A REVISION OF FOUR GENERA OF THE TRIBE LEGUMINOSAE-CAESALPINIOIDEAE-CYNOMETREAE IN INDOMALESIA AND THE PACIFIC

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CONTENTS

SUMMARY

This revision is largely based on the gross morphology of the plants concerned. Four genera can be distinguished. In order to verify their delimitation also a wood-anatomical study was carried out, which supported their distinction. Furthermore, I tried to gain knowledge about their blastogeny, but this could only be recorded for three species.

The genera have been redefined. Two keys to the genera are given, one based on gross morphology, another based on the wood anatomy.

Within each genus a key is given to the species.

The monotypic genus *Schizoscyphus* has been transferred to *Maniltoa*.

In all, 28 specific names have been reduced and 34 are maintained; four new species and one new infraspecific taxon have been described. It has appeared that the enigmatic *Cynometra polyandra* Roxb. must be incorporated in *Maniltoa* and that *Hardwickia pinnata* Roxb. should be arranged in *Kingiodendron*. Otherwise no transfers of species from one genus to another appeared necessary.

A full synonymy and description is given of all taxa, with their geographical range and, if available, notes on their ecology.

Hutchinson's opinion that the occurrence of hairs on stamens is a taxonomically important character in generic delimitation, could not be corroborated for the genera treated here.

It has sometimes been claimed that the presence of a stipe under the ovary can be used for generic delimitation. Such a classification is not possible since this character varies in *Maniltoa* in which three species out of fourteen have a sessile ovary.

A similar statement can be made about the unilateral fusion of the stipe and ovary base with the receptacle; in a single indubitable species of *Cynometra*, *C. mirabilis*, this is the case, in all other species the stipe is free from the receptacle.

In *Kingiodendron* I found that the cotyledons are very strongly folded in the seed.

INTRODUCTION

The purpose of this thesis is to revise four genera of the tribe *Cynometreae* of the subfamily *Leguminosae-Caesalpinioideae*. It comprises all the representatives of these genera, which occur in the Indo-Malesian-Pacific area.

The classification of the *Leguminosae* used here follows that of Taubert (1892). The tribe includes the following generic names: *Cynometra*, *Maniltoa*, *Hardwickia*, *Kingiodendron*, *Schizoscyphus*, *Sindora*, and *Copaifera*. The latter two genera have already been revised by de Wit (1949a, 1954).

In the area under consideration the *Cynometreae* have never been revised as a whole; yet in the course of time a considerable number of species have been proposed. Through the exploration activities of the forestry services, notably in New Guinea where *Maniltoa* is centered, a fairly large amount of material has been assembled, especially in the past two decades. As new acquisitions from the past three years did not yield obvious novelties, it may be concluded that the collections are sufficiently large to guarantee a fairly complete treatment.

Several problems had to be solved, not only for a proper delimitation of the species of which some fifty had been attributed to *Cynometra* and *Maniltoa*, but also for a better distinction of the genera.

Maniltoa was distinguished from *Cynometra* by Scheffer (1876), but there has been confusion about its delimitation, as one species, *Cynometra polyandra*, was treated by some authors as belonging to *Cynometra*, but by other authors referred to *Maniltoa*.

Similarly *Kingiodendron* has been distinguished as a monotypic genus from the Indian genus *Hardwickia* by Harms (1897). In 1909 Merrill & Rolfe transferred to *Kingiodendron* a Philippine species of *Cynometra* described by Elmer in that year, thereby extending the distribution of the genus outside continental South East Asia. In 1936 Burtt assigned two new species from the Solomon Islands and Fiji to *Kingiodendron*, thus extending the generic area considerably further eastward into West Polynesia. Given such a rather disjunct area of distribution, the problem was whether *Kingiodendron* remained to represent a natural entity.

A further question to be solved was the interrelationships of the four genera.

Finally, the position of the Papuan genus *Schizoscyphus* had to be taken into consideration.

METHODS USED

In the first place a taxonomic revision, based by tradition on the gross morphology, was carried out. As usual this yielded sufficient results for a proper separation of the genera. During this work it appeared that *Schizoscyphus* should be transferred to *Maniltoa*, viz. *M. rosea* (K. Sch.) van Meeuwen. The characters used in the key to the four genera show that they can be sharply distinguished.

The work by Léonard on the blastogeny of the tribes *Cynometreae* and *Amherstieae* in Africa (1957) inspired me towards an attempt to perform a similar investigation for the Indo-Malesian *Cynometreae*. There appeared to be considerable difficulty in the execution of this side of the subject, as will be observed from the remarks made in the chapter on morphology.

A second parallel line of research was performed on the wood anatomy of the four genera. This was executed by Miss Dr S. M. Jutte, and appeared to yield some useful results, as can be observed from the key to the genera based on wood structure. Miss Jutte's results will be published in full in a separate paper.

MORPHOLOGY AND WOOD ANATOMY

Inflorescence

In *Cynometra* and *Maniltoa* the inflorescence is a simple, sessile raceme; it is very dense and contracted. In bud it is almost globular and densely covered by bracts and resembles a strobilus; in anthesis it usually retains a globular shape. In *Kingiodendron* and *Hardwickia* the inflorescence is a lax panicle, in *Kingiodendron* with long rachises and many flowers, in *Hardwickia* with short rachises and only 5—10 flowers.

Bracts

The inflorescences in all genera (except *Hardwickia*) are covered in bud by conspicuous, imbricate bracts giving them a cone-like appearance. Towards anthesis the bracts in *Kingiodendron*, which are rather small, become widely spaced by the stretching of the rachises. In *Cynometra* and *Maniltoa* the large bracts remain conspicuous between the protruding flowers. They are not important for specific distinction.

Bracteoles

In all genera (except *Hardwickia*) fugacious bracteoles are found, in *Cynometra* and *Maniltoa* inserted in the basal half of the pedicel, in *Kingiodendron* at the apex of the pedicel. Within *Maniltoa* it appeared that the Fijian species possess minute bracteoles in contrast with all others.

Flower

Within each genus the flower structure is very constant, variations being found almost exclusively in the dimensions of the floral parts.

The receptacle is formed by the fusion of the bases of the calyx and the stamens.

In *Cynometra* and *Maniltoa*, in each of which a disk is absent, the stamens can be traced right down to the central part of the receptacle. In *Kingiodendron* this is not possible as the disk is completely fused with the bottom of the receptacle. In *Hardwickia* a disk is absent, but the stamens seem to sprout from the edge of the receptacle.

The stamens are glabrous or hairy and their number is 10(—15) except in *Maniltoa* where 15—80 stamens are found. In *Kingiodendron*, *Hardwickia*, and *Cynometra* they are free, in *Maniltoa* they are usually connate to some extent.

The anthers are quite often apiculate and are cleft below the insertion of the filament. In *Hardwickia* they are warty.

The ovary contains normally one ovule; in *Cynometra* and *Maniltoa* it is sometimes obliquely attached to the receptacle. The ovary is generally stipitate but in *Maniltoa* three species and in *Cynometra* one species possess a sessile ovary. Moreover, *Hardwickia* has a sessile ovary.

In *Cynometra* the stipe is free from the receptacle, except in *C. mirabilis*.

Fruit and seed

The pod is 1-seeded (occasionally 2-seeded in *Cynometra*), indehiscent, and lignified, except in *Hardwickia* where it is samaroid and not lignified. Its shape is generally globular, more rarely flattened; it has a rough surface and is occasionally deeply wrinkled. In *Hardwickia* and in one species of *Kingiodendron* the veins on it run lengthwise. The maturity of the pod can be concluded from its strong lignification. Unfortunately, mature pods and seeds are rarely collected. The fruit structure has no taxonomic value in *Maniltoa* and in *Cynometra* only for some species.

In *Kingiodendron* it was found that the cotyledons are strongly folded, a peculiar feature hitherto not mentioned in literature except in a note on the genus by de Wit (1949) (fig. 7e).

Leaves

The leaves are pinnate in all genera; the leaflets are opposite, except in *Kingiodendron* where they are alternate. In *Cynometra* and *Maniltoa* the young leaves develop conspicuously simultaneously from a foliage bud into limp, drooping, cream-coloured to bright pink tassels. Because of this they are commonly called 'handkerchief-trees' and are quite ornamental. Within a week the tassels turn gradually green and the leaves gain their normal firmness.

The venation in *Cynometra*, *Maniltoa*, and *Hardwickia* is characteristically asymmetric due to the excentric course of the midrib, except in the one unifoliolate species of *Cynometra*. In *Kingiodendron* the leaflets are largely symmetrical in shape, hence in venation. In *Hardwickia* the leaves are like those of *Bauhinia*, with the midrib not very conspicuous, acroscopic, and with the 4—5 nerves in the basiscopic broad half flabellately arranged from the very base.

Stipules

In almost all former descriptions the stipules have not been mentioned. This is easily understood because, especially in *Cynometra* and *Maniltoa*, they are fugacious and evidence of their presence can only be traced in foliage buds; they are often very long, linear, and tender, but leave in these genera no scars on adult twigs. In *Hardwickia* and *Kingiodendron*, however, such scars are discernible.

Seedlings

Considerable trouble was taken to obtain seed for growing seedlings and study germination, as I wanted to compare the seedlings of Indo-Malesian species with the African ones described by Léonard (1957).

Several correspondents confirmed that fruit setting in native *Cynometra* and *Maniltoa* is rare. Trees which had abundantly flowered were later carefully examined but yielded no fruit. This is sustained by the fact that pods in many herbarium specimens proved to be sterile. Furthermore, the seed of seemingly mature pods which I received often failed to germinate. Troup (1921) stated that *Hardwickia binata* seeds sporadically every year, and that gregarious seeding takes place averagely every three to five years. This could be applicable to all *Cynometreae*, from what I heard from collectors. I have only been able to raise seedlings of *Maniltoa browneoides*, *M. schefferi*, and *Cynometra cauliflora*. Excellent descriptions and pictures of seedlings from *Hardwickia* and *Kingiodendron pinnatum* were given by Troup.

Léonard introduced a new definition of the concept 'epigeal', hitherto generally estimated by the length of the hypocotyl and whether or not the cotyledons are elevated above the soil. Among his numerous germination experiments with tropical African *Leguminosae* he observed several other modes of germination, necessitating a reconsideration of the concepts epigeal and hypogeal.

Both Troup and Léonard consider the crucial difference between epigeal and hypogeal germination defined by the position of the primary stem, viz. whether this is produced *centrally* between the cotyledons (epigeal) or *laterally* (hypogeal), hence irrespective of the length of the hypocotyl. By necessity, or at least connected with epigeal germination, the seed coat is shed and the cotyledons expand to various degree, whether or not enlarging and functioning as leaves, either in or (usually) above the ground. In hypogeal germination the seed coat is not or badly shed, while the cotyledons remain stuck together in the same situation which they had in the seed, while the primary stem is produced laterally, the hypocotyl usually remaining short.

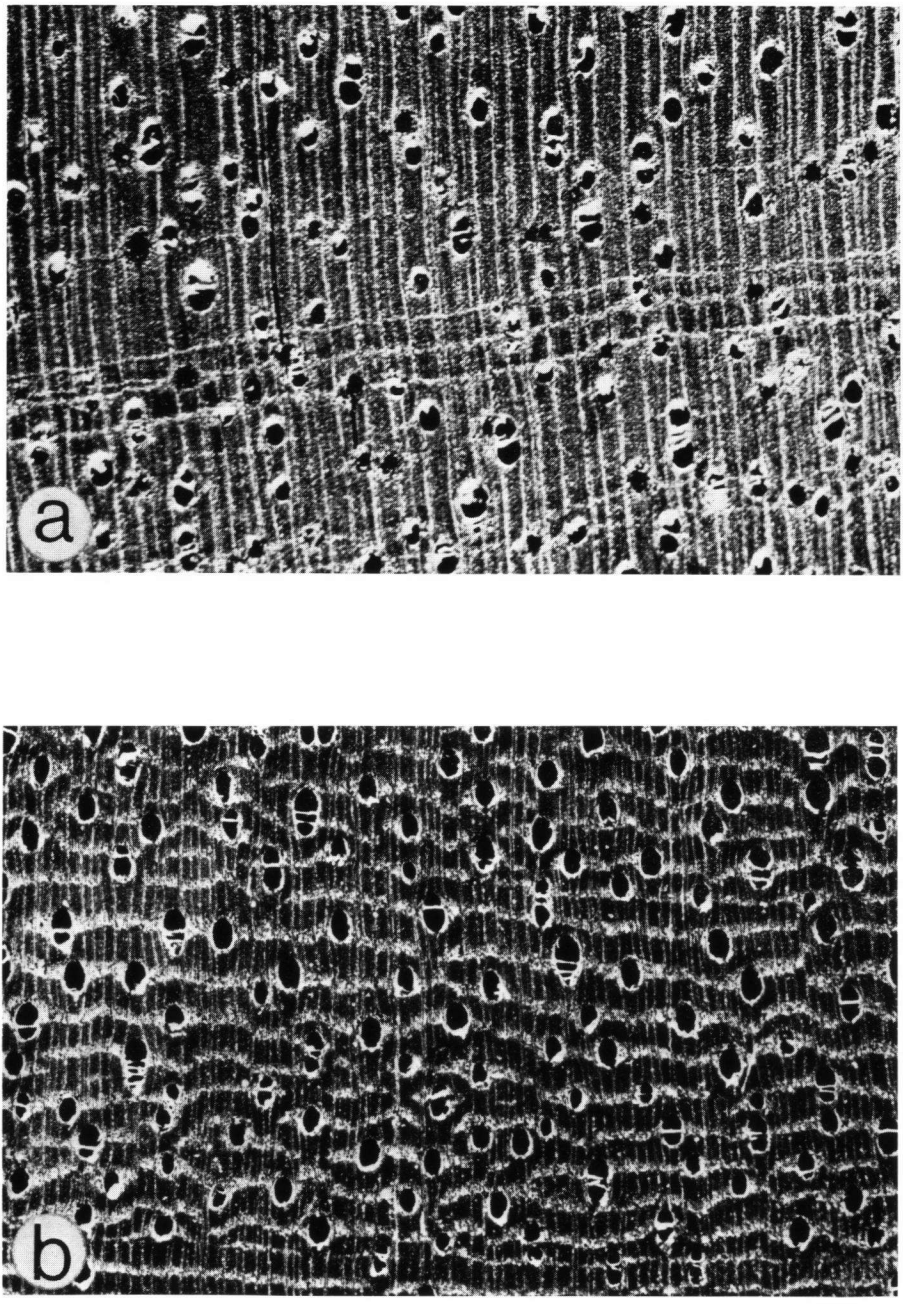

Plate 1. — a. End-grain surface of the wood of *Kingiodendron*, × 13. — b. End-grain surface of the wood of *Maniltoa*, × 13. — Unfortunately, no reference is available to voucher specimens.

Unfortunately, I had only three seedlings of *Maniltoa browneoides*, each from a different parent tree. The cotyledons of two emerged well above the soil, but one had cotyledons that remained in the soil. In all three the primary stem was central and germination must be considered epigeal in Troup's and Léonard's sense; the hypocotyl reached a length of 0—15 cm. Also, germination of *Maniltoa schefferi* and of *Cynometra cauliflora* was found to be epigeal. Unfortunately, Léonard did not mention the germination mode of African *Cynometra* (1951, 1957); this is a study which he had postponed; consequently I could not make comparisons with the African taxa.

The seedling of *Hardwickia binata* is described by Troup as follows: 'Epigeous. The apex of the pod dehisces slightly and the radicle emerges, rapidly developing into a taproot. The cotyledons expand and turn green, extricating themselves from the testa and the pod; they remain just above ground-level. The pod and the testa are left on the ground'.

The seedling of *Kingiodendron pinnatum* is described by Troup as follows: 'Hypogeous. The pod dehisces slightly at the apex, enabling the radicle and plumule to emerge; these elongate rapidly while the cotyledons remain within the pod'.

Wood anatomy

Miss S. M. Jutte (1965) performed an investigation of the wood anatomy of the four genera as part of her practical work for her doctoral examination at Leyden University. It was in particular of importance to see whether the genera *Cynometra* and *Maniltoa* could also be distinguished in wood anatomy. This appeared to be the case. She kindly permitted me to translate her key for use in this thesis.

The wood samples she could use are: *Hardwickia*: one sample; *Kingiodendron*: 28 samples, from one species; *Cynometra*: 25 samples, from 6 species, 1 variety, and 2 unidentified specimens; and *Maniltoa*: 36 samples, from 3 species. Samples were used of which voucher specimens were identified by the author.

KEY TO THE GENERA BASED ON WOOD ANATOMY

1. Axial gum ducts clearly present, regularly distributed between the vessels. Parenchyma predominantly apotracheal, being of the terminal type, consisting of narrow or rather narrow bands; fibres septate as well as non-septate. Specific gravity 0.51. Plate 1a . . . . . **3. Kingiodendron**

1. Axial gum ducts absent. Parenchyma of a different type; fibres always divided.
   2. Rays homogeneous; width medium-sized (max. 60 μ, max. 5 cells). Apotracheal, diffuse parenchyma with characteristic crystal fibres (max. 15 crystals) usually bordering to the rays; the parenchyma occupies 1 % of the end-grain surface. Specific gravity 1. . . . . **4. Hardwickia**
   2. Rays heterogeneous, type II—III (Kribs, 1935). Paratracheal parenchyma occupying 20—40 % of the end-grain surface.
      3. Vessels solitary and in multiples. The multiples consist of radial groups of 3 and more vessels and of clusters of 10 and more vessels per mm^2. Solitary vessels $\frac{1}{3}$—$\frac{1}{2}$ the number of multiples. Rays moderately fine to medium (30—100 μ), often 3—4 cells wide. Specific gravity 0.98. **1. Cynometra**
      3. Vessels solitary and in multiples. The multiples consist of radial groups of 3 and more vessels. Solitary vessels 2—5 times the number of multiples. Rays narrow (16—30 μ), usually 2 cells wide. Specific gravity 0.88. Plate 1b . . . . . **2. Maniltoa**

ECOLOGY AND GEOGRAPHICAL DISTRIBUTION

Almost all Indo-Pacific *Cynometreae* are woody constituents of the mixed, tropical, evergreen, lowland rain forest. The highest altitude so far recorded is attained by *Cynometra simplicifolia*, *C. malaccensis*, and the doubtful *C. brachymischa* at 1300 m altitude.

They do not grow in regions subject to a dry season, except the Indian *Hardwickia binata* which is bound to seasonal conditions.

Though they may be rather common, as for example *Maniltoa* in New Guinea, they never gain dominance, to judge from collector's field notes. Hardly any is characteristic of a specialized ecology, save for *Cynometra ramiflora* (and probably *C. iripa*) which is a constituent of the back-mangrove.

Usually, they do not reach a large size; some even belong distinctly to the lowest storey of the forest. The largest sizes, *c.* 35—40 m tall, are reached by *Cynometra malaccensis* in Malaya, *Maniltoa plurijuga* and *M. schefferi* in New Guinea, and *Kingiodendron pinnatum* and *Hardwickia binata* in India.

Of the four genera *Cynometra* has the widest distribution, being pantropical. The greatest density of its species is found in Africa, but its area extends through continental tropical Asia and Malesia to the West Pacific (as far as Fiji). The most widely distributed species (*C. ramiflora*) occurs as far as the Carolines, while another widely distributed species (*C. iripa*) occurs even in NE. Queensland.

Maniltoa distinctly centres in New Guinea (9 spp.) but extends into the Pacific with 4 spp. (Solomons, Fiji, and Tonga), but curiously also extends far to the west, with one species in East Malesia (Celebes and Moluccas) and even one in India (*M. polyandra*).

Kingiodendron has a rather similarly large, but more patchy distribution, viz. in India, the Philippines, New Guinea, the Solomon Islands, and Fiji.

Hardwickia is a monotypic genus from India.

USES

The chief use of the larger sized trees of the *Cynometreae* is for timber (Burkill, 1966). They furnish a fairly heavy wood; logs of *Cynometra*, *Maniltoa*, and *Hardwickia* have a high specific gravity and sink in water.

The wood of *Maniltoa polyandra* from India is said to be useful for building and to make good charcoal. That of *Hardwickia binata* from India is very durable and is used for bridge- and house-construction; its bast yields a strong fibre; its foliage is used for fodder. Beams of *Cynometra malaccensis* are also used for house-building. *Maniltoas* from New Guinea are used for sawnwood; the wood is light brown to brown, and yields hard and rather heavy timber, with fine, straight grain.

There is one fruit tree among these *Cynometreae*, viz. *Cynometra cauliflora*. The taste of the brownish green pod is suggestive of an apple; the pods can be eaten raw, but are better stewed.

Maniltoas are very decorative through the simultaneous development of young leaves from thick, scaly buds. The conspicuous tassels produced are drooping, limp, cream to pink coloured leaf-bundles lasting for several days before turning gradually green and rigid. Also the head-like racemes of pink flowers, which are sometimes produced at the same time as the leaves, contribute to the lively aspect of the flowering trees. They show this decorative fashion already at an early age and are, at least in West Java, not rarely planted in gardens and on estates. *Maniltoa* trees are popularly called 'handkerchief trees', as are the species of *Brownea* and *Amherstia*, which display similar showy drooping tassels.

DELIMITATIONS AND INTERRELATIONSHIPS

Retaining the essence of Taubert's classification, the tribal division of the subfamily *Caesalpinioideae* is as follows:

Tribes:	*Genera of Cynometreae in Indo-Malesia:*
Dimorphandreae	
Cynometreae	Cynometra Maniltoa Hardwickia Kingiodendron Sindora* Copaifera**
Amherstieae	
Bauhinieae	
Cassieae	
Kramerieae	
Eucaesalpinieae	
Sclerolobieae	

The delimitation of the tribes has always offered difficulties. As soon as one becomes intimately acquainted with a tribe, it appears that the interrelationships within the subfamily are so close that separations become of doubtful significance.

The distinction of the tribes *Cynometreae* and *Amherstieae* brings along great difficulty, especially as to the choice of the taxonomically most important characters. Bentham & Hooker *f.* (1865) used the properties of the disk as a key character. Unfortunately in several *Cynometreae* a disk is absent. Léonard (1957) used the bracteoles which are valvate (*Amherstieae*) or non-valvate (*Cynometreae*); this character holds for the *Cynometreae* treated here.

With the great progress made in the exploration of the tropical forest flora in this century many new genera have been described. These had to be fitted in the system proposed by Taubert, which had become very incomplete since 1892.

In his recent survey of the genera Hutchinson (1964) has abandoned Taubert's tribes and replaced these by five groups which he admits to be artificial (l.c. p. 225), though he maintains that they are phylogenetically arranged. He treated the genera in the sequence in which they appear in the equally artificial keys within the groups. The unsatisfactory result was of course that though *Cynometra*, *Schizoscyphus*, and *Maniltoa* belong to one group (group 2), their genus numbers were 23, 34, and 55 respectively. From this it appears that his sequence of the genera does not at all reflect natural affinity as *Cynometra* and *Maniltoa* are manifestly more closely related to each other than to any other genus, and *Schizoscyphus* even appeared to be congeneric with *Maniltoa*.

This is a considerable disadvantage as compared with the treatment by Taubert who seriously attempted to have the allied genera close together. His arrangement facilitated the earlier recognition of the congenerity of *Afrormosia* with *Pericopsis* (Knaap-van Meeuwen, 1962).

It is clear that the characters used in Hutchinson's key are artificial. One of them, valued fairly high by Hutchinson, is the occurrence of hairs on the stamens. This may be correct, but mention of this has so much been neglected in descriptions that before making use of it as a key character all species should be checked anew on this point. I have found the

*) Revised by H. C. D. de Wit (1949a).
**) Revised by H. C. D. de Wit (1954).

stamens occasionally hairy in some species of *Cynometra* and *Maniltoa*, and always hairy in *Kingiodendron*, a feature not recorded before.

Though Hutchinson's survey is the most complete enumeration of the genera, it is not a digest of systematical affinity. Conversely, Taubert's treatment, though now incomplete to a considerable extent, possessed the great merit that genera which were closely allied were also placed side by side. A new system of genera and tribes remains a great desideratum. Taubert's system is probably the best base to start from.

The great difficulty, as usual in taxonomy, is to find characters or combinations of these, which reflect natural affinity. And in this respect *Caesalpinioideae* are capricious, by which I mean that sometimes a character constant in almost all species of a genus breaks down in a single species.

There exists a close reticulate affinity among many genera of the *Cynometreae*. The very nature of reticulate affinity would lead to a subdivision based on single characters. To apply this method would result in the opposite of what was intended because if single and unrelated characters were to govern the delimitation of reticulately connected genera, an unnatural system must result (de Wit, 1956).

Consequently, it seems unadvisable to use single characters for delimitation, but instead combinations of these, of which admittedly one may break down occasionally. For example, a major characteristic in the *Cynometreae* used for the delimitation of African genera is whether the stipe of the ovary is distinctly merged with the lateral wall of the receptacle. Using this character for our *Cynometras* would result in an undesired isolation of *C. mirabilis*. Similarly the feature of unifoliolate leaves has been used as a character for the African genera. Unifoliolate leaves do occur in *C. simplicifolia*, and should be accompanied by other characters before it can be used for generic delimitation. Three species in *Maniltoa* share the very marked character of a sessile ovary, as opposed to a stipitate ovary in all the other *Maniltoas*; however, one should not separate them on this basis from the rest of the genus, as there is no doubt of their being congeneric.

The same holds for the blastogeny, though this is probably a more important, hence more reliable feature. Though I admit the importance of the mode of germination, it does not seem to be so important as has been assumed by Léonard, who believed to have found in this an absolute criterion for generic delimitation. This is a statement which may lead to circular reasoning, because he concluded that if a genus is heterogeneous in blastogenic aspect, it must also be heterogeneous taxonomically. As a consequence the genus would have to be split, each part becoming a blastogenically homogeneous genus of its own. Blastogenic characters could, however, also be used with profit to define infrageneric taxa. Here again, I feel that blastogeny must be accompanied by a set of other, more or less constant characters for the purpose of generic delimitation.

In conclusion, the overall picture of affinities within *Caesalpinioideae* displays a pattern of complex reticulate affinities, which makes a classification difficult.

ACKNOWLEDGEMENTS

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I am highly indebted to Miss Dr S. M. Jutte whose results on the systematical wood anatomy of the four genera treated in this thesis were freely put at my disposal. To Dr W. van Heel I owe the clarification of the structure of the seed of *Kingiodendron pinnatum*.

The few data I could gather on the blastogeny resulted from the receipt of seed of some species through the appreciated cooperation of the curators of the Botanic Gardens, Peradeniya, Ceylon, and of Kebun

Raya Indonesia, Bogor, Indonesia. Seedlings were raised thanks to the help offered by the staff in the greenhouses of the Botanic Gardens at Leyden and Wageningen.

The drawings are by the able, artistic hand of Miss C. van Crevel and the typing of the MS was performed by Miss E. E. van Nieuwkoop, both experts in their fields.

Mr J. F. Veldkamp assisted in the ticketing of the specimens and in the compilation of the Identification List for which I am grateful.

Sincere thanks are due to Prof. Dr C. G. G. J. van Steenis under whose guidance I became, as a student, interested in *Leguminosae*. He kindly supervised the present work in its botanical aspects.

I gratefully acknowledge many loans received from directors and curators of herbaria abroad. As usual, types and other essential material are scattered over many institutes.

I must admit to having retained this material for a rather long period and feel very happy that no complaints were made. That the work was interrupted twice for the birth of my two daughters, and once because I accompanied my husband on a year's leave of absence to Canada and the United States, is, I hope, an acceptable explanation.

LIST OF HERBARIA FROM WHICH MATERIAL WAS EXAMINED*,**

*A	Arnold Arboretum, Cambridge, Mass., U.S.A.
BISH	Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.
BM	British Museum (Natural History), London, U.K.
BO	Herbarium Bogoriense, Bogor, Java, Indonesia.
*BR	Jardin Botanique de l'Etat, Brussels, Belgium.
BRI	Botanic Museum and Herbarium, Brisbane, Australia.
C	Botanical Museum and Herbarium, Copenhagen, Denmark.
CAL	Indian Botanic Gardens, Howrah, Calcutta, India.
E	Royal Botanic Garden, Edinburgh, Scotland, U.K.
G	Conservatoire et Jardin Botanique, Geneva, Switzerland.
*GH	Gray Herbarium, Harvard University, Cambridge, Mass., U.S.A.
*K	Herbarium of the Royal Botanic Gardens, Kew, U.K.
KEP	Forest Research Institute, Kepong, Malaya.
L	Rijksherbarium, Leyden, Netherlands.
M	Botanische Staatssammlung, München, Germany.
MEL	National Herbarium of Victoria, Melbourne, Australia.
MH	Botanical Survey of India, Coimbatore, Madras, India.
MICH	University Herbarium Michigan, Ann Arbor, Mich., U.S.A.
NY	New York Botanical Garden, New York, N.Y., U.S.A.
P	Muséum National d'Histoire Naturelle, Paris, France.
S	Naturhistoriska Riksmuseet, Stockholm, Sweden.
SAR	Sarawak Museum, Kuching, Sarawak.
SING	Herbarium of the Botanic Gardens Singapore, Singapore.
TAI	Herbarium, Department of Botany, National Taiwan University, Taipei, Taiwan.
TI	Botanical Institute, Faculty of Science, Tokyo, Japan.
*TRT	Department of Botany, University of Toronto, Toronto, Ontario, Canada.
U	Botanisch Museum en Herbarium, Utrecht, Netherlands.
*UC	Herbarium of the University of California, Department of Botany, Berkeley, Calif., U.S.A.
*US	National Museum, Smithsonian Institution, Washington, D.C., U.S.A.
ZT	Institut für spezielle Botanik, Zürich, Switzerland.

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**) An account of the specimens examined will be incorporated in an 'Identification List' in the series issued by the Rijksherbarium, Leyden.

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KEY TO THE GENERA*

1. Flowers in sessile, dense racemes, mostly spherical in outline. Sepals 4 (rarely 5). Petals 5. — Leaves even-pinnate with 2—12 asymmetric leaflets, or 1 leaflet, and that symmetric. Bracteoles present, inserted at the base of or halfway the pedicel. Disk absent. Stigma small. Anthers very often cleft below the insertion of the filaments, mostly apiculate, smooth. Pod not samaroid.
   2. Stamens 10, rarely less (8), rarely more (up to 13). Filaments not connate at base. Rachis of the inflorescence tender. Sepals 2—6 mm long, petals 2—9 mm long. Pod rugose, warty or smooth. **1. Cynometra**
   2. Stamens *c.* 15—*c.* 80. Filaments often connate at base. Rachis of the inflorescence usually sturdy. Sepals 5—18 mm long, petals 5—19 mm long. Pod smooth . . . . . **2. Maniltoa**
1. Flowers in lax panicles. Sepals 5. No petals. Anthers never cleft and not apiculate.
   3. Leaves uneven-pinnate, leaflets 3—7, alternate, symmetric, primary nerves pinnately arranged. Bracteoles present, inserted on the receptacle or at its base. Disk present. Stigma small. Anthers smooth. Ovary densely curly hairy. Pod not samaroid, smooth . . . . . **3. Kingiodendron**
   3. Leaves even-pinnate, leaflets 2, opposite, asymmetric, primary nerves flabellately arranged from the base. Bracteoles absent. No disk. Stigma peltate. Anthers warty. Ovary glabrous. Pod samaroid, smooth . . . . . **4. Hardwickia**

1. CYNOMETRA

Linné, [Act. Soc. Sc. Upsal. (1741) 78] Gen. Pl. ed. 5 (1754) 179; Sp. Pl. (1753) 382; Lamk, Illustr. 2 (1797) t. 331, f. 1, 2; Boerl., Handl. Fl. Ned. Ind. 1, 2 (1890) 337, 678; Taubert in E. & P., Nat. Pfl. Fam. 3, 3 (1892) 129, *pro* sect. *Eucynometra* Baker; Harms, ibid. Nachtr. 1 (1897) 193; Corner, Wayside Trees (1940) 391; Léonard, Bull. Jard. Bot. Brux. 21 (1951) 373—400; Fl. Congo Belg. 3 (1952) 309—327; Mém. Ac. Roy. Belg. Cl. Sc. 30, 2 (1957) 56, 94. — *Iripa* [Rheede, Hort. Malab. 4 (1673) t. 31] Adans., Fam. 2 (1763) 508. — [*Cynomorium* Rumph., Herb. Amb. 1 (1741) t. 62—63.] — *Cynomora* Hedw., Gen. Pl. (1806) 304. — Lectotype species: *C. cauliflora* L.

Metrocynia Thou., Gen. Nov. Madag. (1806) 22, *p.p., quoad fruct.* — **Fig. 1—3.**

Trees (or shrubs). Growth flush-wise, flushes in buds before development. Buds small,

*) Proper generic identification is only possible with flowers. For a key to the genera based on the wood anatomy, see p. 7.

with numerous brown scales in two ranks. New leaves developing in bright pink tassels. *Leaves* 1-pinnate, 1—3(—6)-jugate, rarely simple (unifoliolate), the leaflets opposite, asymmetric and the midrib acroscopic; basiscopic side of the base of the leaflet often auriculate, the acroscopic side cuneate; leaflets entire and mostly glabrous; petiolules usually very short. *Stipules* present in the buds, very tender, (in Indo-Mal.) caducous immediately after the unfolding of the bud, leaving no scar. *Racemes* mostly spherical in outline, sometimes elongated (fig. 2a), sessile, dense, 1(—2) per axil, exceptionally cauliflorous and then 3—5 together. Rachis tender. Bracts scale-like, lower ones broad-reniform, gradually becoming ovate and acute halfway through the raceme (fig. 2a), mostly persistent, appressed-hairy, often glabrescent. Bracteoles caducous after anthesis, usually lengthwise folded, obovate, with a tuft of hairs at the top and with a line of hairs running down the dorsal side, rarely glabrous. *Flowers* bisexual. Receptacle campanulate, under the ripening fruit circumscissile, not present under the ripe fruit. *Sepals* 4 (rarely 5) imbricate, reflexed at anthesis. *Petals* 5, narrow, free, glabrous (fig. 2b). *Disk* absent. *Stamens* (8—)10 (—15), in one species 1 stamen sterile, in another species stamens alternately shorter and longer, sometimes with a few hairs; anthers medi-dorsifix, lengthwise dehiscent, introrse, *c.* 1 mm long, the connective very often cleft below the insertion of the filament, mostly apiculate at apex. *Ovary* (in Indo-Mal.) with 1(—2) ovules, mostly glabrous inside, almost always stalked; stipe central (fig. 1a) or excentric, rarely merged with the lateral wall of the receptacle (fig. 1b). *Pod* woody, on a ± thickened stipe, 1(—2)-seeded, flat to ± globular, smooth or rugose, sometimes warty, indehiscent.

Distribution: Pantropical, in the West Pacific found eastwards as far as Micronesia, the Solomons, and Fiji.

Ecology: All Indo-Pacific species grow under everwet climatic conditions and are forest constituents, nowhere gregarious or dominant. Most localities are in the lowland and on many labels the habitat is noted as banks of rivers or streams or as swamps, so that one gets the impression that there is a preference for waterlogged soil conditions. The highest altitude is reached by *C. simplicifolia* and *C. malaccensis* which are both recorded to go up to 1300 m. *C. ramiflora* is confined to the back-mangrove and throughout its large range characteristic for this coastal forest; also *C. iripa* is recorded for the back-mangrove but is found in mixed forest as well.

Uses: According to Burkill (Dict., 1935) the timber is light red to dark brown, close-grained, hard, and durable. Burgess (Timbers of Sabah, 1966, p. 347) mentioned for the *Cynometreae* two species: *C. inaequifolia* (syn. *C. polyandra*) and *C. ramiflora*, without any records on the provenance of the wood samples. His '*C. inaequifolia*' is probably *C. elmeri*, which in the past was often mistaken for *C. inaequifolia*. It is highly unadvisable to give information on properties of plants without reference to voucher specimens.

Notes. The Indo-Malesian species form a truly homogeneous assemblage. Still, some species have some characteristic individual deviations: in *C. copelandii* one stamen is sterile; *C. glomerulata* has only 8 stamens (but it must be noted that I know it only from the type); *C. falcata* has no stipe under the ovary and pod; *C. cauliflora* is cauliflorous; *C. opelandii* has 4—6-jugate leaves; *C. simplicifolia* has 1-foliolate leaves; *C. ramiflora* var. *bifoliolata* has distinct long petiolules.

As to the insertion of the stipe, which in African genera of *Cynometreae* is assumed to be a significant character and is therefore frequently used in keys to genera, there is a fairly large variation. Usually it is inserted centrally in the receptacle (fig. 1a), but in *C. ramiflora* it is found a little off centre; in *C. iripa* and *C. warburgii* it is distinctly obliquely inserted, and finally, in *C. mirabilis*, it is distinctly merged laterally with the wall of the receptacle (fig. 1b)! These observations show that there is here a series of neat intergrades from the

central position of insertion of the ovary towards a completely lateral one in one genus. This shows that Taubert was correct in not attaching too much value to this character. At the same time it shows that Léonard's opinion in his assigment of the African *Cynometra* (1957, p. 56—57), in which he assigned all species with an adnate ovary to different genera, not admitting any to *Cynometra*, is untenable.

The ovary is glabrous inside, but those of *C. iripa*, *C. mirabilis*, and *C. novoguineensis* form an exception.

Three species have a typically rugose or warty pod, viz. *C. ramiflora* (fig. 1c), *C. iripa* (fig. 1d), and to a lesser extent *C. cauliflora*. *C. glomerulata* has rugose and smooth pods, both forms being warty. In the pod of *C. iripa* the distal part is beak-like and pointing aslant (fig. 1d), a character already present in the pistil in wich the syle is not in a straight line with the ovary.

The number of nerves has always been counted on the basiscopic leaf-half, as they are there best observed.

The number of ovules is usually cited to be 1—2 (sometimes even to 3—4 in non-Indo-Malesian spp.). I have tested this character in many specimens and have found that in our area the ovules are mostly solitary but that 2 ovules occasionally occur.

Buds, stipules, and limp young leaves are seldom present in herbarium specimens, but the scars of the bud scales are often visible on the adult plants.

KEY TO THE SPECIES

1. Leaves unifoliolate. . . . . **1. C. simplicifolia**
1. Leaves 1—3(—6)-jugate.
   2. Leaves 4—6-jugate Stamens 10, one sterile . . . . . **2. C. copelandii**
   2. Leaves 1—3-jugate. Stamens (8—)10(—15), all fertile.
      3. Leaves (2—)3-jugate, never exclusively 2-jugate.
         4. Leaflets all of approximately the same size.
            5. Bracteoles inserted at the base of the pedicel.
               6. Rachis of inflorescence 2.6—6.5 cm. Style in a straight line with the dorsal side of the ovary, 4—5 mm long. Leaflets 3.8—5.3 by 1.7—1.9 cm. . . . . **3. C. dongnaiensis**
               6. Rachis of inflorescence 2—3 cm. Style 0.5—3 mm long, curved over the ovary in flower, straightened after anthesis. Leaflets 4—8.5 by 1.8—3 cm. . . . **4. C. malaccensis**
            5. Bracteoles inserted on the pedicel. Style in a straight line with the dorsal side of the ovary, up to 2.5 mm long. Leaflets 2.5—4 by 1—1.5 cm. Rachis of inflorescence 12—20 mm. **5. C. bourdillonii**
         4. Lower pair of leaflets smaller than the two upper pairs, 1.3—3 by 0.7—1.3 cm and 4.5—7 by 2—3 cm respectively. Style in a straight line with the dorsal side of the ovary, 4 mm long. Rachis of inflorescence up to 7 mm. . . . . **6. C. beddomei**
      3. Leaves 1—2-jugate or 1-jugate.
         7. Pod rugose (already clearly visible in the immature state, often even on the developing ovary) or warty.
            8. Inflorescence cauliflorous, consisting of 4 or 5 small racemes crowded together on hard knots on the trunk. Leaves 1-jugate. Only known cultivated. . . . . **7. C. cauliflora**
            8. Inflorescence(s) 1(—2), axillary.
               9. Style not in line with the dorsal side of the ovary, but aslant, away from the centre of the flower. The distal part of the pod beak-like and pointing aslant (fig. 2). Ovarial wall inside hairy. Sepals reflexed in anthesis, but the distal part curls up again. Leaves 1—2-jugate. . . . . **8. C. iripa**
               9. Style in line with the dorsal part of the ovary, never pointing away from the centre of the flower. Ovarial wall inside glabrous. Sepals reflexed in anthesis, but straight.
                  10. Young pod rhomboic in outline. Petiole 2—3 mm. Leaf-rachis 1—1.5 cm; apex of leaflets acuminate-cuspidate. Leaves 2-jugate . . . . . **9. C. glomerulata**
                  10. Young pod elliptic in outline. Petiole 3—15 mm. Leaf-rachis 1.5—4 cm; apex of leaflets acute-acuminate. Leaves 1-, 1—2-, or 2-jugate. . . . **10. C. ramiflora**

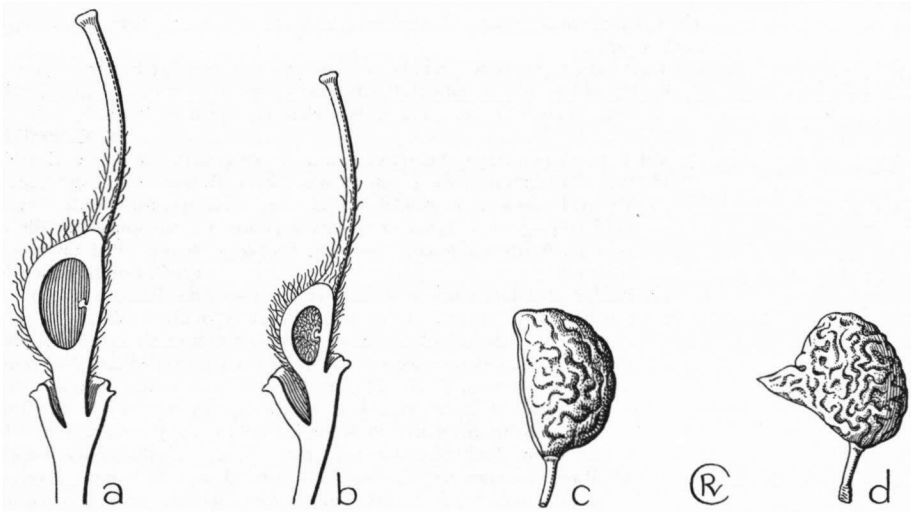

Fig. 1. *Cynometra.* — a. *C. inaequifolia* A. Gray, longitudinal section through ovary; stipe centrally inserted, × 6. — b. *C. mirabilis* van Meeuwen, ditto section through ovary; stipe unilaterally merged with the receptacle, × 6. — c. *C. ramiflora* L., pod, × 2/3. — d. *C. iripa* Kostel., pod, × 2/3 (a. *Merrill 1861*, b. *Miranda 20528*, c. *Hoffmann 6557*, d. *Haniff & Nur 7475*).

7. Pod not rugose or warty, generally smooth, surface unwrinkled, sometimes slightly knobbly in spp. 12 and 14.
   11. Stipe of the ovary over its entire length merged laterally with the wall of the receptacle. Ovary wall inside lined with a few curly appressed hairs . . . . . **11. C. mirabilis**
   11. Stipe of the ovary centrally or obliquely inserted in the receptacle, never entirely merged with the wall of the receptacle.
      12. Leaves 2-jugate. Midrib of leaflets straight.
         13. Leaflets coriaceous, obtuse to acute at apex (tip sometimes emarginate). Ovary pubescent and with scattered longer hairs.
            14. Leaflet pairs of about equal size; margin flat; base of leaflets auriculate at the basiscopic side; petiole 11—23 mm. Rachis of inflorescence 7—20 mm. Pedicels 8—10 mm, patently long-hairy, sometimes ± glabrescent. Bracts 7—9 mm. Stipe of ovary 0.5—1 mm; style 5—6 mm . **12. C. insularis**
            14. Upper pair of leaflets 11—20 by 4—8 cm, lower pair 4—8.5 by 1.8—5 cm; margin ± recurved; base of leaflets not auriculate; petiole 6—15 mm. Rachis of inflorescence 10—12 mm. Pedicels 10—17 mm, pubescent. Bracts 4—5 mm. Stipe of ovary 1.5 mm; style 4 mm . . . . . **13. C. inaequifolia**
         13. Leaflets thinnish, acuminate to spathulate (tip broad-emarginate); margin flat; upper pair of leaflets 3.5—4.5 by 1.1—1.9 cm, lower pair 1.8—2 by 0.7—0.9 cm; petiole 2 mm. Rachis of inflorescence 2—3 mm. Pedicels 2 mm, short-pubescent. Bracts minute (*sec.* F. v. M.). Stipe of ovary very short; style 2 mm. **14. C. minutiflora**
      12. Leaves 1-jugate.
         15. Ovary sessile, short-puberulous; style 1.5 mm. Leaflets with normal texture, midrib curved; base of the leaflet acute; petiole 3 mm. Inflorescence small, rachis 4—5 mm. Pedicels 4—5 mm, puberulous. Bracts 3 mm long. Pod unknown (3 sheets). . . . . **15. C. falcata**
      * 15. Ovary not sessile, possibly mostly glabrous (only known with certainty in *C.*

*) The following 5 species are all inadequately known as either flowers or pods have not been collected. Moreover, of *C. warburgii* (of which the type is lost) and of *C. novoguineensis* I had only one sheet. Therefore, neither their variability nor their exact circumscription is possible at this stage. Only of *C. craibii* there is a reasonable certainty that it is a good species by its unusual pod. *C. novoguineensis* deviates by very small flowers, a feature further only seen in *C. minutiflora.*

craibii, *C. travancorica*, and *C. warburgii*; in *C. novoguineensis* glabrous or laxly hairy at apex).

16. Valves of the pod paper-thin. Leaflets (ob)ovate-oblong to falciform, 4.5—6.5 by 1.7—3 cm, apex acute and acuminate-cuspidate. Sepals 2.5 mm. Petals 2.5 mm. Stamens 2—2.5 mm; anthers cleft and apiculate (3 sheets). **16. C. craibii**

16. Valves of the pod not so thin (unknown in *C. novoguineensis* and *C. warburgii*).

17. Rachis of inflorescence 4 mm. Bracts 1 mm. Pedicels 4—5 mm. Sepals 2 mm. Petals 1 mm. Stamens 2 mm; connective apiculate. Style 2 mm. Leaflets 4—7 by 1—3 cm, not very asymmetric, acuminate; midrib at 1—1.4 cm from acroscopic margin; petiole 4—6 mm. Pod unknown (2 sheets) . . . . . **17. C. novoguineensis**

17. Rachis of inflorescence 3—6 mm. Bracts 1—3 mm. Pedicels 2—4 mm. Sepals 3—3.5 mm. Petals 4—4.5 mm. Stamens 5—6 mm. Style 1—3.5 mm. Leaflets 3.2—15 by 0.8—4 cm, midrib at 3—12 mm from acroscopic margin.

18. Rachis of inflorescence 5—6 mm. Bracts 3 mm. Pedicels 3—4 mm. Sepals 3.5 mm. Petals 4.5 mm. Stamens 5—6 mm; connective not apiculate. Style 3.5 mm. Leaflets 3.2—6.5 by 0.8—2.7 cm (midrib at 3—11 mm from acroscopic margin), obtuse, not acuminate; petiole 2—4 mm. Pod unknown (2 sheets) . . . . . **18. C. warburgii**

18. Rachis of inflorescence up to 6 cm. Bracts 1—3 mm. Pedicels 2—4.5 mm. Sepals 3 mm. Petals 4 mm. Stamens with ± apiculate connective. Style 1 mm. Leaflets 3.5—8.5 by 1—2.8 cm (midrib at 8—11 mm from acroscopic margin), acute to ± acuminate, tip obtuse or emarginate; petiole 4—6 mm. Pod flattish, sutures thickened, 2—2.2 by 1.1 cm, inner suture ± straight, outer widely curved (5 sheets) . . . . . **19. C. travancorica**

18. Flowers unknown. Leaflets 3.5—15 by 1.3—4 cm (midrib at 6—12 mm from acroscopic edge), acuminate, apex blunt (tip emarginate); petiole 4—8 mm. Pod flattish, along sutures ± thickened, inner suture straight, outer one widely curved, 4—6 by 2.5—3.5 cm (many sheets). **20. C. elmeri**

1. **Cynometra simplicifolia** Harms, Notizbl. Berl.-Dahl. 3 (1902) 186; Merr., Philip. J. Sc. 1 (1906) Suppl. 63; ibid. 5 (1910) Bot. 37; En. Philip. 2 (1923) 255. — T.: *Cuming 1134* (holotype †, isotypes in BM, C, G, K, L, M, NY).

Crudia spicata (*non* Willd.) Blanco, Fl. Filip. ed. 2 (1845) 261; ibid. ed. 3, 2 (1878) 121, *p.p.*

C. luzoniensis Merr., Philip. J. Sc. 4 (1909) Bot. 266; En. Philip. 2 (1923) 255. — T.: *Merrill 2128* (holotype lost?, isotype in US).

C. simplicifolia var. *oblongata* Merr., Philip. J. Sc. 5 (1910) Bot. 37; En. Philip. 2 (1923) 255. — Lectotype: *Ahern's coll. FB 2978* (holotype lost?, isotypes in K, NY, US).

Small tree, 4—6 m. *Leaves* simple (1-foliolate), symmetric, 2.5—16 by 1—6 cm, either narrowly triangular, or nearly broadly ovate and short-acuminate, or (ob)ovate-oblong or lanceolate with acuminate or cuspidate tip; base rounded or auriculate; nerves 5—7 pairs; petiole 1—8 mm, short patent-hairy as are the branches, glabrescent. *Rachis* of inflorescence 6—8 mm, hairy, glabrescent. Bracts 2.5 by 2.5—3(—4) mm, ciliate, hairy. Bracteoles 2 mm long, inserted at the base of the pedicel or 0.1—0.2 mm above it. Pedicels 5—10 mm, patently, sometimes laxly hairy, glabrescent. Receptacle minute. *Sepals* 2 mm long, with a few hairs. *Petals* 2.5 mm long. *Stamens* 10 (or 11); connective cleft at base, apiculate. *Ovary* densely hairy, hairs partly longer and curly, glabrescent; style 3 mm, with an occasional hair. *Pod* (nearly) sessile, orbicular or kidney-shaped, mature 4.5 by 3.5 by 0.3 cm.

Distribution: Philippines (Luzon, throughout, Mindoro, Mindanao, and Basilan).

Ecology: In thickets and open, dry forests on the slope of mountains, up to 1300 m.

2. Cynometra copelandii (Elm.) Elm., Leafl. Philip. Bot. 8 (March 27, 1915) 2734; Merr., Philip. J. Sc. 10 (April 23, 1915) Bot. 13; En. Philip. 2 (1923) 254. — *Gleditschia copelandii* Elm., Leafl. Philip. Bot. 2 (1910) 695. — T.: *Elmer 12234* (holotype †, isotypes in BO, L).

Tree, 15 m. *Leaves* 4—6-jugate; leaflets sessile, (ob)ovate-oblong to oblong, 1.8—2 by 0.5—0.8 cm, with a few hairs on the midrib on both sides, glabrescent, apex very deeply emarginate; midrib at 1.5 (at base) to 3 mm (at tip) from the acroscopic margin; nerves 6—9 pairs, barely visible; margin thickened by a vein; petiole *c.* 0.3 cm, rachis 3—3.5 cm, both densely, patently hairy. *Rachis* of inflorescence 2.5—4.5 mm, with hairs. Bracts up to 9 mm long, hairy, glabrescent. Bracteoles 1.5—3.5 mm long, inserted at 0.25 and 1 mm above base of pedicel respectively. Pedicels up to 7 mm, patently densely hairy. Receptacle minute, *c.* 0.25 mm. *Sepals* up to 4 mm long, with a few hairs on the back. *Petals* 4.5 mm long. *Stamens* 10, *c.* 6 mm long, one sterile; connective cleft at base, apex apiculate. *Ovary* laxly long-hairy; stipe 0.5 mm; style up to 4 mm, hairy in the lower half. *Fruit* unknown.

Distribution: Philippines (Sibuyan I.). Only known from the type collection.

Ecology: Forests, 250 m.

Notes. Merrill (1915, l.c.) stated that the species is 'anomalous in *Cynometra* in that the ovules are solitary'. This does not seem a serious obstacle for its accommodation in *Cynometra* since in the Malesian species I found very rarely two ovules in an ovary or two seeds in a pod. In Africa this number seems to vary much more, as Léonard mentioned (1957, p. 56): 'ovules 1—2(—3—4)' for the genus.

It is true that two of the characters are unique within Malesian *Cynometra*, to wit, the greater number of leaflets and the occurrence of one sterile stamen; otherwise, it fits perfectly the general characteristics of other species.

3. Cynometra dongnaiensis Pierre, Fl. For. Cochin. 5 (1899) t. 389; Gagnep., Fl. Gén. I.-C. 2 (1913) 155; Merr., En. Philip. 2 (1923) 254 (*'dongnainsis'*). — Lectotype: *Pierre 352*, ad flumen Be, in praefectura Bienhoa (holotype in P, isotypes in A, BO, E, G, K, L, US).

Tree, 15—20 m. *Leaves* 3-jugate; leaflets (ob)ovate-oblong to oblong, 3.8—5.3 by 1.7—1.9 cm, apex obtuse, obliquely emarginate; midrib at 6—8 mm from the acroscopic margin; nerves 6—9 pairs; petiole 3 mm, rachis 4—4.5 cm, deeply grooved, both laxly pubescent. *Rachis* of inflorescence 2.6—6.5 cm, densely curly hairy. Bracts 2—8 mm long, appressed-hairy. Bracteoles 1.5 (—2.5, *sec.* Pierre) mm, inserted at base of pedicel. Pedicels 3.5—5.5 mm, densely patent-hairy. Receptacle 0.5 mm deep. *Sepals* 3—4 mm long, glabrous. *Petals sec.* Pierre 4.25 mm long. *Stamens:* connective apiculate, cleft at base. *Ovary* densely curly hairy; stipe 0.5—1.5 mm; style 4—5 mm, glabrous. *Pod* unknown.

Distribution: Cochinchina, ? Philippines.

Notes. Undoubtedly related to *C. bourdillonii* but well distinct from that species. See the key.

Pierre 352 is known from two localities, collected on four different dates:

1. Lectotype: ad flumen Be, in praefectura Bienhoa, collected 2—1872 (in A, BO, E, G; K, fl.; L).
2. Ad Noc, in praefectura Baria, collected 6—1866 (in BM, BO, K), 12—1866 (in K), and 1—1868 (in A, BM, BO, E, G, L).

Merrill (1923, l.c.) cited under *C. dongnaiensis* three collections from the Philippines, viz. 'Cebu, Mindanao (Butuan, Davao), *FB 6488 Espinosa, 20563 Miranda, 26244 Ceballos*'. Unfortunately, I have neither seen any duplicates of these numbers in the herbaria con-

Fig. 2. *Cynometra malaccensis* van Meeuwen. a. Habit, × 2/3; b. sectioned flower, × 6; c. pods, × 2/3 (a—c. *Maingay 589*).

sulted, nor other Philippine collections which can be referred to this species, so the record remains questionable.

4. Cynometra malaccensis van Meeuwen, *sp. nov.* — **Fig. 2.**

C. inaequifolia (*non* Asa Gray) Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 267; Prain, J. As. Soc. Beng. 66, ii (1897) 199 ('*inaequalifolia*'); Ridl., Fl. Mal. Pen. 1 (1922) 635; Craib, Fl.

Siam. En. 1 (1928) 540; Burk., Dict. Ec. Prod. Mal. Pen. (1935) 730; Corner, Wayside Trees (1940) 392, f. 127. — T.: *Kochummen CF 94633* (holotype in L, isotype in KEP).

Arbor, 20—40 m alta. *Folia* 2—3-jugata; foliola ovato-oblonga, obovato-oblonga vel oblonga, 4—8.5 cm longa, 1.8—3 cm lata, plerumque acuminata, emarginata; costa 6—15 mm a margine acroscopo remota; nervi 5—7 paria; petiolus 3—8 mm; rhachis 5—6 cm, juvenilis puberulus. *Rhachis* inflorescentiae 2—3 cm, puberulus. Bracteae 2—9 mm longae, tomentosae, interdum glabrescentes. Bracteolae 3—4 mm longae, ad pedicelli basin insertae. Pedicelli 4—8 mm, strigosi ad tomentosi, interdum laxe pilosi. Receptaculum excavatum 1.25—2 mm altum. *Sepala* 3—4 mm longa. *Petala* 2—4 mm longa. *Stamina* 3 mm, ut videtur usque ad 6 mm accrescentia; antherae ± apiculatae, connectivo basi fisso. *Ovarium* sericeum, lanatum vel villosum; stipes 0.8—1.5 mm; stylus 0.5—3 mm, conspicue brevis ac curvatus. *Legumen* orbiculare, planum, leve, 4—5 cm longum, 4 cm latum, 0.4—0.5 cm crassum, marginem versus paullo incrassatum.

Tree, 20—40 m. *Leaves* 2—3-jugate; leaflets (ob)ovate-oblong to oblong, 4—8.5 by 1.8—3 cm, mostly acuminate, emarginate; midrib at 6—15 mm from the acroscopic margin; nerves 5—7 pairs; petiole 3—8 mm, rachis 5—6 cm, puberulous when young. *Rachis* of inflorescence 2—3 cm, puberulous. Bracts 2—9 mm long, tomentose, sometimes glabrescent. Bracteoles 3—4 mm long, inserted at base of pedicel. Pedicels 4—8 mm, strigose to tomentose, sometimes laxly hairy. Receptacle 1.25—2 mm deep. *Sepals* 3—4 mm long. *Petals* 2—4 mm long. *Stamens* 3 mm, finally up to 6 mm; anther ± apiculate, connective cleft at base. *Ovary* sericeous, woolly or villous; stipe 0.8—1.5 mm; style 0.5—3 mm, conspicuously short and curved in the flower, straightened after anthesis. *Pod* orbicular, flat, smooth, 4—5 by 4 by 0.4—0.5 cm, somewhat thickened towards the margin.

Distribution: India (Assam), Peninsular Thailand (Puket), Malay Peninsula (Malacca; Selangor: Gintive Simpah Road; Perak; Pahang).

Ecology: Forests, 50—1300 m.

Notes. Following Baker (l.c.), this species was always misinterpreted as *C. inaequifolia* A. Gray. The latter is, however, a species endemic in the Philippines and related to *C. ramiflora* which belongs to a distinctly different group of species.

C. malaccensis is closely related to the other 3-jugate Indo-Chinese *Cynometras: C. bourdillonii, C. dongnaiensis,* and *C. beddomei.*

Though *C. malaccensis* shows a great resemblance in the fruit and the shape of the leaflets with *C. elmeri,* the latter is at once differentiated by the 1-jugate leaf (see fig. 3).

5. Cynometra bourdillonii Gamble, Kew Bull. (1908) 446; Fl. Pres. Madras 3 (1919) 414. — T.: *Bourdillon 1617* (holotype in ? CAL, *n.v.*, isotype in K).

Tree, up to 18 m. *Leaves* 3-jugate; leaflets obovate-oblong and oblong, sometimes ± spathulate, 2.5—4 by 1—1.5 cm, apex obtuse, obliquely emarginate; midrib at 5—7 mm from the acroscopic margin; nerves 6 pairs, visible beneath but scarcely so above; glabrous except for the proximal part of the midrib above; petiole 3.5—4 mm, rachis 3.5—4 cm, very deeply grooved above, both laxly pubescent. *Rachis* of inflorescence 12—20 mm, densely patent-hairy. Bracts up to 6 mm long, appressed-hairy, ciliate, striate. Bracteoles 3 mm long, both inserted at 2 mm above the base of the pedicel. Pedicels up to 5 mm, pubescent. Receptacle 1—2 mm deep. *Sepals* 3 mm long, hairy, ciliate. *Petals* 3.5 by 1 mm. *Stamens* alternately 5 and 7 mm; connective cleft at base, apex apiculate. *Ovary* densely long brown hairy; stipe 0.8 mm, excentric; style up to 2.5 mm, hairy up to halfway. *Pod* globular, 1.7 by 1.7 by 1.5 cm, grooved near the seams.

Distribution: India (Madras, S. Kanara). Known from only 2 collections.

Notes. Gamble stated to have found 3 and 4 sepals. In the isotype (K) I found just 4 sepals, as is normal in the genus; one of the flowers he investigated was obviously incomplete. Furthermore, Gamble 'frequently' observed black glands on the undersurface of the leaflets. These spots are due to a fungus, as I could observe on the isotype.

See for a comparison between *C. bourdillonii* and *C. beddomei* the note under the latter.

6. Cynometra beddomei Prain, J. As. Soc. Beng. 66, ii (1897) 478; Brandis, Ind. Trees (1906) 255; Gamble, Kew Bull. (1908) 446; Fl. Pres. Madras 3 (1919) 414. — Lectotype: *Beddome 2545*, Wynaad, at Tambacheri Ghat, 2500 ft, in fl. (holotype in ? CAL, *n.v.*, isotype in Z).

A large tree. *Leaves* 2—3-jugate; leaflets (ob)ovate-oblong to oblong, lower leaflets 1.3—3 by 0.7—1.3 cm, upper ones 4.5—7 by 2—3 cm; apex obtuse, very slightly emarginate; midrib at 3—7 mm from acroscopic margin in the lower and at 11 mm in the upper pair of leaflets; nerves in the lower leaflets 5 pairs, in the upper ones 8; leaflets glabrous; petiole 5 mm, rachis 1—3.5 cm, both puberulous. *Rachis* of inflorescence up to 7 mm, hairy. Bracts up to 6 mm, tomentose or glabrous. Bracteoles unknown, their scars visible at 1 and 3 mm above the base of the pedicel. Pedicels 9 to 10 mm, puberulous. *Sepals* 4 mm long, laxly hairy. *Petals* 6 mm long. *Filaments* 9 mm long; anthers unknown. *Ovary* tomentose and with a few long hairs; stipe 1.5 mm; style 4 mm. *Pod* unknown.

Distribution: India (Wynaad, S. Kanara). Known from only 2 collections.

Notes. Gamble (Kew Bull. 1908, 446) is correct in stating that *C. beddomei* is specifically distinct from *C. bourdillonii*. Aside from the differences used in the key, he stated that they also differ in fruit, but did not specify in which way. This is unfortunate since the fruit of *C. beddomei* is unknown to me. The situation became more complicated as one of the two specimens which Prain indicated as the types of *C. beddomei* proved to belong to *C. bourdillonii*. It is a specimen collected by Beddome in S. Kanara and mentioned in his Flora Sylvatica (1873) 316 as probably representing a new species. Baker also mentioned this specimen in Hooker *f.*, Fl. Br. Ind. 2 (1878) 268 but under *C. 'inaequifolia'*.

Furthermore, Prain stated in a note to his description of *C. beddomei* that 'Mr. Beddome sent Dr. King two specimens from the Wynaad, one in flower and one in very young fruit, with the note — *Cynometra n. sp.*; this is mentioned at tab. 316 Fl. Sylvatica —'. The latter statement is surely not true because the specimen Beddome mentioned in Flora Sylvatica tab. 316 was from S. Kanara and not from the Wynaad. The Beddome specimen from Wynaad 'in flower' is the lectotype of *C. beddomei*. The Beddome specimen 'in very young fruit', which is unknown to me, was probably used by Mr Gamble for his comparison between *C. bourdillonii* and *C. beddomei*.

7. Cynometra cauliflora Linné, [Act. Soc. Sc. Upsal. (1741) 382] Sp. Pl. (1753) 382; Gaertn., Fruct. 2 (1791) 350, t. 156; DC., Prod. 2 (1825) 509; W. & A., Prod. (1843) 293; Kostel., Allg. Med. Pharm. Fl. 4 (1835) 1341; Span., Linnaea 15 (1841) 201; Hassk., Pl. Jav. Rar. (1848) 413; Benth. in Miq., Pl. Jungh. (1852) 265; Miq., Fl. Ind. Bat. 1, 1 (1855) 78; Hoola van Nooten, Fl. Fr. Java (1863) t. 21; Kurz, Fl. Burma 1 (1877) 416; Baker in Hook *f.*, Fl. Br. Ind. 2 (1878) 268; Kurz, J. As. Soc. Beng. 45, ii (1876) 289; F.-Vill., Novis. App. (1880) 71; Naves in Blanco, Fl. Filip. ed. 3, 4 (1880) t. 213; Vidal, Sinopsis, Atlas (1883) 24, t. 42 f. F; Prain, J. As. Soc. Beng. 66, ii (1897) 479; Harms, Notizbl. Berl.-Dahl. 3 (1902) 188; Brandis, Ind. Trees (1906) 255; Back., Voorl. Schoolfl. Java (1908) 103; Schoolfl. Java (1911) 423; Koord.-Schum., Syst. Verz. 1, 1 (1912) fam. 128, 21; Koord., Exk. Fl. Java 2 (1912) 363; Merr., Int. Rumph. Herb. Amb. (1917) 253; En. Born. 1921) 295; En. Philip. 2 (1923) 254; Heyne, Nutt. Pl. (1927) 726; Ochse & Bakh., Fruits

& Fruit Cult. Dutch East Ind. (1931) 59, t. 23; Burk., Dict. Ec. Prod. Mal. Pen. (1935) 730; Corner, Wayside Trees (1940) 391; Masamune, En. Phan. Born. (1942) 340; Back. & Bakh. *f.*, Fl. Java 1 (1963) 526. — T.: *Cynomorium* Rumph., Herb. Amb. 1 (1741) t. 62.

C. cauliflora L. *α subsessilis et β elongatis* Hassk., Flora Beibl. (1842) 95; Pl. Jav. Rar. (1848) 413; Miq., Fl. Ind. Bat. 1, 1 (1855) 78. — T.: *herb. Reinwardt s.n.* (holotype in L).

C. acutiflora Vidal, Rev. Pl. Vasc. Filip. (1886) 118. — T.: *Vidal 1278 (n.v.)*.

Tree, 3—15 m. *Leaves* 1-jugate; leaflets (ob)ovate, (ob)ovate-oblong to (ob)ovate-lanceolate, 5.5—16.5 by 1.6—5.6 cm, apex obtuse or slightly acuminate, emarginate; midrib at 5—16 mm from acroscopic margin; nerves 7—10(—14) pairs; petiole 2—8 mm, glabrous, sometimes pubescent; petiolules very short, sometimes pubescent. *Inflorescence* cauliflorous: 4 or 5 small racemes crowded together on hard knots on the trunk; rachis 5—30 mm, glabrous. Bracts 1—10 mm long, ciliate. Bracteoles 1.5 mm, inserted at 1.25—1.5 and 1.5—2 mm respectively above the base of the pedicels. Pedicels 3—6.5 mm, laxly pubescent or glabrous. Receptacle *c.*, 1—2 mm. *Sepals* 4 (rarely 5), 2—4 mm long. *Petals* 3—4 mm long. *Stamens* (8—9—)10, varying in one plant; connective cleft at base, apiculate; filaments seldom with 1—2 hairs. *Ovary* rather densely hairy, with long and short hairs; stipe 0.75 mm; style 5—6 mm, hairy up to halfway. *Pod* fleshy, rugose, 2.7—3 by 1.8—2 by 1 cm, glabrescent.

Distribution: Only known in the cultivated state, possibly a cultigen, according to Burkill probably derived from East Malesia from where it spread since Europeans arrived in the Archipelago, so that Rumphius, writing between 1653 and 1692, said that it was scarcely known in the western islands, except that a few people, with a fancy for it, had carried it from Amboina to Batavia. In Malacca it was in the early part of last century, and it was taken from there to Penang. Now it is also cultivated in India.

Ecology: Forests at low altitude, in gardens.

Uses: The taste of the brownish green, kidney-shaped pods of *namnam*, the only name in the various languages in West Malesia (Javanese, Sundanese, Malay), suggests that of an apple; they can be eaten raw, but are better stewed with sugar (Burkill, l.c.). But there is variation of opinion about this: Heyne (l.c.) finds it tasteless to tart; Ochse (l.c.) says that fully ripe fruits are rather savoury and should be cooked and eaten as compote; they are also used as seasoned additions to food known as '*rudjak*', or pickled. Koorders noted in NE. Celebes two races, one with sweet and one with sour fruit. The single name and the occurrence of sour fruit in East Malesia offer some additional evidence of its eastern origin.

8. Cynometra iripa Kostel., Allg. Med. Pharm. Fl. 4 (1835) 1341. — T.: *Iripa* Rheede, Hort. Malab. 4 (1673) t. 31. — **Fig. 1 d.**

C. ramiflora var. *β* W. & A., Prod. (1834) 293. — *C. ramiflora* var. *mimosoides* Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 267; F.-Vill., Novis. App. (1880) 71; Ridl., J. Str. Br. R. As. Soc. 59 (1911) 99; Fl. Mal. Pen. 1 (1922) 635; Disp. Plants (1930) 284. — *C. ramiflora* ssp. *bijuga* Prain var. *mimosoides* Prain, J. As. Soc. Beng. 66, ii (1897) 198, 478. — *C. mimosoides* Prain, Rec. Bot. Surv. India 2 (1903) 303; Brandis, Ind. Trees (1906) 708; Gamble, Fl. Pres. Madras 3 (1919) 414. — *C. bijuga* var. *mimosoides* Merr., Philip. J. Sc. 5 (1910) Bot. 36; Alston, Handb. Fl. Ceyl. Suppl. (1931) 94; Hosokawa, Trans. Nat. Hist. Soc. Form. 32 (1942) 15; Masamune, En. Phan. Born. (1942) 340. — Lectotype: *Wallich Cat. 5817 A* (holotype in ? CAL, *n.v.*, isotypes in BO, G).

C. ramiflora var. *bijuga* (non Span. ex Miq.) Bth., Fl. Austr. 2 (1864) 296, *quoad specim. austral.*, excl. syn. *C. bijuga* Span.; Bailey, Queensl. Fl. (1900) 46; Domin, Bibl. Bot. 22, Heft 89 (1929) 800.

C. ramiflora (*non* L.) Britt., Ill. Bot. Cook's Voy. 1 (1900) 26, t. 81.

Shrub or tree, 3—8 m. *Leaves* 1—2-jugate, leaflets of lower pair smaller than those of upper pair, the former (ob)ovate to elliptic, 1.5—5.5 by 0.9—3.5 cm, the latter (ob)ovate-oblong to oblong, 2.5—9 by 1—4.5 cm; apex rounded, always emarginate, sometimes mucronate; midrib at 0.4—1.4 cm and 0.8—2.1 cm respectively in lower and upper pair from acroscopic margin; nerves 5—7 pairs; petiole 4 mm, rachis 13 mm, petiolules 1 mm, all short hairy. *Rachis* of inflorescence 3—4 mm, densely pubescent. Bracts 1 mm, very small, hairy, glabrescent. Bracteoles 2 mm, inserted at 0.25 and 2 mm above the base of the pedicel. Pedicels 4—6 mm, patently short-hairy. Receptacle 0.8—1 mm deep. *Sepals* 4—5, 2.5—3.5 mm long, in anthesis reflexed but the distal part curving up again; with rather long hairs. *Petals* very narrow, 2 by 0.3 mm. *Stamens* 3—5 mm; anthers 0.5 mm long, connective cleft at base, ± apiculate. *Ovary* densely, patently long-hairy, inside hairy; stipe 1 mm, inserted not quite in the middle of the receptacle but a little bit higher on the wall; style 3—3.5 mm, glabrous, not in line with the dorsal side of the ovary, but aslant, away from the centre of the flower. *Pod* deeply rugose (fig. 1d), short patent-hairy, the distal part beak-like and pointing aslant.

Distribution: Ceylon, India (Bengal, Sundribuns), Andaman Is., Burma (near Rangoon, Tenasserim), Peninsular Thailand, Malay Peninsula (Kedah, Setul, Kuala Lumpur, Malacca), Java, Philippines (Panay, Tablas, Mindanao), Micronesia, Marianas (Guam), Australia (N. Queensland).

Ecology: Mangrove swamps, littoral scrub; on or near the beach, but also found in the hills up to 500 m.

Notes. For no obvious reason *C. iripa* was considered in the past as a variety of *C. ramiflora*. It is, however, in many respects quite different and is by no means its closest ally. The hairs lining the inside of the ovary (a feature it shares with *C. mirabilis*), the not totally reflexed sepals, and the shape of its pod, are unique characteristics in the genus.

It should be noted that *C. ramiflora* does not occur in Australia; all records were listed under the name *C. ramiflora* L. var. *bijuga* Bth. by Bentham and subsequent authors, and though this name is based on *C. bijuga* Span. from the Lesser Sunda Islands — which is *C. ramiflora* — the Australian material belongs to *C. iripa*. Bentham's description, though not mentioning the more decisive characters, fits *C. iripa* well. Furthermore, he wrote: 'widely spread over E. India and the Archipelago, most frequently with 2 pairs of leaves (recte leaflets!) in Ceylon and the Archipelago, with 1 pair only on the continent of India, but the two can scarcely be distinguished, even as varieties'. This statement agrees with the distribution of *C. ramiflora*, but does not fit that of *C. iripa* which is not widely spread in the Malesian Archipelago. Also, *C. iripa* never has 1-jugate leaves. Bailey (l.c.) of course followed Bentham and added that the habitat of *C. ramiflora* var. *bijuga* is the mangroves of the tropical beach. Domin (l.c.) provided a good survey of Australian literature concerning *C. iripa* (under the name *C. ramiflora* var. *bijuga*).

9. Cynometra glomerulata Gagnep., Bull. Mus. Hist. Nat. Paris 24 (1952) 317. — Lectotype: *J. & M. S. Clemens 3625* (holotype in P, isotypes in K, NY).

Small tree. *Leaves* 2-jugate; leaflets (ob)ovate-oblong to oblong, of lower pair 2.5—3 by 1—1.1 cm, of upper pair 5.5—10 by 2—3.5 cm, apex acuminate-cuspidate, tip obtuse; midrib in lower and upper pair at 3—4 and 8—16 mm from acroscopic margin respectively; nerves 7 and 10 pairs respectively; petiole 2—3 mm, rachis 1—1.5 cm, glabrous. *Racemes* small; rachis 0.5—1 cm, virtually glabrous. Bracts 2.5 by 1.5 mm, ciliate, glabrescent. Bracteoles unknown, their scars at 0.5 and 1 mm above the base of the pedicel. Pedicels 7 mm, laxly pubescent. Receptacle proportionally deep, 1 mm. *Sepals* 4 (? 5), 3 mm long, glabrous. *Petals* 1—2.25 mm long. *Stamens* 8, 5 mm; anthers 0.8 mm long,

connective cleft at base, apiculate. *Ovary* densely long hairy; stipe comparatively long, 1.25 mm; style 3.5 mm, hairy, glabrescent near the top. Young *pod* very rugose, mature pod 4.1 by 3.2 by 2 cm, thin-woody, still wrinkled, but wrinkles rather flattened out compared to those of the young pods. Also unwrinkled immature pods have been found. In all pods the surface is warty.

Distribution: Laos, Annam. Known from 3 collections only.

Ecology: Near river.

Notes. This species is an exception within the genus in having 8 instead of 10 stamens. However, more material will be necessary to establish whether this is an exceptional occurrence within the species or not.

Gagnepain stated that there are 5 sepals; I found only 4 as is the rule in the genus. Besides, according to him the sepals should be emarginate; in the isotype I examined, however, the sepals are not emarginate, but their apex is blunt and rounded as is usual in the genus.

10. Cynometra ramiflora Linné, [Act. Soc. Sc. Upsal. (1741) 79] Sp. Pl. (1753) 382, excl. syn. *Iripa* Rheede; DC., Prod. 2 (1825) 509; Kostel., Allg. Med. Pharm. Fl. 4 (1835) 1341; Miq., Fl. Ind. Bat. 1, 1 (1855) 78; Thw., En. Ceyl. Pl. (1859) 97; Bedd., Fl. Sylv. 2 (1873) 315, t. 315; Kurz, J. As. Soc. Beng. 45, ii (1876) 289; Fl. Burma 1 (1877) 415; Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 267; F.-Vill., Novis. App. (1880) 71; Koord. & Val., Bijdr. Booms. Java 2 (1895) 51; Pierre, Fl. For. Cochin. 5 (1899) t. 389; K. Sch. & Laut., Fl. Deutsch. Schutzgeb. Südsee (1900) 347; Harms, Notizbl. Berl.-Dahl. 3 (1902) 188; Brandis, Ind. Trees (1906) 255; Back., Voorl. Schoolfl. Java (1908) 103; Merr., Philip. J. Sc. 5 (1910) Bot. 37; Back., Schoolfl. Java (1911) 423; Koord.-Schum., Syst. Verz. 1, 1 (1912) fam. 128, 21; Koord., Exk. Fl. Java 2 (1912) 363; Atlas Baumart. Java 1 (1913) t. 18; Merr., Int. Rumph. Herb. Amb. (1917) 254; Ridl., Fl. Mal. Pen. 1 (1922) 635; Merr., En. Philip. 2 (1923) 255; Alston, Handb. Fl. Ceyl. Suppl. (1931) 93; Kaneh., Bot. Mag. Tokyo 45 (1931) 283; Burk., Dict. Ec. Prod. Mal. Pen. (1935) 731; Record, Trop. Woods 81 (1945) 19; Glassm., Bern. P. Bish. Mus. Bull. 209 (1952) 75. — *C. ramiflora* var. α W. & A., Prod. (1834) 293. — *C. ramiflora* ssp. *genuina* Prain, J. As. Soc. Beng. 66, ii (1897) 198, 478; Ridl., Disp. Plants (1930) 284. — T.: *Cynomorium sylvestre* Rumph., Herb. Amb. 1 (1741) t. 63. — **Fig. 1 c.**

C. polyandra (*non* Roxb.) Miq., Anal. Bot. Ind. 1 (1850) 11.

C. bijuga Span. [Linnaea 15 (1841) 201, *nom. nud.*] *ex* Miq., Fl. Ind. Bat. 1, 1 (1855) 78; Kurz, J. As. Soc. Beng. 45, ii (1876) 129, 289; Merr., En. Born. (1921) 295; En. Philip. 2 (1923) 254; Craib, Fl. Siam. En. 1 (1928) 539; Masamune, En. Phan. Born. (1942) 340; Hosokawa, Trans. Nat. Hist. Soc. Form. 32 (1942) 14; Glassm., Bern. P. Bish. Mus. Bull. 209 (1952) 75. — *C. ramiflora* var. *bijuga* Bth., Fl. Austr. 2 (1864) 296, *pro nomen.* — *C. ramiflora* ssp. *bijuga* Prain, J. As. Soc. Beng. 66, ii (1897) 198, 478, *p.p.*; Back. & Bakh. *f.*, Fl. Java 1 (1963) 526. — T.: an unpublished drawing no 6 of Spanoghe (in L).

C. ramiflora var. *heterophylla* Thw., En. Ceyl. Pl. (1859) 97; Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 267. — *C. ramiflora* ssp. *bijuga* var. *heterophylla* Prain, J. As. Soc. Beng. 66, ii (1897) 198, 478. — T.: *Gardner s.n.*, Ceylon, Trincomalee, Caltuna Dist. (holotype in PDA ?, *n.v.*).

Trachylobium verrucosum (*non* Gaertn.) Engl., Bot. Jahrb. 7 (1886) 457.

C. schumanniana Harms, Notizbl. Berl.-Dahl. 3 (1902) 186; in K. Sch. & Laut., Nachtr. Fl. Deutsch. Schutzgeb. Südsee (1905) 275. — T.: *Hollrung 736* (holotype †, isotypes in BO, L).

C. whitfordii Elm., Leafl. Philip. Bot. 8 (1915) 2734. — T.: *Elmer 13465* (holotype †,

isotypes in A, BO, E, G, GH, K, L, US, Z, the isotype in NY is wrongly numbered *13645*).

C. carolinensis Kaneh., Bot. Mag. Tokyo 46 (1932) 455; Fl. Micron. (1933) 133, f. 45; En. Micron. Pl. (1935) 330. — T.: *Kanehira 510* (holotype in ?, *n.v.*, isotype in NY).

C. carolinensis var. *glabrescens* Kaneh., En. Micron. Pl. (1935) 330, *nom. nud.* — T.: *Kanehira 1915* (holotype in TAI).

C. hosinoi Kaneh., En. Micron. Pl. (1935) 330. — T.: *Kanehira 2140* (holotype in TAI, isotype in US).

C. neo-caledonica Guillaumin, Bull. Soc. Bot. Fr. 83 (1936) 307; Fl. Anal. Nouv. Caléd. (1948) 156. — Lectotype: *Balansa 3662* (holotype in P, isotypes in A, L).

Tree, 4—26 m. *Leaves* 1- or 1- and 2-jugate, more seldom 2-jugate only; if 2-jugate, leaflets of lower pair usually smaller than those of upper pair, but sometimes both pairs equal, those of the lower pair 1.2—6.5 by 0.5—3.5 cm, (ob)ovate, elliptic, orbicular, (ob)ovate-oblong, or oblong, those of upper pair 4.5—20 by 2.5—7 cm, (ob)ovate-oblong to oblong, (ob)ovate-lanceolate or lanceolate; apex of lower leaflets acute, of upper leaflets acute but more often acuminate (tip can be emarginate); margin flat; midrib at 2.5—13 mm from acroscopic margin in lower pair, at 13—30 mm in upper pair; nerves 4—7 and 8—16 pairs respectively; petiole 3—15 mm, rachis 15—40 mm, both sometimes patent-hairy and then sometimes glabrescent, usually glabrous; petiolules indistinct. *Rachis* of inflorescence 13—25 mm, densely hairy and glabrescent, or glabrous. Bracts 1—11 mm long, appressed-hairy, usually glabrescent, sometimes glabrous. Bracteoles 3—4 mm long, inserted at or near the base of the pedicel. Pedicels 7—15 mm, densely patent-hairy or pubescent, sometimes glabrescent, or glabrous. Receptacle *c.* 1—1.25 mm deep. *Sepals* 4—6 mm long, usually with a few hairs near the tip, sometimes haired all over, sometimes glabrous. *Petals* 5—8 mm long, lanceolate, sometimes with a small mucro. *Stamens* 10 (once 11, once 13, once 15); anthers comparatively small, orbicular, 0.8—1 mm long, connective cleft at base, not or very slightly apiculate. *Ovary* densely, often curly hairy; stipe 1 mm, inserted a little off the centre of the receptacle; style 4—5.5 mm, with a few hairs up to halfway. Ovules sometimes 2. *Pod* ovate or elliptic, the tip pointing up (fig. 1 c), thick-woody, deeply rugose, short patent-hairy, glabrescent, 2.2—5 by 1.3—4 by 0.8—1.5 cm.

Distribution: From India throughout SE. Asia and Malesia to the Pacific, not in Australia (see note under *C. iripa*).

Ecology: Characteristic constituent of the back-mangrove forest. Its dispersal is by way of its easily floating pod. The layers of fiber in the pericarp, radiating from its centre, contain numerous little air pockets. Also found inland, up to 400 m.

Uses: According to Heyne (Nutt. Pl. 1927, 726) the dark brown timber is heavy and hard but not very durable and only available in small quantity.

Notes. The species is rather variable, and this variability caused some confusion in the past, especially with *C. iripa*. Most of the synonyms were based on differences in the number and size of leaflets, characters of minor importance and, moreover, never consistent. *C. iripa* was included in *C. ramiflora* with the varietal epithet '*mimosoides*' in various combinations. It is, however, entirely different from *C. ramiflora*; the only character they share is a deeply rugose pod, but even the shape of the pod is different.

Australian specimens ascribed to *C. ramiflora* as var. *bijuga* all belong to *C. iripa*.

Kanehira based two new species and a variety on specimens from the Caroline Is. It is true that the size of the leaflets is, on the average, in the Carolines somewhat smaller than in Indo-Malesia, viz. 4.5—11 by 1.8—4.5 cm and 8—20 by 3.2—7 cm, respectively. Furthermore, specimens from the Caroline Is. tend to be more hairy than

those from elsewhere. However, none of these tendencies justifies the distinction of a species restricted to the Carolines.

Harms based *C. schumanniana* on differences in the number of flowers in the raceme and in the length of the petiole. In these respects the type specimen falls well within the range of variation. The same holds for *C. neo-caledonica* Guillaumin.

It is possible that *C. brachymischa* Harms, described from New Guinea, must be referred to *C. ramiflora*. See under Doubtful species.

10a. var. **bifoliolata** (Merr.) van Meeuwen, *comb. nov.* — *C. bifoliolata* Merr., Philip. J. Sc. 12 (1917) Bot. 272; En. Philip. 2 (1923) 254. — T.: *Barros FB 24211* (holotype †, isotypes in K, US).

Petiolules distinct, 5—8 mm.

Distribution: Philippines (Luzon: Cagayan Prov.; Mindanao: Agusan and Davao Prov.). Three collections seen.

Ecology: On river banks, at low altitude.

11. Cynometra mirabilis van Meeuwen, *sp. nov.* — T.: *Miranda FB 20528* (holotype in L, isotypes in BO, UC, US). — **Fig. 1 b.**

Arbor glabra, 10—20 m alta. *Folia* 1—2-jugata, paria sub-aequalia; foliola ovata, ovato-oblonga, obovata, obovato-oblonga ad elliptica vel oblonga, 6.5—10 cm longa, 3—5 cm lata, apice acuminata, interdum paullo emarginata; costa 1.1—2 cm a margine acroscopo remota; nervi 6—7 paria; petiolus 0.5—1 cm; rhachis (si 2-pinnata) 4.5—7 cm. *Rhachis* inflorescentiae 10 mm, glaber vel pilis paucis munitus. Bracteae 1—11 mm longae, glabrescentes. Bracteolae parvae, angustae, 1—4 mm longae, plerumque ad pedicelli basin insertae, interdum una eorum ad dimidiam insidens. Pedicelli 18—26 mm (in alabastro multo breviores), glabrescentes. Receptaculum excavatum, 1—1.5 mm altum. *Sepala* 5—6 mm longa, glabra. *Petala* 7 mm longa. *Stamina* interdum pilis paucis munita; connectivum basi non fissum, apiculatum. *Ovarium* toto lanatum vel pilis paucis solum munitum; ovarii paries intus pilis appressis crispis lineatus; stipes c. 1 mm, per totam longitudinem ad parietum lateralem receptaculi adnatus; stylus c. 5.5 mm, glaber vel apice excepto pilosus. *Legumen* immaturum mihi solum notum, planum, laeve, 3 × 1.7 × 0.2 cm.

Glabrous tree, 10—20 m. *Leaves* 1—2-jugate, upper and lower pair largely of the same size; leaflets (ob)ovate, (ob)ovate-oblong to elliptic or oblong, 6.5—10 by 3—5 cm, apex acuminate, sometimes slightly emarginate; midrib at 1.1—2 cm from acroscopic margin; nerves 6—7 pairs; petiole 0.5—1 cm, rachis (if 2-pinnate) 4.5—7 cm. *Rachis* of inflorescence 10 mm, glabrous or with a few hairs. Bracts 1—11 mm, glabrescent. Bracteoles small, narrow, 1—4 mm, usually both at base of pedicel, sometimes one halfway. Pedicels 18—26 mm (in bud much shorter!), glabrescent. Receptacle 1—1.5 mm deep. *Sepals* 5—6 mm long, glabrous. *Petals* 7 mm long. *Stamens* occasionally with a few hairs; connective not cleft at base, apiculate. *Ovary* woolly hairy or only with a few hairs; ovary wall inside lined with curly appressed hairs; stipe *c.* 1 mm, over its entire length on one side laterally merged with the wall of the receptacle (fig. 1b); style *c.* 5.5 mm, glabrous or hairy except near the tip. *Pod* only known immature, then flat, smooth, 3 by 1.7 by 0,2 cm.

Distribution: Philippines (Mindanao: Butuan, Surigao Prov.; Sulu Is.: Tawitawi), N. Borneo (Bettotan, Sandakan, Kinabatangan R., Banggi I.).

Ecology: Near the seashore or along rivers, 0—150 m.

Note. Miranda FB 20528 (type) and *Rafael & Ponce FB 20504* were both identified and cited by Merrill (En. Philip. 2, 1923, 254) as *C. bijuga* var. *mimosoides* (Baker) Merr., which

is *C. iripa* Kostel. *C. mirabilis* shares a few characters with *C. iripa*, among others the lining of the inside of the ovary wall with hairs, but otherwise they are quite different.

12. Cynometra insularis A. C. Smith, Sargentia 1 (1942) 38; J. Arn. Arb. 31 (1950) 166. — T.: *Degener 15491* (holotype in A, isotypes in L, MICH, NY, US).

Tree, up to 25 m. *Leaves* 2-jugate; leaflets ovate, elliptic, or ovate-oblong to oblong, in the narrow half of the leaflet greatest width near the apex, in the broader half greatest width near the base or halfway, rarely obovate, 5—16 by 2.3—7 cm, apex obtuse (tip emarginate); midrib at 7—23 mm from the acroscopic margin; nerves 6—9 pairs, scarcely visible because of the thick leaf-texture, glabrous; petiole 11—23 mm, glabrous. *Rachis* of inflorescence 7—20 mm, densely long-hairy, sometimes glabrescent. Bracts 7—9 mm long, long-hairy, especially densely so on the median part, ciliate. Bracteoles 3—4 mm long, inserted at the base of the pedicel. Pedicels 8—10 mm, patently long-hairy, sometimes slightly glabrescent. Receptacle 0.8—1 mm deep. *Sepals* 4(—5, once noted), 4 mm long. *Petals* 9 mm. *Stamens* 10—12 mm; filaments glabrous or with a few hairs; anthers 1.5 mm long, connective cleft at base, apiculate. *Ovary* densely pubescent and with scattered long hairs; stipe 0.5—1 mm; style 5—6 mm, glabrous. *Pod* 4—5 by 3—3.5 by 2—2.5 cm, sometimes slightly knobbly, surface rough.

Distribution: Fiji (Viti Levu, Vanua Levu, Taveuni).

Ecology: In forests, 50—500 m.

Note. Distinctly allied with C. falcata but not conspecific.

13. Cynometra inaequifolia A. Gray, Bot., in Wilkes, U.S. Expl. Exped. 1 (1854) 473; F.-Vill., Novis. App. (1880) 71; Vidal, Rev. Pl. Vasc. Filip. (1886) 118; Merr., Philip. J. Sc. 1 (1906) Suppl. 63; ibid. 5 (1910) Bot. 36; Sp. Blanc. (1918) 169; En. Philip. 2 (1923) 254. — T.: *Wilkes, U.S. Expl. Exped.*, Luzon, Los Baños (holotype not located in GH and US; paratype *Cuming 1297* seen in BM, K). — **Fig. 1 a.**

Schotia speciosa (*non* Jacq.) Blanco, Fl. Filip. (1837) 356; ibid. ed. 2 (1845) 251; ibid. ed. 3, 2 (1878) 100.

Tree, up to 20 m. *Leaves* 2-jugate; lower pair of leaflets much smaller than the upper ones, the lower pair being (ob)ovate or elliptic, 4—8.5 by 1.8—5 cm, the upper pair (ob)ovate-oblong or oblong, 11—20 by 4—8 cm, all coriaceous, margin slightly recurved, glabrous; apex obtuse, tip sometimes emarginate; midrib in the smaller leaflets at 7—9 mm, in the larger ones at 8—30 mm from acroscopic margin; nerves 6 and 9—10 pairs respectively; petiole 6—15 mm, rachis 2.5—5.5 cm. *Rachis* of inflorescence 10—12 mm, densely pubescent. Bracts 4—5 mm, very densely hairy. Bracteoles 1.5—2 mm, inserted at 0.2—0.25 and 0.75 mm on the pedicel. Pedicels 10—17 mm, pubescent. Receptacle *c.* 1—1.5 mm deep, the stipe centrally attached (fig. 1 a). *Sepals* 4 mm long, laxly pubescent. *Petals* 4 mm long. *Stamens* 6—7 mm; anthers 0.8 mm long, connective cleft at base, very inconspicuously apiculate. *Ovary* densely pubescent and with scattered longer hairs; stipe 1.5 mm; style 4 mm, with a few hairs. *Pod* flat, 4—4.5 by 2—2.5 by 0.7 cm, with a rough surface, but not rugose.

Distribution: Philippines (Luzon, Panay, Negros).

Ecology: Forests at low and medium altitudes.

Notes. This species is closely allied to *C. ramiflora* L. but easily separated from it, as can be observed from the key.

It is endemic in the Philippines. However, since 1878 this species has been erroneously reported to occur in the SE. Malay Peninsula. This was caused by a wrong identification made by Baker (in Hook. *f.*, Fl. Br. Ind. 2, 1878, 267), an error perpetuated until the

present revision. The specimens to which Baker referred are in this revision distinguished as a new species, *C. malaccensis*. This is not closely related to *C. inaequifolia*.

Hosokawa (Trans. Nat. Hist. Soc. Form. 32, 1942, 16) stated that *C. inaequifolia* occurred in the Carolines. His specimens belong to the variable *C. ramiflora*, though it has a slightly smooth pod. This is, however, the only character that points towards *C. inaequifolia*; the leaf texture, etc., are just the same as in *C. ramiflora*.

Ridley (Kew Bull. 1938, 279) erroneously recorded *C. inaequifolia* from Borneo by reducing *C. elmeri* to it.

14. Cynometra minutiflora F. v. M., Austr. J. Pharm. (April 1886) 123. — T.: *Chalmers s.n.*, SE. New Guinea (holotype in MEL).

Tree or shrub, 3 m. Branchlets thin. *Leaves* 2-jugate; leaflets of lower pair smaller than those of upper pair, the former 1.8—2 by 0.7—0.9 cm, the latter 3.5—4.5 by 1.1—1.9 cm, (ob)ovate-oblong or oblong, acumen acute or spathulate, at the tip broad-emarginate, and mucronate; midrib in the small leaflets at 3—4 mm, in the larger ones at 7 mm from the acroscopic margin; nerves 5 and 7 pairs respectively; petiole 2 mm, rachis 12 mm, both short patent-hairy. *Rachis* of inflorescence 2—3 mm. Bracts minute, almost ovate, glabrous (*sec.* F. v. M.). Bracteoles unknown, but their scars visible just above the base of the pedicels. Pedicels 2 mm, short-pubescent. Receptacle minute. *Sepals* exact number unknown, 2 by 1.5 mm, with a few hairs. *Petals* unknown. *Stamens* 10, 2—4 mm; anthers 0.5 mm, connective cleft at base, hardly apiculate. *Ovary* very shortly stipitate, glabrous or with 1 or 2 hairs; style 2 mm, glabrous. *Pod* small, 8 by 7 by 4 mm, rough and somewhat knobbly, on a 2 mm long stipe.

Distribution: New Guinea. Three collections.

Ecology: Forests, 300—600 m.

Note. This very rare species is only known to me from the type sheet and two other specimens. The absence of the petals is probably due to the advanced state of anthesis of the flowers. It is the most delicate representative of the genus in the Old World.

15. Cynometra falcata A. Gray, Bot., in Wilkes, U.S. Expl. Exped. 1 (1854) 472; Seem., Fl. Vit. (1865) 71; Horne, A Year in Fiji (1880) 260; A. C. Smith, Sargentia 1 (1942) 38; J. Arn. Arb. 31 (1950) 165. — T.: *Wilkes, U.S. Expl. Exped.*, Mba, Viti Levu (holotype in US).

Tree, 4 m. *Leaves* 1-jugate; leaflets falcate-ovate-oblong, 6—8 by 2—3cm; obtuse, base acute or cuneate; midrib curved, at 8—12 mm from the acroscopic margin: nerves *c.* 8 pairs, hardly visible; leaf texture not particularly thick; petiole 3 mm, petiolules 1—2 mm, both glabrous. *Inflorescence* small; rachis 4—5 mm, short-puberulous. Bracts 3 mm long, puberulous. Bracteoles unknown, narrow scars near the base of the pedicel. Pedicels 4—5 mm, puberulous. *Sepals, petals, stamens* etc. unknown. From the scars of the stamens one can deduce that there are not more than 10. *Ovary* patently short-hairy, sessile; style 1.5 mm, glabrescent near the tip.

Distribution: Fiji (Viti Levu: Mba; Vanua Levu: Mathuata). Known from three collections only.

Note. Known only from the type and from sterile collections made by Horne, in 1877—1878, and by A. C. Smith in 1947. It is allied to, but well distinct from *C. insularis*, the only other *Cynometra* of Fiji.

16. Cynometra craibii Gagnep., Not. Syst. 2 (1912) 235; Fl. Gén. I.-C. 2 (1913) 151; Craib, Fl. Siam. En. 1 (1928) 539. — T.: *Harmand 36* (holotype in P, *n.v.*, isotypes in BO, E, K).

Tree, 20—25 m. *Leaves* 1-jugate; leaflets (ob)ovate-oblong or oblong to falciform, 4.5—6.5 by 1.7—3 cm, apex acute and cuspidate-acuminate; midrib at 5—9 mm from the acroscopic margin; nerves 5—9 pairs; petiole 5—6 mm, pubescent or glabrous. *Racemes* 1 (rarely 2, twice observed) in a leaf-axil; rachis 1—4 mm, glabrous. Bracts broader than long, 1.5 by 2 mm, ciliate. Bracteoles 1 mm long, glabrous, one inserted at 1 mm above the base of the pedicel, the other at its base. Pedicels 3 mm, glabrous. Receptacle *c.* 1 mm. *Sepals* 2.5 mm long, glabrous. *Petals* 2.5 mm long. *Stamens* 2—2.5 mm long; anthers 0.8 mm long, connective cleft at base, apiculate. *Ovary* glabrous; stipe 0.25 mm; style unknown. *Pod* 5 by 3.2 by 0.2 cm, pericarp paperthin (once observed in a sterile pod).

Distribution: Thailand, Laos. Three collections seen.

Notes. Kerr 8417 and *8417A* have flowers which are thickened and distorted by gall insects.

Gagnepain stated that this species is related to *C. travancorica* but differs from it by, amongst other things, its glabrous ovary. *C. travancorica*, however, also has a glabrous ovary. As far as can be concluded from the scant material, the major difference between the two species lies in the structure and appearance of the pod.

17. Cynometra novoguineensis Merr. & Perry, J. Arn. Arb. 23 (1942) 397. — T.: *bb 25712* (holotype in A, isotypes in BO, L).

Tree, 19 m. *Leaves* 1-jugate; leaflets (ob)ovate-oblong or oblong, sometimes lanceolate, ± falcate, 4—7 by 1—3 cm; leaflets not very asymmetric; midrib at 1—1.4 cm from the acroscopic margin; leaflets glabrous, very inconspicuously veined, apex acuminate, tip emarginate; petiole 4—6 mm. *Rachis* of inflorescence less than 4 mm, with very few flowers. Bracts 1 mm. Bracteoles unknown. Pedicel 4—5 mm, glabrous. Receptacle minute. *Sepals* 5, 2 mm long. *Petals* 1 mm long. *Stamens* 2 mm long; connective cleft, ± apiculate. *Ovary* glabrous or laxly hairy at the top; style 2 mm; stipe very short; once found with a few hairs lining the ovary cavity. *Pod* unknown.

Distribution: New Guinea (Hollandia, Bernhard Camp). Known from the type collection which is in flower and an additional sterile collection (*bb 25713*).

Ecology: Swampy locality at 50 m.

Note. See the discussion concerning its relationship with *C. travancorica*, *C. warburgii*, and *C. elmeri* under the latter species.

18. Cynometra warburgii Harms, Notizbl. Berl.-Dahl. 3 (1902) 187; Merr., En Philip. 2 (1923) 255. — Lectotype: *Warburg 12427* (holotype in B †, no isotypes seen).

Tree, 10 m. *Leaves* 1-jugate; leaflets (ob)ovate-oblong, oblong, or lanceolate, 3.2—6.5 by 0.8—2.7 cm, glabrous; apex obtuse (tip not emarginate); midrib at 3—11 mm from the acroscopic margin; nerves 7 pairs; petiole 2—4 mm. *Rachis* of inflorescence 5—6 mm, glabrous. Bracts 3 by 2 mm, glabrous on the back, ciliate. Bracteoles unknown, their scars visible on the pedicel just above its base. Pedicels 3—4 mm, glabrous. Receptacle minute. *Sepals* 3.5 mm long. *Petals* 4.5 mm long. *Stamens* 5—6 mm long; anthers 0.8 mm, connective cleft at base, not apiculate. *Ovary* glabrous, obliquely inserted in the receptacle; stipe 0.8 mm; style 3.5 mm. *Pod* unknown.

Distribution: Philippines (Luzon: Prov. of Ilocos Norte). Known from 2 collections only, apart from the type.

Ecology: In forests chiefly near streams, at low and medium altitudes.

Note. See the discussion of the relationship with the species *C. travancorica*, *C. novoguineensis*, and *C. elmeri* under the latter species.

19. Cynometra travancorica Beddome, Fl. Sylv. 2 (1873) 316, t. 316; Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 267; Brandis, Ind. Trees (1906) 255; Gamble, Fl. Pres. Madras 3 (1919) 413. — Lectotype: *Beddome 2542*, Tinnevelly Ghats (holotype in CAL, *n.v.*, isotype in BM).

Tall tree. *Leaves* 1-jugate; leaflets often falciform, (ob)ovate-oblong, oblong, or (ob-) lanceolate, 3.5—8.5 by 1—2.8 cm; apex acute to ± acuminate, tip obtuse or emarginate; midrib at 8—11 mm from the acroscopic margin; nerves 6—8 pairs; leaflets glabrous, concolorous, lower surface reticulate-veined; petiole 4—6 mm. *Rachis* of inflorescence up to 6 mm, ± puberulous. Bracts 1—3 mm, puberulous and ciliate. Bracteoles 2 mm long, very narrow (0.2 mm), with only a few hairs at the tip, inserted near the base of the pedicel. Pedicels 2—4.5 mm, glabrous. Receptacle 0.25 mm deep. *Sepals* 4 (5 mentioned by Beddome), 3 mm long, glabrous. *Petals* 4 mm long. *Stamens:* anthers 0.8 mm long, connective cleft at base, very slightly apiculate. *Ovary* glabrous; stipe 0.8 mm; style 1 mm. *Pod* flat (also when mature and fertile ?), 2—2.2 by 1.1 by 0.1—0.2 cm, the inner suture nearly straight, the outer one widely curved; edges ± thickened.

Distribution: India (W. Ghats, S. Travancore, Tinnevelly, Tambacheri Ghats, Wynaad; largely according to literature).

Ecology: At 700—1000 m.

Notes. The sheet of *Beddome 302* from Travancore has a few leaves with one or two supernumerary minute leaflets on the petiole; these are *c.* 2—4 mm long, are not always present, early caducous, and hardly seem to account for another pair of leaflets as they are attached at different height. The petiole does not show any difference in texture at the height of their insertion as it should do if they were 'real' leaflets, because in all other species there is an abrupt transition from petiole to rachis at the insertion of the first pair of leaflets.

The species is closely related to *C. elmeri*. See note under that species.

20. Cynometra elmeri Merr., Pl. Elm. Born. (1929) 98. — T.: *Elmer 21386*, N. Borneo, Tawao (Merrill published incorrectly the number as *21368*). — **Fig. 3.**

C. inaequifolia (*non* A. Gray) Ridl., Kew Bull. (1938) 279; Masamune, En. Phan. Born. (1942) 340 ('*ianaequalifolia*').

Tall tree, 10—25 m. *Leaves* 1-jugate; leaflets (ob)ovate-oblong or oblong, ± falcate, 3.5—15 by 1.3—4 cm, apex acuminate, tip blunt and emarginate; midrib at 6—12 mm from the acroscopic margin; nerves 5—7 pairs, slender; petiole 4—8 mm. *Infructescence:* rachis 4.5 cm, thick and lignified. No scars of bracteoles visible. Pedicels (in fruit) 10 mm. *Pod* pendulous, flat, but along the sutures slightly thickened, inner suture ± straight, outer suture widely curved, with a small beak on the inner suture side of the apex, 4—6 by 2.5—3.5 by 0.7 cm, surface rough.

Distribution: North Borneo, Philippines (Luzon, Rizal Prov., one collection).

Ecology: Forest near mangrove swamps, 50—300 m.

Notes. C. elmeri belongs to a group of three Malesian and one Indian species which would at a first glance be supposed to be conspecific. They are *C. travancorica* from the Deccan, *C. elmeri* from North Borneo, *C. warburgii* from the Philippines, and *C. novo-guineensis* from New Guinea. They are all the more suspect by occupying separate ranges, by being rare, and by being inadequately known. More material may lead to a future emendation of the present conclusion.

C. travancorica is only known from four collections, one in flower and three with immature (?) fruit (possibly with aborted or non-developed ovules).

C. elmeri is only known from fruiting material which is quite abundantly available.

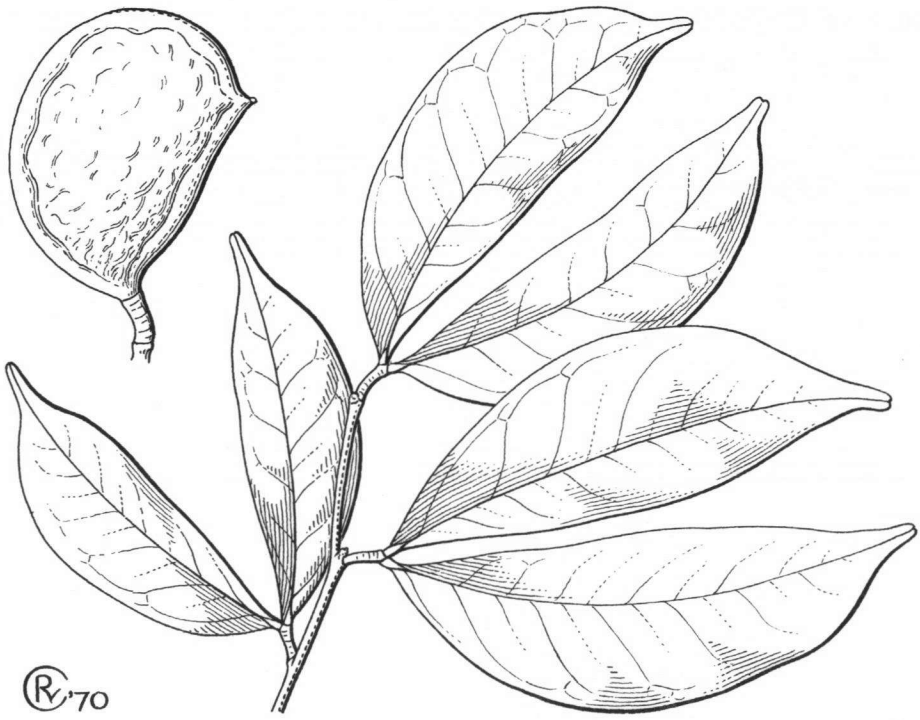

Fig. 3. *Cynometra elmeri* Merr., leaves and pod, nat. size (*Wood SAN A 4137*)

C. warburgii, of which the type is lost, I know from two additional collections, one in flower and one sterile, which I believe to have correctly identified.

C. novoguineensis is known only from the rather poor type (*bb 25712*), which is only in flower, and from the sterile collection *bb 25713*.

The keeping apart of these four species needs some comment.

A slight character of distinction is found in the tip of the leaflets: in *C. travancorica* it is acute-acuminate, in *C. elmeri* and *C. novoguineensis* it is acuminate, and in *C. warburgii* it is obtuse.

The connective of the anthers is unfortunately only known in *C. travancorica* and *C. warburgii*; in the former it is apiculate, in the latter it is not. I found this a constant character in other species and hence it may be so in this case.

The length of the style does not show much variation within the species. This does not go parallel with the size of the sepals and petals which also do not show much variation within a species. The respective sizes of these three flower parts are for *C. travancorica*, *C. warburgii*, and *C. novoguineensis*: style length 1, 3.5, and 2 mm; sepal length 3, 3.5, and 2 mm; petal length 4, 4.5, and 1 mm. Through these different ratios, somewhat different types of flowers are shown by these three species.

A single interesting character of *C. warburgii* is that the stipe of its ovary is attached obliquely to the wall of the receptacle. In *C. travancorica* and *C. novoguineensis* the stipe is inserted centrally at the bottom of the receptacle. However, in *C. ramiflora* the place of attachment may vary, whereas in *C. mirabilis* it is perfectly constant. From this follows

that stipe insertion is not always constant in all species and I have refrained from using it in the key, leaving it for future checking.

A similar statement must be made about the size, shape, and surface of the pod. This is unknown in *C. warburgii* and *C. novoguineensis*. One sterile or immature pod is known of *C. travancorica*. Of *C. elmeri* I had abundant mature pods on hand. Their shape is similar to that in *C. travancorica*, only differing slightly in degree of lignification, size, and colour. But it is hard to tell the stage of maturity of the pod of *C. travancorica* and what further changes it may undergo before reaching full maturity.

DOUBTFUL SPECIES

Cynometra brachymischa Harms, Bot. Jahrb. 55 (1917) 46. — T.: *Schlechter 19772* (holotype in B †).

Branches slender, glabrous. *Leaves* 1-jugate, 4—6 mm petioled; leaflets inequilateral, obliquely lanceolate to oblong-lanceolate, at base obliquely obtuse (basiscopically rounded), at apex long-acuminate, glabrous, 14—25 by 4—7 cm. *Racemes* very short (*'büschelformig'*), sessile, pauci- to multiflorous. Bracts broad, obtuse, scarious, striate. Pedicels very short. Receptacle short, hairy. *Sepals* 4, hairy, 5—6 mm long, 'probably partly connate in an infundibuliform tube'. *Petals* 5, lanceolate, unguiculate, acute, membranous, not exserted. *Stamens* 10, with glabrous filiform filaments. *Ovary* small, sessile, hirsute; style elongate, filiform, basally puberulous; stigma minute, not capitellate. (Translated from the Latin type description).

Distribution: East New Guinea (Waria R. area, Herkules R.: Govidjoa).

Ecology: Mountain forest, 1300 m. Fl. June.

Notes. Harms remarked that though his material was scanty he dared to describe it, finding it distinct by the '1-jugate, very short-petioled leaves, large leaflets, and short, fascicle-like racemes'. He was not certain about the partial connation of the sepals.

Unfortunately many details have not been mentioned in the description.

The only species with which I can compare it from the description is *C. ramiflora*, the leaflets of which are also sometimes long-acuminate. But the mountain locality seems to exclude this identity. Basally connate sepals are not known from any *Cynometra*; admittedly Harms himself doubted this observation, obviously made on immature flowers. Or did he confuse this connate part with the receptacular tube? Topotype material must solve the problem.

EXCLUDED SPECIES

Cynometra densiflora Elm., Leafl. Philip. Bot. 1 (1907) 222 = **Erythrophloeum densiflorum** (Elm.) Merr. & Rolfe, Philip. J. Sc. 4 (1909) Bot. 267.

Cynometra pinnata Lour., Fl. Cochin. (1790) 268; ed. Willd. (1793) 329; DC., Prod. 2 (1825) 509; Mém. Lég. (1825) 458; Gagnep., Fl. Gén. I.-C. 2 (1913) 155 = **Ormosia pinnata** (Lour.) Merr., Lingn. Sc. J. 14 (1935) 12.

2. MANILTOA

Scheff., Ann. Jard. Bot. Btzg 1 (1876) 20; Boerl., Handl. Fl. Ned. Ind. 1, 2 (1890) 337, 407, 678, 680; Harms in E. & P., Nat. Pfl. Fam. Nachtr. 1 (1897) 193; Notizbl. Berl.-Dahl. 3 (1902) 189; Bot. Jahrb. 55 (1917) 47; Funke, Ann. Jard. Bot. Btzg 40 (1929) 45, t. 11, t. 13, f. 5; White, Proc. R. Soc. Queensl. 57 (1946) 23; A. C. Smith, J. Arn. Arb. 31 (1950) 166; Hutch., Gen. Flow. Pl. 1 (1964) 244. — *Cynometra* sect. *Maniltoa* Taubert in E. & P. Nat. Pfl. Fam. 3, 3 (1892) 129. — *Maniltoa* sect. *Eumaniltoa* Harms, series *Paucijugae* Harms,

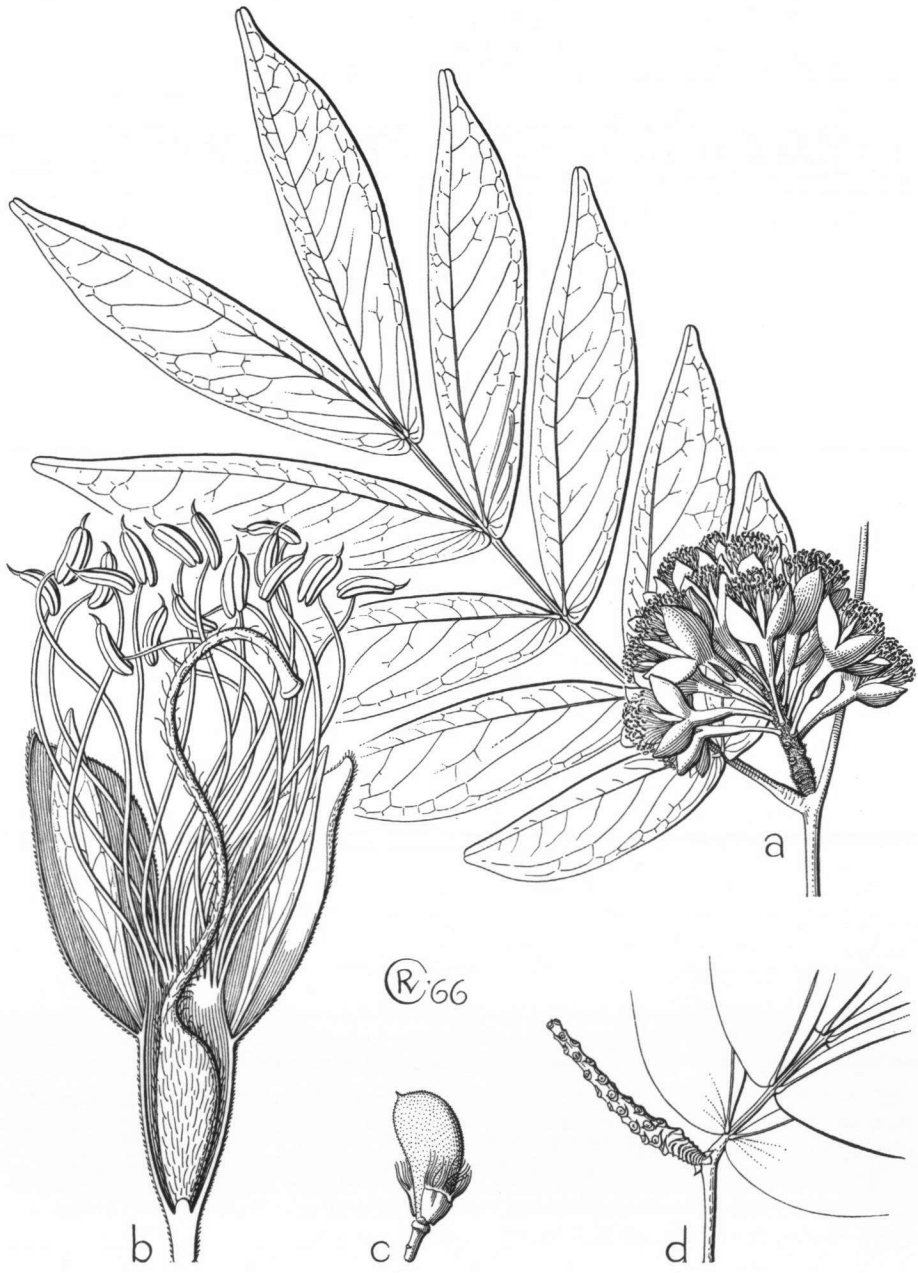

Fig. 4. *Maniltoa.* — a. *M. rosea* (K. Sch.) van Meeuwen, habit, × 2/3. — b. *M. mariettae* van Meeuwen, sectioned flower, × 4. — c. *M. brassii* Merr. & Perry, young pod, × 2/3; d. flower rachis, × 2/3 (a. *C. T. White 10301*, b. *C. T. White, Dadswell & L.S. Smith 1661*, c & d. *Brass 3780*).

series *Plurijugae* Harms, sect. *Polyandrosiphon* Harms, Bot. Jahrb. 55 (1917) 48—49. — Type species: *M. schefferi* K. Sch. — **Fig. 4—6.**

Cynometra sect. *Pseudocynometra* W. & A., Prod. (1834) 294; Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 268; Taubert in E. & P., Nat. Pfl. Fam. 3, 3 (1892) 129. — *Pseudocynometra* O. Kuntze in Post & Kuntze, Lexic. (1903) 464. — *Maniltoa* sect. *Pseudocynometra* Harms, Bot. Jahrb. 55 (1917) 48. — Type species: *C. polyandra* Roxb.

Schizosiphon K. Sch. in K. Sch. & Hollr., Fl. Kais. Wilh. Land (1889) 101, *non* Kütz. 1843 (*Cyanoph.*); Boerl., Handl. Fl. Ned. Ind. 1, 2 (1890) 678, 680. — *Schizoscyphus* K. Sch. *ex* Taubert, Bot. Centralbl. 41 (1890) 265; in E. & P., Nat. Pfl. Fam. 3, 3 (1892) 130; Hutch., Gen. Flow. Pl. 1 (1964) 238. — Type species: *S. rosea* K. Sch.

Trees. Growth flush-wise, flushes developing from large buds. Buds covered by 2-ranked, brown, caducous bud-scales veined lengthwise (fig. 5a); new leaves developing in bright white or pink tassels. *Leaves* 1-pinnate, (1—)2—15-jugate; leaflets opposite, asymmetric and the midrib acroscopic (fig. 5a, 6a); mostly glabrous. Stipules present in the buds, very tender, caducous immediately after the unfolding of the bud, leaving no scar. *Racemes* axillary, sessile, globular, contracted, dense. *Rachis* usually sturdy (fig. 4d). Bracts scale-like, veined lengthwise, lower ones broad-reniform, gradually becoming ovate to lanceolate halfway through the raceme (fig. 6b), mostly persistent, appressed-hairy, glabrescent or not. Bracteoles caducous, either linear, flat, small (not exceeding 5 mm), or larger (5—20 mm), obovate to spathulate, folded lengthwise with an apical tuft of hairs and usually a line of hairs running down the dorsal side. Receptacle either campanulate and then circumscissile under the ripening fruit (fig. 5h, i), *or* tube-like (fig. 4b), containing the ovary, and then spathaceous-disrupting when the fruit ripens (fig. 4c), in both cases *not* present under the ripe fruit. *Sepals* 4 (rarely 5, in *M. yokotai*), imbricate, reflexed at anthesis. *Petals* 5 (very occasionally some or all absent in *M. brassii*), narrow, free (fig. 5b, c), glabrous. *Disk* absent. *Stamens c.* 15—80, filaments often connate at base, sometimes with a few hairs; anthers medi-dorsifix, lengthwise introrsely dehiscent, *c.* 1—2 mm long, very often cleft below the insertion of the filament, mostly apiculate at apex (fig. 4b, 5f). *Ovary* with 1(—2) ovules, glabrous inside, sessile or stalked, the stipe central, in one species excentric. *Pod* woody, flat to globular, indehiscent. *Seed* globular, cotyledons smooth, semi-globular.

Distribution: India and SE. Asia (1 sp.), Malesia (Celebes 1 sp., Moluccas 2 spp., New Guinea 10 spp.), Australia (1 sp.), and the Pacific Is. (Carolines 1 sp., Solomons 2 spp., Tonga 1 sp., Fiji 4 spp.).

Ecology: In primary forests at low altitudes, 0—500(—1250)m, often in swampy localities, *M. brassii* even found occasionally in the mangrove. The highest altitude is recorded for *M. polyandra*, up to 1300 m.

In New Guinean lowland forests *Maniltoa* seems always regularly represented though it is never gregarious. According to a summary, made for me by Mr W. Vink, in five forest surveys along the northcoast of West New Guinea, together covering an area of *c.* 50000 ha, *Maniltoa* was represented by 0.5—2.1 trees over 35 cm diameter breast height per hectare, which is a not unusual frequency in these mixed rain-forests.

Uses: Because of the beautifully coloured young leaves and flowers, and as flowering starts at a very young age, *Maniltoas* are esteemed ornamentals in Java; cf. Bruggeman, Indisch Tuinboek ed. 2 (1948) 205—206, col. fig. 195—196.

Notes. Two groups may be recognized within the genus: (1) the group with a sessile ovary enclosed by the tubular receptacle (*M. brassii*, *M. rosea*, and *M. mariettae*) and (2) the group with a stalked ovary not enveloped by the receptacle.

Among the latter group is a cluster of species (*M. floribunda*, *M. minor*, *M. yokotai*, and

M. grandiflora) which are characterized by very small linear bracteoles, not exceeding 5 mm; these are all confined to the Pacific.

M. cynometroides from New Guinea is rather isolated within *Maniltoa* in having not such densely flowered racemes and not such a sturdy flower rachis as the other species.

KEY TO THE SPECIES

1. Ovary and fruit sessile, entirely or at least the lower part enveloped by the tubular receptacle which disrupts spathaceously as the ovary starts developing.
   2. Leaves 2—5-jugate; leaflets glabrous, (ob)ovate-oblong to oblong, (ob)ovate-lanceolate to lanceolate, 7—23 by 3—6 cm; rachis laxly pubescent, usually glabrescent. Receptacle 1.5—6 mm deep, funnel-shaped, partially or entirely enclosing the ovary, sometimes with hairs inside. Pedicels sturdy, 2—10 mm long, tapering into the receptacle. Sepals 10—16 mm, glabrescent. Stamens connate at base over 0.25—2 mm . . . . . **1. M. brassii**
   2. Leaflets hairy beneath. Receptacle cupular, entirely enclosing the ovary. Pedicels slender, 7—12 mm, distinctly set off from the receptacle. Sepals 8—10 mm. Stamens connate at base over 1.5—3 mm.
      3. Leaves 4—11-jugate; leaflets (ob)ovate-lanceolate to lanceolate, laxly hairy beneath, often only on the midrib, 2.2—13 by 0.7—2.7 cm; rachis hairy. Receptacle 9—10 mm deep, glabrous on both faces. Sepals glabrous or with a few hairs . . . . . **2. M. rosea**
      3. Leaves 2—3-jugate, (ob)ovate, elliptic, (ob)ovate-oblong and oblong, lower surface laxly hairy, 5—10 by 2.5—4.5 cm; rachis glabrous. Receptacle 4—5 mm deep, in- and outside densely hairy. Sepals densely hairy . . . . . **3. M. mariettae**
1. Ovary and fruit stalked, not enclosed by the campanulate receptacle, the latter circumscissile.
   4. Bracteoles very short and narrow, not exceeding 5 mm, glabrous. Pacific Islands, but compare also *M. schefferi* sub 4 second lead.
      5. Leaves (2—)3(—4)-jugate, rachis 3.5—4 cm, leaflets 5—10 by 3—6 cm. Pedicels, bracts, rachis of inflorescence, ovary, and rachises of young leaves densely set with thick, transparent, short hairs. Sepals 10—15 mm . . . . . **4. M. floribunda**
      5. Pedicels etc. without such transparent hairs.
         6. Leaves 1—2-jugate, rachis 1.5—6 cm, leaflets 3.5—10.5 by 2—6 cm. Pedicels densely patent-hairy. Ovary densely velutinous or long-hairy. Sepals 5.5—13 mm . . . . . **5. M. yokotai**
         6. Pedicels puberulous, glabrescent. Ovary puberulous, often glabrescent.
            7. Leaves (1—)2—3(—4)-jugate, rachis 2—5 cm, leaflets 3—8.5 by 1.5—5 cm. Sepals 9—15 mm. **6. M. grandiflora**
            7. Leaves 1—2-jugate, rachis 1.3—2 cm, leaflets 2.5—4.5 by 1—3.5 cm. Sepals 5.5—7 mm. **7. M. minor**
   4. Bracteoles 3—20 mm, often folded lengthwise or spathulate, with a tuft of hairs at the top and a line of hairs running down the dorsal side.
      8. Leaves 2-jugate, rachis 1.2—2 cm; upper leaflets larger than the lower ones, upper 3.5—5 by 1.8—4 cm, lower 2—3 by 1—1.5 cm, obovate-cuneate, midrib very excentric, at 4 and 2 mm respectively from the acroscopic margin . . . . . **8. M. cynometroides**
      8. Leaves not exlusively 2-jugate, but predominantly 3- or more-jugate, rachis 1.5—23 cm; upper leaflets occasionally larger than the lower ones; not obovate-cuneate.
         9. Midrib very excentric, 1—5 mm from the acroscopic margin.
            10. Leaves 10—15-jugate. Pedicels 15—30 mm. Ovary densely long-hairy . **9. M. plurijuga**
            10. Leaves 2—3(—5)-jugate. Pedicels 5—15 mm. Ovary glabrous or with a few scattered hairs. **10. M. steenisii**
         9. Midrib not so extreme, 6—25 mm from the acroscopic margin.
            11. Leaflets sessile, conspicuously auriculate on the basiscopic side. Filaments connate at base over 2—4 mm. . . . . **11. M. browneoides**
            11. Leaflets not sessile, not conspicuously auriculate. Filaments connate at base over 0.2—1 mm.
               12. Leaves 2—3-jugate; rachis puberulous or glabrous. Petiolules 2—3 mm. Tip of the leaflets obtuse. Stipe of the ovary 1—3 mm.
                  13. Leaflets glabrous, those of the lower pair usually asymmetrically rhomboid, of the two upper pairs (ob)ovate to elliptic; the rhomboid pair always in the broad basiscopic half with 2—4 lateral nerves running parallel with the acroscopic margin, reaching from the base up to near the apex. . . . . **12. M. psilogyne**
                  13. Leaflets hairy on the midrib beneath, ovate-oblong and oblong. Asiatic mainland. **13. M. polyandra**

12. Leaves 2—5-jugate; rachis glabrous, petiolules 2—10 mm; leaflets acuminate to cuspidate. Stipe of the ovary 2.5—10 mm.
    14. Leaves 4—5(—7)-jugate; leaflets 4—10.5 by 2.3—6 cm, acuminate-cuspidate. Venation above faintly impressed, nerves beneath finely prominent. Stipe of the ovary 5—10 mm . . . . . **14. M. lenticellata**
    14. Leaves 2—5-jugate; leaflets 7—20 by 3—10 cm, acuminate. Veins distinct, reticulate. Stipe of the ovary 2.5—5 mm . . . . . **15. M. schefferi**

1. Maniltoa brassii Merr. & Perry, J. Arn. Arb. 23 (1942) 398. — T.: *Brass 1428* (holotype in A, isotype in K). — **Fig. 4 c & d.**

Shrub or tree, up to 10 m. *Leaves* 2—5-jugate; leaflets variable in shape, size, and leaf-texture according to their age and probably their place on the tree: 7—23 by 3—6 cm, (ob)ovate-oblong, oblong, (ob)ovate-lanceolate or lanceolate, acuminate or obtuse, tip usually emarginate, sessile; petiole 0.5—1.5 cm, leaf-rachis 3—21 cm, both laxly pubescent, usually glabrescent. *Rachis* 2.5—4 cm, densely hairy, glabrescent (fig. 4d). Bracts 2.5—3 cm, densely appressed-hairy. Bracteoles 9—15 mm. Pedicels 2—10 mm, hairy, sturdy, tapering into the receptacle. Receptacle funnel-shaped, 1.5—6 mm, inside sometimes lined with hairs, usually splitting lengthwise when the enclosed ovary starts developing (fig. 4c). *Sepals* 10—16 mm, glabrescent. *Petals* 16—19 mm; not always all present (even in young buds). *Stamens* 32—43, sometimes with a single hair; filaments 15—24 mm, connate at base over 0.25—2 mm (fig. 4c); connective apiculate. *Ovary* densely appressed-hairy, glabrescent, sessile, partially or entirely enclosed by the receptacle; style 14—22 mm. Mature *pod* 20—25 by 15—18 by *c.* 10 mm.

Distribution: New Guinea. Known from 8 collections.

Ecology: Mangrove swamp or swamp forest, up to 100 m.

Field notes: Bark smooth, dirty grey-green. Wood cream-brown.

2. Maniltoa rosea (K. Sch.) van Meeuwen, *nov. comb.* — *Schizosiphon roseus* K. Sch. in K. Sch. & Hollr., Fl. Kais. Wilh. Land (1889) 101; Boerl., Handl. Fl. Ned. Ind. 1, 2 (1890) 680. — *Schizoscyphus roseus* K. Sch. *ex* Taubert, Bot. Centralbl. 41 (1890) 265; Warb., Bot. Jahrb. 13 (1891) 331; Taubert in E. & P., Nat. Pfl. Fam. 3, 3 (1892) 130; K. Sch. & Laut., Fl. Deutsch. Schutzgeb. Südsee (1900) 347. — T.: *Hollrung 492* (holotype in B †, isotypes not in WRSL or LE). Neotype: *NGF 10226 K. J. White* (K, BRI). — **Fig. 4 a & b.**

M. urophylla Harms, Bot. Jahrb. 55 (1917) 51, *pro folia, excl. infl.*; Kaneh., Bot. Mag. Tokyo 56 (1942) 363 (*'ulophylla'*). — T.: *Ledermann 8848* (holotype in B †, isotypes not in WRSL and LE).

Tree, 6—9 m. *Leaves* 4—11-jugate; leaflets sessile, (ob)ovate-lanceolate and lanceolate, acute or acuminate, emarginate, 2.2—13 by 0.7—2.7 cm, laxly hairy beneath, often only on the main nerves; petiole 5—11 mm, hairy or puberulous; leaf-rachis 3.5—17 cm, densely hairy. *Rachis* 2 cm. Bracts 1—4 cm, sericeously hairy. Bracteoles 8 mm. Pedicels 7—9 mm, hairy. Receptacle cupula-shaped, 9—10 mm deep, glabrous, splitting lengthwise when ovary starts developing. *Sepals* 10 mm long, glabrous or with a few hairs. *Petals* 9 mm. *Stamens* 25—35, above the receptacle connate over 1.5—3 mm; filaments 22 mm; connective apiculate. *Ovary* sessile, completely enclosed by the receptacle; style 24 mm. *Pod* unknown.

Distribution: New Guinea. Known from 5 collections.

Ecology: Once noted from 70 m.

Notes. M. brassii, M. mariettae, and *M. rosea* form a distinct group in this genus. They share a sessile ovary completely or partially enclosed by a deep receptacle. After anthesis the swelling ovary causes the receptacle to split; the location of this split is random. Earlier

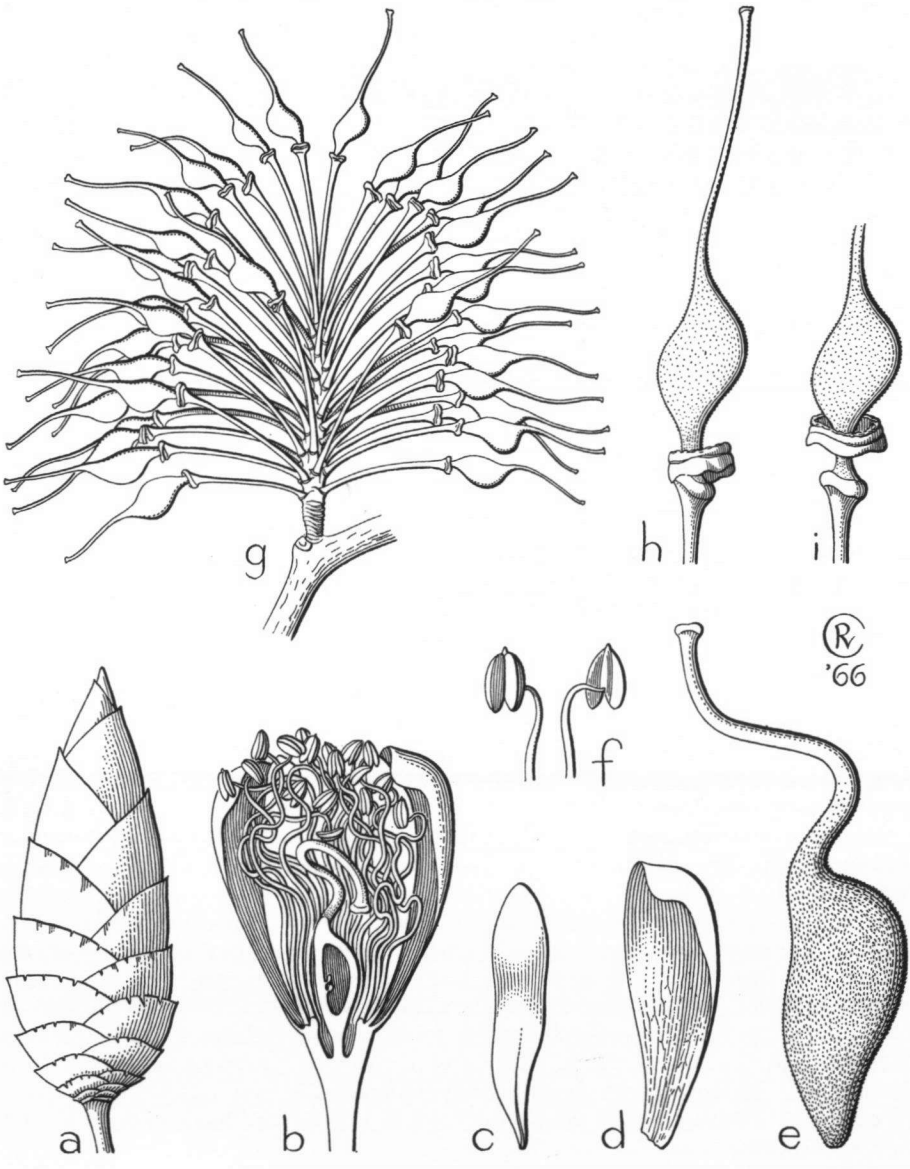

Fig. 5. *Maniltoa floribunda* A. C. Smith. a. Leaf bud, × 2/3; b. sectioned flower, × 2/3; c. petal × 2/3; d. sepal, × 2/3; e. ovary, × 4; f. anthers, × 4; g. infructescence, × 2/3; h. very young pod, × 2; i. very young pod with circumscissile receptacle, × 2 (a. *A. C. Smith 4502*, b—f. *A. C. Smith 4588*, g—i. *A. C. Smith 4627*).

authors assumed this a character of generic rank, but in my opinion it is only a consequence of the absence of a stipe under the ovary.

I reached the conclusion about the conspecificity of *M. urophylla* with *M. rosea* by deduction from the descriptions rather than by actual comparison of the specimens. As can be seen from the typification the holotypes of both species have been lost and no isotypes could be located.

Harms' description of the inflorescence of *M. urophylla* differs totally from that of *M. rosea*; but he stated (literatim): *'racemi e ramulo orti (?)'*. From this I conclude that the inflorescence Harms had available was not attached to his specimen. As Harms stated himself, he could find no difference between the leaves of *M. urophylla* and *M. rosea*. Furthermore, I did not find any flowering specimen fitting his description of *M. urophylla*. From these facts I deduce that the specimen Harms described was a sterile *M. rosea* with a loose inflorescence of one of the more common *Maniltoas* like *M. schefferi* or *M. browneoides*.

3. Maniltoa mariettae van Meeuwen, *nov. sp.* — T.: *C.T. White, Dadswell & Smith NGF 1661* (holotype in BRI).

Arbor parva. *Folia* 2—3-jugata; foliola ovata, obovata, elliptica, ovato-oblonga, obovato-oblonga vel oblonga, obtusa vel acuminata, emarginata, 5—10 cm longa, 2.5—4.5 cm lata; pagina inferior laxe pilosa; costa a margine acroscopo 8—12 mm remota; petiolus 6—12 mm; petioluli 2 mm, pilosi, glabrescentes; rhachis 3—11 cm, glaber. *Rhachis* inflorescentiae 2—2.5 cm, pilosus. Bracteae 2 cm longae, adpresse pilosae. Bracteolae 9—10 mm longae, ad pedicellam 2 mm supra eius basin insertae. Pedicelli 8—12 mm, dense pilosi, sed prope flores magis pilosi, graciles. Receptaculum cupuliforme, 4—5 mm utrinque, dense pilosum, longitudinaliter fissum cum ovario in legumen evoluto. *Sepala* 8 mm longa, dense pilosa. *Petala* 6—10 mm longa. *Stamina*: filamenta 8—15 mm, praeter receptaculum longitudine 2—2.5 mm connata; connectivum apiculatum. *Ovarium* receptaculo omnino inclusum, sessile, dense longe pilosum; stylus 12—15 mm, pilum unicum munitus. *Legumen* (probabiliter immaturum) 2.7 cm longum, 1.8 cm latum, 0.5 cm crassum, rugosum, glabrum; pedicellus 16 mm.

Small tree. *Leaves* 2—3-jugate; leaflets (ob)ovate, elliptic, (ob)ovate-oblong, or oblong, obtuse or acuminate, emarginate, 5—10 by 2.5—4.5 cm; midrib at a distance of 8—12 mm from the acroscopic margin; lower surface laxly hairy; petiole 6—12 mm, petiolules 2 mm, glabrescent; leaf-rachis 3—11 cm, glabrous. *Rachis* 2—2.5 cm, hairy. Bracts 2 cm, appressed-hairy. Bracteoles 9—10 mm, inserted on the pedicel 2 mm above its base. Pedicels 8—12 mm, densely hairy, especially towards the flower, slender. Receptacle cupular, 4—5 mm, densely hairy at both faces, splitting lengthwise when the ovary starts developing. *Sepals* 8 mm, densely hairy. *Petals* 6—10 mm. *Stamens*: filaments 8—15 mm, connate beyond the receptacle over a length of 2—2.5 mm; connective apiculate. *Ovary* completely enclosed by the receptacle, sessile, densely long-hairy; style 12—15 mm with an occasional hair. *Pod* (probably immature) 2.7 by 1.8 by 0.5 cm, rugose, glabrous; pedicel 16 mm.

Distribution: New Guinea (Morobe Dist.: Yalu). Known from 3 collections.

Ecology: Near creeks or streams, on rain-forest margin, at very low altitude.

Note. Named after my first-born little daughter.

4. Maniltoa floribunda A. C. Smith, J. Arn. Arb. 31 (1950) 169. — T.: *A. C. Smith 4588* (holotype in A, isotypes in BRI, L, S, U, US). — **Fig. 5.**

Tree, up to 23 m. *Leaves* (2—)3(—4)-jugate; leaflets 5—10 by 3—6 cm, (ob)ovate to elliptic, apex somewhat acuminate or obtuse, tip emarginate; nerves 6—12 pairs; young

shoots short-hairy; adult parts glabrous; petiole 1.7—2 cm; leaf-rachis 3.5—4 cm. *Rachis* 2.5—4 cm, covered by short, thick, and somewhat transparent hairs which also occur on the pedicels, bracts, ovary, on young leaf rachises, and often on the sepals. Bracts 2—3.5 cm. Bracteoles 2—4 mm. Pedicels 15—30 mm. *Sepals* 10—15 mm. *Petals* 10—15 mm. *Stamens*: filaments 18—27 mm long; connective apiculate. *Ovary* 7.5—8.5 by 2.5—3.5 mm, puberulous and with some longer hairs when young; stipe *c.* 4 mm; style 13—15 mm. *Pod* unknown.

Distribution: Polynesia: Fiji (Viti Levu, various localities).

Ecology: In forests, along streams, at 200—600 m.

Field notes: Leaf buds rich brown. Petals and filaments white, ovary pinkish.

5. Maniltoa yokotai (Kaneh.) Hosokawa, J. Jap. Bot. 13 (1937) 277 ('*yokotae*'). — *Cynometra yokotai* Kaneh., Bot. Mag. Tokyo 46 (1932) 454; Fl. Micron. (1933) 134, f. 46; J. Dep. Agric. Kyushu Imp. Univ. 4 (1935) 330. — T.: *Kanehira 1277* (holotype in FU ?, isotype in NY).

M. vestita A. C. Smith, J. Arn. Arb. 31 (1950) 170. — T.: *A. C. Smith 6442* (holotype in A, isotypes in BRI, L, S, US).

Tree, 10—20 m. *Leaves* 1—2-jugate; leaflets (ob)ovate, elliptic, (ob)ovate-oblong, or oblong, obtuse or acuminate, emarginate, 3.5—10.5 by 2—6 cm; midrib at 1.5—3 cm from the acroscopic margin; nerves 6 pairs; petiole 4—10 mm; petiolules 0.1—2 mm; leaf-rachis 1.5—6 cm. *Rachis* 12—35 mm, patent-hairy. Bracts 1—2 cm, densely short-hairy. Bracteoles 2—3.5 mm, inserted at the base of the pedicel. Pedicels 10—25 mm, patent-hairy. Receptacle 1—2 mm deep. *Sepals* 4—5, 5.5—13 mm, hairy. *Petals* 7—12 mm long. *Stamens* 16—25, occasionally with a few hairs; filaments 9—15 mm; connective apiculate. Ovary velutinous or densely long-hairy; style 4—10 mm, glabrous or hairy up to halfway; stipe 2—3 mm. *Pod* 3.5—4.5 by 3—3.5 by 1.5—2 cm.

Distribution: Carolines (Truk, Tol) and Fiji (Vanua Levu, Ongea Levu). In all 8 collections.

Ecology: Forests, 150—1250 m.

Field notes: Flowers white.

Notes. The Fijian specimens, until now attributed to *M. vestita*, consisted of three collections: the type (*A. C. Smith 6442*), a Horne specimen (*Horne 922*), and an unnumbered collection from *Bryan Jr.*, the latter in very poor condition.

The specimens from the Carolines I know are from five homogeneous collections. Horne's specimen is in perfect agreement with those from the Carolines, but the flowers of Smith's specimens were somewhat larger than those from the Carolines and the ovary is more velutinous. I could not find differences in the leaves between the Fijian and Caroline plants, both being 1—2-jugate, of the same size, and with the same type of venation and texture. As it does not seem reasonable to retain a species based on one collection which shows a slightly larger flower and some difference in the hairiness of the ovary, I have tentatively reduced *M. vestita*.

M. yokotai forms together with *M. grandiflora*, *M. minor*, and *M. floribunda* a distinct Pacific Islands group. The four of them share very short bracteoles not exceeding 5 mm, while all the Papuan and SE. Asiatic species have as a rule much longer bracteoles.

6. Maniltoa grandiflora (A. Gray) Scheff., Ann. Jard. Bot. Btzg 1 (1876) 20, *quoad nomen, excl. descriptio*; Harms in E. & P., Nat. Pfl. Fam. Nachtr. 1 (1897) 194; Notizbl. Berl.-Dahl. 3 (1902) 191; Bot. Jahrb. 55 (1917) 48; A. C. Smith, Sargentia 1 (1942) 36; J. Arn. Arb. 31 (1950) 167. — *Cynometra grandiflora* A. Gray, U.S. Expl. Exped., Bot. 1 (1854)

470. — T.: *Wilkes, U.S. Expl. Exped.*, Vanua Levu (lectotype in US; A. Gray, l.c. fig. B).

M. brevipes A. C. Smith, J. Arn. Arb. 31 (1950) 168. — T.: *A. C. Smith 6600* (holotype in A, isotypes in BISH, BRI, L, S, US).

M. amicorum A. C. Smith, Bern. P. Bish. Mus. Bull. 220 (1959) 132, f. 11. — T.: *Yuncker 16168* (holotype in US, isotype in GH).

Tree, 3—20 m. *Leaves* (1—)2—3(—4)-jugate; leaflets 3—8.5 by 1.5—5 cm, (ob)ovate, elliptic, (ob)ovate-oblong, or oblong, apex obtuse, sometimes slightly emarginate, nerves 6—9 pairs; petiole 1—5 mm, usually glabrous; rachis 2—5 cm. *Rachis* 7—30 mm, glabrescent, usually with hairs left at the base of the pedicels. Bracts to 3.5 cm, densely hairy to glabrous. Bracteoles 1.5—5 mm. Pedicels 11—23 mm, puberulous or glabrous. *Sepals* 9—15 mm, glabrous. *Petals* 8—19 mm. *Stamens*: filaments not connate at base; anthers slightly or clearly apiculate. *Ovary* puberulous, glabrescent to finally glabrous; stipe 2—3 mm; style 5—10 mm, glabrous or hairy. *Pod* obliquely ellipsoid, up to 5 by 5 by 2 cm.

Distribution: Polynesia: Fiji (Viti Levu, Vanua Levu, Wakaya, Koro, Taveuni, Kanathea, Ongea Levu), Tonga (Vava'u group and Eua), and Solomon Is (Robroy I.).

Ecology: Along tidal creeks and up to 500 m.

Field notes: Flowers white.

Notes: As can be observed from the description there exists variability in hairiness in all parts of the plant. A variability in sizes, used by A. C. Smith (1950) to differentiate between *M. grandiflora* and *M. brevipes*, can be noted too. Both characters are insufficient to recognize any groups within this species. The characters of *M. amicorum* knit the three species recognized by A. C. Smith even closer together.

Scheffer's introduction of a new genus *Maniltoa* based on *Cynometra grandiflora* A. Gray was done correctly. The New Guinean specimens which he thought to be conspecific with the Fijian specimens of *Cynometra grandiflora* proved, however, to represent another species, *M. schefferi*, as pointed out by K. Schumann (in K. Sch. & Hollr., Fl. Kais. Wilh. Land, 1889, 101).

7. Maniltoa minor A. C. Smith, Sargentia 1 (1942) 37; J. Arn. Arb. 31 (1950) 169. — T.: *A. C. Smith 1333* (holotype in GH, isotypes in A, BO, K, NY, UC, US).

Tree, *c.* 7—15 m. *Leaves* 1—2-jugate; leaflets 2.5—4.5 by 1—3.5 cm, (ob)ovate or elliptic, emarginate; nerves 5—8 pairs; petiole 7—11 mm; petiolules 1—3 mm; leaf-rachis 1.3—2 cm. *Rachis* 1—2 cm, hairy, more sparsely so towards the apex. Bracts 0.7—1 cm, hairy and ciliate. Bracteoles 1—2 mm. Pedicels 10—17 mm, puberulous, glabrescent. *Sepals* 5.5—7 mm long, glabrous or with a few hairs. *Petals* 5—7 mm long. *Stamens*: filaments 7—8 mm, connate at base over 0.25—1 mm; connective apiculate. *Ovary* 4—5 by 1.5 mm, nearly glabrous or densely puberulous; stipe 1 mm; style 5—7 mm, glabrous or with a few hairs. *Pod* 7.5 by 5 by 1 cm.

Distribution: Polynesia: Fiji (Viti Levu, Ovalau, Moala, Matuku).

Field notes: One tree was recorded at 200 m.

Note. A. C. Smith noted in his description of the species that it has 5 sepals. In the type specimen I found only 4, the usual number in the genus.

8. Maniltoa cynometroides Merr. & Perry, J. Arn. Arb. 23 (1942) 397. — T.: *Brass 6903* (holotype in A, isotypes in BM, BO, BRI, L).

Tree, 21—30 m. *Leaves* 2-jugate, upper leaflets larger than lower ones, upper ones 3.5—5 by 1.8—4 cm, lower ones 2—3 by 1—1.5 cm, both obovate-cuneate, obtuse, emarginate, midrib very excentric, 2 and 4 mm respectively from the acroscopic margin,

nerves 6—8 pairs, nearly invisible above, barely visible beneath; petiole 7—10 mm; leaf-rachis 12—20 mm. *Rachis* 4—11 mm, densely puberulous, glabrescent. Bracts up to 1 cm. Bracteoles 5—6 mm. Pedicels 7—9 mm, densely puberulous, glabrescent. *Sepals* 5 mm long. *Petals* unknown. *Stamens* 25; filaments 3 mm, connate at base over 0.2 mm; connective apiculate. *Ovary* densely long-hairy; stipe 0.25 mm; style 3 mm, with long hairs. *Pod* 1.5—5 by 1.2—2 by 0.5—2 cm.

Distribution: Moluccas (Morotai, one coll.), Key Is (one coll.), New Guinea (various localities), and Polynesia: Fiji (Matuku, one sterile coll. *Milne* a. 1855).

Ecology: Rather common, 0—100 m, once at 530 m. Several times reported from primary forest on sandy soil.

Notes. Many specimens have been collected in fruit, but hardly any in flower. The specific epithet is suggestive of *Cynometra* and refers to the habit, but the flower characters point clearly to *Maniltoa*. This is the only representative of the genus widely ranging from the Moluccas eastward through New Guinea, and in Fiji. There are no recent collections made in Fiji, but Milne's specimen, though sterile, can hardly be misinterpreted.

9. Maniltoa plurijuga Merr. & Perry, J. Arn. Arb. 23 (1942) 398. — T.: *Brass & Versteegh 13539* (holotype in A, isotypes in BO, BRI, L).

Tree (10—)25—40 m. *Leaves* 10—15-jugate, leaflets oblong to lanceolate, 2.5—5.5 by 0.6—2 cm, midrib very excentric, at 1—2.5 mm from the acroscopic margin, tip obliquely emarginate; leaflets sessile, base rounded to auriculate on the basiscopic side, usually glabrous, sometimes along the midrib with a few hairs, nerves invisible on both sides; petiole 5—11 mm, leaf-rachis 8.5—23 cm. both hairy. *Rachis* 3—4.5 cm, densely hairy. Bracts 0.4—4 cm, densely silky. Bracteoles 7 mm. Pedicels 1.5—3 cm, rather densely hairy. Receptacle 2—2.5 mm deep. *Sepals* 13—18 mm, with a few scattered hairs. *Petals* 9—13 mm. *Stamens* 30—32, free to connate over 0.75 mm; filaments 13—18 mm; connective apiculate. *Ovary* densely rather long hairy; style 5—7 mm; stipe 7 mm. Immature *pod* 15 by 9 by 1.6 mm, with a few hairs left.

Distribution: New Guinea (common).

Ecology: Primary forests, 0—650 m, at river-sides, on ridges, both on alluvial clay and limestone.

Field notes: Bark grey, brown, or black; sapwood pink, light brown to red; heartwood orange-red to dark brown; sometimes buttressed. Trees often reach proportionally large diameters, e.g. 11 m high by 45 cm ∅ at breast height, 12 m by 40 cm ∅, 18 m by 44 cm ∅, 23 m by 75 cm ∅, 27 m by 90 cm ∅.

10. Maniltoa steenisii van Meeuwen, *nov. sp.* — T.: *Hoogland 4581* (holotype in BRI).

Arbor parva vel mediocris. *Folia* 2—3(—4—5)-jugate; foliola sessilia, lanceolata, basi rotunda usque ad auriculata in latere abaxiali, apice oblique emarginata, interdum obtusa, nonnumquam mucronata, supra obscure viridia nitidula, subtus pallidius opaca, pilis paucis in marginis parte dimidia repertis exceptis glabra; nervi 3—4, conspicui solum in folii parte dilatata, praesertim ad paginam inferiorem; petiolus 5—9 mm; folii rhachis 1.5—4 cm, pilosa. Stipulae uno tempore cum foliis juvenilibus flaccidis solum repertae, 13—17 mm longae, 2—3 mm latae, cirro 10—17 mm longo terminatae, valde caducae, cicatricibus destitutis. Gemma expansa mox cirrus tener 2 cm longus prolongatio folii rhachis apparet. *Rhachis* 1—2.1 cm, dense pilosa. Bracteae 0.2—2.2 cm longae, pilosae, glabrescentes. Bracteolae 3—12 mm longae. Pedicelli (5—)9—15 mm. Pedicelli atque receptacula laxe vel dense pilosi, interdum glabrescentes. Receptaculum 1—1.5 mm altum. *Sepala* 7—10 mm longa, laxe pilosa pilis brevissimis vel longiusculis. *Petala* 7—10

mm longa, interdum pilo unico terminata. *Stamina* 15—18, basi libera, filamentis 8 mm longis, interdum pilis paucis munitis, connectivo apiculato. *Ovarium* 3—5 mm longum, 2—2.5 mm diam., pauce pilosum vel glabrum; stipes 2—3 mm; stylus 8—14 mm, glaber. *Legumen* 3.2 cm longum, 2.3 cm latum, 0.8 cm crassum, probabiliter non bene maturum.

Small to medium-sized tree, 4—13 m high, 5—11 cm d.b.h. *Leaves* 2—3(—4—5)-jugate; leaflets lanceolate, 3.5—10 by 1.2—3.5 cm, midrib very excentric, at 1.2—5 mm from the acroscopic margin, tip obliquely emarginate (sometimes obtuse or mucronate), base rounded to auriculate on the basiscopic side; leaflets sessile, dark green and ± glossy above, underneath paler and dull, glabrous except for a few hairs along the margin up to halfway; nerves only visible in the broader part and especially beneath, 3—4 pairs; petiole 5—9 mm, leaf-rachis 1.5—4 cm, both hairy; a 2 cm long filiform prolongation beyond the upper pair of leaflets is present in unfolding buds but is very early caducous. Stipules only found together with the young limp leaves, 13—17 by 2—3 mm, ending in a filiform acumen 10—17 mm long, very early caducous, leaving no scar. *Rachis* 1—2.1 cm, densely hairy. Bracts 0.2—2.2 cm, glabrescent. Bracteoles 3—12 mm. Pedicels (5—)9—15 mm. Pedicel and receptacle laxly to densely hairy, sometimes glabrescent. Receptacle 1—1.5 deep. *Sepals* 7—10 mm, very short to rather long, laxly hairy. *Petals* 7—10 mm, with an occasional hair at the tip. *Stamens* 15—18, not connate at the base; filaments 8 mm, sometimes with a few hairs; connective apiculate. *Ovary* 3—5 by 2—2.5 mm, with a few hairs or glabrous; stipe 2—3 mm, style 8—14 mm, glabrous. *Pod* 3.2 by 2.3 by 0.8 cm, probably not fully mature.

Distribution: West New Guinea (along Idenburg River) and East New Guinea: Northern Div. (4 coll.), Central Div. (1 coll.), and Gulf Dist. (1 coll.).

Ecology: Rain-forest, at 30—100 m.

Field notes: Bark grey-brown to brown, underbark green or red-brown. Sapwood white to dark straw-coloured, heartwood brown. Flowers white to pink.

11. Maniltoa browneoides Harms, Notizbl. Berl.-Dahl. 3 (1902) 190; Bot. Jahrb. 55 (1917) 49; Back., Bekn. Fl. Java (em. ed.) 5 (1941) fam. 118, p. 7 .— *Pseudocynometra browneoides* (Harms) O. Kuntze, Deutsch. Bot. Monatsschr. 21 (1903) 173. — T.: *Forbes 1204a* (holotype in B †, isotype in BM). — **Fig. 6.**

M. gemmipara Scheff. *ex* Back., Voorl. Schoolfl. Java (1908) 103; Funke, Ann. Jard. Bot. Btzg 40 (1929) t. 11, t. 13, f. 5; Schimper & v. Faber, Pflanzengeogr. ed. 3, 1 (1935) 483. f. 139, 484, f. 140. — *M. grandiflora* [non (A. Gray) Scheff.] Back. & Bakh. *f.*, Fl. Java 1 (1963) 526. — T.: *Backer s.n.*, culta at Weltevreden (Djakarta) (holotype in L).

M. megalocephala Harms, Bot. Jahrb. 55 (1917) 52, f. 2. — T.: *Ledermann 7895, 7857* (syntypes in B †, not present in LE, W, or WRSL).

Tree, 10—30 m. *Leaves* (2—)3(—4)-jugate, variable in shape, size, and texture according to their age and probably their place on the tree; leaflets sessile, conspicuously auriculate on the basiscopic side, (ob)ovate, elliptic (ob)ovate-oblong, or oblong, 4.5—20 by 3—8 cm, apex mostly ± acuminate, tip usually obtuse and emarginate; petiole 1—2 cm, rugose; leaf-rachis 5.5—21 cm, puberulous, glabrescent. Stipules only found together with the limp young leaves, 17—22 cm long, leaving no scar. *Rachis* 14—25 mm, puberulous or pubescent, glabrescent. Bracts 4—6 cm, sericeous, glabrescent. Bracteoles at and 3 mm above base of pedicel, 13—19 mm. Pedicels 16—34 mm, puberulous, glabrescent. Receptacle 1.5—2.5 mm deep. *Sepals* 13—18 mm, sometimes with a few hairs near the tip. *Petals* 11—19 mm long. *Stamens* 60—80, connate over 2—4 mm; filaments 17—29 mm; connective apiculate. *Ovary* 15—30 mm, appressed-hairy or with a few hairs; stipe 3—4 mm; style 15—17 mm, with an occasional hair. *Pod* 2.2—2.5 by 1.2—1.3 by 1.1 cm, probably not fully mature, breaking off above the stipe.

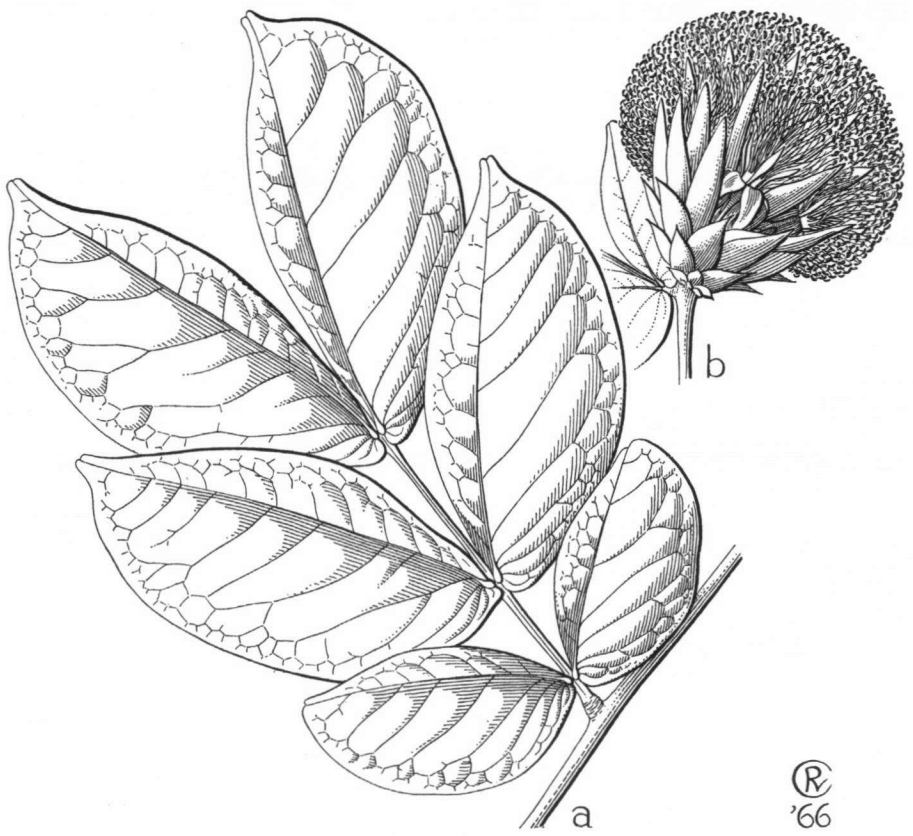

Fig. 6. *Maniltoa browneoides* Harms. a. Leaf, × 2/3; b. inflorescence, × 2/3 (a. & b. *Kostermans 11058*).

Distribution: New Guinea. Cultivated in Java, Kangean I., and N. Sumatra.

Ecology: Rather common, in rain forest, in swampy localities, 0—75 m, once at 400 m.

Field notes: Flowers white, anthers brown. Bark not fissured, reddish to black. Buttresses up to 1 m.

Notes. The description of *M. browneoides* by Harms is based on *Forbes 1204a* from Java. This was taken from a cultivated specimen growing in the Botanic Garden at Bogor under the number I-i-33 and raised from seed or seedlings brought by Forbes from New Guinea.

Judging from Harms' description, based on two Ledermann collections which unfortunately are lost, *M. megalocephala* is doubtless conspecific with *M. browneoides*. The two species seem to differ in sizes only. Conspicuous differences in the size of the leaflets can be found at various heights on a single tree, as can be observed in other collections.

One of the 4 syntypes of *M. schefferi* K. Sch.,: 'Teysmann, N. Guinea', with white flowers belongs to *M. browneoides*.

M. gemmipara is first mentioned as a name by Treub in his book 's-Lands Plantentuin

te Buitenzorg 18 Mei 1817—18 Mei 1892' (1892) 93. From then on the *Maniltoas* cultivated in the Buitenzorg Botanic Gardens carry this name. In 1902 Harms published *Maniltoa browneoides*. In 1908 Backer validated the name *M. gemmipara* by publishing it in the Voorl. Schoolfl. Java (1908) 103. Later, he concluded (Bekn. Fl. Java (em. ed.) 5, 1941, fam. 118, p. 7) that the name *M. gemmipara* must give way to the earlier *M. browneoides*. The confusion arose because all the *Maniltoas* cultivated at Bogor were called *M. gemmipara* though really two species of *Maniltoa* grow in the gardens: *M. browneoides* and *M. schefferi*. Both originated from New Guinea and occur cultivated in Java also outside the Botanic Gardens. Former identifications as *M. gemmipara* are mostly referable to *M. schefferi*.

I found two unnumbered specimens collected by *Backer* in 1908 at Weltevreden where they were cultivated. These specimens carry the name *M. gemmipara*. I consider them to be the types of *M. gemmipara*. They are conspecific with *M. browneoides*.

12. Maniltoa psilogyne Harms, Bot. Jahrb. 55 (1917) 50. — T.: *Schlechter 16934* (holotype in B †, isotypes in A, E, G, K, L, S, Z).

M. hunsteiniana Harms, Bot. Jahrb. 55 (1917) 51. — T.: *Ledermann 8193* (holotype in B †, isotypes in BM, K).

Tree, 10—25 m. *Leaves* 3-jugate; leaflets 3—10 by 1.5—4.5 cm, of the lower pair usually asymmetrically rhomboid, of the two upper pairs (ob)ovate to elliptic; the rhomboid pair always with 2—4 lateral nerves in the broad basiscopic half running parallel with the acroscopic margin, reaching from the base up to near the apex; tip obtuse, emarginate; petiole 5—12 mm, petiolules 2—3 mm, both puberulous, sometimes glabrous; leaf-rachis 4.5—8 cm, puberulous or glabrous. *Rachis* 1—3.5 cm, appressed long-hairy, glabrescent. Bracts 1—2 cm, appressed hairy or glabrous. Bracteoles 5.5—8 mm. Pedicels 8—20 mm, densely hairy or glabrous. Receptacle 1—2 mm deep. *Sepals* 7—10 mm, usually glabrous. *Petals* 6—12 mm. *Stamens c.* 20, very shortly connate at base; filaments 7—12 mm; connective apiculate. *Ovary* usually with hairs on the swollen side, sometimes glabrous; stipe 1.5—3 mm; style 5—9 mm. *Pod* unknown.

Distribution: New Guinea (fairly common).

Ecology: Forests, 0—400 m.

Field notes: Flowers white.

Notes. Harms (l.c. 51) stated the main differences between *M. psilogyne* and *M. hunsteiniana* as follows (I have added those which can be derived from his diagnoses). *M. psilogyne*: rather thin, glabrous to subglabrous rachis and ovary; rachis 5—13 cm. However, he stated that the rachis is short, which cannot be reconciled with 5—13 cm; this is probably a printing error for 5—13 mm. *M. hunsteiniana*: stout, hairy rachis 1—2 cm long; ovary hirsute along the dorsal margin, for the rest glabrous.

In the isotypes of *M. psilogyne* I found the rachis with a few hairs near the insertion of the pedicels; rachis 1 cm, but not particularly thin.

In the isotypes of *M. hunsteiniana* I found the rachis hairy. Rachis 1.2 cm, but not particularly stout.

Other material which I refer to *M. psilogyne* showed a rather densely hairy rachis. As there are no other differentiating characters but, indeed, only characters in common such as the conspicuous venation and the size and shape of the leaves, it is clear that *M. hunsteiniana* and *M. psilogyne* are conspecific.

13. Maniltoa polyandra (Roxb.) Harms in E. & P., Nat. Pfl. Fam. Nachtr. 1 (1897) 194; Notizbl. Berl.-Dahl. 3 (1902) 191; Bot. Jahrb. 55 (1917) 48. — *Cynometra polyandra*

Roxb., [Hort. Beng. (1814) 32, *nomen*] Pl. Corom. 3 (1820) 84, t. 286; DC., Prod. 2 (1825) 509; Mém. Lég. (1825) 458; Roxb., Fl. Ind. ed. Carey 2 (1832) 372; W. & A., Prod. (1834) 294; Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 268; Prain, J. As. Soc. Beng. 66, ii (1897) 200; Brandis, Ind. Trees (1906) 255; Gagnep., Fl. Gén. I.-C. 2 (1913) 154; Ridl., Fl. Mal. Pen. 1 (1922) 636; Kanjilal & Das, Fl. Assam 2 (1938) 134. — T.: *Roxburgh 2241* (K); Roxburgh Pl. Corom. t. 286, cf. Sealy, Kew Bull. (1956) 329.

Lofty tree. *Leaves* 2—3-jugate; leaflets 3.5—6 by 1.5—2.5 cm, ovate-oblong to oblong, tip emarginate, midrib hairy below, glabrescent; petiole 5 mm, leaf-rachis 5 cm, both puberulous. *Rachis* 7—10 mm, tomentose. Bracts 2—6 mm, puberulous, glabrescent. Bracteoles 4.5—6 mm, at 1—2 and 4—5 mm high on the pedicel. Pedicels 11—25 mm, tomentose. Receptacle 1 mm deep. *Sepals* 5.5—7 mm, glabrous or tomentose near the apex. *Petals* 6—8 mm. *Stamens c.* 50, at base connate over 0.25 mm, villous or glabrous (this varies even within one flower); filaments 10—13 mm; connective apiculate. *Ovary* woolly-villous; stipe 1 mm, obliquely inserted off the centre of the receptacle and adnate to the wall; style 5—7 mm. *Pod* 5.5—6 by 3.5—4 by 1—1.5 cm, glabrous, rough, smooth.

Distribution: (largely from literature): Assam, (Cachar, Khasia), Silhet, East Bengal, Cambodia, Chittagong; in Malesia: Penang, Malaya.

Ecology: There is only scant information about the ecology. It has been found in the hills, at 1300 m.

Notes. Miquel (Anal. Bot. Ind. 1, 1850, 11) misidentified a specimen of *Cynometra ramiflora* from Borneo as *Cynometra polyandra.* Merrill (En. Born. 1921, 295) and Masamune (En. Phan. Born. 1942, 340) copied this erroneous record.

Cynometra malaccensis and *M. polyandra* are very much alike when sterile.

13a. var. **kurzii** (Prain) van Meeuwen, *nov. comb.* — *Cynometra polyandra* Roxb. var. *kurzii* Prain, J. As. Soc. Beng. 66, ii (1897) 200, 479. — T.: *Kurz s.n.*, loc. Gort. Hill 'Apl. 1890' (lectotype in CAL, no isotypes seen).

Leaves as in typical *M. polyandra.* Pod very rugose even in mature state, 6 by 3—4.5 cm, flat, with a pronounced beak.

Distribution: Burma (2 collections).

Note. Since the original discovery by Kurtz this apparently extremely rare variety has been found only once (Meebold, 1912). The final decision on its taxonomic status will depend on its other characters, e.g. those of the flower which are as yet unknown.

14. Maniltoa lenticellata C. T. White, J. Arn. Arb. 8 (1927) 130. — T.: *Lane Poole 203* (holotype in A, isotype in BRI).

Large tree, 10—30 m. *Leaves* 4—5(—7)-jugate; leaflets 4—10.5 by 2.3—6 cm, (ob)ovate, elliptic, (ob)ovate-oblong, to oblong, acuminate-cuspidate, emarginate; venation above faintly impressed, nerves beneath finely prominent; petiole 5—20 mm; petiolules 3—7 mm; leaf-rachis 10—18 cm. *Rachis* 3—6 cm, glabrescent. Bracts 1.5—5 cm, appressed-hairy. Bracteoles 5—8 mm. Pedicels 14—30 mm. Receptacle 2.5—4 mm deep. *Sepals* 13—15 mm. *Petals* 12—18 mm. *Stamens* connate over 0.2—1 mm; filaments 14—23 mm; connective apiculate. *Ovary* long-stalked, puberulous, glabrescent to finally glabrous stipe 5—10 mm. *Pod* 2.5 by 1.8 by 0.7 cm.

Distribution: New Guinea.

Ecology: Rain forest, 0—900 m.

Field notes: Large buttresses, up to 2 m. Flowers white cream.

15. Maniltoa schefferi K. Sch. in K. Sch. & Hollr., Fl. Kais. Wilh. Land (1889) 101; Boerl., Handl. Fl. Ned. Ind. 1, 2 (1890) 680; Harms in E. & P., Nat. Pfl. Fam. Nachtr. 1

(1897) 194; in K. Sch. & Laut., Nachtr. Fl. Deutsch. Schutzgeb. Südsee (1905) 275; Bot. Jahrb. 55 (1917) 49. — *M. grandiflora* [*non* (A. Gray) Scheff.] Scheff., Ann. Jard. Bot. Btzg 1 (1876) 20, *quoad descriptio*; Boerl., Handl. Fl. Ned. Ind. 1, 2 (1890) 407; K. Sch. & Laut., Fl. Deutsch. Schutzgeb. Südsee (1900) 347. — *Pseudocynometra schefferi* O. Kuntze, Deutsch. Bot. Monatsschr. 21 (1903) 173. — Lectotype: *Teysmann s.n.*, Doré, NW. New Guinea (L).

M. hollrungii Harms, Notizbl. Berl.-Dahl. 3 (1902) 189; Bot. Jahrb. 55 (1917) 49. — *Pseudocynometra hollrungii* O. Kuntze, Deutsch. Bot. Monatsschr. 21 (1903) 173. — T.: *Hollrung 689* (holotype in B †, no isotypes known).

Tree, 5—40 m. *Leaves* 2—5-jugate; leaflets 7—20 by 3—10 cm, (ob)ovate, elliptic, (ob)ovate-oblong to oblong, (ob)ovate-lanceolate to lanceolate, acuminate, tip usually emarginate, midrib at 13—25 mm from the acroscopic margin; nerves 6—9 pairs; petiole 1.5—2.5 cm, puberulous, glabrescent; petiolules 2—10 mm, leaf-rachis 5—25 cm, both usually glabrous, sometimes puberulous. In the buds stipules of 25—35 by 1—2 mm were found, very early caducous, leaving no scars. A long hispid tendril prolonging the leaf-rachis is present right after the unfolding of the bud, but drops soon. *Rachis* 2—6 cm, puberulous, sometimes glabrescent. Bracts 0.5—5 cm, appressed-hairy, sometimes glabrescent. Bracteoles 5—15 mm. Pedicels 1.5—3 cm, pubescent, sometimes glabrescent. *Sepals* 6.5—18 mm, glabrous or hairy. *Petals* 8—11 mm (insufficiently known). *Stamens* 30—35; filaments up to 0.75 mm connate, 14—18 mm; connective apiculate. *Ovary* densely appressed-hairy or pubescent, glabrescent with maturity, or glabrous; stipe 2.5—5 mm; style 5—10 mm. *Pod* 2.5—3.5 by 1.5—2.5 by 0.3—1.5 cm.

Distribution: Celebes (known from 5 sterile collections), Moluccas (Morotai, Halmahera, Batjan, Ambon, Tanimbar Is), New Guinea (fairly common), Solomon Is. (Guadalcanal), Australia (N. Queensland, known from one sterile collection).

Ecology: Often near a river or along the seacoast, at 30—100 m.

Notes. M. schefferi is one of the two Papuan species that extends into the Pacific (viz. Solomons) and is the only representative of the genus in Australia.

Many specimens of *M. schefferi* were erroneously referred to *M. gemmipara*. For a discussion of that name see under *M. browneoides*.

M. hollrungii is not retained by me. The type is lost, and other specimens mentioned by Harms (1917) (*Ledermann 10747, 10858*) are probably also destroyed. Hence I know the species only from Harms' description, but this differs hardly from that of *M. schefferi*. Harms himself pointed out that *M. hollrungii* only differs from *M. schefferi* in the broader leaflets and thicker rachis. I cannot use these characters since they are too variable in this as in other species. K. Schumann & Lauterbach (l.c.) already considered a type specimen (*Hollrung 689*) to belong to *M. grandiflora* (*non* A. Gray) Scheff., which is *M. schefferi*.

The Teysmann collection with white flowers ('*flores alba*') from New Guinea belongs to *M. browneoides*.

DOUBTFUL SPECIES

Maniltoa peekelii Harms, Bot. Jahrb. 55 (1917) 50; Peekel, Illustr. Fl. Bismarck Arch. Naturfr. (1945) 703, t. I—IV, unpublished. — T.: *Peekel 841* (holotype in B †).

Tree, 20 m; vegetative parts glabrous. *Leaves* 2—3-jugate; petiole *c.* 1—2 cm, rachis 2—8 cm; leaflets (sub)sessile, inequilateral, obliquely obovate to oblong-obovate or oblong or ovate, short-acuminate (tip obtuse or slightly emarginate), 5—9 by 3.6 cm. Young *inflorescences* enclosed by brownish, rigid, somewhat silk-hairy, scarious-edged bracts

3—4 cm long. *Racemes* rather many-flowered; rachis sturdy, laxly pilose, 2—4 cm; pedicels laxly pilose, or in the upper part subglabrous to glabrous, 2—3 cm or longer. *Flowers* white-rosa. *Ovary* stipitate, (sub) glabrous.

Distribution: New Britain (Neu-Mecklenburg): Lemakot, Garamate, flat land behind beach, fl. July 1912 (*Peekel 841*).

Notes. Harms added that according to Peekel two other specimens belong to the same species, viz. *Peekel 787*, May 1911 (sterile), from Namatanai: leaflets with longer, more emarginate tip, 16—18 by 6—7 cm; and *Peekel 825*, Febr. 1912 (with fruit), from Lemakot in shore forest: leaves as type; leaf-buds 10—11 cm; lower bracts 0.5—2.5 cm, broad, upper ones narrow, 8—10 cm long, all caducous; pods flattened, obliquely ovoid, short-stiped, one edge rather straight, the other curved, red-brown, not verrucose (*'ohne Höcker'*), ± lepidote, 3—4 by 2—3 cm: pericarp thick; seed oblong, rather thick. Vern. *nubul* or *kapsil*.

Harms added that this species would be allied to *M. psilogyne* but differs by broader, larger leaflets, thicker rachis, and longer pedicels, and from *M. hollrungii* and *M. schefferi* by the glabrous ovary.

Neither Harms' description, nor Peekel's drawings give a clear picture of this species. Harms' description can be applied without any difficulty to *M. psilogyne*. Peekel's sterile specimen (no *787*) with leaflets of 16—18 cm belongs in my opinion to *M. schefferi*.

Further notes of Harms on no *825* are not of much help either, as neither pod nor buds furnish reliable characteristics. New flowering collections from the localities mentioned may shed light on the proper identity of *M. peekelii*.

3. KINGIODENDRON

Harms in E. & P., Nat. Pfl. Fam. Nachtr. 1 (1897) 194; Troup, Silvicult. Indian Trees 2 (1921) 361; Burtt, Kew Bull. (1936) 461; de Wit, Bull. Bot. Gard. Btzg III, 18 (1949) 211; A. C. Smith, J. Arn. Arb. 36 (1955) 279; Hutch., Gen. Flow. Pl. 1 (1964) 255. — **Fig. 7.**

Type species: *K. pinnatum* (Roxb. *ex* DC.) Harms.

Large, handsome, evergreen trees. *Leaves* uneven-pinnate; leaflets 3—7, alternate, largely equal-sided, with pellucid dots, glabrous; nerves 7—9 pairs, visible on both sides; petiolules swollen and with many annular grooves. Stipules very small, fugacious, leaving scars. *Inflorescence* an axillary panicle of racemes with a (very) short peduncle, branches rather lax-flowered, glabrous or hairy. Bracts minute, scale-like, persistent. Bracteoles (1—)2, minute, inserted on the short receptacle or at its base, sometimes one or both connate with the receptacle. Pedicels short. *Flowers* 1—2 mm. Disk distinct in young flowers, connate with the stipe of the ovary, becoming obsolete in the mature flower. *Sepals* 5, broadly ovate, convex, usually with pellucid dots, ciliate. *Petals* absent. *Stamens* 10, infolded in bud, hairy at base, in anthesis exserted; anthers medi-dorsifix, lengthwise dehiscent, introrse. *Ovary* seemingly sessile in young flowers, later on a short stipe which is in mature flowers sometimes demarcated against the ovary by a unilateral constriction, hairy, 1-ovuled; style glabrous or hairy. *Pod* variable; globular, flattened oval, or ellipsoid and flattened outside the seed area; venation, if present, lengthwise prominent on the hard to woody pericarp. *Seed* ellipsoid, the cotyledons strongly folded. Germination hypogeal. (Troup, *vide infra* fig. 142, and van Heel, Proc. K. Ned. Akad. Wet. C, 73, 1970).

Distribution: India, Malesia (Philippines, Moluccas, New Guinea), and the Pacific (Solomon Islands, Fiji).

Ecology: Evergreen forests, at low and medium altitudes.

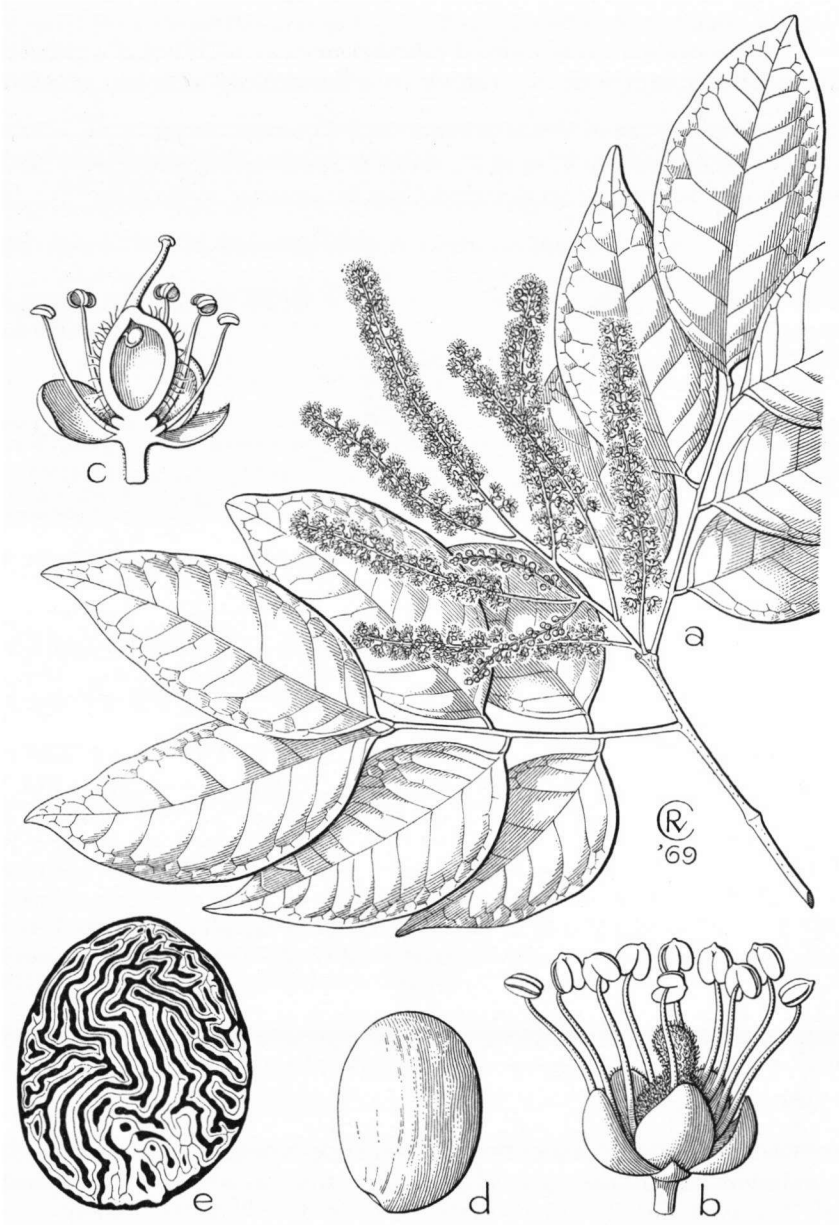

Fig. 7. *Kingiodendror*. — a. *K. pinnatum* (Roxb. *ex* DC.) Harms, habit, × 2/3. — b. *K. platycarpum* Burtt, young flower, × 8. — c. *K. alternifolium* (Elm.) Merr. & Rolfe, sectioned flower beyond anthesis, × 8; d. pod, × 2/3; e. longitudinal section of seed, nat. size (a. Hort. Calc. Herb. Hooker (1867), b. *Bourdillon s.n.* (1894), c. *Brass 8101*, d. *Merrill 2761*, e. *Rosenbluth FB 12668*).

Field notes: Upon cutting a *Kingiodendron* tree the wood produces a white, cream-yellow, or green clear exudate. Logs float.

Notes. In the herbarium sterile material, and sometimes even flowering material has been confused with that of the genus *Crudia*. In a sterile state *Kingiodendron* can be distinguished from *Crudia* by the characteristic pellucid-dotted leaves, even though some specimens show only a few dots. The fruit of *Crudia* is a dehiscing pod and the embryo has two large, plano-convex cotyledons. Flowers of *Crudia* are arranged in simple racemes, are 4-merous, and the anthers have a distinct appendage to the connective.

KEY TO THE SPECIES

1. Inflorescence glabrous, the racemes with a very tender, more or less tortuous, at least not straight rachis. Bracteoles triangular, glabrous. *Solomons*. . . . . **4. K. micranthum**
1. Inflorescence hairy, at least in the lower part. Bracteoles broadly ovate, ciliate.
   2. Ovary hairy, after anthesis style glabrous, in bud short and obliquely appressed to the ovary, in a later stage enlarging (1.5—2 mm) and becoming erect, stigma distinct (fig. 7c). Pod ellipsoid, 3.7—4.4 by 3.1—4 by 2.1—3.5 cm. *Philippines, New Guinea, Solomons*. . . **2. K. alternifolium**
   2. Ovary woolly, style very short, properly an extension only of the apex of the ovary and equally hairy (fig. 7b).
      3. Pod broad-ellipsoid, *c.* 3—3.5 by 2—3 by 0.6—0.9 cm. Petiolules almost of the same thickness and colour as the rachis, not darker-coloured. *Western Peninsular India*. . . . **1. K. pinnatum**
      3. Pod flattened, oblong, *c.* 7—8 by 4—4.5 by 1 cm. Petiolules thicker and mostly darker coloured than the rachis. *New Guinea, Solomons, Fiji* . . . . . **3. K. platycarpum**

1. Kingiodendron pinnatum (Roxb. *ex* DC.) Harms in E. & P., Nat. Pfl. Fam. Nachtr. 1 (1897) 194; Gamble, Fl. Pres. Madras 3 (1919) 412. — *Hardwickia pinnata* Roxb. [Hort. Beng. (1814) 33, *nomen nudum*] ex DC., Prod. 2 (1825) 487; Fl. Ind. ed. Carey 2 (1832) 425; Miq., Fl. Ind. Bat. 1, 1 (1855) 80; Bedd., Fl. Sylv. (1872) 255, t. 255; Baker in Hook. *f.*, Fl. Br. Ind. 2 (1878) 270; Taubert in E. & P., Nat. Pfl. Fam. 3, 3 (1892) 130; Troup, Silvicult. Indian Trees 2 (1921) 361, fig. 142. — T.: *Roxburgh s.n.*, Ind. Or. (holotype in ? CAL, no isotypes seen; not in K, cf. Sealy, Kew Bull. 1956, 345). — **Fig. 7a.**

Tree up to 30 m by 1.3 m diameter. Leaflets 3—5(—6—7), 4.5—9 by 1.7—4.5 cm, (ob)ovate-elliptic, elliptic, quite often falcoid, apex acute, acuminate to cuspidate, base rounded to acute; rachis 6.5—10 cm, petiolules 3—6 mm, 0.75—1.5 mm thick, not darker coloured than the rachis. *Inflorescence*: racemes 2.5—5.5 cm, pubescent, glabrescent in the upper part. Bracteoles broadly ovate, ciliate. Pedicels comparatively sturdy, 0.5—1.5 mm, pubescent. *Ovary* woolly; style very short, properly an extension of the apex of the ovary and equally hairy. *Pod* ellipsoid, *c.* 3—3.5 by 2—3 by 0.6—0.9 cm, ± flattened outside the seed area, especially towards the pedicel; stipe 0—1 mm.

Distribution: India (Western Ghats from South Canara to Travancore).

Ecology: Evergreen forests, 300—1000 m. Flowering in Jan.-Febr., the pods ripening in May—June.

Field notes: Wood moderately hard, dark red or reddish brown.

Note. 'Germination: hypogeous. The pod dehisces slightly at the apex, enabling the radicle and plumule to emerge; these elongate rapidly, while the cotyledons remain within the pod' (Troup, l.c. 361). In Troup's figure the leaves of seedlings are 2-foliolate.

2. Kingiodendron alternifolium (Elm.) Merr. & Rolfe, Philip. J. Sc. 4 (1909) Bot. 267; Merr., Philip. J. Sc. 5 (1910) Bot. 38; En. Philip. 2 (1923) 255; Merr. & Perry, J. Arn. Arb. 23 (1942) 398; Walker, For. Brit. Solom. Isl. Prot. (1948) 134. — *Cynometra alternifolia* Elm., Leafl. Philip. Bot. 1 (1907) 223. — *Hardwickia alternifolia* Elm., Leafl.

Philip. Bot. 1 (1908) 362. — T.: *Elmer 7356* (Merr. & Rolfe: '*7366*') (holotype †, isotype seen from BO). — **Fig. 7c—e.**

Tree, 15—30 m. *Leaflets* 3—7, 11—17 by 1.5—6.5 cm, (ob)ovate-elliptic, elliptic, (ob)ovate-oblong to oblong, more seldom long-triangular, quite often falcoid, apex acute, acuminate or cuspidate; base rounded to acute; rachis 8—14 cm; petiolules 4—7 mm long, 0.75—2.75 mm thick, mostly darker coloured than the rachis. *Inflorescence*: racemes 3.5—12 cm, pubescent, glabrescent, rather sturdy and straight. Bracteoles broadly ovate, ciliate, attached on the pedicel, appressed to the sepals, or one or both attached on the short receptacle, or one absent. Pedicels comparatively sturdy, 0.5—1.5 mm, pubescent, sometimes glabrescent. *Ovary* hairy, after anthesis glabrous, the style glabrous, in bud short and obliquely appressed to the apex of the ovary, in a later stage style enlarging (1.5—2 mm) and erect, stigma distinct (fig. 7c). *Pod* globular, sometimes ± flattened outside the seed area, especially towards the pedicel, ultimate sizes 3.7—4.4 by 3.1—4 by 2.1—3.5 cm with a pericarp 2—4 mm thick; stipe 0—1.5 mm.

Distribution: Philippines (Luzon, Masbate, Negros, Leyte, Samar), New Guinea, and the Solomon Islands (Bougainville, Choiseul).

Ecology: In forests, up to 800 m altitude.

Field notes: Bark smooth, grey to greyish brown. Sapwood white to pale brown. Sap reported to be dark red or green.

Notes. In sterile state this species cannot be distinguished from *K. platycarpum.*

Ponce FB 27821, Leyte, Philippines, has a flat pod, but this seems surely immature.

3. Kingiodendron platycarpum Burtt, Kew Bull. (1936) 460. — T.: *Horne 483* (holotype in K, isotype in BO). — **Fig. 7b.**

Tree, 5—30 m. *Leaflets* 3—5(—6—7), 6.5—26 by 4—8.5 cm, (ob)ovate-elliptic, elliptic, (ob)ovate-oblong to oblong, apex obtuse, acute, or acuminate, base rounded to acute; rachis 4—25 cm; petiolules 3—6 mm long, 1.5—2.5 mm thick, mostly darker coloured than the rachis. *Inflorescence*: racemes 3—15 cm, pubescent, glabrescent. Bracteoles broadly ovate, ciliate. Pedicels comparatively sturdy, 0.5—1.5 mm, pubescent. *Ovary* woolly; style very short, properly an extension of the apex of the ovary and equally hairy. *Pod* flattened, oblong, often cordate at base, with lengthwise venation, at maturity veins standing out as thick cords, pod then thick though still flat, and completely lignified, when fully mature 7—8 by 4—4.5 cm, *c.* 1 cm thick; pericarp very thick.

Distribution: New Guinea, Solomon Is. (Bougainville, S. Ysabel, Guadalcanal), Fiji (Viti Levu, Serua).

Ecology: Primary forests, 70—550 m.

Field notes: Bark grey, brown, or black. Sapwood white or cream. Heartwood pinkish to red. Sap light green or dark olive.

Note. In sterile state undistinguishable from *K. alternifolium.*

4. Kingiodendron micranthum Burtt, Kew Bull. (1936) 460. — Lectotype: *Waterhouse B 812* (holotype in K, isotypes seen from A, BISH, BRI, NY).

Tree, 18—21 m. *Leaflets* 3—4, 10—16 by 4.5—9 cm, (ob)ovate-elliptic to elliptic, sometimes ± falcoid; apex acute to acuminate, base attenuate-acute; rachis 4.5—10 cm; petiolules 7—8 mm. *Inflorescences* glabrous: *racemes c.* 10 cm long, slender, not straight. Bracteoles triangular, glabrous, attached on the short receptacle. Pedicels tender, 1—1.25 mm. *Ovary* glabrous except for a few woolly hairs near the stigma and at the base; style very short, properly an extension of the apex of the ovary. *Pod* unknown.

Distribution: Solomon Is. (Bougainville: Siwai). Known only from the type collection.

Note. According to Burtt, l.c. *Waterhouse B 812* is the same collection as *Waterhouse Y 172.*

4. HARDWICKIA

Roxb., Pl. Coromandel 3 (1811) 6, t. 209.

Deciduous tree, rarely nearly evergreen. *Leaves* 2-foliolate; leaflets sessile, unequal-sided, without pellucid dots, almost curvinerved, by 4—5 nerves in the broad basiscopic half. Stipules scale-like, at their base and round their insertion with a few, subulate, trichome-like enatia. *Inflorescence* a lax, axillary or terminal panicle of racemes. Bracts with enatia similar to those found with the stipules. Bracteoles absent. *Flowers* with a shallow receptacle. *Sepals* 5, with glands. *Petals* and disk absent. *Stamens* 10(—11), infolded in bud; anthers dorsifix, warty. *Ovary* sessile, with glands; ovule 1; stigma peltate. *Pod* flat and samaroid, oblong-lanceolate, parallel and lengthwise veined. *Seed* apical, exalbuminous, flat. Germination: epigeal (Troup vide infra, fig. 141).

Distribution: Monotypic, restricted to western India.

1. **Hardwickia binata** Roxb., Pl. Coromandel 3 (1811) 6, t. 209; Hort. Beng. (1814) 33; DC., Prod. 2 (1825) 487; Roxb., Fl. Ind. ed. Carey 2 (1832) 423; Miq., Fl. Ind. Bat. 1, 1 (1855) 79; Dalz. & Gibs., Bomb. Fl. (1861) 83; Bedd., Fl. Sylv. (1869) 26, t. 26; Bak. in Hook. *f.*, Fl. Br. Ind. 2 (1878) 270; Taubert in E. & P., Nat. Pfl. Fam. 3, 3 (1892) 130; Harms in E. & P., ibid. Nachtr. 1 (1897) 194; Gamble, Fl. Pres. Madras 3 (1919) 412; Troup, Silvicult. Indian Trees 2 (1921) 340—361. — T.: Roxburgh, Pl. Coromandel 3 (1819) t. 209.

H. trapesiformis R. Grah. in Wall., Cat. (1831/2) 5809, *nomen.*

A moderate-sized to large tree, 18—36 by 0.3—1.5 m diameter, glabrous, leafless for a short time or nearly evergreen, with graceful, drooping, slender branchlets and greyish green, coriaceous, bifoliolate leaves. *Leaflets* 2.5—5.2 by 0.7—3.3 cm, semi-orbicular or ovate, asymmetric, apex rounded, base obtuse; midrib nearer to the acroscopic margin, the 4—5 nerves in the broad basiscopic half flabellately arranged from the very base. New leaves develop in limp tassels, tinged with red. Stipules very small. *Inflorescence*: racemes 3—5 cm. Bracts minute, scale-like. Pedicels 1—1.5 mm. *Flowers* 2—4 mm, pale yellowish green. Receptacle 0.5—0.75 mm wide. *Sepals c.* 3.5 mm long, broadly ovate, with glands. *Stamens*: anthers 1.5 mm long, with a warty appearance caused by the epidermal cells which fit together like jigsaw pieces and which carry a small pustule each; filaments 4 mm long, very thin as compared with the size of the anthers. *Ovary* glabrous, 2.5 mm by 0.75 mm; style 2.5 mm long; stigma 1 mm wide. *Pod* coriaceous 5—7.5 by 1—1.5 cm. *Seed* averaging 1.5 by 0.75 cm, subreniform, pointed at one end and rounded at the other, with a fairly hard testa (known to me from one collection only: *Wight 874*).

Distribution: According to Troup (l.c. 341) this species occurs in isolated blocks and patches, varying in extent, in the drier parts of the Indian Peninsula, extending as far north as the Banda District, United Provinces. In Madras it occupies well-defined areas. In Bombay it is fairly common in certain parts. It occurs locally in the Central Provinces and Mysore. The remarkable local distribution of the species, which is not altogether accounted for by soil and climate, is somewhat puzzling and has not yet been satisfactorily explained.

Ecology: H. binata thrives, according to Troup (l.c. 343), in a climate characterized by a long period of drought, scant to moderate rainfall, and intense heat during the hot season.

The tree is leafless or nearly so for a short time towards the end of the cold season; in the hot season the trees are in leaf, and their feathery foliage is conspicuous when most other species are leafless. The dimensions of the tree vary greatly with locality. On trap formations, characterized by a shallow and somewhat stiff soil, it rarely attains a height of 20 m and often does not reach a height of more than 10—13 m and a maximum girth of 1 m. On deeper sandy soil overlying sandstone, granite, and other formations it may attain a height of 25—35 m and a girth of 2—3 m.

Uses. The wood is perhaps the hardest and heaviest in India, the specific gravity being c. 1.4. It is very durable, used for bridge and house construction, agricultural implements, carts, wheelwork, etc.; the bast yields a strong fibre largely used for ropes; the branches are much lopped for manure and fodder. Because of this, almost everywhere the trees have been mutilated, and in most localities the larger trees are old pollards. Large trees are frequently hollow, owing, it is generally held, to former damage by fire and mutilation, and possibly also to the repeated dying back in the seedling stage which produces a centre of infection for subsequent decay.

INDEX

New names are in **bold type**, synonyms in *italics*. Numbers refer to number of genus and accepted species or variety. 'Excl.' refers to names exluded from the genus, 'Doubtful' refers to names doubtful in a genus. Both categories are entered at the end of the genus concerned.