FLORAE MALESIANAE PRAECURSORES L.
A REVISION OF LEPISANTHES (SAPINDACEAE)

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I. INTRODUCTION

Lepisanthes in the broad sense accepted in the present revision comprises several genera and even two tribes as they were defined by Radlkofer in his Monograph of the family (Pfl. R. Heft 98). An argumentation for this new delimitation has been given in the first part of Chapter II. By analysing the phylogeny of a few characters, an effort has been made to make the mutual relationships within *Lepisanthes* more clear and to give a synthesis of it (Chapter II, parts 2 and 3). The taxonomic part proper is preceded by three chapters on resp. *L. tetraphylla* (Chapter III), *L. fruticosa* (Chapter IV), and *L. senegalensis* (Chapter V), the three most complex species. Though the treatment is somewhat different, all three chapters are intended to give a picture of the variable complex as a whole as well as an analysis of its elements and an argumentation in defence of the acceptance of such wide limits.

The present revision of *Lepisanthes* is primarily intended as a precursor to the future treatment in the Flora Malesiana. For that reason the species are not all uniformly treated in the Taxonomic part (Chapter VI). The synonymy and typification are complete for all taxa; the genus and the infrageneric taxa are described in full, and the keys to the species are complete. Complete literature and descriptions are given for those species which are exclusively or mainly non-Malesian; in the case of new Malesian species only the Latin diagnosis based upon the type specimen has been given. Under all species or infraspecific taxa all specimens studied are cited except (1) when the number of collections was very large and many of these had already been cited by Radlkofer, either under the same name or under one or more synonyms, and (2) for those regions of which more than 5 collections were seen; in the latter case the number of collections studied has been mentioned. No index has been given to all collections seen; they will be included in a future issue of the Identification Lists of Malaysian Specimens on all *Sapindaceae*.

Material has been studied from the following herbaria: A, BM, BO, E, FI, K, L, M, NY, P, SAR, SING, and UC. My sincere thanks are due to the directors of these institutes for the loan of these specimens sometimes for a long period.

II. DELIMITATION AND SUBDIVISION OF THE GENUS

Delimitation

Lepisanthes as accepted in the present paper encompasses the genera *Erioglossum*, *Aphania*, *Thraulococcus*, *Hebecoccus*, *Aphanococcus*, and *Manongarivea* from the tribe *Aphanieae* as well as *Lepisanthes* and *Otophora* from the tribe *Lepisantheae* in the sense of Radlkofer (1932), furthermore the genus *Sapindopsis* How & Ho (1955). *Phoenicimon* Ridl. (1925),

originally also placed in this relationship, appeared to be synonymous with *Glycosmis (Rutaceae)* (see Leenhouts, Blumea 15, 1967, 452).

In a discussion of the combination of taxa it is always the differences that are stressed, criticized, and evaluated. It should be kept in mind, however, that the prime and main argument always is, or ought to be, the general resemblance in all characters, the feeling that the group of taxa concerned forms a coherent and natural entity. The discussion and evaluation of the differences, or supposed differences, comes only second.

The position of the two monotypic genera not seen by Radlkofer, *Manongarivea* and *Sapindopsis*, provides the least difficulties: they are both doubtless synonymous with *Aphania*.

Radlkofer (1932, p. 5) gives only one real difference between his tribes *Aphanieae* and *Lepisantheae*: the fruits of the former should be 'knopfig-gelappt ohne selbständige Trennung der Teile' (parted though not breaking up into mericarps), those of the latter 'gefurcht oder furchig gelappt' (grooved or slightly lobed)[1]. However, if we compare this with the differences between *Hebecoccus* and *Aphanococcus* he gives in the key to the genera of the *Aphanieae* (p. 8) we find 'Fruchtlappen am Grunde verbunden' (fruit lobes connected at base) for *Hebecoccus* and 'Fruchtlappen seitlich verbunden' (fruit lobes connected laterally) for *Aphanococcus*. Moreover, under *Aphanococcus* he states (p. 723): 'Genus fructu parum coccato quasi transitum ab *Aphanieis* ad *Lepisantheas* et quidem ad genus *Lepisanthes* ipsum exhibens, attamen glandulis foliorum singularibus verruciformibus in nullo alio harum tribuum generi nisi in *Hebecocco* obviis generi huic maxime affine.' Summarizing, though probably on theoretical grounds the fruit characters weigh heavily with Radlkofer, in practice the obvious close relationship between *Hebecoccus* and *Aphanococcus* prevails (but the distinct resemblance between *Aphanococcus* and *Lepisanthes* is also stressed!). In still an other case the difference between the *Aphanieae* and *Lepisantheae* is violated. Within the very natural relationship of *Otophora* two species, *Lepisanthes kinabaluensis* and *L. multijuga*, have the fruits parted like in *Aphania* and *Erioglossum*. The latter of these species was known to Radlkofer, and he made even use of this character in his key to the species of *Otophora* (p. 758), without any comment.

The genera *Hebecoccus* and *Aphanococcus* are differentiated by Radlkofer (1932, p. 8) as follows: 'Fruchtlappen lederig, ..., am Grunde verbunden, mit rostfarbigem Haarfilz' (fruit lobes coriaceous, connected at base, ferruginous tomentose) in *Hebecoccus*, 'Fruchtlappen rindenartig, ..., seitlich verbunden, mit gelbem Haarfilz' (fruit lobes crustaceous, connected laterally, yellow tomentose) in *Aphanococcus*. Actually, as far as *Hebecoccus* is concerned this refers mainly to *Hebecoccus ferrugineus* (= *L. ferruginea*), the only species of which well-developed fruits were known; the fruits of *H. inaequalis* were young, those of *H. falcatus* with only 1 cell developed (the colour of the tomentum is described in these species as '*pallide ochracei*' and '*ochraceo-sufferrugineo*' resp.). The mature fruits of *L. falcata* (incl. both *Hebecoccus falcatus* and *inaequalis*) I had at my disposal were not parted and agreed completely with those of *Aphanococcus*. I do not see any reason to keep these two genera separate.

The demarcation between *Thraulococcus* and *Hebecoccus* is still more feeble. According to the key the former has 'Fruchtlappen krustenartig, ... radiär-ellipsoidisch', *versus*

[1]) This character, fruits not, hardly, or distinctly lobed or parted, and in the latter case breaking up into mericarps or not, plays an important part in Radlkofers delimitation of the tribes and settles their sequence. This gives an interesting insight into the phylogenetic ideas of Radlkofer further hardly expressed emphatically. He seems to have accepted Engler's list of primitive *versus* derived character states, and apparently considered a fruit as nearly apocarpous as possible as more primitive than a syncarpous one, even in a relationship where syncarpy seems to be the rule.

the latter '... lederig, ziemlich kugelig'. Actually, *Thraulococcus* has spreading, ellipsoid fruit-parts (at least *Th. erectus*, the only species the fruits of which are known), *Hebecoccus* erect, subglobular ones. Furthermore, however, they agree so completely in vegetative parts as well as in flowers that I do not see any reason to keep them separate. Why Radlkofer compared *Thraulococcus* with *Aphania* rather than with *Hebecoccus* (1932, p. 718) is incomprehensible to me.

Thraulococcus-Hebecoccus-Aphanococcus on the one hand, *Lepisanthes* on the other appear to be coherent natural entities. Moreover, there can hardly be any doubt that they are mutually closely related. Radlkofer already knew that the link between his *Aphanieae* and *Lepisantheae* lies between these genera; as well his remark under *Aphanococcus* cited above as the following under *Lepisanthes* may prove this point (1932, p. 729): 'Genus fructus fabrica quasi intermedium inter *Aphanieas* et reliquas *Lepisantheas*, attamen ad has ulteriores arctius accedens loculis tota altitudine connatis nec coccorum modo vel basi vel medio tantum cohaerentibus.' A scrutiny of the two taxa showed that the only real difference is: pericarp more or less fleshy, wrinkled when dried in *Thraulococcus- Hebecoccus-Aphanococcus*, thin and hardly or not wrinkled when dried in *Lepisanthes*. I am of the opinion that this does not even warrant generic, let alone tribal differentiation.

Otophora is a coherent, doubtless natural group, though less clearly delimited than botanists identifying collections from Indo-Malesia may suppose. For its most distinctive characters, the presence of 'stipules' in all and of wings along petiole and rachis in some species are not conclusive. Though rarely, 'stipules' are also met with in *Lepisanthes* and in *Aphania*; in both they are represented only by a basal pair of slightly to distinctly smaller leaflets, but in some species of *Otophora* they are of the same kind. A winged petiole and rachis is also known from *L. (Aphania) mixta*, a species which shows a great resemblance to *Otophora*, but agrees completely with *Aphania* in its flowers and fruits. Furthermore, as already cited above, two species of *Otophora* show fruits in good accordance with the *Aphanieae*. *Otophora* seems nearest to *Lepisanthes*, and a scrutiny of the differences showed that there are only two: petals shorter than sepals and filament shorter than anther in *Otophora*, petals longer than sepals (of the same length in *Aphania*) and filament longer than anther in all other genera discussed, including also *Lepisanthes*. The only difference given by Radlkofer (1932, p. 8) 'Frucht rindig-holzig' (fruit woody-coriaceous) in *Lepisanthes versus* 'Frucht beerenartig, fleischig oder ziemlich saftlos' (fruit like a berry, more or less pulpy) in *Otophora*, feeble as it was already (and it was slightly exaggerated!) disappears completely when *Lepisanthes* and *Hebecoccus* are combined. I see no reason left to maintain *Otophora* as a genus.

Aphania is mainly distinguished by its glabrous, petaloid sepals, its petals which do not exceed the sepals, and its parted, mostly 2-lobed fruits. Only the relation in length between sepals and petals is exclusive, however: in *Otophora* are the petals shorter, in all other groups longer than the sepals. Curiously, *Aphania* comes nearest to *Otophora* which has also mostly glabrous, petaloid sepals, the petals still shorter, and in two species a comparable, parted fruit. Moreover, *L. (Aphania) mixta* shows in its vegetative parts a great resemblance to *Otophora*. As a whole the differences between *Aphania* and *Otophora* are the same as those between *Lepisanthes* and *Otophora*, and there seems no reason whatever to maintain *Aphania* as a genus of its own within this relationship.

Among the group of genera under discussion, *Erioglossum* is the one most clearly delimited, but only on a combination of several characters each of which is also represented in one or more of the other elements: leaves without terminal leaflet and 'stipules', terminal inflorescences, sepals outside sericeous, petals exceeding sepals, mostly 4, petalar scale crested, fruits 3-merous, parted. It seems more isolated within this relationship than

one would expect from its distinct resemblance to *Aphania* also stressed by Radlkofer (1932, p. 693). After combination of the other genera it is impossible to keep this one separate.

Summarizing, I may propose the following subdivision of the genus *Lepisanthes* in this broad sense: subg. *Lepisanthes* (with two sections, *Lepisanthes* and *Hebecoccus*), subg. *Otophora* (with 3 sections), subg. *Aphania*, and subg. *Erioglossum*.

Characters

Any speculation on a phylogeny of taxa depends on, and hence should be preceded by a discussion of, the supposed phylogeny of character states. The characters to be considered here will be treated in two groups, at first those the phylogeny of which seems reasonably certain (nrs 1—3), next those of which it is less clear (nrs 4—7).

1. Stipules. Some remarks on the morphology of the 'stipules' in *Sapindaceae* have already been made in Weberling & Leenhouts, Akad. Wiss. Abh. Math.-Naturwiss. Kl. 1965 (1966) 563; a special study on the 'stipules' of subg. *Otophora* will be published by Dr F. Weberling. For our present purpose a short survey may be sufficient. The main conclusion reached in the study cited was that the 'stipules' of the *Sapindaceae*, with the possible exception of those of the *Paullinieae*, are pseudostipules derived from a basal pair of leaflets. This course of development is finely illustrated by the genus *Lepisanthes*. Here we meet, apart from the complete absence of stipules, with the following possibilities:

a. a pair of normal, though mostly slightly smaller, leaflets attached at the base of the petiole. This character is known from *L. (Lepisanthes) andamanica*, *L. (Anomotophora) amplifolia*, and *L. (Aphania) senegalensis*, hence scattered throughout the genus.

The further development is restricted to subg. *Otophora*.

b. typical penninerved 'stipules' (miniature leaflets) are known from *L. amoena*, *divaricata*, *kinabaluensis*, *multijuga*, and *unilocularis* in sect. *Otophora*, *fruticosa* in sect. *Pseudotophora*, and *alata* and *ramiflora* in sect. *Anomotophora*.

c. typical palmati- or retinerved 'stipules' are known from *L. amoena*, *kinabaluensis*, and *multijuga* of sect. *Otophora* and *bengalan* and *fruticosa* in sect. *Pseudotophora*. In *L. amoena* and *fruticosa* these 'stipules' are even sometimes furcate which may represent a further development.

Some species with many-jugate leaves (*L. amoena*, *multijuga*, and *unilocularis*) show transitions between normal leaflets and the 'stipules'.

An obvious sequence seems to be: leaves without stipules, then character states a, b, and c, and finally the furcate 'stipules' and the tendency towards two pairs of 'stipules' sometimes shown by *L. multijuga*.

2. Flower. The 'normal' situation in the *Sapindaceae* is a 5-merous calyx and corolla, a complete disk, and a 3-merous ovary. In several groups within this family there is a distinct tendency towards zygomorphy, resulting in the reduction and final suppression of one of the petals and usually also of the sector of the disk in front of this. A reduction of the calyx to 4 sepals is far more rare. Apparently independently, the ovary is not rarely 2-celled.

This same development can also be found in *Lepisanthes*. Here also, it seems reasonable to accept the 5-merous condition with complete disk and with a 3-merous ovary as original. There is a strong tendency towards reduction of the number of petals to 4 (rarely, in subg. *Otophora* and *Aphania*, still further; see under 6). Here also we find a correlation between the reduction of one petal and of the part of the disk in front of it, with a few notable exceptions, however. These exceptions are *L. fruticosa* '*fruticosa*' and

L. ramiflora: here calyx and corolla are both 4-merous, and the disk is complete, possibly secondarily (?).

The scale inside the petal above the claw, which is typical for most *Sapindaceae*, is nearly always well-developed in *Lepisanthes*. In several species it is 'crested' by an appendage varying from a slight wart (and then often present in only part of the petals of one flower, or part of the flowers of the same specimen) to rather elaborate structures. It seems a reasonable supposition that absence of these appendages is more primitive than their presence, but the further development seems rather erratic.

3. *Fruit.* Whereas in the ovary the cells are always completely separated, in the fruit the septa may be interrupted to nearly completely suppressed in a few cases *(L. fruticosa p. maj. p., L. ramiflora)*. It can hardly be doubted that this is a derived condition.

Summarizing, the following character states are accepted as primitive: absence of 'stipules', calyx and corolla 5-merous, petalar scale not crested, disk complete, ovary 3-celled, fruit septa not interrupted; derived states appear to be: presence of 'typical' stipules, calyx and corolla 4-merous, petalar scale crested, disk interrupted (or possibly, if the calyx also is 4-merous, again complete), ovary 2- or in one case 1-celled, fruit septa incomplete to hardly developed. The species showing a combination of all primitive character states are *L. tetraphylla* (mainly *'montana'* and some of its nearest allies), *aphanococca, borneensis, erecta, falcata, ferruginea,* and *simplicifolia,* those most derived are *L. fruticosa* (mainly *'fruticosa'*), *alata, ramiflora,* and *senegalensis.*

The second group of characters the phylogeny of which is less evident comprises:

4. *Presence or absence of a terminal leaflet.* In *Lepisanthes*, like in most *Sapindaceae*, the mature leaves usually lack a terminal leaflet. The exceptions are more numerous, however, than in most genera. Imparipinnate leaves are the rule in several species of subg. *Otophora*, notably in sect. *Otophora*, whereas in other species of the same subgenus the terminal leaflet may be variably reduced. In *L. (Aphania) senegalensis* the leaves are sometimes simple, but usually paripinnate. Seedling leaves are ternate in *L. (Erioglossum) rubiginosa* which lacks a terminal leaflet in its mature leaves, pinnate with a terminal leaflet in *L. (Otophora) amoena* in good agreement with the mature ones, simple in some other genera which also have paripinnate mature leaves.

At first sight, presence of a terminal leaflet seems to represent a more primitive state, its absence a more derived one. Probably, this holds true for the *Sapindaceae* as a whole, but I doubt the validity in the present relationship. Presence of a terminal leaflet shows a distinct correlation with some characters accepted as derived (presence of 'stipules', reduction of corolla, a 2- or 1-celled ovary). Moreover, the seven species accepted as the most primitive cited above lack a terminal leaflet with the exception of *L. simplicifolia* which has simple leaves. Like in the case of simple-leaved *L. senegalensis* (see Chapter V) I would suggest here derivation by retardation rather than primitiveness to account for the presence of a terminal leaflet in the mature leaf.

5. *Inflorescence.* As to place of inflorescence 3 different character states are possible, viz. (a) terminal and in the upper leaf axils; (b) axillary, sometimes together pseudoterminal, but never truly terminal; (c) rami- and/or cauliflorous. Which of these three states is more primitive, which is derived, is not obvious. Terminal inflorescences show a rather strong correlation with primitive states of the first group of characters (especially with a completely 5-merous flower with a 3-merous ovary). The evidence for the two other states is less clear. Among the 'primitive' species mentioned above, *L. aphanococca, borneensis, falcata, ferruginea,* and *simplicifolia* have always terminal inflorescences, but this character is rare in *L. tetraphylla 'montana'* (but present in some other races). The four species cited as highly derived all may be rami- or cauliflorous, *L. fruticosa, alata,* and

senegalensis may also bear axillary inflorescences, and they are sometimes truly terminal in *L. fruticosa*, even in the possibly most derived form *'fruticosa'*.

6. Flower. In subg. *Lepisanthes* and *Erioglossum* the sepals are outside hairy, mostly only the inner three with the exception of a narrow to broad 'petaloid' margin which may even be crenulate, and the petals are longer than the sepals. In subg. *Otophora* and *Aphania*, on the contrary, the sepals are outside (nearly) glabrous, and for the greater part to completely 'petaloid' (often mentioned as being pink to red!), and the petals never exceed the sepals in length and may even be variably reduced in number (to 3 in *L. fruticosa*, to 0 in *L. senegalensis*). It seems reasonable to accept this (partial) functional replacement of the corolla by the calyx in two of the most derived groups as a derivation.

7. Fruit. In principle, there are two kinds of fruit, viz. (a) parted with the axis not or hardly accrescent, and (b) more or less lobed with the axis proportionally grown out. This difference is discernable already in the ovary which is 'shouldered' in the first case. Neither of these two kinds shows a distinct overall correlation with either the primitive or the derived character states referred to above. It is striking, however, that parted fruits are exceptional in subg. *Lepisanthes* to which all species accepted as most primitive belong, whereas they characterize the two derived subgenera *Aphania* and *Erioglossum*.

Systematics

The phylogenetic conclusions derived from the analysis of the characters as applied to the relationships within the genus *Lepisanthes* lead to the following overall picture:

The seven species considered most primitive all belong to subg. *Lepisanthes*. Within sect. *Lepisanthes*, the West-Malesian *L. tetraphylla 'montana'* seems more primitive than any other form. The different phylogenitical series evolving within the complex of *L. tetraphylla* are discussed in Chapter III and are shown to spread mainly from this West-Malesian centre towards the outskirts of the total specific area. *L. andamanica* is hardly more than a relatively derived form out of the same complex, mainly characterized by the presence of a primitive kind of 'stipules', by a 4-merous corolla and an interrupted disk. Within sect. *Hebecoccus*, the western species, *L. banaensis* (Indo China; ramiflorous, petalar scale crested) and *L. erecta, ferruginea*, and *simplicifolia* (W. Malesia and India; fruit parted) appear slightly more derived; the further three species are all more primitive, mutually hardly separable, and scattered over Borneo, the Philippines, and Celebes. Morphologically, sect. *Lepisanthes* and *Hebecoccus* start from about the same level of primitiveness, but *Lepisanthes* reaches a much higher level than *Hebecoccus* does. The development of *Hebecoccus* from its Central-Malesian centre in a western direction seems independent from that of *Lepisanthes*. *Hebecoccus* makes the impression of being a relict by its scattered distribution and its apparent scarcity, in contrast with *Lepisanthes* which shows a well-coherent wide area of distribution and seems to be common in great parts of it. An important point may be that *Hebecoccus* is mostly a tree and apparently confined to the primary rain forest, whereas *Lepisanthes* are mostly shrubs or treelets and adapted to many kinds of habitats, mostly in secondary vegetation.

As compared with subg. *Lepisanthes*, subg. *Otophora* makes the impression of being more derived. At first sight, the mutual relationships between its three sections are less clear. If presence of a terminal leaflet may be considered a derived character state, sect. *Otophora* should be slightly higher evolved than the two other sections. Sect. *Pseudotophora* and *Anomotophora* are doubtless closely allied; the latter differs mainly from the former by the development of wings along petiole and rachis which may be a specialization. A study of the mutual relationships between the species within each section makes

the situation somewhat more clear, however. Sect. *Otophora* is, apart from the presence of a terminal leaflet in all species, relatively primitive, the only further more evolved characters being the 4-merous corolla in *L. kinabaluensis* and the 1-merous ovary in *L. unilocularis*. It is mainly restricted to W. Malesia, with one derived form on Hainan. Sect. *Pseudotophora* is especially interesting. It comprises two species, viz. *L. fruticosa*, widely distributed and with a strong tendency towards different morphological specializations, and *L. bengalan*, a rather restricted endemic of E. Borneo. The latter is specialized only in the presence of welldeveloped 'stipules' and of a terminal leaflet, on the other hand, however, it is the only species of subg. *Otophora* with sericeous sepals, and as to the epidermal leaf glands which play an important part on sectional level in subg. *Otophora* it takes a position in between sect. *Otophora* and *Pseudotophora*. *L. bengalan* makes the impression of being a morphological relict in its subgenus. Within sect. *Anomotophora* the mutual relationships are less clear. The only more widely distributed species, *L. alata* (W. Malesia, but probably partly dispersed by man) is distinctly related to *L. fruticosa*. *L. amplifolia* (Indo China) appears slightly more derived in a few characters; it is distinctly allied with *L. ramiflora* (Sarawak) which is among the highest evolved species of subg. *Otophora*. Summarizing, a derivation of subg. *Otophora* via a form near *L. bengalan* from subg. *Lepisanthes* seems possible. Within subg. *Otophora* the first division may have been between sect. *Otophora* and *Pseudotophora*, whereas sect. *Anomotophora* may have evolved lateron from near *L. fruticosa*. This development should have taken place in W. Malesia, possibly mainly in Borneo.

Subg. *Aphania* and *Erioglossum* are parallel in several points. Both are distinctly more evolved than subg. *Lepisanthes*, both are distinctly more isolated than the two other subgenera, both go relatively far to the west — subg. *Erioglossum* to northern India, subg. *Aphania* even to W. Africa —, both consist mainly of one wide-spread species which in both cases reaches from the western boundaries eastwards to E. Malesia, in both cases with a rather *(L. senegalensis)* to surprisingly *(L. rubiginosa)* narrow range of variation, and both have developed one or two distinct species on New Guinea. Of these two, subg. *Erioglossum* seems to be less evolved and may be derived from sect. *Hebecoccus*. The subg. *Aphania* shows a combination of more evolved character states and resembles in some points (tendency towards stipules; winged petiole and rachis in *L. mixta*; reduction of corolla and functional replacement by calyx) subg. *Otophora*.

The subdivision and the pattern of affinities as sketched above are in good agreement with the results of a palynological study reached independently by Mr J. Muller. A complete palynological revision of *Lepisanthes* of his hand will be published separately

III. THE LEPISANTHES TETRAPHYLLA COMPLEX

The complex species *Lepisanthes tetraphylla* as accepted here includes nearly the whole genus *Lepisanthes* in the sense of Radlkofer (1932) and subsequent authors. Out of the 38 species distinguished by Radlkofer, 33 have been included. Excluded are in the first place the two *'species mihi ignotae'*: *L. hirta* Ridl. which is referred to subg. *Erioglossum* as a synonym of *L. rubiginosa*, and *L. forbesii* Bak. *f.* which is a Meliacea. Further, *L. palawanica* Radlk. belongs definitely not to *Lepisanthes* but rather to *Alectryon*; *L. membranifolia* Radlk. is hesitatingly referred to subg. *Erioglossum*; and *L. andamanica* King is maintained as a separate species next to *L. tetraphylla*, though a feeble one. Among the species added by later authors, two have been excluded from this relationship: *L. balansaeana* Gagnep. is referred to subg. *Erioglossum* in the synonymy of *L. rubiginosa*, whereas *L. banaensis* Gagnep. is referred to sect. *Hebecoccus*.

As a matter of fact, *Lepisanthes tetraphylla* in this wide delimitation shows much variation in many characters, and encompasses a number of at least locally more or less well-defined and recognizable forms. In the main part of this chapter 47 of these forms are enumerated and treated briefly; diagnoses are included in a synoptical key in which several of the more important varying characters are given. This provisional subdivision resulted from a study making use of the traditional methods: trying to recognize natural entities and to delimit them as sharply as possible.

Among the characters included in the key, those most promising from a phylogenetical point of view — and hence for gaining insight in the structure of the complex as a whole — appear numbers 9, 10, 13, 14, 15, and 19. An analysis of the correlations between these and a few other characters led to some interesting conclusions. On the one hand there is, apart from the obvious absolute correlation between petals 5 and disk complete versus petals 4 and disk interrupted, a distinct correlation between terminal inflorescences and 4 petals, and a 75 % correlation between petalar scale crested and 4 petals, whereas petalar scale not crested correlates to *c.* 70 % with 5 petals. On the other hand it turned out that a 3-merous ovary correlates to somewhat more than 50 % with 4 petals, a 2-merous ovary on the contrary even to 75 % with 5 petals, whereas a distinctly closed nervation correlates to only 33 % with 4 petals. A first conclusion from this study is that the two most obvious phylogenetical series: petals 5 and disk complete to petals 4 and disk interrupted, and ovary 3-celled to 2-celled, are mutually independent. Hence, these two series could provide an excellent basis for a main subdivision of the complex, as has mainly been done by Radlkofer (1932) if not both varied gradually making them useless for taxonomy. The same holds true for the supposedly derived character of a closed nervation: it developed independently, mainly in the Malay Peninsula and Borneo, but gradually. A second conclusion is that the supposedly primitive characters are mainly concentrated in West Malesia, whereas the forms with exclusively derived character states are arranged along the borders of the area of the complex (race 4, NW. Deccan; '*burmanica*', Burma; '*siamensis*', Thailand; '*mekongensis*', Cambodia; race 46, Philippines; '*hirtella*', New Guinea). Furthermore, these forms, though sharing a whole set of derived character states, are not only often widely separated geographically, but show also no clear mutual relationships; they seem to be the results of a diverging development, parallel only in a few tendencies which are common to many *Sapindaceae*. Finally, of three out of the six highly derived forms mentioned the fruit is known, and they have all a glabrous endocarp, suggesting that this character is also a derived one within the limits of the present relationship.

The insight gained from the application of the two methods mentioned above results in the following picture of the complex as a whole. The basic or central form is '*montana*', primitive in all points cited, distributed mainly in Java, Sumatra, the Malay Peninsula, and Borneo, reaching the Philippines in Palawan (as '*acutissima*') and Mindanao (as '*viridis*'). The delimitation of '*montana*' from some other forms is fully artificial. Among these, '*heterolepis*' differs only from '*montana*' by the crested petalar scales; actually, specimens with in some flowers a minute central or lateral wart on one of the petalar scales are included in '*heterolepis*', those without in '*montana*'. '*L. heterolepis*' shows a wide range of variation as to the appendages of the petalar scale: they may vary from one central or lateral wart via three warts, or one or two subulate appendages, or a bifid, tongueshaped one, to an appendage comparable in shape and size with the scale itself but more deeply emarginate; if only faintly developed they may be missing in part of the petals of one flower, or even completely in some flowers. Typical '*montana*' has a 3-merous pistil, but '*pallens*' in Timor, furthermore hardly separable from it, may have a 3- or a

2-merous pistil. The same holds true for '*cuneata*'; the delimitation from '*montana*' is vague, the specimens from the Malay Peninsula show nearly exclusively a 2-merous pistil, those from Sumatra, however, have a 3-celled one. Even the most important character, the number of petals, does not provide a clear delimitation. In Borneo race 35 is hardly separable from '*heterolepis*' but for the number of petals which is mostly 4, and even if there are 5 petals the disk is at least unequal. In Sumatra '*lamponga*' shows in nearly all characters the same range of variation as '*montana*' and '*heterolepis*' and the three are at first sight not separable; '*lamponga*', like race 35, has most of the flowers with 4 petals and an interrupted disk, some however with 5 petails — the 5th one sometimes smaller — and the disk complete though mostly unequal. Another difference between '*montana*' and '*lamponga*' is that the former has the seed glabrous, the latter hairy. The value of this character is not yet clear: hairy seeds are only known from '*lamponga*' and '*siamensis*', two forms which are not closely allied mutually, and both related to forms with glabrous seeds; of many forms, moreover, the seeds are unknown. '*lamponga*' appears to be the main link between '*montana*' and the mainly continental group of forms around '*tetraphylla*', to begin with '*longifolia*' (Mal. Pen.) and '*browniana*' (Burma), '*appendiculata*' (Mal. Pen.), '*scortechinii*' (Mal. Pen.), '*langbianensis*' (Vietnam), '*poilanei*' (Thailand, S. Vietnam), and race 38 from N. Borneo. Most of the races from continental Asia are distinctly allied to '*tetraphylla*'; mutually, they are often better separable than the races around '*montana*' but none of them shows any character delimiting it clearly from the *tetraphylla* complex as a whole. Contrary to the situation in the centre, however, that in the outskirts of the area is not yet clear. Several races are known only from one or two collections, hence very incompletely, and they show sometimes an unusual combination of characters; a more complete knowledge may show that at least some of these deserve specific recognition. Even '*tetraphylla*' which as a whole is well-known shows a peculiarity: whereas the flowers have normally 4 petals, in the western part of its area the number in female flowers is 5, distinctly in contrast with what could be expected from the phylogenetic picture sketched above.

The following synoptical key and the enumeration give a survey of the 47 entities distinguished within the *tetraphylla* complex. At least locally these entities are mostly reasonably well delimited, and most of them represent doubtless geographical races; some, especially among those which are sympatric, possibly also ecological races, but the ecological differences can hardly ever be derived from the field labels. Whereas some would deserve the rank of subspecies, others are too vague to give them any formal rank, and still further races are so incompletely known that they may as well be separate species as deviating specimens of related races. For these reasons the neutral term 'race' has been used for all these provisional entities. Typical specimens have been cited under the races, and have been labelled with identification up to the race.

The key is a multiple-entry key in which all races are cited under each couplet. This provides a maximum possibility of identification; moreover, diagnoses of all races are included. Most of the couplets consist of two leads only; in that case only one lead is cited completely, the other one is only mentioned in brackets. The numbers refer to the races; numbers in plain type represent races which show no variation in the character concerned, those which are variable are represented by a numbet in italics, those of which the character concerned is unknown by a number with a question mark, of course also in italics. The races have been numbered from West to East.

SYNOPTICAL KEY TO THE RACES OF L. TETRAPHYLLA

1. Geography
   a. Ceylon: *1. 2.*
   b. Deccan Peninsula: *1. 2.* 3. 4. 5.
   c. Assam: 6. 7.
   d. Burma: *1.* 8. 9. 10.
   e. Thailand: *1.* 12. *13.*
   f. Indo China: *1. 13.* 14. 15. 16.
   g. Hainan: 17.
   h. Malay Peninsula: *1.* 18. 19. 20. 21. *22.* 23. *24. 25.*
   i. Sumatra: *22. 24. 25.* 26. 27. 28. 29. 30.
   j. Java: *25. 31?* 32. *34.*
   k. Lesser Sunda Islands: *31.*
   l. Borneo: *22. 25.* 33. *34.* 35. 36. 37. 38. 39. 40. 41. 42.
   m. Philippines: 43. 44. 45. 46.
   n. Celebes: 47.
   o. New Guinea: 48.
2. Twig
   a. glabrous (terminal bud excepted): *1.* 3. 6. *18?* 24. 27. *29?* 30. 31. 32. *40? 42?* 43. 44. *45?* 46. *47?*
   (*b*: hairy).
3. Number of leaflets per side
   a. 1—3: 1. *2. 4.* 5. *7. 9. 10.* 12. 14. 19. *20. 21. 24. 25. 27.* 28. *33. 35.* 38. *40? 41?* 44.
   b. 4 or 5: *2. 3. 4. 6. 7. 8. 9. 10.* 13. *15.* 16. 17. *18? 20. 21.* 22. *23. 24. 25.* 26. *27.* 29. 30. 31. *32. 33.* 34. *35. 36.* 39. *40? 41? 42? 43.* 45. *46.* 47.
   c. 6 or more: *3. 6. 8. 15. 18? 23. 25. 32. 36.* 37. *40? 41? 42? 43. 46.* 48.
4. Axial parts of leaf
   a. glabrous: *1.* 3. *9?* 13. 18. *24. 25.* 27. 29. 31. 32. 36. 38. *42. 43.* 44. (*b*: hairy, though often ± glabrescent).
5. Petiole (base excepted)
   a. flat to grooved above: *1.* 4. 7. *10.* 12. *13.* 14. 17. *22. 24. 27.* 30. 32. *33.* 35. 39. *40? 41? 42? 45?* 46.
   (*b*: terete).
6. Leaflets
   a. glabrous: 1. 2. 3. 4. 6. 9. 13. 14. 15. 16. 17. 18. 23. *24. 25.* 27. 28. 29. 31. 32. *34.* 36. *42. 43.*
   b. hairy on midrib (and sometimes nerves) only: 7. 8. 10. 19. 20. *24. 25.* 26. 30. 33. *34.* 35. 38. *43.* 44. 45. 46. 47.
   c. hairy at least all over the lower surface: 5. 12. 21. 22. 37. 39. 40. 41. *43.* 48.
7. Base of leaflets
   a. rounded to cordate: *1.* 5. *6.* 7. 8. 10. *12. 13. 15. 18. 19.* 20. 21. *22. 25.* 26. *27. 28.* 30. *31. 32.* 33. *34. 35.* 36. *37. 39. 40. 42. 43.* 44. 45. *46.* 48. (*b*: cuneate).
8. Midrib above near base
   a. sunken: 2. 3. 7. 9. 12. 14. 19. *20.* 21. *22. 25.* 26. *27.* 29. 30. *32.* 34. *35.* 36. 37. *39?* 40. 41. *43.* 45. 46. 47.
   (*b*: prominent).
9. Nerves
   a. all distinctly looped and joined near the margin: *10. 22. 31.* 32. 33. *35.* 36. 37. 40. (*b*: not or only the upper looped and joined).
10. Inflorescences
   a. terminal: 4. 5. 12. 14. *41? 42?* 46. *47?* 48. (*b*: axillary, rami-, or cauliflorous).
11. Bracts
   a. broad-ovate, 4—7 x 2½—6 mm: *10.* 21. 22. 37. *47?* (*b*: subulate to lanceolate or deltoid, up to 6 mm long).
12. Full-grown sepals
   a. all with petaloid margin: *2? 7? 10? 16?* 21. *23? 30? 31?* 33. 36. *38?* 39. 42. *47?*
   b. only inner with petaloid margin: *1. 2? 4.* 5. *7?* 9. *10?* 13. 15. *16?* 17. 18. 19. 20. 22. *23?* 25. 26. 27. 28. 29. *30? 31?* 32. 34. 35. 37. *38?* 40. 41. 43. 44. 45. *46. 47?* 48.
   c. none with petaloid margin: *1. 2?* 3. *4.* 6. *7?* 8. *10.* 12. 14. *17. 23?* 24. *30? 31?* 39. *46. 47?*
13. Number of petals
   a. 5: *1.* 5. 6. 7. 9. 16. 17. 19. 21. 22. *23?* 24. 25. 26. 31. 32. 33. 34. *35.* 36. 40. 41. 42. 43. 44. 45. *47?*
   (*b*: 4).
14. Petalar scale
   a. not crested: 3. 5. *7?* 9. 17. 19. 20. 21. *23?* 24. 25. 26. *27.* 28. 29. *30?* 33. 36. 40. 41. 42. 43. 44. 45. *47?*
   (*b*: crested).

15. Disk
    a. complete: 5. 6. 7. 9. 16. 17. 19. 21. 22. *23?* 24. 25. 26. 31. 32. 33. 34. 36. 40. 41. 42. 43. 44. 45. *47?* (*b*: interrupted).
16. Disk
    a. hairy: *1.* 5. 8. 10. 11. 14. 15. *23? 25. 27. 34.* 37. *47?* (*b*: glabrous).
17. Connective
    a. hairy: *1.* 3. 4. 5. 6. *7?* 9. 16. 18. 19. *20?* 21. 22. *23?* 24. *25.* 26. 27. *30?* 31. 32. 33. *34. 35.* 36. 37. *38?* 44. 45. *47?* (*b*: glabrous).
18. Ovary
    a. glabrous: *23?* 40. *42? 47?* (*b*: hairy).
19. Ovary
    a. 2-celled: 16. 17. *24.* 28. *31.* 40. 42. 43. *47?* 48. (*b*: 3-celled).
20. Fruit
    a. ultimately glabrous: *3? 5? 6? 8? 9? 13?* 14. *15? 23? 26? 28? 29? 31? 32? 36? 37? 39?* 40. *41? 42? 43. 44? 45? 46? 47? 48?* (*b*: remaining hairy).
21. Endocarp
    a. glabrous: *3? 4? 5? 6?* 7. *8? 9?* 10. 12. *13?* 14. *15?* 21. *23? 26? 28? 29? 31? 32? 36? 37? 39? 40? 41? 42?* 43. *45? 46? 47? 48?* (*b*: hairy).
22. Seed
    a. hairy: *3? 4? 5? 6? 8? 9?* 12. *13? 15? 21? 23? 26?* 27. *28? 29? 31? 32? 36? 37? 39? 40? 41? 42? 44? 45? 46? 47? 48?* (*b*: glabrous).

1. *'tetraphylla'* (incl. *Sapindus tetraphylla* Vahl, *Molinaea canescens* Roxb., *L. tetraphylla* var. *cambodiana* Pierre, and *L. granulata* Radlk.). This is the predominant race in continental Asia (but rare in the Malay Peninsula and Indo China). In India it is rather homogeneous and well characterized by its mostly 2-jugate leaves, the leaflets mostly rounded at apex, by its axillary or ramiflorous, sparsely branched, greyish- to fulvous-tomentose inflorescences, and the smooth fruits. The flowers, always with an interrupted disk, have usually 4 petals; in India, however, female ones often have 5. Towards the east the variability becomes wider. Whereas in Ceylon and the southern Deccan a separation between *'tetraphylla'* and *'trichocarpa'* is fairly easy, in Burma it is not well possible to distinguish between true *'tetraphylla'* and *L. granulata*, though the latter is about identical with *'trichocarpa'*. The Indo Chinese var. *cambodiana* is mainly characterized by the broader and thinner leaflets; the separation from true *'tetraphylla'* (Pierre's var. *indica*) is not at all sharp; possibly the difference is mainly ecological and clinal.

CEYLON. *Thwaites CP. 3508.*

INDIA. Bombay: *Fernandes 181*, between Kumta and Sirsi (A); *1345*, Siroli ghat 9—10 miles from Dandeli (A). — Mysore: cf. Radlk. (1932) 744. — Madras: *Barber 620*, Tinnevelly, Mundanthorai (K); *Brandis 912* (A); *Gamble 21747*, Nellore Dist., Stuhaukota; *E. Govindarajalu 7929*, Mahabalipuram (L); *Stocks 6*, Concan. — Orissa: *Haines 4101*, Puri Dist., Dhuanali (K); *4101a*, ditto, Pratab for. (K); *Mooney 218*, Ranpur State (K).

BURMA. Upper: *Prazer 24*, type of *L. granulata*. — Tenasserim: 'from Moulmein southwards' (Kurz, 1876, l. c.), cf. Radlk. (1932) 745. — Mergui Arch.: *Helfer KD 986/1*, Domal I.

THAILAND. Eastern: *Kerr 8106*, Korat, Pak Tong Chai, alt. 200 m. — Peninsular: *Annandale SF 1587*, Koh si Kah; *Haniff & Nur SF 7099*, Terutau, Telok Apan.

N. VIETNAM. *Pételot 936*, Cho Gonh.

S. VIETNAM. *Müller 1039*, Gia-ray (UC); *Pierre 4131*, Prov. Bien hoa, Song lu; *4132*, ditto, syntype of *L. tetraphylla* var. *cambodiana*; *Poilane 5536, 5545*, Prov. Ca-Na, Phanrang.

CAMBODIA. *Béjaud 330*, forêt de Phnom Penh; *Pierre 508*, Prov. Samrong tong, Mt Proc, syntype of *L. tetraphylla* var. *cambodiana*.

MALAY PENINSULA. Langkawi Is: *Batten Pooll s.n. in herb. SING 22942.*

MARTINIQUE. Escaped from the Botanical Garden at St. Pierre and naturalised, *Duss 1837* (NY).

cultivated in the Botanical Gardens at Bogor: *III-J-34* and *III-K-8*; and at Calcutta: *Gamble 6841A, HB 14282, HB 14401, Wallich 8040 D.*

2. *'trichocarpa'* (*Hemigyrosa trichocarpa* Thw.). Compared with *'tetraphylla'* this represents a more coarse form with often 3- or 4-jugate leaves, large and widely branched, pseudo-

terminal inflorescences which are more ferruginous tomentose, and with finely warty fruits. These differences, however, hold only good for Ceylon and southern Deccan, the regions where the two races grow together. *L. granulata*, described from Burma, is hardly different from '*trichocarpa*', but is inseparable from '*tetraphylla*' in its own region. '*tetraphylla*' and '*trichocarpa*' may represent ecotypes: acc. to Trimen (1893, l. c.) in Ceylon '*tetraphylla*' should be more common in the drier, '*trichocarpa*' in the wetter and higher parts.

CEYLON. *Alston 260*, between Nugatenne and Madugoda; *803*, Veragantota; *Thwaites CP 607*; *Mrs Col. Walker 86* (K); *Worthington 4966*, Kandy.
INDIA. Madras: *Barber 5660*, Tambracheri ghaut, Wynaad.

3. '*deficiens*' (incl. *Sapindus ? deficiens* W. & A.).

INDIA. Southern Madras and Travancore. Only specimen seen: *Wight KD 535*, Shenapherry Hills, -8-1836.

Repeatedly reported from Ceylon: Wight, Ic. (1839) 141, *sub Sapindus deficiens*; Trim., Fl. Ceyl. 1 (1893) 302, *sub Hemigyrosa deficiens*; Alston, Fl. Ceyl. Suppl. (1931) 55, *sub Lepisanthes deficiens*. As far as can be judged from the description Radlkofer (1932, l. c.) is right in referring these somewhat hesitatingly to *L. trichocarpa*.

4. An undescribed form from Bombay. Though superficially it shows a great resemblance to '*tetraphylla*' it differs in several characters. Apart from those mentioned in the key the most important are the big flowers (outer sepals $3\frac{1}{4}$ mm, inner sepals 4 mm, petals $8\frac{1}{2}$ mm; for '*tetraphylla*' these measurements are $1\frac{3}{4}$—$2\frac{3}{4}$ mm, 2—$3\frac{1}{2}$ mm, and $3\frac{3}{4}$—$6\frac{1}{2}$ mm resp.) and the undivided petalar scales bearing two narrow, 3-dentate appendages (in '*tetraphylla*' the petalar scale is mostly biparted and the appendage composed of an erect hornlike part and a second part appressed to and conform with, but slightly smaller and more deeply dentate than the lobe).

INDIA. Bombay: *Bor 9666*, Jellapur (NY); *11299*, Mali mauri (SING).

5. An undescribed form from Bihar. Superficially, this also strongly resembles '*tetraphylla*'. It differs in some rather important characters, however, viz. the terminal inflorescence, the completely 5-merous flower, a petalar scale which is only represented by 2 small, hairy auricles, and an uninterrupted, densely villous disk.

INDIA. Bihar: *J. J. Wood s.n.*, Chota Nagpur, 187. (FI, L. sh. 908.270—313).

6. '*assamica*' (incl. *L. assamica* Radlk.). A relatively isolated form, though vegetatively and as to the inflorescences resembling '*tetraphylla*' (but leaves 4—6-jugate). It is mainly characterized by the large flowers (outer sepals 5 × 4 mm, inner $5\frac{1}{2}$ × 5 mm, petals 6 mm long), the brushlike appendages of the bilobed petalar scale, and the (abnormal?) androecium consisting of 11 or 12 stamens, *c.* 8 of which long.

ASSAM. *A. T. Gage 185*, S. Lushai Hills near Fort Lungleh, alt. 900—1200 m, type.

7. '*listeri*' (incl. *L. listeri* Radlk.). Distinctly different from '*assamica*', the only sympatric form, in several characters, apart from those mentioned in the key among others in the far bigger and relatively broader leaflets (15—30 × 5—14 cm, ratio 2—3, *versus* $4\frac{1}{2}$—19 × 2—4 cm, ratio *c.* $4\frac{1}{2}$). It may also be related to race 21 from the Malay Peninsula from which it differs in the narrowly lanceolate, 2—3 mm long bracts (in 21 the bracts are broad-ovate and *c.* 5 × 5—6 mm).

ASSAM. *J. L. Lister s.n.*, Duphla Hills, Dikrung Valley, type.

8. *'basicardia'* (incl. *L. basicardia* Radlk.; *L. burmanica auct. non* Kurz: Pottinger & Prain, Rec. Bot. Surv. Ind. 1, 1898, 236). Nearest allied to *'burmanica'* from which it differs, apart from the characters mentioned in the key, by the narrower leaflets (ratio *c.* 5, in *'burmanica' c.* 3), the more distant nerves (2—3 cm along the midrib, in *'burmanica'* 1—1½ cm), and the rami- (or cauli-?)florous inflorescences (in *'burmanica'* they are supra-axillary, up to 2 cm above the leaf-axil).

BURMA. Upper: *S. Mokim s.n.*, Kachin Hills, Myitkyina, type of *L. basicardia.*

9. *'browniana'* (incl. *L. browniana* Hiern; *L. montana auct. non* Bl.: Kurz, J. As. Soc. Beng. 44, ii, 1876, 183; Fl. Burm. 1, 1877, 291). This form is especially close to *'montana'* from which it apparently mainly differs by its longer pedicels (¾—1 cm, in *'montana'* up to ¼ cm) and the deeply bilobed petalar scale (in *'montana'* entire).

BURMA. Tenasserim: *W. Gomez 342 = herb. Wallich 7497*, Tavoy, Martaban, type.

10. *'burmanica'* (incl. *L. burmanica* Kurz; *L. montana auct. non* Bl.: Hiern in Hook. *f.*, Fl. Br. Ind. 1, 1875, 679; Kurz, Rep. Pegu, 1875, App. A p. 38, App. B p. 40). Nearest to *'basicardia'*; for differences see there.

Possibly, two different races are included, but on the basis of the 4 collections studied by me I can not clearly distinguish between them. The two syntypes appear distinctly different: the Brandis collection which I have chosen as the lectotype is the most complete one; it shows parts of a twig with leaves, inflorescences, male flowers, and young fruits. The inflorescences are supra-axillary and up to *c.* 10 cm long, the sepals are distinctly partly petaloid. In these characters it differs considerably from the second syntype, the Kurz collection, which only consists of a big terminal infructescence, or the bare upper part of a twig with several pseudoterminal up to *c.* 30 cm long infructescences, with ripe fruits; as far as can be judged from the remainders of the flower under the fruit the sepals were not or hardly petaloid. Of two further collections one consisted only of part of a leaf which agreed very well with *Brandis* 737; the other one, *Griffith cat. 1020*, consists of a twig with leaves, also well in accordance with *Brandis 737*, and some pseudoterminal infructescences about 20 cm long, bearing young fruits but without sepals, in excellent agreement with *Kurz 2030*. The latter specimen hence apparently bridges the gap between both syntypes.

BURMA. *Griffith cat. 1020*, also bearing the numbers *307* and *636* in different handwritings, without collector or locality (K). — Lower: *D. Brandis 737*, Pegu, hills between Sitang and Beeling, lectotype; *S. Kurz 2030*, Pegu Yomah, E. and W. slopes, 9-4-1871, syntype; *Anonymus s.n.*, Salunn, Martaban, alt. 900 m, -3-1880 (NY).

11. This race is now included in 10.

12. *'siamensis'* (incl. *Sapindus ? siamensis* Radlk.). The commonest form in Thailand. Though superficially resembling *'tetraphylla'* it is distinctly different from that as well as from all other forms.

THAILAND. North: 11 collecions. — Southwest: *Kerr 10641*, Ratburi Prov., Chawm Bung, 100 m alt.

The citation from Laos by Gagnepain (Fl. Gén. I.-C. Suppl. 1, 1950, 946) 'Lakhone *(Kerr)*' may refer to *Kerr 2563* which, however, comes from Lakon in N. Thailand.

13. *'poilanei'* (incl. *L. poilanei* Gagnep.). Nearest allied to *'langbianensis'* but distinctly different.

THAILAND. Southwestern: *Kasin Kwae Noi Basin exp. 364*, near Neeckey, 150 m alt. (A, K, L).
S. VIETNAM. *Poilane 8904*, Prov. Ca-na, Phanrang, alt. 850 m, type.

14. *'mekongensis'* (incl. *L. mekongensis* Pierre). A relatively isolated form which might be the first to deserve specific rank.

CAMBODIA. *D'Alleizette herb. 1393*, Stun-Tren (L); *A. Chevalier 31874*, Kratié; *Harmand 25 = herb. Pierre 5669*, Mekong R., type; *Pierre 883*, Prov. Samrong tong, foot of Mt Cheréer.

15. *'langbianensis'* (incl. *L. langbianensis* Gagnep.). Nearest allied to *'poilanei'* on the one hand, to *'appendiculata'* on the other, but well separable from both.

S. VIETNAM. *Poilane 18633*, between B. Dlé and Dankia, Langbiang, alt. 1100—1200 m, type.

16. *'tonkinensis'* (incl. *L. tonkinensis* Radlk.). Nearest allied to race 17 from Hainan and to *'pallens'* from Timor.

N. VIETNAM. *Bon 2805*, Hanoi Prov., Lat-son, syntype.

17. *Hainan race*, published by Merr. & Chun, Sunyatsenia 2 (1934) 38, as *L. montana*. Distinctly allied to *'tonkinensis'*, mainly different in some flower details.

HAINAN. *S. P. Ko 52170*, Po-ting, Lingshin (NY); *H. Y. Liang 61769*, Lingmoon, N. Seven Finger Mts (A, NY).

18. *'appendiculata'* (incl. *Ostodes appendiculata* Hook. *f.*). Nearest allied on the one hand to *'langbianensis'* from S. Vietnam, on the other to race 38 from N. Borneo.

MALAY PENINSULA. Perak: *Chelliah KEP 98655*, K. Temengor; *King's coll. 7359*, near G. Boobo, alt. *c.* 200 m, syntype of *L. kunstleri*.

19. *'longifolia'* (incl. *Hemigyrosa longifolia* Hiern). Among the races with 5 petals and an uninterrupted disk in the Malay Peninsula this form is distinguished by its widely branched inflorescences, its big, ferruginous hairy flowers, and its strongly warty fruits, apart from the characters mentioned in the key. Its nearest allies seem to be *'browniana'* from Tenasserim and *'acuminata'* from Sumatra.

MALAY PENINSULA. Perak: *S. Chelliah KEP 104640*, Trolak F. R.; *King's coll. 8465*, Taiping. — Selangor: *J. H. Burkill SF 9049*, Klang Watercatchment for.; *J. Sinclair SF 40145*, Klang Gates. — Malacca: *Alvins 857*, B. Naning; *Maingay KD 446*, Mt Pangai, syntype.

20. *'scortechinii'* (incl. *L. scortechinii* King). Apart from the characters mentioned in the key, this race is characterized by the fruits with a thickened rib over the lobes. *'appendiculata'* seems to be closest allied to the present race. King, J. As. Soc. Beng. 65, ii (1896) 429, basing himself upon Scortechini's field notes, mentioned 5 petals; this is improbable in view of the interrupted disk, and I found in bud 4.

MALAY PENINSULA. Kedah: *Ridley 5360*, Yan Woods. — Perak: *Scortechini 2090*, type.

The localities mentioned by Henderson, Gard. Bull. S. S. 4 (1928) 243 (Lower Siam, Langkawi, Johore) are doubtful; I have not seen the material on which they were based.

21. An undescribed form from the Malay Peninsula where it seems to be rather common and widespread. Originally it was mostly identified as *Chailletia griffithii* Hook. *f.*, later as *Lepisanthes nov. sp. aff.* (*scortechinii* var.) *hirta* Ridl. Actually, it is closest to the latter form with which it shares the peculiar character of the broad-ovate, large (5 × 5—6 mm) bracts. Apart from the characters mentioned in the key it differs from the latter in its peculiar, drooping, amentiform inflorescences and in its indumentum which consists of a dense covering of short, patent, soft hairs intermingled with more scattered, patent, irritating, *c.* 5 mm long hairs ('*hirta*' has oblique-errect, sparsely widely branched inflorescences and is densely velvety but lacks the long irritating hairs).

MALAY PENINSULA. Pahang: *Henderson SF 19420*, B. Senai near Chegar Perah. — Selangor: *H. L. Hume 9333*, Ginting Simpak, 550 m alt.; *KL 510*, Ulu Langat; *Symington KEP 22773*, Sungei Lalang Kajang, alt. 120 m. — Negri Sembilan: *I. H. Burkill SF 2848*, G. Tampin, alt. 400 m; *Ridley s.n. in herb. SING 22990*, B. Tangga, 20-12-1920. — Malacca: *Alvins 215*, Selandar, common; *Derry 501*, Jarni (?), sea-level; *Griffith s.n.*, Ayer Pannus (K); *Holttum 9673*, B. Sedanau (SING).

22. '*hirta*' (incl. *L. scortechinii* King var. *hirta* Ridl.). This form is on the one hand distinctly allied to race 21, on the other hand to the race of the Anambas Is. With '*scortechinii*' it has far less in common. Apart from the characters mentioned in the key it is characterized by the beautiful reddish-, yellowish-, or greyish-brown velvety indumentum, the large leaflets (19—39 × 7—17 cm) which are hispid all over the lower surface by hairs inplanted on minute warts and with many straight nerves, and the relatively large (4 × 4 mm, broad-ovate bracts.

MALAY PENINSULA. Pattânî: *Kiah SF 24307*, Becho. — Dindings: *Ridley 10282*, Sumut, syntype. — Pahang: *Kochummen KEP FRI 2059*, Kuantan, Baloh F.R., low alt.; *M. Soh KEP 15491*, Rompin. — Johore: *Kostermans s.n.*, Mersing, 1-8-1938, sea-level (BO, SING sh. 22985); *Ridley 11085*, Serom.

SUMATRA. East Coast: *Rahmat si Toroes 1715*, Bila near Rantau Parapat; *3372*, Langga Pajung on the Sungei Kanan; *4199*, Si Mandi Angin on the Sungei Kanan; *Soepadmo 190*, Pakanbaru, Tenajan R., alt. 30 m.

BORNEO. Sarawak: *Murthy & Chai S. 24817*, Kuching-Serian Rd; *Ilias Paie 13599*, Lundu Dist., G. Gading (L, SAR).

23. A collection from Johore which shows some resemblance to '*longifolia*' but differs in some characters (see key). The material bears infructescences with neither a remnant of a flower, nor any of the few fruits they have borne. '*montana*' is the only race from the Malay Peninsula from which it can not be separated using the characters included in the key (as far as they are known). Additional differences are the purplish-brown twigs (whitish-brown in '*montana*'), the midrib which is above prominulous till the base and even extended as a rib on the petiolule (in '*montana*' the midrib is mostly sunken near the base), and the apparently monochasial, racemoid or possibly nearly spicate, up to more than 1 cm long partial inflorescences ('*montana*' has patent, short-stalked, up to 7-flowered cymes, the normal condition in the genus). The inclusion as a separate race under *L. tetraphylla* is only a provisional solution; when flowers and fruits become available the taxonomic position must be settled anew.

MALAY PENINSULA. Johore: *Corner SF 28996*, Mawai-Jemaluang Rd, low alt.

24. '*cuneata*' (incl. *L. cuneata* Hiern). The commonest form in the Malay Peninsula, here well characterized by the combination of 5 petals and an uninterrupted disk with a nearly always 2-celled ovary. The Sumatran material, however, has the ovary predominantly 3-merous, but is otherwise indistinguishable.

MALAY PENINSULA. Perak: 10 collections. — Pahang: *W. Fox s.n.*, Sungei Clunei, 1893 (SING sh. 22945); *M.*

R. Henderson SF 24519, Tembeling; *Mahamud KEP 17125*, Endau Rampin. — Negri Sembilan: *Alvins 1259*; *Holttum SF 9583*, G. Tampin, alt. 60 m. — Johore: *Corner SF 28494*, S. Rhu Reba, Jason Bay, low alt.; *SF 28593*, Kangka Sedili Ketchil, low alt.; *SF 32496*, Sungai Kayu, Mawai-Jemaluang Rd, low alt.; *Kadim & Noor KN 124 & 187*, Kuala Sedili. — P. Penang: *Curtiss 2439 & 3009*; *M. Haniff 181*; *Porter s.n.*, type.

SUMATRA. East coast: *Rahmat Si Toroes (= Si Boeea) 802*, Asahan, Silo Maradja; *1742, 2026*, Bila, near Rantau Parapat; *7325*, Asahan, near Loemban Ria.

25. '*montana*' (incl. *L. montana* Bl. and *L. confinis* Bl.). A common form, widespread in W. Malesia. The delimitation of '*montana*' against several other forms is either vague or highly artificial. Systematically, it takes up a central position, showing a combination of primitive characters, from which in several directions — morphologically as well as geographically — several other forms can be derived, primarily directly most of those characterized by 5 petals and an uninterrupted disk, secondarily either directly or via some other forms those with 4 petals and an interrupted disk. As far as the Malay Peninsula is concerned, the only race from which it is not sharply separated in the key is race 23; additional differences are given under that form. In Sumatra the delimitation against '*acuminata*' is vague (see there).

MALAY PENINSULA. Perak: *King's coll. 4563*, Goping, Kuala Lumpur. — Kelantan: *M. R. Henderson SF 29536*, Sungai Chalil, S. Lebir. — Pahang: *Burkill & Haniff SF 17595*, Beserah; *Burn-Murdoch 163*, Temerloh (SING). — Selangor: *Gadoh KL 1490*, Ulu Langat, K. Pansom; *KL 1593*, ditto, B. Timbok; *H. L. Hume 7320*, Klang Gates (SING); *Symington KEP 22673*, Sungei Lalang Kajang. — Negri Sembilan: *Alvins 1946*, G. Burumban (SING). — Malacca: *Alvins 2297*, common (SING). — Johore: *Henderson SF 18372*, P. Aor, alt. 300 m; *Ridley s.n.*, G. Panti (SING sh. 22980). — P. Penang; *Curtis 2774*, Balick Pulau.

SUMATRA. Palembang: *van Steenis 3310, 3448, & 3781*, N. of Lake Ranau, alt. 500—700 m.

JAVA. *Junghuhn Pl. Ined. 375* (L). — West: 6 collections. — Central: *Koorders 5121*, Res. Banjumas, Midangan Mts near Pringombo. — Nusa Kambangan: *Koorders 15658, 39656*.

BORNEO. East and Northeast: *Jaheri 1671*, Tepah; *Kostermans 6133*, near Samarinda; *21072 & 21698*, Berau, Tdg. Redeb. — North: *G. H. S. Wood SAN A 1995*, Sandakan, Sepilok F. R. (L).

26. '*acuminata*' (incl. *L. acuminata* Radlk.). This form is distinctly allied to '*longifolia*' from the Malay Peninsula. In Sumatra it is hardly different from '*montana*' and the separation may be due to lack of material. The main characters locally separating it from '*montana*' are the denser and more regular nervation (nerves *c.* 1—2 cm distant and nearly straight, in Sumatran '*montana*' 2—3 cm distant and curved), cymes sessile (in '*montana*' short-stalked), and sepals of about the same size (outer 4—5 × 4 mm, inner $4\frac{1}{2} \times 4\frac{3}{4}$ mm, in '*montana*' $2\frac{1}{2}$—$3\frac{1}{2} \times 1\frac{1}{2}$—3, resp. 3—4 × 2—4 mm).

SUMATRA. West Coast: *Beccari PS 114*, Mt Singalan, syntype.

27. '*lamponga*' (incl. *L. lamponga* Radlk. and *L. latifolia* Radlk.). Superficially, this race is hardly separable from '*montana*' and '*heterolepis*'; it differs mainly in the predominantly 4-merous corolla and the slightly to distinctly interrupted disk, the big fruits (3—5 cm diam., in '*montana*' as well as in '*heterolepis*' up to *c.* $2\frac{1}{2}$ cm), and the seeds which are rather densely appressed brown hairy. The latter character is in this relationship furthermore only known from '*siamensis*' which seems not very close to '*lamponga*' (the character is not known, however, in 26 out of the 47 races!). By its predominantly 4-merous corolla and always more or less unequal disk it links up '*montana*' with e.g. *L. andamanica* and '*appendiculata*', '*deficiens*', and '*tetraphylla*'.

SUMATRA. Tapanuli: *Rahmat si Toroes 5134*, Sopsopan on Aek Si Olip (NY); *5295*, Aek Si Olip, near waterfall (NY). — West Coast: 7 collections. — East Coast: 13 collections. — Lampong Districts: *Forbes 1708*, Penangungan, type; *Iboet 399*, Wai Lima (BO). — Batoe Is: *H. Raap 166, 328*, P. Massa (BO); *497, 539*, P. Pini (BO).

28. An undescribed form from the East Coast of Sumatra, doubtless allied to '*lamponga*', but different in the following points: tree 18 m × 45 cm ('*lamponga*' is a shrub or treelet, up to 9 m × 16½ cm), twigs dark purplish brown ('*lamponga*' whitish brown), petiole 6—12 cm long (in '*lamponga*' 12—24 cm), and connective glabrous (sparsely to densely woolly in '*lamponga*'), apart from the characters mentioned in the key. It shows also a distinct resemblance to '*tetraphylla*' from which it differs in the petalar scales without an appendage and the 2-merous pistil.

SUMATRA. East Coast: *Thijssen bb 9408*, Karolands, near Sembaikan, alt. 1000 m (BO).

29. An undescribed form from the Lampong Districts, Sumatra, allied to '*lamponga*'. It differs from the latter race, apart from the characters mentioned in the key, in the following points: twigs *c.* 2½ cm ⌀ (in '*lamponga*' up to 1¾ cm), dark purplish brown (in '*lamponga*' whitish brown), petiole 45—50 cm long (in '*lamponga*' 12—24 cm), flowers big: outer sepals 5 × 5½ mm, inner 6 × 5 mm, petals in bud already 5 mm (in '*lamponga*' outer sepals up to 3¼ × 3½ mm, inner up to 4 × 3½ mm, full-grown petals up to 5½ mm long), anther more than 2 mm long (in '*lamponga*' 1 mm).

SUMATRA. Lampong Districts: *Iboet 399*, Wai Lima, alt. 200 m (L).

30. '*sumatrana*'. This race has never been published, though in 1899 already Radlkofer recognized this as a new species and named it provisionally *L. sumatrana*. It may be nearest allied to '*burmanica*'.

SUMATRA. West Coast: *Beccari PS 170*, Mt Singalan.

31. '*pallens*' (incl. *Erioglossum alliaceum* Span.). Distinctly allied to '*tonkinensis*' and '*angustifolia*', on the other hand connected with '*montana*' via the two van Steenis collections from E. Timor. The variation in several characters is rather wide compared with the few specimens studied. The one syntype (L sh. 908.272—610) has a terminal inflorescence whereas the other one (L sh. 908.272—660) shows an axillary one; both syntypes have the petalar scale with an appendage of about the same shape and size, whereas it is not crested in the two van Steenis collections; the two van Steenis collections, though very similar, differ in that *van Steenis 18077* bears 2-merous fruits (in agreement with the types) whereas *18203* has a 3-merous pistil. The occurrence of '*pallens*' on Java is doubtful to me: this rests only on a specimen in L (sh. 908.270—30) labelled *Lepisanthes angustifolia Bl.* in Blume's handwriting and 'Java' printed. It is very well possible that the specimen and the label do not belong together: the specimen fits very well with *Zippelius 10a* and is certainly not '*angustifolia*' (though the two resemble each other superficially).

JAVA. *Unknown coll.* (L sh. 908.270—30) (record doubtful, see above).
TIMOR. *Spanoghe*, syntype (L sh. 908.272—610); *van Steenis 18077*, E. Timor between Baucau and Vemassi, alt. 100—350 m (L); *18203*, E. Timor, S. coast near Lorè, alt. 1—5 m (BM, BO, L); *Zippelius 10a*, syntype.

32. '*angustifolia*' (incl. *L. angustifolia* Bl.). This form seems to be nearest allied to '*pallens*', '*tonkinensis*', and '*heterolepis*'. Blume, Rumphia 3 (1849) 154, cites as the type locality: 'In mediterraneis orae occidentalis Sumatrae, locis montanis'. The only specimen bearing the name in Blume's handwriting and still preserved in the Rijksherbarium, Leiden, *Korthals 8*, is labelled 'Nagara' and, printed on the herbarium label, 'Java'. The few other specimens known to me are all from a very restricted part of the Preanger Regentschappen, W. Java; localities mentioned are Santiang and Pameungpeuk. Korthals is also known to have collected around Santiang and Pameungpeuk. Nagara is not only a

locality in S. Sumatra, but also a district in the Preanger the capital village of which is mentioned as Pomengpek. In my opinion there is hardly any doubt that the type locality also should be sought in W. Java.

JAVA. West, Preanger Regentschappen: *Korthals 6*, Zuiderstrand (southern beach) (L); *8*, Nagara, type; *Scheffer s.n.*, 3 collections from Leuweung Santjiang, E. of Pameungpeuk, -6-1872 (BO).

33. An undescribed form from the Anambas Is between the Malay Peninsula and Borneo. It is distinctly nearest allied to the races 21 and '*hirta*' (22). With the former it shares the double indument and the large bracts (in the present race *c.* 4 × 2½ mm), differs, however, in the more lax inflorescence, and from both by the closed nervation.

ANAMBAS Is. Siantan: *Henderson SF 20114*, near Terempak; *van Steenis 699*, E. of Terèmpa, alt. 200 m. — Temaja: *Henderson SF 20385*, G. Adung, alt. 300 m.

34. '*heterolepis*' (incl. *L. heterolepis* Bl., *L. sessiflora* Bl., and *L. blumeana* K. & V.). Actually, the delimitation of this race against '*montana*' is fully artificial, the only difference being the absence of any appendage to the petalar scale in '*montana*', its presence in '*heterolepis*'. In some specimens of the latter, however, there are flowers with only one of the petalar scales with a minute central or lateral, hollow wart, other flowers may show in some or all of the petalar scales 1, 2, or 3 minute warts. Furthermore, '*montana*' and '*heterolepis*' show the same variability.

JAVA. West: 6 collections. — Central, Banjumas Res.: *C. A. Backer 406*, G. Slamat, S. slope, alt. 700 m (BO); *Koorders 40229*, G. Puseran, alt. 600 m. — Nusa Kambangan: *Koorders 24802*.

BORNEO. Sarawak: *Clemens 20611*, Bidi Caves (SAR); *21051*, Kapit, Upper Rejang R., low alt. (K, NY, SAR). — South: *Korthals s.n.*, G. Pamatton, type. — East: *Amdjah 462*, B. Ulu Sebuku (BO); *Endert 5203, 5299*, W. Kutai, Kambeng, alt. 30 m (BO); *Kostermans 21046*, Berau, T. Redeb, Kelai R., alt. 10 m. — North: *Elmer 20922*, Elphinstone Prov., Tawao; *Sayu Ellen SAN 35574*, Sandakan Dist., Labuk Rd, alt. 30 m. — P. Laut: *van Slooten 2250*, Sungai Paring, NE. of Stagen, alt. 75 m (BO, L).

35. An undescribed group of closely allied forms from Borneo, on the one hand hardly separable from '*heterolepis*', on the other hand hardly more different from '*cuneata*', especially the Sumatran specimens with a 3-celled ovary, than by the closed nervation (open in '*cuneata*', but '*heterolepis*' tends in the same direction). The corolla may be 5- or 4-merous, the disk varies from complete though unequal to interrupted.

BORNEO. Sarawak: *J. A. R. Anderson 4748*, Baram Dist., G. Api, alt. 900 m (L, SAR). — East: *Endert 3328*, W. Kutai, near L. Petah, alt. 450 m (BO, L); *4176*, ditto, near Mt Kemul, alt. 1500 m (BO, L); *Sauveur K 23*, Sambodja, Balikpapan (L). — North: *Clemens 30266, 50335*, Mt Kinabalu, alt. 900 and 1650 m resp.

36. '*petiolaris*' (incl. *L. petiolaris* Radlk.). Near '*montana*', differing mainly by the distinct intramarginal nerve. Furthermore too incompletely known (only male flowers) to settle it definitely.

BORNEO. Sarawak: *Clemens 21829*, Gat, Upper Rejang R. (A, K, NY, SAR); *Hose 551*, Baram Dist., Mt Trekan, alt. 300 m, type.

37. An undescribed form from E. Borneo, probably nearest allied to '*hirta*', especially characterized by the relatively large leaflets (27—48 × 7½—11 cm) with a very regular, dense nervation (distance along midrib 1½—2 cm) and a conspicuous intramarginal nerve.

BORNEO. East: *Endert 2823*, W. Kutai, near L. Ibut, alt. 250 m (A, BO, L); *3728*, ditto, near Mt Kemul, alt. 1100 m (A, BO, L).

38. An undescribed form from N. Borneo, distinctly allied with '*appendiculata*' and '*scortechinii*', both from the Malay Peninsula.

BORNEO. North: *Muin Chai SAN 25591*, Lahad Datu Dist., Sg. Serai, E. of Tungku, alt. 3 m.

39. An undescribed form from N. Borneo the alliance of which seems to be on the one hand with '*tetraphylla*', on the other hand with race 46 from the Philippines.

BORNEO. North: *Carr SF 26768*, Mt Kinabalu, Lobang, alt. 1200 m.

40. An undescribed form from Sarawak, mainly in its flower characters reminescent of '*cuneata*' from the Malay Peninsula.

BORNEO. Sarawak: *Haviland & Hose 3724*, near Kuching (BM, K).

41. An undescribed form from Sarawak, probably identical with race 40, different, however, by the 3-merous, hairy pistillode (in race 40 the pistillode is 2-merous and glabrous).

BORNEO. Sarawak: *Haviland 1624*, near Kuching (K).

42. A form from North Borneo distributed as '*Lepisanthes ? sp. nov. affl. eriolepis*'. Indeed, at least closely allied with the Philippine '*schizolepis*', mainly different in some flower details, viz. outer sepals $4\frac{1}{2} \times 3$ mm (in '*schizolepis*' up to $3\frac{1}{2} \times 3$ mm), inner sepals 5×4 mm ('*schizolepis*' $4 \times 4\frac{1}{2}$ mm), petals $6\frac{1}{2} \times 2\frac{3}{4}$ mm, outside claw and part of plate hairy ('*schizolepis*' up to $4\frac{1}{2} \times 2\frac{1}{2}$ mm, only claw hairy), stamens 18, filament $3\frac{1}{2}$ mm, anther $1\frac{1}{2}$ mm ('*schizolepis*' up to 8 stamens, filament up to $2\frac{1}{2}$ mm, anther up to 1 mm). Especially the number of stamens makes the impression that the flower is abnormal which may also account for the bigger size.

BORNEO. North: *Kadir & Enggoh B. N. B. For. Dept 10351*, Elopura Dist., Sapagaya F. R. (A, BO, L).

43. '*schizolepis*' (incl. *L. schizolepis* Radlk., *L. eriolepis* Radlk., *L. perviridis* Elm, and *L. macrocarpa* Radlk.). This is the most common form in the Philippines. The variation is as a whole moderate and continuous. The fruits provide the only exception: these may be either densely tomentose until maturity, or about glabrous already when young. I could neither find any correlation with other characters, nor with habitat or distribution.

PHILIPPINES. Mindoro: *Kienholz s.n.*, Puerto Galera, alt. 30 m (UC sh. 263037); *Ramos BS 39682*, Paluan (A); *Sulit PNH 17108*, Mansalay, Bo. Manaul, low alt. — Batanes Is: *Ramos BS 80684*, Uyogan, low alt. (NY). — Babuyan I.: *Fénix 3911* (M). — Luzon: 35 collections. — Polillo I.: *Fox PNH 9014*. — Marinduque: *Vidal 2464*, Gasan (A). — Ticao I.: *Kondo & Edaño PNH 36858*. — Leyte: cf. Merr., En. Philip. 2 (1923) 500. — Bohol: *Ramos BS 42828*, Valencia, alt. 600 m (A, SING, UC). — Negros: cf. Merr., En. Philip. 2 (1923) 500. — Mindanao: *Ramos & Convocar BS 83642*, Agusan Prov., Jabonga (NY).

A deviating collection is *Ramos & Edaño BS 33478* (Luzon, Camarines Prov., Paracale; A); in it the scale of the petals is hardly more than a hairy rim, whereas the disk is rather densely short-hairy (normally, the petalar scale is distinctly developed, and the disk is glabrous).

44. '*acutissima*' (incl. *L. acutissima* Radlk.). This form is especially hardly separable from '*montana*'.

PHILIPPINES. Palawan: *Merrill BS 9564*, Lake Manguao, alt. 80 m, type.

45. *'viridis'* (incl. *L. viridis* Radlk.). Like the former hardly different from *'montana'*.

PHILIPPINES. Mindanao: *Whitford & Hutchinson 9266*, Zamboanga Prov., Banga, type.

46. An undescribed form from the Philippines, near *'schizolepis'* but distinctly different.

PHILIPPINES. Leyte: *Wenzel 824* (A). — Mindanao: *Elmer 13450*, Mt Urdaneta; *Wenzel 2857*, Surigao Prov. (A, L, M, NY, UC).

47. *'celebica'* (incl. *L. celebica* Radlk.). The identity of *L. celebica* is uncertain and will remain so until new collections become available. It was based upon sterile material; the holotype is lost in Berlin and probably nothing more is left than the Munich isotype: part of a leaflet, a few mm of the petiole, and a dissected axillary bud. These fragments agree completely with *'schizolepis'*, the species to which Radlkofer already pointed for possible affinity. Of course, a new species should never have been described upon such scanty material.

CELEBES. North: *Warburg 15537*, Bojong, type.

48. *'hirtella'* (incl. *L. hirtella* Radlk.). Not only geographically, but also systematically this form is somewhat isolated; still, it can not satisfactorily be delimited against the whole of the *tetraphylla*-complex.

NEW GUINEA. Vogelkop Pen.: *Beccari herb. 2837*, Amberbakin, type.

IV. THE LEPISANTHES FRUTICOSA COMPLEX

Lepisanthes fruticosa in the broad sense accepted in this paper is a complex species. This is clearly demonstrated by the list of 24 heterotypic synonyms, including 15 species recognized by Radlkofer (1932) and 3 more he did not know, as well as by the relative vagueness in several points of the description. Still, a subdivision into clearly delimited infraspecific taxa reflecting apparently natural affinities is not well possible, but the geographical pattern of the variability is remarkable and deserves some discussion (the names in this discussion are used in the sense of Radlkofer, 1932).

Those varying characters which are of the greatest importance for the definition of local races are: (1) the number of leaflets pro leaf; (2) whether the inflorescence is terminal or axillary, or rami- to cauliflorous; (3) whether the calyx and the corolla are 5- or 4-merous; (4) whether the pistil is 3- or 2-merous; and (5) whether the fruit septum (septa) is (are) complete or interrupted to nearly fully reduced.

The pattern of variation in the western part of the specific area (continental SE. Asia, the Malay Peninsula, and Borneo) is clearly distinct from that in the Philippines, Celebes, and the Moluccas. Whereas in the Philippines, Celebes, and the Moluccas the variation is continuous and no further delimitation seems possible, the several western races can be arranged into three groups which represent distinct closer affinities. (Whether the populations of Java and the Lesser Sunda Islands are natural is doubtful; the species is only represented here in the typical, West Malesian form *'fruticosa'* which is also cultivated for its edible fruits.)

The Philippines, Celebes, and the Moluccas. Typical *'fruticosa'* has 2—4-jugate leaves with relatively narrow leaflets (ratio *c.* 4), axillary or sometimes terminal inflorescences, 4-merous flowers with a 2-merous pistil, and the fruit septum strongly reduced. In the Philippines, Celebes, and the Moluccas, however, the variability is distinctly wider:

the number of leaflets per side may vary from 1 to 8, they are often broader (ratio *c.* 3), the inflorescences may be rami- to cauliflorous, and the number of flowerparts is also not constant: *Rachmad 372* (Central Celebes) has 5-merous flowers with a 2-merous pistil, *Elbert 2894* (Muna I., Celebes) shows in the same inflorescence 4- as well as 5-merous flowers, and, varying independently, 3- and 2-merous pistils, *Eyma 4210* (Central Celebes) has between many 2-merous some 3-merous fruits, and *Fénix BS 28121* (Luzon) and *Warburg 2494* (SW. Celebes) have 4-merous flowers with a 3-merous pistil. This regards all undisputable '*fruticosa*' in the strict sense of Radlkofer; the *Elbert* and *Warburg* collections were also cited by him.

None of the species accepted by Radlkofer was described from Celebes, four, however, were based upon Philippine material. One of these, *Otophora grandifoliola*, unknown to Radlkofer, deserves no further attention: it represents no more than the broader leaved Philippine '*fruticosa*'. The other three, *Otophora cauliflora*, *oliviformis*, and *setigera* form a distinct Philippine alliance. They should differ from '*fruticosa*' in their 5-merous flowers (only known from '*oliviformis*') and their rami- or cauliflory. Both these characters are already known from Philippine and Celebes '*fruticosa*', hence there is no reason for separation.

The fruticosa-group. In West Malesia this group can be characterized as having the inflorescences axillary or sometimes terminal, the flowers 4-merous, the pistil 2-, exceptionally 3-merous, and the fruit septum interrupted to nearly completely reduced. Apart from *Otophora fruticosa* itself it includes *O. anomala*, *bijuga*, *eberhardtii*, *resecta*, *sessilis*, and *siamensis*, the former two described from Borneo, the latter four from the Malay Peninsula, Thailand, and Indo-China.

Otophora anomala and *bijuga* are closely related mutually. According to Radlkofer's key (1932, p. 756) they should differ from *O. fruticosa* in their 5-merous flowers and the uninterrupted septum of the ovary, the former, moreover, in the presence of a reduced terminal leaflet. Actually, the number of flowerparts of *O. bijuga* is unknown, and for *O. anomala* Radlkofer gives in his description (1932, p. 766) rightly the flowers as 4-merous. His observations on the septum are in both cases made from ovaries short after fertilization; these are completely 2-celled, but this applies also to *O. fruticosa* if studied in a comparable young stage. A more or less strongly reduced terminal laeflet, which should characterize *O. anomala*, may also be found, though occasionally, in true *O. fruticosa*. This means that both *O. anomala* and *bijuga* fall completely within even the narrow range of variability of western '*fruticosa*'.

The three forms, described from the Malay Peninsula and Thailand, are mutually hardly different. *Otophora sessilis* differs from *O. resecta* only in the relatively broader leaflets (ratio 3—3½ *vs.* 4—7) and the larger and more ovoid fruits (17 mm long *vs.* 10 mm). *O. siamensis* is about intermediate between these two. The combination differs from *O. fruticosa* only in degree, mainly in the more-jugate leaves (6—14 *vs.* 1—8) with subsessile to sessile, often narrower leaflets (ratio 3—7 *vs.* 3—4). Apparently, *O. resecta*, *sessilis*, and *siamensis* represent no more than a slightly different, western extension of true '*fruticosa*'. *Otophora eberhardtii*, known from S. Vietnam only, belongs to this same alliance; it mainly differs by the somewhat less-jugate (3—6), partly hairy leaves and flowers which are 3—4-merous.

The glandulosa-group. This group is restricted to Borneo and encompasses *Otophora glandulosa* and *lancifolia*; it is characterized by 5-merous flowers, a 2-merous pistil, and interrupted fruit septa.

Otophora lancifolia should differ from *O. glandulosa* in two characters: the inflorescences should be axillary instead of rami-or cauliflorous and the fruit septum should be complete

instead of interrupted (Radlkofer, 1932, p. 756). Whereas Radlkofer had only one collection of each at his disposal, I could study at least 40 specimens from this group, all doubtless representing one species. The position of the inflorescence appears to vary: ♂ as well as ♀ inflorescences may be either axillary or rami- or cauliflorous, I see no rule in it. As to the second character, a careful analysis of the fertilized ovary of *O. lancifolia* — the same material on which Radlkofer based his opinion — revealed that the septum is complete in the lower half only, in the upper half it splits, and the apical part of the ovary is even 1-celled. Comparable ovaries of *O. glandulosa* are incompletely 2-celled throughout, but the pistillode is completely 2-celled. Summarizing, both characters appear to be variable, and hence there is no reason left to keep these two forms separate.

'glandulosa' can more or less be split into two ecotypes, a lowland race and a mountain race. The latter, mainly confined to the higher parts of Mt Kinabalu, has a more slender rachis which, when very thin, is acute above, otherwise terete in the lower part, beneath the upper pair of leaflets flattened above between fine ridgelike wings (the lowland race has the rachis thick and terete); smaller (4 × 1½ mm *vs.* 2½—3 × 2½—2¾ cm), elliptic (*vs.* suborbicular), and more caducous stipules; narrower leaflets (ratio 4—6 *vs. c.* 4) up to 30 cm long (*vs.* up to 40 cm), at base more distinctly oblique, the apex longer acuminate, midrib more often rounded beneath.

One further difference between *'glandulosa'* and *'fruticosa'* deserves to be mentioned: whereas in *'fruticosa'* the anthers are glabrous, in *'glandulosa'* they are rather densely short-hairy. This character varies in other races of *L. fruticosa*, however, though none has the anthers as densely hairy as *'glandulosa'*.

The erythrocalyx-group. This group is richest developed in Indo China and the Malay Peninsula, with two geographically apparently rather restricted races in Borneo. It encompasses *Otophora acuminata, cambodiana, erythrocalyx, furcata,* and *nodosa,* the collection *Squires 850* from S. Vietnam, and a form from the Peak of Balikpapan, E. Borneo, represented by *Kostermans 7329* and *7680*. Though this group seems to represent a natural entity its only common character is: flowers 5-merous, all of the other main characters are as variable as in the species as a whole.

The group can easily be subdivided into two subgroups, one with the pistil 3-merous (*acuminata, erythrocalyx, nodosa,* and the Kostermans collections), the other with a 2-merous pistil (*cambodiana, furcata,* and *Squires 850*).

Otophora erythrocalyx and *nodosa* are distinctly allied. The main differences are: leaves 6—10-jugate in *erythrocalyx*, at least 12-jugate in *nodosa*; leaf-ratio 3—4 in *erythrocalyx*, 4—6 in *nodosa*; apex acute in *erythrocalyx*, blunt in *nodosa*; inflorescences axillary in *erythrocalyx*, cauliflorous in *nodosa*. *Whitmore KEP FRI 3377* (Malay Peninsula: Pahang) seems to belong here, differs, however, from all further *L. fruticosa* in the fruits being fulvous puberulous outside, though glabrescent.

Otophora acuminata (W. Borneo) differs from *O. erythrocalyx* in the leaf-ratio (7—8) and in being cauliflorous, from *O. nodosa* in the smaller number of leaflets (6—8 pairs) with an acute apex. *Ashton S 18404* (Sarawak) comes close to this form, differs in the less-jugate (4—5), hairy leaves and the completely 3-merous flowers.

The Kostermans material from the Peak of Balikpapan differs from *Otophora erythrocalyx* in the smaller number of leaflets (5 pairs), in the outer sepals being distinctly smaller than the inner (in all other races from this group they are equal, but in the other groups they may also be smaller), and in being rami- or cauliflorous. In habit it shows a great resemblance to *'glandulosa'* from which it differs by the 3-merous pistil.

Squires 850 had erroneously been cited under *Otophora nodosa* (Gagnepain, 1950, p. 950); it really differs from that 'species' by the 2-merous pistil. In my opinion it repre-

sents '*cambodiana*', though it differs from the type in the longer petiolules (7—10 mm *vs.* 2—4 mm) and the distinctly clawed petals (claw $\frac{3}{4}$ mm; the petals of '*cambodiana*' are hardly clawed) with a distinct scale (about $\frac{1}{4}$ the length of the plate; in '*cambodiana*' the scale is only represented by a hairy rim).

Otophora furcata differs from *O. cambodiana* in the broader (ratio 4 *vs.* 4½—8), acute leaflets and the petalar scale which is more distinct than in *O. cambodiana*, though less so than in *Squires 850*. The stipules, considered most characteristic for *O. furcata*, vary strongly even in the type. Another difference is the complete fruit septum in *O. cambodiana*, the very incomplete one in *O. furcata*. The importance of this difference here is debatable, however. Two specimens cultivated in the Botanic Gardens, Bogor, under the numbers III. J. 48 and 70 resp., agree completely with *O. cambodiana* — the former has been cited under that name by Radlkofer (1932) — but they have the fruit septum incomplete.

Summarizing, the differences within the western *fruticosa-* and the *glandulosa*-group are either slight or gradual only and do not warrant any subdivision. Only within the *erythrocalyx*-group part of the races seem to be better founded. These races are all represented by one or few collections only, so in reality they may be less sharp. A mutual comparison of the three western groups shows that '*fruticosa*' clearly differs from the others in its 4-merous flowers; the differences between '*glandulosa*' and the *erythrocalyx*-group are vague. Drawing the Philippine and E. Malesian material into the comparison learns that all these differences are already included in its range of variability, making a specific (as well as a sensible infraspecific) subdivision of the complex impossible.

V. THE LEPISANTHES SENEGALENSIS COMPLEX

Lepisanthes senegalensis as accepted here encompasses the genus *Aphania* in the sense of Radlkofer (1932) with the exception only of *A. dictyophylla*, and the genera *Manongarivea* and *Sapindopsis*, 32 heterotypic synonyms in all, and occupies an area which stretches from W. Africa to New Guinea. The range of the variation is nearly as wide, its pattern nearly as complicated as in *L. tetraphylla*, more so than in *L. fruticosa*, and like in those two cases it may be hard to accept this solution, especially for botanists working on the flora of a restricted region in which two or more locally clearly distinguishable forms are represented. Contrary to the chapters on *L. tetraphylla* and *L. fruticosa*, in this chapter I will demonstrate primarily the way of working and thinking which led to this far-going lumping.

Like in the two fore-going chapters, binomials used are in the sense of Radlkofer (1932), between inverted comma's if referring to a more or less distinguishable race, without comma's if only the name is discussed.

The most common, most widely spread, and most variable one among the Malesian forms is '*montana*'. Radlkofer cited this form from Sumatra and Java only, but I have also specimens which doubtless belong to the same form from Borneo, the Philippines, S. Celebes, and the Moluccas. The specimens from Celebes and the Moluccas available to me were partly cited by Radlkofer under *A. boerlagei*, partly identified — by others — as *A. montana*. Vegetatively and in fruit they show no difference at all with *A. montana*. The only further character which was highly valued was the supposed absence of a scale inside of the petals of *A. boerlagei*; it should be replaced by a hair tuft. Actually, the margin of the petal is in the basal part slightly incurved and thickened and somewhat hairy mainly towards the centre. Among undisputable *A. montana* the petalar scale is one of the most variable parts, however, varying from minute to rather large and from

entire to deeply bilobed or even (*Yates 2247* from Sumatra) to divided into two small marginal auricles at either side of the claw.

The New Guinea counterpart of *A. montana* is *A. cuspidata*. According to Radlkofer's key the main difference is that the fruit parts in *A. cuspidata* should be globular — his description gives '*subglobosis*', however — whereas in *A. montana* they should be short-ellipsoid — in his description '*breviter ellipsoideis vel denique . . . subglobosis*'. The differences given in the key are already neutralised by his own descriptions! A careful comparison of the two forms gave as only differences: *A. montana* with the leaflets blunt or rarely acuminate, fruits less than 1 mm stipitate and with short-ellipsoid to subglobular lobes; *A. cuspidata* with the leaflets acuminate, but acumen rarely more than 2 cm long, fruits not stalked and with globular lobes. Furthermore, there is a wide overlap in the variability of these two, and in my opinion they are no more than — probably more or less clinal — variants of one species.

Breaking down the difference '*fructus cocci globosi*' versus '*fructus cocci breviter ellipsoidei*' (this same difference played already a part, wrongly, between *A. boerlagei* and *A. montana*) means that two more New Guinea species have to be compared directly with *A. montana*, viz. *A. sphaerococca* and *A. longipes*. The latter is mainly characterized by the larger number of leaflets (3—4 per side) and the very long petiolules (10—13 mm), but *A. montana* from the Philippines may also have up to 4 leaflets per side, and the petiolules may be up to at least 10 mm long. Flowers and fruits of *A. longipes* are unknown; the type specimen makes the impression to have been collected from a young plant.

According to the key, *A. sphaerococca* differs from *A. cuspidata* by the still larger number of leaflets: 4—6 per side. As up to 4 leaflets are already known from *A. montana*, and as there is no further difference in the vegetative parts, the flower, or the fruit, it seems impossible to maintain this species.

The next step is towards the Philippines. Whereas Radlkofer could dispose of 7 Philippine specimens, 5 of which were cited under *A. philippinensis*, 1 under *A. angustifolia*, and 1 under *A. loheri*, I had 18, including all but two of his, and all three types. Though this is not yet plenty of material, the more so as most of the specimens are from the island of Luzon, this widened the known range of variability already considerably. Part of this material could without any hesitation be identified as *A. montana sensu stricto*. Those which, according to Radlkofer, should represent *A. philippinensis* also showed neither in the vegetative parts, nor in the inflorescence, nor in flower or fruit any real difference with *A. montana* in the already broadened sense. The main key character '*fructus cocci obovoidei*' is too vague to deserve consideration. *A. angustifolia* should differ from *A. philippinensis* by the narrower and more acuminate leaflets, whereas the leaflets of *A. loheri* should be still narrower. Actually, these differences are grading and vague; as in so many species the leaf shape is more variable in the Philippines than in most other parts of Malesia — possibly as the climatological pattern of the Philippines is relatively varied — and *A. montana* seems to show here a tendency towards narrower leaflets. Any demarcation in this range seems to be arbitrary, and hence senseless.

Of two other E. Malesian species hardly more than the description is known. These are *A. fascicularis* (fragments of the type are preserved in M) and *A. masakapu*. The former was insufficiently known, the latter completely unknown to Radlkofer. In both cases there is nothing in the description that does not fit into the gradually widening description of *A. montana*.

Simple, mostly large leaves seem to be a rare and erratic feature in *A. montana sensu stricto* and *A. cuspidata*. Towards the inflorescence the leaves are often less-jugate and sometimes simple; in some specimens (*D. Burger 2151*, E. Java; *Lam 417*, W. New Guinea;

Treub in herb. L 932.82—589, Aru Is.) the older leaves are simple, the younger ones pinnate; some specimens (*van Steenis 3157*, Sumatra; *Pulle 262*, the type of *Hydnocarpus tamiana*, and *Kalkman BW 3407*, both from NW. New Guinea; *Koorders 18015*, the type of *A. macrophylla*, N. Celebes) have exclusively simple leaves. A striking fact is that the specimens cited were all collected from shrubs, the Koorders' specimen 6 m high, the van Steenis' specimen 4 m high, the others even no more than 1½ m. It makes the impression that these simple leaves represent a youth stage, though it is impossible to draw this conclusion from herbarium studies alone. (A still very incomplete study of seedlings of *Sapindaceae*, in which *Lepisanthes* subg. *Aphania* is not yet included, shows that the primary leaves are often simple, and only gradually become pinnate, often combined with a gradual reduction of the terminal leaflet. *A. danura*, characterized by simple leaves and apparently never reaching more than a few meters height, could then be a neotenic form.) The flowers and the fruits of these specimens agree completely with those of *A. montana*, and I see no reason to keep *A. macrophylla* and *Hydnocarpus tamiana* separate.

The first form west of Malesia is *A. nicobarica*. This gives no special difficulties. It was originally included, also by Radlkofer, in *A. montana*, lateron described by him as a separate species mainly on its leaf shape. The resemblance to the New Guinea *A. cuspidata* was stressed and should have been a warning.

The species described from continental SE. Asia form a coherent group. They show the following characters or tendencies : reduction of the leaf to 1-jugate, often with a short to very short petiole and sometimes with a true terminal leaflet (*A. langsonensis*, *microcarpa*, *philastreana*, *spirei*, *viridis*, *Sapindus oligophylla*), pseudoterminal or possibly sometimes truly terminal inflorescences (*A. microcarpa*, *spirei*, *viridis*) with subsessile cymes of few long-pedicelled flowers, giving the branches of the inflorescence a racemoid appearance (especially *A. microcarpa* and *viridis*), reduction of the number of petals (4 or 5 in *A. microcarpa* and *viridis*, 3—0 in *A. langsonensis*; this reduction starts already in Sumatran specimens of *A. montana*), petals outside sometimes slightly hairy (*A. spirei*). These are mainly shrubs of a rather open vegetation under a periodically dry climate. The delimitation of this in itself very coherent group against *A. montana* is impossible. *A microcarpa* is in every character indistinguishable from some specimens of *A. montana* from Sumatra, E. Java, and the Philippines. *A. viridis* should differ from *A. microcarpa* by the number of 4 instead of 5 petals and by the sessile cymes. Actually, both have flowers with 4 and with 5 petals sometimes in the same inflorescence, and the difference between sessile and stalked cymes is gradual, and varies even between the base and the apex of the same inflorescence. *Sapindus (Sapindopsis) oligophylla*, already recognized by M. Capuron as representing a species of *Aphania (in sched.)*, is about identical with *A. microcarpa*. *A. langsonensis* shows a great resemblance to *Sapindus oligophylla*, represents probably only a teratological specimen with reduction of the corolla. According to the description it should have 1—3 petals. The only flower analysed by me showed no petals at all, but 6 sepals, the innermost of which agreeing completely with the 'petal' of Gagnepain's drawing which is attached to the type sheet. *A. philastreana* is on the one hand hardly different from *A. viridis* and *A. microcarpa*, shows on the other hand a great resemblance to *A. angustifolia* from the Philippines. Moreover, it comes close to *A. paucijuga* from the Malay Peninsula. *A. spirei* comes close to *A. langsonensis*, differs mainly by the densely and relatively long ciliate sepals and petals. All these forms are either only vaguely delimited mutually, or they differ in but a few details, and in the latter case mostly only the type specimen is known (the whole number of specimens known, moreover, is too small to represent the full range of variability). I do not hesitate to combine all these forms with the Malesian *A. montana*.

Up till now, two species described from W. Malesia have been mentioned only incidentally. They are *A. paucijuga* from the Malay Peninsula and *A. dasypetala* from Borneo. Radlkofer placed *A. paucijuga* in his key next to *A. microcarpa*; *A. dasypetala* was to him still insufficiently known, but rightly he pointed to *A. paucijuga* for probable relationship. Within Malesia these two forms are more or less distinguishable from *'montana' sensu latiore* by the petals — often 4 in number and outside slightly *(A. paucijuga)* to rather densely *(A. dasypetala)* sericeous —, by the longer stipitate ovary, and by the inconspicuous venation, whereas the nerves are more transverse and more distinctly looped and joined at a slightly greater distance from the margin. All specimens from the Malay Peninsula belong to *A. paucijuga*, whereas from Borneo both *A. dasypetala* and *A. montana* are known, there apparently clearly distinct. Though some Sumatran specimens of *A. montana sensu stricto* show also reduction of the corolla to 4 petals and have sometimes also some hairs on the outside of the petals, and though some Philippine races show nearly the same kind of nervation, the pair *A. paucijuga-dasypetala* is distinguishable within Malesia. However, if the comparison is broadened to include the races from continental SE. Asia it appears that they are gradually connected with *A. montana* via *A. philastreana*, from which they are hardly distinguishable, *A. viridis*, and *A. microcarpa*.

Turning to the west again we meet with three more species described from South Asia: *A. bifoliolata* (Ceylon and SW. peninsular India), *A. danura* (northern India and E. Pakistan), and *A. rubra* (E. Pakistan to Indo-China). Locally, they make the impression of being undisputable 'good' species, well characterized — *A. bifoliolata* with 1-jugate, *A. danura* with simple, and *A. rubra* with several-jugate leaves — and each with its own coherent area of distribution, only those of *A. danura* and *A. rubra* slightly overlapping. The picture becomes quite different, however, if we compare these three species with the continuously broadened conception of *A. montana*. The flowers and fruits are all the same and do not fall outside the scope of *A. montana s. l.*; *A. rubra* can not be distinguished from some of the Sumatran specimens of *A. montana s. s. A. danura* is not well distinguishable from simple-leaved *A. montana*, especially not from *A. macrophylla* from Celebes which was originally identified by Radlkofer as *A. danura*, and from *Hydnocarpus tamiana* from New Guinea. *A. bifoliolata* is fully comparable with the continental SE. Asian group of species.

Radlkofer stressed still another difference between on the one hand *A. danura* and *A. rubra*, on the other hand the further species discussed above. *A. danura* and *A. rubra* should be characterized by the mucilagination of the inner cell-walls of the leaf-epiderm. On this character he based his section *Didymococcus* in contrast with the section *Euaphania*. I did not pay attention to this character, for a theoretical as well as for a practical reason. In the first place I get the impression that Radlkofer, who studied exclusively herbarium material, in most cases derived his anatomical characters from a study of rarely more than one leaf of probably only part of the species. He belonged to a generation which, far more than our, was convinced of the stability or constancy of this kind of characters in contrast with the plasticity of the 'outer' characters usual in taxonomy. This contrast seems to be reflected in the then usual distinction between General and Special Botany. (A further argument can be found in the discussion on the palynology of *A. senegalensis*.) We now know that anatomical characters, just like palynological or biochemical ones, behave like other characters, and may be constant in large, or variable in small taxa. They have to be studied like every character: variation among the different parts of the same individual, variation between individuals belonging to the same population, variation between individuals of the same species growing under different ecological conditions and/or varying in other characters. Anatomical characters can only be used when these

requirements are fulfilled to a reasonable degree. Moreover, apart from these theoretical considerations, it would be very unpractical to delimit species exclusively on anatomical characters.

Concluding, I combine *A. bifoliolata*, *A. danura*, and *A. rubra* with the SE. Asian and Malesian *A. montana s. l.*, even though I am aware that in the Indian region they make the impression to be three 'good', well distinguishable species which may even be genetically isolated.

In Africa, three species are involved: *A. senegalensis*, *A. silvatica*, and *Manongarivea perrieri*. *A. silvatica* is already usually reduced to *A. senegalensis* (e. g. in Hutchinson & Dalziel, Fl. W. Trop. Afr. ed. 2, 1, 1958, p. 716). Why the monotypic genus *Manongarivea*, endemic in Madagascar, was described is fully ununderstandable to me. Nothing in the description falls outside the scope of *Aphania* in the sense of Radlkofer, and Choux, the author of *Manongarivea*, apparently knew the African species of *Aphania* quite well. As far as can be judged from the description and from a photograph of the type, *Manongarivea perrieri* is nothing else than *A. senegalensis*.

In this way the problem can be reduced to a comparison of *A. senegalensis* with the *A. montana* complex. Radlkofer put *A. senegalensis* in a separate monotypic section, *Pycnaphania*, different by the thick and hard endocarp (*'endocarpium crassiusculum, cartilagineo-crustaceum'*) and in the pollen (*'subgloboso-ellipsoideum'*). In the other two sections the endocarp should be *'cartilaginea-chartaceum'*, except in *A. nicobarica* and *A. philastreana* where it is described as *'subcrustaceo'*. Apparently, there is a gradation in the measure of lignification of the three cell-layers constituting the endocarp. It appears that indeed the endocarp is only very slightly thicker and harder than in *A. nicobarica* and *A. philastreana*.

As to the pollen, this has been described for the other sections as *'trigono-placentiforme'*. This could be an indication that Radlkofer trusted so much the general validity of characters supposed to be less influenced by external conditions that he studied only very few specimens. I have compared the pollen of *A. senegalensis* with that of several other 'species' of *Aphania* (in a simple way, in water at 600 × magnification) and I did not find the difference given by him. To all probability Radlkofer compared mature pollen of *A. senegalensis* with unripe of other species; unripe pollen is more or less flattened and agrees with Radlkofer's short description. This would only be possible, however, if he studied no more than 1 or 2 samples. The palynologist Mr J. Muller came to the same conclusion.

A careful comparison of several specimens of *A. senegalensis* with the many forms of *A. montana* showed that vegetatively the former is about identical with *A. microcarpa* and *A. viridis*, that the flowers are not different from *A. montana s. l.*, and that the fruit, though relatively big — but not bigger than in *A. spirei* var. *mekongensis* and only slightly bigger than in *A. rubra* — is about identical with that of *A. rubra*. Summarizing, there is no sharp morphological difference between *A. senegalensis* and *A. montana s. l.*

There being no clear boundaries in the complex the delimitation of infraspecific taxa is as impossible as that of species. Only locally it may be practical to distinguish between some entities which had better be designated as races. In my opinion only the three Indian forms and *A. montana* versus *A. dasypetala-paucijuga* in West Malesia deserve locally this special position.

VI. TAXONOMIC PART

LEPISANTHES

Uitenia Noroña, Verh. Bat. Gen. K. W. 5 (1791) 4, *nom. nud.*; ed. 2 (1827) 67, *ditto*.

Lepisanthes Bl., Bijdr. (1825) 237; Radlk., Pfl. R. Heft 98 (1932) 726. — *Lepisanthes* sect. *Eulepisanthes* Radlk., Sapind. Holl.-Ind. (1879) 34, *nom. illeg.* — *Lepisanthes* subg. & sect. *Lepisanthes*. — Type: *L. montana* Bl. (= *L. tetraphylla* Radlk.).

Erioglossum Bl., Bijdr. (1825) 229; Radlk., Pfl. R. Heft 98 (1932) 692. — *Lepisanthes* subg. *Erioglossum* Leenh., *comb. nov.* — Type: *E. edule* Bl. (= *L. rubiginosa* Leenh.).

Aphania Bl., Bijdr. (1825) 236; Radlk., Pfl. R. Heft 98 (1932) 699. — *Aphania* sect. *Euaphania* Radlk., Sapind. Holl.-Ind. (1879) 69, *nom. illeg.* — *Lepisanthes* subg. *Aphania* Leenh., *comb. nov.* — Type: *A. montana* Bl. (= *L. senegalensis* Leenh.).

Moulinsia Cambess., Mém. Mus. Hist. Nat. Paris 18 (1829) 27, *non* Rafin. (1830). — Type: *M. cupanioides* Cambess. (= *L. rubiginosa* Leenh.).

Otolepis Turcz., Bull. Soc. Nat. Mosc. 21 (1848) 572. — Type: *O. nigrescens* Turcz. (= *L. fruticosa* Leenh.).

Didymococcus Bl., Rumphia 3 (1849) 103. — *Aphania* sect. *Didymococcus* Radlk., Sapind. Holl.-Ind. (1879) 69. — Lectotype: *D. danura* Bl. (= *L. senegalensis* Leenh.).

Otophora Bl., Rumphia 3 (1849) 142; Radlk., Pfl. R. Heft 98 (1932) 753. — *Otophora* sect. *Euotophora* Radlk., Sapind. Holl.-Ind. (1879) 86, *nom. illeg.* — *Otolepis* sect. *Otophora* O.K. in Post & O.K., Lex. Phan. (1903) 408. — *Lepisanthes* subg. *Otophora* & sect. *Otophora* Leenh., *comb. nov.* — Lectotype: *O. amoena* Bl. (= *L. amoena* Leenh.).

Otophora subg. *vel* sect. *Pseudophora* Bl., Rumphia 3 (1849) 142, *nom. inval.* — *Otophora* sect. *Pseudotophora* Radlk., Sapind. Holl.-Ind. (1879) 85. — *Otolepis* sect. *Pseudotophora* O.K. in Post & O.K., Lex. Phan. (1903) 408, *nom. illeg.* — *Lepisanthes* sect. *Pseudotophora* Leenh., *comb. nov.* — Lectotype: *O. fruticosa* Bl. (= *L. fruticosa* Leenh.).

Scorododendron Bl., Rumphia 3 (1849) 149. — *Lepisanthes* sect. *Scorododendron* Radlk., Sapind. Holl.-Ind. (1879) 36. — Type: *S. pallens* Bl. (= *L. tetraphylla* Radlk.).

Anomosanthes Bl., Rumphia 3 (1849) 151. — *Lepisanthes* sect. *Anomosanthes* Radlk., Sapind. Holl.-Ind. (1879) 34. — Type: *A. deficiens* Bl. (= *L. tetraphylla* Radlk.).

Hebecoccus Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 246; Pfl. R. Heft 98 (1932) 719. — *Lepisanthes* sect. *Hebecoccus* Leenh., *comb. nov.* — Type: *H. ferrugineus* Radlk. (= *L. ferruginea* Leenh.).

Thraulococcus Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 246; Pfl. R. Heft 98 (1932) 717. — Lectotype: *Th. erectus* Radlk. (= *L. erecta* Leenh.).

Aphania sect. *Pycnaphania* Radlk., Sapind. Holl.-Ind. (1879) 69. — Type: *A. senegalensis* Radlk. (= *L. senegalensis* Leenh.).

Otophora sect. *Anomotophora* Radlk., Sapind. Holl.-Ind. (1879) 85. — *Otolepis* sect. *Anomotophora* O.K. in Post & O.K., Lex. Phan. (1903) 408. — *Lepisanthes* sect. *Anomotophora* Leenh., *comb. nov.* — Type: *O. ramiflora* Radlk. (= *L. ramiflora* Leenh.).

Aphanococcus Radlk. in Durand, Ind. Gen. (1888) 74; Pfl. R. Heft 98 (1932) 722. — Type: *A. celebicus* Radlk. (= *L. aphanococca* Leenh.).

Lepisanthes sect. *Anomorrhiza* Radlk. in E. & P., Nat. Pfl. Fam. Nachtr. 3 (1907) 203. — Type: *L. mekongensis* Pierre (= *L. tetraphylla* Radlk.).

Manongarivea Choux, C. R. Ac. Sc. Paris 182 (1926) 713; Radlk., Pfl. R. Heft 98 (1932) 723. — Type: *M. perrieri* Choux (= *L. senegalensis* Leenh.).

Sapindopsis How & Ho, Act. Phytotax. Sin. 3 (1955) 385. — Type: *S. oligophylla* How & Ho (= *L. senegalensis* Leenh.).

Trees or shrubs, sometimes more or less scandent. Indumentum consisting of solitary, simple hairs; no glandular scales. *Leaves* spirally arranged, pari- or imparipinnate, sometimes simple, 1- to more than 40-jugate, without or with stipules, petiole and/or rachis winged or not, petiole, rachis, petiolules, and leaflets hairy or glabrous; leaflets opposite or alternate, not papillose beneath, base equalsided to oblique, margin entire, nervation open or closed. *Inflorescences* terminal, axillary, rami-, or cauliflorous. *Flowers* unisexual, probably mostly monoecious. *Sepals* (6) 5 or 4 (3), free, imbricate, outer 2 (or 1) mostly distinctly smaller, mostly at least inner ones partly petaloid, outside glabrous to sericeous, inside glabrous to partly puberulous, mostly (often partly glandular-) ciliolate, entire or, if petaloid, partly denticulate. *Petals* (7—) 5 or 4 (—0 exceptionally in *L. senegalensis*), shorter to longer than sepals, mostly distinctly clawed, outside glabrous to sericeous for the greater part, claw nearly always ciliate, plate sometimes partly ciliate or (mostly partly glandular-) ciliolate, inside often slightly hairy at base; scale mostly well-developed, sometimes only represented by a hairy rim or a pair of small auricles, hairy or glabrous, crested or not. *Disk* complete or interrupted and crescent-shaped, mostly slightly lobed, without appendage, hairy or glabrous. *Stamens* mostly *c.* 8 (4—18), in male flowers not to distinctly exserted; filament nearly always hairy mostly either the base or the apex excepted; anther basally attached, emarginate at base, hairy or glabrous, dehiscing lengthwise laterally to latero-introrse. *Ovary* sessile to short-stipitate, lobed or not, hairy or glabrous, 2- or 3-, rarely 1- or 4-celled; style apical, from about as long as ovary to stigma sessile, hairy mainly in the lower half or glabrous; stigma globular or dome-shaped, slightly lobed; ovules 1 per cell, attached axillary near the base to about halfway, ascending, apotropous, ana- or campylotropous, placenta with an obturator. *Fruit* sessile or sometimes short-stipitate, either not to distinctly lobed and with the longitudinal axis accrescent, or with the axis not accrescent and with spreading (rarely erect) lobes (butterfly-nut shaped), drupaceous; exocarp smooth or sometimes slightly warty, hairy to glabrous; pericarp thin-, rarely thick-fleshy; endocarp hairy or glabrous; cells mostly fully separated, sometimes incompletely separated or septa even nearly totally suppressed. *Seeds* with a shining brown to black, glabrous or sometimes hairy testa; hilum basal, small; no aril.

Distribution: Old World tropics from W. Africa via Madagascar, S. and SE. Asia (Ceylon and India to Hainan), and Malesia to New Guinea.

Ecology: Most species of *Lepisanthes* grow under everwet, some also or even mainly under seasonal climatic conditions. They are shrubs or treelets, hardly ever exceeding a height of 20 m, and make part of the middle and lower storey of the Lowland and Submontane Rain forest, up to *c.* 2000 m alt., probably especially on open places, escarpments, steep slopes, river banks, forest edges, clearings, etc., further of different kinds of secondary vegetations.

Nomenclature: The names *Lepisanthes* sect. *Eulepisanthes* Radlk., *Aphania* sect. *Euaphania* Radlk., *Otophora* sect. *Euotophora* Radlk., and *Otolepis* sect. *Pseudotophora* O.K. are illegitimate as in all cases the type of the genus was included.

The names *Otophora* subg. *Pseudophora* Bl. and sect. *Pseudophora* Bl. are invalid as Blume hesitated which of the two ranks should be given to the taxon concerned.

Morphology: The *germination* is known only from *L. amoena* and *rubiginosa*. Both are hypogaeous; the first two leaves are opposite and are in both cases pinnate with a true terminal leaflet. The presence of simple leaves in some races of *L. senegalensis* and in *L. simplicifolia* suggests that here the first leaves of the seedling may be simple.

KEY TO THE SUBGENERA

1. *a.* Petals shorter than sepals; filament shorter than anther. Stipules always present; leaves pari- or imparipinnate . . . . . subg. **Otophora**
   b. Petals as long as or longer than sepals; filament longer than anther. Stipules rare; leaves paripinnate or rarely simple 2
2. a. Petals as long as sepals . . . . . subg. **Aphania**
   b. Petals distinctly longer than sepals 3
3. a. Fruits parted, (sub)glabrous . . . . . subg. **Erioglossum**
   b. Fruits either lobed, or tomentose if parted . . . . . subg. **Lepisanthes**

subg. LEPISANTHES

Lepisanthes Bl., 1825. — *Anomosanthes* Bl., 1849. — *Scorododendron* Bl., 1849. — *Hebecoccus* Radlk., 1878. — *Thraulococcus* Radlk., 1878. — *Aphanococcus* Radlk., 1888.

Leaves paripinnate, exceptionally stipulate, petiole and rachis not winged; leaflets opposite to alternate, nervation open to closed. *Inflorescences* terminal, axillary, rami-, or cauliflorous. *Sepals* 5, outer 2 mostly smaller, sericeous outside, outer rarely, inner mostly petaloid at margin. *Petals* (7—) 5 or 4, longer than sepals, outside at least partly sericeous, scale crested or not. *Disk* complete or interrupted, glabrous or hairy. *Stamens* (4—)8(—18); filament longer than anther. *Ovary* 2- or 3-merous, densely hairy to subglabrous. *Fruits* slightly lobed or parted, densely hairy to (rarely) glabrous, septa never interrupted.

KEY TO THE SECTIONS

1. a. Pericarp thin, fruits smooth when dry . . . . . sect. **Lepisanthes**
   b. Pericarp thick, fruits more or less strongly wrinkled when dry . . . . . sect. **Hebecoccus**

1. sect. **Lepisanthes**

Lepisanthes Bl., 1825. — *Anomosanthes* Bl., 1849. — *Scorododendron* Bl., 1849. — *Lepisanthes* sect. *Eulepisanthes* Radlk., sect. *Anomosanthes* (Bl.) Radlk., and sect. *Scorododendron* (Bl.) Radlk., 1879. — *Lepisanthes* sect. *Anomorrhiza* Radlk., 1907.

Shrubs or trees. *Leaves* glabrous or at least petiole, rachis, and petiolules hairy; basal pair of leaflets sometimes attached at the very base of the leaf, simulating a pair of stipules; leaflets without glandular-pitted warts, apex not mucronulate, midrib sunken to prominulous above, rounded to angular beneath. *Inflorescences* mostly axillary or rami- to cauliflorous, rarely terminal, solitary or fascicled, simple or (mostly sparsely) branched. *Petals* (7—) 5 or 4, scale mostly crested. *Disk* complete or interrupted. *Ovary* 2- or 3-merous, densely hairy to subglabrous. *Fruits* lobed, smooth or sometimes warty, densely hairy to (rarely) glabrous; pericarp thin; endocarp hairy or glabrous. *Seeds* glabrous or sometimes hairy.

KEY TO THE SPECIES

1. a. Petiole 0, basal pair of leaflets simulating stipules . . . . . **L. andamanica**
   b. Petiole distinctly developed, no stipules . . . . . **L. tetraphylla**

Lepisanthes andamanica King, J. As. Soc. Beng. 65, ii (1896) 428; Radlk., Pfl. R. Heft 98 (1932) 748. — Lectotype: *King's coll. s.n.*, S. Andaman, Hobdaypur, 4-3-1893, fl. (CAL, not seen; iso in L sh 908.270-70, P).

Twigs 3—4 mm ø, light silvery- to purplish-brown, glabrous. *Leaves* 2-jugate, the lower pair inserted at the very base and caducous, glabrous. *Rachis* terete to slightly flattened, 3—6 cm long; petiolules deeply groved above, 2—7 mm. *Leaflets* opposite, ratio 2—3, widest about the middle, upper pair 14—21 × 5—7 cm, lower pair 2—10 ×

1½—5 cm, chartaceous; base slightly oblique and cuneate in the upper, equalsided and rounded in the lower pair; apex blunt; midrib prominulous above, prominent and rounded beneath; nerves 1½—4 cm distant, angle with midrib *c.* 60—65°, fairly strongly curved, only the few upper ones looped and joined, prominulous on both surfaces; intercalary veins distinctly developed, veins and veinlets finely reticulate, prominulous on both sides. *Inflorescences* ramiflorous, solitary or two serially from the same leaf-axil, 8—*c.* 20(—30) cm, densely fulvous to greyish puberulous, either simple, or with one or two long erect branches near the base, or with some shorter, patent branches mainly in the basal half; cymes patent, 2—3 mm long stalked, lax, several-flowered; pedicels 1—2 mm; bracts narrowly triangular, *c.* 1 mm. Outer 2 *sepals* distinctly smaller, ovate, 2½ × 1¾ mm, densely ciliate, inside glabrous, inner elliptic to obovate, 3—3½ × 2—2¼ mm, margin petaloid. *Petals* 4 (King, l.c., seemed to be wrong in mentioning 5), spathulate, 5½ mm long, claw 1¾ mm, plate oblong-obovate, 1¾ mm wide, outside claw woolly, woolly-ciliate beneath insertion of scale, inside glabrous; scale ⅓—½ as long as the plate, oblong, rounded to emarginate or with a laciniate, crisped margin, inside woolly, not crested. *Disk* interrupted, glabrous. *Stamens* 8; filament 4½ mm, woolly except at the very base; anther ovoid, 1¼ mm, connective rather narrow, pointed, glabrous. *Pistillode* 3-celled, glabrous. *Fruits* (unripe) 3-lobed, at least 2 × 1½ cm, smooth, rather densely appressed short-hairy, inside rather densely long-hairy. *Seeds* glabrous.

ANDAMANS. S. Andaman: *King's coll. s.n.*, Hobdaypur, 4-3-1893, fl., lectotype; Port Mouat, 15-4-1893, y. fr., syntype (K, M); Goplakabang, 16-9-1895, fl., syntype (M).

Ecology: hill jungle.

Note. L. andamanica seems to be nearest allied to *L. tetraphylla ('lamponga')*. It is the only species of subg. *Lepisanthes* with the basal leaf-pair shifted to the very base of the leaf and simulating a pair of stipules.

Lepisanthes tetraphylla (Vahl) Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.- Ph. Kl. Münch. 8 (1878) 276; Pierre, Fl. Coch. (1895) t. 325 B text; Brandis, Ind. Trees (1906) 189; Gamble, Fl. Madras 2 (1918) 247; Ridl., Fl. Mal. Pen. 5 (1925) 301; Craib, Fl. Siam. En. 1 (1926) 327; Alston, Fl. Ceyl. Suppl. (1931) 55; Radlk., Pfl. R. Heft 98 (1932) 743, f. 15; Gagnep., Fl. Gén. I. -C. Suppl. 1 (1950) 947. — *Sapindus tetraphylla* Vahl, Symb. 3 (1794) 54. — *Anomosanthes tetraphylla* Pierre, Fl. Coch. (1895) t. 327 text. — *L. tetraphylla* Radlk. var. *indica* Pierre, Fl. Coch. (1895) t. 325 B text, *nom. illeg.* — Type: *Koenig in herb. Vahl*, India, fl. (C, photo seen).

Molinaea canescens Roxb., Pl. Corom. 1 (1796) 43, t. 60; Fl. Ind. ed. 2 (1832) 243. — *Cupania canescens* Pers., Syn. Pl. 1 (1805) 413. — *Hemigyrosa canescens* Bl., Rumphia 3 (1849) 166; Thw., En. Pl. Zeyl. (1858) 56; Beddome, Fl. Sylv. (1871) t. 151; Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 671; Kurz, J. As. Soc. Beng. 44, ii (1876) 184; Fl. Burm. 1 (1877) 290; Trim., Fl. Ceyl. 1 (1893) 301; Cooke, Fl. Bombay 1 (1902) 264; Talbot, For. Fl. Bombay 1 (1909) 332, f. 196; Lecomte, Fl. Gén. I.-C. 1 (1912) 1016. — Type: *Roxburgh*, India, Madras, Circars, fl. & fr. (G, not seen).

L. montana Bl., Bijdr. (1825) 238; Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 679; Kurz, Rep. Pegu (1875) 32, App. A p. 38, App. B p. 40; J. As. Soc. Beng. 44, ii (1876) 183; Fl. Burm. 1 (1877) 291; Pierre, Fl. Coch. (1895) t. 327 B, C; Radlk., Pfl. R. Heft 98 (1932) 732; Merr. & Chun, Sunyatsenia 2 (1934) 38. — Type: *Blume 676*, W. Java, Mt Salak, -10/11-, fl. (L).

Sapindus ? deficiens W. & A., Prod. (1834) 111; Wight, Ic. (1839) 141. — *Anomosanthes deficiens* Bl., Rumphia 3 (1849) 151; Beddome, Fl. Sylv. 3 (1869) 72. — *Hemigyrosa deficiens* Beddome, Fl. Sylv. (1872) t. 231; Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 671. —

L. deficiens Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 276; Alston, Fl. Ceyl. Suppl. (1931) 55; Radlk., Pfl. R. Heft 98 (1932) 748. — Type: *Wight 390* (K, not seen).

Erioglossum alliaceum Zipp. *ex* Span., Linnaea 15 (1841) 181. — *Scorododendron pallens* Bl., Rumphia 3 (1849) 149, *nom. illeg.* — *L. pallens* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 300, 309, *nom. illeg.*; Pfl. R. Heft 98 (1932) 742. — Syntypes: *Spanoghe 21* and *Zippelius 10a*, both Timor, fl. and y. fr. (L).

L. confinis Bl., Rumphia 3 (1849) 152. — Type: *van Hasselt s.n.*, W. Java, Bantam, G. Pulasari, June, fl. (L sh. 908.270-28 & 48).

L. frutescens Bl., Rumphia 3 (1849) 152. — Type: *Blume 2300 b*, W. Java, Mt Salak,-6/7-, fl. (L).

L. heterolepis Bl., Rumphia 3 (1849) 153; Radlk., Pfl. R. Heft 98 (1932) 734. — Type: *Korthals s.n.*, S. Borneo, G. Pamatton, fl. (L sh. 908.270-35, 41, 61, & 87).

L. sessiflora Bl., Rumphia 3 (1849) 153; Radlk., Pfl. R. Heft 98 (1932) 734. — Type: *Blume 3100*, W. Java, Bantam, Harriang, Sept., y. fr. (L).

L. angustifolia Bl., Rumphia 3 (1849) 154; Radlk., Pfl. R. Heft. 98 (1932) 735. — Type: *Korthals s.n.*, W. Java, Nagara, in bud (L sh. 908.270-26, 81, & 100).

Hemigyrosa trichocarpa Thw., En. Pl. Zeyl. (1858) 56. — *Hemigyrosa canescens* Bl. var. *trichocarpa* Trim., Ceylon Br. J. R. As. Soc. 9 (1885) 20. — *L. trichocarpa* Radlk., Fedde Rep. 18 (1922) 335; Pfl. R. Heft 98 (1932) 745. — Type: *Thwaites CP 607 p.p.*, Ceylon, fl. & fr. (iso in A, BO).

Hemigyrosa longifolia Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 671. — *L. longifolia* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 276; Pfl. R. Heft 98 (1932) 749. — *Anomosanthes longifolia* Pierre, Fl. Coch. (1895) t. 327 text. — Syntypes: *Griffith KD 994* (M) and *Maingay KD 446* (L, M), both Malay Pen., foot of Mt Pangai, fl. and fr.

L. browniana Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 680; Radlk., Pfl. R. Heft 98 (1932) 736. — *Sapindacea?* Wall., Cat. (1832) no. 7497. — Type: *W. Gomez 342* = *herb. Wallich 7497*, Burma, Tavoy, Martaban, 2-10-1827, fl. (K, not seen; iso in M).

L. cuneata Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 680; Radlk., Pfl. R. Heft 98 (1932) 737. — Type: *Porter s.n.*, Malay Pen., P. Penang, fl. (iso in M).

L. burmanica Kurz, [Rep. Pegu (1875) Errata, *nom. nud.*] J. As. Soc. Beng. 44, ii (1876) 183; Fl. Burm. 1 (1877) 291; Radlk., Sapind. Holl.-Ind. (1879) 34, 35; Brandis, Ind. Trees (1906) 189; Radlk., Pfl. R. Heft 98 (1932) 747. — Lectotype: *D. Brandis 737*, Burma, Pegu, hills between Sitang and Beeling, -2-1862, fl. and y. fr. (K; iso in M).

L. hirtella Radlk., Sapind. Holl.-Ind. (1879) 35; Pfl. R. Heft 98 (1932) 751. — Type: *Beccari herb. 2837*, New Guinea, Vogelkop Pen., Amberbakin, 1872, fl. (FI; iso in M).

L. eriolepis Radlk., Sapind. Holl.-Ind. (1879) 36; Pfl. R. Heft 98 (1932) 738. — Type: *Cuming 785*, Philippines, Luzon, Tayabas Prov., 1841, fl. (K, not seen; iso in A, FI, M).

L. schizolepis Radlk., Sapind. Holl.-Ind. (1879) 87; Pfl. R. Heft 98 (1932) 739. — *L. schizolepis* Radlk. f. *genuina* Radlk. in Perk., Fragm. Fl. Philip. 1 (1904) 60, *nom. illeg.* — Type: *Barthe s.n.*, Philippines, Luzon, Manila, 1857, fl. (P, not seen; iso in M).

Ostodes appendiculata Hook. *f.*, Fl. Br. Ind. 5 (1887) 401. — *L. kunstleri* King, J. As. Soc. Beng. 65, ii (1896) 427, *nom. illeg.*; Radlk., Pfl. R. Heft 98 (1932) 746. — *L. appendiculata* Symington, Kew Bull. (1937) 320. — Type: *King's coll. 4634*, Malay Pen., Perak, fl. (K, not seen).

L. mekongensis Pierre, Fl. Coch. (1895) t. 326 A; Lecomte, Fl. Gén. I.-C. 1 (1912) 1017; Radlk., Pfl. R. Heft 98 (1932) 751; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 947. — *Anomosanthes mekongensis* Pierre, Fl. Coch. (1895) t. 327 text. — Type: *Harmand 25* = *herb. Pierre 5669*, Cambodia, Mekong R., -1-1877, old fem. fl. (P; iso in L, M).

L. tetraphylla Radlk. var. *cambodiana* Pierre, Fl. Coch. (1895) t. 325 text. — *L. cambodiana* Pierre, l. c. t. 326 B, *nom. illeg.* — Syntypes: *Pierre 508*, Cambodia, Prov. Samrong tong, Mt Proc. -3-1870, fl. (P, not seen; iso in K, L, M); *4132*, S. Vietnam, Prov. Bien Hoa, Song lu, 23-2-1877, st. (P, not seen; iso in M).

L. scortechinii King, J. As. Soc. Beng. 65, ii (1896) 429; Radlk., Pfl. R. Heft 98 (1932) 750. — Type: *Scortechini 2090*, Malay Pen., Perak, fr. (CAL, not seen; iso in K, M).

L. blumeana K. & V., Bijdr. 9 (1903) 168. — Type: *Koorders 7406*, W. Java, Bantam, Dist. Tjibaliung, Tjibanor, alt. 10 m, 14-7-1892, fl. (L; iso in M).

L. schizolepis Radlk. f. *sphenolepis* Radlk. in Perk., Fragm. Fl. Philip. 1 (1904) 60. — Type: *E. D. Merrill 2331*, Philippines, Luzon, Rizal Prov., Tanay, -5-1903, fl. (B, lost; iso in M).

L. assamica Radlk., Rec. Bot. Surv. Ind. 3 (1907) 343; Pfl. R. Heft 98 (1932) 736. — Type: *A. T. Gage 185*, Assam, S. Lushai Hills, near Fort Lungleh, alt. 900—1200 m, 14-4-1899, fl. (M).

L. granulata Radlk., Rec. Bot. Surv. Ind. 3 (1907) 344; Pfl. R. Heft 98 (1932) 746. — Type: *Prazer 24*, Upper Burma, fr. (G, not seen; iso in BO, K, L, M, SING).

L. listeri King *ex* Radlk., Rec. Bot. Surv. Ind. 3 (1907) 344; Pfl. R. Heft 98 (1932) 737. — Type: *J. L. Lister s.n.*, Assam, Duphla Hills, Dikrung Valley, 1874, fr. (M; iso in K).

L. basicardia Radlk., Rec. Bot. Surv. Ind. 3 (1907) 345; Pfl. R. Heft 98 (1932) 747. — Type: *S. Mokim s.n.*, Upper Burma, Kachin Hills, Myitkyina, 1897, fl. (CAL, not seen; iso in M, P).

L. lamponga Radlk., Rec. Bot. Surv. Ind. 3 (1907) 345; Pfl. R. Heft 98 (1932) 749. — Type: *H. O. Forbes 1708*, Sumatra, Lampong Districts, Penangungan, 4-9-1880, fl. (M).

L. tonkinensis Radlk., Not. Syst. 1 (1910) 303; Pfl. R. Heft 98 (1932) 741; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 943. — Syntypes: *Bon 2805*, N. Vietnam, Hanoi Prov., Lat-son, 5-11-1884, fl. (P); *2828*, Hanoi Prov., Vo-Xa, Mt Chua-Hac, 23-12-1884, st. (P); *2910*, same loc., -5-1885, fr. (P, not seen; iso in M).

Sapindus ? siamensis Radlk., Kew Bull. (1912) 265. — *L. siamensis* Radlk., Kew Bull. (1914) 279; Craib, Fl. Siam. En. 1 (1926) 327; Radlk., Pfl. R. Heft 98 (1932) 752; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 946. — Lectotype: *L. VanPruk 191*, N. Thailand, Prae, alt. 245 m, -5-1910, fl. (K).

L. viridis Radlk., Philip. J. Sc. 8 (1914) Bot. 454; Pfl. R. Heft 98 (1932) 735. — Type: *Whitford & Hutchinson FB 9266*, Philippines, Mindanao, Zamboanga Prov., Banga, -1-1908, fl. (PHN, lost; iso in M).

L. perviridis Elm., Leafl. Philip. Bot. 8 (1919) 3101; Radlk., Pfl. R. Heft 98 (1932) 740. — Type: *Elmer 18355*, Philippines, Luzon, Laguna Prov., Mt Makiling, -6/7-1917, y. fr. (PNH, lost; iso in BO, FI, L, M, NY, UC).

L. scortechinii King var. *hirta* Ridl., Fl. Mal. Pen. 1 (1922) 493. — Lectotype: *H. N. Ridley 11085*, Malay Pen., Johore, Serom, -11-1900, fl. (SING; iso in K).

L. acutissima Radlk., Philip. J. Sc. 20 (1922) 657; Pfl. R. Heft 98 (1932) 737. — Type: *E. D. Merrill 9564*, Philippines, Palawan, Lake Manguao, alt. 80 m, -5-1913, fl. (M).

L. macrocarpa Radlk., Philip. J. Sc. 20 (1922) 657; Pfl. R. Heft 98 (1932) 738. — Type: *Ramos BS 19460*, Philippines, Luzon, Tayabas Prov., Mt Pular, -1-1913, fr. (M).

L. petiolaris Radlk., Fedde Rep. 18 (1922) 334; Pfl. R. Heft 98 (1932) 733. — Type: *Hose 551*, Borneo, Sarawak, Baram Dist., Mt Trekan, alt. *c.* 300 m. -7-1895, bud (B, lost; iso in BM, E, K, L, M).

L. acuminata Radlk., Fedde Rep. 18 (1922) 335; Pfl. R. Heft 98 (1932) 735. — Syntypes: *O. Beccari PS 114*, Sumatra, W. Coast, Padangse Bovenlanden, Mt Singalan, -6/7-1878, bud (K, M); *PS 304*, same loc. (M).

L. latifolia Radlk., Fedde Rep. 18 (1922) 336; Pfl. R. Heft 98 (1932) 750. — Type: *Beccari PS 644*, Sumatra, W. Coast, Padang Prov., Ajer Mantjur, alt. 360 m, -8-1878, fl. (FI, not seen; iso in L, M).

L. celebica Radlk., Fedde Rep. 18 (1922) 337; Pfl. R. Heft 98 (1932) 753. — Type: *Warburg 15537*, N. Celebes, Bojong, 1887, st. (B, lost; iso in M).

L. langbianensis Gagnep., Not. Syst. 13 (1947) 31; Fl. Gén. I.-C. Suppl. 1 (1950) 942. — Type: *Poilane 18633*, S. Vietnam, between B-dlé and Dankia, Langbiang, alt. 1100—1200 m, 25-10-1930, fl. (P; iso in K).

L. poilanei Gagnep., Not. Syst. 13 (1947) 33; Fl. Gén. I.-C. Suppl. 1 (1950) 942. — Type: *Poilane 8904*, S. Vietnam, Prov. Ca-na, Phanrang, alt. 850 m, 29-11-1923, bud (P).

Mostly a shrub or treelet, sometimes a tree up to 20 m × 45 cm. *Twigs* up to 2½ cm ⌀, (glabrous or) variably hairy, mostly early glabrescent. *Leaves* 1—9-jugate, without stipules. *Petiole* 2—50 cm long; petiolules 1—25 mm. *Leaflets* opposite to alternate, ratio 2—7½, widest above to below the middle, 4—55 × 2—20 cm, chartaceous (rarely pergamentaceous), glabrous or variably hairy; base slightly (rarely strongly) oblique to equalsided, acute to rounded or sometimes subcordate; apex (slightly emarginate to) rounded to variably acuminate; midrib sunken to prominulous above, prominent and rounded to acute beneath; nerves variable, upper ones mostly, rarely all looped and joined or exceptionally connected with an intramarginal vein, above prominulous or sometimes sunken, beneath prominulous to prominent; intercalary veins variable, veins and veinlets finely reticulate. *Inflorescences* axillary or rami- to cauliflorous, rarely terminal, solitary or (especially when rami- or cauliflorous) fascicled, simple or (mostly sparsely) branched, 1½-70 cm long, variably, mostly shortly and densely hairy, hardly to long peduncled, the main branches often racemoid; cymes patent, sessile or up to ½ cm long stalked, lax to glomerulous, 1—*c.* 15-flowered; pedicels up to 1 cm long; bracts ovate-lanceolate to subulate, up to 5 mm long, rarely ovate and up to 7 × 6 mm. *Flowers* white, sometimes greenish-white, cream, or pink, sweet-scented. Outer 2 *sepals* mostly smaller, ovate or elliptic to orbicular, 1¼—7 × 1¼—6 mm, margin rarely petaloid, densely (sometimes partly glandular) ciliolate, inside glabrous to sometimes sparsely hairy, inner 3 oblong to transversely elliptic, ovate to obovate, 2—6½ × 1¾—6 mm, margin mostly petaloid and sometimes hardly ciliolate, indument further like outer sepals. *Petals* (7—)5 or 4, 2½—10 mm long, the claw ½—2(—4) mm, plate elliptic to oblong to ovate or obovate, 1¼—4 mm wide, outside mostly up to 2/3 sericeous, rarely subglabrous, margin glabrous or ciliate mainly in the basal part, inside glabrous or the claw (rarely also base of plate) sparsely hairy; scale exceptionally only represented by a hairy rim or by 2 small auricles, mostly well-developed, entire to deeply 2—4-lobed, glabrous, ciliate, or inside sparsely to densely woolly, without or more often with an appendage which may vary from a small wart (then often present in part of the petals only) to a deeply bilobed duplication of the scale or to 2 brushes. *Disk* complete or interrupted, glabrous or short-hairy. *Stamens* (4—)8(—18); filament 1½—6½ mm, sparsely to densely woolly, mostly mainly in the upper, rarely in the lower half; anther (broad-)elliptic to oblong, ovate to obovate, ¾—2½ mm, connective broad and blunt (rarely narrow and/or pointed), woolly to glabrous. *Pistil* 2- or 3-merous; ovary and lower part of style densely hairy (to subglabrous). *Fruits* flattened ellipsoid, shortly obovoid, or subglobular, slightly lobed, the lobes rarely carinate, *c.* 1¼—5½ cm ⌀, smooth to warty, green when young, later yellowish, grey, or greyish-pink (ripe?), outside densely hairy and sometimes glabrescent or rarely glabrous, inside hairy to glabrous. *Seeds* glabrous or rarely densely hairy, brown, testa papery or sometimes crustaceous, probably partly fleshy when fresh.

Note. A full account of the variability, including a subdivision into 47 local races and citation of specimens can be found in Chapter III.

Nomenclature. The names *L. tetraphylla* var. *indica* Pierre and *L. schizolepis* f. *genuina* Radlk. are illegitimate as they refer both to the type variety resp. forma. The names *Scorododendron pallens* Bl., *L. pallens* Radlk., and *L. kunstleri* King are illegitimate as in all three cases an older legitimate epithet was available and should have been used. In the latter case King was apparently not aware that Hooker *f.* had based *Ostodes appendiculata* upon one of the specimens cited by him under *L. kunstleri*. The name *L. cambodiana* Pierre is illegitimate as it appears under the plate only whereas it has been corrected in the text to *L. tetraphylla* var. *cambodiana* Pierre.

2. sect. **Hebecoccus**

(Radlk.) Leenh. — *Hebecoccus* Radlk., 1878. — *Thraulococcus* Radlk., 1878. — *Aphanococcus* Radlk., 1888.

Trees or shrubs. *Leaves* glabrous; no stipules; leaflets mostly with scattered glandular-pitted warts on both surfaces, apex mucronulate, midrib prominulous above, rounded beneath. *Inflorescences* mostly terminal and in the upper leaf axils, sometimes axillary or ramiflorous, sparsely but mostly widely branched. *Petals* 5, scale mostly not crested. *Disk* complete. *Ovary* 3-merous, ferruginous velvety. *Fruits* lobed or parted, smooth but with fleshy pericarp which is more or less strongly wrinkled when dry; endocarp glabrous. *Seeds* glabrous.

KEY TO THE SPECIES

1. a. Ramiflorous. Petalar scale crested . . . . . **L. banaensis**
   b. Inflorescences terminal and/or axillary. Petalar scale not crested 2
2. a. Leaves simple . . . . . **L. simplicifolia**
   b. Leaves pinnate 3
3. a. Fruits parted 4
   b. Fruits lobed 5
4. a. Fruit-parts ellipsoid, spreading. Leaves 3—5-jugate. Petals distinctly clawed, outside nearly glabrous **L. erecta**
   b. Fruit-parts subglobular, erect. Leaves (1—)2(—3)-jugate. Petals hardly clawed, outside sericeous in the basal half. . . . . **L. ferruginea**
5. a. Nerves at least for the greater part not joined . . . . . **L. borneensis**
   b. All nerves distinctly looped and joined at some distance from the margin 6
6. a. Leaflets slightly falcate, oblique at base, up to 16 × 6 cm . . . . . **L. falcata**
   b. Leaflets not falcate, the base not oblique, about 25 × 7 cm . . . . . **L. aphanococca**

Lepisanthes aphanococca Leenh., *nom. nov.* — *Aphanococcus celebicus* Radlk. in Durand, Ind. Gen. (1888) 74; Pfl. R. Heft 98 (1932) 723. — Type: *Riedel s.n.*, Celebes, Gorontalo, -6-1875, fr. (K; iso in M).

No more than the type specimen is known.

Lepisanthes banaensis Gagnep., Not. Syst. 13 (1947) 32; Fl. Gén. I.—C. Suppl. 1 (1950) 943. — Type: *Clemens 3892*, S. Vietnam, Tourane, Mt Bana, 13/30-7-1927, fl. (P; iso in A, K, NY, UC).

Small tree. *Branches* greyish- to purplish-brown, glabrous. *Leaves* at least 3-jugate. *Petiole* unknown; rachis thick, angular; petiolules thick, narrowly grooved above, *c.* 2 cm long. *Leaflets* alternate, ratio *c.* 2, widest above the middle, 35—45 × 18—20 cm, coriaceous; base cuneate; apex damaged; nerves 3½—5 cm distant, angle with midrib

50—60°, slightly curved, looping towards the margin, not joined, prominulous above, prominent beneath; intercalary veins often strongly developed, veins and veinlets finely reticulate, prominulous on both surfaces. *Inflorescences* ramiflorous, up to *c.* 25—30 cm long, densely ferruginous velvety, from near the base sparsely widely branched with decussate branches, peduncle at base *c.* ¾ cm thick, branches narrowly thyrsoid; cymes rather crowded, short-stalked, mostly 3—5-flowered, lax; pedicels up to *c.* 5 mm long, robust; *bracts* threadlike, *c.* ¾ cm long. *Flowers*: only male buds known. Outer 2 *sepals* smaller, ovate, 5¼ × 3¼ mm, outside sericeous except a narrow, petaloid, glandular-ciliolate margin, inside glabrous, inner 3 more orbicular, indument about the same. *Petals* outside till about 2/3 of the plate sericeous, the claw woolly ciliate, inside glabrous; scale deeply bilobed, woolly, each lobe with an appendage of about the same shape and size. *Disk* glabrous. *Stamens* 10—13; filament woolly except at the very base; connective broad, blunt, glabrous. *Pistillode* densely pilose. *Fruits* and *seeds* unknown.

Only known from the type.

Ecology: forest trail.

Note. L. banaensis differs in a few characters — mainly the apparent absence of glandular-pitted warts on the leaflets, the ramiflorous inflorescences, and the crested petalar scale — from the other species of sect. *Hebecoccus*. On the other hand, however, it shows the typical habit of this section: bright green, glabrous leaflets and ferruginous velvety inflorescences. Moreover, its nearest relative seems to be *L. borneensis* which, in its turn, is hardly separable from *L. aphanococca*. The systematic position of the present species as well as of *L. borneensis* will remain uncertain as long as the fruits are unknown.

Lepisanthes borneensis Leenh., *sp. nov.* — Type: *Chew, Corner, & Stainton RSNB 2936*, N. Borneo, Mt Kinabalu, Ulu Liwagu and Ulu Mesilau, 1200 m, 10-9-1961, fl. (L; iso in BO, SAR).

Arbor 12 m alta. *Ramuli* teretes, 1 cm crassi, griseo-fuliginei, dense minute verruculoso-lenticellati, glabri. *Folia* 5—6-jugata. *Petiolus* teres, 14—25 cm longus; rhachis teres, canaliculata, apicem versus carinata; petioluli dimidio inferiore tumidi, supra late canaliculati, 10—15 mm longi. *Foliola* subopposita vel alterna, 14—26 cm longa, 4—10 cm lata, (ovato-)oblonga, chartacea, subtus glandulis immersis sparsis notata; basis cuneata, attenuata; apex usque ad 2 cm acute acuminatus; costa supra prominula, subtus obtuse prominens; nervi laterales inter sese 1½—3 cm distantes, a costa angulo 70—85° abeuntes, subcurvati, pro parte arcuato-conjuncti; venae intercalares distinctae. *Thyrsi* terminales et axillares, 20—30 cm longi, breve denseque subappresse fulvo-pilosi; cymuli sparsi, patentes, breviter stipitati, pluriflori; pedicelli c. 1 mm longi; bracteae anguste 3-angulatae, 3—½ mm longae. *Sepala* exteriora ovata, 4 mm longa, 3½ mm lata, interiora suborbiculata, c. 4½ mm diam. *Petala* 7 mm longa, ungue 2½ mm longo, dense ciliato, intus sparse piloso, lamina late ovata, 5 mm lata, squama rotundata. *Discus* pubescens. *Stamina* 8; connectivum angustum, apiculatum, basi pilosum.

BORNEO. Sarawak: *Smythies 15669*, Lundu Dist., S. Sebat Besar, G. Pueh F. R., alt. 60 m (SAR). — North, Mt Kinabalu: *Chew, Corner, & Stainton RSNB 2936*, type; *Clemens 29896*, Tenompok, alt. 1500 m (L); *Mikil SAN 56518*, Tenompok, alt. 1200 m (L).

Note. L. borneensis is distinctly allied to *L. aphanococca* on the one hand, to *L. banaensis* on the other. The comparison with the former is hampered as in the present species only male flowers, in *L. aphanococca* only fruits are known; the differences in vegetative parts are slight and more complete material may show that the two are not specifically distinct.

Lepisanthes erecta (Thw.) Leenh., *comb. nov.* — *Nephelium erectum* Thw., En. Pl. Zeyl. (1858) 57; Beddome, Fl. Sylv. 3 (1869) lxxiv. — *Sapindus erecta* Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 683; Trim., Fl. Ceyl. 1 (1893) 308.— *Thraulococcus erectus* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 300; Alston, Fl. Ceyl. Suppl. (1931) 58; Radlk., Pfl. R. Heft 98 (1932) 718. — Type: *Thwaites CP. 1150 p.p.*, Ceylon (PDA?; iso in K).

Shrub, 1.20—3 m. *Branches* greyish- to purplish-brown, glabrous. *Leaves* 3—5-jugate. *Petiole* terete, striate, 8—22 cm long; rachis terete, in the upper part with two lateral ribs; petiolules slender, narrowly deeply grooved above, 2—10 mm long. *Leaflets* (sub)-opposite, ratio $2\frac{1}{2}$—$3\frac{1}{2}$, widest about the middle, 12—25 × 5—$7\frac{1}{2}$ cm, pergamentaceous; base cuneate to blunt, attenuate; apex blunt to short, broad, and blunt acuminate; nerves 1—3 cm distant, angle with midrib 80—85°, curved, looping and more or less distinctly joined towards the margin, slightly more prominent beneath than above; intercalary veins variably developed, veins and veinlets rather finely reticulate, prominulous on both faces. *Inflorescences* in the upper leaf axils and probably truly terminal, $2\frac{1}{2}$—20 cm long, fulvous velvety, nearly simple to sparsely branched, branches sparsely rebranched; cymes scattered, short-stalked, several-flowered, dense; pedicels *c.* 1 mm; bracts small. *Flowers*: only male known. Outer 2 *sepals* smaller, ovate, $2\frac{3}{4}$ × 2 mm, outside sericeous, ciliolate, inside glabrous, inner $3\frac{3}{4}$ × 3 mm, furthermore the same. *Petals* 5 mm long, claw 2 mm, plate obovate, 3 mm wide, outside claw with some appressed hairs, claw and base of plate ciliolate, inside glabrous; scale oblong, emarginate (sometimes entire acc. to Hiern), inside sericeous, densely ciliate, outside glabrous, not crested. *Disk* glabrous. *Stamens* 8; filament sericeous in upper half; anther glabrous. *Pistillode* slightly pilose around the style base. *Fruits* deeply 3(—4)-parted, the parts spreading, ellipsoid, *c.* 3 × 2 cm, yellow, thin-tomentose; pericarp thin, apparently fleshy, coarsely wrinkled when dry. *Seeds* with a shining blackish-brown testa.

CEYLON. *Thwaites CP. 1150*, type.
INDIA. Madras: *C. A. Barber 5479*, Anamalais, Udumanparai (K). See further Beddome, l.c.
BURMA. *R. N. Parker 2258*, Tavoy Dist., Zimba valley (K).

Ecol.: Under moist conditions at up to 1000 m alt. in dense evergreen forest. *Fl.* April-June (Ceylon, S. India), Nov. (Burma); *fr.* April (S. India).

Note. Nearly all authors, up to Alston (1931), when describing the seed, make mention of a thin, white, fleshy aril; only Radlkofer emphatically gives '*arillo nullo*' (1932, p. 718). Like in all species of *Lepisanthes* I could not find a trace of an aril-like structure. Probably, the original inclusion in *Nephelium* still accounts for the wrong belief that there should be an aril.

Lepisanthes falcata (Radlk.) Leenh., *comb. nov.* — *Hebecoccus falcatus* Radlk., Philip. J. Sc. 8 (1914) Bot. 453; Pfl. R. Heft 98 (1932) 721. — Lectotype: *Rosenbluth FB 12631*, Philippines, Leyte, alt. 60 m, -3-1909, fr. (M; iso in L).

Hebecoccus inaequalis Radlk., Philip. J. Sc. 8 (1914) Bot. 453; Pfl. R. Heft 98 (1932) 721. — Type: *Everett FB 6459*, Philippines, Cebu, alt. 320 m, -2-1907, y. fr. (M; iso in L).

PHILIPPINES. Luzon: *Alvarez FB 23711*, Camarines Prov. (K); *Darling FB 18689*, Tayabas Prov., Guinayangan, alt. 30 m, syntype of *Hebecoccus falcatus* (L, M). — Leyte: *Rosenbluth FB 12631*, type. — Cebu: *Everett FB 6459*, type of *Hebecoccus inaequalis*.

Lepisanthes ferruginea (Radlk.) Leenh., *comb. nov.* — *Hebecoccus ferrugineus* Radlk.,

Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 301; Pfl. R. Heft 98 (1932) 720. — Type: *Zollinger 3459*, Java, Bantam, -2-1848, fl. & fr. (iso in FI, L).

MALAY PENINSULA. Perak: *King's coll. 7441*, near G. Bubu, alt. 100—150 m (M). — P. Tioman: *Nur SF 21731*, Telok Paya, sea-level, perhaps cultivated (K, L, SING).

SUMATRA. E. Coast: *Lörzing 5560*, Sibolangit, alt. *c.* 450 m, probably rare (L).

JAVA. West: *Forbes 1179*, Preanger, alt. 160 m; *Koorders 7303* & *7304*, Preanger, Sukabumi, for. Palabuanratu, S. coast, common; *Zollinger 3459*, type. — East: *Backer 30480*, Pasuruan Res., Srigontjo, alt. 50 m (BO); *Koorders 23482*, Pasuruan Res., Dist. Turen & Kepandjen, Tangkil for., Zuidergebergte, alt. 200—300 m, not common.

Lepisanthes simplicifolia (Thw.) Leenh., *comb. nov.* — *Nephelium simplicifolium* Thw., En. Pl. Zeyl. (1858) 57. — *Sapindus thwaitesii* Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 683; Trim., Fl. Ceyl. 1 (1893) 308. — *Thraulococcus simplicifolius* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 304; Alston, Fl. Ceyl. Suppl. (1931) 58; Radlk., Pfl. R. Heft 98 (1932) 719. — Type: *Thwaites CP. 443*, Ceylon (PDA?; iso in BM, K).

Shrub, 1.80—3 m. *Branches* greyish- to purplish-brown, glabrous. *Leaves* simple; petiole 2—3 cm, slender, swollen at base, above with a broad groove; blade *c.* 3½ × as long as wide, widest about the middle, 25—40 × 6—11 cm, chartaceous; base acute, decurrent along the petiole; apex rather abruptly acuminate, acumen 1—2 cm long, broad and blunt to slender and acute; nerves *c.* 2 cm distant, angle with midrib 75—80°, slightly curved, distinctly looped and joined at some distance from the margin, slightly more prominent beneath than above; intercalary veins strongly developed, veins and veinlets finely reticulate, prominulous on both faces. *Inflorescences* terminal, 6—10 cm long, short fulvous velvety, with 1 or 2 short branches near the base, racemoid, rather dense, cymes hardly stalked, few-flowered, dense; pedicels 1 mm; bracts minute. *Flowers:* only male buds known. Outer 2 *sepals* smaller, elliptic, 2¾ × 2 mm, outside sericeous, glandular-ciliolate, inside glabrous, inner at least 3¼ × 2 mm, ciliolate (not glandular). *Petals* at least 4½ mm long, claw 2 mm, plate elliptic, 1½ mm wide, outside claw thin-hairy, ciliate till halfway the plate, inside glabrous; scale tongue-shaped, rounded, inside sericeous, densely ciliate, outside glabrous, not crested. *Disk* glabrous. *Stamens* 8; filament appressed pilose in the upper half; anther glabrous, *Pistillode* pilose. *Fruits* and *seeds* unknown.

Distr.: S. Ceylon, rare. Only known from the type.

Ecol.: Moist low country. *Fl.* Sept.

Note. Apparently nearest to *L. erecta* but distinctly different.

subg. OTOPHORA

(Bl.) Leenh. — *Otolepis* Turcz., 1848. — *Otophora* Bl., 1849.

Leaves pari- or imparipinnate, stipulate, petiole and rachis winged or not; leaflets opposite to alternate, nervation open to closed. *Inflorescences* terminal, axillary, rami-, or cauliflorous. *Sepals* 5 or 4 (rarely 6 or 3), outer 2 often slightly smaller, outside mostly glabrous, at least inner ones partly petaloid. *Petals* 5 or 4 (rarely 6 or 3), shorter than sepals, outside mostly glabrous, scale not crested. *Disk* complete, glabrous or hairy. *Stamens* 5—10; filament shorter than anther. *Ovary* 2- or 3- (rarely 1- or 4-)merous, often glabrous. *Fruits* mostly not or only slightly lobed, sometimes with shortened axis (butterfly-nut shaped), glabrous or thin-hairy, septa often more or less interrupted.

KEY TO THE SECTIONS

1. a. Leaves usually imparipinnate, often many-jugate (up to more than 40 pairs of leaflets), petiole and rachis not winged; leaflets especially above with pitted warts looking like small white scales. Inflorescences terminal and axillary. Sepals 5. Petals 5 (rarely 4). Fruits often scurfy or hairy, sometimes butterfly-nut shaped; septa complete. . . . . sect. **Otophora**
   b. Leaves mostly paripinnate, up to 8(—14)-jugate, petiole and rachis exceptionally winged; leaflets nearly always densely finely pitted underneath, exceptionally with pitted warts. Inflorescences rarely terminal. Sepals and petals 5 or 4. Fruits glabrous; septa rarely complete. sect. **Pseudotophora**
   c. Leaves pari- or imparipinnate, up to 6(—13)-jugate, petiole and rachis winged; leaflets densely finely pitted underneath. Inflorescences never terminal. Sepals and petals 5 or 4. Fruits glabrous; septa mostly complete . . . . . sect. **Anomotophora**

1. sect. **Otophora**

(Bl.) Leenh. — *Otophora* sect. *Euotophora* Radlk., 1879. — *Otolepis* sect. *Otophora* (Bl.) O.K., 1903.

Twigs glabrous or glabrescent. *Leaves* usually imparipinnate, often many- (3—42-) jugate, hairy or glabrous; petiole and rachis not winged; leaflets especially above with pitted warts resembling small white scales, often hairy, midrib beneath usually rounded. *Inflorescences* terminal and axillary, mostly pyramidal, hairy or glabrous. *Sepals* 5 (rarely 6), mostly (sub)glabrous. *Petals* 5 (rarely 4), outside often hairy; scale either represented by two auricles, or lobed, ciliolate. *Stamens* 5—10; anther hairy. *Ovary* (1- or) 2- or 3-merous, hairy or glabrous. *Fruits* (if more than 1-merous) lobed, butterfly-nut shaped or not, smooth to scurfy, hairy or glabrous, septa complete.

KEY TO THE SPECIES

1. a. Nervation open or, if nerves vaguely looped and joined, leaves rarely less than 30-jugate 2
   b. Nerves distinctly looped and joined at some distance from the margin; leaves (3—)7—14(—16)-jugate 3
2. a. Fruit axis shortened, fruit butterfly-nut shaped. . . . . **L. multijuga**
   b. Fruit axis not shortened, fruit not butterfly-nut shaped. . . . . **L. amoena**
3. a. Leaflets up to 6½ × 1½ cm. Fruits 1-celled . . . . . **L. unilocularis**
   b. Leaflets 7 × 2 cm or more. Fruits 2- or 3-celled 4
4. a. Flowers small (up to 3½ mm); petals 5. Fruit axis not shortened, fruit not butterfly-nut shaped **L. divaricata**
   b. Flowers big (4—5 mm); petals 4. Fruit axis shortened, fruit butterfly-nut shaped . **L. kinabaluensis**

Lepisanthes amoena (Hassk.) Leenh., *comb. nov.* — *Melicocca amoena* Hassk., Flora 25, 2 (1842) Beibl. p. 39 (*'Melicoccus amoenus'*). — *Schleichera amoena* Walp., Rep. 5 (1845) 366. — *Otophora amoena* Bl., Rumphia 3 (1849) 142; Radlk., Pfl. R. Heft 98 (1932) 771. — *Otolepis amoena* O. K., Rev. Gen. Pl. 1 (1891) 144. — Type: *Reinwardt s.n.*, Java, fl. (L sh. 908.270—241 & 251).

Otophora spectabilis Bl., Rumphia 3 (1849) 142; Radlk., Pfl. R. Heft 98 (1932) 772. — *Capura spectabilis* T. & B., Cat. Hort. Bog. (1866) 214. — *Otolepis spectabilis* O. K., Rev. Gen. Pl. 1 (1891) 144. — Syntypes: *Unknown coll. s.n.*, all Java, fl. and st. (L sh. 908.269—1458 & 1478, 908.272—661, and 910. 95—752).

Otophora spectabilis Bl. var. *pubicosta* Bl., Rumphia 3 (1849) 143. — Syntypes: *Zippel in herb. L 908.272—621*, Java, st.; *Unknown coll. in herb. L 908.272—601* & *641*, Java, resp. st. and with young fr. (all L).

Otophora confinis Bl., Rumphia 3 (1849) 143. — Type: *Korthals s.n.*, E. Borneo, Dano Kalakhien, fl. (L sh. 908.269—1438 & 1494).

Otophora imbricata Bl., Rumphia 3 (1849) 144; Radlk., Pfl. R. Heft 98 (1932) 773. —

Otolepis imbricata O. K., Rev. Gen. Pl. 1 (1891) 144. — Syntypes: *Korthals* (all?) *s.n.*, Borneo, fl., y. fr., and st. (L sh. 908.269—1434, 1435, 1455, 1475, 1495, & 1496).

Otophora pubescens Bl., Rumphia 3 (1849) 145; Radlk., Pfl. R. Heft 98 (1932) 770. — *Otolepis pubescens* O.K., Rev. Gen. Pl. 1 (1891) 144. — Syntypes: *Korthals s.n.*, Borneo, st. (L sh. 908.269—1436, 1437, 1457, 1477, & 1497); *S. Müller s.n.*, S. Borneo, fl. (L sh. 908.269—1456).

Otophora cordigera Radlk., Sapind. Holl.-Ind. (1879) 85; Pfl. R. Heft 98 (1932) 770. — *Otolepis cordigera* O. K., Rev. Gen. Pl. 1 (1891) 144. — Type: *O. Beccari PB. 3359*, Borneo, Pontianak Prov., Sungei Unpanang, -5-1867, fl. (FI; iso in M).

Otophora styligera Radlk., Pfl. R. Heft 98 (1932) 774. — Type: *Native collector 1784*, Borneo, Sarawak, fl. (PNH lost; iso in A, M).

MALAY PENINSULA. Pahang: *Burn Murdoch SF 199*, Chenik Res. — Selangor: *Ridley 7395*, Labu R.
SUMATRA. West Coast: *Teijsmann 580 HB*, near Lubu Along. — Djambi: *Posthumus 913*, Batang Sungai, alt. 200 m. — Palembang: 6 collections. — Lampong: *Forbes 1717*, Penang-gungan, alt. 180 m; *Iboet 407*, Estate Wai Lima; *Idenburg 49*, Tulang Bawang, upper Sg. Gelang near Talangbatu, alt. 30 m. — Banka: *Kostermans & Anta 648*, G. Mangkol, alt. 50 m; *J. Meeter 54*; *Teijsmann 14545 HB*, Djibus; *14547 HB*, Sungei Liat. — Billiton: *Riedel s.n.*, -10-1876 (FI).
JAVA. West: 26 collections, mainly around Depok and G. Tjibodas west of Bogor; *Wirawan 63*, Udjung Kulon Nat. Res., Mt Pajung, alt. 50 m.
LESSER SUNDA ISLANDS. Timor: *HB 4772* (L).
BORNEO. 68 collections from the whole island.

A separate form is known from Sumatra East Coast; it is represented by the following collections: *Lörzing 4164*, *5219*, and *11988*, all from Sibolangit.

Lepisanthes divaricata (Radlk.) Leenh., *comb. nov.* — *Otophora divaricata* Radlk., Fedde Rep. 18 (1922) 338; Pfl. R. Heft 98 (1932) 758. — Type: *Unknown coll. 103*, Sarawak, Kalaka, 10-4-1893, fl. (M; iso in SAR).

Otophora pyramidalis Radlk., Fedde Rep. 18 (1922) 338; Pfl. R. Heft 98 (1932) 759. — Type: *Native coll. 375*, Sarawak, fl. (M).

Otophora lunduensis Radlk., Fedde Rep. 18 (1922) 339; Pfl. R. Heft 98 (1932) 769. — Type: *Foxworthy 17*, Sarawak, Lundu, -5/6-1908, fl., y. fr. (M).

Otophora macrocarpa Ridl., Kew Bull. (1933) 190; Radlk., Pfl. R. Heft 98 (1934) 1494. — Type: *Haviland 67*, Sarawak, near Kuching, 6-10-1892, fl., fr. (K, not seen; iso in SAR).

Two forms can be distinguished, as follows:

a. f. divaricata. — *Otophora divaricata* Radlk. — *Otophora macrocarpa* Ridl.

Leaves imparipinnate, 6- or more-jugate; stipules orbicular, at least 8 by 8 mm, sessile with a rounded to cordate base, never penninerved; leaflets sessile, 3—4 times as long as wide, up to 4 cm wide, with parallel sides. Ovary 2-celled.

BORNEO. Sarawak. *Native coll. 177* (K); *1075* (A, M); near Kuching: *Haviland 67* (SAR), ? = *917*, 12-3-1893 (SING sh. 23155), *1847* (SAR), = *1847*, 6-3-1893 (L), *2138* (SAR); Kalaka, *Unknown coll. 103* (M, SAR); Stapok For. Res.: *Brunig S. 17527* (SAR); Sg. Mata, Semarahan: *Rehal S. 13015* (L, SAR).

Intermediates are:

BORNEO. Sarawak: *Daun (herb. Haviland) 917*, near Kuching (fl.; terminal leaflet present, ovary 3-celled) (SAR); *s.n.*, near Kuching, 17-11-1892 (fl.; no terminal leaflet, ovary 3-celled) (SING sh. 23156); *Native coll. 375* (fl.; habit of f. *lunduensis*, with terminal leaflet, small stipules, 2-celled ovary) (M).

b. f. lunduensis (Radlk.) Leenh., *stat. nov.* — *Otophora lunduensis* Radlk.

Leaves paripinnate, up to 6-jugate; stipules elliptic, up to 8 by 4 mm, subsessile with a

cuneate base, mostly penninerved; leaflets short-stalked, 2½—3 times as long as wide, up to 5½ cm wide, the sides not parallel. Ovary 3-celled.

BORNEO. Sarawak: Lundu, *Beccari PB 2370* (FI); *Foxworthy 17* (M); *Kalong (herb. Haviland) 1511* (SAR).

Lepisanthes kinabaluensis Leenh., *sp. nov.* — Type: *Chew & Corner RSNB 4998*, N. Borneo, Mt Kinabalu, Mesilau Riv., alt. 1525 m, 28-4-1964, y. fr. (K; iso in L).

Arbor 10 m alta. *Ramuli* teretes, ¾ cm crassi, griseo-fuliginei, minute puberulis, sparse et inconspicue lenticellati lenticellis linearibus. *Folia* imparipinnata, 7—9-jugata; petiolus rhachisque dense minute puberula. *Petiolus* teres, basi applanatus, 5—6½ cm longus; rhachis teres, apicem versus carinata. *Stipulae* basi petioli insertae, sessiles, suborbiculares, 2—3 × 3—4 cm, cordata, apice rotundata. *Foliola* subopposita vel superiora alterna, (sub)sessilia, oblonga, circa 3-plo longiora quam lata, c. 12½ cm longa 4½ cm lata, pergamentacea, virentia, utrinque glandulis verrucis immersis sparse obtecta, subglabra; basis late cuneata vel dimidio inferiore rotundata; apex gradatim acuminatus, obtusus; costa supra prominula, subtus acute prominens; nervi laterales per 1—2 cm distantes, a costa angulo 70—75° abientes, recti vel subcurvati, arcuato-conjuncti, utrinque prominuli; venae intercalares nonnullae, distinctae; venae venulaeque subdense reticulatae, inconspicuae. *Thyrsi* terminales, pyramidati, c. 25 cm longi, minute puberuli, ramis patentibus, cymis pluribus breviter stipitatis vel sessilibus, plurifloris. *Fructus* (immaturus) 3-lobus, coccis patentibus ellipsoideis, c. 12—15 × 4 mm metientibus, scaber, glaber.

BORNEO. North, Mt Kinabalu: *Carr SF 26934*, above Tenompok, alt. 1585 m (SING); *Chew & Corner RSNB 4640*, Bembangan R., alt. 1525 m (K); *4944*, Bembangan R., alt. 1585 m (K, L); *4998*, type; *Clemens 27836*, Lumu-Lumu, alt. 1980 m (A, BM, BO); *29017*, Tenompok, alt. 1525 m (BO, K); *29389*, Tenompok, alt. 1675 m (A, BM, BO, K, L).

Note. Like *L. multijuga*, this species differs from *L. amoena* mainly by the 3-parted fruit.

Lepisanthes multijuga (Hook. *f.*) Leenh., *comb. nov.* — *Nephelium multijugum* Hook. *f.*, Trans. Linn. Soc. 23 (1860) 164. — *Capura multijuga* Hook. *f. ex* Radlk., Sapind. Holl.-Ind. (1879) 11, *nom. invalid.* (Code 1966, art. 34). — *Otophora imbricata auct. non* Bl.: Radlk., Sapind. Holl.-Ind. (1879) 82 *p.p.* — *Otophora multijuga* Merr., En. Born. (1921) 358; Radlk., Pfl. R. Heft 98 (1932) 774. — Type: *Motley*, Borneo, Labuan, fl. (K?, not seen).

Otophora tricocca Radlk. in Merr., Pl. Elm. Born (1929) 174, *nom. nud.* — Syntypes: *Elmer 20010* and *20200*, N. Borneo, Sandakan, Myburgh Prov., -10/12-1921, fl. and y. fr., resp. fr. (A, BO, L, M, SING).

BORNEO. North: 7 collections. — Labuan: *Motley s.n.* (*ex* Hook. *f.*).

Lepisanthes unilocularis Leenh., *sp. nov.* — Type: *S. K. Lau 5773*, Hainan, Yai-hsien Dist., Fat Loh Shi, 19/29-3-1935, fr. (A). — **Fig. 1.**

Frutex 3 m altus. *Ramuli* teretes, 5 mm crassi, laeves, dense fusco-tomentosi. *Folia* imparipinnata, 12—14-jugata, 25—30 cm longa, petiolus rhachisque dense breviter fulvo-tomentosa. *Petiolus* teres, basi applanatus, 1½—3½ cm longus; rhachis apicem versus carinata. *Stipula* ebasi petioli insertae, sessiles, ovatae, 1½ × 1 cm, cordatae, apice acutae, penninerviae. *Foliola* opposita vel alterna, sessilia, lanceolata, c. 4½-plo longiora quam lata, usque ad 6½ cm longa et 1½ cm lata, chartacea, supra virideo-grisea, subtus fusca, utrinque glandulis verrucis immersis sparse obtecta, supra in costa strigosa, ceterum glabra; basis dimidio superiore cuneata, inferiore rotundata; apex gradatim longe obtuse acuminatus; costa supra prominula, subtus obtuse prominens; nervi laterales per ¾—1 cm

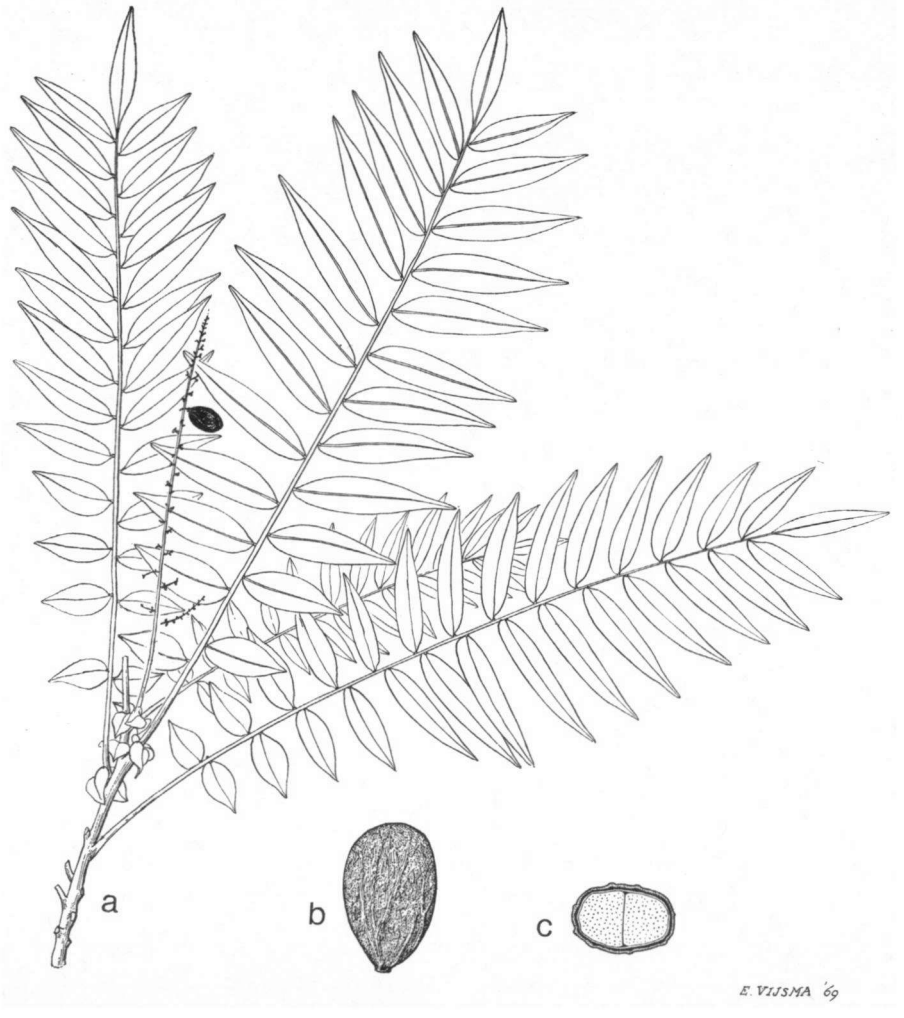

Fig. 1. *Lepisanthes unilocularis* Leenh. a. Habit, x 2/5; b. fruit, x 2½ c. *ditto*, cross-section, x 2½. *(S. K. Lau 5773).*

distantes, a costa angulo 55—65° abientes, recti, arcuato-conjuncti, subtus quam supra plus prominuli; venae intercalares distinctae, venae venulaeque dense reticulatae utrinque prominulae. *Infructescentia* terminalis (ut videtur), haud vel a basi longe erecte ramosa, glabra, anguste thyrsoidea, cymis pluribus 1—2 mm stipitatis 3—5-floris. *Fructus* ellipsoidei, 12 mm longi, 8—9 mm lati, laeves, rubri, glabri, uniloculares, unigrani. *Semina* 8 mm longa, 4—5 mm lata, avellanea, hilo orbiculato.

Ecology: dry land, sandy soil, scattered and rare.

Note. Only known from the type specimen. It belongs doubtless to sect. *Otophora* (presence of a terminal leaflet; presence of glandular-pitted warts on the leaflets; number of

leaflets) where it seems to be nearest to *L. amoena* and possibly *divaricata*. The fruits remind more of *L. fruticosa*, are unique in the genus, however, by being 1-celled and 1-seeded. No trace of a second fruit-cell has been found.

2. sect. Pseudotophora

(Radlk.) Leenh. — *Otophora* subg. *vel* sect. *Pseudophora* Bl., 1849. — *Otophora* sect. *Pseudotophora* Radlk., 1879. — *Otolepis* sect. *Pseudotophora* (Radlk.) O.K., 1903.

Twigs glabrous or sometimes hairy. *Leaves* mostly paripinnate, 1—8(—14)-jugate, mostly glabrous; petiole and rachis only very rarely winged; leaflets nearly always densely finely pitted underneath, exceptionally with pitted warts, often glabrous, midrib beneath angular or more rarely rounded. *Inflorescences* rarely terminal, nearly always axillary, rami-, or cauliflorous, solitary or few together, simple or branched, hairy or glabrous. *Sepals* 5 or 4 (rarely 3), outside hairy or glabrous. *Petals* 5 or 4, outside glabrous or hairy; scale often faint, entire, hairy. *Stamens* 5—8(—10); anther hairy or glabrous. *Ovary* 2- or 3- (rarely 4-)merous, mostly glabrous. *Fruits* rarely lobed, smooth, glabrous, septa mostly interrupted to nearly fully reduced.

KEY TO THE SPECIES

1. a. Branches of the inflorescence, sepals, and lower half of petals densely hairy . . **L. bengalan**
   b. Inflorescence and sepals glabrous, petals glabrous or slightly hairy at base . . . **L. fruticosa**

Lepisanthes bengalan Leenh., *sp. nov.* — Type: *A. Kostermans 4889*, NE. Borneo, E. Kutei, Sangkulirang I., alt. 20 m, 24-5-1951, fl. (L; iso in SING).

Arbor 8 m alta, 20 cm diam. *Ramuli* teretes, 1¼ cm crassi, nitide olivaceo-brunnei, sparse verruculoso-lenticellati, glabri. *Folia* pinnata (foliolo terminali reducto), 5—6-jugata, glabra. *Petiolus* teres, basi tumidus, 4—9 cm longus; rhachis basin versus teres, medio angulata, apicem versus marginata; petioluli 1 mm longi. *Stipulae* basi petioli insertae, suborbiculatae, c. 4 cm longae, 5 cm latae, sessiles, basi cordatae, apice rotundatae, palmati- vel retinerviae. *Foliola* terminalia lanceolata, 5½ cm longa, 1 cm lata, lateralia subopposita, oblonga, c. 3½-plo longiora quam lata, usque ad 19 cm longa et 6 cm lata, rigide chartacea, supra viridi-grisea, subtus pallide fusca, supra sparse glandulis verrucosis centro immersis obtecta, subtus dense minute punctata; basis subobliqua, angustate rotundata; apex obtusus vel angustate rotundatus; costa subtus acute prominens; nervi laterales inter sese per 1½—3 cm distantes, a costa angulo c. 65° abientes, subcurvati, ex parte arcuato-conjuncti; venae intercalares distinctae, venae venulaeque inconspicuae. *Thyrsi* axillares, 30—35 cm longi, ample ramosi, ramis oblique erectis, longis, cymis sessilibus, pauci- vel unifloris; rhachis subglabra, ramis dense fulvo-puberulis; pedicelli crassi, 2 mm longi; bracteae usque ad 1 mm longae, acute deltoideae, puberulae. *Sepala* 5, margine petaloidea, dense ciliolata, extus dense fulvo-puberula, intus glabra, exteriora elliptica, 4½ mm longa, 2½ mm lata, interiora suborbiculata, 3½ mm longa, 3 mm lata. *Petala* 5, sessilia, elliptica, 3 mm longa, 2½ mm lata, carnosa, dorso dimidio inferiore subdense sericea, margine ciliolata, intus supra basin squama angusta reflexa ciliolata aucta. *Discus* annularis, glaber. *Stamina* 8, filamentis pilosis, antheris basifixis, anguste ovatis, 1½ mm longis, curvatis, apiculatis, basi emarginatis, glabris. *Pistillodium* dense pilosum, 3-loculare.

BORNEO. NE.: *Endert 2082*, W. Kutei, L. Temelen, alt. 200 m (L); *Kostermans 4889*, E. Kutei, Sangkulirang I., alt. 20 m (L, SING); *4922*, *ditto*, alt. 30 m (L).

Notes. Superficially, *L. bengalan* reminds strongly of subg. *Lepisanthes* because of the densely hairy inflorescences and flowers; the pseudostipules are distinctly different, however. Within subg. *Otophora* it shows the greatest resemblance to some races of *L. fruticosa*, especially '*Otophora erythrocalyx*' and '*Otophora sessilis*'; the densely hairy inflorescences, sepals, petals, and pistillode fall outside the wide range of variability of that species, however. Though the densely, finely pitted lower leaf-face is in accordance with the inclusion in sect. *Pseudotophora*, the scattered glandular-pitted warts on the upper surface characterize mainly sect. *Otophora*.

The specific epithet is derived from the vernacular name, mentioned with the type specimen.

Lepisanthes fruticosa (Roxb.) Leenh., *comb. nov.* — *Sapindus fruticosa* Roxb., [Hort. Beng. (1814) 29, *nom. nud.*] Fl. Ind. ed. 2, 2 (1832) 283. — *Otophora fruticosa* Bl., Rumphia 3 (1849) 142; Radlk., Pfl. R. Heft 98 (1932) 759. — *Otolepis fruticosa* O. K., Rev. Gen. Pl. 1 (1891) 144. — *Capura fruticosa* Vidal in Ceron, Cat. Pl. Herb. Manila (1892) 54. — Type: *Roxburgh*, Hort. Bot. Calcutta, introduced from the Moluccas (C, not seen).

Capura pinnata Blco, Fl. Filip. (1837) 264. — *Capura purpurata auct. non* L.: Blco Fl. Filip. ed. 2 (1845) 184; *ditto*, ed. 3, 1 (1877) 328. — *Sapindus arborescens auct. non* Aubl.: Llanos, Mem. R. Ac. Cienc. Madr. 4 (1859) 507. — *Otophora paucijuga auct. non* Hiern: F.-Vill., Nov. App. (1880) 52. — *Otophora pinnata* Merr., Bull. Bur. For. Philip. 1 (1903) 35.— Type:

Sapindus baccata Blco, Fl. Filip. (1837) 290. — *Koelreuteria edulis* Blco, Fl. Filip. ed. 2 (1845) 202, *nom. illeg.* — *Otophora blancoi* Bl., Rumphia 3 (1849) 142, *nom.illeg.*—Neotype: *Merrill Sp. Blancoanae 374*, Philippines, Palawan, Taytay, -5-1913, fl. and y. fr. (iso in A, BO, L).

Otolepis nigrescens Turcz., Bull. Soc. Nat. Mosc. 21 (1848) 573. — *Otophora nigrescens* F.-Vill., Nov. App. (1880) 52. — *Capura nigrescens* Vidal, Sinops. (1883) 21, t. 34 f. E. — Type: *Cuming 1922*, Philippines, Luzon, (CW or KW?, not seen).

Otophora zollingeriana T. & B., Nat. Tijd. N. I. 25 (1863) 423. — *Capura zollingeriana* T. & B., Cat. Hort. Bog. (1866) 215. — Type: '*Hab. ins. Javam orientalem; Zollinger.*', possibly *Zollinger 3345*, Lesser Sunda Is, Dompo I., fl. (L); a specimen, cultivated in the Hort. Bot. Bogor under the name *Capura zollingeriana* T. & B. was collected by Beccari, -7-1876, and is represented in FI.

Otophora erythrocalyx Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 680; Radlk., Pfl. R. Heft 98 (1932) 769. — *Otolepis erythrocalyx* O. K., Rev. Gen. Pl. 1 (1891) 144. — Type: *Maingay K. D. 447*, Malay Peninsula (K, not seen; iso in M).

Otolepis cambodiana Pierre, Fl. Coch. 5 (1895) t. 330 A. — *Otophora cambodiana* [Pierre, Fl. Coch. 5 (1895) *sub* t. 330 A, *nom. inval.*] Lecomte, Fl. Gén. I.-C. 1 (1912) 1033, f. 129 1, 4—9; Radlk., Pfl. R. Heft 98 (1932) 764. — Type: *Harmand 103 = herb. Pierre 4129*, Cambodia, Stung treng, bank of Mekong R., -12-1875, fl. (P; iso in K, M. P).

Otolepis furcata Pierre, Fl. Coch. 5 (1895) t. 330 B. — *Otophora furcata* [Pierre, Fl. Coch. 5 (1895) *sub* t. 330 B, *nom. inval.*] Lecomte, Fl. Gén. I.-C. 1 (1912) 1033; Radlk., Pfl. R. Heft 98 (1932) 764. — Type: *Pierre 4127*, S. Vietnam, Prov. Bien hoa, Mt Lu, -3-1877, fl. & fr. (P; iso in K, L, M).

Otolepis nodosa Pierre, Fl. Coch. 5 (1895) t. 331 A. — *Otophora nodosa* [Pierre, Fl.Coch. 5 (1895) *sub* t. 331 A, *nom. inval.*] Lecomte, Fl. Gén. I.-C. 1 (1912) 1032, f. 129[2]; Radlk., Pfl. R. Heft 98 (1932) 765. — Type: *Pierre 1283*, S. Vietnam, Prov. Bien hoa, bank of Dongnai R. near Tri huyen, -1-1873, fl. (P; iso in L, M).

Otophora sessilis King, J. As. Soc. Beng. 65, ii (1896) 430; Radlk., Pfl. R. Heft 98

(1932) 763. — Syntypes: *King's coll. 2460*, Malay Pen., Perak (iso in M); *King's coll. 5043, ditto* (M drawing).

Otophora resecta Radlk., Rec. Bot. Surv. Ind. 3 (1907) 346; Pfl. R. Heft 98 (1932) 766. — Type: *Ridley 6948*, Malay Pen., P. Penang, Penara Bukit, -12-1895, fl. (CAL, not seen; iso in M, SING).

Capura pulchella Ridl., J. Str. Br. R. As. Soc. 54 (1910) 35. — *Otophora pulchella* Merr., En. Born. (1921) 359; Radlk., Pfl. R. Heft 98 (1934) 1494. — Type: *Ridley s.n.*, N. Borneo, Kudat, -12-1897, y. fr. (SING sh. 23153).

Otophora oliviformis Radlk., Philip. J. Sc. 6, Bot. (1911) 181; Pfl. R. Heft 98 (1932) 767, — Type: *McGregor BS 10330*, Philippines, Polillo I., -10/11-1909. fr. (M).

Otophora setigera Radlk., Philip. J. Sc. 8, Bot. (1914) 455; Pfl. R. Heft 98 (1932) 767. — Type: *Mearns & Hutchinson FB 4569*, Philippines, Mindanao, Misamis Prov., Mt Malindang, -5-1906, fr. (M).

Otophora cauliflora Merr., Philip. J. Sc. 13, Bot. (1918) 24; Radlk., Pfl. R. Heft 98 (1932) 762. — Type: *Ramos & Edaño BS 28516* (as cited) or *28561* (as written on the M sheet), Philippines, Luzon, Tayabas Prov., Mt Binuang, -5-1917, fr. (PNH, lost; iso in M).

Otophora siamensis Craib, Kew Bull. (1926) 360; Radlk., Pfl. R. Heft 98 (1932) 775. — Type: *Kerr 9401*, Thailand, Chantaburi, Kao Saming, Krat, low, 25-11-1924, fl. (K).

Otophora grandifoliola Quis. & Merr., Philip. J. Sc. 37 (1928) 163; Radlk., Pfl. R. Heft 98 (1934) 1493. — Type: *Ramos & Edaño BS 49051*, Philippines, Mindanao, Davao Prov., Mati, -3/4-1927, y. fr. (PNH, lost; iso in L).

Otophora glandulosa Radlk. [in Merr., Pl. Elm. Born. (1929) 174, *nom. nud.*] Pfl. R. Heft 98 (1932) 763, *non* Ridl. (1933). — Type: *Elmer 20128*, N. Borneo, Sandakan, -10/12-1921, fr. (M; iso in A, BO, L, SING).

Otophora bijuga Radlk. [in Merr., Pl. Elm. Born. (1929) 173, *nom nud.*] Pfl. R. Heft 98 (1932) 765. — Syntypes: *Elmer 20749*, N. Borneo, Elphinstone Prov., Tawao, -10-1922/-3-1923, y. fr. (UC, not seen; iso in M); *Kloss SF 19103*, N. Borneo, Bettotan near Sandakan, 12-8-1927, fr. (UC, not seen; iso in SING).

Otophora anomala Radlk., Pfl. R. Heft 98 (1932) 766. — Type: *Clemens 9880*, N. Borneo, Kibayo to Keung, 29-10-1915, fl. (PNH, lost; iso in A).

Otophora lancifolia Radlk., Pfl. R. Heft 98 (1932) 766. — Type: *Ramos 1443*, N. Borneo, Sandakan, fl. (M).

Otophora acuminata Radlk., Pfl. R. Heft 98 (1932) 769. — Type: *Hallier 911*, W. Indonesian Borneo, Sanggouw, 1893/4, fr. (L; iso in M).

Otophora latifolia Ridl., Kew Bull. (1933) 190, *nom. illeg.* — *Otophora glandulosa* Radlk. *ex* Ridl., Kew Bull. (1933) 490, *nom. illeg., non* Radlk. (1932). — Type: *Creagh s.n.*, N. Borneo, East coast (K, not seen).

Otophora eberhardtii Gagnep., Not. Syst. 13 (1947) 63. — Syntypes: *Clemens 3346*, S. Vietnam, Tourane, 4/13-6-1927, fl. (A, P); *Eberhardt 2656*, S. Vietnam, Prov. Thùa Thiên, Thùa-lun, fl. (P); *Poilane 1016*, S. Vietnam, Prov. Thùa Thiên, Hói mít, 16-2-1920, fl. (P).

Shrub or tree, 1½—10 m by 2—15 cm, exceptionally liana *(Eberhardt 2656). Twigs* 2½—20 mm ⌀, red when young, later variably brown to silvery grey, glabrous or sometimes variably fulvous-hairy and glabrescent. *Leaves* pari- or exceptionally imparipinnate (in the latter case terminal leaflet rather strongly reduced), 1—14-jugate, 25 cm to more than 1 m long, glabrous or sometimes axial parts more or less densely variably hairy. *Petiole* terete or sometimes flattened, ½—32 cm long; rachis terete to laterally flattened, in the upper part often marginate to exceptionally narrowly winged; petiolules 0—30 mm. *Stipules* inserted at or on the base of the pétiole, persistent or sometimes caducous,

sessile, ovate to obovate to orbicular, sometimes very oblique, 0.2—12 by 0.1—12 cm, cordate to blunt at base, blunt to rounded or sometimes furcate at apex, reti-, palmati-, or sometimes penninerved. *Leaflets* opposite to alternate, ratio 2½—9, widest above to below the middle, 9—40 by 2—12 cm, thin-chartaceous to coriaceous, above with scattered sunken glands, beneath sparsely to densely finely pitted, glabrous or sometimes beneath mainly on the midrib hairy; base oblique or not, subcordate to acute, mostly attenuate, in oblique leaflets lower half sometimes rounded, upper cuneate; apex blunt (rarely acute) to more or less tapering acuminate, acumen short, broad, and blunt to long, slender, and acute, sometimes mucronate; midrib acute or rounded beneath; nerves ¾—5 cm distant, angle 35—75°, straight to curved, none to all looped and joined. *Inflorescences* sometimes terminal, mostly axillary, not rarely rami- or cauliflorous, solitary or if cauliflorous sometimes few together, simple or branched, either pyramidal or with some to several ascending long branches from near the base, up to 75 cm long, glabrous; cymes mostly sessile or nearly so, exceptionally up to 1 cm long stalked, few- to several-flowered, in the upper part often flowers solitary; pedicels filiform, 0.3—1(—1½) cm long. *Calyx:* sepals (3) 4 or 5, all equal or more rarely outer 2 smaller, elliptic, orbicular, or obovate, 2—5 × 1½—3 mm, dark red or more rarely yellow to white, margin, especially of the inner ones, petaloid, crenulate to fimbriate-ciliolate, glabrous or very sparsely glandular-ciliolate. *Corolla:* petals 4 or 5 (exceptionally 3 or 6), short-clawed (up to ¾ mm), plate broad-ovate or elliptic to obovate, 1½—3½ × 1—2½ mm, mostly dark red, sometimes yellow to white, mostly glabrous, sometimes slightly hairy near the base either outside or inside, sometimes ciliate near the base or, exceptionally, for the greater part; scale varying from a hairy line via 2 small, inflexed, ciliate auricles to an undivided, erect or reflexed, ciliate scale up to ¼ the length of the petal. *Stamens* 5—8(—10); anther 1¼—2½ mm, yellow, glabrous to rather densely hairy. *Ovary* 2—3(—4)-celled, glabrous, with a (sub)sessile stigma. *Infructescences* with patent, mostly slender, up to 1½ cm long pedicels. *Fruits* ovoid, ellipsoid, subglobular, or transversely ellipsoid, rarely distinctly lobed, 1—3 × 0.6—2 × ½—2 cm (fresh up to 4 cm in diam.), apparently white when young, dark red to blackish when ripe; fruit wall thin, apparently fleshy when fresh; septum rarely complete, usually interrupted to (mostly) reduced to a rib all around. *Seed* subglobular to semi-ellipsoid, flattened on one side, 8—23 × 6—18 × 4—18 mm, hilum orbicular to lanceolate, up to 6 × 3—4 mm.

LAOS. *Thorel 3056*, Lakhon; *3105 p.p.*, Vientiane.

CAMBODIA. *Harmand 103* = *herb. Pierre 4129*, Stung treng, bank of Mekong R.; *Lecomte & Finet 1740*, Angkor; *Poilane 14874*, Prov. Kg-thom, between Tabeng and Pra-prassap.

S. VIETNAM. 6 collections.

BURMA. *R. N. Parker s.n.*, Mergui, Pawut, 29-1-1927 (K).

THAILAND. Chantaburi: *Kerr 9401*, Kao Saming, Krat, alt. under 20 m; *Marcan 1271*, Koh Chang I., alt. 2 m, paratype of *Otophora siamensis* (K); *Ploenchit 2209*, Trat, Hui Rang, alt. 4 m (L). — Krungtep: *Zimmermann 112*, Bangkok, wild? (K, L, M). — Surat: *Seidenfaden 2149*, Bandon R., Wat Sa Uhm (SING). — Puket: *Haniff & Nur SF 3933*, Khaw Pok Hill, alt. 300 m. — Pattani: see Craib, Fl. Siam. En. 1 (1926) 328 *sub Otophora fruticosa*.

MALAY PENINSULA. *Forest Dept FMS 33853* (SING); *Maingay KD 447*. — Nakawn Srîtamarât: *Annandale s.n.*, Singgora (SING sh. 23098). — Kedah: *Kiah SF 35021*, G. Lang. — Perak: *King's coll. 2460*; *5043*; *L. Wray jr. 2883*, Belau Tujor. — Kelantan: *Corner SF 33523*, Bachok; *Haniff SF 10101*, Kuala Krai. — Pahang: *Burkill & Haniff SF 17566*, Beserah; *W. Fox s.n.*, P. Plah (SING sh. 23101); *Haviland s.n.*, Pekan (SING sh. 23102). — Selangor: *Burn Murdoch 86/11*, Weld Hill (SING); *Chelliah KEP 98209*, Chadangan F.R. (L); *For. Dept CF 349*, Weld Hill. — Malacca: *Alvins 290*, Selandor; *Derry 894*, Selandar; *Goodenough 1765*, Ayer Panas. — Langkawi Is: *Corner SF 37991*, G. Raya, alt. 60 m; *Curtis 2672* (SING). — P. Penang: *Ridley 6948*, Penara Bukit. — P. Tioman: *Nur SF 18759*, Ayer Besar, alt. 250 m. — P. Setindan: *Corner SF 32230*, sea-level.

SUMATRA. Indragiri: *W. Meijer 4238*, Taluk region near biv. Dewan I. (L).

JAVA. Central: *Beumée 3440*, Semarang, Houtvesterij NW. Wirosari, alt. 50 m; *Hemken s.n.*, Solo, alt. 104 m (L sh. 922.258—4).

LESSER SUNDA Is. Dompo I. near Sumbawa: *Zollinger 3345* (L).

BORNEO. Sarawak: 10 collections. — Brunei: *Anderson S 5683*, Badas F. R., alt. 15 m; *Ashton BRUN 958*, alt. 6 m; *Ashton S 5931*, Andulau F. R., alt. 45 m (L); *Hasan S 5555*, Berakas F. R., alt. 12 m (SAR); *van Niel 3433*, Dist. Tutong, Danau (L). — West: *Hallier 850*, Suka Lanting (L); *911*, Sanggouw; *Teijsmann HB 8599*, Kapuas, Mt Biang (BO, L). — East: *Endert 2922*, W. Kutei, Temelen, alt. 200 m (L); *Kostermans 7329*, Peak of Balikpapan, alt. 600 m (L); *7680*, ditto, alt. 1000 m (L); *21333*, Mt Njapa on Kelai R., alt. 100 m (K, L). — North: 40 collections. — Banguey I.: *Castro & Melegrito 1577*, low alt. (M); *Kloss SF 19211*. — Natuna Is: *van Steenis 1205*, P. Bunguran, E. slope of G. Ranai (BO).

PHILIPPINES. Balabac I.: *Mangubat BS 423* (M); *S. Vidal 209 bis*, Indalaguan (A). — Palawan: 12 collections. — Calamianes, Busuanga I.: *Lopez BS 41389*, Lungbuan, low alt. (A). — Mindoro: 9 collections. — Luzon: 28 collections. — Polillo I.: *Fox PNH 9225*, alt. 50 m (A); *R. C. McGregor BS 10330* (M). — Marinduque: *S. Vidal 721 h*, Santa Cruz (A). — Samar: *Sulit PNH 14388*, Mt Cansayo, Catarman, alt. 200 m (A). — Leyte: *Elmer 7104*, Palo (A, BO). — Cebu: *Usteri 141*, Guadelupe R., acc. to Radlk. (1932) 762. — Negros: *Usteri 8 = 142*, Pontevedra (M). — Panay: acc. to F.-Vill. (1880) 52. — Basilan: *Hallier 4156 b, 4496* (L). — Malamaui I.: *Moseley s.n.*, -1/2-1875 (K). — Mindanao, incl. also Bucas Grande I.: 7 collections.

CELEBES. North, Minahassa: *Hose 821* (CGE, K); *Koorders 18821*, alt. 12 m (L); *18822*, alt. 200 m (L, M). — Central: *Eyma 4210*, Subdiv. Malili, between Tawi baru and Tomoni (L); *Kjellberg 2330*, Malili Dist., N. of Tabarano, alt. 400 m (BO); *Noerkas 429*, Tapalaëng (L); *Rachmad 372*, P. Wali; *794*, G. Sungkuwatawo (L). — Southwest: *Teijsmann 12154 & 12865*, Pangkadjene. — Southeast: *Kjellberg 503*, Kendari, alt. 100 m (BO). — Muna I.: *Elbert 2894*, Raha, alt. 0—125 m (L); *2934*, Raha, alt. 0—75 m (L). — Buton I.: *Elbert 2676*, Bau bau, alt. 0—75 m (L).

MOLUCCAS. Talaud Is: *Lam 2981*, Karakelang, Pasir Malap, E. of Lobo, alt. 30 m (L). — Ternate: *Beccari herb. 2819*; *Pleyte 115*, E. coast, alt. 50 m (L). — Batjan: *Warburg 18167*, acc. to Radlk. (1932) 761. — Ambon: *Beccari herb. 2814*; *de Fretes 5567* (BO); *HB 14347* (BO).

Nomenclature. The names *Koelreuteria edulis* Blco and *Otophora blancoi* Bl. are illegitimate as in both cases the earlier epithet *baccata* (from *Sapindus baccata* Blco) could, and hence should, have been used.

The combinations *Otophora cambodiana, furcata,* and *nodosa* are all invalid with Pierre, Fl. Coch. 5 (1895), as they have been mentioned under the plates only, but have been corrected in the accompanying text to combinations under *Otolepis.*

The case of *Otophora latifolia* Ridl. and *O. glandulosa* Ridl. is more complicated. *Otophora latifolia* was published in May 1933, with a Latin diagnosis and a Latin description, and based upon an unnumbered *Creagh* collection as type and some paratypes, among which was cited *Elmer 20138. Otophora glandulosa* Ridl. was published in Dec. 1933, again with a short Latin diagnosis, and with a description in English. The type was also an unnumbered *Creagh* collection. It was clear that Ridley intended to validate *Otophora glandulosa* Radlk. which was published as a *nomen* in 1929 by Merr., Pl. Elm. Born.; apparently he was not aware of the fact that the name was already validated in Pfl. R. (1932). As he chose a different type and cited the type of Radlkofer's name as a paratype Ridley's name has to be treated as a heterotypic homonym. Surprising is, however, that he did not at all refer to his *O. latifolia.* A comparison of the publications of these two names shows that the Latin diagnoses are the same in all essential points, that the Latin description of the one is a translation of the English description of the other, and that the specimens cited are the same, with one notable exception: *Elmer 20138* under *O. latifolia* has been corrected to *20128* under *O. glandulosa* — and that is the type of *O. glandulosa* Radlk.! Hence, *O. latifolia* Ridl. was a superfluous new name for *O. glandulosa* Radlk.

Note. A full account of the variability can be found in Chapter IV.

3. sect. **Anomotophora**

(Radlk.) Leenh. — *Otophora* sect. *Anomotophora* Radlk., 1879. — *Otolepis* sect. *Anomotophora* (Radlk.) O. K., 1903.

Twigs hairy or glabrous. *Leaves* pari- or (more rarely) imparipinnate, 3—6(—13)-jugate,hairy or glabrous; petiole and rachis winged; leaflets densely finely pitted underneath, glabrous or hairy, midrib beneath angular or rounded. *Inflorescences* axillary, cauli-, or ramiflorous, solitary or fascicled, simple or slightly branched, glabrous. *Sepals* 5 or 4 (rarely 6), outside glabrous. *Petals* 5 or 4 (rarely 6), outside nearly always glabrous; scale entire to bilobed, glabrous or hairy. *Stamens* 5—8; anther (sub)glabrous. *Ovary* 2- or 3- (rarely 4-)merous, glabrous. *Fruits* not or slightly lobed, smooth, glabrous, septa mostly complete.

KEY TO THE SPECIES

1. a. Ovary 3- (rarely 4-)merous. Twigs and leaves glabrous; leaflets narrow (normal ratio 4—7), rarely more than 20 × 4 cm, base acute or sometimes rounded . . . . . **L. alata**
   b. Ovary 2-merous. Twigs and leaves sparsely hairy; leaflets broader (ratio 2½—5), mostly more than 20 × 4 cm, base cordate 2
2. a. Flowers 5-merous; inflorescences solitary, up to 40 cm long, widely branched. Fruits completely 2-celled . . . . . **L. amplifolia**
   b. Flowers 4-merous; inflorescences fascicled, *c.* 1½ cm long, racemoid. Fruits incompletely 2-celled **L. ramiflora**

Lepisanthes alata (Bl.) Leenh., *comb. nov.* — *Otophora alata* Bl., Rumphia 3 (1849) 145; Radlk., Pfl. R. Heft 98 (1932) 768. — *Capura alata* T. & B., Cat. Hort. Bog. (1866) 214. — *Otolepis alata* O. K., Rev. Gen. Pl. 1 (1891) 144. — Lectotype: *Korthals s.n.*, S. Borneo, Bang. Masray (?), fl. & fr. (L sh. 908.269—1431 & 1432).

Otophora edulis C. E. C. Fischer, Kew Bull. (1932) 178; Radlk., Pfl. R. Heft 98 (1934) 1493. — Type: *P. Orolfo 1319*, N. Borneo, Tapadong, Segama, Lahad Datu, alt. 100 m, 6-1-1931, fl. & fr. (K).

MALAY PENINSULA. Johore: *W. L. Wood in herb. SING 23118*, Pasir Plangie Istana.

JAVA. *Teijsmann 14553* (BO); *Zollinger 3456* (L). — West: *Backer in herb. L 922.258—19*, Meester Cornelis, '*spontanea e seminibus specim. cult.*'; *Bakhuizen v. d. Brink 4095*, Res. Batavia, Angsana near Leuwiliang Tjiampèa, alt. 400 m (L); *Ploem in herb. L 909. 25—51*, near Bogor. — Central: *Backer 18529*, Banjumas, Madjenang (BO).

BORNEO. Brunei: *M. Hotta 12660*, Seria Dist., Kpg. Mendaram, alt. *c.* 100 m (KYO, L). — Sarawak: 4 collections. — South: 4 collections. — East: *Endert 1702*, bank of Mahakam R. near Muara Kaman, alt. 10 m, very common (A, L); *3335*, W. Kutai, near L. Petah, alt. 450 m (L). — North: 4 collections.

PHILIPPINES. Sulu Is.: *Ramos & Edaño BS. 44403*, Jolo I., low alt. (M).

Lepisanthes amplifolia (Pierre) Leenh., *comb. nov.* — *Otolepis amplifolia* Pierre, Fl. Coch. 5 (1895) t. 331 B. — *Otophora amplifolia* [Pierre, Fl. Coch. 5 (1895) *sub* t. 331 B, *nom. inval.*] Lecomte, Fl. Gén. I. C. 1 (1912) 1031, f. 129[3, 10]; Radlk., Pfl. R. Heft 98 (1932) 764. — Type: *Pierre 4128*, S. Vietnam, Prov. Bien hoa, Chiao xhan, -3-1877, fr. (P; iso in K, L, M).

Otophora capillipes Gagnep., Not. Syst. 13 (1947) 63; Fl. Gén. I. C. Suppl. 1 (1950) 948. — Type: *Poilane 31825*, S. Vietnam, Prov. Quang-nam, southern border near Moï de Plang bra, 26-2-1941, y. fr. (P).

Otophora poilanei Gagnep., Not. Syst. 13 (1947) 64; Fl. Gén. I. C. Suppl. 1 (1950) 948. — Type: *Poilane 6674*, S. Vietnam, Prov. Nhatrang, SE. slope of Mt Mère de l'Enfant, alt. 600 m, 24-5-1923, y. fr. (P).

Treelet, 1.20—3 m. *Twigs* ¾—2 cm ⌀, yellowish- or greyishbrown, smooth to verruculose, sparsely hairy to glabrous. *Leaves* pari- or imparipinnate (in the latter case terminal leaflet often strongly reduced), 4—6-jugate, 40—90 cm, petiole and rachis hirsute or at least apical part of rachis pulverulent. *Petiole* terete or flattened, 9—28 cm long;

wings of petiole and rachis 2—15 mm wide; petiolules 0—5 mm. *Stipules* broad-ovate to oblong, 1—14 by 1—5 cm, base cordate, apex blunt to shortly and bluntly acuminate, penninerved. *Leaflets* (sub)opposite, ratio 2½—4, widest above to below the middle, 17—32(—40) by 6—9 cm, (thin)chartaceous, either sparsely hirsute on midrib and nerves beneath, or fulvous tomentulose on the midrib near the base above; base slightly oblique, cordate; apex (acute or) tapering acuminate, acumen 1—2 cm long, broad and blunt; midrib rounded beneath; nerves 1—3½ cm distant, angle 50—70°, straight to slightly curved, at least the upper ones distinctly looped and joined. *Inflorescences* ramiflorous, solitary, 6—40 cm long, purple, with one or a few up to 20 cm long branches at or slightly above the base, flowers on short side-branches or in scattered to dense, short-stalked, few-flowered cymes; pedicels (in fruit) ½—1½ cm, slender. *Flowers* (acc. to Gagnep.) 5-merous. *Sepals* obovate, 3 mm long. *Petals* oblong, short-clawed, with a broad, short, 3-angular, puberulous scale. *Disk* glabrous. *Stamens* 8; anther 1½ mm. *Ovary* 2-celled. *Fruits* slightly 2-lobed, 1½ by 2 by 1 cm, cuneate at base, cordate and pointed at apex, dark-purple, completely 2-celled. *Seed* ellipsoid, 12—15 by 7 mm, hilum orbicular, 3 mm ⌀.

Distr. S. Vietnam (only the 3 types cited above are known).

Notes. The name *Otophora amplifolia* was cited in Pierre, Fl. Coch. 5, under the plate, changed in the accompanying text, however, into *Otolepis amplifolia*.

The nearest relative of this species seems to be *L. ramiflora* (Borneo: Sarawak) which differs in its 4-merous flowers, its glomerulous and very small inflorescences, and its incompletely 2-celled fruits.

All flower details in the above description have been derived from Gagnepain.

Lepisanthes ramiflora (Radlk.) Leenh., *comb. nov.* — *Otophora ramiflora* Radlk., Sapind. Holl.-Ind. (1879) 32, 85; Pfl. R. Heft 98 (1932) 758. — *Otolepis ramiflora* O. K., Rev. Gen. Pl. 1 (1891) 144. — Lectotype: *Beccari PB 364*, Borneo, Sarawak, Kutein (= Kuching), -8-1865, fl. (FI).

BORNEO. Sarawak: 10 collections, all from around Kuching.

subg. ERIOGLOSSUM

(Bl.) Leenh. — *Uitenia* Noroña, 1791. — *Erioglossum* Bl., 1825. — *Moulinsia* Cambess., 1829.

Leaves paripinnate, exstipulate, neither petiole nor rachis winged; leaflets (sub)opposite, nervation open. *Inflorescences* terminal and/or axillary. *Sepals* 5, outer 2 smaller, outside sericeous, margin sometimes petaloid. *Petals* 4 (rarely 5), longer than sepals, outside subglabrous, scale crested. *Disk* interrupted, glabrous. *Stamens* 8; filament longer than anther. *Ovary* 3-merous, very sparsely to densely hairy. *Fruits* with shortened axis (butterfly-nut shaped), (sub)glabrous, septa complete.

KEY TO THE SPECIES

1. a. Inflorescences axillary to pseudoterminal, up to 5 cm long, hardly branched. Ovary subglabrous; style short . . . . . **L. membranifolia**
   b. Inflorescences terminal and in the upper leaf-axils, 25—50 cm long, widely branched. Ovary densely hairy; style long . . . . . **L. rubiginosa**

Lepisanthes membranifolia (Radlk.) Radlk., Bot. Jahrb. 56 (1920) 252, 269; Pfl. R. Heft 98 (1932) 746. — *Erioglossum membranifolium* Radlk., Sapind. Holl.-Ind. (1879) 17,

55. — Lectotype: *Beccari PP 317*, New Guinea, Vogelkop Pen., Ramoi, 1872, bud (FI; iso in M).

NEW GUINEA. Vogelkop Pen.: *Beccari PP 317*, Ramoi; *PP 385*, Andai, Syntype of *Erioglossum membranifolium*; *Kostermans 2838*, Momi, alt. 30 m.

Lepisanthes rubiginosa (Roxb.) Leenh., *comb. nov.* — *Sapindus rubiginosa* Roxb., Pl. Corom. 1 (1796) 44, t. 62. — *Moulinsia rubiginosa* G. Don, Gen. Hist. 1 (1831) 667. — *Erioglossum rubiginosum* Bl., Rumphia 3 (1849) 118; Radlk., Pfl. R. Heft 98 (1932) 693. — *Pancovia rubiginosa* F. v. M., Fragm. 9 (1875) 100. — Type: Roxb., Pl. Corom. 1 (1796) t. 62.

Sapindus edulis Bl., Cat. (1823) 64, *nom. illeg., non* Ait. (1789). — *Erioglossum edule* Bl., Bijdr. (1825) 229. — *Uitenia edulis* Steud., Nomencl. ed. 2, 2 (1841) 776, *nom. inval.* — *Pancovia edulis* Baill., Hist. Pl. 5 (1874/5) 359, f. 375—377. — *Erioglossum edule* Bl. var. *genuina* Bl. *ex.* K. & V., Bijdr. 9 (1903) 156, *nom. illeg.* (Code, 1966, art. 24). — Type: *Reinwardt 823*, Java, Hort. Bot. Bogor, cultivated (L).

Sapindus fraxinifolia DC., Prod. 1 (1824) 608. — *Erioglossum edule* Bl. var. *fraxinifolium* Bl., Rumphia 3 (1849) 120. — Type: *Riedlé*, Timor, 1802 (G, not seen).

Moulinsia cupanioides Cambess., Mém. Mus. Hist. Nat. Paris 18 (1829) 40, t. 2, *fruct. excl.* — Type: *Riedlé*, Timor, 1802 (P, not seen; iso in L).

Sapindus edulis Blco, Fl. Filip. ed. 2 (1845) 201, *nom. illeg., non* Ait. (1789). — Neosyntypes: *Merrill Sp. Blanc. 320*, Philippines, Palawan, Taytay, -5-1913, fr. (BO); *1042*, Philippines, Luzon, Batangas Prov., -4-1915, fl. (BO, L).

Erioglossum edule Bl. var. *album* Bl., Rumphia 3 (1849) 119. — Syntypes: *Blume 120*, W. Java, Batavia, fl. (L); *s.n.*, W. Java, Bantam, fl. (L sh. 908.269—1286, 1288, & 1289).

Erioglossum edule Bl. var. *subcorymbosum* Bl., Rumphia 3 (1849) 119. — *Erioglossum edule* Bl. var. *corymbosum* T. & B., Cat. Hort. Bog. (1866) 215, *in err.?* — Syntypes: *Blume s.n.*, W. Java, Tjikao, fl. (L sh. 908.269—1270, 1272, & 1273).

Lepisanthes hirta Ridl., J. Fed. Mal. St. Mus. 10 (1920) 132. — Type: *Ridley FMS 13161*, Malay Pen., Kelantan, Channing Woods, 31-1 & 6-2-1917, fl. (SING; iso in K).

Lepisanthes balansaeana Gagnep., Not. Syst. 13 (1947) 31. — Lectotype: *Balansa 3143*, Indo-China, Tonkin, Tu-Phap, -4-1887, fl. (P).

Erioglossum rubiginosum Bl. var. *villosum* Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 934, *nom. inval.* — Syntypes: 15 specimens are cited, no type is selected.

Nomenclature: The name *Uitenia edulis* Steud. is invalid, as the generic name was invalid.

The name *Erioglossum rubiginosum* Bl. var. *villosum* Gagnep. is invalid, as the description was in French only.

Note. I have refrained from citing the about 300 collections studied as the present circumscription of the species is the same as that given by Radlkofer, as many collections were cited by him already, and as the species seems to be fairly common throughout its area. Only the occurrence on the mainland of New Guinea, though reported a few times, was uncertain. The only specimen cited from there by Radlkofer (1932) but not seen by him *(Forbes 579)* represents *Cupaniopsis platycarpa* Radlk. Kanehira & Hatusima (Bot. Mag. Tokyo 57, 1943, 76) cited their collection *13274* which I have not seen; the identification may be right but they do not give any descriptive details. Van Royen (Man. For. Trees Papua & N. G. 2, 1964, 20, f. 9) makes also mention of it but the figure he gives clearly represents a different genus, probably *Elattostachys*. I have two recent collections from Sorong, Vogelkop Peninsula: *Djamhari 416* (BO) and *Pleyte 479* (L) without any doubt representing the present species.

subg. APHANIA

(Bl.) Leenh., *stat. nov.* — *Aphania* Bl., 1825. — *Didymococcus* Bl., 1849. — *Manongarivea* Choux, 1926. — *Sapindopsis* How & Ho, 1955.

Leaves paripinnate, sometimes simple, sometimes stipulate, petiole and/or rachis exceptionally winged; leaflets mostly ± opposite, nervation closed. *Inflorescences* axillary and rami- to cauliflorous. *Sepals* 5 (rarely 4), outer (1 or) 2 smaller, outside glabrous, inner mostly petaloid at margin. *Petals* 5 (rarely 4 or 3), equalling sepals, outside glabrous or partly sericeous, scale not crested. *Disk* mostly complete, glabrous. *Stamens* 5—7(—9); filament as long as or longer than anther. *Ovary* 2- (rarely 3-)merous, glabrous or sparsely pilose at the base of the style. *Fruits* with shortened axis (butterfly-nut shaped), glabrous, septa not interrupted.

KEY TO THE SPECIES

1. a. Petiole and/or rachis winged. . . . . **L. mixta**
   b. Neither petiole nor rachis winged 2
2. a. Midrib angular beneath, nerves up to 1 cm distant. Inflorescences solitary, simple, up to 5½ cm long **L. dictyophylla**
   b. Midrib rounded beneath, nerves at least 1 cm distant. Inflorescences either solitary and widely branched, or simple and fascicled, up to 60 cm long . . . . . **L. senegalensis**

Lepisanthes dictyophylla (Radlk.) Leenh., *comb. nov.* — *Cupaniopsis dictyophylla* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 20 (1890) 359. — *Aphania dictyophylla* Radlk., Bot. Jahrb. 56 (1920) 268; Pfl. R. Heft 98 (1932) 713. — Type: *W. Sayer s.n.*, Papua, base of Mt Obree, -8-1887, bud (M).

This species is only known from the rather fragmentary holotype. It was originally described in the genus *Cupaniopsis*, probably on account of the shape of the leaflets, later transferred to *Aphania* because of the anatomy. The flower characters, as far as they can be judged from the buds, seem to be in good agreement with this position. Though distinctly close to *L. senegalensis* it seems sufficiently different to keep it separate, at least as long as no better material is available.

Lepisanthes mixta Leenh., *sp. nov.* — Type: *Docters van Leeuwen 11326*, Albatros Biv., Mamberamo R., alt. 60 m, -11-1926, fl. & y. fr. (K; iso in L). — **Fig. 2.**

Frutex, 3 m, praeter inflorescentiam glaber. *Ramuli* teretes, 8 mm crassi, atri, verruculoso-lenticellati, lenticellis orbicularibus minutis. *Folia* paripinnata, 3—6-jugata. *Petiolus* semiteres, 10-20 cm longus, anguste alatus, alis ad basin abrupte dilatatis, semiorbicularibus, usque ad 3 cm latis, stipulas mentientes; rachis semiteres, usque ad 5 mm alata. *Foliola* (sub)opposita, sessilia, lanceolata, 4—7 × longiora quam lata, 20—30 cm longa, 3½—5 cm lata, tenuiter chartacea, flavo- vel griseo-virentia; basis cuneata ad subcordata; apex gradatim longe acuminatus, obtusus; costa supra prominula, subtus acute prominens; nervi laterales per 1—3½ cm distantes, a costa angulo 55—60° abientes, recti vel subcurvati, ad marginem arcuato-conjuncti, utrinque prominuli; venae intercalares nonnullae, distinctae; venae et venulae laxe reticulatae, supra inconspicuae. *Thyrsi* axillares, singuli, graciliter pyramidati, 25—30 cm longi, minute fulvo-pubescentes; pedunculus usque ad 15 cm longus; rami patentes, usque ad 6 cm longi, racemoidei, cymis pluris breviter stipitatis multifloris; pedicelli graciles, 2—3 mm longi. Flores albi, ♂♂ tantum visi. *Sepala* 5, 2 exteriora minora, ovata, 1¼ mm longa, 1 mm lata, margine sparse glandulifera, 3 interiora orbiculato-obovata, 2 mm longa et lata, margine petaloidea, glanduloso-ciliolata. *Petala* 5, breviter unguiculata, 2 mm longa, 1 mm lata, partim sparse glanduloso-ciliolata,

Fig. 2. *Lepisanthes mixta* Leenh. Habit, x 1/3. *(W. M. Docters van Leeuwen 11326).*

intus supra basin squama emarginata parva villosa aucta. *Discus* patelliformis, lobatus, glaber. *Stamina* 5, filamentis subulatis 1 mm longis, dimidio inferiore lanosi, antheris basifixis ovatis 1 mm longis, basim emarginatis. *Pistillodium* minutum, 2-lobum, glabrum. *Fructus* (immaturus) 2-lobus, sessilis, glaber, coccis breviter obovoideis, 7 mm longis, 6 mm latis.

NEW GUINEA. Vogelkop Pen.: *Aet 679*, Babo on McCluer Bay, alt. 10 m, 17-8-1941, fl. & fr. (K, L). — Northwest: *Docters van Leeuwen 11326*, type.

Note. The epithet *mixta* refers to the fact that, though the flower and fruit are typical for subg. *Aphania*, the general habit strongly reminds subg. *Otophora*, the name under which both collections were originally distributed.

Lepisanthes senegalensis (Poir.) Leenh., *comb. nov.* — *Sapindus senegalensis* Juss. *ex* Poir., Enc. 6 (1805) 666. — *Aphania senegalensis* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 238; Pfl. R. Heft 98 (1932) 703; Hutch. & Dalz., Fl. W. Trop. Afr. ed. 2, 1 (1958) 716; Haum., Fl. Congo Belge 9 (1960) 343, t. 36; Dale & Greenway, Kenya Trees and Shrubs (1961) 507; Exell, Fl. Zambesiaca 2 (1966) 525, t. 108. — Type: *Adanson & Geoffroi fils in herb. Jussieu n. 11386*, Senegal (P, not seen).

Aphania montana Bl., Bijdr. (1825) 236; Radlk., Pfl. R. Heft 98 (1932) 711; Back. & Bakh., Fl. Java 2 (1965) 134. — *Sapindus montana* Bl., Rumphia 3 (1849) 97. — Type: W. Java, Mt Parang, probably collected by Blume (probably L sh. 908.272—100).

Euphoria verticillata Lindl., Bot. Reg. (1827) t. 1059, *nom. illeg.* — *Nephelium verticillatum* G. Don, Gen. Hist. 1 (1831) 670. — *Scytalia verticillata* Roxb., [Hort. Beng. (1814) 29, *nom. nud.*] Fl. Ind. ed. 2, 2 (1832) 273. — *Didymococcus verticillatus* Bl., Rumphia 3 (1849) 103. — *Sapindus verticillata* Kurz, Rep. Pegu (1875) App. A, p. 38. — Type: *Roxburgh*, cult. Hort. Calcutta (BR, not seen).

Ornitrophe thyrsoides Schum. & Thonn., Kong. Dansk. Vid. Selsk. Skrift. 3 (1828) 205. — *Schmidelia thyrsoides* Bak. in Oliv., Fl. Trop. Afr. 1 (1868) 423, *nom. illeg.* — Type: *Thonning*, 'Guinea, Quitta' (probably Kwitta in Ghana) (C, not seen).

Scytalia rubra Roxb., [Hort. Beng. (1814) 29, *nom. nud.*] Fl. Ind. ed. 2, 2 (1832) 272. — *Nephelium rubrum* [G. Don, Gen. Hist. 1 (1831) 671, *nom. nud.*] Wight, Ic. (1838) t. 24 & 25. — *Sapindus rubra* Kurz, Fl. Burm. 1 (1877) 298. — *Aphania rubra* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 238; Pfl. R. Heft 98 (1932) 714. — Type: *Roxburgh*, Silhet (BR, not seen).

Scytalia danura Roxb., [Hort. Beng. (1814) 29, *nom. nud.*] Fl. Ind. ed. 2, 2 (1832) 274. — *Sapindus danura* Voigt, Hort. Suburb. Calcutt. (1845) 94. — *Nephelium danura* [G. Don, Gen. Hist. 1 (1831) 671, *nom. nud.*] Walp., Rep. 5 (1845/6) 365. — *Didymococcus danura* Bl., Rumphia 3 (1849) 103. — *Aphania danura* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 238; Pfl. R. Heft 98 (1932) 716; Kanjilal & Das, Fl. Assam 1 (1936) 322; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 951. — Type: *Roxburgh*, 'native of the Delta of the Ganges and of the parts to the east of it' (BR?, not seen).

Sapindus abyssinica Fresen., Mus. Senckenberg. 2 (1837) 277. — Type:

Sapindus cuspidata Bl., Rumphia 3 (1849) 98. — *Aphania cuspidata* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 238; Pfl. R. Heft 98 (1932) 706. — Type: *Zippelius 210 b*, SW. New Guinea, 1828, fl. (L).

Nephelium bifoliolatum Thw., En. Pl. Zeyl. (1858) 57. — *Sapindus bifoliolata* Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 684. — *Aphania bifoliolata* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 238; Pfl. R. Heft 98 (1932) 708. — Type: *Thwaites*

CP. 1721, Ceylon, Lower Badulla Road from Kandy at no great elevation, April, fl. (iso: L, P).

Otophora paucijuga Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 680. — *Aphania paucijuga* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 239; Pfl. R. Heft 98 (1932) 708. — Type: *Maingay 1529* = *KD. 462*, Malacca, -2-1867, fl. (K; iso in L).

Sapindus attenuata Wall. *ex* Hiern in Hook. *f.*, Fl. Br. Ind. 1 (1875) 684, *nom. illeg.* — Type: *Wallich 8037* (K, not seen).

Sapindus microcarpa Kurz, J. As. Soc. Beng. 44, ii (1876) 205, *nom. illeg., non* Ruiz & Pavon (1804). — *Aphania microcarpa* Radlk., Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 238, 301; Pfl. R. Heft 98 (1932) 708. — Type: *Teijsmann HB. 5989*, Thailand, Kamborie (prob. Kanburi), -3/4-1862, y. fr. (BO; iso in L).

Aphania spirei Lecomte, Not. Syst. 2 (1911) 54; Radlk., Pfl. R. Heft. 98 (1932) 712. — Type: *Spire 1463*, Laos, fl. (P).

Aphania sphaerococca Radlk., [Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 238, *nom. nud.*] Sapind. Holl.-Ind. (1879) 7, 21; Pfl. R. Heft 98 (1932) 705. — Syntypes: New Guinea, Vogelkop Pen.: *Beccari PP. 503*, Andai, y. fr. (FI; iso in M); *Beccari PP. 908*, Mt Arfak, Putat, -10-1872, fr. (FI; iso in M).

Aphania longipes Radlk., [Sitz. Ber. K. Bayer. Ak. Wiss. M.-Ph. Kl. Münch. 8 (1878) 239, *nom. nud.*] Sapind. Holl.-Ind. (1879) 68; Pfl. R. Heft. 98 (1932) 705. — Type: *Teijsmann HB. 7872*, New Guinea, Vogelkop Pen., near Dorèh, 1871, st. (M; iso in L).

Aphania viridis Pierre, Fl. Coch. (1895) t. 329 A; Radlk., Pfl. R. Heft 98 (1932) 710; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 953. — Type: *Harmand 176* = *herb. Pierre 4125*, Indo China, Khong, -1-1876, fl. (P).

Aphania philastreana Pierre, Fl. Coch. (1895) t. 329 B; Radlk., Pfl. R. Heft 98 (1932) 711; Gagnep., Fl. Gén. I.-C. Suppl. 1 (1950) 953. — Type: *Pierre 1293*, Cochin China, Prov. Bien Hoa, Tri huyen, -1-1873, fl. & y. fr. (P; iso in K, L).

Aphania philippinensis Radlk. in Perk., Fragm. Fl. Philip. 1 (1904) 60; Radlk., Pfl. R. Heft 98 (1932) 709. — Syntypes: Philippines: *Ahern 216 p. p.*, Luzon, Prov. Camarines Sur, Pasacao, 1902, fl., fr. (M); *Warburg 14597*, Sulu Arch., Jolo I., -8-1888, fl. (B, lost).

Aphania boerlagei Val., Ic. Bog. 2 (1906) 281, t. 185; Radlk., Pfl. R. Heft 98 (1932) 706. — Syntypes: *Hort. Bot. Bogor III. C. 43 & 43a* (BO, not seen; iso in M) ? = *Teijsmann HB. 12763*, SW. Celebes, Maros, 1877, fr. (L).

Aphania angustifolia Radlk., Elm. Leafl. Philip. Bot. 1 (1907) 209; Pfl. R. Heft 98 (1932) 710. — Type: *Elmer 7330*, Philippines, Leyte, Palo, -1-1906, fr. (M; iso in BO, K, L).

Aphania ochnoides Pierre *ex* Lecomte, Fl. Gén. I.-C. 1 (1912) 1037. — Syntypes: *Pierre 7047* = *Siam 137*, Thailand, Rachaburi, Muong Pran (= Pran Buri), -8-1868, st. (BO, FI, P); *Pierre 7047*, Cochinchina, Prov. Baria, ad caput Ti Wan, -6-1867, y. fr. (FI, L, P).

Hydnocarpus tamiana Pulle, Nova Guinea 8 (1912) 671. — Type: *Gjellerup 262*, NW. New Guinea, Tami R., 6-7-1910, st. (L).

Aphania loheri Radlk., Philip. J. Sc. 8 (1914) Bot. 452; Pfl. R. Heft 98 (1932) 710. — Type: *Loher 5874*, Philippines, Luzon, Rizal Prov., Montalban, -7-1905, fl. (M; iso in K, L).

Aphania macrophylla Radlk., Fedde Rep. 18 (1922) 332; Pfl. R. Heft 98 (1932) 713. — Type: *Koorders 18015*, N. Celebes, Minahasa, Pingsan for. near Kojuwatu, alt. 50 m, 30-1-1895, fr. (M; iso in L).

Aphania nicobarica Radlk., [in E. & P., Nat. Pfl. Fam. Nachtr. 3 (1907) 203, *nom. nud.*] Fedde Rep. 18 (1922) 332; Pfl. R. Heft 98 (1932) 707. — Syntypes: Nicobar Is: *Jelinek 141*, 1857/9 (W, not seen); *Kurz 25948*, Kamorta, -2-1875, fr. (K, not seen); *King's coll. 527*, 1884 (G; iso in CAL; not seen).

Aphania dasypetala Radlk., Fedde Rep. 18 (1922) 333; Pfl. R. Heft 98 (1932) 714. — Type: *Native coll. 709*, Borneo, Sarawak, 25-7-1911, fl. (M; iso in BO, K, L).

Aphania fascicularis Radlk., Fedde Rep. 18 (1922) 334; Pfl. R. Heft 98 (1932) 714. — Type: *Warburg 18168*, Moluccas, Batjan, -9-1888, fl. (B, lost; iso in M).

Manongarivea perrieri Choux, Comptes Rendus Ac. Sc. Paris 182 (1926) 713; Mém. Ac. Malgache 4 (1927) 34, f. 5; Radlk., Pfl. R. Heft 98 (1932) 723. — Syntypes: Madagascar: *Perrier de la Bâthie 1744*, Ambongo, Kasiza for., on banks of Tampoketsa, -10-1904 (P, not seen); *1812*, Manongarivo, -10-1905 (P, not seen).

Aphania masakapu Melch., Notizbl. Berl.-Dahl. 10 (1928) 277; Radlk., Pfl. R. Heft 98 (1934) 1491. — Type: *Peekel 941*, Bismarck Arch., New Ireland, Lamekot, -6-1924, fl., fr. (B, lost).

Aphania silvatica A. Chev. [Expl. Bot. Afr. Occid. Franç. 1 (1920) 152, *nom. nud.*] *ex* Hutch. & Dalz., Fl. W. Trop. Afr. 1 (1928) 502; Radlk., Pfl. R. Heft 98 (1932) 705. — Type: *Chevalier 20064*, Ivory Coast, Cavally Basin (P, not seen).

Sapindus oligophylla Merr. & Chun, Sunyatsenia 2 (1935) 271, t. 58. — *Sapindopsis oligophylla* How & Ho, Act. Phytotax. Sin. 3 (1955) 386. — Type: *F. C. How 70627*, Hainan, Yaichow, alt. 520 m, -3/7-1933, old fl. (isotype in P).

Aphania langsonensis Gagnep., Not. Syst. 13 (1947) 29; Fl. Gén. I.-C. Suppl. 1 (1950) 953, f. 119[10–17]. — Type: *Pételot 6322*, Tonkin, Prov. Langson, between Dong Mô and Van Linh, 24-3-1938, fl. (P).

SENEGAL. *Vigneron 1388*, near Cayor (L).

PORTUGUESE GUINEA. *Santo 1687*, Bissao, Brene.

TOGO. *Warnecke 383*, near Lome (L).

NIGERIA. *Chizea FHI. 23959*, Busogboro-Ibadan North Res.

CENTRAL AFRICAN REPUBLIC. *Chevalier 7329 bis*, eastern Shari, Pays de Snoussi, Mbélé.

ETHIOPIA. *Schweinfurth & Riva 1838*, Eritrea, Vallée Barasio, alt. 1500 m (BO).

UGANDA. *Harris 721*, S. of Masindi-Butiaba Rd., alt. 1200 m; *Leggat 45*, E. Madi, Zoka For., alt. 850 m.; *Scheffler 229, 344*, Kibwezi, alt. 1000 m (both L).

TANGANYIKA. *Tanner 1094*, Lake Prov., Mwanza Dist., Solima Parish, alt. 1200 m.

MOZAMBIQUE. *Gomes e Sousa 4489*.

INDIA. Sikkim: *Clarke 13939; 27551 D*, Runget, alt. 600 m. — Bhutan: *Lister 93*, alt. 1050 m. — Assam: *Gammie 76*, Makúm Dihing R.; *Koelz 24608*, Garo Hills, near Nokrek, alt. 1200 m; *24693*, ditto, Tura Mt, alt. 1200 m; *27251*, Naga Hills, Nichuguard, alt. 300 m; *29274*, Menoka; *Parry 618*, Lushai Hills, Ayal, alt. 900 m; *Prain's coll. 686*, near Jengale Bam.

CEYLON. *Thwaites CP. 1721*, Lower Badulla Rd from Kandy, low alt.

E. PAKISTAN. Sylhet: *Wallich 8051 C.* — Chittagong: *Clarke 19947 C*, Seelakoondo; *King's coll. 246, 265*.

BURMA. *Falconer 369*, Moulmein; *Lace 4665*, Thalon Dist., Thaungyu Valley.

THAILAND. Udawn: *Kerr 8419*, Nakawn Panom, alt. 200 m. — NE.: *Anuwat Wanaraks 67*, Ma Aw, alt. 100 m (K). — Prâchinburi: *Collins 58, 380, 875*, Sriracha, low alt. — Ayuthia: *Kerr 3911*, Mûang Singburi, alt. 20 m. — Krungtêp, Bangkok: *Kerr 3898*; *Marcan 611*; *Zimmermann 108* (L). — Râchaburî: *Pierre 7047* = *Siam 137*, Muong Pran; *Teijsmann HB 5970, 5989*, Kamborie.

LAOS. *Harmand 126, 428*, Bassin du Sè-Moun; *176*, Khong; *Spire 1463*; *Thorel 2676*, Bassak et Lakhon; *3105 p.p.*, Lukhân.

N. VIETNAM. *Pételot 6322*, between Dong Mô and Van Linh.

S. VIETNAM. *Pierre 1293*, Bien Hoa, Tri Huyen; *7047*, Baria Prov., Ti Wan.

HAINAN. *F. C. How 70627*, Yaichow, alt. 500 m.

MALAY PENINSULA. Perak: *Scortechini 1674*; *Whitmore KEP FRI 3034*, Pangkor, alt. 150 m; *3090*, S. Pangkor F. R., alt. 15 m. — Trengganu: *Corner s.n.*, B. Kajang, alt. 150 m (SING sh. 23023). — Selangor, Weld's Hill: *Abdul Rahman KEP 359 & 1814*; *Burn Murdoch 12*. — Negri Sembilan: *Alvins 605*, B. Danan. — Malacca: *Alvins 499, 638*, Selandor; *748, 779*; *Maingay 1529* = *KD 462*. — Johore: *Kiah SF 32350*, Sungai Kayu, low alt. — P. Penang: *Curtis 1164*, Penara Bukit; *2226*, Government Hill.

SUMATRA. Tapanuli: *Junghuhn s.n.*, Regio Battarum (L sh. 908.269—1227 & 1228). — West Coast: *Beccari herb. 2848*, Padang, Ajer Mantjur, alt. 360 m. — East Coast: *Yates 1922*, Simelungun; *1950*, Gurach Batu; *2246, 2247, 2608*, Batu Bahra. — Bencoolen: *Endert E. 1043*, Bt Kaba, alt 1100 m; *van Steenis 3157*,

Kroei, low alt. — Lampong Dist.: *Backer 52*, Tandjung Rata. — Banka: *Kostermans & Anta 54, 122, 259, 260, 271*, Lobok-besar, alt. 20 m.

JAVA. 39 collections, from West (incl. P. Penaitan), Central, and East.

BORNEO. Sarawak: *Brunig S 6846*, Bako Nat. Park; *Chai S 19331*, alt. 180 m; *Clemens 20611*, Bidi Cave; *Native coll. 709*. — Brunei: *Ashton BRUN 3295*, Andulau F. R., alt. 45 m. — Northeast: *Kostermans 13767*, S. Berau, Mt Ilas Bungaan, alt. 600 m. — North: 12 collections.

PHILIPPINES. Luzon: 11 collections. — Samar: *Edaño PNH 15334, 15358*, Mt Sarawag, alt. 130 m; *Ramos Philip. Pl. 1634*. — Leyte: *Elmer 7330*, Palo. — Mindanao: *Frake PNH 38140*, Zamboanga del Norte, Disakan, alt. 300 m; *38246*, ditto, Dikus, alt. 500 m; *Zwickey 323*, Lanao, near Abaga.

CELEBES. North: *Koorders 18015*, Minahasa, Pingsan For. near Kojuwatu, alt. 50 m. — Southwest: *Teijsmann HB 12595, 12891*, Pangkadjene; *12763*, Maros.

MOLUCCAS. Morotai: *Kostermans 1535, 1538*, Tjaw For., alt. 30 m. — Halmaheira: *Anang 560*, S. Peninsula, Tiliope. — Batjan: *Warburg 18168*. — Obi Is: *Hort. Bot. Bogor III. C. 46; Saänan 58*, P. Bisa. — Buru: *Toxopeüs 475*, Fakal, alt. 1200 m. — Key Is: *Jaheri 444*.

NEW GUINEA. Vogelkop Pen.: 9 collections. — Northwest: 8 collections, Mamberamo & Tami R. — Southwest: *Docters van Leeuwen 10692*, Nassau Mts, Expl. Biv., alt. 700 m; *Janowsky 97*, Siriwo R.; *Zippelius 210 b*. — Papua: 9 collections. — Northeast: *Frodin & Hill NGF 26378*, Morobe Dist., McAdam Park E. of Wau, alt. 1100 m; *Millar NGF 15618*, Morobe Dist., Kauli Creek, alt. 1300 m. — Islands near the coast in the Geelvink Bay: *Schram BW 14908*, Job I., alt. 80 m. — Aru Is: *Beccari herb. 2819 p.p.*, Giabu-lengan; *Treub s.n.* (L. sh. 932.82—589).

Nomenclature. The names *Euphoria verticillata* Lindl. and *Schmidelia thyrsoides* Bak. are illegitimate as in both cases the name of the genus is illegitimate.

The name *Sapindus attenuata* Hiern is illegitimate as the older, legitimate name *Scytalia rubra* Roxb. is cited, the epithet of which could still be used in *Sapindus*.

Note. A survey of the pattern of variation and an argumentation for the combination of so many species into one can be found in Chapter V.

EXCLUDED SPECIES

Aphania neo-ebudica Guill., J. Arn. Arb. 12 (1931) 240; Radlk., Pfl. R. Heft 98 (1934) 1492 = **Pometia pinnata** Forst. f. **pinnata**. The type specimen, *Kajewski 335* in P, has been studied and identified by Dr M. Jacobs.

Erioglossum cauliflorum Guill., Perr., & A. Rich., Fl. Senegamb. Tent. 1 (1831) 118, t. 28 = **Pancovia bijuga** Willd.; see Radlk., Pfl. R. Heft 98 (1932) 802.

Erioglossum cuneifolium Bl., Rumphia 3 (1849) 118, *nom. illeg.* — *Sapindus saponaria auct. non* L.: Blco, Fl. Filip. (1837) 288. — *Sapindus guisian* Blco, Fl. Filip. ed. 2 (1845) 201. The identity remains uncertain; F.-Vill., Nov. App. (1880) 51 cited it under *Dittelasma rarak* (DC.) Hiern = *Sapindus rarak* DC., Radlk., Pfl. R. Heft 98 (1932) 695, hesitatingly under *Erioglossum rubiginosum* Bl. = *Lepisanthes rubiginosa* (Roxb.) Leenh., but Merrill, Sp. Blanc. (1918) 241, may be more right in referring it to **Guioa**.

Lepisanthes forbesii Bak. *f.*, J. Bot. 62, Suppl. (1924) 25; Radlk., Pfl. R. Heft 98 (1932) 753 = **Dysoxylum** *aff.* **cauliflorum** Hiern *(Meliaceae)*.

Lepisanthes palawanica Radlk., Elm. Leafl. Philip. Bot. 5 (1913) 1604; Pfl. R. Heft 98 (1932) 741; Merr. & Perry, J. Arn. Arb. 21 (1940) 512; Desch, Mal. For. Rec. 15 (1954) 529; P. van Royen, Man. For. Trees Papua & N. G. 2 (1964) f. 1, 1 = **Alectryon sp.**

Otophora hullettii (Ridl.) Ridl., Fl. Mal. Pen. 1 (1922) 494; Radlk., Pfl. R. Heft 98 (1932) 775. — *Capura hullettii* Ridl., J. Str. Br. R. As. Soc. 54 (1910) 36. — *Vatica? stipulata* Ridl., J. Str. Br. R. As. Soc. 82 (1920) 172, *nom. illeg.* Acc. to Dr P. S. Ashton, Aberdeen, this is certainly a **Vatica** *sp. (Dipterocarpaceae)*, but the name *Vatica stipulata* can not be used; it was based upon the same type (*Hullett 781* in K) as *Capura hullettii*, and the epithet of the latter could, and hence should, have been used.

Otophora javanica (Hassk.) Miq., Fl. Ind. Bat. 1, 2 (1859) 561. — *Melicocca javanica* Hassk., Hort. Bog. Descr. 1 (1858) 138 = **Elattostachys verrucosa** (Bl.) Radlk.; see Radlk., Pfl. R. Heft 98 (1933) 1260.

Otophora paradoxa Bl., Rumphia 3 (1849) 146 = **Crescentia alata** H.B.K. *(Bignoniaceae)*; see Radlk., Pfl. R. Heft 98 (1932) 775; Back. & Bakh., Fl. Java 2 (1965) 542.

INDEX TO BOTANICAL NAMES

Synonyms are printed in *italics*, new names in **bold characters**, an asterisk denotes a figure.