BLUMEA 24 (1978) 395—403

SYSTEMATIC NOTES ON THE SAPINDACEAE-NEPHELIEAE

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SUMMARY

1. The interrelations between the genera together constituting the *Dimocarpus* group in the tribe *Nephelieae* are represented in a scheme. In this scheme are added the main characters that are thought to be of phylogenetic importance.

2. A neotype is proposed for *Cubilia cubili* (Blanco) Adelb., the single species of its genus. To its distribution can be added the eastern half of Borneo, incl. also the Island of P. Laut. Mention is made of a geographic clinal variation in a few macromorphological characters.

3. *Litchi* is considered to comprise only one species, *L. chinensis* Sonn., which is subdivided into three subspecies: subsp. *chinensis*, the commonly grown form, cultivated for thousands of years already, apparently adapted (by nature or partly by selection by man?) to a monsoon climate, if actually wild probably originating from northern Indo China; subsp. *philippinensis* (Radlk.) Leenh., a wild form closely related to subsp. *chinensis*, known from the Philippines and New Guinea; and subsp. *javensis* Leenh., strikingly different from both other forms, known only as a cultivated fruit tree from southern Indo China and Java, apparently adapted to an everwet tropical climate. For subsp. *philippinensis* a lectotype is proposed.

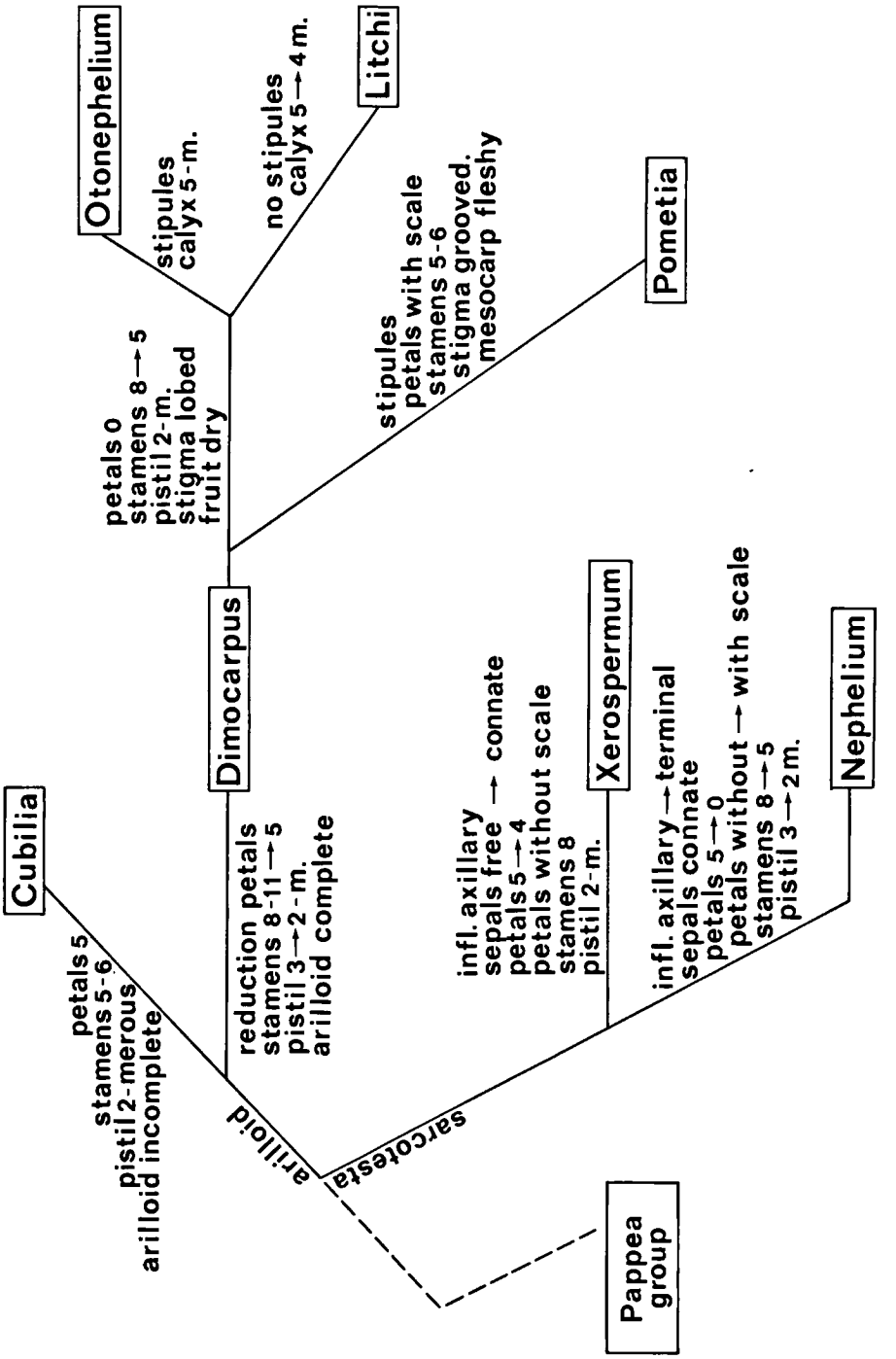
4. *Pometia*, though macromorphologically distinctly derived and, moreover, palynologically apparently very exclusive in the alliance under discussion, seems clearly connected with *Dimocarpus*, the central genus in the group.

I. INTRODUCTION

In an earlier publication (J. Muller & P. W. Leenhouts, 1976: 427) a brief sketch was given of the phylogenetic relationships within the *Sapindaceae-Nephelieae*, based upon macromorphological characters. To this were added some notes on the pollen morphology of the tribe. A tentative division was made into two groups, the *Dimocarpus* group and the *Pappea* group. The publication of a more detailed study of the pollen morphology of several genera out of the *Dimocarpus* group (van den Berg, 1978) made a more extensive paper on the relationships between these genera desirable. Moreover, van den Berg referred in the systematic part of his paper to unpublished material, which, accordingly, should be made available.

II. THE INTERRELATIONS BETWEEN THE GENERA OF THE DIMOCARPUS GROUP

The supposed interrelations between the seven genera, together forming the *Dimocarpus* group, are summarized in the accompanying scheme. Phylogenetically, this scheme schould be read from left to right. At the bifurcations, the characters on which these are based have been mentioned. The main phylogenetic trends in macromorphology seem to be: 1) development of stipules (*Oton-*


Cubilia
petals 5
stamens 5-6
pistil 2-merous
arilloid incomplete
arilloid
reduction petals
stamens 8-11→5
pistil 3→2-m.
arilloid complete
Dimocarpus
petals 0
stamens 8→5
pistil 2-m.
stigma lobed
fruit dry
Otonephelium
stipules
calyx 5-m.
Litchi
no stipules
calyx 5→4 m.
stipules
petals with scale
stamens 5-6
stigma grooved.
mesocarp fleshy
Pometia
sarcotesta
infl. axillary
sepals free → connate
petals 5→4
petals without scale
stamens 8
pistil 2-m.
Xerospermum
infl. axillary→terminal
sepals connate
petals 5→0
petals without→with scale
stamens 8→5
pistil 3→2 m.
Nephelium
Pappea group

ephelium, *Pometia*); 2) coalescence of the calyx (all but part of *Xerospermum*); 3) reduction of the calyx to 4-merous (*Litchi*, *Xerospermum*, *Nephelium*, all partly); 4) complete suppression of the petals (*Pometia* rarely, *Nephelium* partly, *Otonephelium* and *Litchi* completely); 5) development of a scale on the inside of the petals (*Nephelium* rarely, *Pometia* mostly); 6) reduction of the number of stamens to 5 (*Otonephelium*, *Litchi*, and *Nephelium* partly, *Cubilia* and *Pometia* completely); 7) reduction of the pistil to 2-merous (rarely still 3-merous in *Dimocarpus*, *Pometia*, and *Nephelium*, possibly also in *Litchi*); 8) development of a grooved stigma (*Pometia*, *Xerospermum*, *Nephelium*); 9) shift of the attractive part of the fruit from a sarcotesta (*Xerospermum*, *Nephelium*) via an arilloid (all other genera) to the mesocarp (*Pometia*).

Otonephelium, *Litchi*, and *Pometia* are all clearly allied with *Dimocarpus*, but in some characters more derived. The position of *Cubilia* is a bit uncertain. It seems distinctly to belong in the same alliance, is as a whole slightly more derived than *Dimocarpus*, but shows also some primitive characters. Therefore, I included it in my scheme as a basal offshoot before *Dimocarpus*, even though this placed it too much to the left. *Nephelium* and *Xerospermum* are mutually closely allied, just sufficiently different to be kept separate. In some characters, *Xerospermum* seems the more primitive of the two. The alliance between these two and the other five genera seems less close.

It is interesting to compare this scheme with the one given by van den Berg (1978) on pollen morphological grounds. As a whole the agreement is reasonably good, even with the inclusion of *Cubilia*. *Xerospermum* and *Nephelium* come closer to *Dimocarpus* than in my scheme; *Pometia*, as the only exception, takes a much more isolated, strongly derived position.

A few additional notes on *Cubilia*, *Litchi*, and *Pometia* will be given in the following chapters; for *Dimocarpus* may be referred to Leenhouts (1971, 1974), for *Otonephelium* also to Leenhouts (1971). The genera *Xerospermum* and *Nephelium* are still under revision and will be published within a few years, I hope.

III. NOTES ON CUBILIA

CUBILIA

Cubilia Bl., Rumphia 3 (1847—49) 100; Radlk., Pfl. R. Heft 98 (1932) 921—924. — Lectotype (Index Nom. Gener.): *C. blancoi* Bl. (= *C. cubili* Adelb.).

For the description may be referred to Radlkofer, l.c., to which only can be added that the number of pairs of leaflets to the leaf may vary from 3 to 7. I also agree with Radlkofer that the genus is monotypic. The specific epithet used by him has to be corrected, however, and the nomenclature oughts to be as follows:

Cubilia cubili (Blanco) Adelb.

Euphoria cubili Blanco, Fl. Filip. (1837) 287, *nom. illeg.* (the generic name *Euphoria* Juss., 1789, is illegitimate, being a superfluous new name for *Litchi* Sonn., 1782). — *C. blancoi* Bl., Rumphia 3 (1847—49) 101, *nom. illeg.* (the epithet *cubili* schould have been used); Radlk., Pfl. R. Heft 98 (1932) 923, f. 22. — *C. cubili* Adelb., Blumea 6 (1948) 325. — Neotype (here proposed): *Merrill Sp. Blancoanae 705*, Philippines, Luzon, Bulacan Prov., Angat, -12-1914, fl. (L; iso in BO, P).

[*Boa massy* Rumph., Herb. Amb. Auct. (1755) 5, t. 3. —] *C. rumphii* Bl., Rumphia 3 (1847—49) 100. — Type: Rumphius' description and figure.

Distribution: To the distribution given by Radlkofer, l.c., can be added the eastern half of Borneo, incl. also P. Laut.

BORNEO. Southeast Kalimantan: Berouw, *bb 18974*, *bb 19170* (both BO, L). — East Kalimantan: *Kostermans 7011*, Loa Haur, W. of Samarinda, near Liut (BO, L, P), *12670A*, W. Kutei, Kelindjau R. near Melan (A, BO, CANB, K, KEP, L, NY, P, SING), *13716*, Berouw, foot of Mt. Ilas Bungaan (A, BO, CANB, K, L, P, SING), *13874*, ditto (A, BM, BO, BRI, CAL, CANB, K, L, LAE, NY, P, PNH, SING). — Sabah: *A. Buntar SAN 27366*, Tenom Dist., Paal, Sapong (L); *J. Singh SAN 28336*, Ranau Dist., path to Hot Spring (K, L); *A. Talip SAN 54920*, Lahad Datu Dist., mile $2^1/_2$ Silam (K, L). — P. Laut: *L. Verhoef bb 13251*, near Sei Paring (BO).

Variability: Though as a whole the species is rather uniform, it shows a clinal variation in a few characters. In Borneo the leaves are 3—5-jugate, glands on the lower side of the leaflets are relatively rare, and the apex of the leaflets is blunt or blunt-acuminate; in the Philippines the leaves are sometimes up to 6-jugate, glands are always present, and the apex is mostly acute-acuminate; in Celebes the leaves are 5–, 6–, or sometimes 7-jugate, glands are always present, though in some specimens rare, and the apex is sometimes acute-acuminate. (From the Moluccas only one collection was seen, viz. *bb 28852* from the Sula Is., and this material was too scanty to include it in this comparison.)

IV. NOTES ON LITCHI

LITCHI

Litchi Sonn., Voy. Ind. Or. Chine 2 (1782) 230, t. 129; Radlk., Pfl. R. Heft 98 (1932) 914—921. — *Scytalia* Gaertn., Fruct. 1 (1788) 197, *nom. illeg.* (ICBN 1972, Art. 63). — *Euphoria* Comm. *ex* Juss., Gen. (1789) 247, *nom. illeg.* (ICBN 1972, Art. 63). — Type: *L. chinensis* Sonn.

For further synonymy, literature, and description may be referred to Radlk. (l.c.). Contrary to that author, who distinguished two species, each subdivided into two forms, I am of the opinion that the genus comprises only a single species, which can be divided into three subspecies. The argumentation will be given in the notes to the respective subspecies.

Litchi chinensis Sonn.

L. chinensis Sonn., Voy. Ind. Or. Chine 2 (1782) 230, t. 129; Radlk., Pfl. R. Heft 98 (1932) 917, f. 21. — Type: *Sonnerat 1062* (G, P. *n.v.*).

For further synonymy and literature and for a complete description may be referred to Radlk. (l.c.).

KEY TO THE SUBSPECIES

1a. Inflorescences with few spike-like branches, flowers in sessile clusters. Twigs thick, to 7 mm ∅ . . . . . **c.** subsp. **javensis**

b. Inflorescences widely branched, flowers in lax cymules. Twigs slender, no more than 3.5 mm ∅ 2

2a. Leaves 1- or 2-, rarely some 3-jugate. Stamens mostly 7, rarely 6. Fruits with up to 3 mm high, acute, pyramidal warts. . . **b.** subsp. **philippinensis**

b. Leaves 2—4-jugate. Stamens mostly 6, exceptionally up to 10. Fruits nearly smooth or rarely with up to 1 mm high, acute, pyramidal warts
a. subsp. **chinensis**

a. subsp. **chinensis**

Twigs 2.5—3.5 mm ∅, greyish-brown, when young covered with appressed, short, centrally attached, brown hairs, early glabrescent. Axillary buds 1 per leaf axil. *Leaves* 2—4- (exceptionally 5-)jugate; petiole 0.75—1 mm ∅; rachis above flat or grooved and with a fine central rib (lower interjugae) to carinate (upper ones), beneath rounded; petiolules 3—8 mm long. *Leaflets* (3—)8—11(—16) × 1.75—4 cm, ratio *c.* 2—4, widest in, exceptionally in relatively broad leaflets distinctly above the middle, chartaceous to coriaceous, mostly rather stiff; base if oblique broadest at acroscopic side; midrib beneath prominent and rounded; nerves 0.5—1 cm distant along midrib, angle to midrib *c.* 50—70°, variable; veinlets clear. *Inflorescences c.* 15—30 cm long with few long erecto-patent branches, these mainly in their upper half sparsely rebranched, the cymules erecto-patent, up to 5 mm long stalked, lax, *c.* 5—12-flowered; pedicels slender, 2—3(—4) mm; bracts 0.5—2 mm long. *Calyx* 4-merous (sometimes reported as being exceptionally 5-merous), *c.* 1.5 × 2 mm. *Disk* variably hairy to glabrous. *Stamens* 6(—10); filament 2.5 mm long, rather densely hairy all over. *Ovary* 2 × 5 mm; style 1 mm. *Fruit c.* 3.5 × 3 cm, bright red to purplish when ripe, nearly smooth or scaly to densely set with flat, conical, acute warts.

N o t e s. This is the commonly cultivated Chinese fruit tree *lychee*. Like so many plants cultivated for a long time, its taxonomy, phytogeography, and history put questions that are difficult to answer. The written history of *lychee* goes back to at least *c.* 100 B.C. when the emperor Wu Ti (140—86 B.C.) of the Chinese Han Dynasty in vain tried to introduce it from northern Indo China into Central China (his capital Changan in the Province of Shensi). In writings from the 8th century it was mentioned as being commonly cultivated in many varieties in the southeastern parts of China. Until the end of the 18th century culture concentrated in the coastal districts of the provinces of Kwangtung and Fukien, apparently at some time also in some more of the southern provinces, especially Yunnan. Outside of China proper there was probably *lychee* culture in the northern part of Indo China. More recently, *lychee* culture spread to several countries on the fringe of the tropics and in the subtropics, like northern India, South Africa, Florida, and Hawaii. For more detailed information on the history and culture may be referred to Groff (1921).

Notwithstanding the many races in cultivation, the material as a whole, whether from cultivated trees or of 'wild' origin, makes a relatively uniform impression to the taxonomist. The main variation is in the shape and size of the fruit, its prickles, the size of the seed, and of course the taste of the 'aril', characters typical for the races of a fruit tree but taxonomically usually not of much weight. In China, the races are arranged in two groups, the '*water lychee*' and the '*mountain lychee*'. The former comprises the best varieties, is cultivated in the lowlands, and has the fruits mostly nearly smooth. The '*mountain lychee*' is used as a stock, is as a fruit tree grown in hilly regions, and bears smaller and more prickly fruits. I have the impression that the latter comes nearer to the wild form.

With these common fruit trees, the seeds of which are thrown away and germinate easily, it is always difficult to assess how 'wild' wild growing specimens are. Conclusions regarding the original distribution of the wild form can better be derived from other sources. Very probably, the fairly restricted area in southeastern China where the *lychee* has been cultivated for such a long time must either include its original area of distribution, or border on it. The culture of *lychee* in China is restricted to the north by frost and drought, so it is grown as far north as climatologically possible, doubtless farther north than natural. On the other hand, culture has been tried in vain in the everwet tropics (Malaya) 'where it grows well but seldom flowers and still more rarely fruits' (Corner, 1940: 592). So it apparently needs a monsoon climate with a drier and cooler season. I believe that all these facts point to northern Indo China as the most probable area of its original distribution, well in accordance with the history of Emperor Wu Ti referred to above and also with Poilane (1967) who mentioned it as fairly commonly wild growing in N. Vietnam and Cambodia.

Regarding the morphological characters of the wild *lychee*, selection has been mainly on the fruit and especially on the 'aril'. Consequently, really wild *lychee* probably has a thinner aril than the cultivated one, possibly protected by a more spiny skin. This increases the resemblance with subsp. *philippinensis*, which is not cultivated and comes from everwet tropical regions, so it can hardly be an escape from old cultivation.

b. subsp. **philippinensis** (Radlk.) Leenh., **nov. stat.**

Euphoria didyma Blanco, Fl. Filip. (1837) 288, *nom. illeg.* (*Euphoria* Juss., 1789, is a superfluous new name for *Litchi* Sonn., 1782). — *Nephelium didymum* Craib, Fl. Siam. En. 1 (1926) 329, excl specim. — Neotype (here proposed): *M. Ramos BS 17429*, Philippines, Samar, March-April 1904, fl. (L; iso in P).

L. philippinensis Radlk. [*ex* Whitford, Philip. J. Sc. 1 (1906) 637, 639, 645, 647, *nom. nud.*; in E. & P., Nat. Pfl. Fam. Nachtr. 3 (1907) 204, *nom. nud.*] Philip. J. Sc. 8, Bot. (1914) 458; Pfl. R. Heft 98 (1932) 915. — [*L. philippinensis* Radlk. f. *genuina* Radlk., Philip. J. Sc. 8. Bot. (1914) 459, *nom. inval.* (ICBN, Art. 24). —] *L. chinensis* Sonn. subsp. *philippinensis* Leenh., *nov. stat.* — Lectotype (here proposed): *W. M. Maule FB 2995*, Philippines, Luzon, Prov. Zambaes, Lubic, –4–1905, fr. (M; iso in BO, L).

L. philippinensis Radlk. f. *mindanaensis* Radlk., Philip. J. Sc. 8, Bot. (1914) 459. — Type: *A. D. E. Elmer 13270*, Philippines, Mindanao, Prov. of Agusan, Mt. Urdaneta, Cabadbaran, –7–1912, fr. (M, *n.v.*; iso in BO, FI, L, P, U).

Twigs 1.5—3 mm ∅, (yellowish- to silvery-)grey, glabrous. Axillary buds 1 per leaf axil. *Leaves* 1—3-, mostly 2-jugate; petiole *c.* 1 mm ∅; rachis terete or above slightly flattened and carinate; petiolules 4—10 mm long. Leaflets (7—)8—11(—14) × 2.75—4.5(—8) cm, ratio *c.* 2.5—3, widest about or slightly below the middle, stiff-coriaceous; base if oblique broadest at basiscopic side; midrib beneath prominent and rounded; nerves 0.75—1.5 cm distant along the midrib, angle to midrib *c.* 60—85°; veinlets above invisible, beneath inconspicuous to clear (mainly as the surface over the veins and veinlets is not dull but sometimes even shining; see, however, f. *mindanaensis*). *Inflorescences* 6—14 cm long, often tufted (terminal one with 2 slightly smaller ones at the same level from the upper leaf axils, axillary ones with up to 4 smaller ones or with 2 strong branches from the base), branches few, (erecto-)patent, sparsely rebranched, with up to 5 mm long stalked, lax, *c.* 5—15-flowered cymules; pedicels very slender, 2—5 mm, in ♀ flowers thickening short after fertilization; bracts 0.5—

1 mm long. *Calyx* 4- or 5-merous, 1.75—2 × 2—3 mm. *Disk* hairy. *Stamens* (6 or) 7; filament 2—4 mm long, densely hairy all over. *Ovary* 1 × 3.5 mm; style 1 mm. *Fruit* 2.5—3 × 2—2.5 cm, densely set with acute pyramidal warts about 4 mm ∅ and *c.* 3 mm high.

Distribution: Up till the present only known from the Philippines (Luzon, Sibuyan, Samar, Mindanao). To this a very peculiar and still unexplained addition can be made: a collection made by *R. D. Hoogland* (*nr. 3684*) in SE. New Guinea (Northern Div., near Oitatandi village, 19–8–1953, at 25 m alt. in partly felled rain forest, known by the vernacular name of *hamboiina*, the wood used for housepoles; present in CANB, L). As the present subspecies is not cultivated, and as the fruits are not eaten in the Philippines as far as known, introduction by man seems improbable. But I am hesitating to accept this as part of the original area of distribution on the basis of one, moreover sterile, specimen.

Notes. It is a bit astonishing that Radlkofer separated the present taxon on a specific level from *L. chinensis*. The main differentiating character he gives is in the arilloid, edible and completely enveloping the seed in *L. chinensis*, not edible and only partly enveloping the seed in *L. philippinensis*. I have dissected several fruits of subsp. *chinensis* in different states of maturity and it appeared that the arilloid grows out very late during the maturation of the fruit, just what I have found in several other *Sapindaceae*. It is difficult to tell whether a dried fruit in the herbarium is really fully mature, and Radlkofer's statement regarding *L. philippinensis* was based upon only two collections said to be mature. In my opinion he overrated this character, if it is correctly observed at all. The further differences given by him are in the number of pairs of leaflets, in the shape of the leaflets, and in the shape and size of the spines on the fruit. These characters are partly grading, and seem to me not of great importance. I have the impression that Radlkofer insufficiently realized that he compared a wild form with one that he knew mainly from cultivation, for a few thousand years shaped by man, forced mainly in one direction, and that is just the point where he differentiated between his two species. His overrating of this 'aril' character is also clear from his treatment of the few specimens from Java, included by him as a forma under *L. chinensis*, whereas the differences in other characters are so conspicuous that I even hesitated to keep them as a separate subspecies on the same level as the other two; if it was a wild form I should probably have given it specific rank.

The above description was exclusively based upon f. *genuina* Radlk. The only collection known from Mindanao, the type of f. *mindanaensis*, differs in the following few characters: Twigs 3—4 mm ∅. Leaves 1- or 2-jugate; petiole 1—2 mm ∅; ratio of leaflets 2—2.5, veins and veinlets beneath hardly visible as the whole surface is dull-papillose. As only this one specimen is known, as compared with only 8 specimens of the typical form, it is undesirable to decide on the, probably low, taxonomic status of this form.

c. subsp. **javensis** Leenh., **nov. stat.**

Euphoria lit-chi Desfont. var. *undulata* Bl., Bijdr. (1825) 233, *nom. illeg.* (*Euphoria* is illegitimate, see above). — Type: *Blume s.n.*, Java, young fr. (L. sheet nr. 908.270—288).

L. chinensis Sonn. f. *glomeriflora* Radlk., Pfl. R. Heft 98 (1932) 919. — *L. chinensis* Sonn. subsp. *javensis* Leenh., *nov. stat.* — Lectotype: *Blume s.n.*, Java, fl. (B, lost; iso in L sheet nrs. 908.270—268, -273, -286, and -298).

Twigs up to 7 mm ∅, greyish brown, glabrous. Axillary buds often 2 per axil, the upper of which stronger developed. *Leaves* 2—4-jugate; petiole mostly *c.* 1.5 mm ∅; rachis often flattened as well beneath as above; petiolules 3—8 mm long. *Leaflets* 5.5—10(—13) × 1.5—3.5(—5) cm, ratio 2.5—5, widest about the middle, chartaceous to coriaceous; margin tending towards being 'shouldered' to the apex; midrib nearly always slender and angular beneath; nerves up to 1.75 cm distant along midrib, angle to midrib *c.* 50—70°; reticulations above always clear, beneath nearly always less conspicuous to sometimes invisible. *Inflorescences c.* 12–20 cm long with few long, erecto-patent, spicoid, thick branches that are hardly rebranched, flowers in sessile clusters; pedicels up to 1 mm long. *Calyx* 4- (rarely 5-) merous, 0.75—1 × 2—2.5 mm. *Disk* sparsely hairy. *Stamens* 7—11; filament 2 mm long, sparsely hairy in lower half only. *Ovary* 1 × 2 mm, acc. to some authors exceptionally 3-celled; style 0.75 mm. *Fruit* as in subsp. *chinensis*.

Distribution: All the few specimens known are probably collected from cultivated trees. It seems to be rarely grown in West Java in the gardens of Chinese (collections are available from the 18th century onwards), and in BM I found two specimens collected by Loureiro in southern Indo China.

Note. It is astonishing that Radlkofer treated *L. philippinensis* as a different species though it looks so much alike the typical *L. chinensis*, and the present subspecies as no more than a forma of *L. chinensis*. The main reason may have been that subsp. *javensis* is only known as a cultivated tree, which was supposed to have been introduced from China and possibly was considered to be no more than an aberrant cultivar. Actually, the differences between the present subspecies and both the others are distinctly greater and more conspicuous than those between the other two subspecies mutually. The specimens collected by Loureiro in southern Indo China, though probably originating from cultivated trees, may point to the country of origin of the present subspecies. Contrary to subsp. *chinensis*, it seems to flower and fruit well under everwet tropical conditions. This may even be the cause of its apparent rarity in culture: the *lychee* is typically a Chinese fruit, whereas the people of the everwet tropical parts of Malesia themselves apparently prefer the indigenous *rambutan* (*Nephelium lappaceum* L.).

General remark. It was a pleasing surprise to me that van den Berg (1978) on the facts derived from his pollen studies concluded to the same subdivision into three about equivalent entities as I did. He even suggested a derivation of subsp. *chinensis* and subsp. *javensis*, independently, from subsp. *philippinensis*. Though this sounds plausible, I dare not go so far on the basis of my macromorphological and geographical data alone, especially not as so much culivated material is involved.

V. NOTES ON POMETIA

For *Pometia* may be mainly referred to the revision by Jacobs (1962). I want to make only a few remarks on its systematic position.

Van den Berg (1978) came to the conclusion that, as far as pollen is concerned, *Pometia* takes a very isolated position in the present group of genera, or, actually, does not make part of it at all. However, in contrast to his opinion, but in agreement with e.g. Radlkofer (1932) and Jacobs (1962) and after a systematic study of all the genera involved, I am convinced that *Pometia* has rightly been included in this alliance, even though I too consider it as by far the most derived genus of it. Its most peculiar character is in the fruit, which has, under the thin-coriaceous skin that is also present in the other genera, a thick very juicy mesocarp; the arilloid is present, but thin, and envelopes the seed only partly. For the rest, however, the alliance especially with *Dimocarpus* seems clear enough. With that genus it shares characters like the orbicular glands on the lower side of the leaflets and, in case of incised leaflets, the typical nervation described by Jacobs (1962), apart from essential characters in flower structure, the free arilloid, and the tendency to develop pseudo-stipules as are also present in *Otonephelium*, another close ally of *Dimocarpus*.

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