

NOTES ON MAGNOLIACEAE

with a revision of *Pachylarnax* and *Elmerrillia* and the Malesian species of
Manglietia and *Michelia*

H. P. NOOTEBOOM

Rijksherbarium, Leiden, The Netherlands

CONTENTS

Summary	66
Introduction	66
1. Characters and subdivision of the family	67
Wood anatomy	67
Leaf epidermis and foliar sclereids	69
Embryology and chromosome numbers	71
Phytochemistry	72
Palynology	72
Morphology	74
Subdivision of Magnoliaceae	78
2. Subfamily Magnolioideae	78
Key to the tribes	78
Generic delimitation in Magnolieae	78
References to chapters 1 & 2	81
3. Special part	82
A. Tribus Magnolieae	82
Key to the genera	82
1. <i>Magnolia</i>	83
Key to the subgenera and sections	84
a. Subgenus <i>Magnolia</i>	85
b. Subgenus <i>Yulania</i>	89
c. Subgenus <i>Talauma</i>	89
2. <i>Manglietia</i>	91
Key to the species in Malesia	92
3. <i>Pachylarnax</i>	97
4. <i>Kmeria</i>	98
Excluded genera	99
Collections of Magnolieae examined	99
B. Tribus Michelieae, the Malesian species	99
Key to the genera	100
5. <i>Elmerrillia</i>	100
Key to the species, based on flower and fruit characters	100
Key to the species, based on fruit characters	101
6. <i>Michelia</i>	108
Key to the species in Malesia	109

SUMMARY

After the general chapters, mainly based on literature and dealing with wood anatomy, characters of the leaf epidermis and foliar sclereids, embryology and chromosome numbers, phytochemistry, and characters of the fruit, the generic delimitation of subfamily Magnolioideae is discussed. *Paramichelia* Hu and *Tsoongiodendron* Chun are reduced to *Michelia* Linné; *Talauma* Juss., *Aromadendron* Blume, *Alcimandra* Dandy, *Dugandiodendron* Lozano and *Manglietiastrum* Law are reduced to *Magnolia* Linné. *Parakmeria omeiensis* Cheng & Hu is renamed *Magnolia omeiensis*, *Parakmeria yunnanensis* Cheng & Hu is renamed *Magnolia yunnanensis*, *Manglietiastrum sinicum* Law is renamed *Magnolia sinicum*, and *Alcimandra cathcartii* Dandy is renamed *Magnolia cathcartii*. *Manglietia singalanensis* Agostini is reduced to *M. glauca* var. *sumatрана*. *Elmerrillia mollis* Dandy and *E. papuana* Dandy are reduced to *Elmerrillia tsiampacca* (Linné) Dandy, the former is named subsp. *mollis* (Dandy) Noot. and of the latter var. *glaberrima* is renamed *E. tsiampacca* var. *glaberrima* (Dandy) Noot. *Michelia arfakiana* Agostini is reduced to *Elmerrillia tsiampacca* var. *tsiampacca* and *Michelia sumatrae* Dandy is renamed *M. salicifolia* Agostini. Newly described is *Michelia koordersiana* Noot. and keys are given to the genera, subgenera and sections.

INTRODUCTION

The late Dr. J. E. Dandy, Keeper of Botany of the British Museum (Natural History) from 1956 to 1966, started his work on Magnoliaceae in 1925 working for Dr. John Hutchinson at Kew. He continued working at Magnoliaceae until his death in November 1976. He can be considered the greatest authority ever on the family. He constantly maintained a very high standard of scholarship and became almost morbidly reluctant to publish his continually revised works which were never, for him, quite perfect enough. Consequently the monograph on the Magnoliaceae, upon which he worked for nearly 50 years, remained unpublished. Because many of the collections were together at the time he died, it was decided that I, looking for a new family to revise for the Flora Malesiana, should start with the Magnoliaceae. During that work I had to look outside the Malesian area, studying the genus concept within the family. In doing that, and studying the species within the area as well, I came to the conclusion that the tricks of nature which are apparent in the evolution of Magnoliaceae have prevented Dr. Dandy, as a perfectionist, from the final circumscription of many taxa. Often there are no clear-cut limits between the taxa, and a more or less arbitrary choice has to be made. In order to arrive at 'sensible' but not undisputable taxa, I decided to reduce several genera, even one described by Dandy himself, and also some species.

After finishing the manuscript for this paper, the article of Law Yuh-wu on the taxonomy of the family Magnoliaceae in *Acta Phytotaxonomica Sinica* 22 (1984) 89–108 was published. Most of it is written in Chinese and thus the argumentation is for most botanists not accessible. His division of the family in subfamilies is used here. Law's division (l.c. p. 105–106) is rather confusing as he, unintentionally, puts the tribes Magnolieae and Michelieae under the subfamily Liriiodendroideae and all the subtribes under the tribe Michelieae.

1. CHARACTERS AND SUBDIVISION OF THE FAMILY

Wood anatomy

(Largely from H. Gottwald, manuscript of a lecture given for the International Association of Wood Anatomists in Amsterdam, which he kindly put at my disposal.)

The structural pattern in the secondary xylem, typical for all species, shows a well developed fibrous ground tissue of thin to medium thick-walled fibres, with diameters from 15 to 25 μm depending on the species.

The vessels show a slight tendency of radial grouping. The diameters based on species averages, range from 50 to 180 μm . The vessels are mostly evenly distributed except for the temperate species which tend to possess porous zones. The horizontal parenchyma consists of unstoried rays of mostly 3 cells in width and 0.5–1 mm high. The vertical parenchyma consists of continuous parenchyma rings, 3 to 6 cells wide. The layers between these rings were recognized by Chowdhury (1964) as perfect annual rings, also for the tropical *Michelia champaca*. Only in the genus *Talauma* (*Magnolia* subg. *Talauma*) this main feature shows some alteration in that the bands tend to fork. A parenchymatic sheath surrounding the vessels is always incomplete; in most species parenchyma cells are even difficult to detect. With reference to the contents of parenchymatic tissues none of the species contain any kind of crystals, nor were any phenolic substances found in the vessels. Altogether this general topographic pattern represents a structural principle which can also be found in very different families as e.g. in *Swietenia* of Meliaceae, *Beilschmiedia* of Lauraceae, in Verbenaceae, and in others, widely dispersed in lesser or higher developed groups of the Angiosperms.

While the architecture of the xylem of Magnoliaceae has no individual pattern, there are some striking anatomical details occurring only in groups of individual taxa. Firstly the extremely primitive vessel pitting varying from purely scalariform to opposite. Though this feature represents the least developed type of pitting, the vessel perforations contain mostly multiple perforations of only 1 to 15 bars. In the advanced taxa *Liriodendron* and the section *Yulania* of *Magnolia* also simple perforated vessels occur, but always in connection with opposite pits.

Also a rare feature – in connection with the vessels – is the occurrence of amorphous silica as a coating on the cell walls including the tyloses, or as solid occlusions completely closing the lumina. According to Professor Gottwald's investigations, the complete solid plugs of silicium dioxide occur in all species of section *Blumiana* of *Magnolia* subg. *Talauma* and in the monotypic section *Lirianthe* of *Magnolia* subg. *Magnolia*. The estimated volume percentage of silica is up to 8%, based on air-dried volume; sometimes almost every vessel is filled with silicium dioxide. This means that these taxa belong to the woody species with the highest silica content known in the vascular plants. Spiral thickenings on the vessel walls are a further special feature of limited occurrence in Magnoliaceae. They are only weakly pronounced and hard to detect.

The problem of an irregular distribution, frequency, and morphology is also typical for the rare idioblastic parenchyma cells, to be found mainly between the marginal cells of the rays. They are thin-walled, have mostly amorphous brownish contents, and are often referred to as 'oil cells', although their chemical nature is still unknown. In some genera these enlarged cells always occur, in others they may occur or not, so their taxonomical value is limited.

Yet another specific feature is the occurrence of silica particles in the ray cells of a few species in the sections *Maingola* (of *Magnolia* subg. *Magnolia*) and *Blumiana* (of *Magnolia* subg. *Talauma*), pointing to their close relationship.

The only crystalline inclusion is found in fine splits of wood of *Magnolia* and its subg. *Talauma*; they could be identified as consisting of calcium carbonate and are always of traumatic origin.

The last special item concerns the occurrence of tyloses in the fibres, besides those in the vessels. This rare feature was observed in 24 species, belonging to 7 genera.

Concluding, it can be stated that the family Magnoliaceae as a whole can be identified easily on its xylem by its pronounced homogeneity and its special features. It can, therefore, be distinguished from all other families, particularly from those which are also part of the order Magnoliales. This structural separation within the flowering plants is very remarkable if the Magnoliaceae are considered as the root of all other families.

The homogeneity of characters enhances a mixture of overlapping structural details which is detrimental to the internal classification of the family. The largest genus, *Magnolia* (without the taxa reduced to it in this paper), includes almost all structural items which are otherwise spread over the remaining genera.

There are only few taxa that can be distinguished from all others as e.g. the genus *Liriodendron* which has neither spirals in the vessels nor tyloses in the fibres. Similarly section *Yulania* of *Magnolia* subg. *Yulania* is characterized by exclusively simple perforations, and section *Blumiana* of *Magnolia* subg. *Talauma* by its silica-bearing vessels and the pronounced heterogeneity of the rays.

Canright (1955) comes to the following conclusions. *Aromadendron* (*Magnolia* subg. *Talauma* sect. *Aromadendron*) differs from the rest of subg. *Talauma* in that the pores are almost twice the size of the investigated Asiatic species. They are also the largest in the whole family. Differences are also apparent in the wood parenchyma distribution and fibre tracheid characteristics. The wood of *Elmerrillia* falls within the range of the woods of *Michelia* whereas the wood of *Kmeria* is indistinguishable from that of many tropical *Magnolia* species.

There is little difference in the wood anatomy of *Manglietia* and many temperate *Magnolia* species. Although the primitive nor the advanced wood anatomical characters are confined to one genus, there are many indications that the woods of the temperate species of *Magnolia* and *Liriodendron* are the most specialized while most tropical species of *Magnolia* subg. *Paramanglietia* Hu & Cheng (1951: 255) are within the range of *Manglietia* according to Chang Chetseng (1984: 483). *Talauma* exhibits the largest assemblage of primitive characters. The tropical *Magnolia paenetalauma* from Hainan exhibits a number of primitive features such as small solitary pores,

long vessel elements with many-barred perforation plates, and extremely tall heterogeneous rays. Also in the external morphology the species of section *Gwillimia* (of *Magnolia* subg. *Magnolia*), to which *M. paenetalauma* belongs, resemble the species of subg. *Talauma* so closely that they cannot be distinguished in absence of fruits.

Leaf epidermis and foliar sclereids

(Mainly after Baranova, 1972, and Tucker, 1977.) The ordinary epidermal cells of leaves of Magnoliaceae are commonly irregular in form, or less often polygonal, with sinuous to merely curved or nearly straight, often thickened, walls. Many members of the family have a subepidermal layer beneath the upper epidermis, some have such a layer associated with both upper and lower epidermis, and few have it only with the lower epidermis. Many species lack specialized subepidermal cells entirely. In many species the outer walls of the epidermal cells have pores, fewer or more numerous according to the species. Similar pores are seen in *Cycas* and some other genera of the Cycadales.

Hairs may be present on both upper and lower epidermis, or only on the lower. In some species the leaves lack hairs altogether. They are uniseriate, consisting of one to several or many cells. There are two types of hair base. In the first type the hair rests on a normal or modified epidermal cell or group of cells. The position of the detached hair may readily be observed on the cuticular membrane because of the persistent hair base. This type of hair base may have only 2–3 cells or many highly modified cells. In the second type the hair base replaces a normal epidermal cell, so that the loss of a hair leaves a pore in the cuticular membrane. This type of hair base is only seen in *Manglietia*. Baranova (1972) regards this hair base as primitive. The hair bases of the other genera are more or less advanced. An early stage of specialization is seen in several genera: *Magnolia*, incl. *Aromadendron* and *Talauma*, and *Michelia* incl. *Paramichelia*. In this type the hair base consists of 2–4 slightly modified epidermal cells. Intermediates between this type of hair and the *Manglietia* type occur in *Manglietia* and in *Magnolia maingayi*. The most complex hair base types occur in *Elmerrillia*, *Tsoongiodendron*, and scattered species of *Magnolia*. Here the hair base consists of many highly modified epidermal cells. Baranova distinguishes, in order of advancement, the following hair base types: 1. *Manglietia* type, 2. *Magnolia maingayi* type, 3. *Talauma* type, 4. *Elmerrillia* type. *Manglietia* has type 1 and 2. *Magnolia s.s.* has type 2, 3, and 4; the other pubescent genera possess only one type each. The different types of hair base in *Magnolia* are concentrated in sect. *Maingola*, whereas all the other species possess only the *Talauma* type.

The stomata are paracytic in Magnolioideae (but in rare cases Nong Van Tiep, 1980: 519, found also anomocytic stomata in *Manglietia*), paracytic as well as anomocytic in Liriodendroideae. They are confined to the lower surface. Significant thickenings on the walls of the epidermal and subsidiary cells, as well as strongly developed cuticular thickenings on the outer walls of the guard cell, occur mainly in the tropical sections of *Magnolia s.s.* as well as in many Asiatic species of *Talauma*. They are lacking in all temperate species of *Magnolia* and in *Elmerrillia*, *Pachylarnax* and *Liriodendron*.

Foliar sclereids are present in certain taxa. They vary widely in form, size, wall thickness, pitting, and degree of ramification. They may be found in four tissues or cell assemblages: idioblasts, mesophyll, dermal layers, and in the vein sheath system including veinlet endings.

Idioblastic sclereids occur commonly in the petiole and midrib. They are concentrated around the midrib bundles, but always intermittent rather than continuously distributed. This distributional pattern along the midrib is found in the majority of taxa sampled. Sclerification of the midrib, however, appears less well developed in short-lived deciduous magnoliaceous leaves. This pattern of sclereids along the midrib is so common among evergreen taxa, that with few exceptions it is of little use diagnostically. Less common are the following patterns of distribution of sclereids: 1) Throughout the leaf ('diffuse'), these sclereids occur in the mesophyll at the same paradermal level as the veinlet terminations. 2) Bordering the larger veins as well as the midrib. 3) Scattered along the margin of the leaf, as well as along the midrib.

Sclerified spongy mesophyll is found in all examined species of *Manglietia* (this is not mentioned by Nong Van Tiep, 1980), in eight species of *Magnolia*, in five species of *Michelia*, and in four species of *Talauma*.

Adaxial or abaxial epidermal and/or hypodermal layers may be sclerified. Sometimes only scattered cells of a layer, such as those over a vein, are sclerified. Usually the wall thickenings are not massive and the cells probably remain alive. Sclerified epidermis is found in species of *Alcimandra*, *Elmerrillia*, *Magnolia s.s.*, *Michelia*, *Talauma*, and in all the *Manglietia* species examined. Sclerification takes the form of a sclerified hypodermis in 13 taxa examined, including 10 species of *Manglietia*.

Except for the types discussed above, most sclereids in magnoliaceous leaves are associated with the venation system. For instance with the vein sheath in taxa with prominent lateral veins, with the bundle sheath extensions along leaf margins, and sclerified transitional elements at the veinlet terminations. Differentiation of the sclerified vein sheath differs among species.

Sclerified leaf margins occur in many taxa. They may be discontinuous or scattered, or they may form a continuous massive marginal ridge. This ridge may be entirely fibrous or contain a vascular bundle, or it may contain essentially continuous sclerified epidermal and subepidermal cells.

At the veinlet terminations of Magnoliaceae a variety of tracheids, sclereids, and intermediate or transitional cells are found.

Taxonomically the mentioned characters are of different value. Each genus shows a particular range of features, some of which can be used diagnostically to separate genera. The coriaceous texture of tropical leaves is achieved in various ways arising from the variable form and diverse distribution of the sclereids.

Talauma species characteristically have the entire vein system of the leaf encased in sclerenchymatous sheaths, and the veinlets terminate in sclerified elements.

Manglietia species in contrast have parenchymatous vein sheaths near the terminations and lack sclerified terminal cells, but most of the mesophyll and epidermal cells are sclerified. *Manglietia* leaves are characterized by sclerified epidermal and hypodermal layers, sclerified spongy parenchyma in the mesophyll, unligified lobate vein-

sheath cells, and an absence of either sclerified veinlet terminal cells or a sclerified leaf margin. No other genus combines all those features, although others do show one or more. Sterile specimens of *Manglietia* can easily be recognized on the basis of cleared leaf segments.

Magnolia s. s., *Michelia*, and *Talauma* exhibit in many of their members sclerified veinlet terminal cells, thick sclerified leaf margins, and stellate sclereids along the midrib. Rarely those features may be diagnostic for species, but in most cases they are too common to be useful. The foliar characteristics of *Talauma* include veinlets terminating in thick-walled stellate sclereids and thinner walled tracheary elements. These cell types are typically absent from temperate *Magnolia* sections and therefore obviously an adaptation to climatic conditions. In all the Asiatic species of *Talauma* examined there is a thick sclerified margin, usually including a vein. In the American species this is absent but in few of them a weak approach to this condition is seen.

The massice marginal ridge helps to identify certain species of *Talauma* and *Magnolia*, *Manglietia* (3 species), *Michelia* (3 species) and *Aromadendron elegans*.

In *Alcimandra*, *Liriodendron*, *Paramichelia*, and most *Elmerrillia* species foliar sclereids are rare. This may indicate that these taxa have not developed vegetative modifications different from those of the related large genera.

It seems to me that on leaf anatomical characters *Manglietia* is a specialized offshoot of *Magnolia*. Regarding the other genera there are no leaf anatomical evidences pointing to them being separate genera.

Embryology and chromosome numbers

(Hayashi, 1964, 1966; Bhandari, 1971.) The anther wall at the microspore mother cell stage comprises epidermis, endothecium, 3 or 4 middle layers, and a bilateral glandular tapetum. By the time the cytokinesis is completed in the microspore mother cells, a large number of Ubisch granules line the inner walls of the tapetum. In a fully mature anther the papillate epidermis and endothecium along with 2 or 3 middle layers persist. After meiosis II in the microspore mother cell the cytokinesis takes place by furrowing, resulting in tetrahedral or isobilateral tetrads. The mature pollen is shed at the 2-celled stage. The generative cell is surrounded by a thin sheath of finely granular cytoplasm and a delicate membrane.

The ovules are anatropous, bitegmic, and crassinucellate; the outer integument is vascularized. The hypodermal archesporium is multicellular and of hypodermal origin although ultimately only one cell functions. The primary parietal cell divides repeatedly to form the parietal tissue so that the megaspore mother cell is buried deep in the nucellus. At the end of meiosis II linear or T-shaped megaspore tetrads are formed. The chalazal megaspore functions, giving rise to the *Polygonum* type of embryo sac. The synergids and antipodal cells are ephemeral. The endosperm is cellular from the beginning, and embryogeny conforms to the *Myosurus* variation of the Onagrad type or is irregular.

The seed coat is organized chiefly from the outer integument while the inner integument is represented by a layer of crushed cells. In a ripe seed the testa consists of an outer fleshy region comprising the epidermis of the outer integument, 2 or 3

layers of tangentially elongated cells, a 10–12-layered fleshy zone, 2 or 3 layers of tangentially compressed cells, and an inner stony region of 3 or 4 layers of lignified cells.

The basic chromosome number is $x = 19$. Polyploidy has been demonstrated in *Magnolia*. Treseder (1978: 208) reports for cultivated Magnolias besides diploid, also triploid, tetraploid, pentaploid, hexaploid, heptaploid, and octoploid numbers, while aneuploid numbers also are recorded.

Phytochemistry

(After Hegnauer, 1969.) Like other families of woody Polycarpicae the Magnoliaceae show a combination of chemical features highly characteristic for this alliance. They are characterized by the following metabolic peculiarities:

1. Accumulation of silica in many species.
2. Synthesis of isochinolin alkaloids.
3. Production of essential oils and depositing the latter in idioblasts.
4. The absence of triterpene accumulation.
5. In the phenolic constituents vicinal trihydroxylation appears to be absent in anthocyanins, leucoanthocyanins, flavonols, and C_6-C_1 acids. Syringyl substitution occurs in cinnamic acids (sinapic acid), cinnamic alcohols (syringin) and lignans (lirioresinol).
6. Cyanogenesis is at the moment only known in the genus *Liriodendron*. The cyanogenetic compounds appear to belong to the same kinds as those found in other Polycarpicae.
7. Oil accumulation in seeds.
8. Synthesis of cyclitolols (pinitol, liriodendritol, and quercitol). Much research is still needed, especially for the cardiac active compounds found in Magnoliaceae, of which the chemistry is still entirely unknown.

Palynology

(After J. Pragłowski, 1974.) The pollen grains of Magnoliaceae are 1-(ana-)colpate, bilateral, heteropolar. Aperture simple, with markedly thin, frequently slightly undulated margins. Colpus usually longer, occasionally as long as, or rarely shorter than the longest axis. Colpus invagination usually absent or insignificant. Exine structure in tectate grains (about 95%) consists of a continuous tectum perforatum supported by bacula which have no geometrical connection with the tectine of the exine sculpture. In rarely occurring semitectate grains the exine structure is microreticulate, without sculpturing. Sculpturing rugulose, or less frequently pollen grains have a comparatively smooth tectum. Sexine at the proximal face thicker than nexine. Bacula minute, usually indistinct. Nexine thicker than sexine, usually half of the sexine thickness or less.

Pragłowski distinguished between the following pollen types (E_1 = longest axis):

1. Pollen grains tectate, exine structure consisting of tectum perforatum and bacula arranged without geometrical connection to the tectum.
 2. Tectum surface smooth.
 3. Pollen grains large, $E_1 \geq 45 \mu\text{m}$ or larger Type 1
 3. Pollen grains small, $E_1 < 45 \mu\text{m}$ Type 2
 2. Tectum surface with rugulose sculpturing.
 4. Sculpturing slightly rugulose.
 5. Pollen grains large, $E_1 \geq 45 \mu\text{m}$ or larger Type 3
 5. Pollen grains small, $E_1 < 45 \mu\text{m}$ Type 4
 4. Sculpturing coarsely rugulose Type 5
1. Pollen grains semitectate, exine structure microreticulate.
 6. Pollen grains large, $E_1 \geq 45 \mu\text{m}$ or larger Type 6
 6. Pollen grains small, $E_1 < 45 \mu\text{m}$ Type 7

In the genera of Magnoliaceae the following pollen types occur:

Elmerrillia: type 7 (*E. tsiampacca* subsp. *mollis*) or type 2 (the other investigated taxa, *E. tsiampacca* subsp. *tsiampacca* and *E. ovalis*).

Michelia (incl. *Paramichelia* and *Tsoongiodendron*): type 2, but in *M. floribunda* (Garrett 649, BM) as well type 2 as type 4 are found.

Pachylarnax: type 7.

Alcimandra: type 2.

Kmeria: no pollen was investigated.

Magnolia: the types 1, 2, 3, 4, and 6.

Talauma: type 1 (and 3: *T. rabianae*).

Manglietia: type 1 and 3.

Aromadendron: type 2 and 4.

Liriodendron: type 3, 5, and 6.

Elmerrillia pollen grains show partly similarity with pollen grains of *Michelia*, but the microreticulate structure of the grains of *E. tsiampacca* subsp. *mollis* is rather unique showing no resemblance to *Michelia* pollen. The reticulum is considerably coarser than that of *Pachylarnax* pollen grains.

Michelia, *Paramichelia*, and *Tsoongiodendron* possess pollen grains that are very similar. *Pachylarnax* possesses pollen with microreticulate exine structure consisting of thin muri encompassing very minute lumina. This rather peculiar exine structure is more delicate than that in other Magnoliaceae. Similarly, the rather symmetric ellipsoidal shape of the pollen makes it quite difficult to include them among typical magnoliaceous pollen.

Alcimandra pollen possess an exine without sculpturing which show resemblance with some *Talauma* pollen. *Magnolia* pollen grains show a rather large morphological variation, only types 5 and 7 do not occur in this genus. As type 5 is only met with in the genus *Liriodendron*, nearly all the pollen types of subfamily Magnolioideae are

found in *Magnolia*. However, pollen grains of *Elmerrillia* and *Michelia* show slight differences to that of *Magnolia*.

Manglietia pollen grains show a high morphological similarity to those of *Magnolia*. *Talauma* pollen grains show features similar to those encountered in *Magnolia* subg. *Magnolia*. *Aromadendron* pollen grains show similarity to *Alcimandra* pollen grains, but also with those of *Magnolia* sect. *Maingola*.

On palynological evidence the joining of *Michelia*, *Tsoongiodendron*, and *Paramichelia* is strongly supported. The same holds for *Manglietia*, *Magnolia*, and *Talauma*, while the joining of *Aromadendron* with *Magnolia* is not contradicted.

Morphology

All Magnoliaceae are trees or shrubs with caducous or (always in Malesia) persistent leaves. The leaves possess a pair of stipules which are connate in bud, forming a cap enclosing the young leaves in such a way that the stipules of the last developed leaf enclose the terminal bud and then rupture longitudinally (the two original stipules become separate) and fall, leaving a circular scar around the twig. They can be free from the petiole or (partly) adnate to it, leaving a conspicuous scar when falling. Growth of the internodes often is faster in the beginning of the season, thus forming longer internodes than later. In tropical species, however, there may be no conspicuous difference in length of internodes throughout the twig.

Flowers — The flowers are borne on a pedicle which mostly is the ultimate internode of a brachyblast (always in *Elmerrillia* and *Michelia*, where the brachyblast is axillar; in the other genera the brachyblast or the pedicle with the flower is terminal). The flower bud is often protected by the stipules of the uppermost leaf especially in the genera with terminal flowers. In temperate species these stipules often are leathery and/or hairy. The brachyblast, if present, bears one to several spathaceous bracts which also surround and protect the flower bud. Essentially these bracts consist of a petiole with its stipules (here always adnate to it), together forming a cap like the one surrounding the vegetative buds. Usually the leafblade is absent, but sometimes a reduced blade can be observed. The uppermost spathaceous bract, sometimes called bracteole, surrounds the base of the pedicle. This pedicle can be very short or (nearly) absent to very long.

Perianth — The perianth consists of 6 to many parts which, at least when present in low numbers, are inserted in whorls. Tucker (1960) demonstrated that the 6 perianth parts of *Michelia fuscata* are initiated successively, although from two tiers.

There is little difference in the fundamental plan of vascular systems in the different genera (Ueda, 1984). The outer whorl of the perianth often is not recognized as a calyx. Erbar & Leins (1982) found in *Magnolia stellata*, in which the constituent flower appendages are many and in indefinite numbers, that the tepals arise in a spiral, rather fast after each other. The first primordia possess a relatively broad plain of insertion. After developing of six primordia there is a more or less alternation of 3×3 , on a triangular apex of the flower axis. Higher on this apex becomes 5-angular because the primordia 7 and 8 stay not much higher than 4, 5, and 6. The primordia 1, 2, and 3 often do not differentiate, or only one of them differentiates. The spiral

in which the tepals origin is maintained when, successively, the stamens and carpels arise and can be turning right or left.

In *Magnolia denudata* the number of tepals is fixed. The tepals of the outer whorl arise after each other, with a clear time delay between the first and the other two who arise rather fast after each other. As in *Magnolia stellata* the plain of insertion becomes gradually narrower in the later arising tepals. The nine tepals are arranged in three whorls of 3, but are not equidistant within their whorl. I observed the same phenomenon in *Michelia nilagirica* from Ceylon. Erbar & Leins (1982, 1983) explain the existence of tepals in alternating whorls of three because in a spiral 3 tepals are inserted in one revolution and because there is a time delay after the formation of each whorl. After the arising of three primordia there is a long pause. This forces the next three primordia into the gaps between the former.

According to Ueda (1984) Magnoliaceae possess a true calyx. There are several differences between the outer whorl and the others like texture, shape and size, thickness, and width at the base. Except for the texture those differences can be explained by Erbar & Leins' conclusions too. Another difference is in the vascularization. Ueda also argues that the direction of the helix is commonly different in the sepals and the petals, which is in my opinion contradictory to the observations of Erbar and Leins.

Vascular system — The floral axis of the representatives of Magnoliaceae is characterized by two vascular systems (Skipworth, 1970), a stelar and a cortical system of vascular bundles. The brachyblast, at its base, contains a ring of normal collateral vascular bundles. The cortical system arises below the flower, either directly from the stele or as branches of leaf and stipule traces. In many cases it finally comprises a lattice in gynoecial and androecial regions, while its strands are frequently interconnected by apparent rings of vascular tissue in the region of the perianth. Generally the cortical system provides the lateral traces of the flower appendages, the stelar system the median traces. This strongly suggests the essential similarity of bracts, perianth members, stamens, and carpels. According to Skipworth it is highly probable that all floral parts in Magnoliaceae are of leaf rank. According to Ueda (1984) sepals are supplied by five to fifteen strands which are arranged in two levels at the base of the sepals: a midvein and two strong lateral veins, sometimes an additional two strong lateral veins, in the lower level, and the other, weak, veins in the upper level. Petals are vascularized by eleven to seventeen traces in three levels at their base. A midvein and two strong lateral veins in the lower level, three to five lateral veins in the middle level, and the other five, weak veins in the upper level.

Stamens — The stamens are spirally arranged and develop either directly after the tepals and in the same 8 (7–10) parastichies like in *Magnolia stellata* (Erbar & Leins, 1982), or after a relatively long interval like in *Magnolia denudata* (l.c.) and *Michelia fuscata* (Tucker, 1960). In *Magnolia denudata* the spiral of the stamens jumps in relation to the basal spiral. Several primordia originate too early compared with the other ones. So stamen 9 arises before stamen 6. This jump is conveyed to a higher level where the same phenomenon occurs with stamen 14 and 17 and with stamen 22 and 25.

A number of tropical species has stamens closely comparable to those of Degeneriaceae and Himantandraceae, viz. broad 3-veined microsporophylls with two pairs of linear sporangia deeply embedded in their surface. Trends of specialization found in the stamens of the Magnoliaceae are: 1. elongation of the apices; 2. differentiation of a filament; 3. reduction in number of veins from three to one; 4. an increase in the relative size of the sporangia and a concomitant increase in their amount of protuberance; 5. transition from a laminal to a marginal position of the sporangia; and 6. development of an enveloping fibrous layer in the 'connective' (Canright, 1952). The stamens mostly are innervated by three veins. The median trace normally departs from the stelar system of the floral axis while the two lateral depart from the cortical system. In several species (most in *Michelia*) only one trace is present. In other genera also 5–7 traces can be found, often in the same flower as stamens with three traces. Teratological stamens often occur, from broad petaloid stamens to narrow filamented ones. They were found in the same flower of *Michelia champaca*. Also carpels with varying degrees of fertility were found among the stamens.

Carpels — The carpels are arranged spirally on the lengthened receptacle. As said above, in *Magnolia stellata* at least they arise in the same spirals as stamens and tepals, i.e. they arise in the same 8 (sometimes 7 or 9) parastichies. Tucker (1961) found the same for the carpels in *Michelia fuscata* of which she investigated the phyllotaxis and the vascular organization. The phyllotaxis and the vascular organization are closely related. The carpels in this species are initiated along each of 7, 8, or 10 helical parastichies according to a complex repetitive sequence. The pattern of the dorsal carpellary trace fusions is orderly for each of the flowers investigated. Among flowers one finds differing numbers of parastichies, different angles of divergence, and varying sequences of parastichies which reflect the order of carpel initiation. The angle of divergence, although consistent for any one parastichy, can vary greatly between parastichies.

The carpels of the Magnoliaceae (and the related Himantandraceae, see Canright, 1960) exhibit drastic trends of modification from the primitive ranalian megasporophylls. The most significant specializations are: 1) closure of the fertile part of the carpel (but see fig. 2 which shows that the carpels in *Magnolia nitida* possess free margins); 2) restriction of the external stigmatic surfaces to the margins of the conduplicate style; and 3) conspicuous changes in the vascularization of the carpels. There is also a tendency towards a reduction in the number of ovules (to two in many Magnoliaceae) and to lateral adherence or actual concrescence of crowded carpels. The carpels of Magnoliaceae exhibit more or less advanced stages of phylogenetic modification. Thus the gynoecium is in contrast to the androecium where relatively primitive forms of microsporophylls are retained by a number of species.

The carpels, too, are supplied by three veins. A dorsal trace runs upwards, enters the carpel, and then suddenly turns downwards. At this point the so-called ascending strand is diverged from the dorsal strand and gradually bifurcates to branch off the ovular strands and to finally unite with the two ventral strands. The dorsal traces commonly originate from the stelar system while the two ventral traces originate from the cortical system. Canright (1960), however, found in cleared material from

Michelia champaca that 'not uncommonly, the basal carpels of a gynoecium are vascularized entirely by the cortical system, and the apical carpels entirely by the stelar system.'

Fruits — The fruits of Magnoliaceae principally consist of one (rarely, in *Michelia montana*) to several or many free carpels spirally arranged around the receptacle. The fruiting carpels are woody and entirely free in some taxa while they are, secondarily, more or less connate in others. The young carpels are always free when initiated, and only relatively late in ontogeny they may become concrescent.

Van Heel (1981, 1983) suggests that the carpels are basically cupuliform. He criticizes conclusions entirely based on investigation of mature carpels. After investigation of ontogenetical stages with a scanning electron microscope he comes to the conclusion that carpels arise as cup-shaped (ascidiate) or partly cup-shaped organs lateral or terminal on the flower apex. In Magnoliaceae the carpels arise as hemispherical primordia according to Van Heel. The development begins with the widening of the lower half of the hemispherical primordium, after which a thick margin grows outwards and also upwards. The upper (adaxial) region of the initial primordium develops into the inside margin of the cup. The adaxial inside margin originally is distinct, as well as the obliquely cup-shaped lateral development of the carpel as a whole. Later on, however, this adaxial region cannot be distinguished any more from the floral axis. According to Canright the margins of the carpels become adnate to the floral axis. According to Van Heel's observations there is no later fusion, but already in an early state there is no abaxial margin present. On the side of the floral axis the cup is deepened secondarily, and the ovules originate in it laterally on the inside margin close to the floral axis when an ovary and a style have not yet differentiated.

Dehiscence of the mature carpels is mostly along the dorsal suture, often also along the ventral suture. Sometimes the carpels become bivalved, the two valves only adnate to the central axis, shedding their seeds. Sometimes the carpels form a pseudosyncarp, becoming more or less concrescent. But only the outer layers of the exocarpium are really concrescent, giving the fruit the appearance of a syncarp. In the latter case the dorsal (abaxial) parts of the carpels finally fall away, leaving their base, which is inbedded in the receptacle, exposed with the seeds mostly hanging from their placenta on the elongate funicle which in that stage consists of spiral vessels. In some taxa abaxial parts of the carpels when falling also dehisce along the dorsal suture (*Tsoongiodendron*, but also in some *Talauma* species and in *Manglietiastrum*, fig. 3). In *Magnolia nitida* and *M. kachiraricharai* the carpels are essentially connate. When maturing they tear apart and dehisce along the dorsal suture thus giving the appearance of a common *Magnolia* fruit (fig. 1, 2). This condition probably exists in many species with crowded carpels. The concrescence of the carpels has apparently developed independently in different lineages of Magnoliaceae. Species with free and concrescent carpels sometimes are very closely allied, judging from the other characters. Therefore I do not accept the concrescence of the carpels alone as a good character for delimitation of genera and I consider e.g. *Paramichelia* and *Tsoongiodendron* as congeneric with *Michelia*. No more do I see reason to split *Elmerrillia* on the base of this character.

Subdivision of Magnoliaceae

The family can easily be divided into two subfamilies:

- *Magnolioideae*. Leaves entire or occasionally 2-lobed at the apex; stipules free from the petiole or adnate to it. Anthers introrse or latrorse. Fruiting carpels longitudinally dehiscent or circumscissile, at least the base remaining adnate to the torus, free or conerescent into a syncarp, never samaroid. Testa free from the endocarp, externally ariloid.
- *Liriodendroideae* (Bark.) Law Yuh-wu. Leaves 2–10-lobed, the apex truncate or widely emarginate; stipules always free from the petiole. Anthers extrorse. Fruiting carpels indehiscent, samaroid, produced at the apex into a long wing-like beak, caducous. Testa adherent to the endocarp.
Only one genus, *Liriodendron*, which will not be treated here.

2. SUBFAMILY MAGNOLIOIDEAE

In subf. Magnolioideae two tribes clearly can be recognized.

KEY TO THE TRIBES

1 a. Growth sympodial. Flower buds arising terminal on the twigs

A. Tribus Magnolieae

b. Growth monopodial. Flower buds arising on brachyblasts in the axis of the leaves B. Tribus Michelieae

GENERIC DELIMITATION IN MAGNOLIEAE

The problem of Dugandiodendron. — The genus *Dugandiodendron* Lozano-Contreras (1975) differs, according to Lozano, from *Talauma* in the position of the flower and in the prefoliation of the vegetative buds. The morphology of those characters is extensively discussed. Lozano recognizes in the family Magnoliaceae two types of anthotaxis: 1) a terminal flower ('flor terminal') and 2) a pseudolateral flower ('flor pseudolateral'). He states that the so-called pseudolateral flower is found in the genera *Alcimandra*, *Elmerrillia* and *Michelia* and his newly described *Dugandiodendron*. As a matter of fact, the flowers in *Alcimandra* are terminal as they are in *Magnolia* and *Talauma*. *Alcimandra* was described because of its stipitate gynoeceium. In *Elmerrillia* and *Michelia* the flowers (or flowershoots) are axillary and the growth monopodial. From Lozano's description of *Dugandiodendron* 'Flores solitarii pseudolaterali (ob ramificationem sympodialeam pro maxima parte accrescentum acrotomicam in vertice ramulorum)', as well as from the drawings and the collections that I have seen (the lectotypes of *Magnolia ptaritepuiana* Steyermark and *M. roraimae* Steyermark, both from FI) it is clear that the flowers in his genus are terminal as they are in *Magnolia* and *Talauma*. From Lozano's commentary in *Taxon* (1984) I understand that he distinguishes between a terminal flowerbud giving rise to one pair

of bracts and one flower only in *Dugandiodendron* and a terminal flowerbud giving rise to a short shoot with more than one pair of bracts, the latter morphologically being stipules often possessing a petiole and sometimes a leaf as well, in *Magnolia* and *Talauma*.

Both states are met elsewhere in *Talauma* and *Magnolia* and do not constitute a differential character at genus niveau.

The other differential character mentioned by Lozano is the prefoliation in the vegetative buds. He distinguishes between 'prefoliation erecta convoluta' and 'prefoliation erecta heliciconvoluta'. The latter is, according to Lozano, only found in *Dugandiodendron* and probably in *Elmerrillia* and is accompanied by obvious longitudinal marks on the lamina. However, those marks are often hardly or not at all visible according to both Lozano's and my own observations. In my opinion, and according to Van Heel (pers. comm., 1983) who examined preserved buds of *Elmerrillia ovalis*, collected by me, it is only a matter of degree whether the prefoliation is convolute or heliciconvolute. In *Elmerrillia* the younger buds are often the convolute kind, while the older ones sometimes become heliciconvolute. As a matter of fact, in a *Talauma* species from Mt Kinabalu, Sabah, North Borneo, which is not yet described (Carr's *Talauma*, W. Meijer, 1968; P. Cockburn, 1980), the same marks occur, described by Meijer as '2 furrow-like lines of depression at both sides of the midrib or less parallel with the leaf margin.' These lines originate from the same kind of prefoliation as in Lozano's *Dugandiodendron*. The only conclusion I can reach is that *Dugandiodendron* was described on differential characters that I fail to observe.

Dr. Praglowski in Stockholm (author of Magnoliaceae in World Pollen and Spore Flora 3, 1974) has been so kind as to look at the pollen of *Magnolia (Dugandiodendron) ptaritepuiana*. His conclusion is that the pollen 'can perfectly well be considered a *Magnolia* species . . . The exine surface with rugulose exine structure and tectal perforations . . . both features which are very typical for *Magnolia* pollen.' From the above I conclude that the species ascribed to *Dugandiodendron* by Lozano belong to *Magnolia* or *Talauma*. As I consider *Talauma* to be congeneric with *Magnolia*, all species of *Dugandiodendron* belong to *Magnolia*.

Delimitation of the other genera of Magnolieae. — After coming to the conclusion that in *Michelia* and *Elmerrillia* concrescence of the carpels is of no importance as a character on generic level, but can be on a species level (example: it is the only character that always holds good between *Elmerrillia ovalis* and *E. tsiampacca*), I came to study the species of *Magnolia* sect. *Gynopodium* Dandy. The species are characterized by a usually shortly stalked gynoeceum, a complete lack of hairs, and comparatively small glossy green leaves with free stipules. Because of the gynophore Keng (1955) based his genus *Micheliopsis* on *Magnolia kachirachirai*, which had been described as *Michelia kachirachirai* by Kanehira & Yamamoto because of the same character and reduced to *Magnolia* by Dandy (1927). Keng later (1976) reduced the genus to *Magnolia*. An interesting feature, already described by Keng (1955), is that the carpels are connate when young (Keng, 1978, joined already the genera *Magnolia*, *Manglietia*, *Talauma*, and *Aromadendron*). When they become ripe they tear apart

Characters of the 'genera' involved.

	<i>Dugandiodendron</i>	<i>Magnolia</i>	<i>Talauma</i> <i>Aromadendron</i>	<i>Alcimandra</i>	<i>(Elmerrillia)</i>	<i>(Michelia)</i>
position of flower	terminal*	terminal	terminal	terminal	axillary	axillary
carpels	concescent or free	concescent or free	concescent	free	concescent or free	concescent or free
prefoliation of bud	heliciconvolute	convolute	convolute or heliciconvolute	convolute	heliciconvolute	convolute
stipitate gynoecium	no	sometimes	no	yes	no	yes
growth	sympodial	sympodial	sympodial	sympodial	monopodial	monopodial
pollen	magnolia type**	magnolia type	magnolia type	magnolia type	different	different

* Pseudolateral according to Lozano because the axillary bud giving the new shoot arises from a leaf some nodes below the flower. This condition frequently is found in *Magnolia* and *Talauma* too.

** Only known from *Magnolia (Dugandiodendron) ptaritepuiana*.

and open along the dorsal suture. The number of ovules in *Magnolia kachirachirai* was described as two. I found, however, 4 ovules in each carpel (*Liao & Lai 10534*, Taiwan, Hengchun Peninsula). To be certain that this species does not belong to *Manglietia* (although it is glabrous whereas all *Manglietia* species possess hairs), Dr. P. Baas (L) examined the leaf anatomy. The epidermis is weakly sclerified, the hypodermis absent, spongy parenchyma ('arm parenchyma') not sclerified. The vein sheath cells are lignified (it is not clear in sections whether there is an additional unlignified sheath of lobate cells). The leaf margin is not sclerified. Terminal cells are difficult to observe in sections. The conclusion is that the leaf anatomy rules out that this specimen belongs to *Manglietia*.

In *Magnolia nitida* the fruit is similar and the number of ovules per carpel two. Moreover, in Dandy's genus *Alcimandra*, based on *Michelia cathcartii* Hook. f. & Thomson, also a gynophore is present. The fruits are similar to common *Magnolia* fruits, or even more to the fruits of free carpelled *Michelias*. Dandy (1927) states that *Alcimandra* is not related to *Michelia* but 'is more correctly placed near *Magnolia gustavii* and *Aromadendron*'. *Alcimandra*, however, has 2–5 ovules in each carpel.

As *Talauma* and *Aromadendron* only differ from *Magnolia* because of the concescence of the carpels, a character now demonstrated to occur in *Magnolia* itself albeit not in the same gradation, I see no grounds to uphold *Alcimandra*, *Aromadendron* and *Talauma* as genera separate from *Magnolia*. Moreover, the species of *Talauma* are

so closely related to the species of *Magnolia* sect. *Gwillimia* from Southeast Asia, that they are indistinguishable in the absence of fruits.

The genus *Manglietiastrum* Law, of which no collections could be obtained, shows similarities with sect. *Gynopodium*. The fruit, however, is that of *Talauma*. According to Chang Chetseng (1982) the wood is very similar to that of *Talauma*, *Aromadendron* and the majority of *Magnolia*. Therefore I have no problem to reduce *Manglietiastrum* to *Magnolia*. The number of ovules is 3–5, thus demonstrating that this character, considering also *Alcimandra* and *Magnolia kachirachirai*, does not have the value formerly ascribed to it by Dandy.

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3. SPECIAL PART

A. Tribus Magnolieae

Growth sympodial. Flower buds arising terminal on the twigs, the latter growing in length from an axillary bud of one of the upper leaves. Genera: *Magnolia* (incl. *Talauma*, *Alcimandra*, *Manglietiastrum*, *Aromadendron*), *Manglietia*, *Kmeria*, *Pachylarnax*.

Note. Only the species that are more extensively studied are treated here with full synonymy or reduced when necessary.

KEY TO THE GENERA

- 1 a. Flowers bisexual; tepals 9 or more, sometimes the outer whorl forming a calyx . . . 2
 b. Flowers unisexual; tepals 6 or 7, subequal 4. *Kmeria*
 2 a. Fruit a woody loculicidal capsule composed of few (2–8) concrescent carpels. Tepals 9–15, subequal. Ovules about 4–8 in each carpel. Stipules free from the petiole 3. *Pachylarnax*
 b. Fruit consisting of few to many separate carpels along the torus 3
 3 a. Ovules 4 or more in each carpel. The hair base replaces a normal epidermal cell, so that the loss of a hair leaves a pore in the cutical membrane. Leaf anatomical characters: sclerified epidermal and hypodermal layers, sclerified spongy parenchyma in the mesophyll, unligified lobate vein-sheath cells, absence of either sclerified veinlet terminal cells or a sclerified leaf margin 2. *Manglietia*
 b. Ovules 2 in each carpel (4 in *Magnolia kachirachirai*), sometimes 4 in the lower carpels. The hair base consists of at least two epidermal cells. The hair does not leave a pore when falling 1. *Magnolia*

1. MAGNOLIA

- Magnolia* Linné, Sp. Pl. (1753) 535; Gen. Pl. ed. 5 (1754) 240; Dandy, Kew Bull. (1927) 259; in Hutch., Gen. Fl. Pl. 1 (1964) 55; in Camellias and Magnolias, Conf. Rep. Roy. Hort. Soc. (1950) 64; in Praglowski, World Pollen & Spore Flora 3 (1974) 3; in Treseder, Magnolias (1978). – Type: *Magnolia virginiana* Linné (eastern U.S.A.).
- Talauma* Juss., Gen. Pl. (1789) 281; Dandy, Kew Bull. (1927) 259; in Hutch., Gen. Fl. Pl. 1 (1964) 55; in Praglowski, World Pollen & Spore Flora 3 (1974) 4. – *Magnolia* sect. *Talauma* Baill., Adansonia 7 (1866) 3, 66. – *Magnolia* subg. *Talauma* Pierre, Fl. For. Cochinch. 1 (1881) sub t. 1. – *Violaria* Post & O. Ktze, Lexic. Gen. Pl. (1903) 588, p.p. – Type: *Talauma plumierii* (Schwartz) A. DC. (*Magnolia plumierii* Schwartz).
- Aromadendron* Blume, Bijdr. (1825) 10; Fl. Java Magnol. (1829) 25 ('*Aromadendrum*'); Dandy, Kew Bull. (1927) 259; in Hutch., Gen. Fl. Pl. 1 (1964) 55; in Praglowski, World Pollen & Spore Flora 3 (1974) 3. – *Violaria* Post & O. Ktze, Lexic. Gen. Pl. (1903) 588, p.p. – *Talauma* sect. *Aromadendron* Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 70 (excl. *Talauma vrieseana*). – Type: *Aromadendron elegans* Blume.
- Blumia* Nees, Flora 8 (1825) 152, non *Blumea* DC., nom. cons. – *Magnolia* sect. *Blumia* (Nees) Baill., Adansonia 7 (1866) 2. – Type: *Talauma candollei* Blume.
- Yulania* Spach, Hist. Natur. Veget., Phanerog. 7 (1839) 462. – Type: *Yulania conspicua* Spach = *Magnolia heptapeta* (Buchoz) Dandy.
- Tulipastrum* Spach, Hist. Natur. Veget., Phanerog. 7 (1839) 481. – Type: *Magnolia acuminata* Linné.
- Lirianthe* Spach, Hist. Natur. Veget., Phanerog. 7 (1839) 485. – Type: *Lirianthe grandiflora* Spach = *Magnolia pterocarpa* Roxb.
- Buergeria* S. & Z., Abh. Math.-Phys. Cl. Kön. Bayer. Ak. Wiss. 4, 2 (1846) 186. – Type: *Magnolia stellata* (S. & Z.) Maximowicz.
- Alcimandra* Dandy, Kew Bull. (1927) 260. – Type: *Alcimandra cathcartii* (Hook. f. & Thoms.) Dandy.
- Svenhedinia* Urban, Repert. Spec. Nov. Regni Veg. 24 (1927) 3. – Type: *Svenhedinia minor* (Urban) Urban (*Talauma minor* Urban).
- Parakmeria* Hu & Cheng, Acta Phytotax. Sinica 1, 2 (1951) 1. – Type: *Parakmeria omeiensis* Hu & Cheng (acc. to Dandy, 1974).
- Micheliopsis* H. Keng, Quart. J. Taiwan Mus. 8 (1955) 207, t. 345. – Type: *Micheliopsis kachirachirai* (Kaneh. & Yamam.) H. Keng.
- Dugandiodendron* Lozano-Contreras, Caldasia 11 (1975) 33. – Type: *Dugandiodendron mahechae* Lozano.
- Manglietiastrum* Law Yuh-wu, Acta Phytotax. Sinica 11 (1979) 72, t. 2. – Type: *Manglietiastrum sinicum* Law.

Trees or shrubs. Stipules adnate to or free from the petiole. Flowers terminal, solitary, bisexual. Tepals 9–21, 3–5-merous, subequal or more rarely the outer whorl forming a true calyx. Anthers introrse to latrorse, connective produced into a longer or shorter appendage or rarely unappendaged. Gynoecium sessile or in some species stipitate; carpels many to few, usually free but connate in the sections *Talauma* and *Gynopodium*, and in some other species. Fruiting carpels free, crowded, dehiscent along the dorsal suture, in subg. *Talauma* the basal parts of the ripe carpels staying adnate to the torus, the apical parts falling and thus exposing the seeds which hang from the lengthened funiculus, sometimes the apical parts during or before falling dorsally dehiscing; in some species of sect. *Gynopodium* the carpels connate but tearing apart when maturing and dehiscing dorsally. Ovules generally two in each car-

pel, rarely 3 or 4 in the lower carpels, in few species up to 4 or 5 in all carpels. Ripe seeds often hanging from the funicles which lengthen through uncoiling of the spiral vessels.

Distribution. About 120 species of which about one third in the New World from SE. North America to S. Brazil, the remainder in temperate and tropical South-east Asia from the Himalayas to China, Japan, Taiwan and Malesia.

KEY TO THE SUBGENERA AND SECTIONS

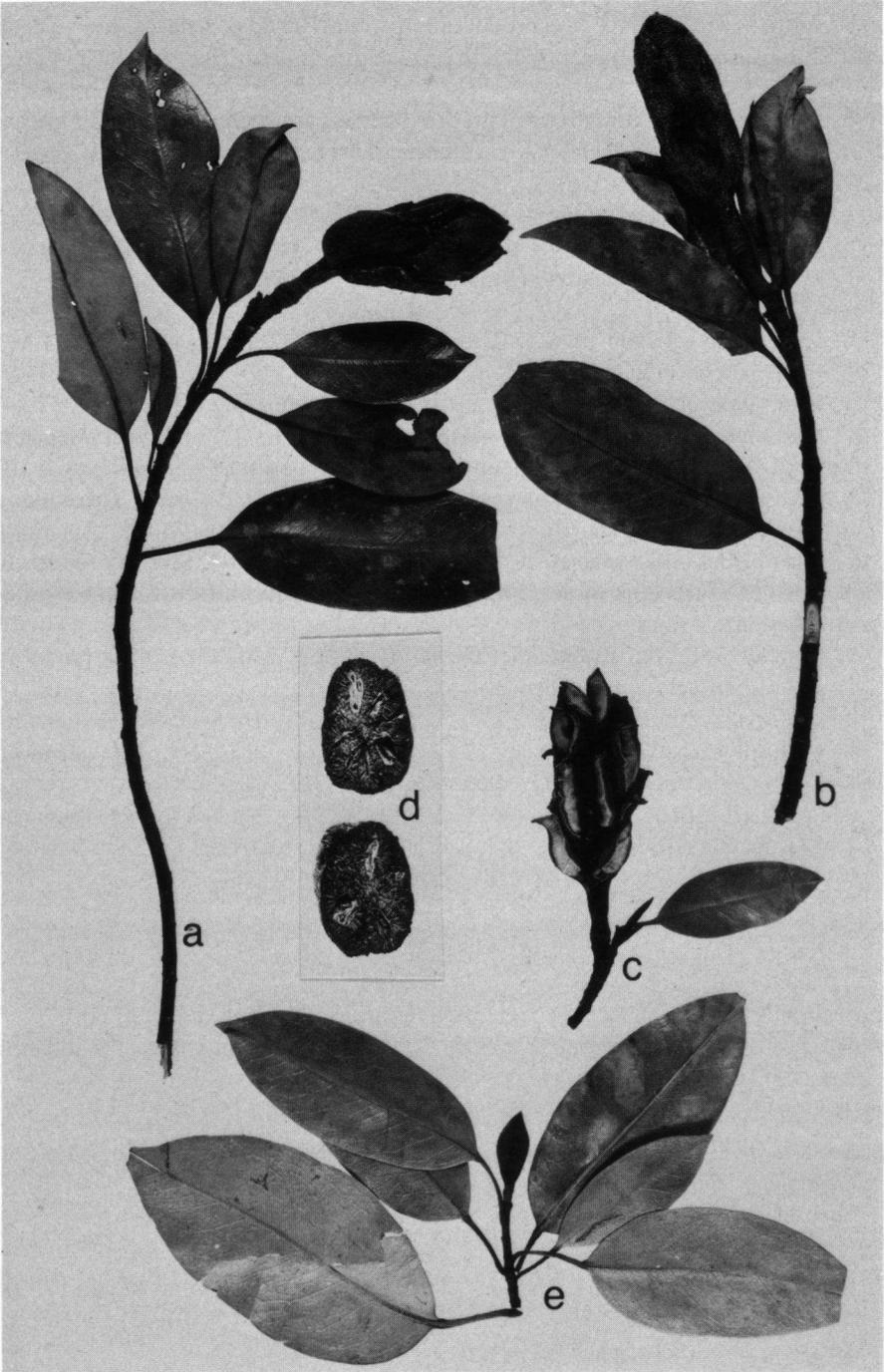
(Modified after Dandy, 1978)

- 1a. Fruits at least finally consisting of free carpels which dehisce along the dorsal suture 2
- b. Fruits with connate carpels. When mature the apical parts of the carpels circumscissile and falling, dehiscing along the dorsal suture or not, the basal parts remaining adnate to the torus, or apical parts falling in irregular masses. —
 - 1c. Subg. *Talauma* 13
- 2a. Anthers dehiscing laterally or sublaterally. Flowers precocious and/or with a much reduced calyx like outer whorl of tepals. Leaves deciduous. Fruit cylindrical or oblong, usually more or less distorted. — 1b. Subg. *Yulania* 3
- b. Anthers dehiscing introrsely. Flowers neither precocious nor with a much reduced (calyx-like) outer whorl of tepals. Leaves evergreen or deciduous. —
 - 1a. Subg. *Magnolia* 5
- 3a. Tepals subequal. Flowers appearing before the leaves, white to rose-purple. Asian species 10. Sect. *Yulania*
- b. Tepals very unequal, those of the outer whorl forming a true calyx 4
- 4a. Flowers appearing before the leaves. Inner (large) tepals white, sometimes tinged with rose or purple. Asian species 11. Sect. *Buergeria*
- b. Flowers appearing with or after the leaves. Inner (large) tepals purple or green to yellow. Asian and American species 12. Sect. *Tulipastrum*
- 5a. Stipules adnate to petiole, leaving a scar on its upper surface 6
- b. Stipules free from the petiole, the latter unscarred. Leaves evergreen 10
- 6a. Leaves evergreen. Flower buds at first enclosed in one or more spathaceous bracts which leave as many annular scars on the peduncle (terminal brachyblast). Asian species 7
- b. Leaves deciduous (sometimes persistent in the American sect. *Magnolia*). Flower buds at first enclosed in a single spathaceous bract which leaves a single annular scar on the peduncle 8
- 7a. Fruiting carpels shortly beaked, the beak not dorsally flattened 2. Sect. *Gwillimia*
- b. Fruiting carpels long beaked. The beak forming a dorsally flattened coriaceous appendage and finally becoming more or less recurved 3. Sect. *Lirianthe*
- 8a. Leaves crowded into false whorls at the ends of the branchlets, usually large or very large. Asian and American species 4. Sect. *Rytidospermum*
- b. Leaves not crowded into false whorls at the ends of the branchlets 9

- 9 a. Anthers with a connective produced into a short acute appendage. Leaves deciduous or sometimes persistent, glaucous on the undersurface. American species
1. Sect. *Magnolia*
- b. Anthers with the connective blunt or retuse and not normally produced into an appendage. Leaves deciduous, the undersurface pale green or somewhat glaucescent. Asian species 5. Sect. *Oyama*
- 10 a. Gynoecium stipitate. Carpels with 2–5 ovules. Fruits cylindrical, 1–4 seeds in each carpel. Stamens with short filament and very long anther, hiding the gynoecium, the connectivum produced into a short linguiform appendage
9. Sect. *Alcimandra*
- b. Gynoecium stipitate or not. Carpels usually with 2 ovules, rarely with 4 and then plant entirely glabrous 11
- 11 a. Fruit more or less cylindrical. Tepals of the outer whorl much thinner in texture than those of the inner whorls. Asian species 8. Sect. *Maingola*
- b. Fruit ellipsoid to oblong, sometimes distorted. Tepals subsimilar in texture . 12
- 12 a. Gynoecium sessile. American species 6. Sect. *Theorhodon*
- b. Gynoecium usually shortly stipitate. Plants entirely glabrous. Ovules sometimes 4 per carpel. Asian species 7. Sect. *Gynopodium*
- 13 a. Stipules adnate to petiole, leaving a scar on its upper surface. Connective produced into a short appendage 15
- b. Stipules free from the petiole, the latter without scar. Connective produced into a long (setaceous) appendage. 14
- 14 a. Gynoecium stipitate 16. Sect. *Manglietiastrum*
- b. Gynoecium sessile 15. Sect. *Aromadendron*
- 15 a. Leaf margin thick, sclerified, often including a vein. Asian species
14. Sect. *Blumiana*
- b. Leaf margin not or only weakly sclerified. American species 13. Sect. *Talauma*

1a. Subgenus *Magnolia*

1. Section *Magnolia*. — *Magnolia* sect. *Magnoliastrum* DC., Prod. 1 (1824) 80.
Species: 1, *Magnolia virginiana* Linné, the type of the genus from the Atlantic coastal plain of the U.S.A.
2. Section *Gwillimia* A. DC., Syst. Nat. 1 (1817) 455, 548; Dandy in *Camellias and Magnolias*, Conf. Report (1950) 68. — Type: *Magnolia coco* DC.
Species: c. 15, Southeast Asia from S. China to the Malay Archipelago.
3. Section *Lirianthe* (Spach) Dandy in *Camellias and Magnolias*, Conf. Report (1950) 68. — *Lirianthe* Spach, Hist. Natur. Veget., Phanerog. 7 (1839) 485. — Type: *Lirianthe grandiflora* Spach = *Magnolia pterocarpa* Roxb.
Species: 1, Central Himalayas through Assam and Bangladesh to Burma.



4. Section *Rytidospermum* Spach, Hist. Nat. Veget., Phanerog. 7 (1839) 474; Dandy in Camellias and Magnolias, Conf. Report (1950) 68. — Type: *Magnolia tripetala* Linné.
Species: 9, in Asia as well as in America.

5. Section *Oyama* Nakai, Fl. Sylv. Koreana 20 (1933) 117; Dandy in Camellias and Magnolias, Conf. Report (1950) 70. — *Magnolia* sect. *Cophantera* Dandy, Curtis Bot. Mag. 159 (1936) sub t.9467. — Type: *Magnolia sieboldii* C.Koch.
Species: 4, temperate East Asia.

6. Section *Theorhodon* Spach, Hist. Natur. Veget., Phanerog. 7 (1839) 470; Dandy in Camellias and Magnolias, Conf. Report (1950) 70. — Type: *Magnolia grandifolia* Linné.
Species: c. 18, all in the New World and, except *M. grandifolia*, tropical.

7. Section *Gynopodium* Dandy, Curtis Bot. Mag. 155 (1948) t. 16; in Camellias and Magnolias, Conf. Report (1950) 71. — *Parakmeria* Hu & Cheng. — *Micheliopsis* Keng. — Type: *Magnolia nitida* W.W. Smith.
Species: c. 4, Southeast Asia from SE. Tibet and NE. Burma through S. China to Taiwan.

7a. *Magnolia kachirachirai* (Kaneh. & Yamam.) Dandy

M. kachirachirai (Kaneh. & Yamam.) Dandy in Kew Bull. (1927) 264; Sasaki, Cat. Gov. Herb. (1930) 215; Kaneh., Form. Trees rev. ed. (1936) 189, f. 138, pl. 39; Dandy, Curtis Bot. Mag. 155 (1948) t. 16. — *Micheliopsis kachirachirai* (Kaneh. & Yamam.) Keng, Quart. J. Taiwan Mus. 8 (1955) 210, t. 345. — Type: *Kanehira* s.n. (TAIF), Taiwan, Taririku, Daibu, May 1924; syntype: *Kanehira* s.n. (TAIF), Nov. 1924.

Distribution. Endemic in Taiwan, in the southeastern part of the island near the southernmost tip at 500–1300 m.

Specimens collected. C.E. Chang 4384; Chun & Tso 44041, 44042; J.C. Liao & Y.K. Lai 10534; J.C. Liao 10377; Liu & Keng 48215; L.J. Wang 48218.

Fig. 1. *Magnolia nitida* W.W. Smith. a–b. Twigs with young fruit, $\times \frac{1}{2}$; c. ripe fruit, $\times \frac{1}{2}$; d. cross-section of young fruit, $\times 1$; e. twig with flowerbud, $\times \frac{1}{2}$ (a, c. *J. F. Rock* 10136; b. *Wang* 67553; d–e. *G. Forrest* 20860).

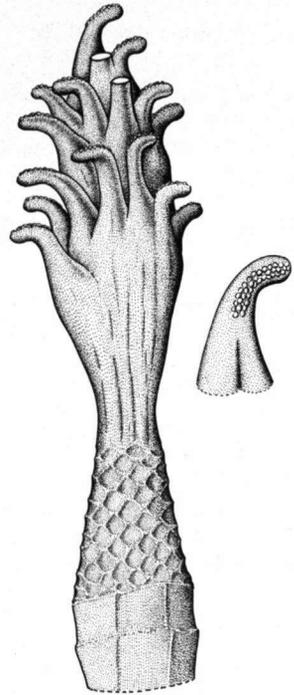


Fig. 2. *Magnolia nitida* W.W. Smith. Developing ovary and one detached free apical part of carpel with style from the inside showing the margins of the carpel which are in that part not connate, $\times 2\frac{3}{4}$ (from *George Forrest* 21616).

7b. *Magnolia nitida* W.W. Smith – Fig. 1 & 2.

M. nitida W.W. Smith, Notes Roy. Bot. Gard. Edinb. 7 (1920) 212; Dandy, Curtis Bot. Mag. 155 (1948) t. 16; in Camellias and Magnolias, Conf. Report (1950) 71; in Treseder, Magnolias (1978) 79, t. – Type: *Forrest 15059*, Yunnan.

Distribution. NW. Yunnan, SE. Tibet and NE. Upper Burma in montane forests at an altitude of 2250–3700 m. About 20 collections seen.

7c. *Magnolia omeiensis* (Cheng & Hu) Noot., *comb. nov.*

Parakmeria omeiensis Cheng & Hu, Acta Phytotax. Sinica 1, 2 (1951) 2 (n.v., acc. to Dandy). – Type: ?.

Distribution. Szechuan, Kweichau.

7d. *Magnolia yunnanensis* (Cheng & Hu) Noot., *comb. nov.*

Parakmeria yunnanensis Cheng & Hu, Acta Phytotax. Sinica 1, 2 (1951) 2 (n.v., acc. to Dandy). – Type: ?.

Distribution. Yunnan.

8. Section *Maingola* Dandy, Curtis Bot. Mag. 155 (1948) sub t. 16; in Camellias and Magnolias, Conf. Report (1950) 71. – Type: *Magnolia maingayi* King.

Species: c. 14, from Assam to Indochina and southward into Malesia as far south as Java.

9. Section *Alcimandra* (Dandy) Noot., *stat. nov.* – *Michelia cathcartii* Hook. f. & Thoms., Fl. Ind. 1 (1855) 79; Fl. Br. India 1 (1872) 42. – *Alcimandra* Dandy, Kew Bull. (1927) 260. – Type: *Alcimandra cathcartii* (Hook. f. & Thoms.) Dandy.

Species: 1, *Magnolia cathcartii* (Hook. f. & Thoms.) Noot.

9a. *Magnolia cathcartii* (Hook. f. & Thoms.) Noot., *comb. nov.*

Michelia cathcartii Hook. f. & Thoms., Fl. Ind. 1 (1855) 79; Fl. Br. India 1 (1872) 42. – *Alcimandra cathcartii* Dandy, Kew Bull. (1927) 260. – Type: *Hooker* (K; iso E, GH, L), Sikkim.

Distribution. Sikkim to Assam and Upper Burma, and Tonkin. 25 collections seen.

1b. Subgenus *Yulania*

Subg. *Yulania* (Spach) Reichenbach, *Der Deutscher Botaniker* 1 (1841) 192; Dandy in Treseder, *Magnolias* (1978) 33. — *Yulania* Spach, *Hist. Natur. Veget., Phanerog.* 7 (1839) 462. — *Magnolia* subg. *Pleurochasma* Dandy, *J. Roy. Hort. Soc.* 75 (1950) 161; in *Camellias and Magnolias*, Conf. Report (1950) 72. — Type: *Yulania conspicua* Spach = *Magnolia heptapeta* (Buchoz) Dandy.

10. Section *Yulania* (Spach) Dandy, in *Camellias and Magnol.*, Conf. Report (1950) 72.
Species: c. 7, temperate E. Asia from Central Himalaya to E. China.

11. Section *Buergeria* (S. & Z.) Dandy, in *Camellias and Magnolias*, Conf. Report (1950) 73. — *Buergeria* S. & Z., *Abh. Math.-Phys. Cl. Kön. Bayer. Ak. Wiss.* 4, 2 (1846) 186. — Type: *Magnolia stellata* (S. & Z.) Maximowicz.
Species: 5 in temperate E. Asia (China, S. Korea, and Japan).

12. Section *Tulipastrum* (Spach) Dandy, in *Camellias and Magnolias*, Conf. Report (1950) 74. — *Tulipastrum* Spach, *Hist. Natur. Veget., Phanerog.* 7 (1839) 481. — Type: *Magnolia acuminata* Linné.
Species: 2, one in SE. North America, and one in E. China.

1c. Subgenus *Talauma*

Subg. *Talauma* (Juss.) Pierre, *Fl. For. Cochinch.* 1 (1881) sub t. 1. — Type: *Magnolia plumieria* Schwarz.

13. Section *Talauma* Baill., *Adansonia* 7 (1866) 3, 66, p.p. — *Talauma* sect. *Richardiana* Blume, *Fl. Java Magnol.* (1829) 32.
Species: c. 12 in tropical America from S. Mexico and Cuba through the Lesser Antilles and Central America to E. Brazil.

14. Section *Blumiana* Blume, *Fl. Java Magnol.* (1829) 32. — *Blumia* Nees, *Flora* 8 (1825) 152. — Sect. *Blumia* Baill., *Adansonia* 7 (1866) 2. — Type: *Talauma candollei* Blume.
Species: c. 40, in tropical and subtropical Southeast Asia from Central Himalaya to Indochina and through Malesia into New Guinea.

15. Section *Aromadendron* (Bl.) Noot., stat. nov. — *Aromadendron* Blume, *Bijdr.* (1825) 10; *Fl. Java Magnol.* (1829) 25. — *Talauma* sect. *Aromadendron* Miq., *Ann. Mus. Bot. Lugd.-Bat.* 4 (1868) 70 (excl. *Talauma vrieseana*). — Type: *Aromadendron elegans* Bl.
Species: 4, confined to W. Malesia, in Sumatra, Malay Peninsula, Banka, Java, and Borneo.



Fig. 3. *Magnolia sinica* (Law) Noot. — Twig with fruit. Photograph by courtesy of the Director of the South China Institute of Botany.

16. Section *Manglietiastrum* Noot., *stat. nov.* – *Manglietiastrum* Law, *Acta Phytotax. Sinica* 11 (1979) 72. – Type : *Magnolia sinica* (Law) Noot.

16a. *Magnolia sinica* (Law Yuh-wu) Noot., *comb. nov.* – Fig. 3.

Manglietiastrum sinicum Law Yuh-wu, *Acta Phytotax. Sinica* 11 (1979) 73, t. 2, 3. – Type : Law & Wang 6075 (Hb. I.B.A.S., only a photo of the type available).

Distribution. Yunnan, at an altitude of c. 1550 m.

2. MANGLIETIA

Manglietia Blume, *Verh. Bat. Gen.* 9 (1823) 149; *Bijdr.* (1825) 8; *Fl. Java Magnol.* (1829) 22; Dandy, *Kew Bull.* (1927) 259; in Hutch., *Gen. Fl. Pl.* 1 (1964) 54; Baranova, *Bot. Zhurn. Leningrad* 54 (1969) 1952; Nong Van Tiep, *Vent & Natho, Wiss. Zeitschr. Humb. Un. Berlin, Math. Nat. R.* 29 (1980) 323; Nong Van Tiep, *Feddes Rep.* 91 (1980) 497. – *Magnolia* sect. *Manglietia* (Bl.) Baill., *Adansonia* 7 (1866) 66. – Type : *Magnolia glauca* Blume.

Paramanglietia Hu & Cheng, *Acta Phytotax. Sinica* 1, 2 (1951) 255. – Type : *Paramanglietia aromatica* (Dandy) Hu & Cheng.

Trees. Stipules adnate to or free from petiole. Flowers terminal, solitary, bisexual. Tepals 9–13, 3-merous, subequal. Anthers introrse, connective produced into a short or long appendage. Gynoecium sessile. Carpels many, free, or often connate when young; ovules 4 or more in each carpel. Fruiting carpels free, crowded, dehiscent along the dorsal and sometimes also the ventral suture.

Distribution. About 25 species in tropical and subtropical Asia from the Eastern Himalayas eastwards to S. China and Malesia (not in the Moluccas and New Guinea).

Note. *Manglietia* is closely related to *Magnolia*. There are, however, a number of differences that warrant to uphold the genus. Firstly, the placenta of *Magnolia* (incl. *Talauma*) is very short, adnate to the receptacle, and bears only two ovules, while in *Manglietia* the placenta is long, free from the receptacle and bears 4–12(–16) ovules. Another difference lies in the leaf anatomical characters. *Manglietia* leaves are characterized by sclerified epidermal and hypodermal layers, sclerified spongy parenchyma in the mesophyll, unligified lobate vein-sheath cells, and an absence of either sclerified veinlet-terminal cells or a sclerified leaf margin. No other genus within Magnoliaceae combines all those features, although others do show one or more. Sterile specimens of *Manglietia* can easily be recognized on the basis of clear leaf segments. Another leaf anatomical difference form the hairs. In *Manglietia* a unique type of hair is found in which the hair base replaces a normal epidermal cell, so that the loss of a hair leaves a pore in the cuticular membrane. The hair itself consists of a row of 2–6 cells. In the other genera of Magnoliaceae the hair base consists of 2 to more modified epidermis cells (Baranova, 1972; Tucker, 1977; Nong Van Tiep, 1980; Nong Van Tiep et al., 1980).

KEY TO THE SPECIES IN MALESIA

- 1a. Stipules only adnate to the very base of the petiole. Stipular scar hardly or not present. Innovations, stipules, young petioles and underside of leaves never woolly pubescent 2
- b. Stipules higher adnate to petiole, stipular scar clearly present 4
- 2a. Peduncles appressedly hairy 1b. *M. glauca* var. *sumatrana*
- b. Peduncles glabrous 3
- 3a. Underside of leaves densely minutely reddish brown appressedly hairy. Nerves in 10–15 pairs 3. *M. calophylla*
- b. Underside of leaves glabrous. Nerves in 14–20 pairs 4. *M. sabahensis*
- 4a. Innovations, peduncles, stipules and underside of leaves rufous woolly pubescent 2. *M. lanuginosa*
- b. Twigs and stipules glabrous or nearly so. Hairs of present minute and appressed 5
- 5a. Fruits cylindrical, 2–3 times as long as wide; carpels mostly opening along the dorsal suture first. Ovary conical or cylindrical 5. *M. dolichogyna*
- b. Fruits ellipsoid or ovoid, only slightly longer than wide 1. *M. glauca*

1. *Manglietia glauca* Blume

M. glauca Blume, Verh. Bat. Gen. 9 (1823) 150; Bijdr. (1825) 8; Fl. Java Magnol. (1829) 22, t. 6; Korth., Ned. Kruidk. Arch. 2 (1851) 97; Miq., Fl. Ind. Bat. 1, 2 (1858) 15; Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 71; Groppler, Bibl. Bot. 31 (1894) 31; K. & V., Meded. Lands Plantent. 17 (1896) 150; Backer, Schoofl. Java (1911) 14; Koord., Exk. Fl. Java 2 (1912) 238, f. 47; Koord.-Schum., Syst. Verz. 1, Fam. 95 (1913) 1; Rant, Nat. Tijd. Ned. Ind. 89 (1929) 446; von Malm in Fedde, Rep. 34 (1934) 274; Backer & Bakh. f., Fl. Java 1 (1963) 97; Baranova, Bot. Zhurn. Leningrad 54 (1969) 1957. – *Michelia doitsopa* auct. (non Buch.-Ham. ex DC.): Spreng., Syst. Verz. 4, 2 (1827) 217; Hassk., Cat. Hort. Bog. (1844) 178. – *Magnolia blumei* Prantl in E. & P., Nat. Pfl. Fam. 3, 2 (1888) 16. – Type: *Blume s.n.* (n.v.), Salak.

M. macklottii (non Korth.) Miq., Fl. Ind. Bat. 1, 2 (1858) 15, p.p. – *M. oortii* (non Korth.) Miq., ibid. Suppl. (1860) 153. – Type: *Teijsmann HB 466* (L, U), Haleban.

M. sumatrana Miq., Fl. Ind. Bat., Suppl. (1860) 153, nomen; ibid. (1861) 367; Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 71. – *M. oortii* (non Korth.) Miq., Fl. Ind. Bat. 1, 2 (1858) 15, p.p. – *M. glauca* var. *sumatrana* Dandy, Kew Bull. (1928) 188. – Type: *Teijsmann 468* (L; iso BO), Bukit Silit.

M. pilosa Parment., Bull. Sc. France et Belg. 27 (1896) 217, 292. – *M. singalanensis* Agostini, Atti Com. Accad. Fisiocrit. Siena IX, 7 (1926) sep. 22. – Type: *Beccari PS 334* (L, FI), Sumatra, Mt Singalan.

Tree up to 35 m by 122 cm diam. Twigs warted, with many ring-formed scars of the fallen stipules, glabrous or with some hairs at the apex, in var. *sumatrana* appressedly hairy in innovations. Stipules glabrous or with some hairs on the apex, adnate to the petiole, c. 15–60(–90) mm. *Leaves* glabrous above, minutely appressedly hairy beneath, sometimes the hairs microscopically small and the leaves seemingly glabrous, glaucous, (long-)elliptic to slightly obovate, 10–35 by 5–12 cm; base acute to slightly acuminate, margin slightly recurved, boney, apex shortly obliquely acumi-

nate, acumen 3–15 mm; midrib much prominent, lengthwise grooved below, sulcate above; nerves in (9–)11–16(–18) pairs, decurrent along the midrib, prominent on both sides, straight, anastomosing at some distance from the margin and merging into the venation, sometimes an intramarginal vein distinct; reticulation fine, prominent on both surfaces. Petiole glabrous, 1.5–3(–4.5) cm, stipular scar c. 3–10(–15) mm, less than one third of its length, rarely slightly longer, sometimes even up to above halfway its length. Peduncle glabrous, or appressedly hairy in var. *sumatrana*, without scars or with one scar, 15–40 mm, pedicle glabrous, or appressedly hairy in var. *sumatrana*, 2–8 mm. *Spathaceous bracts* at least one towards the base of pedicle and one at base of peduncle or more higher up, sometimes a third at the middle of the peduncle or lower. Outer tepals 3, c. 5–6.25 by 2 cm, inner tepals 6, smaller than the outer tepals; stamens many, filament c. 3 mm, anthers c. 6 mm, connective appendage very acute, c. 4 mm. Gynoecium ovoid to orbicular, c. 15 by 7 mm, carpels 20–c. 50, nearly entirely connate when young, c. 3 mm long along the dorsal suture, dorsal face polygonous; style free, 1.5–2 mm long. *Fruits* ellipsoidal or ovoid, 3.5–8(–9.5) by 2.5–5.5(–6.5) cm, each carpel with 2–6 seeds; abaxial part with the dorsal suture (forming the outside of the fruit) polygonal; the carpels start to open ventrally and thereafter dorsally, often staying closed towards the basal side of the dorsal suture; falcate midrib often becoming separate. *Seeds* flat-orbicular to ellipsoidal, often irregularly shaped, 5–8 by 4–5 mm.

1a. var. *glauca*

Peduncle and pedicle glabrous. Fruits at most 8 by 5.5 cm. Dorsal face of carpels from 1–1.5 cm in the upper to at most 2.5 cm in the lower carpels. Twigs in innovations glabrous.

Distribution. Sumatra: Aceh, G. Ketambe, 1 coll.; Sumatera Utara, E. Coast and Tapanuli, c. 7 coll.; W. Coast, 7 coll.; Lampung, G. Tanggamus, 1 coll. – Java: common in the mountains of W. Java, less so in Central and E. Java, many coll. – Lesser Sunda Islands: Bali, 3 coll., Sumba, 1 coll., Flores, 6 coll. – Celebes: Central, near Malili, 2 coll.; North: Mt Nokilalaki, 1 coll.

Ecology. In forest, 500–2400 m altitude; fl. & fr. I–XII.

Uses. Good timber, used for building houses.

Vernacular names. Sumatra: antuang, bungo, madang kaladi, m. bustak, m. tjampago, tjampago; Java: baros, kanti, kerawang, lumu, manglid (manglied), tempoko baros, tjepoko; Bali: tjimpaka; Celebes: manglid.

Collectors' notes. Flowers cream, rarely white or yellowish green. Fruit (reddish) green to red brown.

1b. var. *sumatrana* Dandy

M. glauca Bl. var. *sumatrana* Dandy, Kew Bull. (1928) 188. – *M. sumatrana* Miq. – *M. pilosa* Parment. – *M. singalanensis* Agostini.

Peduncle and pedicle appressedly hairy. Fruits c. 9.5 by 6.5 cm. Dorsal face of carpels from 2 cm in upper to 3.5 cm in lower carpels. Twigs in innovations appressedly hairy. Stipules often adnate to the very base of the petiole only.

Distribution. W. Sumatra, G. Singalan, G. Talang, G. Merapi, G. Silit and Padang Panjan; 6 coll.

Ecology. In forests, 600–1300 m altitude; fl. IX–X, fr. VI.

Vernacular name. Sikibus.

Collectors' notes. Flowers yellow or white, fruits black.

2. *Manglietia lanuginosa* (Dandy) Noot., *stat. nov.*

M. glauca Bl. var. *lanuginosa* Dandy, Kew Bull. (1928) 187. – Type: *FRI/bb 8531* (BO), Sumatra.

Tree up to 40 m high and 1 m diam. Innovations and peduncles, stipules, young petioles and undersides of leaves rufous woolly-pubescent. Leaves (narrowly) elliptic, sometimes slightly obovate, 15–26 by 7–11 cm; nerves in 14–20 pairs. Petiole 2.5–4 cm, with stipular scar only towards the base. Further as *M. glauca*.

Distribution. Sumatra, around lake Tobi: Deli, Simelungun and Karo Lands, Tapanuli; 11 coll.

Ecology. Primary forest, 1000–1500 m altitude; fl. II, fr. II–XI.

Vernacular names. Aduwang, antuang, modang sanggar.

Collectors' notes. Flowers cream or green, sweet scented; fruit grey-green becoming brown.

3. *Manglietia calophylla* Dandy

M. calophylla Dandy, J. Bot. 66 (1928) 46; Baranova, Bot. Zhurn. Leningrad 54 (1969) 1954. – *M. glauca* (non Bl.) Ridley, J. Fed. St. Mus. 8, 4 (1917) 14. – Type: *Robinson & Kloss 200* (BM; iso SING), Sumatra, Korinchi Peak.

Tree to at least 30 m by 1 m. Stipules appressedly hairy to nearly glabrous, only adnate to the very base of the petiole. Leaves ovate, covered by a dense indument of very small glistening reddish brown hairs beneath which often can only be seen with a magnification of more than $\times 50$, 10–20 by 4–8 cm, with faintly acuminate apex, recurved, bony margin and acute to nearly rounded base; midrib much prominent beneath, grooved; nerves prominent on both sides, in 10–15 pairs, anastomosing and meeting in an intramarginal vein which is hardly distinct from the finely netted reticulation on both surfaces. Petiole 2–2.5 cm. Peduncle glabrous. Flowers as in *M. glauca* but smaller, the tepals as far as known not longer than c. 2.5 cm. Fruits as the smaller fruits in *M. glauca*, c. 4–5.5 by 3.5–5 cm, number of carpels c. 20. Seeds c. 4 from each carpel, flat ovoid, c. 7 by 4 mm.

Distribution. Sumatra, W. Coast, G. Kerinci; 4 coll.

Ecology. Primary mountain forest, 2000–2200 m altitude; fl. X, fr. V–VIII.

Collectors' note. Flowers white.

4. *Manglietia sabahensis* Dandy ex Noot., *spec. nov.*

'*Sabah Manglietia*' Dandy ex Meijer, Bot. Bull. Herb. For. Dept. Sandakan 11 (1968) 11, nomen.
– *M. 'sabahensis'* Dandy ex Cockburn, Trees of Sabah 2 (1980) 56, nomen.

Arbor. Stipula vix petiolum adnata. Folia glabra nervis primariis utroque latere 14 ad 20 paribus in venam intramarginalem convenientibus reticulo dense prominente. Fructus ellipsoideus ad ovoideus c. 6 cm longa et c. 4 cm lata pedunculo gracile c. 3 cm longo pedicello gracile c. 2 mm longo. – *T y p u s*: *Clemens 34192* (L; iso A, BO), Kinabalu, Columbon basin, 4,500 ft.

Tree. Stipules glabrous, c. 7 cm long, adnate to the very base of the petiole only. Leaves glabrous, the undersurface in young leaves with an occasional very small hair, elliptic to obovate, 12–22 by 6–9 cm; base cuneate, apex acute to rounded, usually not or only very shortly acuminate; midrib sulcate above, very prominent and grooved below; nerves in 14–c. 20 pairs, meeting in an intramarginal vein which is slightly more prominent than the densely netted reticulation. Petiole 23–30 mm, stipular scar hardly visible. Flowers not seen. Fruits ellipsoid to ovoid, c. 6 by 4 cm, the carpels opening along the dorsal suture only or both along dorsal and ventral suture. Peduncle slender, c. 3 cm long, pedicle slender, c. 2 cm long. Seeds c. 4 in each carpel, 5–8 by 3–4 mm.

Distribution. Borneo, Sabah, Kinabalu; 2 coll.

Ecology. In forest, c. 1300 m altitude; fr. VI–VIII.

5. *Manglietia dolichogyna* Dandy ex Noot., *spec. nov.*

M. glauca (non Bl.) King, J. As. Soc. Beng. 58, ii (1889) 370; Ann. Bot. Gard. Calc. 3 (1891) 213, t. 56, excl. fr.; Ridley, Fl. Mal. Pen. 1 (1922) 14, p.p.; Burkill, Dict. (1935) 1407. – '*Long-pistillate Manglietia*' Meijer, Bot. Bull. Herb. For. Dept. Sandakan 11 (1968) 10, nomen. – *M. 'dolichogyna'* Dandy ex Cockburn, Trees of Sabah 2 (1980) 56, nomen.

Arbor ad 21 m alta et 60 cm diametro. Petiolus cicatrice stipulorum ad dimidium. Flores pedunculo c. 2–3 cm longo pedicello 4–7 mm longo tepalis 9 ovario conico vel cylindrico. Fructus lineares 4 ad 7.5 cm longi, 2–2.5 cm lati carpellis c. 60 secus suturam dorsalem primo dehiscentibus. – *T y p u s*: *SAN 41051* (L; iso SAN), Ranau, Hot Spring, 15 Oct. 1964.

Tree up to 21 m and 60 cm diam. Stipular scar on petiole to c. halfway. Flowers: peduncle c. 2–3 cm, pedicle 4–7 mm, spathaceous bract glabrous, outer tepals 3, c. 3.5 by 14 mm, inner tepals 6, smaller; stamens many, c. 10 mm, incl. the c. 3 mm long acute connective appendage. Ovary conical or cylindrical, dorsal face of carpels 2–3 mm along suture, style c. 2 mm long. Ripe fruits cylindrical 4–7.5 by 2–c. 2.5 cm, 2–3 times as long as wide, carpels c. 60, c. 1 cm along the dorsal suture, opening along the dorsal suture first and sometimes later also along the ventral suture. Seeds flat ellipsoidal, c. 6 by 4 mm. Otherwise as *M. glauca*.

Distribution. Malay Peninsula, Perak, Taiping; 2 coll. – Borneo, Sabah, Tenom, 1 coll.; Tambunan, 1 coll.; Kinabalu, 10 coll.

Ecology. Primary forest, 450–1500 m altitude; fl. III–V; fr. IV–II.

Collectors' notes. Outer tepals dark purple on green, inner tepals lemon with purple tinge; flowers pale yellow.



Fig. 4. *Pachylarnax praecalva* Dandy. — a. Habit, $\times 2/3$; b. fruit, $\times 2/3$; c. ovary, $\times 2$; d. anther, $\times 3$ (Curtis 3012).

EXCLUDED SPECIES

Manglietia ? minahassae Koord. & Valetton, Meded. Lands Plantent. 19 (1898) 328, nomen; Koord.-Schum., Syst. Verz. 3, 1 (1914) 41, nomen = *Madhuca burckiana* (Koord.) Lam. (Sapotaceae).

3. PACHYLARNAX

Pachylarnax Dandy, Kew Bull. (1927) 260; in Hutch., Gen. Fl. Pl. 1 (1964) 55. – Type: *Pachylarnax praecalva* Dandy.

Trees. Stipules free from the petiole. Flowers terminal, solitary, bisexual. Tepals 9–15, 3–5-merous, subequal. Anthers introrse; connective produced into a short appendage. Gynoecium sessile; carpels few (2–8), conerescent; ovules about 4–8 in each carpel. Fruit a thick-walled woody loculicidal capsule, the carpels dehiscent along the dorsal suture and sometimes separating towards the apex.

Distribution. There are 2 species, of which one in Assam and one in Indochina and Malesia (Sumatra and the Malay Peninsula).

1. *Pachylarnax praecalva* Dandy – Fig. 4.

P. praecalva Dandy, Kew Bull. (1927) 260, excl. plantae ex Annam; Keng, Tree Fl. Malaya 2 (1973) 289, t. 4. – Type: *Haniff 4067* (K; iso SING), Penang.

Tree 10–60 m by 30 cm–c. 1 m, glabrous in all its parts. Stipules free from the petiole. Leaves glossy above, less so beneath, (narrowly) elliptic to obovate, 7–16 by 3–6.5 cm; base cuneate or attenuate; margin recurved; apex obtuse or rounded; midrib prominent beneath, slightly so above; nerves in 12–15 pairs, prominent on both surfaces, curved upwards and meeting in a looped intramarginal vein which is rather indistinct from the coarsely netted venation. Petiole without stipular scar, slender, 1.5–3 cm long. Flowers terminal on an incrassate peduncle of 0.5–20 mm (sometimes the peduncle becoming much longer); 1–3 (rarely many) spathaceous bracts under each flower, pedicle very short. Tepals 9(–10), more or less similar, the outermost oblanceolate to oblong, 2.5–3.5 cm long; stamens c. 17–20 mm long with an acute connective appendage; gynoecium elongate-obovoid; carpels 2–4; ovules 4–8. Fruit 3.5–6 cm long, more or less orbicular before opening, loculicidal, splitting into 2–4 valves, the carpels more or less separating from each other later, in the centre a columella with the attached fruits persistent; seeds black with enveloping pink aril.

Distribution. Annam: Bana near Tourane. In Malesia: Sumatra, W. Coast; Malay Peninsula: Kedah, Penang, Selangor.

Ecology. In primary forest, 360–1800 m altitude. Fl. fr. probably the whole year round.

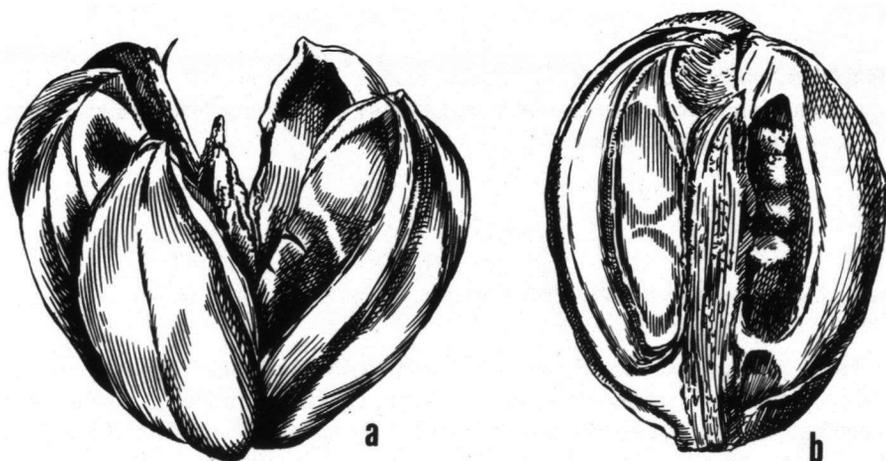


Fig. 5. *Pachylarnax pleiocarpa* Dandy. Fruit, $\times 1$. – a. After dehiscence; b. immature, longitudinal section (after *Purakayastha 9635* in Hb. Shillong. Del. M. Hall, 6 Nov. 1933).

2. *Pachylarnax pleiocarpa* Dandy – Fig. 5.

P. pleiocarpa Dandy, J. Bot. 71 (1933) 313. – Type: *Beat Officer 48427* (BM), Lakhimpur Dist., Jaipur Reserve.

A big glabrous tree, differing from *P. praecalva* in the leaves becoming 23 by 7.5 cm, the –conspicuous– nerves in 10–18 pairs, the (slightly) incrassate petiole, the 13–15 tepals becoming 5–6 cm long and the number of carpels being 5–8, the fruit becoming 5.5–8.5 cm long.

Distribution. Assam, Lakhimpur Dist. Common in the hilly reserves along the foot of the Naga Hills.

Ecology. Fl. VIII–IX, fr. IX–XII.

COLLECTIONS OF PACHYLARNAX EXAMINED

Beat Officer 48427 (T): 2; 48428: 2 – *Curtis 3012*: 1 – *Forest Officer s.n.*: 2 – *FRI bb 6499*: 1 – *Haniff 3485*: 1; 4067: 1 – *Ichlas 4*: 1 – *KEP/FRI 12435, 19132, 20453, 20524*: all 1 – *Meijer, W. 3173*: 1 – *Poilane 7264*: 1.

4. KMERIA

Kmeria (Pierre) Dandy, Kew Bull. (1927) 262; in Hutch., Gen. Fl. Pl. 1 (1964) 56. – *Magnolia* subg. *Kmeria* Pierre, Fl. For. Cochinch. 1 (1879) sub t. 1. – Type: *Kmeria duperreana* (Pierre) Dandy.

Tree; stipules adnate to the petiole. Flowers terminal, solitary, unisexual, with a very short torus. Tepals 6–7, 3-merous, subequal. Anthers introrse, the connective produced into a short or moderately long appendage. Gynoecium sessile; carpels comparatively few, concrescent; ovules 2; fruiting carpels woody, separating on dehiscence, dehiscing completely along the ventral suture and partly along the dorsal suture, thus finally becoming bifid.

Distribution. Cambodia and adjacent Thailand, only one species.

EXCLUDED GENERA

Phelima Noronha, Verh. Bat. Gen. 5, Art. 4 (1790) 3, nomen; *ibid.* ed. 2 (1827) 66, nomen. Based on a Javan plant, the vernacular name being given as champaca ceylon.

This was referred to *Michelia* Linné by Jackson (Index Kew. 2: 492. 1894) and to *Liriodendron* Linné by Dalla Torre & Harms (Gen. Siphonog.: 171. 1901). According to the vernacular name, however, it was based on the species now known as *Horsfieldia iryaghedi* (Gaertn.) Warb. (Myristicaceae). Hasskarl (Cat. Pl. Hort. Bot. Bogor. Cult. Alt.: 174. 1877) referred *Phelima* to *Pyrrhosa horsfieldia* (Blume) Blume, which is a synonym of *H. iryaghedi*.

Spermabolus Teijsm. & Binn., Cat. Hort. Bog. (1866) 178, nomen, with one species, *S. fruticosus* Teijsm. & Binn., nomen, is *Anaxagorea* A. St. Hil. (Annonaceae).

COLLECTIONS OF MAGNOLIEAE EXAMINED (*Manglietia* and *Pachylarnax* excluded)

Mainly belonging to the treated species. 1 = *Magnolia cathcartii*; 2 = *M. nitida*; 3 = *M. kachirachirai*; 4 = *M. roraimae*; 5 = *M. ptaritepuiana*; 6 = *Kmeria duperreana*.

Biswas 3739: 1 – Chang, C.E. 4384: 3 – Chun & Tso 44041: 3; 44042: 3 – Clarke 25456: 1 – Cowan 664: 1; 665: 1 – Farrer R 817: 2; 993: 1 – Forrest, G. 15059, 17300, 20358, 20860, 21616, 22869, 26381, 26509, 27537, 27735, 29707, 30385: all 2 – Gamble 650: 1 – Haines 1109: 1 – Hooker, J.D. s.n.: 1 – Kerr 17847: 6 – Kingdon Ward 12941, 17427, 17433, 20800: all 1 – Lace 2212: 1; 2386: 1 – Liao, J.C. & Y.K. Lai 10534: 3 – Liso, J.C. 10377: 3 – Liu & Keng 48215: 3 – Petelot 6074: 1; 8008: 1 – Pierre 749: 6 – Poilane 255: 6; 12601, 12659, 12686, 12988: all 1; 14680, 14732, 22085, 22092, 23044, 23130, 23289: all 6 – Prain s.n.: 1 – Rock, J.F. 10136, 10235, 11232, 21990, 22475: 2 – Smith, W.W. 4579: 1 – Smitinand 11692: 6 – Stainton 5305: 1 – Steyermark 59000: 4 (T); 59547: 5 – Su Koe 9138: 1 – Tsai, H.T. 54858: 2 – Wang, C.W. 66921–2; 67553: 2 – Wang, L.J. 48218: 3 – Watt, G. 11480: 1.

B. Tribus Michelieae Law Yuh-wu

Growth monopodial. Flower buds arising on brachyblasts in the axils of the leaves. Genera: *Michelia* (incl. *Paramichelia* and *Tsoongiodendron*) and *Elmerrillia*.

KEY TO THE GENERA

- 1 a. Gynoecium sessile 5. *Elmerrillia*
 b. Gynoecium distinctly stipitate 6. *Michelia*

5. ELMERRILLIA

Elmerrillia Dandy, Kew Bull. (1927) 261; in Hutch., Gen. Fl. Pl. 1 (1964) 56; in Praglowski, World Pollen & Spore Flora 3 (1974) 4, 5. – Type: *Elmerrillia papuana* (Schltr.) Dandy = *E. tsiampacca* (L.) Dandy.

Elmerrillia sect. *Pseudoaromadendron* Dandy in Praglowski, World Pollen & Spore Flora 3 (1974) 5. – Type: *Elmerrillia ovalis* (Miq.) Dandy.

Trees. Stipules free from petiole. Leaf margins confluent or conerescent directly beneath the leaf base, forming a (faint) ridge or a very narrow groove on the adaxial side of the petiole for its apical half. Flowers terminal on axillary brachyblasts, solitary or sometimes 2–3-nate, bisexual, growth monopodial. Sepals 4 (or 5); petals 5–c.10, 3–5-merous, subequal. Anthers introrse; connective produced into a short appendage. Gynoecium sessile; carpels many, with the base sunken in the torus, free or conerescent; ovules 2–6 in each carpel. Fruiting carpels basally sunken in the torus, free, crowded, and dehiscent along the dorsal suture, finally 2-valved, or conerescent to form a fleshy syncarp. In the latter case the carpels hexagonal, the apical parts falling away, often in irregular masses, thus shedding the seeds.

Distribution. 4 species, all in Malesia.

Note. The species of *Elmerrillia* are narrowly allied. The main differences are the number of tepals, of which the outer whorl might be considered sepals, 12 versus 15, and the fruit, consisting of nearly free or conerescent carpels. The latter character is definitely only important for discrimination of species. For instance between *E. ovalis* and *E. tsiampacca* it forms the only character that always holds good.

KEY TO THE SPECIES

(based on flower and fruit characters)

- 1 a. Tepals 12. Carpels free (not seen in *E. platyphylla*) 2
 b. Tepals (12–)17. Carpels free or conerescent. For New Guinean plants with tepals 12 and fruiting carpels free, see under *E. tsiampacca* 3
 2 a. Twigs and stipules hairy 4. *E. tsiampacca*
 b. Twigs and stipules glabrous 2. *E. platyphylla*
 3 a. Undersurface of leaves glaucous (sometimes a dense indument of appressed hairs obscuring the glaucousness), hairy (in New Guinea sometimes glabrous: var. *glaberrima*). Fruiting carpels free, dorsally dehiscent 4. *E. tsiampacca*
 b. Undersurface of leaves not glaucous, glabrous or hairy. Fruiting carpels conerescent 4
 4 a. Twigs glabrous or yellowish villous, soon glabrescent, rarely pubescent. Nerves in (10–)14–21 pairs 1. *E. ovalis*

- b. Twigs densely fulvously pubescent or tomentose, later glabrescent. Nerves in 20–24 pairs 3. *E. pubescens*

KEY TO THE SPECIES
(based on fruit characters)

- 1 a. Fruit a syncarp, ripe carpels shedding their apical parts 2
 b. Fruit apocarpous, ripe carpels longitudinally dehiscent 3
 2 a. Young twigs and stipules glabrous, or yellowish villous, soon glabrescent, rarely pubescent. Nerves in (10–)14–21 pairs 1. *E. ovalis*
 b. Twigs densely fulvously pubescent or tomentose, later glabrescent. Nerves in 20–24 pairs 3. *E. pubescens*
 3 a. Twigs and leaves glabrous. Brachyblast glabrous. Philippines . . 2. *E. platyphylla*
 b. Twigs and leaves glabrous or hairy. Brachyblast hairy (except rarely in New Guinea: *E. tsiampacca* var. *glaberrima*) 4. *E. tsiampacca*

1. *Elmerrillia ovalis* (Miq.) Dandy

E. ovalis (Miq.) Dandy, Kew Bull. (1927) 261. – *Talauma ovalis* Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 69; Koord., Meded. Lands Plantent. 19 (1898) 331; Suppl. Fl. N.O. Celebes 2 (1922) t. 8; ibid. 3 (1922) 4; Boerl., Cat. Hort. Bog. (1899) 8; Koord.-Schum., Syst. Verz. 3, 1 (1914) 42. – Type: *Forsten s.n.* (L; iso BO), Celebes, near Tondano, June 1840.
Talauma vrieseana Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 70. – *Magnolia vrieseana* (Miq.) Baill. ex Pierre, Fl. For. Cochinch. 1 (1881) sub t. 2. – *E. vrieseana* (Miq.) Dandy, Kew Bull. (1927) 262. – Type: *de Vriese & Teijsmann s.n.* (L, sheet no. 908.126-1803), N. Celebes.

Tree to 45 m high and 100(–150) cm diam. Twigs glabrous, or yellowish villous, soon glabrescent, rarely pubescent. Stipules glabrous to yellowish villous, becoming c. 3–13 cm long. Leaves glabrous, or underside minutely sparsely appressedly hairy, or rarely sparsely patently pubescent, elliptic, 7–36 by 4–16 cm; apex very shortly (obliquely) acuminate, acumen less than 10 mm; base cuneate (to rounded), usually attenuate, the margins concrescent in the apical part of the petiole; nerves in (10–) 14–21 pairs, curved upwards and meeting in a looped intramarginal vein which often is rather inconspicuous in the prominent fine reticulation. Petiole glabrous, or with same indument as twigs, (1–)2.4–4.5(–7) cm. Flowers (creamy) white. Brachyblast glabrous or yellowish villous, with one scar above the middle. Spathaceous bracts (sparsely) pubescent to glabrous. Tepals c. 16 in 2–3 whorls, more or less coriaceous, the longest 25–35 mm. Stamens 8–14 mm long. Carpels puberulous, 4(–6)-ovuled, concrescent. Fruit ellipsoidal, the ripe carpels disintegrating, losing their apical portions and thus shedding the 1–4 seeds.

Distribution. Malesia: Celebes (incl. Muna), c. 35 coll.; Moluccas: Morotai, no collections seen; Ambon, 1 coll.

Ecology. In forest at low and medium altitudes, up to 1000 m. Fl. fr. Jan.–Dec.

Uses. The timber is very durable and amongst others used for house-building. The trees are cultivated for the timber (see Koorders, 1898).

Note. This species is, vegetatively, very variable. The rather small, coriaceous leaves of some specimens look totally different from the large, and then often thin, leaves of others. The indument is also very variable.

2. *Elmerrillia platyphylla* (Merr.) Noot., *comb. nov.*

Michelia platyphylla Merr., Philip. J. Sc. 13 (1918) Bot. 11; En. Philip. Fl. Pl. 2 (1923) 153. – Type: *FB 26866 Tomeldan* (K), Leyte, Burauen, Cagangon, 21 May 1917.

Tree. Twigs glabrous. Stipules glabrous, dark brown, and rugose, c. 6 cm long. Leaves elliptic, glabrous, 23–30 by 9–13 cm; apex shortly acuminate, acumen shorter than 10 mm; base cuneate, shortly attenuate, the leaf margins confluent directly under the base; nerves 18–23 pairs meeting in an intramarginal vein; reticulation rather fine. Petiole 2–3 cm. Flowers white. Brachyblast glabrous, 4–5 cm long with one scar about in the middle; spathaceous bracts glabrous. Tepals c. 12, the outer ones c. 25–35 mm long. Stamens c. 12 mm. Ovary glabrous. Fruits unknown as yet.

Distribution. Malesia. Philippines: Leyte, Agusan, 2 coll.; Mindanao, Zamboanga Prov., 2 coll.

Ecology. Secondary forest at low altitudes.

Note. Dandy identified this as *E. ovalis*; in that species, however, the number of tepals is c. 15. Besides, the fruits of *E. platyphylla* are not yet known, but from the ovary it is unlikely that the carpels become conerescent.

3. *Elmerrillia pubescens* (Merr.) Dandy

E. pubescens (Merr.) Dandy, Kew Bull. (1927) 261. – *Talauma pubescens* Merr., Philip. J. Sc. 3 (1908) Bot. 133; En. Philip. Fl. Pl. 2 (1923) 152. – Type: *Clemens 686* (iso BO), Mindanao, Lake Lanao, Camp Keithly.

Tree c. 15–40 m high and up to 80 cm diam. Twigs densely fulvously pubescent or tomentose, glabrescent. Stipules densely fulvously long tomentose or pubescent, becoming 3–11 cm long. Leaves pubescent beneath, elliptic to ovate, 15–30 by 8–14 cm; apex shortly obliquely acuminate, acumen less than 1 cm; base nearly rounded, slightly acuminate, not decurrent on the petiole; nerves in 20–24 pairs, meeting in a looped intramarginal vein; reticulation fine. Petiole with same indument as twigs, 20–25 mm. Flowers white. Brachyblast densely fulvously tomentose or pubescent with 1–2 equally distributed scars, 3–5 cm; pedicle absent or very short; spathaceous bracts densely pubescent. Tepals c. 15, glabrous, the outer ones 27–35 mm, the inner ones gradually shorter and narrower. Stamens c. 10 mm, including the c. 1 mm long connective appendage. Carpels many, 3- to 4-ovuled, pubescent. Fruit 3–6 by c. 2 cm; carpels c. 8 mm long, conerescent, tearing apart towards the outside when mature, longitudinally dehiscing, 1–4-seeded.

Distribution. Malesia. Philippines: Mindanao, Lanao Lake, Mt Katanglad; Mt Apo, 4 coll. in all.

Ecology. Altitude c. 2000 m. Fl. fr. Jan.–Dec.

Vernacular name. Hangilon (Bukidnon).

4. *Elmerrillia tsiampacca* (Linné) Dandy — Fig. 6–8.

E. tsiampacca (Linné) Dandy in Praglowski, World Pollen & Spore Flora 3 (1974) 5. — *Michelia tsiampacca* Linné, Mant. (1767) 78; Lamk., Dict. 1 (1785) 691; Willd., Sp. Pl. 2 (1799) 1260; DC., Syst. Nat. 1 (1817) 448, p.p.; Prod. 1 (1824) 79, p.p.; Miq., Fl. Ind. Bat. 1, 2 (1858) 18, p.p.; Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 73; Merr., Interpr. Rumph. (1917) 224. — *Michelia champacca* (auct. non Linné) Linné, Syst. ed. 10, 2 (1759) 1082, p.p. — *Michelia euonymoides* Burm. f., Fl. Ind. (1768) 124, pro syn. *Sampacca sylvestris* Rumph. excl. pl. Jav. — *Sampacca euonymoides* O. Ktze, Rev. Gen. Pl. 1 (1891) 6, p.p. — *Michelia sericea* Pers., Syn. 2 (1807) 94, nom. ill. — *Michelia celebica* Koord., Meded. Lands Plantent. 19 (1898) 328, 631, nom. ill.; Suppl. Fl. N.O. Celebes 2 (1922) t. 9; ibid. 3 (1922) 5; Koord.-Schum., Syst. Verz. 3, 1 (1913) 42. — *E. celebica* (Koord.) Dandy, Kew Bull. (1927) 261. — *Magnolia celebica* Koord. in McLaughlin, Trop. Woods 34 (1933) 36, nom. syn. — Type: *Sampacca sylvestris* Rumph., Herb. Amb. 2 (1741) 202, t. 68.

Talauma papuana Schltr., Bot. Jahrb. 50 (1913) 70; Diels, Bot. Jahrb. 54 (1916) 239. — *E. papuana* (Schltr.) Dandy, Kew Bull. (1927) 261; A.C. Smith, J. Arn. Arb. 23 (1942) 441; Croft in Womersley, Handb. Fl. Papua New Guinea (1978) 130, t. 65. — Type: *Schlechter 19001* (not seen), New Guinea, Ibo Mts, c. 1000 m above sea-level.

Michelia forbesii Baker f., J. Bot. 61 (1923) Suppl. 2. — Type: *Forbes 442a* (K; iso P), Sogeri. *Michelia arfakiana* Agostini, Atti Com. Accad. Fisiocrit. Siena IX, 7 (1926) sep. 25. — Type: *Beccari PP 890* (FI), Mt Arfak, Putat, Oct. 1878. Agostini used the FI herbarium number instead of the collection number.

E. mollis Dandy, Kew Bull. (1928) 184. — *Michelia mollis* (Dandy) McLaughlin, Trop. Woods 34 (1933) 36. — Type: *Endert 5252* (K; iso BO, L), Borneo, W. Kutei.

E. papuana var. *adpressa* Dandy, Kew Bull. (1928) 185. — Type: *Ledermann 13089* (K; iso L), Sepik region.

E. papuana var. *glaberrima* Dandy, Kew Bull. (1928) 185. — Type: *Ledermann 9509* (K), Sepik region, Etappenberg.

E. sericea C.T. White, J. Arn. Arb. 10 (1929) 212. — Type: *Brass 661* (A; iso K), rain forests in Sogeri, alt. 450 m., 15 Nov. 1925.

Tree to 60 m high and 150(–200) cm diam. Twigs (densely) ferruginously or fulvously (woolly) pubescent or tomentose when young, rarely glabrous. Stipules with same indument, up to 13 cm long. Leaves often appressedly pubescent above in innovations, soon glabrescent, hairy beneath but glabrous in var. *glaberrima*, sometimes glaucous, (narrowly) elliptic, rarely ovate (often so in Celebes), 10–46 by 4–15 cm; apex shortly and often obliquely acuminate, acumen 5–17 mm; base cuneate to rounded, rarely subcordate; nerves in 11–28 pairs, meeting in an often hardly distinct intramarginal vein; reticulation rather fine to very fine. Petiole with same indument as twigs, with 1 ventral ridge, 7–35 mm. Flowers white to yellow. Brachyblast densely pubescent (glabrous in var. *glaberrima*), with 0–2 scars, 15–40(–60) mm, pedicel short or absent. Tepals (10–)12–c. 15, glabrous or the outer ones pubescent, more or less all the same and coriaceous, 20–35 mm long. Stamens 10–14 mm long including the c. 1 mm long connective appendage. Carpels many (c. 50), pubescent or puberulous, or glabrous in var. *glaberrima*, 2–4(–6)-ovuled. Fruit cylindrical, 4–9 by 1.5–2 cm, the carpels basally sunken in the torus, dorsally dehiscent, often the falcate midrib persistent. Seeds 1 or 2 from each carpel.

Distribution. Malesia. Sumatra: Mentawai I., Siberut; Borneo, Central & N. Cele-

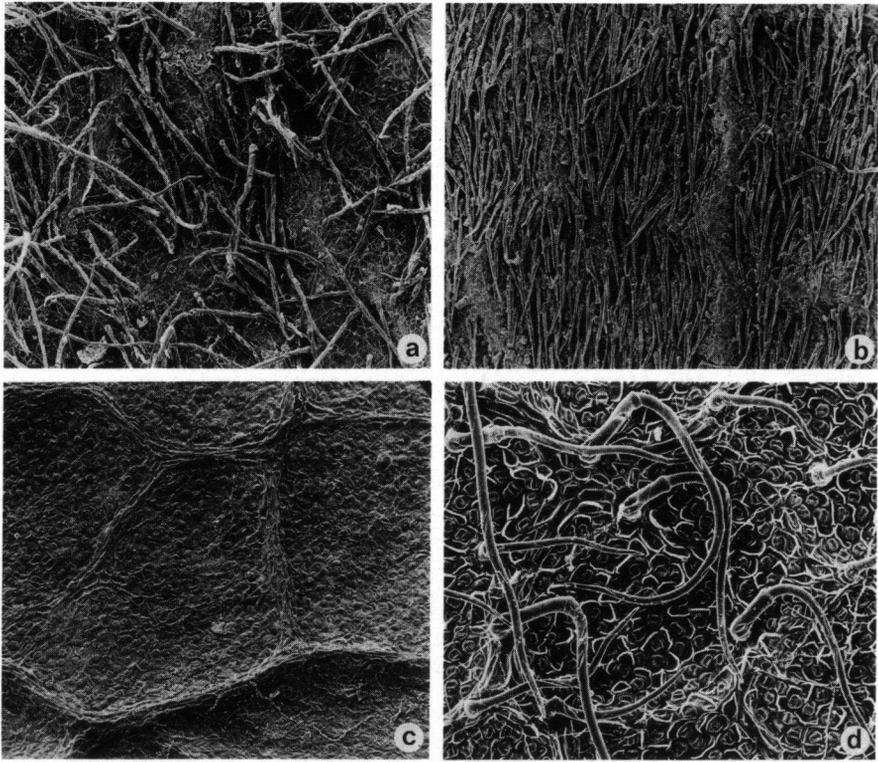


Fig. 6. *Elmerillia tsiampacca* (L.) Dandy; leaves from the underside. — a. subsp. *tsiampacca* var. *tsiampacca*, $\times 75$; b. idem, $\times 75$; c. subsp. *tsiampacca* var. *glaberrima*, $\times 75$; d. subsp. *mollis*, $\times 117$ (a Hoogland & Pullen 6190; b. Koorders 17776; c. T. G. Hartley 9950; d. S 28265).

bes, ?Ambon (see note under var. *tsiampacca*), New Guinea (incl. Biak, Japen), New Britain.

Ecology. On fertile soil in forest, altitude 0–1800 m. Fl. fr. Jan.–Dec.

Note. It appeared to be necessary to reduce *E. papuana* and *E. mollis* to *E. tsiampacca*. Between the collections from Celebes (*E. tsiampacca*) and those from New Guinea (*E. papuana*) the distinction entirely fades away. Whereas the Celebes collections are fairly uniform, those from New Guinea are very variable. In the materials described as *E. papuana* var. *adpressa* the same characters occur as in the Celebes materials (mainly the appressed indument). The Borneo collections (*E. mollis*) differ from the others in the number of tepals being 12 versus 15, in the indument, the hairs mostly being (uncinately) curved towards their base, and in the size of the leaves and the number of primary nerves. The latter two characters show a substantial overlap, however, and in S 16523 from Sarawak, Miri, the indument is of the same appressed type as in many collections outside Borneo. So only the difference in the number of tepals rests, and in my opinion, as the areas do not overlap, the collec-



Fig. 7. *Elmerrillia tsiampacca* (L.) Dandy subsp. *tsiampacca* var. *tsiampacca*. – Flowering twig, $\times 2/3$ (Koorders 17776).

tions from Borneo deserve only the status of subspecies. Praglowski, *World Pollen & Spore Flora* 3 (1974) 23, 31 observed pollen morphological differences between *E. mollis* and *E. papuana*.

KEY TO THE INFRASPECIFIC TAXA

- 1a. Leaves 16–46 cm; nerves (14–)17–28 pairs. Hairs underneath the leaf blade usually (uncinately) curved towards the base. Tepals (10–)12. Sumatra, Borneo
 b. subsp. *mollis*
 b. Leaves 10–30 cm; nerves in (11–)14–22(–24) pairs. Hairs underneath the leaf blade not (uncinately) curved towards the base. Tepals (12–)c. 15. Celebes, ? Ambon, New Guinea a. subsp. *tsiampacca*
 2a. Young twigs and stipules hairy; ovary puberulous a-a. var. *tsiampacca*
 b. Entire plant glabrous a-b. var. *glaberrima*

a. subsp. *tsiampacca* – Fig. 6a–c.

All synonyms except *E. mollis*.

Tree to 60 m high and 150(–200) cm diam. Leaves beneath very densely, often minutely, appressedly hairy or longer appressedly or patently hairy, hairs straight or when not straight not (uncinately) curved towards the base, 10–30 by 4–13(–15) cm; nerves in (11–)14–22(–24) pairs. Petiole 12–35 mm. Tepals (12–)c. 15.

Distribution. Malesia. Sumatra (Siberut), Borneo, Central & N. Celebes, ? Ambon (see note under var. *tsiampacca*), Buru, New Guinea (incl. Biak, Japen I.), New Britain.

a-a. var. *tsiampacca* – Fig. 6a, b; 7.

All synonyms except *E. papuana* var. *glaberrima*.

Distribution. As under the species except Sumatra and Borneo. Common.

Ecology. On fertile soil in forest, altitude to 1400 m. Fl. fr. Jan.–Dec.

Uses. The most valuable and most demanded timber of N. Celebes, obtainable in large planks to 15 m long and over 50 cm broad. According to Koorders (1898!) becoming scarce by cutting in some areas. Also very good for making coffins because of its durability.

Vernacular names. Celebes: tjempaka utan, t. u. aloes, uru tanduk, wasian, w. rintek, w. sela; New Guinea: balamtalogo (Mooi lang.), boska (Manikion lang.), arimot, pui (Biak), hui (Sogeri), wesau, wuka (Morobe), kaule (Kainantu), bibau (Hattam lang.), warmei (Waskuk lang.), pubitza (Garaina lang.), rap (Sepik), biendjung.

Notes. Until recently I had not seen any Moluccan collections. The plate and description of Rumphius clearly point to this species. As Merrill (1917) states, botanical material from Ambon will be necessary before the exact status of the species can be determined. During the Rijksherbarium–Lembaga National Biologi expedition to

Buru in the fall of 1984, however, I found the taxon to be very common in NW. Buru on shales, very rare also on limestone (*Nootboom 5162*).

The undersurface of the leaves is glaucous, the indument is sometimes very dense, sometimes consisting of very small 2–3-celled hairs.

No buttresses or buttresses up to 2 m high and 0.5 m wide. Outer bark 0.5–2 mm, light brown, smooth or shallowly fissured, sometimes flaking, inner bark light brown or white to yellow, slash 6–12 mm; sapwood 4–6 cm, white to light brown; hardwood (greyish) brown.

a-b. var. *glaberrima* (Dandy) Noot., *comb. nov.* – Fig. 6c.

E. papuana var. *glaberrima* Dandy.

Distribution. New Guinea: Kebar valley, 1 coll.; Idenburg R., 1 coll.; Sepik R., 1 coll.; Morobe Dist., 2 coll.

Ecology. Primary forest; altitude up to 1200 m.

Vernacular names. Mamer, mamier (Kebar lang.).



Fig. 8. *Elmerrillia tsiampacca* (L.) Dandy subsp. *mollis* (Dandy) Noot. Twig with flower, deflorated flower, and bud showing the stipular nature of the spathaceous bract. About natural size (*Nootboom 4518A*).

b. subsp. *mollis* (Dandy) Noot., *subsp. et stat. nov.* – Fig. 6d, 8.

E. mollis Dandy.

Tree to 35 m high and 80 cm diam. Leaves beneath villous, pubescent, or puberulous, hairs usually not appressed; hairs basally (uncinately) curved, 16–46 by 5.5–15 cm; nerves in (14–)17–28 pairs. Petiole 7–25 mm. Tepals (10–)12. Carpels with 2 ovules.

Distribution. Malesia. Sumatra: Mentawai I., Siberut (see note), Borneo (common, c. 30 coll.).

Ecology. In forest at low and medium altitude; recorded from 1500–1800 m in Sabah. Fl. fr. Jan.–Dec.

Vernacular names. Minjaran (Mal.), arau, miharo (Daj.).

Notes. Bark smooth, lenticellate, brown or grey, flaking. Sapwood white or pale yellow. Heartwood dirty yellow or brownish. Sometimes narrow buttresses to 3 m high.

The only collection from Siberut differs in the leaf base being rounded or even slightly cordate.

6. MICHELIA

Michelia Linné, Sp. Pl. (1753) 536; Gen. Pl. ed. 5 (1754) 240; Dandy in Hutch., Gen. Fl. Pl. 1 (1964) 56; in Pragłowski, World Pollen & Spore Flora 3 (1974) 4, 5. – *Champaca* Adans., Fam. Pl. 2 (1763) 365, 537. – *Sampacca* O. Ktze, Rev. Gen. Pl. 1 (1891) 6 (excl. *S. cathartii* and *S. evonymodes*). – Type: *Michelia champaca* Linné.

Liriopsis Spach, Hist. Natur. Veget., Phanerog. 7 (1839) 460, non *Liriopsis* Reichb. (1828). – Type: *Liriopsis fuscata* (Andr.) Spach.

Paramichelia H. H. Hu, Sunyatsenia 4 (1940) 142; Dandy in Hutch., Gen. Fl. Pl. 1 (1964) 56; in Pragłowski, World Pollen & Spore Flora 3 (1974) 3. – Type: *Paramichelia baillonii* (Pierre) Hu.

Tsoongiodendron W. Y. Chun, Acta Phytotax. Sinica 8 (1963) 7; Dandy in Hutch., Gen. Fl. Pl. 1 (1964) 56; in Pragłowski, World Pollen & Spore Flora 3 (1974) 3. – Type: *Tsoongiodendron odorum* Chun.

Michelia sect. *Anisochlamys* Dandy in Pragłowski, World Pollen & Spore Flora 3 (1974) 5. – Type: *Michelia mannii* King.

Michelia sect. *Dichlamys* Dandy in Pragłowski, l.c. – Type: *Michelia balansae* (A. DC.) Dandy.

Michelia sect. *Micheliopsis* (Baill.) Dandy in Pragłowski, l.c. – *Magnolia* sect. *Micheliopsis* Baill., Adansonia 7 (1866) 66. – Type: *Michelia figo* (Lour.) Spreng.

Trees or shrubs. Stipules adnate to or free from the petiole. Flowers bisexual, on short brachyblasts in the axils of the leaves, growth monopodial. Tepals 6–21, 3–6-merous, subequal or rarely the outer whorl different. Anthers latrorse or sublatorse (to introrse), connective produced into a short or elongated appendage. Gynoecium stipitate, carpels many to few (rarely 1), free or connate; ovules 2 to many; fruiting carpels free, more or less spaced along the torus, dehiscing along the dorsal suture, finally becoming 2-valved, or concrescent, forming a fleshy syncarp which is tardily and irregularly dehiscent, or a woody syncarp, the upper parts of the carpels falling

away while also dehiscing along the dorsal suture, the basal parts remaining attached to the torus with their suspended seeds.

Distribution. About 30 species, in Southeast Asia from India and Sri Lanka eastwards to S. Japan and Taiwan and southeastwards into Indonesia (not in Celebes and New Guinea). In Malesia 6 species, 2 other species commonly cultivated.

KEY TO THE SPECIES IN MALESIA

- 1a. Petiole 3–5 mm long, stipular scar present for nearly its whole length. Leaves glabrous, 4.5–6.5 by 2–3 cm. Tepals 6 8. *M. figo*
- b. Petiole longer than 5 mm. The other characters different or the tepals more than 6 2
- 2a. Young twigs glabrous. Terminal buds hairy at the apex only. Carpels 1–4. Stipules free from the 15–35 mm long petiole. Leaves glabrous, 9–35 cm long
4. *M. montana*
- b. Young twigs hairy, at least directly under the terminal bud. Carpels 8 or more 3
- 3a. Stipules adnate to the petiole for one third or more of its length 4
- b. Stipules free from the petiole or adnate to its base only (in *M. sumatrae* sometimes up to one third) 6
- 4a. Leaves 8–12 by 2.5–3.5 cm. Petiole 6–16 mm 1. *M. scortechinii*
- b. Leaves 10–35 by 4–11 cm. Petiole 14–50 mm 5
- 5a. Tepals 15, from light yellow to orange, 20–45 mm long. Carpels c. 30, fertile. Leaves 10–30 cm 3. *M. champaca*
- b. Tepals c. 12, white, 30–55 mm long. Carpels c. 10, sterile. Leaves 15–35 cm
7. *M. alba*
- 6a. Leaves 15–35 by 5.5–11 cm. Petiole 15–50 mm. Tepals c. 12, white, 30–55 mm. Carpels sterile, c. 10 7. *M. alba*
- b. Leaves 4–16 by 2.3–6 cm. Petiole 5–20 mm. Tepals white to yellow, 10–40 mm. Carpels fertile 7
- 7a. Brachyblast 10–17 mm. Outer tepals 3, membranous, inner tepals 6, coriaceous. Twigs and stipules puberulous to nearly glabrous. Leaves glabrous beneath, 6–16 by 3–6 cm. Carpels c. 10 2. *M. koordersiana*
- b. Brachyblast 3–7 mm. All tepals the same, 9–17. Twigs and stipules pubescent or puberulous. Leaves glabrous or hairy beneath, 4–13 by 1.5–4 cm. Carpels 8–16 or c. 30 8
- 8a. Tepals 20–40 mm. Leaves 9–13 by 2.3–4 cm, often glaucous beneath. Carpels c. 30 5. *M. salicifolia*
- b. Tepals 10–15 mm. Leaves 4–12 by 1.5–3.5 cm, not glaucous beneath. Carpels 8–c. 16 6. *M. philippinensis*



J.C.W.

Fig. 9. *Michelia scortechinii* (King) Dandy. — a. Habit, $\times 2/3$; b. young fruit, $\times 2$; c. anther, $\times 4$; d—e. ovary, $\times 4$ (a, c—e SF Holttum 31244; b Grashoff 335).

1. *Michelia scortechinii* (King) Dandy – Fig. 9.

M. scortechinii (King) Dandy, Kew Bull. (1927) 262; Keng, Tree Fl. Malaya 2 (1973) 288. – *Manglietia scortechinii* King, J. As. Soc. Beng. 58, ii (1889) 370; Ann. Bot. Gard. Calc. 3 (1891) 213, t. 56; Ridley, Fl. Mal. Pen. 1 (1922) 14. – *Paramichelia scortechinii* (King) Dandy in Praglowski, Pollen & Spore Flora 3 (1974) 21. – Type: *Scortechini 764* (BM, K, SING), Perak.

Tree to 37 m high and c. 50 cm diam. Twigs zigzag, ferrugineously pubescent to tomentose when young. Stipules adnate to petiole for at least half its length, with same indument as twigs, up to 30 mm long. Leaves distichously arranged, elliptic, (densely) ferrugineously pubescent or puberulous beneath, 8–12 by 2.5–3.5 cm; apex shortly acuminate, acumen often obliquely folded when dry, 3–15 mm; base cuneate; nerves in 12–18 pairs, meeting in a looped intramarginal vein, with the very fine reticulation prominent on both sides. Petiole with same indument as twigs, with a stipular scar for at least 0.75 of its length, 6–16 mm. Flowers white. Brachyblast 6–8 mm, with 2 stipular scars, the lowermost in or above the middle. Spathaceous bracts densely ferrugineously pubescent. Pedicle absent. Tepals c. 12, all more or less the same, thinly coriaceous, 12–18 mm long. Stamens including the c. 1 mm long connective appendage c. 8 mm. Carpels c. 20, with the 2–3 mm long gynophore densely ferrugineously pubescent. Fruiting carpels concrescent (only young fruits seen).

Distribution. Malesia. Sumatra: W. Coast, 2 coll., Bengkulu, 2 coll., Palembang, 2 coll.; Malay Peninsula: Perak, 1 coll., Pahang, Cameron Highlands, 2 coll.

Ecology. Primary forest, 650–1300 m. Fl. fr. April–May.

2. *Michelia koordersiana* Noot., *spec. nov.* – Fig. 10.

M. spec. A Keng, Tree Fl. Malaya 2 (1973) 288.

Arbor ramulis junioribus subtiliter appresse puberulis mox glabrescentibus fractiflexis. Stipula indumento simile ad fere glabra petiolum non adnata 10 ad 15 mm longa. Folia glabra c. elliptica disticha 6–16 cm longa 3–6 cm lata apice breviter acuminato base cuneata venis primariis utroque latere 7 ad 13 in venam intramarginalem convenientibus reticulo prominente in superficiebus ambabus petiole 10–20 mm longo. Flos luteus ad aurantiacus. Brachyblastus florifer appresse pubescens nodis duabus pediculo 0.5–1 mm longo. Tepala externa 3, membranacea, 12 ad 22 mm longa; tepala interna 6, in verticillos duos disposita coriacea. Stamina 5 ad 7 mm longa. Carpella c. 10, cum gynophoro 5 mm longo minute tomentella vel puberula. Carpella fructifera 2 ad 10, 15–25 mm longa et 12–15 mm lata, costa tandem separata, seminibus 1–2, base late axem adnata. – Typus: *Van der Zwaan voor Thorenaar E 997* (L; iso BM, BO, K), Sumatra, Palembang, Lematang ilir.

Tree to 32 m high and 62 cm diam. Twigs finely appressedly puberulous when young, or only so directly under the terminal bud, soon glabrescent, often zigzag. Stipules with same indument to nearly glabrous, not adnate to petiole, 10–15 mm. Leaves glabrous, more or less elliptic, distichously arranged, 6–16 by 3–6 cm; apex shortly acuminate, acumen often obliquely folded when dry, (0–)3–8 mm; base cuneate, with 2 ridges decurrent on the petiole; nerves in 7–13 pairs, meeting in a looped intramarginal vein, with the fine reticulation prominent on both sides. Petiole



Fig. 10. *Michelia koordersiana* Noot. – a. Habit, $\times 2/3$; b. fruit, $\times 2/3$; c. ovary, $\times 4$; d. anther, $\times 6$ (v. d. Zwaan voor Thorenaar T 345).

with same indument as twigs, 10–20 mm. Flowers (orange-)yellow. Brachyblast appressedly pubescent, with 2 nodes, 10–17 mm long; lowermost internode 4–8 mm, uppermost 5–9 mm long. Pedicle with same indument, 0.5–1 mm. Outer tepals 3, membranous, 12–22 mm; inner tepals 6, in 2 whorls, coriaceous. Stamens yellow or brown in vivo, including the 0.5 mm long connective appendage 5–7 mm long. Carpels c. 10, with the c. 5 mm long gynophore minutely tomentellous or puberulous. Fruiting carpels 2–10, 15–25 by 12–15 mm, the falcate midrib finally separate, 1–2-seeded, basally broadly adnate to the axis.

Distribution. Malesia. Sumatra: W. Coast, Padang, 2 coll., E. Coast, Palembang, 4 coll.; Malaya: Selangor, 1 coll.

Ecology. Primary forest, on undulating clayish ground or hill slope, from low altitude up to 1000 m. Fl. fr. probably Jan.–Dec.

3. *Michelia champaca* Linné

M. champaca Linné, Sp. Pl. (1753) 536; Syst. ed. 10, 2 (1759) 1082 (excl. Rumph. t. 68); Osb. Dagb. Ostind. Resa (1757) 93; Thunb., Mus. Nat. Acad. Upsal. 16 (1794) 137; DC., Syst. Nat. 1 (1817) 447, excl. syn. Pet.; Prod. 1 (1824) 79; Blume, Bijdr. (1825) 7; Fl. Java Magnol. (1829) 9, t. 1; Decne., Herb. Timor. Descr. (1835) 93; Blanco, Fl. Filip. (1837) 462; Span., Linnaea 15 (1841) 162; Korth., Ned. Kruidk. Arch. 2, Versl. (1851) 96; Miq., Fl. Ind. Bat. 1, 2 (1860) 101, 153; Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 72, excl. var.; Hook. f., Fl. Br. India 1 (1872) 42; F.-Vill. in Blanco, Fl. Filip. ed. 3, 4 Nov. App. (1880) 4; Bisschop Grevelink, Pl. Ned. Ind. (1882) 277, p.p.; Britten in Forbes, Nat. Wand. E. Arch. (1885) 499; Vidal, Rev. Pl. Vasc. Filip. (1886) 38; King, J. As. Soc. Beng. 58, ii (1889) 371; Ann. Bot. Gard. Calc. 3 (1891) 216, t. 64, p.p.; J. Murr. in Watt, Dict. Econ. Prod. India 5 (1891) 241; Ceron, Cat. Pl. Herb. (1892) 9; Curtis, Cat. Fl. Pl. Ferns Penang (1894) 5; Koord. & Valetton. Bijdr. 4 (1896) 159; Atlas 4 (1918) t. 799; Koord., Meded. Lands Plantent. 19 (1898) 330; Exk. Fl. Java 2 (1912) 241; Merr., Bur. Govt. Lab. Publ. 27 (1905) 15; Fl. Manila (1912) 205; Interpr. Rumph. (1917) 223; Sp. Blanc. (1918) 146; Philip. J. Sc. 19 (1921) 351; Enum. Born. (1921) 251, p.p.; En. Philip. Fl. Pl. 2 (1923) 152; Backer, Fl. Batavia 1 (1907) 11; Schoolfl. Java (1911) 16; Foxworthy, Philip. J. Sc. 4 (1909) Bot. 450, t. 23, f. 13; Koord.-Schum., Syst. Verz. 1, Fam. 95 (1913) 4; Juel, Pl. Thunb. (1918) 240, p.p.; Ridley, Fl. Mal. Pen. 1 (1922) 15; Hend., Gard. Bull. Str. Settl. 4 (1928) 215; Burkill & Haniff, Gard. Bull. Str. Settl. 6 (1930) 167, 432; Burkill, Dict. (1935) 1465; Corner, Wayside Trees (1940) 434; Backer & Bakh. f., Fl. Java 1 (1963) 98. – *M. suaveolens* Pers., Syn. 2 (1807) 94, p.p. – *M. rheedii* Wight, Ill. Ind. Bot. 1 (1831) 13. – Type: *Hermann Fl. Zeyl. 144* (BM).

M. euonymoides Burm. f., Fl. Ind. (1768) 124, excl. syn. *Sampacca sylvestris* Rumph. et excl. cit. Sloane quae est *Trichilia hirta*. – Syntypes: *Hb. Burman 15 & 55* (L).

M. suaveolens Pers., Syn. 2 (1806) 94, p.p., excl. syn. Rheede and Rumph., t. 68. – *M. champaca* Wight, Ill. Ind. Bot. (1831) 13, non *M. champaca* Linné 1753. – *M. blumei* Steud., Nomencl. ed. 2, 2 (1841) 139. – *M. tsiampacca* L. var. *blumei* Moritz in Zoll., Syst. Verz. (1846) 36. – *Sampacca suaveolens* O. Ktze, Rev. Gen. Pl. 1 (1891) 6. – Type: Rumph., Herb. Amb. 2 (1741) t. 67.

M. tsiampacca Blume, Bijdr. (1825) 7, non *M. tsiampacca* Linné 1767; Span., Linnaea 15 (1841) 162, p.p. – *M. velutina* Blume, Fl. Java Magnol. (1829) 17, non *M. velutina* DC. 1824; Miq., Fl. Ind. Bat. 1, 2 (1858) 17; Koord. & Valetton, Bijdr. 4 (1896) 162; Backer, Schoolfl. Java (1911) 16; Koord., Exk. Fl. Java 2 (1912) 241; Koord.-Schum., Syst. Verz. 1, Fam. 95 (1913) 6; Keng, Tree Fl. Malaya 2 (1973) 288, pro coll. *KEP/FRI 6943*. – *Champacca velutina* O. Ktze, Rev. Gen. Pl. 1 (1891) 6. – *M. pilifera* Bakh. f., Blumea 12 (1963) 61; Backer &

- Bakh. f., Fl. Java 1 (1963) 98. – Type: *Blume s.n.* (L, sheet nr. 908.126-1868; iso K, NY).
- M. pubinervia* Blume, Fl. Java Magnol. (1829) 14, t. 4. – *M. rufinervis* Blume, Bijdr. (1825) 8, non *M. rufinervis* DC. 1817. – *M. champaca* Miq., Fl. Ind. Bat. 1, 2 (1858) 16, p.p., non *M. champaca* Linné 1753; Bisschop Grevelink, Pl. Ned. Ind. (1882) 277, p.p. – *M. champaca* Linné var. *pubinervia* (Blume) Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 72. – Type: *Blume* 670 (L; iso B, K).
- Talauma villosa* Miq. forma *celebica* Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 70. – Type: *De Vriese & Teijsmann s.n.* (BO).
- Champaca michelia* Noronha, Verh. Bat. Gen. 5, 4 (1791) 11, nomen.
- M. tsiampacca* auct. non Linné: DC., Syst. Nat. 1 (1817) 448, p.p.; Prod. 1 (1824) 79, p.p.; Decne., Herb. Timor. Descr. (1835) 94; Span., Linnaea 15 (1841) 162; Moritzzi in Zoll., Syst. Verz. (1846) 36; Miq., Fl. Ind. Bat. 1, 2 (1858) 18, p.p.
- M. velutina* auct. non Blume: Britten in Forbes, Nat. Wand. E. Arch. (1885) 499, nomen.
- Magnolia membranacea* Parment., Bull. Sc. France et Belg. 27 (1896) 200, 258. – Syn types: *Sieber 111* (K, L, MEL), *Sieber 156* (MEL, P), both Mauritius; *D.J. Anderson s.n.*, 1868 (MEL), locality unknown.
- M. champaca* Linné var. *binnendijkii* Boerl., Cat. Pl. Hort. Bog. (1899) 9, nomen. – *M. champaca* Linné var. *pubinervia* Teijsm. & Binnend., Cat. Pl. Hort. Bog. (1866) 178, nomen: Tree nr. IV F T42 (BO).
- M. champaca* Linné var. *teysmannii* Boerl., Cat. Pl. Hort. Bog. (1899) 9, nomen. – *M. champaca* Linné var. *rufinervia* Teijsm. & Binnend., Cat. Pl. Hort. Bog. (1866) 178, nomen: Tree nr. IV F 45 & 35 (BO).
- M. montana* auct. non Blume: Baker f., J. Bot. 62 (1924) Suppl. 2: *Forbes 2124*.

Huge forest tree up to 50 m high and 183 cm diam. Twigs (appressedly) pubescent when young. Stipules pubescent, adnate to the petiole from about half of its length up to the base of the lamina, up to c. 30(–65) mm long. Leaves spirally arranged, (long) elliptic or ovate, pubescent below, especially on midrib and nerves, often glabrescent, 10–30 by 4–10 cm; apex (shortly) acuminate, acumen often obliquely folded when dry, 7–13(–25) mm; base cuneate to more often rounded or cuneate attenuate, decurrent with 2 ridges on the apical half of the petiole only; nerves in 14–23 pairs, meeting in an intramarginal vein which is often hardly more prominent than the fine reticulation, both nerves and reticulation more prominent on the under-surface than on the upper surface. Petiole (sparsely) pubescent, with a stipular scar from about its middle up to the base of the lamina, 14–35(–40) mm. Flowers light yellow when young, becoming dark (orange) yellow when old. Brachyblast densely pubescent, with 2(–3) nodes (5–)10–18(–25) mm long; the middle node more or less halfway up (when 3 nodes, then the lower 2 more or less evenly distributed); spathaceous bracts pubescent. Pedicle absent or very short, pubescent. Tepals 15, in several inconspicuous whorls, obovate, becoming narrower in the inner whorls, membranaceous, 20–45 mm long. Stamens c. 6–8 mm, connective appendage very short, up to 1 mm. Carpels c. 30, the c. 3 mm long gynophore densely pubescent. Fruiting carpels basally adnate to the axis to shortly stipitate, 3–c. 20, 15–36 by 12–25 mm, with 2–6 seeds.

Distribution. From India to SW. China and Indochina; in Malesia: Malay Peninsula, Sumatra, Java, Lesser Sunda Islands.

Note. Var. *champaca* is commonly cultivated throughout the tropics since old times. Therefore this taxon has been described many times and for many places. This resulted in a complicate synonymy which has been unravelled here for the first time.

KEY TO THE VARIETIES

- 1a. Leaves ovate with cuneate-attenuate base; the acumen often quite long. Petiole with a stipular scar up to shortly below its middle to up to the apex. Tree to c. 30 m high and 50 cm diam. a. var. *champaca*
 b. Leaves more or less elliptic with cuneate to rounded base, the acumen often rather short, oblique. Petiole with a stipular scar from 0.3 of its length up to 0.7 of its length. Tree to 50 m high and c. 180 cm diam. . . . b. var. *pubinervia*

a. var. *champaca*

All synonyms except those under var. *pubinervia*.

Distribution. Commonly cultivated throughout the tropics. Probably originally from India, where it is cultivated on the temple grounds of Jains and Hindus.

Uses. See Burkill, Dict. ed. 2 (1966) 148.

Vernacular names. Djeumpa (Atjeh), djempa (Gajo), tjempaka, t. kuning (M.), tjampaga (Minangk.), tjampaka, t. konèng (Sund.), kantil, lotjari, petjari, tjempaka, t. kuning (J.), kembhang konèng, t. mèra (Mad.), tjampaka, t. barak, t. kuning, t. warangan (Bali), hépaka, kékapa (Sawu), sampakan (Sangi), sampaka, s. modarag, tjampaka mariri (Alf., Cel.), bunga èdja, tjampaga (Mak.), bunga matjèla, tjèpaga (Bug.), kupa haja, sampaka (Ceram), kupa pokur, papokur, pupukuljo, walatol (Ulias), hapaka, tjapaka (N. Halmahera), tjapaka goratji (Ternate, Tidore).

b. var. *pubinervia* (Blume) Miq.

M. champaca Linné var. *pubinervia* (Blume) Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 72. — *M. pubinervia* Blume, Fl. Java Magnol. (1829) 14, t. 4. — *M. tsiampacà* Blume, Bijdr. (1825) 7, non *M. tsiampaca* Linné 1767. — *M. montana* (auct. non Blume) Baker.

Distribution. Malesia. Sumatra: Aceh, Takengon, 1 coll., Bengkulu, Lake Ranau, 1 coll.; Malay Peninsula: Kedah, Langkawi I., 1 coll., Bt. Kaju Hitam, 1 coll., Kelantan, Cameron Highlands, 1 coll.; Java: in the mountains, common; Lesser Sunda Islands: Sumbawa, 3 coll.

Ecology. Evergreen primary forest on fertile soil, altitude 250–1500 m, in Java mostly between 1000 and 1200 m. Fl. fr. Jan.—Dec.

Uses. (Heyne, Nutt. Pl. Ned. Ind. ed. 3, 1, 1950, 622) sub *M. velutina*. The wood is highly esteemed for building and furniture. The properties are at least the same as for *Tectona grandis*. Because of the nice structure its value for furniture is higher than that of the wood of *M. montana*. At the beginning of this century the extinction of the species in Java was already feared by Koorders because of the use made from it. The trees can be easily cultivated and reach a height of c. 27 m and a diameter of c. 55 cm in 27 years (Koorders & Valetton, 1896).

Vernacular names. Sumatra: kemit (M); Java: baros, manglis (S), kadjeng sekar (J), kadju kempheung, kembang (Md), lungjung (J); Sumbawa: tengkel.

4. *Michelia montana* Blume

- M. montana* Blume, Verh. Bat. Gen. 9 (1823) 153; Bijdr. (1825) 7; Fl. Java Magnol. (1829) 15, t. 5; Korth., Ned. Kruidk. Arch. 2, Versl. (1851) 97; Miq., Fl. Ind. Bat. 1, 2 (1858) 17; Fl. Ind. Bat., Suppl. 1 (1860) 153; Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 73; King, J. As. Soc. Beng. 58, ii (1889) 371, excl. coll. Himal.; Ann. Bot. Gard. Calc. 3 (1891) 218, t. 68, excl. coll. Himal. et tab., which is *M. glabra* Parment.; Koord. & Valetton, Bijdr. 4 (1896) 154; Backer, Schoolfl. Java (1911) 15; Koord., Exk. Fl. Java 2 (1912) 241, t. 49; Koord.-Schum., Syst. Verz. 1, Fam. 95 (1913) 5; Ridley, Fl. Mal. Pen. 1 (1922) 15; Dandy, J. Bot. 66 (1928) 322; Burkill, Dict. (1935) 1491; Corner, Wayside Trees (1940) 434; Backer & Bakh. f., Fl. Java 1 (1963) 98. – *Sampacca montana* O. Ktze, Rev. Gen. Pl. 1 (1891) 6. – *Magnolia montana* Blume ex McLaughlin, Trop. Woods 34 (1933) 36, in syn. – Lectotype: *Blume 575* (L, NY).
- M. eciacrisata* Miq., Fl. Ind. Bat., Suppl. [(1860) 153, nomen] (1861) 368. – *M. montana* Blume var. *subvelutina* Miq., Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 73. – Lectotype: *Teijsmann HB 4457* (BO, L).
- M. tsiampacca* auct. non Linné: Thunb., Mus. Nat. Acad. Upsal. 16 (1794) 137 ('*tsiampacca*', for the Javanese coll.).
- M. champaca* auct. non Linné: Juel, Pl. Thunb. (1918) 240, p.p.; Baker f., J. Bot. 62 (1924) Suppl. 2, excl. nota.

Tree, becoming over 40 m tall and over 2 m diam. Twigs glabrous. Stipules pubescent at the apex only, exceptionally entirely pubescent, 8–30(–35) mm long, free from petiole. Leaves glabrous, spirally arranged, more or less elliptic, 9–30(–35) by 4–13(–20) cm; apex shortly acuminate, acumen 0.2–2 cm, often obliquely folded when dry; margin entire; base attenuate, decurrent on the petiole with 2 (faint) ridges for its entire length; nerves in 9–15 pairs, conspicuous, curved upwards and meeting in a rather conspicuous intramarginal vein; reticulation dense, prominent on both surfaces. Petiole (often conspicuously) thickened towards its base, without stipular scars, 15–35 mm long. Flowers 1 (or 2) terminal on a short axillary shoot (brachyblast), rarely terminal on the main twig. Brachyblast 5–20 mm, glabrous to (rarely) densely pubescent, with 1–3 stipular scars with or without a petiolar scar, when 2 scars the middle scar more or less halfway up; length of nodes 3–12 mm. Pedicle 0.5–4 mm, silky or rarely glabrous. The flowerbud surrounded at least by an outer and an inner spathaceous bract respectively inserted on the last 2 nodes below the pedicle; these bracts glabrous except the margins towards the apex. Outer tepals 3, rather thin, 15–30 mm, reflexed, greenish or greenish white in vivo; inner tepals 6, thick, coriaceous, erect, in 2 whorls, 14–40 mm long, creamy or white in vivo. Stamens c. 10–13 mm long, including the c. 2 mm long connective appendage; anthers latrorse, brownish or orange in vivo. Carpels 1–4, together with the 4–8 mm long gynophore between stamens and carpels reddish puberulous when dry, green in vivo (sometimes a few stamens on the gynophore). Fruiting carpels free, 1–4, fleshy, lenticelled 2.5–6.5 by 1.8–4 cm, pink or dirty purple in vivo, dorsally dehiscent and the falcate dorsal nerve often finally becoming separate when the carpels disintegrate by rotting.

Distribution. Malesia. Sumatra: Aceh, 2 coll., W. Coast, 1 coll., Lampong, 3 coll., Palembang, 3 coll., Bangka, 1 coll.; Malay Peninsula: Perak, 4 coll., Pahang, Cameron Highlands, 1 coll.; Borneo: Sabah, 8 coll., E. Kalimantan, 4 coll.; Java: common; Bali: 3 coll. Fig. 11.

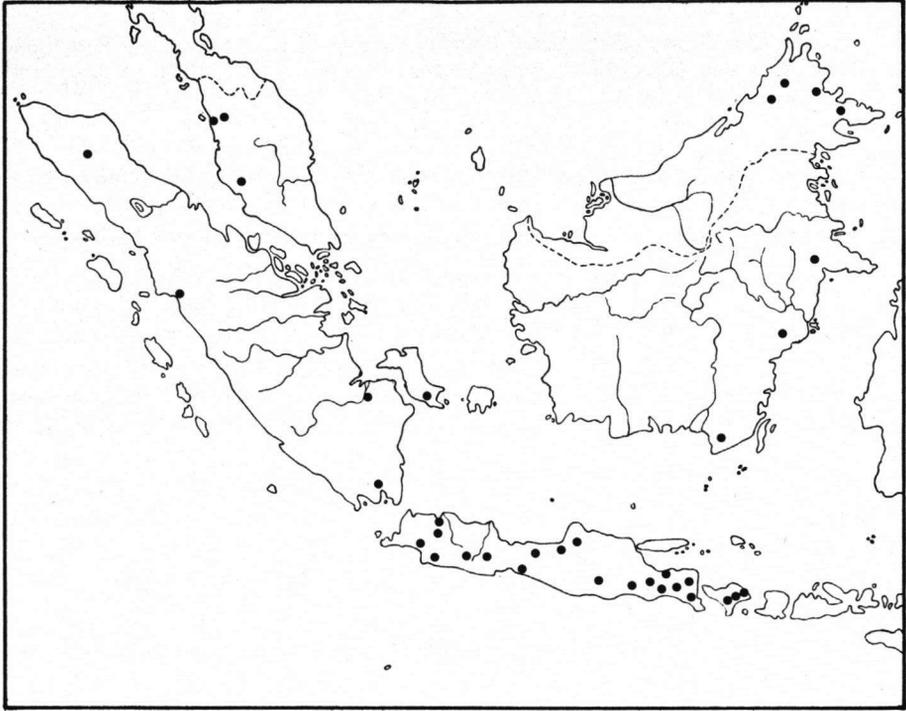


Fig. 11. Distribution of *Michelia montana* Blume.

Ecology. Primary forest, on different soils (volcanic, limestone, sandstone), from low altitude to 1700 m. Fl. fr. Jan.—Dec.

Uses. Very good timber (often used instead of *Tectona grandis*); cf. Heyne, Nutt. Pl. Ned. Ind. ed. 3 (1950) 625; Burkill, Dict. ed. 2 (1966) 1491.

Vernacular names. Sumatra: medang plam, m. tanah, tsempaka utan; Borneo: tjempaka wilis; Java: kembang (kempheung) marsêhe, k. marsiki, kitaleus, sekar, tjempaka baros, t. djaé, t. djahé (because of the ginger smell of the buds, djahé = *Zingiber officinale*), t. putih, tjoko rekitje (M.), mangkli, manglit (Sund., J.), kembang mondhung (Mad.), basé (Bal.).

Notes. Sometimes buttresses are reported to a height of 1.5 m and a width of 0.5 m. The bark is reported to be smooth, thin, often greyish, the sapwood white with ginger smell, the hardwood yellowish or brown, becoming paler when exposed to air. This species is not known outside Malesia.

The Indian records of *M. montana* (Sikkim, Bengal, Assam, Sylhet) refer to an allied species, *M. glabra* Parment., Bull. Sc. France et Belg. 27 (1896) 213, 282 (*M. kingii* Dandy, J. Bot. 66, 1928, 321).

5. *Michelia salicifolia* Agostini

M. salicifolia Agostini, Atti Com. Accad. Fisiocrit. Siena IX, 7 (1926) sep. 23. – *M. sumatrae* Dandy, Kew Bull. (1928) 188. – Type: *Beccari Pl. Sum. 118* (K; iso BM, L), Sumatra W. Coast, Mt Singalan.

Tree 25 m high, 50 cm diam. Young twigs appressedly ferrugineously pubescent. Stipules with same indument, adnate to base of petiole only. Leaves spirally arranged, appressedly ferrugineously pubescent, (often appearing to be glabrous as the hairs are very small), more or less glaucous beneath, narrowly elliptic (to obovate), 9–13 by 2.3–4 cm; apex acuminate, acumen 8–13 mm; base cuneate or faintly attenuate; nerves in 9–16 pairs, meeting in a looped intramarginal vein, rather inconspicuous in the much prominent fine reticulation on both sides. Petiole with same indument as twigs, 10–15 mm, with a stipular scar only at the very base. Brachyblasts appressedly ferrugineously pubescent, 5–7 mm, with 2 stipular scars, the lowermost about in the middle. Pedicle absent or very short. Spathaceous bracts rufous tomentose. Tepals c. 12, about the same, c. 20–40 mm long. Stamens latrorse-introrse, including the up to 2 mm long connective appendage c. 15 mm long. Carpels c. 30, 4-ovuled, with the gynophore appressedly ferrugineously tomentellous. Fruiting carpels free, several, up to c. 20 by 15 mm.

Distribution. Malesia. Sumatra: W. Coast, G. Singalan, 1 coll., Aceh, G. Leusser, 2 coll.

Ecology. Altitude 1500–2600 m. Apparently a rare species in montane rain forest. Fl. fr. March, July.

6. *Michelia philippinensis* (Parment.) Dandy

M. philippinensis (Parment.) Dandy, Kew Bull. (1927) 263. – *Magnolia philippinensis* Parment., Bull. Sc. France et Belg. 27 (1896) 206, 270. – *M. parviflora* Merr., Bur. Govt. Lab. Publ. 35 (1906) 70; Philip. J. Sc. 1 (1906) Suppl. 53, non *M. parviflora* DC. 1817. – *M. cumingii* Merr. & Rolfe, Philip. J. Sc. 3 (1908) Bot. 100; Merr., En. Philip. Fl. Pl. 2 (1923) 153. – *M. figo* auct. non Lour.: Gagnep., Bull. Soc. Bot. Fr. 76 (1929) 739. – *M. spec.* Vidal, Phan. Cuming. Philip. (1885) 19, 91; Ceron, Cat. Pl. Herb. (1892) 9. – Type: *Cuming 783* (MEL; iso A, BM, K, L, NY).

Tree to 18 m high and 80 cm diam. Twigs often zigzag, young parts appressedly pubescent, rarely patently pubescent and nearly tomentose (see notes). Stipules with same indument, free from petiole, 5–15 (–25, see note) mm. Leaves often distichously arranged (narrowly) elliptic to slightly obovate, glabrous to finely appressedly puberulous beneath (or patently pubescent when twigs are so), 4–12 by 1.5–3.5 cm; apex acuminate with rounded tip, acumen (0–)15 mm; base cuneate, with 2 ridges decurrent on the petiole for its entire length; nerves in 8–14 pairs, slightly more prominent than the rather fine reticulation beneath, above with the reticulation often less prominent. Petiole with same indument as twigs, without stipular scars, 5–20 mm. Flowers creamy yellow to white in vivo. Brachyblast 3–7 mm, with 2–3 stipular scars, with

same indument as twigs. Pedicle 0.2–1 mm, with same indument. Spathaceous bracts with same indument as twigs. Outer tepals 3, mostly broader than the 6–14 inner tepals, all becoming c. 10–12 mm (once 15 mm, see note). Stamens 3–5 mm, including the 0.5–1 mm long connective appendage. Carpels 8–c. 16, with the 3–4 mm long gynophore appressedly pubescent. Fruiting carpels free, or partly concrescent, 3–c. 8, dorsally dehiscent, ventrally adnate to the axis, 10–17 by 8–12 mm.

Distribution. Malesia. Philippines: Luzon, Benguet, 4 coll.; Zambales, according to Merrill; Ilocos Norte, 1 coll.; Bataan, 1 coll.; Rizal, 4 coll.; Laguna, 1 coll.; Tayabas, 2 coll.; Batangas, 2 coll.; Abra, 1 coll.; Negros, Dumagueta, 1 coll.; Mindanao, Misamis, 1 coll.; Lanao, 1 coll.; Todaya, 1 coll.; Bukidnon, 2 coll.

Ecology. In forests at medium altitudes, on some mountains ascending to 2100 m. Fl. fr. Jan.–Febr.

Notes. In plants with patent indument the number of tepals and carpels is the lowest (9 and 8 respectively) and the stipules are the longest (Luzon, Bontoc, *Van-overbergh 1177, 1384*; Mindanao, Lanao, *FB 25196*, Mt Katanglad, Bukidnon, *PNH 9971*). *BS 8347*, from Pauai, Benguet, Luzon, also belongs here, and has the largest flowers, the tepals becoming c. 15 mm long. It grows on the highest recorded altitude.

FB 10915, from Luzon, Benguet, has a xeromorphic habit with small, coriaceous leaves.

This species is very closely related to *M. compressa* (Maxim.) Sarg., which occurs in Taiwan and thence extends northeastwards to S. Japan. The carpels of *M. philippinensis* are 2–6 ovulate and they are sessile on the axis of the fruit. In *M. compressa* the carpels are 4–8 ovulate and in mature fruit they become shortly stipitate or sub-stipitate.

7. *Michelia* × *alba* DC.

M. × alba DC., Syst. 1 (1817) 449; Merr., Interpr. Rumph. (1917) 223; En. Philip. Fl. Pl. 2 (1923) 152; Dandy, Not. Roy. Bot. Gard. Edinb. 16 (1928) 129; Lingnan Sc. J. 7 (1929) 143; Burkill, Dict. (1935) 1464; Corner, Wayside Trees (1940) 433, t. 142, pl. 129, 130; Backer & Bakh. f., Fl. Java 1 (1963) 98. – Type: this species is based on *Sampaca domestica IV alba* Rumph., Herb. Amb. 2 (1741) 200.

M. longifolia Blume, Verh. Bat. Gen. 9 (1823) 155; Bijdr. (1825) 7; Fl. Java Magnol. (1829) 12, t. 2; Korth., Ned. Kruidk. Arch. 2, Versl. (1851) 97; Miq., Fl. Ind. Bat. 1, 2 (1858) 17; Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 72; Bisschop Grevelink, Pl. Ned. Ind. (1882) 278; Koord. & Valetton, Meded. Lands Plantent. 17 (1896) 157; Backer, Fl. Batavia 1 (1907) 12; Schoolfl. Java (1911) 15; Koord., Exk. Fl. Java 2 (1912) 241; Koord.-Schum., Syst. Verz. 1, Fam. 95 (1913) 5; Merr., Fl. Manila (1912) 205 ('*longiflora*'); Ridley, Fl. Mal. Pen. 1 (1922) 15; Hend., Gard. Bull. Str. Settl. 4 (1928) 215; Burkill, *ibid.* o (1930) 432. – *Sampaca longifolia* O. Ktze, Rev. Gen. Pl. 1 (1891) 6. – Type: *Blume s.n.* (L., sheet nr. 908.126-1242; iso K).
M. longifolia var. *racemosa* Blume, Fl. Java Magnol. (1829) 13, t. 3. – Type: *Blume s.n.* (L).
M. champaca auct. non Linné: Ridley, Sarawak Mus. J. 1, 3 (1913) 72; Merr., En. Born. (1921) 251, p.p.

Tree to c. 30 m. Twigs appressedly greyish pubescent or puberulous when young. Stipules with same indument as twigs, adnate to the base of the petiole, up to 20

mm. Leaves sparsely appressedly puberulous or glabrous, spirally arranged, mostly ovate, 15–35 by 5.5–11 cm; apex acuminate, acumen 0.7–30 mm; base attenuate, with 2 ridges decurrent on the petiole; nerves in 12–18 pairs, meeting in an intramarginal vein; reticulation fine, prominent on both sides. Petiole with same indument as twigs or glabrous, 15–50 mm long; stipular scar 3–25 mm, but mostly short. Flowers often many, nicely scented, white. Brachyblast with 2–3 evenly distributed scars, densely greyish pubescent, 10–17 mm. Pedicle absent or very short. Tepals c. 12, all nearly the same, 30–55 mm. Stamens c. 10 mm long, including the c. 1 mm long connective appendage. Carpels c. 10, with the c. 5 mm long gynophore greyish puberulous. Fruits not known.

Distribution. Commonly cultivated in tropical and subtropical countries.

Ecology. Growing below 1200 m. Fl. fr. Jan.–Dec.

Uses. The beautiful and nicely scented flowers are sold on the market, the tree is grown as an ornamental.

Vernacular names. Djeumpa gadèng (Aceh), tjempaka putih (M.), tjempaka bodas (Sund.), petjari putih, tjempaka putih (Jav.), tjampaka potè (Mad.), sampaka kulo, s. mopoési, tjampaka momero, tjempaka mawuro (Alf. Cel.), bunga èdga kébo, paténé (Mak.), bunga èdja maputè (Bug.), tjapaka bobudo (Ternate), tjapaka bobulo (Tidore).

Notes. This plant does not produce fruit and is unknown in the truly wild state. It is certainly a cultigen, and as it perfectly combines the characters of *M. champaca* and *M. montana*, it is here presumed to have arisen by hybridisation between these two species, though whether by accident or design we shall never know. The plant was already well known to Rumphius in the first part of the 18th century. As *M. montana* is confined to Malesia, *M. × alba* must have had a Malesian origin, probably in Java where *M. montana* is a common species, wild and sometimes cultivated, and *M. champaca* also very common with an introduced and a wild variety.

FRI bb 11996 from Bali has the characters of this species but produces fruits. Of one of the flowers 2 carpels are grown into young fruits. Therefore Dandy had identified this specimen as *M. montana*. The number of carpels (c. 10) and the indument clearly indicate that this is not *M. montana*.

8. *Michelia figo* (Lour.) Spreng.

M. figo (Lour.) Spreng., Syst. 2 (1825) 643; Finet & Gagnep., Mém. Soc. Bot. Fr. 1, 4 (1906) 42; Fl. Gén. I.-C. 1 (1907) 37; Dandy, Lingnan Sc. J. 7 (1929) 145; Hand.-Mazz., Symb. Sin. 7 (1931) 244; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1938) 45; Burkill, Dict. (1935) 1466; Corner, Wayside Trees (1940) 434; Backer & Bakh. f., Fl. Java 1 (1963) 98. – *Liriodendron figo* Lour., Fl. Cochinch. (1790) 347. – *Magnolia figo* (Lour.) DC., Syst. 1 (1817) 460; Prod. 1 (1824) 81. – Type: Loureiro (not seen).

Magnolia fuscata Andr., Bot. Repos. 4 (1802) t. 229; Sims, Bot. Mag. 25 (1807) t. 1008; DC., Syst. 1 (1817) 457; Prod. 1 (1824) 81. – *M. fuscata* (Andr.) Blume ex Wall., Cat. (1832) n. 6495; Forbes & Hemsley, J. Linn. Soc. Bot. 23 (1886) 24; Backer, Fl. Batavia 1 (1907) 10; Schoolfl. Java (1911) 14; Koord., Exk. Fl. Java 2 (1912) 240. – *Liriopsis fuscata* (Andr.) Spach, Hist. Natur. Veget., Phanerog. 7 (1839) 461. – Type: the plate in Andrews, Bot. Repos.

M. parviflora Deless., Ic. Select. Pl. 1 (1821) 22, t. 85 (excl. calyce fic.) non *M. parviflora* DC. 1817; DC., Prod. 1 (1824) 79, p.p.; Blume, Fl. Java Magnol. (1829) 18; Hassk., Cat. Pl. Hort. Bog. (1844) 178; Moritz in Zoll., Syst. Verz. (1846) 36; Korth., Ned. Kruidk. Arch. 2, Versl. (1851) 97; Miq., Fl. Ind. Bat. 1, 2 (1851) 18; Ann. Mus. Bot. Lugd.-Bat. 4 (1868) 73; Teijsm. & Binnend., Cat. Pl. Hort. Bog. (1866) 178. — *Magnolia parviflora* Blume, Bijdr. (1825) 9. — *Sampacca parviflora* O. Ktze, Rev. Gen. Pl. 1 (1891) 7 ('*parvifolia*'). — *Magnolia parvifolia* DC., Syst. 1 (1817) 459. — *M. parvifolia* (DC.) B.D. Jacks., Index Kewensis 2 (1894) 223. — Type: *Herb. Delessert* (G, not seen).

Shrub. Twigs pubescent to tomentose, often zigzag. Stipules adnate to the petiole for nearly its whole length, long ferruginously pubescent. Leaves often distichously arranged, hardly acuminate, more or less elliptic, glabrous, 4.5–6.5 by 2–3 cm; acumen 0–5 mm; base cuneate; nerves in 9–12 pairs, with the rather fine reticulation prominent on both sides. Petiole with same indument as twigs, 3–5 mm long, stipular scars present for nearly its whole length. Flowerbuds surrounded by the long pubescent to tomentose spathaceous bracts. Brachyblast woolly pubescent, c. 5 mm in Malesia (up to 20 cm outside Malesia). Pedicle very short, pubescent. Tepals all approximately the same, 6 in total, c. 18–20 mm. Stamens c. 10 mm, connective appendage very short. Carpels c. 20–30, with the c. 2 mm long gynophore glabrous, or only the gynophore pubescent. Fruiting carpels 1–several, c. 8 by 8 mm, often only one seed developed.

Distribution. China; in Malesia: frequently and widely cultivated as an ornamental shrub, not known to be naturalized.

Vernacular name. Tjempaka muleng (Jav.).

EXCLUDED SPECIES

Michelia beccariana Agostini, Atti Com. Accad. Fisiocrit. Siena IX, 7 (1926) sep. 23
= *Magnolia* spec.