaniopsis concolor*. *M. exangulatus* is restricted to the eastern parts of the Atherton Tablelands, N. Queensland.

The first two groups seem close to each other. The alliance between *M. sundaicus* and *M. pentapetalus* is closer than between the latter and some of the more derived eastern members of its group. In its nearly constant lack of petals, *M. sundaicus* is more derived than *M. pentapetalus*. No phylogenetic significance can be attached to further differences.

V. Conclusions

Five groups are recognized in *Mischocarpus*. The first two form the nucleus of the genus and are mutually closely allied. In both a morphological specialization is correlated with a southeastern direction on the map. The species nearest to the typological types of these groups, *M. sundaicus* and *M. pentapetalus*, are mutually most closely related and both have their centre of distribution in continental Asia and western Malesia (the southeastern part of the continental block of Asia). Probably, this region was the primary centre of radiation for the first two groups. A possible explanation of the fact that *M. sundaicus* is more widespread than *M. pentapetalus* may lay in their different altitudinal range. *M. sundaicus* is a

lowland species occurring down to sea-level, whereas *M. pentapetalus*, which is a mountain species, rarely occurs below 800 m.

A secondary centre for speciation of the '*pentapetalus*-group' lies in New Guinea and may be there is a (weak) secondary centre for the '*sundaicus*-group' in the Australia-New Guinea region.

The last three groups are all monotypic and have a more or less limited eastern distribution, and probably are relatively early offsprings.

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KEY TO THE SPECIES

1a. Midrib above either not visible, hidden in a narrow groove by the adjacent parts of the leaflet, or rarely visible as a very slender and sharp sunken line 2

b. Midrib above clearly visible, but sometimes covered with hairs 3

2a. Nerves 6—15 per side; inflorescences axillary (incl. pseudoterminal); calyx connate for 50—65%; petals 1—5, unguiculate; disk cup-shaped, interrupted or not, 0.5—1 mm ∅, glabrous; fruit stipe 8—25 mm, inside glabrous or locally with a few hairs. **M. pyriformis**

b. Nerves 12—30 per side; inflorescences axillary (incl. pseudoterminal) and ramiflorous; calyx connate for up to 25%; petals 0—2, not unguiculate; disk annular, not interrupted, *c.* 1.5 mm ∅, puberulous; fruit stipe 1.5—6(—15) mm, inside pubescent to densely woolly . . . . . **M. largifolius**

c. Nerves 12—24 per side; inflorescences ramiflorous (rarely also an axillary one); calyx connate for up to 35%; petals (3—)5, not unguiculate; disk annular or slightly cup-shaped, often interrupted, 0.75—1 mm ∅, glabrous or locally puberulous; fruit not or rarely hardly stiped, inside glabrous . . . . . **M. paradoxus**

3a. Midrib above more or less hairy in at least part of the leaflets 4

b. Midrib above glabrous in all leaflets, rarely subglabrous (see *M. reticulatus*) . . 6

4a. Stigma consisting of lines (also visible in fruit); apex of connective with a wart; fruit outside glabrous; domatia present, mostly hairy . . . . . **M. exangulatus**

b. Stigma consisting of lobes (also visible in fruit); apex of connective without a wart; fruit outside glabrous or hairy; domatia either glabrous and inconspicuous, or absent 5

5a. Petiolules 4—18(—25) mm; cymules stalked, appressedly short-hairy; calyx connate for 35—65%; petals (0) 1—5; filament hairy; fruit outside glabrous; embryo ellipsoid; suture between cotyledons curved (see fig. 1e). . . . . **M. pyriformis**

b. Petiolules 2—5 mm; cymules almost sessile, long-hairy; calyx connate for up to 35%; petals absent; filament glabrous; fruit outside densely ferruginous hairy; embryo globose; suture between cotyledons straight (see fig. 1f) **M. lachnocarpus**

6a. Domatia present in at least a part of the leaflets, 1 or 2 (3), restricted to the basal part of the midrib, conspicuous; petals absent . . . . . **M. anodontus**
b. Domatia either present along the whole midrib and small, or absent; petals present or not 7
7a. Inflorescences ramiflorous (exceptionally also an axillary one) . . . . . 8*)
b. Inflorescences axillary (incl. pseudoterminal) 9
8a. Inflorescence axes branched, up to 25 cm; calyx subcoriaceous, nerves not visible, connate up to 0.35 mm; petals (3—)5(—6), filament hairy; fruit not or rarely hardly stiped . . . . . **M. paradoxus**
b. Inflorescence axes not or very sparsely branched, up to 10 cm; calyx membranaceous, with clear nerves, hardly connate; petals (2—)5; filament sparsely hairy or glabrous; fruit stiped for at least 4 mm . . . . . **M. triqueter**
c. Inflorescence axes branched, up to 5 cm; calyx membranaceous, with clear nerves, connate for at least 1.5 mm; petals absent; filament glabrous; fruit stiped for at least 5 mm . . . . . **M. reticulatus**
9a. Leafy twigs 12—18 mm ∅; leaflets 20—50 × 9—20 cm; domatia absent; midrib beneath in the basal part nearly completely circular in cross-section; fruit 25—30 mm long, base with lobes (alternating with the stamens) . . . . . **M. grandissimus**
b. Leafy twigs 1.5—9(—12) mm ∅; leaflets (5—)7—24(—40) × 1—7(—15) cm; domatia small or absent; midrib beneath in the basal part ± semi-circular in cross-section; fruit 7—20 (exceptionally — 30) mm long, base rarely with lobes 10
10a. Midrib above visible as a prominulous to flattened slender line; calyx connate for 35—65%; petals 1—5, unguiculate; disk annular to cup-shaped, 0.5—1 mm ∅; filament ± hairy . . . . . **M. pyriformis**
b. Midrib above prominent, angular or rounded; calyx connate for up to 35% (if connate for more than 25% then petals absent and filament glabrous); petals either well-developed but not unguiculate, or reduced to absent; disk annular, 1—2(—3) mm ∅; filament hairy or glabrous. 11
11a. Leaflets (1) 2—6 per side; midrib above angular, sometimes locally, rarely completely rounded; reticulation mostly coarse; calyx outside ± puberulous, also in the upper half, hardly connate (rarely for up to 25%); petals 0—5; filament mostly puberulous at least at the base, rarely glabrous; anther glabrous or ± hairy; suture between cotyledons curved (see fig. 1e). . . . . **M. pentapetalus**
b. Leaflets 1—3 (4) per side; midrib above rounded, often locally, sometimes completely angular; reticulation mostly fine and dense; calyx outside ± hairy in the lower half, mostly glabrous in the upper half, connate for 25—35%; petals 0 (rarely up to 3 in the Malay Peninsula); filament glabrous; anther glabrous; suture between cotyledons straight (see fig. 1 f) . . . . . **M. sundaicus**

Mischocarpus anodontus (F. v. M.) Radlk. — **Fig. 1c—d, 2f.**

M. anodontus (F. v. M.) Radlk., Sapind. Holl.-Ind. (1879) 43; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 536, 647; Maiden & Betche, Cens. N. S. Wales Pl. (1916) 129 ('Anodontus'); Domin, Bibl. Bot. 22 (1927) 910; Francis, Austr. Rain. For. Trees (1929) 235; ed. 2 (1951) 261; Radlk., Pfl. R. Heft 98 (1933) 1306. — *Schmidelia anodonta* F. v. M., Fragm. 1 (1858) 2, *comb. illeg.* (code 1972, art. 43). — *Cupania anodonta* F. v. M., Fragm. 2 (1860) 76; 5 (1866) 147; 9 (1875) 90. — *Ratonia anodonta* Benth., Fl. Austr. 1 (1863) 461; Walp., Ann. 7 (1869) 627; F. M. Bail., Queensl. Fl. 1 (1899) 296. — Lectotype: Queensland, Brisbane River, *W. Hill s.n.*, fl., fr. (*MEL 55965*).

*) See also *Mischocarpus prob. nov. spec.*

Shrub or tree up to 18 m; glabrous, sometimes rather densely appressed short hairy in the youngest parts. *Twigs* 1—4 mm ∅, greyish. *Leaves* with 1 or 2 leaflets per side; petiole 2—6 cm; petiolules 3—12 mm. *Leaflets* 1.7—14 × 1.2—8 cm, ratio 1.7—2.5, widest in or slightly beneath the middle, pergamentaceous to subcoriaceous; domatia present in at least a part of the leaflets, 1 or 2 (3) restricted to the lower half of the midrib, conspicuous; base acute to blunt, mostly decurrent; midrib prominulous or flat and mostly carinate; nerves 7—12 per side, angle to midrib 50—80°, moderately curved, prominent on both faces, not very distinct from the veins; veins prominent on both faces; nerves and veins decurrent along the midrib, forming a ± prominulous ridge at each side of the midrib; veinlets above less conspicuous than beneath. *Inflorescences* axillary and pseudoterminal, up to 10(—18) cm long; axes sparsely branched; cymules 1—5-flowered; bracts up to 1.5 mm. *Calyx* connate for 35—50%; lobes triangular, up to 1.5 mm long, subcoriaceous, outside sparsely puberulous, inside glabrous or with a few hairs near the base. *Petals* 0. *Disk* broadly annular, outline ± angular, up to 2.5 mm ∅, glabrous to puberulous. *Stamens* 8, up to 3 mm long; filament glabrous or sometimes with a few hairs; thecae not papillose, glabrous. *Pistil* nearly glabrous. *Infructescences* up to 12 cm long. *Fruit* up to 3 cm, glabrous; stipe up to 15 × 1.5 mm; seedbearing part globose, ellipsoid, or obovoid, sometimes slightly trilobed and truncated, up to 15 mm ∅, up to 1.5 mm apiculate; fruit wall almost woody; endocarp completely sclerenchymatic, thickest at the suture, thinning out towards the septa; endocarp and septa densely red-brownish villous to woolly, hairs up to 2 mm. *Seed* ellipsoid to globose, up to 11 mm long; cotyledons mostly about equal, without folds; suture about transverse and straight, sometimes undulate at the adaxial side.

AUSTRALIA. Queensland. Bellenden Ker, *Iryon s.n.* (*BRI 071279*); Rockingham Bay, *Dallachy s.n.* (CAL, M, *MEL 55964*); Seaview Range, *Dallachy s.n.* (*MEL 55967*); Mount Elliot, *Dallachy s.n.* (K, *MEL 55974*); Geendiah (?), *Kajewski s.n.* (*SING 022653*); Rockhampton, *Dallachy s.n.* (*MEL 55966*); Mackenzie R., *Leichhardt s.n.* (*MEL 55968*); Red Cedar Creek (near Mackenzie R?), *Leichhardt s.n.* (K, *MEL 55972*); Brisbane R. at Moreton Bay, *Hill s.n.* (*MEL 55965, 55969, 55973*); *Hill & Mueller s.n.* (*MEL 55970*); *Cunningham 21* (BM, K); San Keys Scrub, 1887, *Bailey s.n.* (M); near Lamington, *Williams s.n.* (K). — New South Wales. Richmond R., Lismore, *Betche s.n.* (K, L, M, *NSW 22338*); Hunters R., *N. N.* (*MEL 55975*).

Ecology: Rain forest. Fl. April, August; fr. Sept.—Dec.

Note: Because of their fruits which have also a densely hairy endocarp, collections of *M. sundaicus* from E. Australia were often named *M. anodontus*, following the key of Radlkofer. Both species lack petals. For differences see under *M. sundaicus*.

Mischocarpus exangulatus (F. v. M.) Radlk. — **Fig. 2i.**

M. exangulatus (F. v. M.) Radlk., Sapind. Holl.-Ind. (1879) 43; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 536, 647; Domin, Bibl. Bot. 22 (1927) 910; Radlk., Pfl. R. Heft 98 (1933) 1305. — *Ratonia exangulata* F. v. M., Fragm. 4 (1864) 156; F. M. Bail., Syn. Queensl. Fl. Suppl. 3 (1890) 16; Queensl. Fl. 1 (1899) 297. — *Cupania exangulata* F. v. M. [Fragm. 4 (1864) 156, *nom. inval.* (code 1972, art. 34, 4)]; Fragm. 9 (1875) 91; F. M. Bail., Syn. Queensl. Fl. (1883) 76. — Lectotype: Queensland, Rockingham Bay, *Dallachy s.n.*, fl. (*MEL 55993*).

Arytera subnitida C. T. White, Proc. R. Soc. Queensl. 47 (1936) 56. — Type: Queensland, Daintree R., *Brass 2345*, 19-3-1932, fl. (probably A; iso in BRI, SING).

Shrub or small tree up to 4 m; ferruginous densely tomentose to puberulous to nearly glabrous. *Twigs* 1—4 mm ∅. *Leaves* with 1—4 leaflets per side; petiole 2—8 cm; petiolules 0.5—1.5 cm. *Leaflets* 6—22 × 2—8 cm, ratio 2—4, widest beneath to slightly above the middle, pergamentaceous to subcoriaceous, greyish-green above, brownish beneath,

above puberulous to tomentose on midrib and sometimes nerves, beneath tomentose to puberulous mainly on the midrib, the nerves, and along the margin, sometimes glabrous; domatia present, mostly along the whole midrib, sometimes 2 or 3 restricted to the basal part; base mostly equalsided, blunt to acute, sometimes rounded; midrib above ± prominent, rounded or locally slightly angular; nerves 5—13 per side, angle to midrib 40—70°, becoming wider from base to apex, straight to moderately curved, the basal ones running parallel with the margin, sometimes up to the middle of the leaflet; venation prominent on both faces; veinlets only distinct beneath; the pattern of nerves and veinlets is not as regular as in most other species. *Inflorescences* axillary and pseudoterminal, up to 30 cm long; axes at most sparsely branched in the basal half; cymules 1—4-flowered; bracts lanceolate to subulate, up to 2 mm, outside strigose to pubescent, inside glabrous. *Calyx* connate for up to 35%; lobes triangular to ovate, up to 1.5 × 1 mm, subcoriaceous, outside rather densely, inside very sparsely pubescent or glabrous. *Petals* (4) 5, *c.* 1 × 0.75 mm, for 35—65% unguiculate; claw ± tubular; plate elliptic to oblong, inside pubescent, with two hairy auricles, these mostly unequal, shorter or sometimes little longer than the plate, mostly ± 2-lobed. *Disk* annular, sometimes interrupted, up to 1 mm ∅, glabrous. *Stamens* 8, up to 3 mm, filament pubescent; connective with a lighter coloured wart at the top, conspicuous in exserted stamens; thecae papillose, glabrous or sparsely pubescent. *Pistil* sparsely pubescent; style, the stigmas included, as long as to longer than the ovary, with minute, hardly recurved stigmatic lobes from which stigmatic lines are descending to half way the style, sometimes almost down to the ovary. *Infructescences* pendulous (?). *Fruit* up to 3 cm, glabrous; stipe up to 12 × 1.5 mm, widening upwards, rather flexible by lack of sclerenchym; seedbearing part ellipsoid to obovoid, slightly oblique, 1—2 × 0.9—1.2 cm, thin-walled, apiculate for 1—2 mm; endocarp incompletely sclerenchymatic along the sutures for up to 4 mm width, tapering to both ends, not extending into the stalk, glabrous; valves shrivelled and curved inwards after dehiscence; septa glabrous, sometimes separated from each other from the base of the seeds upwards, otherwise easy separable. *Seed* often pendulous from the open fruit by the appendix of the arilloid, ellipsoid, up to 16 × 9 mm; cotyledons mostly unequal, the upper one being the biggest; suture ± transverse, curved upwards at the adaxial side of the embryo, sometimes oblique; upper cotyledon with a radial fold at the adaxial side, starting at the top of the curve of the suture.

AUSTRALIA. Queensland. Thornton Peak, *Olsen 418* (BRI, NSW); Daintree R., *Brass 2345*; *Cowley 4* (BRI); Lamb Ra., Davies Creek, *Webb & Tracey 6712* (BRI); Bailey's Creek, *Wrigley & Telford 44711* (CANB, K, L); Cairns, *Brass 33487* (BRI); Deeral near Babinda, *Blake 14960* (BRI, MEL); Innisfail, *Michael s.n.* (*BRI 071284*); South Johnstone, *Martin AFO/2 778*; many collections from Rockingham Bay and Hinchinbrook Isl. by *Dallachy*; Mt. Spec, *Volck 1040* (BRI); Dalrymple Gape, some anonymous collections (MEL).

Cultivated at Bogor (Java) and Peradeniya (Ceylon).

Ecology: Rain forest, often along salt water creeks, 0—750 m alt. Fl. March—June; fr. April—July.

Notes: From south to north the material becomes more glabrous; collections from Daintree R. and vicinity are almost completely glabrous (only the midrib is very short-hairy above). This is the form described as *Arytera subnitida*.

The vegetative parts, especially the leaflets, bear a superficial resemblance to those of *Lepisanthes rubiginosa* (Roxb.) Leenh. They are easily differentiated by the length of the petiolule and the presence of domatia. The petiolule in *L. rubiginosa* is always shorter than 5 mm, in *M. exangulatus* from 5 to 15 mm. Domatia are absent in *L. rubiginosa*.

Mischocarpus grandissimus (F. v. M.) Radlk. — **Fig. 2 j.**

M. grandissimus (F. v. M.) Radlk., Sapind. Holl.-Ind. (1879) 43; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 536, 647, 649; in E. & P., Nat. Pfl. Fam. 3, 5 (1895) 350; Domin, Bibl. Bot. 22 (1927) 910; Radlk., Pfl. R. Heft 98 (1933) 1306. — *Ratonia grandissima* F. v. M., Fragm. 4 (1864) 156; F. M. Bail., Queensl. Fl. 1 (1899) 296. — *Cupania grandissima* F. v. M., Fragm. 4 (1864) 156, *nom. inval.* (Code 1972, art. 34, 4)]; Fragm. 9 (1875) 91; F. M. Bail., Syn. Queensl. Fl. (1883) 76. — T y p e: Queensland, Rockingham Bay, *Dallachy s.n.*, 5-9-1864, fr. (*MEL 55998*, iso in M, *MEL 55996, 55997*).

Tree up to 15 m, to 25 cm ∅, probably mostly unbranched; young parts and inflorescences puberulous. *Twigs* 12—18 mm ∅. *Leaves* with 4 (5?) leaflets per side; petiole 12—20 cm, up to 8 mm ∅; petiolules 1—2 cm, up to 0.5 cm ∅. *Leaflets* 20—50 × 9—20 cm, ratio 1.7—3, widest in or above the middle, subcoriaceous to coriaceous; domatia absent; base acute to rounded; apex sometimes distinctly acuminate; midrib above prominent, angular, slender, beneath nearly completely circular in cross-section; nerves 20—28 per side, angle to midrib 50—80°, sometimes hardly distinguishable from the intercalated veins, straight to moderately curved, mostly very regular; veins and veinlets very regularly reticulate, prominent on both faces. *Inflorescences* axillary and pseudoterminal; axes branched, up to 12 cm long; cymules 1—5-flowered; bracts triangular, up to 3 mm; pedicels 2 × 0.5 mm. Flowers: just opened buds only. *Calyx* connate for up to 35%; lobes triangular, up to 1.5 × 1 mm, chartaceous to subcoriaceous, with one nerve faintly visible, outside sparsely puberulous, inside glabrous or with a few hairs. *Petals* 0—3, up to 0.5 mm, elliptic, not unguiculate, outside sparsely pubescent, auricles 1 or 2, small, pubescent. *Disk* annular, irregularly lobed, *c.* 1 mm ∅, glabrous, mostly with lobes protruding between the stamens. *Stamens* 8, filament glabrous or with a few hairs; thecae smooth, sometimes papillose at the apex, glabrous. *Pistil* hairy. *Infructescences* axillary or on the stem just under the leaves, accrescent, up to 43 cm; pedicels up to 7 × 1 mm; bracts up to 4 mm. *Fruit* 2.5—3 cm, glabrous; stipe up to 15 × 1.5 mm, at the very base with tiny lobes alternating with the remnants of the stamens; seedbearing part ellipsoid to obovoid, 10—12 mm ∅, shortly apiculate; endocarp incompletely sclerenchymatic, sclerenchyma in sterile cells sometimes reaching, but not extending into the septa; endocarp and septa laxly appressedly long-hairy. *Seed* ellipsoid, up to 1 cm long; suture curved; lower cotyledon folded, mostly smaller than upper one, upper one not folded.

AUSTRALIA. Q u e e n s l a n d. Atherton Tabelands. Danbulla, *Webb & Tracey 5742* (BRI); Gadgarra, *Francis s.n.* (*BRI 071281*); Egan Creek, *Smith 10822* (BRI, L); Rockingham Bay, several specimens of *Dallachy*, probably all representing one collection (M, MEL).

E c o l o g y: Rain forest. Fl. March; fr. Febr., Sept.

Mischocarpus lachnocarpus (F. v. M.) Radlk. — **Fig. 1 f, 2 c.**

M. lachnocarpus (F. v. M.) Radlk., Sapind. Holl.-Ind. (1879) 43; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 536, 647; Domin, Bibl. Bot. 22 (1927) 910; C. T. White, Contr. Arn. Arb. 4 (1933) 63; Radlk., Pfl. R. Heft 98 (1933) 1304; Merr. & Perry, J. Arn. Arb. 21 (1940) 523. — *Ratonia lachnocarpa* F. v. M., Fragm. 4 (1864) 157; F. M. Bail., Queensl. Fl. 1 (1899) 296; J. F. Bail., Queensl. Agr. J. 5 (1899) 396. — *Cupania lachnocarpa* F. v. M. [Fragm. 4 (1864) 157, *nom. inval.* (Code 1972, art. 34, 4)] Fragm. 5 (1865) 6; 9 (1875) 91. — L e c t o t y p e: Queensland, Dalrymple Gape, *Dallachy s.n.*, 14-4-1864, fr. (*MEL 56003*).

Shrub or tree, up to 20 m; ferruginous, densely pubescent to puberulous in the young parts, inflorescences, and infructescences, sometimes nearly glabrous. *Twigs* 2—4 mm ∅. *Leaves* with 1 or 2 (3) leaflets per side; petiole 1—4.5 (—7) cm; petiolules 2—5 mm. *Leaflets* 4—14(—17) × 1.8—6.5 cm, ratio 1.5—3.2, widest about or above the middle,

pergamentaceous to coriaceous, sometimes bullate, above puberulous to pubescent on the midrib and sometimes on the nerves, rarely the whole upper side laxly pubescent, beneath pubescent mainly on the midrib and nerves and along the margin; upper face sometimes becoming smooth and glossy; domatia either inconspicuous along the whole midrib, or absent; base acute to sometimes blunt; midrib above prominent, rounded; nerves 10—14 per side, angle to midrib 60—90°, above prominulous, beneath prominent; veins above prominent to hardly distinct, beneath prominent, becoming more distinct towards the margin; veinlets rather dense, prominulous above, sometimes smoothening, prominent beneath. *Inflorescences* axillary and pseudoterminal, up to 14 cm long; axes branched; cymules almost sessile, densely ferruginous pubescent; bracts triangular, up to 2 × 1 mm, outside densely ferruginous pubescent, inside nearly glabrous; pedicels up to 1 mm. *Calyx* hardly connate; lobes 5 (6), triangular, 1.5 × 1 mm, subcoriaceous, outside pubescent to villous, inside glabrous or with a few hairs near the base. *Petals* 0. *Disk* annular, up to 1.5 mm ∅, puberulous. *Stamens* 8, up to 2 mm; filament glabrous; thecae papillose or not, glabrous or very rarely pubescent. *Pistil* rather densely velutinous. *Infructescences* not accrescent, 1—16 cm. *Fruit* 12—16(—20) mm, densely ferruginous villous to velutinous, sometimes partly glabrescent; stipe 3—7 × 1 mm, seedbearing part globose to ellipsoid to obovoid, triangular in cross-section, apiculate for 1—2 mm, inside laxly pubescent to villous, mainly along the sutures; endocarp completely sclerenchymatic. *Seed* globose, *c.* 7 mm; cotyledons about equal; suture transverse and straight.

NEW GUINEA. Aru Isl. *Buwalda 5511* (BO). — East. Western Dist.: Tarara, Wassi Kussa R., *Brass 8734* (A, BO, BRI, L); *NGF 49679* (A, BRI, CANB, K, L). Morobe Dist.: Aseki Valley, *Schodde & Craven 5047* (K, L); Aseki, *LAE 51986* (L). Central Dist.: Mekeo, *C. T. White 790* (SING); Dieni, Ononge Road, *Brass 3994* (A, BM, BO, BRI, K, L, NY, US); Koitaki, *Carr 11926* (L, SING); *12297* (L, SING); Manumu, *LAE 59058* (A, BRI, CANB, L); near Sogeri, *NGF 4193* (BO, CANB, L, SING); *Womersley NGF 14266* (L); near Boridi, *LAE 60282* (A, BRI, CANB, K, L). Milne Bay Dist.: Mt Suckling, *LAE 54145* (K, L). Normanby Isl.: Waikaiuna Bay, *Brass 25564* (K, L, US).

AUSTRALIA. Queensland. Bamaga near Cape York, *Smith 12469* (BRI); McIlwraith Ra., *Webb & Tracey 9627a* (BRI); Downfall Creek Rd., *Webb & Tracey 7649* (BRI); Atherton Tableland, 15 miles ENE. of Atherton, *van Altena 3622* (K, L); Gadgarra, *Kajewski 1041* (K, MEL, NY, NSW, P, UC); Herbert R., *Dallachy* (?) *s.n.* (*MEL 56000*); Lake Barrine, *Rodway 13255* (NSW); Bellenden Ker, *F. M. Bailey 120* (BRI); Seaview Ra., *Dallachy s.n.* (*MEL 56001*); El Arish, *Webb & Tracey 6862* (BRI); Innisfail, *Michael 133* (BO, BRI); Rockingham Bay, many collections by *Dallachy*; Mackay R., *Dallachy* (?) *s.n.* (*MEL 56002*); Dalrymple Gape, *Dallachy s.n.* (*MEL 56003*). — New South Wales. Macpherson Ra., Springbrook, *C. T. White s.n.* (*BRI 071267*); Mt. Warning, *H. C. Hayes s.n.* (*BRI 071275*).

Ecology: Primary and secondary rain forest, also along streams in open savanna, up to 1300 m alt. Fl. Dec.-July, fr. March-August.

Note: The southernmost collections (Macpherson Ra., Mt. Warning) mostly have abnormal flowers. They consist of several whorls of bracteole-like, sepaloid, and petaloid scales between which no distinct limits can be drawn. A disk is hardly present.

Mischocarpus largifolius Radlk. — **Fig. 1g, 2h.**

M. largifolius Radlk., Bot. Jahrb. 56 (1920) 304, f. 4 G—J; Pfl. R. Heft 98 (1933) 1308, f. 38 G—J. — Type: New Guinea, East Sepik District, Felsspitze, Kaiserin Augusta-Fluss-Exped., *Ledermann 12693*, alt. 1400—1500 m, 7-8-1913, fr. (B, lost; iso in M).

Tree up to 33 × 1 m; puberulous, early glabrescent. Buttresses mostly present, up to 1 m high, 2 m spreading, and 3 cm thick. Bark gray to darkbrown, sometimes white, smooth. *Twigs* 3—10 mm ∅, sometimes grooved. *Leaves* with 1—4 leaflets per side; petiole 4—20 cm; petiolules 4—15 mm. *Leaflets* 7—38 × 2—16 cm, ratio 2—3, widest in or beneath the middle, pergamentaceous to coriaceous, sometimes ± bullate, domatia

either along the whole midrib but inconspicuous, or mostly absent; base rounded or blunt, rarely acute; midrib either not visible above, hidden in a narrow groove by the adjacent parts of the leaflet, or rarely as a very slender and sharp, sunken line; nerves 12—30 per side, angle to midrib 50—85°, mostly very regular, moderately curved; veins and veinlets mostly very regularly reticulate, above prominent to rarely invisible, beneath prominent. *Inflorescences* axillary, pseudoterminal, and ramiflorous on branches up to 12 mm ∅, up to 32 cm long; axes branched; bracts up to 2 mm. *Calyx* connate for up to 25%; lobes triangular up to 1 × 1 mm, subcoriaceous to somewhat fleshy, outside sparsely, inside more densely pubescent, near the base with a dense row of hairs. *Petals* 0—2, elliptic, up to 1 × 0.5 mm, not unguiculate, inside pubescent, with two hairy auricles at the base. *Disk* annular, *c.* 1.5 mm ∅, puberulous. *Stamens* 8, up to 3 mm; filament puberulous; thecae papillose, glabrous, rarely with a few hairs. *Pistil* densely appressedly short-hairy. *Infructescences* not or slightly accrescent, mostly below the leaves, sometimes axillary and pseudoterminal. *Fruit* 14—28(—40) mm, glossy, glabrous; stipe (0—)1.5—6(—15) × 1.5 mm; seedbearing part ellipsoid to obovoid, triangular to rounded-triangular in cross-section, up to 1.5 cm wide; endocarp thin, completely sclerenchymatic, pubescent to densely woolly; septa densely woolly to glabrous. *Seed* ellipsoid, 10—14 mm long; suture curved; lower cotyledon folded, mostly smaller than the upper one; upper one sometimes folded.

New Guinea. West. Vogelkop Dist.: Kebar Valley, *BW 7171* (CANB, L, LAE, P); Momi, *Kostermans 169* (A, BO, K, L). — East. E. Sepik Dist.: *Ledermann 12693*. E. Highlands Dist.: Marafunga near Goroka, *Hartley 13302* (CANB, L, LAE). Morobe Dist.: Gurakor, *Brass 29386* (L); Patep, *NGF 23893* (BRI, CANB, L, LAE); Bulolo, *NGF 17082* (A, BRI, CANB, L, LAE); Sattelberg, *Clemens 2059* (L), *2214* (B); Wantoat, *Clemens 11142* (A, UC); Boana, *Clemens 8570* (B), *41723* (A). Central Dist.: near Port Moresby, *NGF 8267* (BO, L). Milne Bay Dist.: Kwagira R., Peria Creek, *Brass 24327* (A, L).

Solomon Islands. Bougainville Isl. near Buin, *Schodde c.s. 3963* (A, BRI, CANB, K, L, LAE). — Choiseul Isl. N. E., Vacha R., *BSIP 5672* (L). — New Georgia Group. Vella Lavella Isl., *BSIP 11196* (L, LAE). Ranongga Isl.: S. W., *BSIP 15635* (L). New Georgia Isl.: S.W., Roviana Lagoon, *BSIP 1974* (L); S. E., Mango R., *BSIP 6053* (L); Viru R., *BSIP 7146* (L). — Vangunu Isl. Balavaeni, *BSIP 6139* (L). — Guadalcanal Isl. Wanderer Bay, Vuragoba, *BSIP 9069* (L, LAE). — Big Nggela Isl. Nata R., Ghairavu, *BSIP 16851* (L, LAE).

Ecology: Primary and secondary forest from 0—1300 m (*Hartley 13302* at 2800 m). Fl. March—May, fr. May—October. Twigs and leaf rhachises often show holes in the bark and cavities inside as if they were inhabited by ants (see *NGF 23893*).

Mischocarpus paradoxus Radlk. — Fig. 1h, 2e.

M. paradoxus Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 20 (1890) 268; in E. & P., Nat. Pfl. Fam. 3, 5 (1895) 350; Bot. Jahrb. 56 (1920) 306; Baker, J. Bot. 61 (1923) Suppl. p. 11; Radlk., Fedde Rep. 20 (1924) 40; Pfl. R. Heft 98 (1933) 1310; *non* Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 79 [= *Sarcopteryx squamosa* (Roxb.) Radlk.]. — Type: New Guinea, Sogeri, *Forbes 310*, alt. 900 m, 30-10-1885, fr. (M: iso in BM, prob. L).

Shrub or tree up to 5(—20?) m; puberulous, early glabrescent. *Twigs* 3—8 mm ∅. *Leaves* with 3 or 4 leaflets per side; petiole 5—11(—17) cm; petiolules 4—11(—15) mm. *Leaflets* 12—27 × 4.5—11 cm, ratio 1.8—3.2, widest in or beneath the middle, pergamentaceous to subcoriaceous; domatia either inconspicuous, along the whole midrib, or absent; base rounded, sometimes blunt, rarely acute; midrib above an angular line, nearly always visible; nerves 12—24 per side, angle to midrib 50—80°, moderately curved; veins and veinlets very regularly reticulate, prominent on both faces. *Inflorescences* ramiflorous, on 7—13 mm ∅ branches (rarely moreover an axillary one); axes sparsely to rather

strongly branched (up to 25 cm); bracts triangular, up to 1 mm. *Calyx* connate for up to 35%; lobes triangular, mostly slightly acuminate, up to 1.2×0.5 mm, sometimes unequal, subcoriaceous, outside sparsely pubescent, inside puberulous near the base, often as a row of short hairs. *Petals* (3—)5 (6), ± elliptic, up to 0.5 mm long, not unguiculate, glabrous or with a few hairs near the base, not auricled. *Disk* annular or slightly cup-shaped, often irregularly, deeply lobed to interrupted, 0.75—1 mm ∅, glabrous or locally sparsely puberulous. *Stamens* 8, up to 2 mm; filament pubescent; thecae smooth or locally inconspicuously papillose, glabrous. *Pistil* not or shortly stiped, pubescent. *Infructescences* below the leaves (rarely moreover an axillary one), not accrescent, 14—33 cm long. *Fruit* globose, up to 1 cm ∅, not stiped or in unripe fruits with a *c.* 1 mm long stipe, glabrous, with many light-brown dots and faint remnants of a waxy covering, very shortly apiculate, thin-walled; endocarp incompletely sclerenchymatic, consisting of a *c.* 2 mm wide tapering plate at either side of the suture, glabrous; septa glabrous. *Seed* up to 9 mm long, globose to ellipsoid, arilloid without appendix; suture between cotyledons curved; lower cotyledon folded, mostly smaller than the upper one.

NEW GUINEA. East. Central Dist.: Deva Deva, *White 586* (BRI); Boridi, *Carr 13224* (CANB, K, L, SING), *14264* (K, L, SING), *14265* (A, CANB, K, L, NY, SING), *14686* (A, CANB, K, L, NY, SING), *14992* (K, L, NY, SING); near Boridi, *LAE 59057, 60073* (BRI, CANB, L); Sogeri, *Forbes 216* (BM, FI, L, P), *309* (BM, FI, P), *310* (BM, L, M); Subitana, *NGF 12548* (LAE); Efogi, *LAE 52488* (L).

Ecology: Primary and secondary forest from 400—1400 m alt. Fl. June—Sept., fr. Oct.—Nov.

Note: *Mischocarpus guillauminii* Kan. (err.: *Guillauminiana*) mentioned in Kanehira & Hatusima, Bot. Mag. Tokyo 57 (1943) 79, there considered identical with *M. paradoxus*, is *Cupaniopsis concolor* (Gillespie) Van der Ham (see Blumea 23, 1977, p. 289).

Mischocarpus pentapetalus (Roxb.) Radlk. — **Fig. 2b.**

M. pentapetalus (Roxb.) Radlk., Sapind. Holl.-Ind. (1879) 43; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 646, 648; Lecomte, Fl. Gén. I.-C. 1 (1912) 1028; Radlk., Pfl. R. Heft 98 (1933) 1293; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 984. — *Schleichera pentapetala* Roxb. [Hort. Beng. (1814) 29, *nom. nud.*] Fl. Ind. ed. 2 (1832) 275. — *Schmidelia pentapetala* Wight, Ic. 2 (1840) t. 402, *comb. illeg.* (Code 1972, art. 43). — [*Cupania pentaphylla* Wight, l.c., *nom. inval.* (Code 1972, art. 34, 4)]. — [*Schleichera pentaphylla* Roxb. in Wight, l.c., *nom. inval.* (Code 1972, art. 34, 4)]. — *Cupania roxburghii* Wight, l.c., *nom. illeg.* (Code 1972, art. 63); Walp., Rep. 5 (1845) 363. — *Cupan'a pentapetala* Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 678. — *Pedicellia pentapetala* Pierre, Fl. Coch. (1895) text with t. 324A. — Type: India, Silhet, *M. R. Smith* (*3041*?), 1811, fl. (BM).

Schleichera subundulata Turcz., Bull. Soc. Nat. Mosc. 21 (1848) 574. — *Cupania subundulata* Rolfe, J. Bot. 23 (1885) 211; Vidal, Phaner. Cuming. (1885) 6, 105. — Type: Phillippines, Luzon, Prov. of Laguna, Calauan, *Cuming 507*, 1841, fl. (KW, *n.v.*; iso in A, FI, K, KW, *n.v.*, L, M, P, SING).

M. sumatranus Bl., Rumphia 3 (1849) 168; Radlk., Sapind. Holl.-Ind. (1879) 12, 44; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 646, 648; King, J. As. Soc. Beng. 65, 2 (1896) 448; Val., Bull. Inst. Bot. Btzg. 15 (1902) 10; Ridley, Fl. Mal. Pen. 1 (1922) 508; Merr., Pl. Elm. Born. (1929) 176, *err. Elmer 20471* for *20371* (*'sumatrensis'*); Radlk., Pfl. R. Heft 98 (1933) 1298; Burk., Dict. (1935) 1480; Corner, Ways. Trees (1940) 589; Adelb., Blumea 6 (1948) 324. — *Cupania sumatrana* Miq., Fl. Ind. Bat. 1, 2 (1859) 566; Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 678; Kurz, Rep. Pegu (1875) 32; Fl. Burm. 1 (1877) 285; Kanjilal & Das, Fl. Assam 1 (1936) 317. — *Ratonia sumatrana* Kurz, Rep. Pegu (1875) App. A38, App. B40. — *Pedicellia sumatrana* Pierre, Fl. Coch. (1895) text with t. 323B. — Lectotype: S. Sumatra, circ. Indrapura, *N.N.*, fr. (*L 908.269—1030*).

M. fuscescens Bl., Rumphia 3 (1849) 169; Radlk., Sapind. Holl.-Ind. (1879) 12, 43; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 646, 648; King, J. As. Soc. Beng. 65, 2 (1896) 447; Val., Bull. Inst. Bot. Btzg. 15 (1902) 10; K. & V., Bijdr. Booms. 9 (1903) 221; Lecomte, Fl. Gén. I.—C. 1 (1912) 1028, excl. var. *bonii* H. Lec.; Koorders-Schum., Syst. Verz. 1, Java (1912) fam. 165, p. 12; Ridl., Fl. Mal. Pen. 1 (1922) 508; Merr., En. Philip. 2 (1923) 513; Radlk., Pfl. R. Heft 98 (1933) 1294; Meyer Drees, Comm. For. Res. Inst. 33 (1951) 109; K. Ramesh Rao, Ind. Woods 2 (1963) 223, f. 325; Backer &

Bakh. *f.*, Fl. Java 2 (1965) 141. — *Cupania fuscescens* Miq., Fl. Ind. Bat. 1 (1859) 567. — *Pedicellia fuscescens* Pierre, Fl. Coch. (1895) text with t. 323B; Hu, Bull. Fan Mem. Inst. Biol. 1 (1929) 31. — Lectotype: Java, Preanger, *N.N.*, fl. (*L 908.269—555*).

Cupania helferi Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 678; Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. München. 9 (1879) 646. — Type: Burma, Tenasserim (or Andaman Isl.?), *Helfer K. D. 982/1*, fl. (K; iso in CAL, FI, L, M, P).

Pedicellia loureiri Pierre, Fl. Coch. (1895) t. 323A. — *M. loureiri* Radlk. in E. & P. ,Nat. Pfl. Fam. Nachtr. 3 (1907) 206. — Type: Cambodia, Tpong, *Pierre 620*, -5-1870, fl., fr. (P; iso in K, L, M, NY, SING, US; in K, L *p.p.*, = *M. sundaicus*).

Pedicellia tonkinensis Pierre, Fl. Coch. (1895) text with t. 323A. — *M. tonkinensis* Radlk. in E. & P., Nat. Pfl. Fam. Nachtr. 3 (1907) 206; Lecomte, Fl. Gén. I.-C. 1 (1912) 1029; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 984. — Type: N. Vietnam, Tonkin, Prov. Son Tay, Tu Phap, Mt. Bavi, *Balansa 3700*, -5-1887, fl., fr. (P; iso in K).

Pedicellia grandis Pierre, Fl. Coch. (1895) t. 324A. — *M. grandis* Radlk. in E. & P., Nat. Pfl. Fam. Nachtr. 3 (1907) 206; Craib, Fl. Siam. En. 1 (1926) 333; Radlk., Pfl. R. Heft 98 (1933) 1292. — Type: S. Vietnam, Prov. Bien Hoa, Bao Chiang, *Pierre 1800*, -7-1877, fl. (P; iso in BO, K, L, M, NY).

M. salicifolius Radlk. in Perk., Fragm. Fl. Philip. 1 (1904) 64; Merr., En. Philip. 2 (1923) 513; Radlk., Pfl. R. Heft 98 (1933) 1297. — Type: Philippines, Luzon, Prov. of Rizal, Bosoboso, Morong, *Merrill 1842*, -4-1903, fr. (B, lost; iso in M, US).

M. ellipticus Radlk. in Elm. Leafl. Philip. Bot. 1 (1907) 210; Merr., En. Philip. 2 (1923) 513; Radlk., Pfl. R. Heft 98 (1933) 1294. — Type: Philippines, Leyte, Palo, *Elmer 7272*, -1-1906, fl. (M; iso in A, BO, K).

M. pentapetalus (Roxb.) Radlk. var. *cambodianus* Lecomte, Fl. Gén. I.-C. 1 (1912) 1028; Radlk., Pfl. R. Heft 98 (1933) 1293. — Type: Cambodia, Kompong Thom, Chan Sar (6?), Magnen, *Gourgand & Châtillon s.n.*, some time before 20-10-1909, fl. (P).

M. endotrichus Radlk. in Elm. Leafl. Philip. Bot. 5 (1913) 1615; Merr., En. Philip. 2 (1923) 513; Radlk., Pfl. R. Heft 98 (1933) 1303. — Type: Philippines, Palawan, Puerto Princesa, Mt. Pulgar, *Elmer 12977*, -4-1911, fr. (M; iso in A, BM, BO, FI, K, L, P, U, US).

M. brachyphyllus Radlk., Philip. J. Sc. 8, Bot. (1914) 472; Merr., En. Philip. 2 (1923) 512; Radlk., Pfl. R. Heft 98 (1933) 1304. — Lectotype: Philippines, N. Luzon, Prov. of Bontoc, Bauco, *Vanoverbergh 1175*, alt. 1680 m, 3/5-1911, fl. juv. fr. (M; iso in A, L, P, U, WRLS).

M. sublaevis Radlk., Philip. J. Sc. 20 (1922) 662; Pfl. R. Heft 98 (1933) 1303. — Type: Philippines, Leyte, *Wenzel 660* (*err. 600* in Radlk. ll. cc.), 14-5-1914, fl. (M; iso in A, BM).

Nephelium hosei Ridl., Kew Bull. (1933) 191, type only; Harms, Pfl. R. Heft 98 (1934) 1500. — Type: Borneo, Sarawak, Baram, *Hose 124*, 30-11-1894, fl. (BM? *n.v.*; iso in CGE, L).

M. productus Li, J. Arn. Arb. 25 (1944) 306. — Type: China, Yunnan, Ping-pien Dist., *Tsai 60868*, 14-7-1934, fr. (A, *n.v.*; BO, iso).

M. poilanei Gagnep., Not. Syst. 13 (1947) 33; Fl. Gén. I.-C. Suppl. 1 (1950) 984, f. 125: 11—19. — Lectotype: Vietnam, Annam, Prov. de Quang Tri, Massif Dong Che, *Poilane 10689*, 31-5-1924, fr. (P; iso in BM, K, L).

[*M. poilanei* Gagnep. var. *angustifolius* Gagnep., Not. Syst. 13 (1947) 34, *nom. inval.* (Code 1972, art. 36). — Lectotype: Vietnam, Annam, Prov. de Quang Tri, Massif Dong Che, *Poilane 10715*, 31-5-1924, fr. (P)].

Shrub or tree up to 15(—25) m; puberulous, in all young parts and especially in the inflorescences, brownish-ferruginous, partly glabrescent. *Twigs* (2) 3—9 (12) mm ∅, brownish to reddish-brown, sometimes becoming greyish-brown. *Leaves* with (1) 2—5 (6) leaflets per side; petiole 3—25 cm; petiolules 3—12 mm. *Leaflets* (5—)7—20-(—40) × (1—)2—6(—15) cm, ratio 2—5(—8), widest in or beneath the middle, pergamentaceous to coriaceous; domatia mostly present, along the whole midrib; base rounded or angular; midrib above prominent, angular, sometimes rounded in the basal part, rarely so for its whole length, rather flat and broad in the basal part in big leaflets; nerves (6—)-9—20(—25) per side, angle to midrib 40—90°, at least prominent on the lower face, sometimes hardly distinct from veins; veins and veinlets forming a reticulate pattern variable in density, mostly coarse, above hardly or not prominent, resulting in a smooth, glossy upper face, beneath prominent. *Inflorescences* axillary and pseudoterminal; main axis up to 40 cm; secondary axes 1—20 cm; cymules up to 11 mm, 1—10-flowered; bracts triangular, up to 6 × 1.5 mm, very rarely up to 8 × 4 mm, those of the secondary

axes sometimes caducous. *Calyx* hardly connate, rarely so for up to 25%, lobes 5 (6), triangular to ovate, sometimes slightly imbricate at the base, 0.75—2 × 1—2 mm, subcoriaceous to slightly fleshy, sometimes 1, rarely 3 nerves visible, outside puberulous to pubescent, sometimes very sparsely so in the upper part, inside puberulous, at least at the base as a more or less dense row, sometimes hidden by the margin of the disk. *Petals* 0—5, mostly unequal, ovate to elliptic, minute to 2 × 1 mm, glabrous or pubescent (mostly at the base), not unguiculate, mostly auricled. *Disk* annular, (1—)1.5—2(—3) mm ∅, sometimes irregularly lobed, rarely with lobes protruding between the stamens, puberulous or glabrous *Stamens* 7 or 8, 3—4 mm; filament puberulous, rarely glabrous; thecae papillose, sparsely pubescent or glabrous. *Pistil* puberulous. *Infructescences* up to 40 cm, accrescent or not; calyx mostly accrescent, up to 3.5 × 2 mm, with 1—3 prominulous nerves, glabrescent or not, the hairs inside at the base being nearly always present. *Fruit* (0.8—)1—2(—3) cm, glabrous; stipe 2—11 × 1—2 mm, rarely with tiny lobes at the base alternating with the scars of the stamens; seedbearing part globose to ellipsoid to obovoid, triangular or rarely triquetrous in cross-section, 0.4—1.4 cm ∅, inside glabrous to rarely completely rather densely hairy; endocarp from 2 mm width at either side of the suture to completely sclerenchymatic, usually less so in the fertile than in the sterile cells. *Seed* up to 8(—12) mm, ellipsoid to globose; suture curved; both cotyledons or only the lower one folded, lower one mostly smaller.

INDIA. *Roxburgh s.n.* (BM, several sheets); Khasi Hills, *HB 14472* (BO, U); Gomez, *Wallich Cat. 9035* (A, BM, K); Cherrapunjee, *Koelz 30244* (L); Silhet, *Smith (3041?)*, type of *M. pentapetalus*; *Griffith K. D. 986*; *Wallich Cat. 8108* (BM, K, P); Manipur, Karong, *Watt 7138* (CAL, K, P); Lushai Hills, Hmunta, *Thakur Rup Chand 4339* (L); *Koelz 27618* (L, UC); Chittagong, *MADW 24527* (BO, K, L, NY); Chittagong Hill Tracts, *King's collector 335* (P), *338* (FI, US), *354* (CAL, K, US), *383* (L, P), *442* (CAL), *453* (CAL) (*King's coll. 453* from the Andaman Isl. = *M. sundaicus*), *467* (CAL, SING), *472* (CAL, L, P), *479* (SING, U); *Cowan s.n.* (NY).

BURMA. *Griffith K. D. 987* (A, K, P) (Mal. Pen.?); Kachine State, Bhamo, *Lace 5731* (CAL, K); Shan State, Kiug Zuug, *MacGregor 1248* (CAL); Pegu, *Kurz 2044* (CAL, K); Okkan, *Lace 2904* (K); Rangoon, *Rodger 24* (CAL); Tenasserim, *Gallatly 988* (BM, K); Amherst, *Falconer s.n.* (BO, *U 91836*), *380* (K); Paungdaw, *Keenan c.s. 1251* (K); South Ten., *Parkinson 1982* (K); Mergui, *Maung Po Khant 13457* (CAL).

ANDAMAN ISL. ? *Helfer KD 982/1*, type of *Cupania helferi* Hiern (or from Tenasserim?).

CHINA. Yunnan. Szemao, *Henry 11872, 12978* (K, NY, US); Ping-pien, *Tsai 60868, 60890, 61238, 61310* (A, BO). — Kwangsi. Shap Man Taai Shan (SE. of Shang-sze), *Tsang 22317, 22395, 22557* (BM, P), *24004* (NY). — Kwantung. Luichow Pen., Ting Wu Shan, *Tsiang Ying 747* (K, NY, P, SING, UC).

HAINAN. *Fung 20163, 20193* (BM, BO, K, NY, P, SING, UC, US); *How 70362* (NY, US), *70696* (L, NY, UC), *71045* (L, NY), *73081* (BO); *Lau 3703* (P); *Liang 61521* (K, NY, P, US), *62263* (NY, US); *McClure CCC 9663* (BM, K, P); *Tsang 671* (BM, BO, CAL, K, P, UC, US); *Wang 32896* (NY, P, UC); *Woon Young Chun 6949* (UC).

VIETNAM. Tonkin. Prov. Hai Ninh. Sai Womg Mo Shan, *Tsang 29965, 29804* (BO, K, L, P); Kau Nga Shan, Tien Yen, *Tsang 27532* (K, P); Prov. Lao Kay. Chapa, *Pételot 5448* (P); Prov. Tuyen Quang, *Pételot 1942* (P, UC), *1944* (UC); *Chevalier 37658* (P); Prov. Vinh Yen. *Pételot 4815* (NY, P, US); Prov. Hanoi. Ninh Thai, *Bon 3183, 4157* (P); Prov. Phu Tho, *Chevalier 37694* (P); Prov. Son Tay. Da Chong, *Pételot 5750* (P, US); Thu Phap, Mt. Bavi, *Pételot 6802* (P); *Balansa 3696* (P), *3699* (K, L, P), *3700* (K, P); Prov. Hoa Binh. between Hoa Binh and Vu Ban, *Pételot 6395* (BO, NY, US); Annam. North: Prov. Nghe An. Vinh, *Chevalier 32353, 32363, 32374, 32454* (P); Central Prov. Quang Tri. *Poilane 1051* (BM, L, P), *1163* (BM, P, UC), *10863* (K, P), *13446* (K, P); Massif Dong Che, *Poilane 10562* (K, P), *10689* (BM, K, L, P), *10715* (P), *11267* (K, P), *11313* (K, L, P); Prov. Thua Thien. 'iter Mekong-Hué', *Pierre 1824* (P); *Harmand s.n.*(P); *Poilane 990* (K, P); *Eberhardt 2748* (P); Prov. Quang Nam. Da Nang, *J. & M. S. Clemens 3941* (K, NY, P, UC, US); South: Prov. Djiring, Haut Donaï, Djiring, *Poilane 23947* (BM, K, P), *24250* (K, L, P), *24359* (BM, K, L, P); Blao, *Poilane 22068* (P, UC); near Louang, *Poilane 22652* (BM, K, L, P); Cochin Chine, Prov. Bien Hoa, Bao Chiang, *Pierre 1800* (BO, K, L, M, NY, P).

LAOS. Phong Saly, *Poilane 26015* (K, P); Xieng Khouang, Pu Muten, *Kerr 21169* (L, P); near Savannakhet, *Poilane 16323, 16331* (K, P); near Lao Bao, *Poilane 12119* (P), *13287* (K, P).

CAMBODIA. Kompong Thom, *Gourgand c.s.*, type of *M. pentapetalus* var. *cambodianus*; Tpong (Kas Kong), *Pierre 620*, type of *M. loureiri*; *Martin 441* (P).

THAILAND. *Bunchuai 1630* (K, L, P); *Geesink 5021* (BFK, C, E, K, L, P), *7122* (BFK, C, E, K, L, P); *Hansen & Smitinand 12943* (C, K, L, P); *Kerr 1823* (K, M), *3210* (K), *4972* (K, L, P), *5045* (K), *5512* (K, UC), *6911* (K), *8880* (K, P, UC), *11014* (K), *16032* (K, L, P); *Kostermans, Khwae Noi Basin exp. no. 792* (K, L); *Marcan 1292* (BM); *Phusomsaeng 168* (K, L, P); *Put 1313* (K, L), *3836* (K).

MALAY PENINSULA. About 70 collections from all parts of the Peninsula.

SUMATRA. *Teysmann s.n.* (*MEL 56023*). — North: Atjeh, G. Leuser, *De Wilde & De Wilde-Duyfjes 13902* (K, L); Simeuluë Isl., *Achmad 805, 1571, 1609* (BO, L). — Central. Pajakumbuh, Mt. Sago, *Meijer 3667* (BO, L), *7462* (L); Padang, *herb. Pierre 5936* (P); *Teysmann 609* (BO, SING, U); *Beccari 722* (BM, K, L, MEL); near Indrapura, *n.n.*, type of *M. sumatranus* Radlk.; Djambi, *NIFS bh 14115* (BO). — East coast: *Yates 1305* (A, BM, BO, L, NY, P, UC, US), *1369* (BO, BRI, NY, UC). — South: Palembang, *Forbes 2475* (BM, L); *Kostermans 150* (BO, L, P); Prov. Lampung, Mt. Tanggamus, *Jacobs 8087* (A, K, L). — Belitung. *Van Rossum 64* (BO, K, L); Mangar, *Teysmann s.n.* (BO).

JAVA. About 70 collections from the western part as far as G. Willis.

BORNEO. *Beccari PB 452* (K, P). — Sabah. West: Kudat, *NBFD SAN 51105* (K, L); Ranau, Mt. Kinabalu, *SF 26954* (SING); *NBFD SAN 56255, 56332* (K, L); Beaufort, *NBFD SAN 34594* (K, L); Tenom, *NBFD SAN 43029* (K, L); Sipitang, *NBFD SAN 16635* (BO, K, L); East: Elopura, *NBFD 10166* (A,BO. BRI, CANB, K, L, P, US); Sandakan, *NBFD SAN 75365* (K, L); *Elmer 20371* (A, BM, BO, K, L, M,NY, SING, U, UC); *Ramos 1916* (A, BO, K, L, P, UC, US); Kinabatangan, *Arsat 1056* (NY, SING); *Evangelista 867* (A, NY), *1235* (K); Lahad Datu, *NBFD SAN 29333* (BO, K, L); Semporna, *NBFD SAN 63786* (K, L); Tawau, *NBFD SAN 37018* (K, L). — Sarawak. North: Lawas, *S. 31540* (A, BO, K, L, SAN, SAR, SING); Baram, *Hose 124* (BM, CGE, L); *Chew Wee-lek 1000* (K, L, UC); West: near Kuching, *Haviland 2240, 2246, 2258* (BM, K, L, SING); Sampadi Hill, *Native Collector 5221* (NY). — Kalimantan. West: Semedoem, *Hallier 686* (BO); Central: near G. Kelam, *Hallier 2524* (BO, L); S. Kenepai, *Hallier 2011* (BO); Bloe-oe, *Jaheri 1454* (BO, L); Northeast: Tikoeng, *Amdjah 974* (BO, L); East: W. Kutai, Kemoel, *Endert 4495* (BO, K, L); Balikpapan, *Kostermans 4402* (BM, BO, K, L, P, SING).

PHILIPPINES. About 90 collections from all parts of the archipelago.

Ecology: Primary and secondary forest, alt. (300—)800—2000 m. Fl. and fr. throughout the year, but the main periods different in various regions, *e.g.* India: fl. March—April, fr. August—Sept.; Java: fl. Nov., fr. Jan.—March; Philippines: fl. March—May, fr. March—June.

Note: In *M. pentapetalus* many former species are included. Two of these, *M. endotrichus* and *M. brachyphyllus*, were distinguished by the presence of a hairy endocarp (see: Notes on morphology). Further species were differentiated on the variation in the petals. However, the whole variation, from 5 well-developed auricled petals via 5 or less reduced not auricled ones, to petals absent, could be found in each of these species. Hence, the epithet of *M. pentapetalus* is rather a misleading one.

Also the broad variation in the leaflets led Radlkofer and other authors to the description of some more species. Some epithets which show this clearly are *brachyphyllus, ellipticus, fuscescens, salicifolius*, and *sublaevis* (as well as several unpublished ones: *ochraceus, phanerodictyus*, and *rigidifolius*). *M. sumatranus* has leaflets with many pronounced nerves; however, this variation appeared to be widespread (SE. Asia, Sumatra, Borneo, and Luzon). Leaflets of the kind of *M. fuscescens*, with few mostly less pronounced nerves, occur throughout western Malaysia. The variation is extreme in N. Borneo and the Philippines. Relatively many species were described from the latter ecologically very varying region. The range of the leaflet ratio varies here from 2 to 8 (*M. ellipticus* and *M. salicifolius* resp.). The size of the leaflets ranges from 2 × 5 up to 15 × 38 cm. Collections of the *salicifolius* type are widespread in the Philippines. The *ellipticus* type mostly comes from Samar, Leyte, Negros, and northern Mindanao, and is outside the Philippines also represented in Indo-China (*M. pentapetalus* var. *cambodianus*). However, flowers and fruits, with their variations, are not different from those from India, China, Java, or elsewhere. Notwithstanding all this variation *M. pentapetalus* is a well-defined species.

See also notes under *M. sundaicus*: '*M. sundaicus* in Celebes' and 'Hybridisation' and notes under 'Dubious names'.

Mischocarpus pyriformis (F. v. M.) Radlk. — **Fig. 2a.**

M. pyriformis (F. v. M.) Radlk., Sapind. Holl.-Ind. (1879) 43; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 536, 647; Maiden & Betche, Cens. N. S. W. Pl. (1916) 129; Domin, Bibl. Bot. 22 (1927) 910; Francis, Austr. Rain For. Tr. (1929) 235; ed. 2 (1951) 261; Radlk., Pfl. R. Heft 98 (1933) 1305; Merr. & Perry, J. Arn. Arb. 21 (1940) 523; *non* C. T. White, Contr. Arn. 4 (1933) 63 (= *M. sundaicus* Bl.). — *Schmidelia pyriformis* F. v. M., Fragm. 1 (1858) 2, *comb. illeg.* (Code 1972, art. 43). — *Cupania pyriformis* F. v. M., Fragm. 2 (1860) 76; Fragm. 5 (1865) 147; Fragm. 9 (1875) 90; Ch. Moore, Fl. N.S.W. (1893) 91. — *Ratonia pyriformis* Benth., Fl. Austr. 1 (1863) 461; Walp., Ann. 7 (1869) 627; F. M. Bail., Proc. Roy. Soc. Queensl. 1 (1884) 64; J. H. Maiden, Usef. Nat. Pl. Austr. (1889) 593; F. M. Bail., Queensl. Fl. (1899) 296. — L e c t o t y p e: Queensland, Moreton Bay, *Hill & Mueller s.n.*, fr. (*MEL 56010*; iso in K, M, MEL).

?*Cupania laurifolia* Ettingshausen, Blatt-Skel. Dikot. (1861) 145, t. 57: 9. — T y p e: Skeleton of leaflets of a collection from 'Neuholland' (W, *n.v.*; *BRI 71253*, probably iso, labelled *C. laurifolia A. Cunningham 24, Hastings R., N.S.W., May 1819*).

M. papuanus Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 20 (1890) 268; Bot. Jahrb. 56 (1920) 304; Fedde Rep. 20 (1924) 39; Pfl. R. Heft 98 (1933) 1307; Van Royen, Man. For. Trees Papua & New Guinea 2 (1964) f. 14. — T y p e: SE. New Guinea, *Chalmers s.n.*, 1885, fr. (M).

M. retusus Radlk., Bot. Jahrb. 56 (1920) 304, f. 4A—F; Pfl. R. Heft 98 (1933) 1308, f. 38A—F. — L e c t o t y p e: New Guinea, East Sepik Dist., Hunsteinspitze, Kaiserin Augusta-Fluss-Exped., *Ledermann 11231*, alt. 1350 m, -2-1913, fl. (B. lost; M. iso).

M. montanus C. T. White, Proc. R. Soc. Queensl. 47 (1936) 56. — T y p e: Queensland, Thornton Peak, *Brass 2293*, alt. 1200—1350 m, 14-3-1932, fl. (BRI; iso in SING, US).

Shrub or tree up to 30 m; puberulous, glabrescent. *Twigs* 1.5—6 mm ∅. *Leaves* with 1—4 leaflets per side; petiole 1—8 cm; petiolules 4—18(—25) mm. *Leaflets* 3.5—18 × 1.2—7 cm, ratio 2—3.5, widest in or beneath the middle, pergamentaceous to coriaceous; domatia present or absent, sometimes conspicuous, mostly restricted to the basal half of the midrib; base acute to blunt, sometimes rounded, margin flat to revolute; apex angular or rounded, retuse or not, sometimes emarginate, acuminate or not; midrib above either not visible, hidden in a narrow groove by the adjacent parts of the leaflet, or (locally) visible as a slender, sunken to prominulous line, sometimes puberulous, beneath prominent till the apex, mostly very shortly mucronate, sometimes puberulous; nerves 6—15 per side, angle to midrib 50—90°, moderately, sometimes irregularly curved, above prominulous or slightly sunk, sometimes hardly distinct from venation, beneath prominent to prominulous; veins above prominulous to sunken, beneath prominent to prominulous; veinlets rather densely reticulate, above either not visible, or inconspicuous and sometimes prominulous, beneath prominulous, flattened in older leaflets. *Inflorescences* axillary and pseudoterminal, up to 25 cm, axes branched; cymules often crowded to the end of the axes; bracts triangular, up to 1.5 mm. *Calyx* cup-shaped, up to 2 mm, connate for 35—65%; lobes triangular, 0.3—0.8 mm, subcoriaceous, outside densely appressedly short-hairy especially in the upper half, inside glabrous or puberulous. *Petals* 0—5, up to 1.5 mm, unguiculate for 35—75%, variably hairy, ciliate, mainly on the claw and on and between scales or auricles; plate varying from triangular to rhomboid to elliptic to ovate, mostly with 2 scales or auricles at the base, mostly with 2 or 3 rounded or acute lobes at the apex; claw mostly clearly tubular, split inside. *Disk* annular to cup-shaped, complete, lobed, or once or several times interrupted, 0.5—1 mm ∅, glabrous. *Stamens* (7) 8, up to 3 mm; filament pubescent; thecae papillose, pubescent to puberulous or glabrous. *Pistil* stiped; stipe mostly grooved, with hairs in rows, glabrous near the base; ovary not grooved, appressedly short-hairy mainly in the upper half. *Infructescences* not or slightly accrescent, distinctly or sparsely ferruginous short-hairy or glabrescent. *Fruit* up to 3.5 cm, glabrous; stipe up to 2.5 cm long by 1.5 mm ∅ at the base; seedbearing part globose to ellipsoid, rounded to triangular in cross-section, up to 1 cm ∅, apiculate; endocarp partly or completely sclerenchymatic, glabrous or sometimes locally hairy. *Seed* ellipsoid, up to 7 mm; suture curved; lower cotyledon folded, mostly smaller than the upper one.

Note: *M. pyriformis*, *M. retusus*, *M. papuanus*, and *M. montanus*, hitherto considered good, though closely related species, have all been combined here. The morphological differences are very slight as compared with other species in the present genus; *M. montanus* is even found identical with *M. retusus*. The remaining three entities appeared to replace each other either geographically, or altitudinally. Consequently, they are ranked as subspecies.

KEY TO THE SUBSPECIES

1a. Domatia absent; midrib above not sunk between the adjacent parts of the leaflet, visible as a slender, flattened to prominulous line; calyx connate for one half or less; stalk of fruit 4—8 mm. . . . . subsp. **pyriformis**

b. Domatia mostly present in at least part of the leaflets; midrib sunk above, hidden by the adjacent parts of the leaflet, rarely (locally) visible as a sunken, very slender line; calyx connate for one half or more; stalk of fruit 10—25 mm 2

2a. Leaflets not or very shortly acuminate; domatia 1 or 2(—7), mostly conspicuous, very rarely absent; thecae hairy; disk *c.* 1 mm ∅ . . . . . subsp. **retusus**

b. Leaflets with long and slender acumen, or acumen rarely short and broad; domatia either 1 or 2, mostly small, or absent; thecae glabrous or sometimes with a few hairs; disk 0.5—1 mm ∅ . . . . . subsp. **papuanus**

subsp. **pyriformis** — *Schmidelia pyriformis* F. v. M.

Shrub or tree up to 27 m. *Twigs* 2—6 mm ∅. *Leaves* with (1) 2—4 leaflets per side; petiole 2—8 cm; petiolules 5—18(—25) mm. *Leaflets* 4—18 × 1.8—7 cm, ratio 2—3, widest at or sometimes slightly beneath the middle, pergamentaceous to subcoriaceous; domatia absent; base rounded or blunt to acute; margin flat or slightly revolute; apex angular, acuminate, acumen short and broad, slightly retuse; midrib above visible as a slender, prominulous to flattened line, sometimes puberulous; nerves 7—15 per side, angle to midrib 50—80°, sometimes irregularly curved, prominulous above, beneath prominulous to prominent, sometimes hardly distinct from venation; veins prominulous above, prominent beneath; veinlets prominulous, equal on both faces. *Inflorescences* up to 25 cm. *Calyx* connate for 35—50%; lobes 0.5—0.75 mm, inside glabrous. *Petals* (0) 5, up to 1.5 mm, scaled or auricled. *Disk* annular to cup-shaped, *c.* 1 mm ∅. *Stamens* 8; thecae pubescent to nearly glabrous. *Infructescences* distinctly short-hairy. *Fruit* up to 2 cm; stipe (4—)5—8 mm long, up to 1.5 mm ∅ at the base; seedbearing part up to 8 mm ∅; endocarp sometimes locally hairy.

AUSTRALIA. Queensland. 17.20 S, 145.25 E, *Hyland 01638* (BRI); between Atherton and Herberton, *Hoogland 8552* (CANB, L); Evelyn, *J. F. Bailey* (*BRI 071246*); Byfield near Keppel Bay, *C. T. White 8141* (BRI); Mt. Bauple, *C. T. White 3487* (BO, BRI, SING); Fraser Isl., *Webb & Tracey 6326* (BRI), *C. T. White 1203* (BRI, K), *Hubbard 4388* (BRI, K, L); Kin Kin, *C. T. White* (*BRI 071261*); Moreton Bay, *Eaves* (*MEL 56016*), *Hill & Mueller*, type, *Leichhardt* (*MEL 56009*); near Mt. Glorious, *Hoogland 5240* (CANB, K); Logan R,. *Eaves* (*MEL 56011*); near Brisbane, *Hill* (*MEL 56008*); Brisbane R., *Cunningham 49* (K), *50* (BM); Nerang R., *C. T. White* (*BRI 071249*, NSW); Clarence & Richmond R., *Moore 12* (K, MEL), *45* (K); Tweed, *Guilfoyle* (*MEL 56015*); Tweed R., *Eaves* (*MEL 56014*). — New South Wales. Bungaby, Casino, *McAuliffe* (*NSW 133884*); Lismore, *Rothwell* (*NSW 133885*); Mullumbimby, *N. N.* (*NSW 133886*); Iluka near MacLean, *Coveny 2180* (BRI, K, L, NSW); Hayes, *Turner* and *McGillivray 2670* (NSW), *Williams* (*NSW 133891*); Brooklana, *Cromer* (*NSW 133892*); Urunga, *Swain* (*NSW 133895*); Bellinger R., *Swain* (*NSW 133893, 133894*); MacLeay R., *Boorman* (*NSW 133896*); Nambucca Heads, *Boorman 22340* (NSW); Port MacQuarie, *Brown* (*NSW 133897*), *Fraser* (*NSW 133898*); Hastings R., *Cunningham 24* (BRI), *Brown* (*NSW 133899*); Seal Rocks, near Bulahdelah, *Briggs* (*NSW 133901*), *Johnson & Briggs* (*NSW 133900*).

E c o l o g y: In rain forest and on rather dry hill sides, 0—1200 m alt. Fl. April—June, fr. May—Nov.

subsp. **papuanus** (Radlk.) Van der Ham, *stat. nov.* — *M. papuanus* Radlk. — **Fig. 2a.**

Shrub or tree up to 30 m. *Twigs* 1.5—4 mm ∅. *Leaves* with (1) 2 or 3 (4) leaflets per side; petiole 2—8 cm; petiolules 4—20 mm. *Leaflets* 5—16×2—6 cm, ratio 2—3, widest in or beneath the middle, pergamentaceous to subcoriaceous; domatia, if present, 1 or 2, mostly restricted to the lower half of the midrib, small, base acute to blunt, sometimes rounded; margin flat; apex angular, acuminate, acumen long and slender (rarely short and broad), slightly retuse; midrib above not visible or locally rarely so as a very slender sunken line; nerves 7—15 per side, angle to midrib 60—80°, above nearly always slightly sunk, at least at the midrib, beneath prominent; veins above at most prominulous, mostly sunk near the margin, beneath prominulous to prominent; veinlets prominulous, above less conspicuous than beneath. *Inflorescences* up to 20 cm, laxly branched. *Calyx* connate for 50—65%; lobes up to 0.5 mm, inside glabrous or rarely with a few hairs. *Petals* 1—5, up to 1 mm; scales or auricles mostly present. *Disk* cup-shaped, 0.5—1 mm ∅. *Stamens* 7 or 8; thecae glabrous or with a few hairs. *Infructescences* sparsely short-hairy or glabrescent. *Fruit* up to 3.5 cm; stipe (10—)15—25 mm long, up to 1 mm ∅ at the base; seedbearing part up to 1 cm ∅; endocarp glabrous.

NEW GUINEA. W e s t. Vogelkop Dist.: Ajamaru, *BW 15252* (A, BO, BRI, CANB, K, L, LAE, US); Mt. Nettoti, *Van Royen & Sleumer 7931* (A, BO, CANB, K, L, LAE); S. Manokwari, Mt. Krabo, *BW 10779* (L, LAE); Geelvink Bay Dist.: Wandammen Pen., Wondiwoi Mts., *BW 10401, 12373, 12374, 12375, 12379, 12380, 13382* (L); Djajapura Dist.: Idenburg R., near Bernhard Camp, *Brass & Versteegh 13157* (A, BO, BRI, L); Cycloop Mts., *BW 4276* (A, BO, CANB, K, L). — E a s t. Western Dist.: Tarara, Wassi Kussa R., *Brass 8508* (A, BO, BRI, L); Gulf Dist.: near mouth of Vailala R., *Pullen 6477* (CANB, L, LAE); Morobe Dist.: near Bulolo, *NGF 7454* (BM, BO, CANB, K, L, US), *9180* (BO, CANB, L), *10154* (A, BM, BO, BRI, CANB, K, L), *12236* (BO, CANB, K, L), *12768* (CANB, K), *19077* (A, BRI, CANB, K, L); Yamap, *NGF 44054* (CANB, K, L, LAE); Buso R., *NGF 47775* (A, BO, BRI, CANB, K, L, LAE); Kajabit Mission, *Clemens 10737* (A, UC); 'S New Guinea', *Chalmer s.n.* (M).

E c o l o g y: Primary rain forest, 0—1200(—1800) m alt. Fl. March—July, fr. March, April, August.

subsp. **retusus** (Radlk.) Van der Ham, *stat. nov.* — *Mischocarpus retusus* Radlk. — *M. montanus* C. T. White.

Shrub or tree up to 30 m. *Twigs* 2—3 mm ∅. *Leaves* with 1 or 2 (3) leaflets per side; petiole 1—5 cm; petiolules 4—18 mm. *Leaflets* 3.5—13×1.2—4.5 cm, ratio 2—3.5, widest about the middle, coriaceous; domatia mostly conspicuous, 1 or 2(—7), mostly restricted to the basal half of the midrib, very rarely absent; base acute; margin flat to revolute; apex angular or rounded, retuse to emarginate, not or only slightly acuminate; midrib above either not visible, or rarely so as a very slender sunken line; nerves 6—12 per side, angle to midrib 60—90°, above slightly sunk or upper face smooth, prominent beneath; veins above at most prominulous, mostly sunk naer the margin, prominent beneath; veinlets above not prominent, smooth, beneath prominulous, flattened in older leaflets. *Inflorescences* up to 15 cm. *Calyx* connate for 50—65%; lobes up to 0.8 mm, inside puberulous or glabrous. *Petals* 4 or 5, up to 1.5 mm, scaled or auricled. *Disk* cup-shaped, *c.* 1 mm ∅. *Stamens* 8; thecae puberulous. *Infructescences* sparsely short-hairy. *Fruit* up to 2.5 cm; stalk 10—17(—20) mm long, up to 1.5 mm ∅ at the base; seedbearing part up to 8 mm ∅; endocarp sometimes with a few hairs.

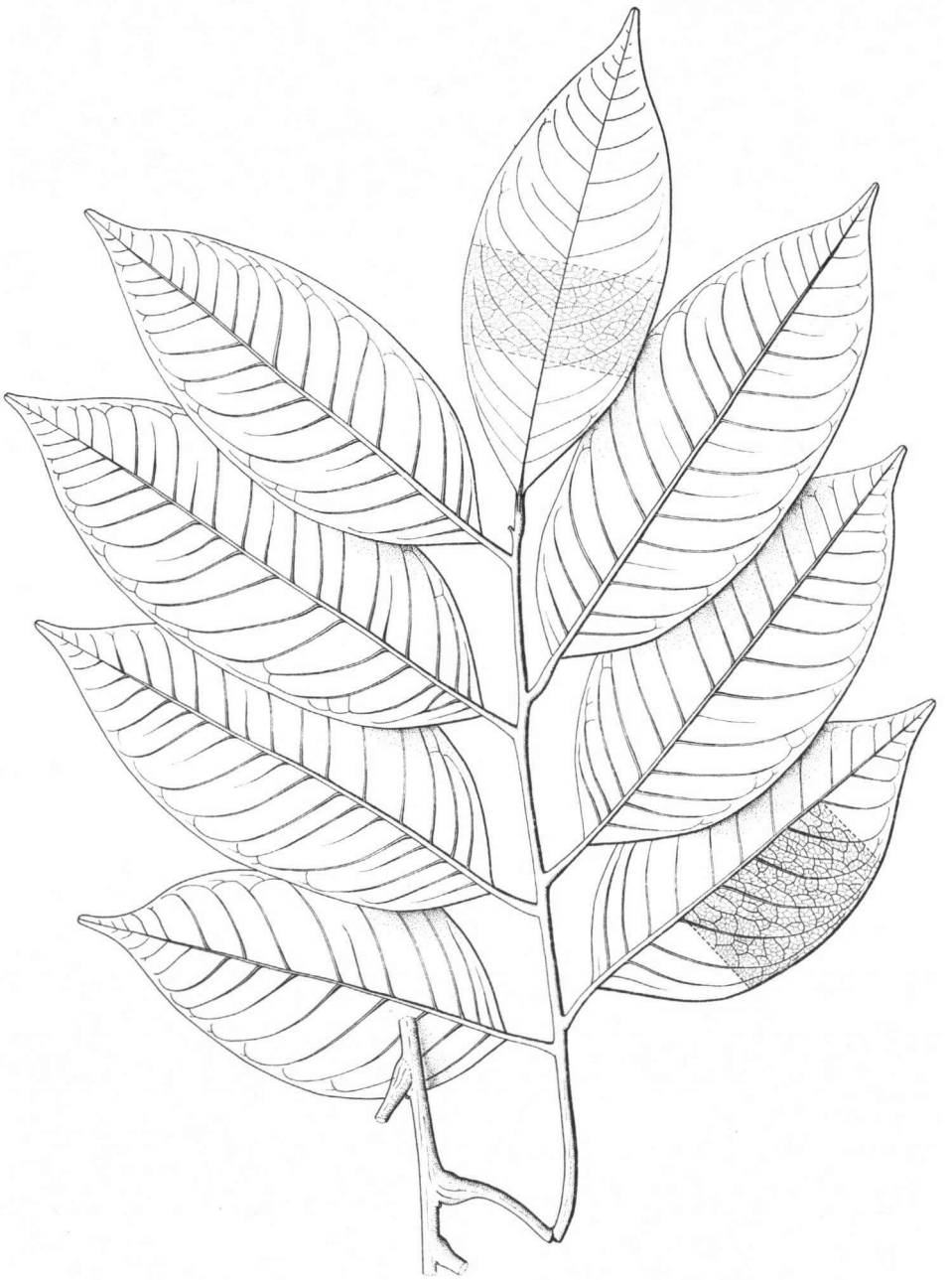

Fig. 4. *Mischocarpus reticulatus* — Part of twig with leaf (top leaflet from above) × ½ (from *Hartley 12423*).

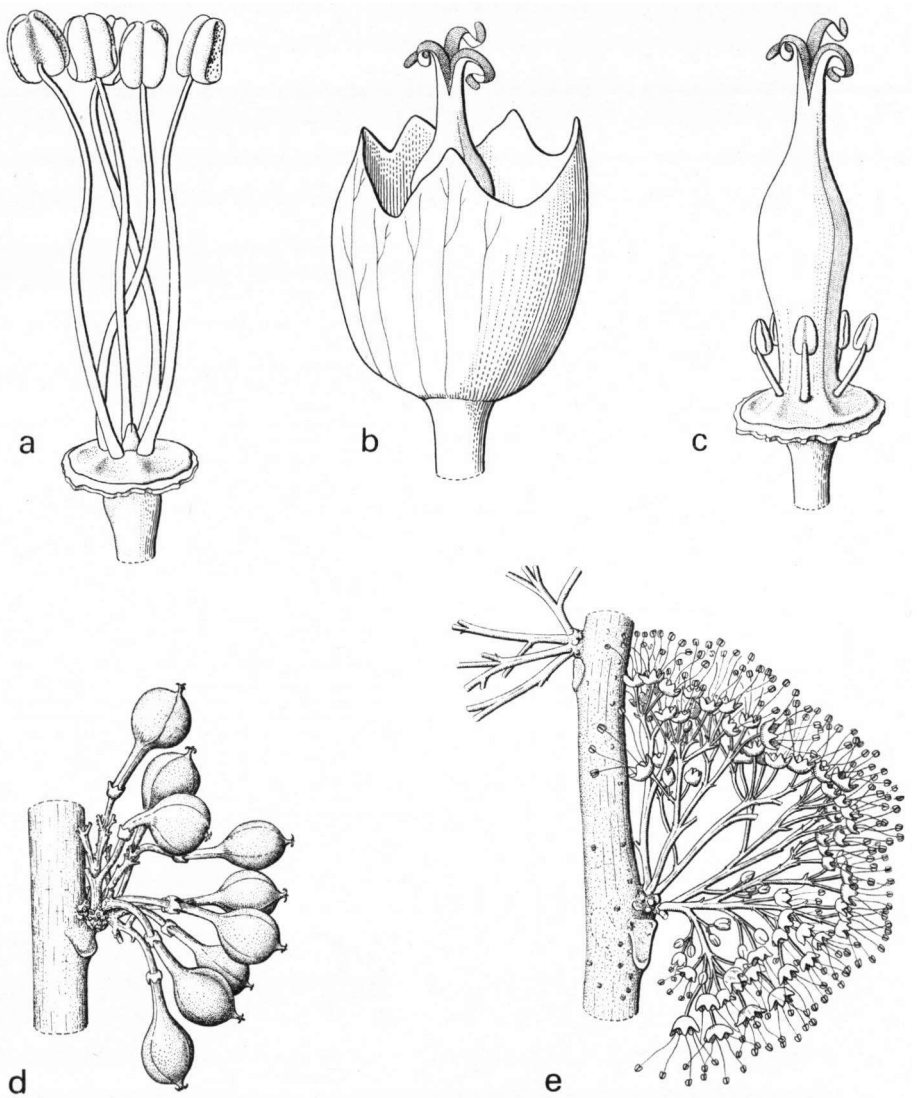

Fig. 5. *Mischocarpus reticulatus* — a. male flower, ×7; b. female flower with calyx, ×7; c. female flower without calyx, ×7; d. infructescence with ripe fruits, ×$\frac{3}{4}$; e. male inflorescence, ×$\frac{3}{4}$. (a and e from *Hartley 12534*; b and c from *Carr 14994*; d from *Clemens 8619*).

NEW GUINEA. West. Djajapura Dist.: Lake Habbema, *Brass & Versteegh 10481* (A, BO, L); Snow Mountains Dist.: Baliem Valley, Wellesey, *Kostermans & Soegeng 715* (A, BO, CANB, K, L, LAE, P), *779* (A, BO, K, L). — East. E. Sepik Dist.: *Ledermann 11231* (M); Western Dist.: Kiunga Subdist., *NGF 42832* (A, BRI, CANB, K, L, LAE); W. Highlands Dist.: near Wabag, *ANU 2357* (A, K, L, LAE); Minj Subdist., Upper Nona R., *Saunders 749* (A, BM, CANB, L, LAE); Upper Minj R., *Pullen 275* (BM, CANB, L, LAE); S. Highlands Dist.: Lei R., Mt. Ambua, *Kalkman 5192* (CANB, K, L, LAE); near Mt. Ne, *NGF 28455* (A, BO, BRI, CANB, K, L, SING, US); E. of Mendi, *Pullen 2690* (CANB, L, LAE); E. Iaro R., Mt. Giluwe, *LAE 60921* (A, BRI, CANB, K, L); Mt. Bosavi, *Jacobs 8932* (BO, CANB, L, LAE); Morobe Dist.: Sattelberg, *Clemens 5232* (A, L), *7561a* (A, CANB, L), *7691* (A, B, BRI, CANB, L); Kasanombe, *NGF 36981* (A, BRI, CANB, K, L); Wau, Edie Creek, *Hartley 12603* (A, CANB, K, L, LAE, P); Mt. Kaindi, *NGF 16037* (BO, CANB, K, L, LAE), *17275* (A, BO, BRI, CANB, K, L, LAE), *23664* (CANB, K, L, LAE), *27003* (A, CANB, K, L, LAE); near Aseki, *Schodde & Craven 4868* (BRI, CANB, K, L, LAE); Lake Trist, *NGF 29009, 29021* (A, BRI, CANB, K, L, LAE); Wagau, *NGF 17830* (A, BRI, CANB, K, L, LAE); Milne Bay Dist.: between Agaun and Bonenau, *Pullen 7959* (CANB, L, LAE); Fergusson Isl.: *Brass 26089* (A, CANB, K, L, LAE).

AUSTRALIA. Queensland. Thornton Peak, *Brass 2293* (BRI, SING, US); *Brass & White 291* (BRI, NY).

Ecology: Primary forest at (1000—)1300—3000 m. Fl. and fr. the whole year round.

Note: The three subspecies are not only different in morphological characters, they are also separated in altitudinal or geographical sense.

Subsp. *pyriformis* more or less replaces the New Guinea lowland subsp. *papuanus* in Australia. The New Guinea montane subsp. *retusus* is found in identical form in N. Queensland, Thornton Peak (*M. montanus*). As there are no high mountains further south and remembering the lowering of the montane climate zone going from the equator southwards, we can understand that south of Thornton Peak *M. pyriformis* is not differentiated in the subspecies.

Morphological differences between lowland and montane forms mostly lie in adaptations to altitude. Difficulties can arise when collections of subspecies in which these altitudinal characters are genetically fixed occur outside the altitudinal range of the subspecies. Especially vegetative characters can be phenotypically adapted and so have the appearance of those in the other subspecies. When such collections are sterile it is hardly possible to decide which subspecies is represented. Some collections from the Vogelkop Peninsula, New Guinea, show such a mixture of characters which further east are typical for subsp. *retusus* and subsp. *papuanus* respectively. In the former region these subspecies are very close, in the latter the differences are much more constant and the characters seem rather independent of altitude.

Subsp. *pyriformis* is the more distinct one.

Mischocarpus reticulatus (Radlk.) Van der Ham, *comb. nov.* — **Fig. 2k, 4, 5.**

Mischocodon reticulatus Radlk., Bot. Jahrb. 50 (1913) 80; 56 (1920) 308; Pfl. R. Heft 98 (1933) 1328; Merr. & Perry, J. Arn. Arb. 21 (1940) 524; Van Royen, Man. For. Trees Papua & New Guinea 2 (1964) 33; Hartley *c.s.*, Lloydia 36 (1973) 270. — Lectotype: New Guinea, Kaiser Wilhelmsland, Kani Gebirge, *Schlechter 17683*, -5-1908, fl. (B, lost; M, iso).

Tree up to 15 m high by 0.75 m stem diam.; puberulous, early glabrescent. *Twigs* 4—7 mm ∅, slightly grooved. *Leaves* with 2—4 leaflets per side; petiole 7—20 cm; petiolules 7—14 mm. *Leaflets* 7—28 × 3.5—10.5 cm, ratio 2—3.2, widest in or beneath the middle, pergamentaceous to subcoriaceous, slightly bullate, ± glossy above; domatia small, along the whole midrib, sometimes also in the axils of the intercalated veins, base acute to blunt or rounded; midrib prominent above, angular or locally obtuse, (sub)-glabrous, beneath sometimes puberulous; nerves 10—14 per side, angle to midrib 50—90°,

moderately curved, prominent on both faces; veins and veinlets prominent above and beneath, veinlets sometimes prominulous above. *Inflorescences* ramiflorous, on branches 6—10 (or more?) mm ∅, probably also cauliflorous, once, moreover, an axillary one present; axes up to 5 cm, branched, ferruginous puberulous; flowers solitary or rarely in pairs; pedicels up to 5 mm; bracts lanceolate to ovate, up to 3 mm. *Calyx* cup-shaped, 3—5 mm, showy, connate for 50—75%, membranaceous, greenish-white; lobes triangular, up to 2×2 mm, with 3 or 5 nerves, outside sparsely pubescent, inside glabrous or with a few hairs near the base. *Petals* absent. *Disk* annular to pentagonal, broad, nearly completely covering the receptacle, surrounding the base of the stamens, confluent with the base of the pistil, 2—3 mm ∅, glabrous or laterally puberulous. *Stamens* 5—7; filament up to 11 mm, filiform, glabrous; thecae smooth or sometimes papillose at the apex, glabrous. *Pistil* glabrous or sparsely hairy, distinctly angular in cross-section; style with 1—1.5 mm long, recurved, twisted stigmatic lobes. *Infructescences* not accrescent. *Fruit* up to 2.5 cm, glabrous; calyx still present, not accrescent; stipe 5—14×1.5 mm; seedbearing part globose, up to 1 cm ∅, apiculate for 1—2 mm, inside glabrous; endocarp incompletely sclerenchymatic for twothirds of the width of a valve. *Seed* ripe not known.

NEW GUINEA. East. Madang Dist.: *Schlechter 17683* (M), *17767* (M, P); E. Highlands Dist.: Sassaura, *Hartley 12423* (CANB, L); Arau, *Brass 32249* (K, L, NY, US); Morobe Dist.: near Lae, *NGF 14313* (CANB, K, L); Mt. Shungol, *Hartley 12534* (CANB, L); S. of Wau, *Hartley 12237* (CANB, K, L); Sattelberg, *Clemens 1933a, 3093* (A), *8073* (A, B); Boana, *Clemens 8446* (A, L), *8619* (B, L); near Kajabit Mission, *Clemens 10578* (A); Central Dist.: Boridi, *Carr 14994* (BM, K, L, SING).

Ecology: Mountain rain forest from 600—1650 m. Fl. March, May, Sept.—Dec.; fr. July, August, Oct.

Mischocarpus sundaicus Bl. — **Fig. 1a—b, 2d.**

M. sundaicus Bl., Bijdr. (1825) 238; Rumphia 3 (1849) 167; Radlk., Sapind. Holl.-Ind. (1879) 12, 91; Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 9 (1879) 646; King, J. As. Soc. Beng. 65, 2 (1896) 447; K. & V., Bijdr. Booms. 9 (1903) 223; Backer, Fl. Bat. 1 (1907) 352; Lecomte, Fl. Gén. I.-C. 1 (1912) 1029, f. 128; Koorders & Schumm., Syst. Verz. 1, Java (1912) fam. 165, p. 13; 2, Sumatra (1910) fam. 165, 5; Radlk., Bot. Jahrb. 56 (1920) 303; Merr., En. Philip. 2 (1923) 513; Craib, Fl. Siam. En. 1 (1926) 333; Radlk., Pfl. R. Heft 98 (1933) 1299; Burk., Dict. (1935) 1479; Elm., Leafl. Philip. Bot. 10 (1939) 3809; Corner, Ways. Trees (1940) 589, f. 211, 212; Adelb., Blumea 6 (1948) 324; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 986; Meyer Drees, Comm. For. Res. Inst. 33 (1951) 109; Backer & Bakh. *f.*, Fl. Java 2 (1965) 141. — *Cupania lessertiana* Cambess., Mém. Mus. Hist. Nat. Paris 18 (1829) 28, 46, t. 3, *comb. illeg.* (Code 1972, art. 63); Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 678. — *Cupania mischocarpus* Steud., Nomencl. ed. 2, 1 (1840) 454, *comb. illeg.* (Code 1972, art. 63). — *Ratonia lessertiana* Turcz., Bull. Soc. Nat. Mosc. 36 (1863) 587, *comb. illeg.* (Code 1972, art. 63). — *Pedicellia sundaica* Pierre, Fl. Coch. (1895) t. 323B. — Lectotype: Java, Nusa Kambangan, *N.N.*, fr. (*L 908.269—749*).

Schleichera revoluta Turcz., Bull. Soc. Nat. Mosc. 21 (1848) 574. — *Cupania revoluta* Rolfe, J. Bot. 23 (1885) 211; Vidal, Phan. Cuming. (1885) 49, 105; *non* Radlk., Fl. Bras. 13, 3 (1900) 577, *comb. illeg.* (Code 1972, art. 64). — Type: Philippines, Luzon, Prov. of Nueva Ecija, *Cuming 1387, c.* 1836, fl. (KW, *n.v.*; iso in BM, K, L, P).

Cupania erythrorhachis Miq., Sum. (1861) 199, 509. — Type: Sumatra, Prov. of Lampong, near Teganennin, *Teysmann 4557, c.* 1858. fl. (U; iso in BO, K, L, M).

M. lessertianus Ridl., Fl. Mal. Pen. 1 (1922) 508; Burk., Dict. (1935) 1479. — Lectotype: Malay Peninsula, Singapore, Changi, *Ridley 1908*, -10-1890, fr. (SING).

[*M. vulcanicus* Elmer *ex* Merr., En. Philip. 2 (1923) 513, *nom. nud.*; Leafl. Philip. Bot. 10 (1939) 3809, *nom. nud.* — Syntypes: Philippines, Luzon, Prov. of Sorsogon, Irosin, Mt. Bulusan, *Elmer 17092, 17116*, -8-1916, fl., fr. (PNH, lost; iso in A, BM, BO, FI, K, L, NY, P, U, UC, US].

M. pyriformis auct. non Radlk.: C. T. White, Contr. Arn. Arb. 4 (1933) 63.

Shrub or tree up to 10(—30) m; puberulous in the young parts and inflorescences. *Twigs* 1.5—5 mm ∅, mostly reddish-brown. *Leaves* with 1—3 (4) leaflets per side or

very rarely simple; petiole 1—11 cm, sometimes dorsi-ventrally flattened (especially in Australia); petiolules 3—8 mm. *Leaflets* 4—17(—26) × 1.5—7(—10)cm, ratio 2—4.5, widest in or beneath the middle, pergamentaceous to subcoriaceous, upper face mostly glossy; domatia mostly present, along the whole midrib; base rounded or angular; margin sometimes slightly revolute; midrib prominent above, broad to rather narrow, mostly rounded, often locally angular, sometimes so over its whole length; nerves 8—15 per side, angle to midrib 60—90°, moderately curved, beneath prominent; veins beneath more prominent to the margin; veinlets nearly always forming a very dense reticulum, beneath prominulous to prominent; nerves, veins, and veinlets above prominulous or upper face smooth. *Inflorescences* axillary and pseudoterminal, 1.5—25 cm, branched, cymules short-stalked; pedicels 1—3 mm; bracts triangular, up to 1.5 mm, rarely up to 6 × 2 mm, mostly caducous. *Calyx* connate for 25—35%; lobes triangular, 0.65—2 × 0.5—1 mm, subcoriaceous, outside puberulous to pubescent in the lower half, rarely so to the top, inside glabrous, rarely with a few hairs. *Petals* 0 (rarely —3 in Malaya), up to 1.5 mm, elliptic to oblong, glabrous or with a few hairs near the base, inconspicuously auricled. *Disk* annular, 1—2 mm ∅, glabrous or sparsely puberulous. *Stamens* (6—)8 (9), up to 4 mm; filament glabrous; thecae not papillose, glabrous. Pistil puberulous. *Infructescences* not accrescent, up to 25 cm. *Fruit* 7—17(—20) mm (once up to 3 cm: see note on Australian collections), glabrous or very sparsely puberulous; stipe 2—14 × 1—1.5 mm; seedbearing part globose to ellipsoid, round to faintly triangular in cross-section, apiculum 1—2 × 0.5—1(—2) mm, inside either glabrous, or sometimes pubescent along the sutures, or rarely (Australian collections) completely densely pubescent to woolly; endocarp completely sclerenchymatic. *Seed* globose to ellipsoid, up to 7 mm; cotyledons about equal; suture transverse and straight.

INDIA. West Bengal. near Calcutta, *Reliq. Helf. 117* (BM, BO, L, NY, P, US). — Assam. Khas Hills, *Kurz (132?)* (CAL). — Cultivated in the Bot. Gard. Calcutta.

ANDAMAN ISL. South Andaman. Several collections of *King's collector* (BM, FI, K, L, MEL, P, SING); *Prain's collector 16* (CAL, L, P, U), *36* (P), *42* (CAL, FI, M), *59* (CAL), *67* (US); *Heinig 140* (A, CAL), *429*, *473* (CAL); *Helfer KD 991* (Tenasserim?) (CAL, P).

CHINA. *Iwan s.n., herb. Richard/Drake* (P).

HAINAN. *Wang 34819* (K, NY), *34927* (NY); Ling-shui, *How 73832* (BO).

VIETNAM. Prov. Hai Ninh, Tien Yen, *Tsang 30538*, *30669* (BO, K, L, P); Prov. Phy Tho, *Chevalier 41027* (P); Prov. Phuc Yen, *Pételot 6637* (P); Prov. Ninh Binh, Khang Thuong, *Bon 1176*, *1683*, *1730* (P); Prov. Thanh Hoa, Lang Bieng, *Bon 5701* (P); Prov. Quang Tri, *Chevalier 41204* (P); Prov. Quang Nam?, *Loureiro s.n.* (BM), type of *Pedicellia oppositifolia* Lour.?; Prov. Djiring, Haut Donaï, Lang Bian Mts., Dran, *Chevalier 31252* (P), *40473* (P), *40592* (P); Blao, *Pételot 8863* (BO), *Poilane 21948* (P), *22215* (P, UC), *22270* (L, P), *22434* (BM, K, L, P, UC), *22699* (L, P); Prov. Phan Rang, *Poilane 6019* (P); Prov. Tay Ninh, *Muller 977* (P); Prov. Bien Hoa, *Poilane 142*, *189* (K, P); *Chevalier 40834* (K, P); Prov. Thu Dau Moth, *Thorel 1180* (BM, K, NY, P); Prov. Gia Dinh, Thu Duc, *Pierre 215*, -8-1867 (P, NY); Prov. Baria, Mt. Dinh, *Pierre 22*, -8-1866 (M, P); *'per totam Cochinchinam australem'*, *Pierre 215*, 1865—77 (BO, L, NY, P, SING, US); *'ad Prov. Saigon frequens'*, *Pierre 22*, -5-1866 (FI, P); *'ad Prov. Saigon'*, *Pierre 215*, -8-1867 (M); P. Condor, *Harmand 794* (P), *Germain 22*, *26* (P), *Pierre 215*, -8-1876 (M, P); Phu Quoc, *Contest-Lacour 285bis* (P), *Pierre 215*, -8-1867 (P), *215*, -3-1874 (L, M, P).

LAOS. Hat Kam near Vientiane, *Kerr 21296* (K, L, P).

CAMBODIA. Pursat near Kom Thom, *Poilane 15047* (P): Phnom Penh, Sandek Prey, *Béjaud 324*, *631* (P); *Gourgand c.s. 1 bis*, *2*, *9*, *11*, *16* (P); Kampot, *Geoffray 1* (P), *Poilane 393* (K, P); Kadak near Kampot, *Poilane 27365* (K, P); Prov. Tpong, *Pierre 620 p.p.* (only 5-1870 in L; see sub *M. pentapetalus*: M. loureiro, *Pierre 620* in other herbaria); Mt. Knang Repoeu, *Pierre 215*, -5-1870 (L, M, P).

THAILAND. North. Many collections from lower altitudes: *Kerr 1265a*, *4199*, *7826* (K), *13958* (K, L, P), *14387* (K), *15599* (K), *16632*, *17374* (K, L), *17399*, *17931* (K), *Put 837*, *1611*, *2716* (K), *2901* (L), *3091* (K), *Rabil 57* (K), *75* (K, L), *Guang 38* (K); Chantaburi, *Vesterdal 2F* (SING); Ko Chang, *Schmidt 711* (BM); Chonburi, Sriracha, *Collins 724* (K, UC, US), *724a* (K), *770* (K, US), *800* (K, US), *908* (US), *1106*, *1437* (K, US); *Din 243* (BFK); Trat, *BKF 6245*; Peninsula, Bang Son, *SF 4250* (BO, CAL, K); 9.45 N, 98.40 E, *Geesink 7462* (BKF, C, E, K, L, P); 9.-N, 98.10 E, *Geesink 5217* (BKF, C, E, K, L, P); Phuket, *Van Beusekom*

& *Phenkhlai 673* (BKF, C, E, K, L, P); Krabi, *Geesink 5245* (BKF, C, K, L, P); Ko Phayam, *Hansen & Smitinand 12553* (C, K, L); Tak Bai, *Phengkhlai 1133* (BKF, K, L).

BURMA. *Kurz s.n. in herb. Pierre* (P); Tenasserim, Mergui, *Griffith 755* (K), *930* (K, P).

MALAY PENINSULA. 60 collections from all coastal parts, also inland. Perak. *Scortechini 1458* (BO, CAL, L, P, US); Pangkor, *KEP 71484* (K); *Burkill 195, 211, 212* (BO, BRI, K, L, SING). — P. Penang. *SF 3381* (BO, CAL, K), *KEP FRI 1059, 1068* (L), *SF 39044* (BM, K, L, P). — Trengganu. Kuala Trengganu, *Corner* (*SING sh 022687*), *SF 39815* (BM, BO, K, L, M, NY, P); Chukai, *Corner* (*SING sh 022703*). — Pahang. Kuantan, *KEP FRI 2098* (L), *SF 22779* (BO, KEP, NY); Pekan, *Seimund 13024* (SING); Nenasi, *SF 29876* (BO, K); Kuala Rompin, *Seimund 964* (SING). — Selangor. P. Angsa, *Burkill 1000* (L, SING). — Singapore. Changi, *Baker 5587* (KEP), *Ridley 1908* (CAL, SING); Geylang, *Teruya 2520* (SING).

SUMATRA. Atjeh. *Koorders 10560, 10561, 10562* (BO). — Lampong Districts. *Gusdorf 133* (BO); *Teysmann HB 4557*, type of *Cupania erythrorhachis* Miq.; K. Riau, *Teysmann s.n.* (BO); K. Lingga, *Teysmann s.n.* (BO). — Bangka. Soengai Liat, *Bünnemeijer 1875* (BO, L); *Teysmann HB 14549* (BO, M); Lobok-besar, *Kostermans & Anta 336* (A, BO, K, L, P). — Several collections from Sumatra without further locality in herb. L (*N. N., Korthals*). — Ile Ste Barbe (P. Pedjantan, between Pontianak and K. Lingga?), *Langlassé 233, 281* (P).

JAVA. 170 collections from all parts of the island below 1350 m (mostly below 800 m).

LESSER SUNDA ISLANDS. Bali. Mt. Prapat Agung, *Kostermans c.s. 3* (BO, K, L); Mt. Batukau, *Kostermans c.s. 150* (BO, K, L, P); Panginuwan, *Kostermans c.s. 265* (A, BO, K, L, P); Tjandikesoema, *Sarip 189* (BO, L, U). — Sumbawa. West: Olat Sekedit, *Kuswata 137* (A, BM, BO, K, L, NY, P); East: Dompu, *Elbert 3956* (L); Bima, *Elbert 3773* (BO, L). — Flores. West: *NIFS bb 21436* (BO), *Kostermans & Wirawan 422* (L, P), *577* (K, L), *Verheijen 773, 925* (L), *Schmutz 598, 617, 759, 669, 1869, 1898A, 2021, 2088, 2794* (L). — Wetar. *Elbert 4402* (A, BO, L), *4498* (A, BO, L, SING), *4543* (A, L). — Timor. *Forbes 3730* (BM, L), *Teysmann 10780* (BO, L); SE. Timor, *Kooy 332* (L); S. coast, *Metzner 141* (L); E. Timor, Lautem, *Van Steenis 18160* (BM, BO, L).

BORNEO. Balembangan Isl. *SF 19264* (BO, K, UC). — Sabah. 28 collections from lowland and coastal regions (*NBFD* and *NBFD SAN* series), furthermore: *Wood 1736* (M, UC), *1971* (BO, SING, UC), *2309* (UC), *2501* (NY, UC), *2637* (SING, UC), *Elmer 20213*. — Sarawak. Kalabit Mts., Bareo, *Nooteboom & Chai 1769* (L). — East. W. Kutai, *Endert 5283* (BO, K, L); Berau, *Kostermans 21511* (BO, K, L, P).

PHILIPPINES. 60 collections from all parts of the archipelago.

CELEBES. North. Minahassa, *Hose 813* (BM, K); Manado, *NIFS bb 17681* (A, BO, L) see note; Gorontalo, *Riedel s.n.* (K). — Southwest. *Teysmann 13711* (BO, K, L, P), *14061* (BO, L); Salajar, *Teysmann 13608* (BO, L). — East. Kendari, *Kjellberg 549* (BO); Wawotobi, *Kjellberg 881, 902* (BO); Aboeki, *Kjellberg 914* (BO).

MOLUCCAS. Batjan. *Warburg 18282* (B). — Seram. Soengei Ake Ternate, *Kornassi 1064* (BO, K, L, U); Moekina, *Rutten 1885* (BO); Kairatu, *Kuswata & Soepadmo 128* (BM, BO, K, L). — Ambon. *Boerlage 505* (BO, M), *Teysmann 14247* (BO, M, U). — Kai Isl. *Warburg 20558* (A), *Jaheri 437* (BO).

NEW GUINEA. West. Vogelkop Dist.: Misoöl, Waigama, *Teysmann s.n.* (BO); Kali, *Pleyte 836* (A, BO, K, L, SING); Sorong, *Van Royen 3092* (A, CANB, K, L); Warsamson Valley, east of Sorong, *BW 5723* (CANB, L), *BW 12803* (L, LAE); Arfak Mts., Minjambau, *BW 12705* (L); Geelvink Bay Dist., Biak, Parieri, *Kostermans & Soegeng 923* (K, L); Mansforbo, *BW 9661* (A, BM, CANB, K, L, LAE); Karadori, *BW 9326* (L); Sennen near Nabire, *Kanehira & Hatusima 12516* (A, BO); Djajapura Dist., Cycloop Mts., *BW 2658* (CANB, L). — East. E. Sepik Dist., Wewak, Angoram, *Pullen 1876* (A, BM, BRI, CANB, L); Sepik R., *Ledermann 7187* (K), *7278* (K); Madang Dist., Gogol R., *NGF 46668* (A, BRI, CANB, K, L); Western Dist., Fly R., Terarama, *NGF 35330* (K, L, LAE); Central Dist., Sogeri Subdist., Rouna no. 2, *NGF 48620* (CANB, K, LAE); Milne Bay Dist., N. Sagarai Valley, *NGF 16846* (A, BO, CANB, K, LAE); Papuan Islands Dist., Sudest Isl., Rambuso, *Brass 28207* (BO, K, L, US). — New Britain. Mt. Penck, Talasea, *NGF 26720* (BO, CANB, L, LAE).

AUSTRALIA. Queensland. Claudie R. near Iron Ra., *Webb & Tracey 8607* (BRI); Iron Ra., *Brass 19266* (CANB, L); Upper Massey Creek near Coen, *Smith 11737* (L); Annan R., Upper Parrot Creek, *Brass 20174* (CANB, L); Beatrice R., *Smith 10182* (BRI, L); 17.10 S, 145.35 E, *Sanderson 27* (L); Lake Barrine, *Kajewski 1116* (K, NY), *1120* (NY), *1128* (K, MEL, NSW, NY), *1255* (K, NY, P), *Flecker 10306*, *herb. Roduay 14323* (NSW); 17.25 S, 145.30 E, *Hyland 00627* (BRI); 17.26 S, 145.36 E, *Hyland 02297* (BRI); Brisbane, Moreton Bay, *Leichhardt 'wood 39'* (P). — New South Wales. McPherson Ra., Acacia Creek, *Dunn 326* (NSW); Mt. Wilson (?), *Dunn 330* (NSW); near McPherson Ra., *Dunn 403* (NSW); Lismore, *NSW 133905*; Bunells Creek, *NSW 133906*; Minmi Creek, *Earp NSW 133909*; Clarence & Richmond R., *Moore 211* (K); about 100 km N. of Newcastle, near Gloucester, *NSW 133907*; near Forster, *Rudder NSW 133908*.

Ecology: Primary and secondary forest in lowland and coastal regions; 0—800-(—1600) m. Fl. mostly Jan.—August, fr. mostly May—Dec.

Notes: *M. lessertianus* Ridl. Ridley emphatically rejected synonymy with *M. sundaicus* Bl. Therefore *M. lessertianus* Ridl. should be considered a newly described species, not a new combination based upon *Cupania lessertiana* Cambess., which itself was a superfluous name for *M. sundaicus*.

Petals. In a few collections petals occur. These collections, restricted to the Malay Peninsula, may represent an original state in this species (see: Infrageneric structure). The petals resemble strongly those of *M. pentapetalus* and other species in the *pentapetalus*-group.

M. sundaicus in N. Celebes. There is one sterile collection from N. Celebes which shows great resemblance with *M. pentapetalus: NIFS bb 17681*, Manado, Minahassa (A, BO, L). It is important as it should be the first record of *M. pentapetalus* for Celebes. Characters of *M. pentapetalus*, that sometimes occur isolated in collections of *M. sundaicus* (coarsely reticulate leaflets, midrib angular, axillary buds a few mm above the base of the petiole), seem to be all concentrated in one collection here. However, the pattern of nervation is normal for *M. sundaicus*. As no characters were found which fall outside the range of variation of *M. sundaicus*, this collection is kept in *M. sundaicus*. To be really sure, flowering and fruiting material is needed. Typical *M. sundaicus* is found in all parts of Celebes.

M. sundaicus in Australia. Collections of *M. sundaicus* from Australia are somewhat unusual in a few characters. The Australian area can be split into two parts: New South Wales, between Brisbane and Sydney, where the material is rather homogeneous, and northern Queensland, from Atherton Tabeleland to Cape York, where it is less so. The collections from northern Queensland are transitional between those from New South Wales and typical *M. sundaicus* from New Guinea. The material in New South Wales is characterized by: 1) a dorsi-ventrally flattened petiole; 2) a triangular to triquetrous fruit which is broadly apiculate; 3) a hairy endocarp (incl. septa).

The occurrence of a dorsi-ventrally flattened petiole is restricted to *M. sundaicus*. Outside New South Wales it sometimes occurs in northern Queensland and rarely in New Guinea.

In *M. sundaicus*, triangular to triquetrous fruits are nearly always caused by absence of seeds and as such occur in all parts of the area of this species. However, in New South Wales such fruits mostly have well-developed seeds. In northern Queensland this is found in part of the material. In New South Wales the fruit bears a broad stylar base, the style being more or less continuous with the seedbearing part rather than the seedbearing part apiculate by the style. Outside New South Wales this character occurs rarely in *M. sundaicus*. In some species (*M. lachnocarpus*, *M. largifolius*, *M. triqueter*) triangular to triquetrous fruits are the rule rather than an exception.

Endocarp and septa are very densely hairy in fruits from New South Wales. Radlkofer did not mention this character. Hence, collections of *M. sundaicus* from New South Wales were always identified as *M. anodontus*, that being the only other Australian species with the fruit inside densely hairy. In northern Queensland the indumentum of endocarp and septa is much less dense or absent as far as can be concluded from the few fruiting collections available. Outside Australia this character only occurs in a few collections from the Philippines (see: Notes on morphology).

The group of collections from northern Queensland is more heterogeneous, partly representing typical *M. sundaicus*, partly showing a mixture of 'N.S.W.-characters' and typical characters. There is one aberrant collection from northern Queensland: *Smith 10182*, with fruits which are extremely large for *M. sundaicus* (up to 3 cm long).

Flowers in the Australian material are not different from those in other parts of the area. The Australian *M. sundaicus* is thought a marginal variation of the typical form. As, moreover, the variation is clinal, there is no clear difference between the Malesian and the Australian material, making a differentiation between two subspecies impossible.

Hybridisation. The delimitation between *M. sundaicus* and *M. pentapetalus* is in some characters not sharp. That is why Gagnepain, Not. Syst. 13, 1947: 34, 35, suggested hybridisation between these two species. A final conclusion could only be drawn after detailed, partly experimental study (see also note at *Mischocarpus prob. nov. spec.*).

See also the notes under 'Dubious names'.

Mischocarpus triqueter Radlk. — **Fig. 1e, 2g.**

M. triqueter Radlk. in Perk., Fragm. Fl. Philip. 1 (1904) 65; Merr., En. Philip. 2 (1925) 514; Radlk., Pfl. R. Heft 98 (1933) 1297. — *M. fuscescens auct. non* Blume: Vidal, Revis. (1886) 95, no. 720, 1039; Cat. Herb. (1892) 83, no. 720, 1039. — L e c t o t y p e: Philippines, Luzon, Prov. Camarines Sur, Pasacao, *Ahern 262*, 1902, fr. (B, lost; iso in BO, US).

M. cauliflorus Radlk., Philip. J. Sc. 8 (1914) 471; Merr., En. Philip. 2 (1923) 513; Radlk., Pfl. R. Heft 98 (1933) 1298. — T y p e: Philippines, Mindoro, Baco R., *McGregor 271*, -4/5-1905, fr. (M; iso in K, US).

Small tree up to 6 m × 12 cm ∅, probably not or hardly branched; puberulous, early glabrescent. *Twigs* 4—9 mm ∅, mostly grooved. *Leaves* with (2) 3—5 leaflets per side; petiole 7—17 cm; petiolules 8—15 mm. *Leaflets* 5—26 × 2—10 cm, ratio 2—4.5, widest beneath to above the middle, pergamentaceous to subcoriaceous, upper face ± glossy; domatia either inconspicuous along the whole midrib, or absent; base acute, sometimes blunt; midrib above prominent, angular; nerves 7—13 per side, angle to midrib 50—70°; moderately curved; nerves, veins, and veinlets prominent on both faces, veinlets above sometimes prominulous or inconspicuous. *Inflorescences* ramiflorous on up to 15 mm thick branches consisting of 1—7 axes which are either simple, or rarely sparsely branched at the base, up to 10 cm long, bracts triangular, up to 1 mm. *Calyx* lobes hardly connate, triangular to ovate, 1.5—2.5 × 1—2 mm, membranaceous with 1 or 3 visible nerves, outside sparsely pubescent, inside glabrous or with a few hairs near the base. *Petals* (2—)5, elliptic, 1.5 × 1 mm, rarely accrescent to 3 × 2 mm in young fruits, not unguiculate, glabrous; auricles mostly present, sparsely pubescent. *Disk* annular, mostly with lobes protruding between the stamens, ± confluent with the base of the fruit, 1.5—2 mm ∅, glabrous. *Stamens* 8, 3—4 mm; filament glabrous to sparsely puberulous; thecae papillose, glabrous. *Pistil* hardly stiped, distinctly triangular, hairy. *Infructescences* slightly accrescent; axes up to 16 cm. *Fruit* up to 3 cm, glabrous; stipe 4—12 mm, triangular in cross-section; seedbearing part ellipsoid to obovoid, triangular or sometimes rounded-triangular in cross-section, up to 1.2 cm ∅, apiculate for 1—3 mm, inside glabrous; endocarp thin, completely or rarely in the fertile locule nearly completely sclerenchymatic. *Seed* ellipsoid, up to 1.2 cm long; suture curved; lower cotyledon folded, mostly smaller than the upper one, the upper one mostly folded.

PHILIPPINES. L u z o n. Rizal Prov.: *Loher 7032* (K, M), *12368* (UC), *13400* (P), *13805* (M, UC), *14300* (UC), *FB 1871* (K, M, NY, US), *BS 42010* (A, BO, BRI, L, US); Laguna Prov.: *BS 21985* (K, M, US); *FB 24669* (US); Tayabas Prov.: *BS 25495* (A), *26935* (A, BM, BO, US), *30679* (NY); *Vidal 720* (K); Camarines Sur Prov.: *Ahern 262* (BO, US); Bulacan Prov.: *BS 22304* (A, US); 'Centro de Luzon': *Vidal 1039* (K). — M i n d o r o. Paluan, *BS 39583* (A, BO, P), *39607* (P, K); *McGregor 271* (K, M, US). — P a n a y. Capiz Prov.: *BS 30802* (BM, P). — G u i m a r a s. *FB 302* (BM, M, NY, US); *Vidal 2465* (A, K). — N e g r o s. *FB 20895* (K, P, US).

E c o l o g y: Primary forest up to 500 m. Fl. Oct., Jan., fr. Feb—July.

Mischocarpus prob. nov. spec.

Small tree, 6 m high; puberulous in infructescences, glabrescent. *Twig* 6—8 mm ∅. Axillary bud *c.* 4 mm above the base of the petiole. *Leaf* with 3 leaflets per side; petiole 17 cm; petiolules *c.* 1 cm. *Leaflets* 12—16 × 4—5 cm, ratio *c.* 3, widest in the middle, subcoriaceous; domatia along the whole midrib, very inconspicuous; base acute; midrib above prominent, angular or locally rounded; nerves *c.* 15 per side, angle to midrib 50—70°, moderately curved; veins and veinlets regularly reticulate, prominent on both faces, veinlets less conspicuous above. *Inflorescences* and *flowers* unknown. Ramifructous *infructescences* 1—4 mm above leafscar, 13 and 16 cm long resp., branched. *Calyx* in fruit connate for up to 25%, lobes slightly unequal, slightly imbricate at the very base, triangular to ovate, *c.* 1.5 × 1 mm, outside glabrous, inside glabrous or with a few hairs, subcoriaceous at the base, to the top becoming somewhat membranaceous with visible nerves, not accrescent. *Petals*: in one case 1 petal was found together with 1 scar of a petal: elliptic, not unguiculate, 0.75 × 0.5 mm, without scales or auricles, glabrous. *Disk* in fruit annular, 1.5—2 mm ∅, slightly lobed, glabrous with lenticel-like dots. *Fruit* immature, green, probably all sterile, 8—10 mm long, glabrous; stipe 1—3 mm long, slightly lobed at the base, grading into the seedbearing part; seedbearing part about rounded-triangular in cross-section, 5—7 mm ∅, inside pubescent on axial and sutural parts, sclerenchyma just reaching into the septa. *Seed* hardly developed (while the fruit itself seems almost full-grown). Aril present, with a slightly lobed appendix nearly as long as the stalk.

New Guinea. East. Central Dist.: Musgrave R., *Millar UPNG 1042*, 29-3-1971, rain forest (K).

Note: This is doubtlessly a *Mischocarpus* fitting in the '*pentapetalus*-group', about on the level between *M. largifolius* and *M. paradoxus*. Whether it is a new species is not certain. The sterile fruits may also point to a hybrid. In that case it is possibly a hybrid either between *M. largifolius* and *M. paradoxus*, or between *M. sundaicus* and one of these two species.

DUBIOUS NAMES

Pedicellia oppositifolia Lour., Fl. Coch. (1790) 655; ed. Willd. (1793) 806; Merr., Lingn. Sc. J. 5 (1927) 118; Hu, Bull. Fan Mem. Inst. Biol. 1 (1929) 31. — *M. oppositifolius* Merr., Lingn. Sc. J. 7 (1931) 313; Comm. Lour. (1935) 250; Corner, Gard. Bull. S. S. 10 (1939) 263. — Type: not known.

Pedicellia oppositifolia is the only species in the genus which is described by Loureiro at the same place as the genus. There is no doubt concerning the identity of *Pedicellia*, it is the oldest name for *Mischocarpus*. The latter name is included in the list of nomina conservanda (Seattle Code). Which species of *Mischocarpus* is represented by *P. oppositifolia* cannot be concluded from the description. Two species, *M. sundaicus* and *M. pentapetalus*, occur in Indo-China, both also near Hue, the type locality. According to Merrill (1931, 1935), *P. oppositifolia* is *M. sundaicus* because he supposed this to be the only species in Indo-China without petals. However, his conclusion is badly argued as *M. pentapetalus* also occurs without petals. The type of *P. oppositifolia* is not known. The specimen mentioned in a list in BM as being received from Loureiro has not been found there.

Vateria flexuosa Lour., Fl. Coch. (1790) 334; ed. Willd. (1793) 407; Moore, J. Bot. 63 (1925) 285. — *M. flexuosus* Merr., Comm. Lour. (1935) 249; Corner, Gard. Bull. S. S. 10 (1939) 263. — Type: Vietnam, Hue (?), *Loureiro s.n.*, detached fruits only (BM).

As type of *Vateria flexuosa*, a few detached fruits are present in BM. Brandis already annotated the material as probably belonging to *Mischocarpus*. (I have studied these fruits and identified them as belonging to *M. sundaicus*). From the suggestions of Brandis and Moore and from the presence of 5 petals, mentioned by Loureiro, Merril concludes that the petaliferous species *M. fuscescens* (= *M. pentapetalus*) is represented here. As *Vateria flexuosa* is an older name for this species, he proposed *M. flexuosus* as a new combination. However, the description of *Vateria flexuosa* is rather a confused one. There are elements that can certainly not be applied to *Mischocarpus* (*e.g.* the shape of petals and sepals, number of stamens, colour of flowers) but also elements that can certainly not be applied to *Vateria* (subglobose anthers, reflexed stigmata, arilloid, wood). *Vateria* does not occur in Indo-China and it is possible that Loureiro described some *Dipterocarpacea* (may be *Vatica* which has subglobose anthers and wood as described by Loureiro)*). It is also possible that his material was a mixture, or that he amplified the description of the genus proposed by Linnaeus with observations from material of *Mischocarpus* or some other genus. There is also a chance that the type of *Vateria flexuosa* in BM, which is *M. sundaicus*, is in fact the lacking type of *Pedicellia oppositifolia* that was mislabeled. This material in BM agrees much better with Loureiro's description of the latter species.

Concluding, I consider both names of Loureiro, *Pedicellia oppositifolia* and *Vateria flexuosa*, as dubious names in *Mischocarpus*, agreeing with Corner that 'only the fullest proofs can persuade botanists to make radical nomenclatural changes based on Loureiro's descriptions.'

EXCLUDED TAXA

M. fuscescens Bl. var. *bonii* Lecomte, Fl. Gén. I.–C. 1 (1912) 1029 = **Xerospermum bonii** (Lecomte) Radlk., Fedde Repert. 18 (1922) 341.

M. guillauminii Kanehira, Bot. Mag. Tokyo 46 (1932) 672 = **Cupaniopsis concolor** (Gillespie) Van der Ham, Blumea 23 (1977) 290.

M. macrobotrys Merr. & Perry, J. Arn. Arb. 21 (1940) 524 = **Arytera macrobotrys** (Merr. & Perry) Van der Ham, Blumea 23 (1977) 291.

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*) I thank Dr. P. S. Ashton, Aberdeen, for his information concerning the *Dipterocarpaceae*.

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