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A REVISION OF THE TRIBE NAUCLEEAE s.s. (RUBIACEAE)

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CONTENTS

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SUMMARY

A world-wide revision of the tribe *Naucleeae* with a general discussion of the systematic position and affinities of the tribe and the genera. The generic concepts have been modified and 21 genera are recognized (*Ochreinauclea, Ludekia, Diyaminauclea, Khasiaclunea, Adinauclea, Sinoadina, Pertusadina,* and *Haldina* being new), which are placed in three subtribes, *Anthocephalinae, Naucleinae,* and *Adininae, subtrib. nov.* There are keys to the subtribes, genera, and species, followed by descriptions of the Asiatic and Malesian genera. The Asiatic species are described and accompanied by complete synonymy, but the Malesian species are treated in an abbreviated form. Three new species are described: *Myrmeconauclea stipulacea, Ludekia borneensis,* and *Pertusadina malaccensis.*

INTRODUCTION

The present paper attempts to synthesize the results of the systematic studies on the *Naucleeae* undertaken in the process of revising the group for Flora Malesiana. An extensive nomenclatural evaluation and typification of the genera has been published by Bakhuizen van den Brink *Jr.* (1970) and has been followed by a synopsis of the African and Madagascan genera (Ridsdale, 1975). Further studies resulted in a revision of the genera *Cephalanthus* (Ridsdale, 1976), and *Mitragyna and Uncaria* (Ridsdale, 1978), and the exclusion of these genera from the *Naucleeae.* This publication considers in detail the genera and species of the *Naucleeae s.s.* from Asia and Malesia — the centre of distribution of the tribe — whereas the genera from other regions already described are only briefly considered.

The last world-wide revision of the group was by Haviland (1897) who, considering the material available at that time. provided an extensive detailed survey of the group and of the problems involved. The availability of more extensive recent collections has increased our knowledge of many of the unusual species only known to Haviland from a few collections. This has also increased the problem of generic distinction as now complete material is available for most species. Merrill (1915) attempted to clarify the situation in *Nauclea* and *Neonauclea* but no author has considered the problematic genus *Adina* which has always been a heterogeneous assemblage of taxa.

In the *Naucleeae* there are few absolutely distinctive generic characters, and the demarcation of the genera will always remain arbitrary. Rather than return to the situation with one or two highly variable loosely defined genera, the older generic concepts have been re-modeled and several small satellite genera are distinguished.

The African and Madagascan genera are included in the key, as are the African species of *Nauclea*; however, neither are treated in detail in the text where only the excluded species are considered. Full descriptions of the genera and a synoptic treatment of the species have already been published (Ridsdale, 1975). Many species have been described in or transferred to different genera, particularly *Nauclea.* An attempt has been made to treat all the names published in the *Naucleeae.* The names of all published genera and species of the Asiatic and Malesian taxa (excluding Malesian species of *Neonauclea*) are here included in the index, other names and transfers are listed at the end of each genus under excluded species, and their present accepted generic position is indicated. These names are not necessarily included in the present index but will be found in the index in the paper where the genera are treated taxonomically (African and Madagascan taxa: Ridsdale, 1975; *Cephalanthus*: Ridsdale, 1976; *Mitragyna* and *Uncaria*: Ridsdale, 1978). The indices are thus complimentary to each other.

SYSTEMATIC RELATIONSHIPS

Relationships of the tribe

The tribal delimitation has been modified during the present investigation; *Cephalanthus* was transferred to a separate tribe (Ridsdale, 1976) and *Mitragyna* and *Uncaria* were transferred to a subtribe of the *Cinchoneae* (Ridsdale, 1975, 1978). However, it must still be seriously questioned whether the *Naucleeae s.s.* form a natural group which may be recognized at tribal level. Bremekamp (1966) excluded most of the genera here placed in the subtribes *Anthocephalinae* and *Adininae*, transferring them to the *Cinchoneae* and thus restricting the tribe to the genera *Nauclea* and *Sarcocephalus*. I believe that the subtribes here recognized are relatively homogeneous but these subtribes have only a rather low level of relationship with each other.

The largest subtribe is the *Adininae* where the hypanthia may be free or connate into a syncarp or pseudosyncarp. It would appear that syncarps or pseudosyncarps have arisen independently from those in the subtribe *Naucleinae*. I consider the *Adininae* to be the most characteristic of the whole group and distinct from the *Cinchoneae* as at present recognized. If future work indicates that the subtribes *Anthocephalinae* and *Naucleinae* can be better placed elsewhere, for example in the *Cinchoneae*, then I consider that the *Adininae* will warrant recognition at tribal level.

Relationships between the genera

It can be seen from table I that many genera are separated only by a few, sometimes small characters. The relationships between the genera as conceived in the present work are represented schematically in table II.

The largest subtribe, the *Adininae*, may be conceived to be composed of three groups of taxa. Those found in Africa and Madagascar seem to form an isolated group which probably evolved quite separately from the Asiatic and Malesian taxa. They differ from *Adina* and close allies in the imbricate corolla lobes.

A second group of taxa contains *Adina* and its close allies and is characterized by the presence of small filiform to filiform-clavate interfloral bracteoles, valvate (but sometimes apically subimbricate) corolla lobes, and usually by the mode of dehiscence of the fruitlets, the cocci of which generally separate to leave the calyx remnants crowning the central axis formed from the septum of the ovary. The only exception, so far as is known from the limited fruiting material, is *Adinauclea*, where the calyx remnants detach with the cocci. This genus is also unusual is having a large flattened terminal vegetative bud as is commonly seen in *Neonauclea*.

A third group of taxa is composed of *Neonauclea* and its satellite genera. *Neonauclea* is here restricted to those taxa in which the apical portion of the calyx lobes is obtrigonal to spathuloid and deciduous, and in which the fruiting head is composed of free fruitlets. *Myrmeconauclea* has the same calyx lobes but the young fruiting head is a pseudosyncarp. Generally the taxa of this group have flattened terminal vegetative buds, but conical terminal vegetative buds occur in *Ludekia* and in some New Guinean taxa generally placed in *Neonauclea*. Interfloral bracteoles are usually absent, only occurring in *Khasiaclunea*, *Diyaminauclea*, and in some species of *Neonauclea*. In the two latter genera the interfloral bracteoles are small, shiny, glabrous conical structures and differ from the pubescent spathulate bracteoles found in *Adina* and close allies. *Khasiaclunea* has filiform to filiform-clavate

Table I — Distribution of characters over the different genera

	TERMINAL BUD					STIPULES									FLOWERING HEADS		INTERFLORAL BRACTEOLES			CALYX LOBES		COROLLA LOBES		FILAMENTS		STIGMA			FORM OF FL. FR. HEADS			ENDOCARP		DEHISCENCE	SEED				
	open	flattened	pyramidal	conical	adpressed	obvolute	connate	deciduous	persistent	entire	shallowly bifid	notched	terminal	lateral	absent	spathulate	conical	upper third	median	'Nuclea' type	'Anthocephalus' type	persistent	deciduous	valvate	imbricate	glabrous	pubescent	ridged	spindle-shaped	globose-clavate	syncarp	pseudosyncarp	free	soft	horny	'Adina' type	'Neonauclea' type	pitted	reticulate	ellipsoidal	winged	short 'tailed'	long 'tailed'
Anthocephalus	–	+	–	+	–	+	–	+	–	+	–	–	+	–	+	–	–	–	+	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Burttdavya	–	–	–	–	+	–	–	+	–	+	–	–	+	–	+	–	–	–	+	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Sarcocephalus	–	+	–	–	+	+	–	–	+	+	+	–	+	–	–	–	–	–	+	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Nauclea	–	+	–	–	+	+	–	–	+	+	+	–	+	–	–	–	–	–	+	+	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Ochreinauclea	–	–	+	+	–	+	–	–	+	+	–	–	+	–	–	–	–	–	+	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Breonia	–	–	–	–	–	+	–	+	–	+	–	+	–	+	–	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Neobreonia	–	+	–	–	+	–	–	+	–	+	+	–	–	+	–	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Myrmeconauclea	–	+	–	–	+	–	–	+	–	+	–	–	+	–	–	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Ludekia	–	–	–	–	–	–	+	+	+	+	–	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Neonauclea	–	+	+	+	+	–	+	+	+	+	–	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Diyaminauclea	–	+	–	–	+	–	–	+	+	+	–	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Khasiaclunea	–	+	–	–	+	–	–	+	–	+	–	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Adinauclea	–	+	–	–	+	–	–	+	–	+	–	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Sinoadina	–	+	–	–	+	+	–	+	–	+	–	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Metadina	–	+	?	–	–	+	–	+	–	+	–	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Pertusadina	–	+	+	+	–	+	–	+	–	+	+	–	+	–	–	–	+	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Adina	+	+	–	–	–	+	–	+	+	+	–	+	–	+	–	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Haldina	–	+	–	–	+	–	–	–	–	+	–	–	–	+	–	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Breonadia	–	–	–	+	+	?	–	+	–	+	–	–	–	+	–	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Gyrostipula	–	–	–	+	+	+	–	+	+	+	–	–	–	+	+	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/
Janotia	–	+	–	–	+	–	–	–	+	+	–	–	–	+	+	–	–	+	–	–	+	+	–	–	+	+	–	+	–	–	–	+	+	/	/	+	–	+	–	/	/

+ = character present; ? = uncertain; – = absent; / = not applicable.

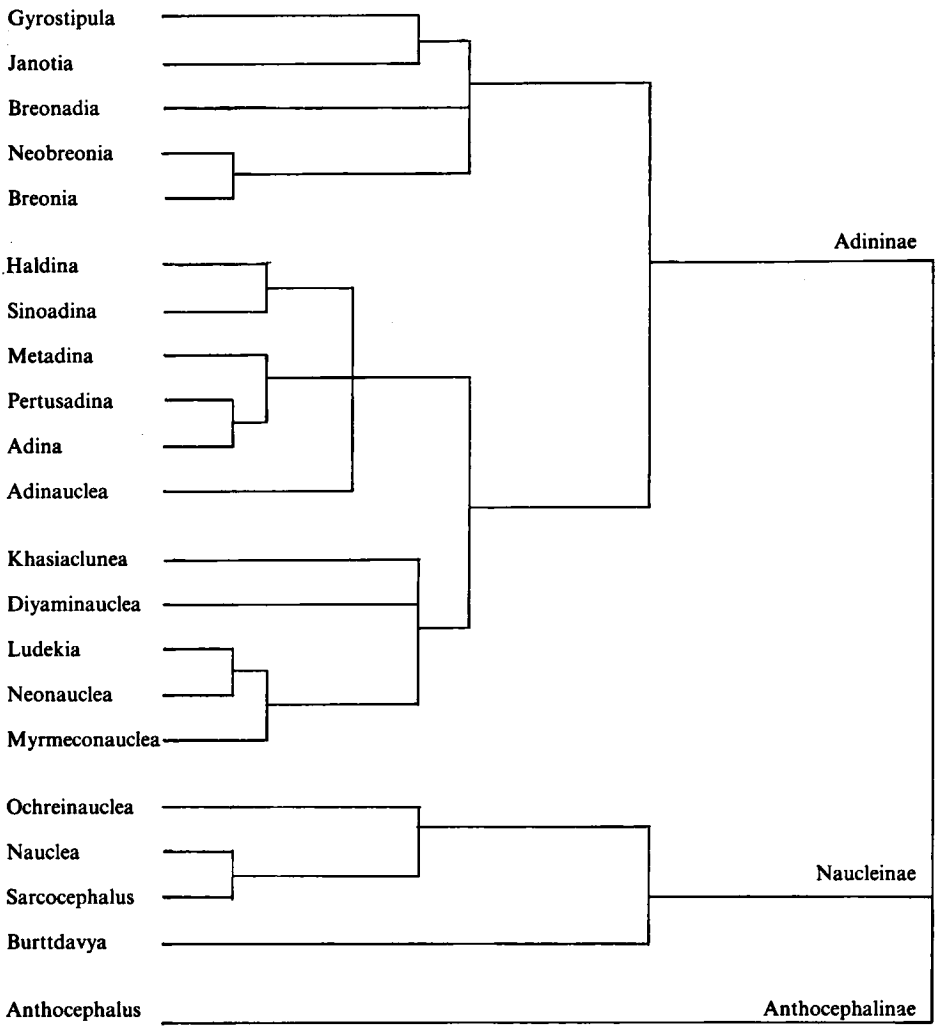

Table II — Schematic representation of relationships between the genera.

interfloral bracteoles, short obtuse calyx lobes, and a flattened terminal vegetative bud, and bridges the gap between the two groups. I have maintained *Myrmeconauclea* as a distinct genus rather than considering it to form an aberrant group in *Neonauclea* from which it differs in the young fruiting head being a pseudosyncarp and in the form of the seeds.

The *Naucleinae* contain *Nauclea* and *Sarcocephalus*, two genera in which the flowering and fruiting head is a syncarp. *Ochreinauclea*, so far as is known, appears to have a fruit which is a pseudosyncarp. In the *Adininae* free fruitlets, syncarps, and pseudosyncarps all occur and thus there is little objection to include *Burttdavya*,

which free fruitlets, in the *Naucleinae* with which it has more characters in common than with the *Anthocephalinae*, which is here limited to *Anthocephalus*.

TAXONOMIC CHARACTERS

It is considered that the spherical to capitate flowering heads are not solely characteristic of the *Naucleeae* but have also arisen independently in *Cephalanthus*, *Mitragyna*, and *Uncaria*. The basic type of inflorescence in the *Rubiaceae* is a monotelic synflorescence; modification and compaction of the various elements is of common occurrance in the family and capitate inflorescences occur sporadically in many tribes.

Secondly it is considered that syncarps and pseudosyncarps have arisen independently within the different subtribes. From a study of the work of Haviland and Bremekamp it may be seen that these authors independently reached the same conclusion.

There are relatively few taxonomic characters which can be used: the position of the flowering heads, form of the stigma, aestivation, form of the calyx lobes, placentation, fruit and seed characters, and of the vegetative characters the most important being the stipules. The position of the inflorescence is a notoriously difficult character to use, but, within limits, seems to hold good in most cases. However, it should be noted that in *Adina rubella* the flowering heads are predominantly terminal and also lateral whilst in *Adina pilulifera* they are lateral, exceptionally terminal on short side shoots. The spindle-shaped stigma is characteristic of the subtribes *Anthocephalinae* and *Naucleinae*. Aestivation is imbricate or valvate and then sometimes subimbricate at the apex, but aestivation is a variable character in other tribes of the *Rubiaceae*. The form of the calyx lobes is used; of particular importance is whether the apical part is deciduous or not. In general the characters of the calyx lobes are exceedingly variable (see Ridsdale 1978: *Uncaria lanosa*) and in *Ludekia* both persistant and deciduous calyx lobes are found in the genus. Placentation appears to be an important character at subtribe level, but is known to be highly variable in other rubiaceous genera e.g. *Hedyotis*. The mode of dehiscence of the fruit varies in the different genera of the tribe, but in other genera such as *Ladenbergia* this varies within the genus as currently recognized. The ornamentation of the seed coat will be discussed separately.

Considerable emphasis has been placed on the characters of the terminal vegetative buds and stipules. I believe that such vegetative characters are of great importance. However, it should be noted that Bakhuizen van den Brink (Beknopte Fl. Java, emergency ed. 15, 1956: 50) has suggested that dimorphic stipules may occur in *Wendlandia*. This seems to me improbable and I have been unable to trace any further references or observations on the subject in the whole of the *Rubiaceae*.

I have found it impossible to draw generic distinctions without using questionable characters. In Continental Asia and Malesia one could lump all species into 3 heterogeneous genera: *Adina*, *Neonauclea*, and *Nauclea*, but then the genera have few distinctive characters. If such a course is taken, the number of characters separating the genera still remains small. *Khasiaclunea (Adina) oligocephala* differs from *Neonauclea* in the form of the interfloral bracteoles and in the form of the calyx. *Ochreinauclea (Nauclea)* differs from *Myrmeconauclea (Neonauclea)* in the form of the stigma and the position of the placentas. These latter two characters are basically all that remain, and following a lumping course to its logical conclusion

one would be left with *Nauclea* and *Neonauclea*. In the present work an attempt has been made to group the species into somewhat homogeneous genera, even though some of the genera are small or monotypic. However, there should be no objections to these small genera as the African and Madagascan genera as well as *Anthocephalus* are also of comparable size. The distribution of the characters over the different genera is given in table 1.

Terminal vegetative buds and stipules

In *Adina* the terminal vegetative bud is more or less open (fig. 1d), loosely surrounded by the interpetiolar stipules. In the remaining genera the growing point is completely enclosed by a pair of stipules. The shape of the vegetative bud is dependent upon the shape and manner of insertion of the stipules. If the stipules are adpressed then the bud is usually flattened (fig. 1a, b) and the stipules may further be partially connate with each other at the lower lateral margins. The length of the connate portion varies, in *Neonauclea lanceolata* it is relatively short but in *Neonauclea solomonensis* it may extend over the lower half of the stipule. In *Ludekia* (fig. 1g) and some species of *Neonauclea* (e.g. *N. hagenii*, *N. obversifolia*, and *N. acuminata*) the stipules are valvately adpressed and initially connate over their whole length. Thus, in these taxa where the stipules are adpressed they are both inter- and intra-petiolar.

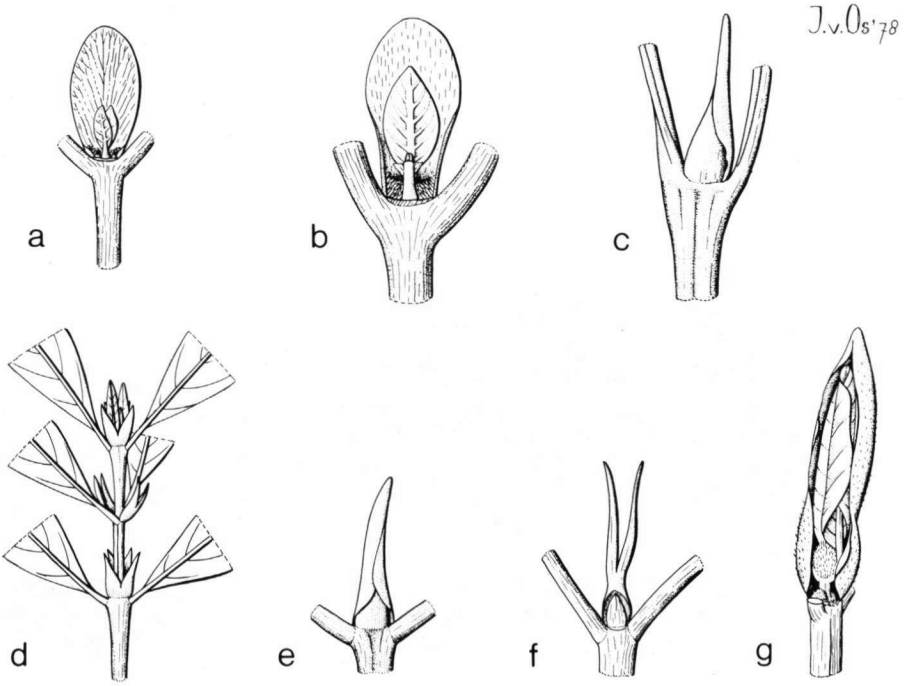

Fig. 1. Stipular forms of some *Naucleeae* — a. *Neonauclea lanceolata*, ×2; b. *Neonauclea solomonensis*, ×2; c. *Anthocephalus chinensis*, ×1; d. *Adina pilulifera*, ×1; e. *Pertusadina malaccensis*, ×3½; f. *Pertusadina eurhyncha*, ×3½; g. *Ludekia borneensis*, ×3½. (a. *Blume s.n.*; b. *BSIP 96*; c. *bb 19211*; d. *Steward & Cheo 734*; e. *SFN 23813*; f. *Kostermans 7072*; g. *Kostermans 6976*).

If the stipules overlap in an obvolute manner then the vegetative bud is pyramidal to conical and the stipules themselves may be entire to deeply bifid (fig. 1e, f). All stipules have basal colleters which produce a mucilaginous exudate.

The stipules are often rapidly caducous and their exact form is not readily seen without dissecting the bud. To overcome this problem to some extent, the form of the terminal bud and that of the stipules are described separately, although this is repetitative in some cases. If vegetative buds are lacking, the form of the stipule may sometimes be deduced from the shape of the small reduced bract-like stipules found along the flowering axes; some caution is needed as the shape of these is sometimes modified.

Position of the flowering heads

It is difficult to establish the position of the flowering heads in respect to the different plant axes. It is highly probable that the majority of the herbarium collections has been made from small side-branches of the lateral axes, some collections may include the vegetative apex of this axis. However, in herbarium material, it can generally be seen whether the flowering heads are terminal or lateral in respect to the immediate axis from which they originate.

Interfloral bracteoles

In flowering heads where the hypanthia, calyces, and fruitlets are free the small structures, here termed interfloral bracteoles, may be present or absent. The term interfloral bracteoles is used because many other different organs, reduced leaves, stipules, and in other *Rubiaceae* calyx lobes, in the past have been termed bracts by some authors. Two basic forms of interfloral bracteoles are found; the clavate to spathulate hairy type (fig. 8f, 9e) is seen in many genera, whilst the glabrous, shiny, conical type (fig. 7f) is restricted to *Diyaminauclea* and to some species of *Neonauclea*.

Calyx lobes

An important feature in the delimitation of the genera is the form of the calyx lobes. In *Neonauclea* and *Myrmeconauclea* the calyx lobes are attenuate into a narrow shaft which broadens into an obtrigonal to spathulate or somewhat clavate apical portion (fig. 6d), which itself is rarely also attenuate into a long acicular point. In the young flowering heads the apical portion of the calyx lobes conceals the young corollas; as the corollas expand the apical portion of the calyx lobes detaches due to breakage at the apex, at the middle or base of the thin shaft. In mature flowering heads only the lower portion of the calyx remains; sometimes the detached apical portions may be found among the corollas, particularly at the base of the flowering head. In the generic delimitation this feature is considered to be diagnostic of *Neonauclea* and *Myrmeconauclea;* taxa formerly placed in *Neonauclea* but without these typical calyx lobes have been placed elsewhere. In *Ludekia*, one of the genera here removed from *Neonauclea*, the calyx lobes are persistent or deciduous. The calyx lobes are, however, of a different type than found in *Neonauclea* as they do not overtop and conceal the young corollas. In *Ludekia* the persistent or deciduous nature is a reflection of the thickness of the shaft.

Aestivation

Different authors often vary considerably in their descriptions of the aestivation in a particular genus. Imbricate or valvate corollas are easily distinguished but in some *Naucleeae* the corolla may be valvate in the lower part but become imbricate in the upper part, often strongly so. In the present work such a condition is described as valvate but apically subimbricate or apically strongly imbricate.

Placentation

The placentation differs in the various subtribes. Within the *Adininae* the placenta is a small boss-like structure with a short attachment somewhere in the apical third of the septum (fig. 2e). In the *Naucleinae* the placenta may be attached to

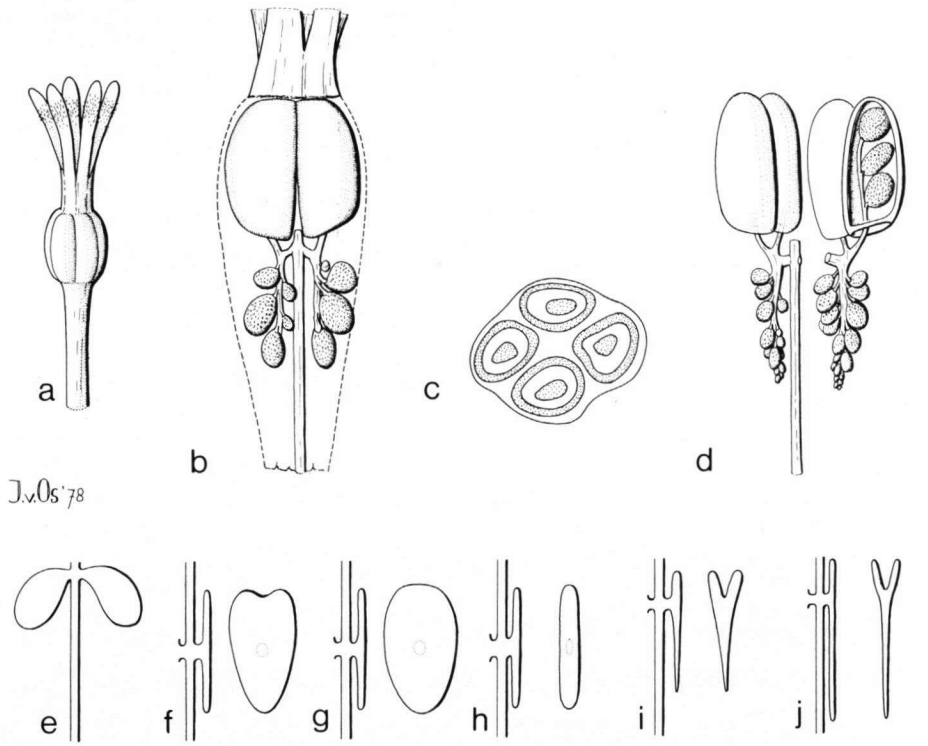

Fig. 2. Types of placentas found in the *Naucleeae* (e—j diagramatic) — a—d. *Anthocephalus chinensis* (after Bakh. f. mss.); e. *Adininae*; f. *Ochreinauclea*; g. *Sarcocephalus;* h. *Burttdavya*; i, j. *Nauclea.*

the middle of the septum or be attached in the upper third. The latter case is found in *Nauclea* and here the placenta is Y-shaped with short ascending arms and a long descending foot (fig. 2i, j). In *Sarcocephalus* and *Ochreinauclea* the placenta is attached by a thin stalk to the middle of the placenta, in *Sarcocephalus* the placenta is discoidal (fig. 2g), whilst in *Ochreinauclea* it is somewhat heart-shaped (fig. 2f). In *Burttdavya* the placenta is linear-oblong and adnate to the middle of the septum (fig. 2h). In *Anthocephalus* the placenta is attached to the upper third of the septum; in *A.*

chinensis two free branches enter the hollow cartilaginous structures in the upper third of the locule (fig. 2a—d).

Mode of dehiscence of the fruit

There are three types of fruit, syncarps, pseudosyncarps, and a head of free fruitlets. Syncarps are characterized by their woody structure (fig. 3a. b). Pseudosyncarps are more difficult to recognize. In *Myrmeconauclea* the hypanthia and calices are both free in the young flowering stages (fig. 6d, e) but in the immature

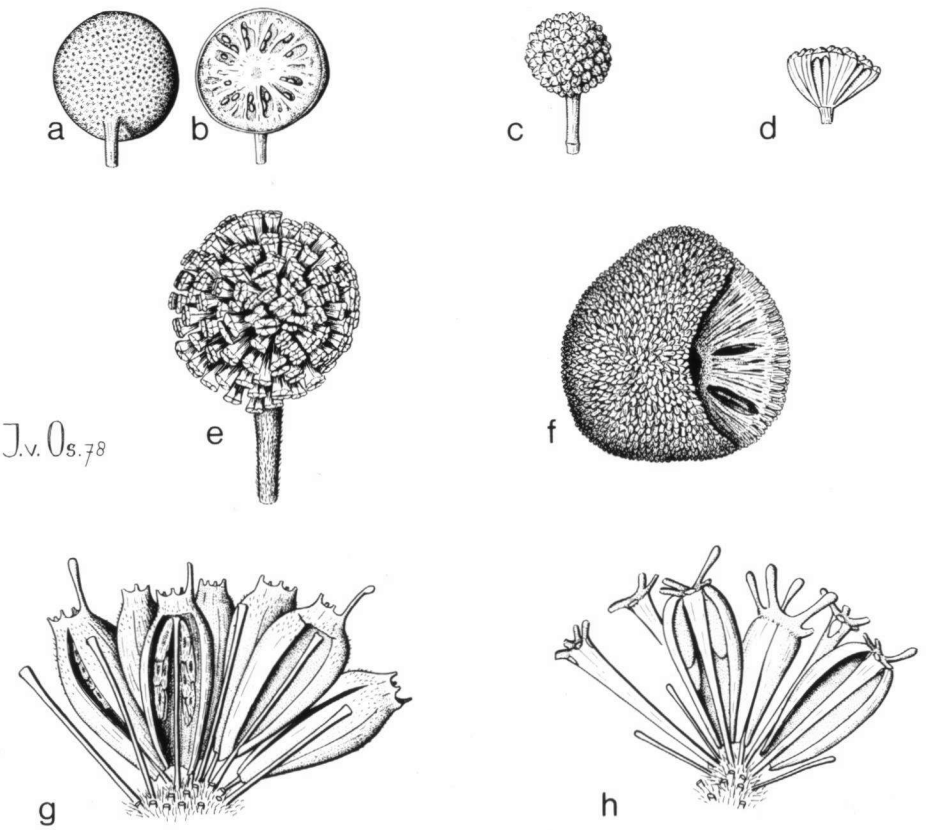

Fig. 3. Types of fruit found in the *Naucleeae* — a, b. syncarp — *Nauclea*, × 1; c—e. pseudosyncarp — *Myrmeconauclea*, all × ½; f. pseudosyncarp — *Ochreinauclea*, × ½; g. free fruitlets with caducous calyx — *Ludekia*, × 7; h. free fruitlets with persistent calyx — *Adina*, × 7.

fruiting stage tissues of the upper part of the hypanthium and probably the lower part of the calyx are continuous over the whole surface of the pseudocarp and extend downwards, at least for about a third of the length of each hypanthium (fig. 3c, d). In mature fruits this tissue disintegrates and the individual cocci become free (fig. 3e). In *Ochreinauclea* in the flowering stages the hypanthia are united together by tissue of the upper part of the hypanthia and lower part of calyx, this tissue again

extends between each individual hypanthium (fig. 3f). Viewed externally the young fruiting heads have the appearance of a syncarp, but in section they are fibrous or only slightly woody, and the individual cocci are usually visible. The receptacle tends to be conical so that the individual cocci are recurved, particularly those at the base, differing thus from *Neonauclea* and allies where the receptacle is more or less sphaerical and the cocci erect. In the remaining genera with free fruitlets there are two types of dehiscence. In one group of genera, *Neonauclea*, *Ludekia*, *Diyaminauclea*, *Khasiaclunea*, *Adinauclea*, and the Madagascan *Gyrostipula*, the calyx remnant detaches with the segments of the fruit wall (fig. 3g), whilst in *Adina* and related genera the calyx remnant remains attached to the central axis formed from the septum of the ovary (fig. 3h).

Seed structure

Bremekamp (1952, 1966) has noted that the *Cinchoneae* are characterized by a 'testa whose cells show in the bottom wall enormous circular or oval pits'. The genera of the subtribes *Anthocephalinae* and *Naucleinae* appear to have testas which correspond to this description, whilst in the *Adininae* the bottom wall appears to be more reticulate. There are certainly features of taxonomic significance in the seed coat, but until a larger range of material from the *Cinchoneae-Rodeletieae* and *Condamineae* has been examined it is impossible to evaluate the significance of these characters. It is proposed to deal with this subject in a future publication.

NODAL ANATOMY

According to Howard (1970) the majority of the genera of the *Rubiaceae* have unilacunar nodes, trilacunar nodes being reported from 12 genera, including *Nauclea* and *Sarcocephalus*. During the present investigation trilacunar nodes were observed in *Anthocephalus chinensis*, *Nauclea subdita*, *Ochreinauclea maingayi*, and *Myrmeconauclea strigosa*. Representatives of other genera investigated, *Neonauclea schlechteri*, *Neonauclea hagenii*, *Neonauclea calycina*, *Adina pilulifera*, *Metadina*, *Haldina*, *Breonadia*, *Breonia pierrieri*, and *Neobreonia* were found to have unilacunar nodes with 3 traces. Two rheophytic species. *Neonauclea chalmersii* and *Myrmeconauclea rheophila* were found to have a derived unilacunar node with 5 traces.

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Tribe NAUCLEEAE DC. *ex* Miq.

Subfamily *Naucleoideae* Rafin., Ann. Gen. Sci. Phys. 6 (1820) 86 (as '*Nauclidia*' under *Cephalantia*). — Subtribe *Naucleinae* DC., Prodr. 4 (1830) 343; G. Don, Gen. Hist. 3 (1834) 466; Endl., Gen. Pl. (1838) 557; Ench. Bot. (1841) 274; (all as '*Cinchoneae* subtribe *Naucleeae*'). — Tribe *Naucleeae* DC *ex* Miq., Fl. Ind. Bat. 2 (1856) 130, 132; Hook.*f.* in Benth. & Hook.*f.*, Gen. Pl. 2 (1873) 9; Hook.*f.*, Fl. Brit Ind. 3 (1880) 17; K. Schum. in E. & P., Nat. Pfl. Fam. ed. 1, 4, 4 (1891) 16; Havil., J. Linn. Soc. Bot. 33 (1897) 20; Dalla Torre, Gen. Siph. 2 (1901) 494; Gamble, Man. Ind. Timb. (1902) reprint (1972) 400; Brandis, Ind. Trees (1906) 364; Verdcourt, Bull. Jard. Bot. Brux. 28 (1958) 251; Bremekamp, Acta Bot. Neerl. 15 (1966) 20. — *Naucleaceae* Wernh., New Phyt. 11 (1912) 225; Airy Shaw, in Willis, Dict. Fl. Pl. & Ferns, ed. 8 (1973) 779. — Type genus: *Nauclea* L.

Subtribe *Sarcocephalinae* DC., Prodr. 4 (1830) 367; G. Don, Gen. Hist. 3 (1834) 487 (both as *Gardeniaceae* subtribe *Sarcocephaleae*); Endl., Gen. Pl. (1838) 558; Ench. Bot. (1841) 247 (both as '*Gardenieae* subtribe *Sarcocephaleae*'). — Type genus: *Sarcocephalus* Sabine.

Trees or shrubs. *Terminal vegetative bud* conical, pyramidal, or flattened. *Stipules* inter- and somewhat intra-petiolar, adpressed or obvolute, inside with colleters at the base. *Branchlets* with serial buds, these restricted to the main orthotropic axis or also found on the branchlets of the lateral axes. *Leaves* opposite, whorled, or whorled on the main axis and paired on the lateral inflorescence bearing axes, pinnately nerved. *Flowering heads* terminal, lateral, or more rarely both terminal and lateral; flowering axes solitary, or branched like a simple cyme or a compound thyrse; leaves and stipules at the node(s) often highly reduced, bract-like, the stipular pair sometimes an involucre-like or calyptra-like structure surrounding the young flowering head, later separating, or less frequently these structures rupturing circumscissile. *Receptacle* hairy; interfloral bracteoles, if present, filiform to filiform-clavate or spathulate and pubescent, or conical, shiny, and glabrous, *Hypanthia* free, or mutually connate into a syncarp or a pseudosyncarp and then becoming free only in fallen fruit. *Ovaries* 2-locular, or sometimes 2-locular below and 4-locular in the upper portion. The two *placentas* variously attached to the septum, if attached to the upper third of the septum then a short obovoid boss, or more or less Y- or ┤-shaped with 1 or 2 short ascending arms and a long descending foot; if attached to the middle of the septum then either discoidal or heart-shaped with a central attachment, or linear-oblong to slightly bilobed and unbranched, and adnate to the median part of the septum; placentas pallid in colour. *Ovules* and seeds either (predominantly) pendulous or spreading in all directions, never up-

wardly imbricate. *Calyces* free, or mutually connate in the lower part and then young fruit a syncarp or pseudosyncarp; tube short to long and then almost equal in length to the calyx lobes; calyx lobes various, shorter than the young corollas or overtopping and concealing the young corollas and then attenuate into a narrow shaft bearing a swollen apical portion, which itself may be attenuate into a long acicular point; this apical portion persistent or deciduous and then breaking away at the apex, middle, or base of the shaft during the elongation of the corolla. *Corolla* hypocrateriform to infundibular; the lobes imbricate, or valvate and then sometimes subimbricate or strongly imbricate at the apex. *Stamens* inserted high in the tube and partially or completely protruding from the throat; filaments glabrous or pubescent; anthers basifixed, introrse. *Style* exserted; stigma globose, or obovoid to obovoid-clavate, or spindle-shaped. *Infructescence* a syncarp, or a pseudosyncarp eventually separating into loose fruitlets or irregularly breaking; or a head of loose fruitlets and then these with a hard endocarp splitting into 4, the apical portion and calyx remnant either falling with the 4 cocci or remaining attached to the central axis formed from the septum of the ovary, the axis later dehiscing from the receptacle. *Seeds* various, ovoidal to ellipsoidal or angular, bilaterally flattened or not, winged or not.

KEY TO THE SUBTRIBES

1a. Placenta a small obovoid boss attached to the upper third of the septum. Hypanthia free or connate into a syncarp or pseudosyncarp, calyces free or upper part of hypanthium and lower part of calyx tube connate and then the young fruiting stage a syncarp or a pseudosyncarp. Stigma globose to obovoidal-clavate. Africa, Madagascar, Asia, Malesia . . . . **Adininae**

b. Placenta ┤- or Y-shaped, and then attached to the upper third of the septum, or discoidal or heart-shaped and then attached to the median part of the septum, or oblong and adnate to the middle of the septum. Stigmas spindle-shaped 2

2a. Terminal vegetative bud conical, stipules obvolute. Hypanthia mutually free; upper part of ovary with 4 cartilaginous structures, these hollow or solid. Continental Asia and Malesia . . . . . **Anthocephalinae**

b. Terminal vegetative bud flattened, stipules adpressed. Hypanthia fused into a syncarp or pseudosyncarp, if mutually free (only in Africa) then the upper part of ovary without 4 cartilaginous structures. Africa, Asia, Malesia **Naucleinae**

ADININAE Ridsd., *subtribus nov.*

Hypanthia libera, vel ad syncarpium vel pseudosyncarpium connata, calycibus liberis vel hypanthii parte superiore atque tubi calycis parte inferiore sesse adnatis, statu fructescenti praematuro syncarpium vel pseudosyncarpium formante. *Bracteolae* interflorale (filiformi-)clavatae usque spathulatae, vel conicae, vel nudae. *Ovarium* 2-loculare, placentis obovoideis tertio superiore septorum instructis, ovulis pendulis. *Corolla* hypocrateriformis usque anguste infundibularis; lobi imbricati, vel valvati sed apice subimbricati. *Stigma* globosum usque (obovoideo-) clavatum. *Semina* bilateraliter compressa, generaliter leviter alata.

Hypanthia and *fruitlets* free, or connate into a syncarp or pseudosyncarp, *calyces* free or upper part of hypanthium and lower part of calyx tube connate and then the

young fruiting stage a syncarp or a pseudosyncarp. *Receptacle* with or without interfloral bracteoles, if present these (filiform-)clavate to spathulate, or conical. Ovary 2-locular, the 2 *placentas* attached to the upper third of the septum, shaped as short obovoid bosses. *Ovules* pendulous. *Corolla lobes* imbricate, or valvate and sometimes subimbricate or strongly imbricate at the apex. *Stigma* globose to (obovoidal-)clavate. *Seeds* bilaterally flattened, usually shortly winged.

Type genus: *Adina* Salisb.

NAUCLEINAE DC.

Subtribe *Naucleinae* DC., Prodr. 4 (1830) 343 (as '*Cinchoneae* subtribe *Naucleeae*').
Subtribe *Sarcocephalinae* DC., o.c. 367 (as '*Gardeniaceae* subtribe *Sarcocephalinae*').

Hypanthia and *fruitlets* free, or connate into a syncarp or a pseudosyncarp, *calyces* free. *Receptacle*, if bearing free hypanthia, without interfloral bracteoles. *Ovary* 2-locular; the two *placentas* if attached to the upper third of the septum then Y-shaped, each with 2 short ascending arms and a long descending foot; if attached to the middle of the septum then either discoidal or heart-shaped and with a central peltate attachment, or linear-oblong and adnate to the median part of the septum. *Ovules* spreading in all directions but predominantly pendulous. *Corolla lobes* imbricate. *Stigma* spindle-shaped. *Seeds* ovoidal to ellipsoidal, somewhat angular, or slightly bilaterally compressed and then with a narrow wing.

Type genus: *Nauclea* L.

ANTHOCEPHALINAE Ridsd. (see p. 366)

Anthocephalinae Havil., J. Linn. Soc. Bot. 33 (1897) 21 (as '*Anthocephalidae*'), *nom. illeg.* (incl. *Sarcocephalus* and *Nauclea*).

Hypanthia and *fruitlets* free, *calyces* free. *Receptacle* without interfloral bracteoles. *Ovary* 2-locular or 2-locular in the lower half and seemingly 4-locular in the upper half. *Placentas* attached to the uppermost third of the septum, sometimes branched; upper part of the ovary with 4 cartilaginous structures, these small, solid, hyaline, and inconspicuous from outside or hollow, pallid, and conspicuous from outside and then with branches of the placentas within. *Ovules* predominantly pendulous. *Corolla lobes* imbricate. *Stigma* spindle-shaped. *Seeds* angular.

Type genus: *Anthocephalus* A. Rich.

KEY TO THE GENERA OF THE NAUCLEEAE *s.s.* *)

1a. Hypanthia and fruitlets free (cf. fig. 3g, h) 8
b. Hypanthia and fruitlets persistently connate into a syncarp (cf. fig. 3a, b) or in the flowering or young fruiting stage connate or cohering to form a pseudosyncarp (cf. fig. 3c—f) 2
2a. Flowering heads always terminal; stigma spindle-shaped or globose. Continental Africa, continental Asia, and Malesia 4
b. Flowering heads always lateral; stigma clavate to globose. Madagascar 3

* Excluding *Cephalanthus*, *Mitragyna*, and *Uncaria:* see Ridsdale, Blumea 22 (1975) 543.

3a. Terminal vegetative bud conical. Flowering heads enclosed by strongly cohering modified stipules, these calyptra-like, usually rupturing circumscissile **1. Breonia**

b. Terminal vegetative bud strongly flattened. Flowering heads enclosed by loosely adpressed, ovate, bract-like stipules which later separate **2. Neobreonia**

4a. Flowering heads or young fructescence a pseudosyncarp, in section adjoining ovary walls clearly distinguishable. Stigma spindle-shaped (*Ochreinauclea*) or globose. Seeds winged, sometimes with a long tail 7

b. Flowering heads and infructescence a true fused syncarp, or apparently so (*Ochreinauclea*), in section adjoining ovary walls not clearly distinguishable. Stigma spindle-shaped. Seeds ovoidal to ellipsoidal, winged or not, never with a long tail 5

5a. Terminal vegetative bud pyramidal to somewhat flattened. Stipules deltoid or shortly obtuse, semi-persistent. Placentas attached to the middle of the septum (see fig. 2), somewhat discoidal. Africa . . . . . **3. Sarcocephalus**

b. Terminal vegetative bud flattened, or conical to pyramidal (but then not distributed in Africa). Stipules ovate, elliptic, or obovate, or somewhat narrowly triangular (not in Africa), deciduous or semi-persistent. Placentas (see fig. 2) attached to the upper third of the septum, Y-shaped, or attached to the middle of the septum and heart-shaped but then not distributed in Africa. Continental Asia, Malesia, Africa 6

6a. Terminal vegetative bud flattened, rarely somewhat narrowly triangular and strongly keeled and appearing somewhat conical and then the stipules densely pubescent. Stipules adpressed in bud, (narrowly-)elliptic to obovate, rarely somewhat narrowly triangular, glabrous to densely pubescent, keeled or not, usually deciduous. Calyx lobes short and obtuse or spathulate, persistent. Seeds ovoidal to ellipsoidal, sometimes slightly compressed, not winged. Continental Africa, continental Asia, and Malesia . . . . **4. Nauclea**

b. Terminal vegetative bud conical to pyramidal. Stipules obvolute in bud, narrowly triangular to oblong, glabrous, not keeled. Calyx lobes oblong-trigonal, persistent. Seeds winged. Continental Asia, Malesia. **5. Ochreinauclea**

7a. Terminal vegetative bud conical to pyramidal. Stipules obvolute in bud, narrowly triangular to oblong. Calyx lobes oblong-trigonal, persistent. Stigma spindle-shaped. Placenta heart-shaped, attached to the middle of the septum. Seeds winged but not long-tailed. . . . . **5. Ochreinauclea**

b. Terminal vegetative bud flattened. Stipules adpressed in bud, elliptic to ovate-oblong(-lanceolate). Calyx lobes with a clavate to obturbinate deciduous apical part. Stigma globose. Placenta a small obovoid boss attached to the upper third of the septum. Seeds winged, ventral wing long-tailed, at least 5 × length of the central portion . . . . . **10. Myrmeconauclea**

8a. Stigma globose or obovoid to (obovoid-)clavate (rarely somewhat trigonal), sometimes ridged. Placentas (see fig. 2) short obovoid bosses attached to the upper third of the septum. Seeds flattened, tricornute or winged and then sometimes with a long tail 11

b. Stigma spindle-shaped. Placentas (see fig. 2) heart-shaped to linear-oblong to slightly bilobed and attached, or adnate, to the middle of the septum; or placentas ⊣- or Y-shaped and attached to the upper third of the septum. Seeds

ovoidal to ellipsoidal, trigonal, or flattened and winged 9

9a. Placentas heart-shaped, attached to the middle of the septum by a thin stalk. Hypanthia and fruitlets forming a pseudosyncarp, fruitlets separating in fallen fruit. Seeds flattened, winged. Continental Asia and Malesia.
5. Ochreinauclea

b. Placentas linear-oblong to slightly bilobed and adnate to the middle part of the septum and then African, or +- or Y-shaped and attached to the upper third of the septum and then Asiatic or Malesian. Fruitlets indehiscent. Seeds ovoidal to ellipsoidal or trigonal, not winged 10

10a. Terminal vegetative bud conical; stipules obvolute in bud, narrowly triangular. Upper part of the ovary 4-locular with hollow, white, cartilaginous structures (see fig. 2a—d); or ovary 2-locular throughout with 4 solid hyaline structures. Continental Asia and Malesia. . . . . **6. Anthocephalus**

b. Terminal vegetative bud flattened; stipules adpressed in bud, ovate. Ovary 2-locular without thickened structures. Africa . . . . . **7. Burttdavya**

11a. Flowering heads strictly lateral, or predominantly lateral and sometimes terminal on the shorter shoots. 23

b. Flowering heads strictly terminal. 12

12a. Interfloral bracteoles present 16

b. Interfloral bracteoles absent 13

13a. Terminal vegetative bud strongly flattened; stipules elliptic to obovate 15

b. Terminal vegetative bud conical; stipules narrowly triangular to oblong-lanceolate 14

14a. Flowering heads usually over 5; diameter across calyces (3—)5—8, across corollas 10—15 mm. Stigma with longitudinal ridges (see fig. 5g), always copiously covered with pollen. Calyx lobes elliptic-lanceolate to ensiform or spathuloid, apical portion deciduous or subpersistent, in young flowering heads shorter than the immature corollas. Borneo, Philippines.
8. Ludekia

b. Flowering heads 1—3(—5); diameter across calyces over 8 mm, across corollas over 15 mm. Stigma smooth, not copiously covered with pollen. Calyx lobes with a distinct swollen obtrigonal to spathuloid or somewhat clavate deciduous apical portion, in young flowering heads longer than the immature corollas and concealing them. New Guinea, Moluccas . . **9. Neonauclea**

15a. Hypanthia and fruitlets always free. Ventral wing of seed up to 3 × length of central portion. Shrubs and trees, sometimes rheophytic . **9. Neonauclea**

b. Hypanthia free, becoming loosely connate in young fruiting stages to form a pseudosyncarp, mature fruitlets becoming free by decay of the connecting tissue. Ventral wing of seed over 5 × length of central portion (see fig. 6i). Mostly rheophytes, sometimes trees. . . . . **10. Myrmeconauclea**

16a. Interfloral bracteoles filiform to filiform-clavate to spathulate (compare fig. 8f, 9e) 18

b. Interfloral bracteoles conical, shiny, glabrous (compare fig. 7f) . . 17

17a. Calyx lobes with long obtrigonal to spathuloid or somewhat clavate deciduous apical portion. Not in Ceylon. . . . . **9. Neonauclea**

b. Calyx lobes elliptic-oblong, without deciduous apical portion. Ceylon
11. Diyaminauclea

18a. Terminal vegetative bud not strongly flattened, pyramidal to conical, or ill-defined and loosely surrounded by the stipules (not seen in *Sinoadina*). Stipules

entire or shallowly notched to deeply bifid. Corolla lobes valvate, sometimes apically (sub) imbricate 20
b. Terminal vegetative bud strongly flattened. Stipules entire. Corolla lobes imbricate or valvate and apically subimbricate 19
19a. Calyx lobes very short, obtuse. Corolla lobes imbricate. NE. India, Burma **12. Khasiaclunea**
b. Calyx lobes elliptic-oblong. Corolla lobes valvate but subimbricate at the apex. Moluccas. . . . . **13. Adinauclea**
20a. Terminal vegetative bud ill-defined, loosely surrounded by the stipules. Stipules deeply bifid for over two-thirds of the length. Flowering heads solitary, rarely up to 7, arranged like a simple thyrse. Ovules up to 4 per locule **17. Adina**
b. Terminal vegetative bud (where known) pyramidal to conical. Stipules deltoid to narrowly triangular or oblong, sometimes shallowly notched at the apex. Inflorescence with numerous flowering heads, generally over 7. Ovules 4—12 per locule 21
21a. Calyx lobes short, obtuse, densely villose. Corolla tube densely pubescent. Flowering heads (1—)3—9(—13), lateral flowering axes unbranched. Japan, Taiwan, China across to Burma, NE Thailand . . . . . **15. Sinoadina**
b. Calyx lobes deltoid to elliptic-oblong, not densely villose. Corolla tube not densely pubescent, rarely mealy pubescent but then distribution: Peninsular Thailand, Moluccas, New Guinea 22
22a. Flowering heads numerous, generally over 9, lateral flowering axis branched, bearing several flowering heads. . . . . **14. Metadina**
b. Flowering heads 1(—3) . . . . . **16. Pertusadina**
23a. Interfloral bracteoles present 24
b. Interfloral bracteoles absent. Madagascar 27
24a. Leaves, at least those of main axes, arranged in whorls of 3 or 4. Continental Africa and Madagascar.. . . . . **19. Breonadia**
b. Leaves all arranged in pairs. Continental Asia and Malesia . . . 25
25a. Terminal vegetative bud flattened. Stipules adpressed in bud, entire, pubescent, keeled. Continental Asia.. . . . . **18. Haldina**
b. Terminal vegetative bud not flattened, conical or ill-defined and loosely surrounded by the stipules. Stipules obvolute, more or less free in bud, entire or bifid. Continental Asia and Malesia 26
26a. Terminal vegetative bud loosely surrounded by stipules. Stipules more or less free in bud, deeply bifid, somewhat persistent. Ovules up to 4 per locule. **17. Adina**
b. Terminal vegetative bud conical. Stipules obvolute in bud, in the upper third sometimes filiformly bifid or entire. Ovules (2—)4—10. . **16. Pertusadina**
27a. Terminal vegetative bud conical with stipules superobvolute **20. Gyrostipula**
b. Terminal vegetative bud strongly flattened with stipules adpressed **21. Janotia**

1. BREONIA A. Rich.

A genus restricted to Madagascar (cultivated on Mauritius). See Ridsdale, Blumea 22 (1975) 544—546, for generic description, key to the species, and synoptical account.

N o t e : *Bancalus cuspidatus* (Baker) O.K. = *Breonia citrifolia* (Poir) Ridsd.

EXCLUDED FROM BREONIA

1. *B. mayorii* Setch., Dept. Marine Biol. Carnegie Inst. Wash. 20 (1924) 44 = **Sarcopygme mayorii** Setch. & Christoph.

Transferred or reduced to **Anthocephalus:**
B. chinensis (Lamk.) Capuron.

Transferred or reduced to **Neobreonia:**
B. decaryana Homolle, *B. keliravina* Homolle.

2. NEOBREONIA Ridsd.

A monotypic genus restricted to Madagascar. See Ridsdale, Blumea 22 (1975) 546, for generic description and synoptical account.

3. SARCOCEPHALUS Afz. *ex* Sabine

A genus of two species restricted to tropical Africa. See Ridsdale, Blumea 22 (1975) 546—547, for generic description and synoptical account.

EXCLUDED FROM SARCOCEPHALUS

1. *S. pacificus* Reinecke, Bot. Jahrb. 25 (1898) 684, pl. 13, fig. c = **Sarcopygme pacifica** Setch. & Christoph.
2. *S. ramosus* Laut., Bot. Jahrb. 41 (1908) 235 = **Sarcopygme ramosa** Setch. & Christoph.
3. *S. leichhardtii* F. v. M., Essay Pl. Coll. Smith Exp. Est. Burdek (1860) 12, *pro parte* = **Morinda citrifolia** L., *fide* Benth., Fl. Austr. 3 (1866) 424.

Transferred or reduced to **Anthocephalus:**
S. cadamba (Roxb.) Kurz.

Transferred or reduced to **Breonia:**
S. madagascariensis Baill., *S. richardianus* Baill., *S. richardii* Drake.

Transferred or reduced to **Myrmeconauclea:**
S. fluviatilis Elm.

Transferred or reduced to **Nauclea:**
S. annamensis Dubard & Eberh., *S. badi* Aubr., *S. bartlingii* F. v. M., *S. buruensis* Miq., *S. coadunatus* Druce, *S. cordatus* Miq., *S. dasyphyllus* Miq., *S. diderrichii* De Wild., *S. gilletii* De Wild., *S. glaberrimus* Miq., *S. hirsutus* Havil., *S. horsfieldii* Miq., *S. junghuhnii* Miq., *S. macrocephalus* K. Schum., *S. mitragynus* Miq., *S. multicephalus* Elm., *S. nervosus* Hutch. & Dalz., *S. officinalis* Pierre *ex* Pitard, *S. orientalis* Merr., *S. ovatus* Elm., *S. ovoideus* Pierre *ex* Pitard, *S. papagola* Domin., *S. parvus*

Havil., *S. pubescens* C. B. Robinson, *S. pubescens* Val., *S. subditus* Miq., *S. tenuiflorus* Havil., *S. trillesii* Pierre, *S. undulatus* Miq., *S. vanderguchtii* De Wild., *S. xanthoxylon* Chev.

Transferred or reduced to **Neonauclea:**
S. bartlingii Miq., *S. gracilis* K. Schum. *ex* Havil.

Transferred or reduced to **Ochreinauclea:**
S. maingayi Havil., *S. missionis* Havil.

4. NAUCLEA L.

Medium to large sized trees. *Terminal vegetative bud* strongly flattened, rarely appearing somewhat conical. *Stipules* ovate, elliptic, or obovate, flattened to strongly keeled, adpressed, deciduous or semi-persistent. *Leaves* opposite. *Flowering heads* terminal or terminal and lateral; *flowering axes* unbranched with a node bearing reduced leaves and stipules, these not surrounding the young flowering heads. *Flowers* 4- or 5-merous; hypanthia mutually connate; calyx lobes triangular, obtuse to oblong or (sub-)spathulate, persistent. *Corolla* infundibular; lobes oblong, imbricate; stamens inserted in the upper part of the tube, filaments short, glabrous, anthers basifixed, introrse, protruding from the throat. *Style* exserted, stigma spindle-shaped. *Ovary* 2-locular; placentas attached to the upper third of the septum, Y-shaped with 2 short ascending arms and a long descending foot; ovules numerous in each locule, mostly pendulous, some erect or horizontal but these mostly abortive. Ovaries and *fruitlets* connate into an indehiscent syncarp. *Seeds* ovoidal to ellipsoidal, sometimes slightly bilaterally compressed, not alate.

Lectotype (Merrill, 1915): *N. orientalis* (L.) L. See Ridsdale, Blumea 23 (1976) 184—186, for full discussion on lectotypification, and Blumea 22 (1975) 547—548 for synoptic account of African species, and further references.

KEY TO THE SPECIES OF NAUCLEA *

1a. Calyx lobes (sub-)spathulate with a distinct narrow shaft 2
b. Calyx lobes obtuse, not (sub-)spathulate, shaft absent 3
2a. Diameter of flowering heads across calyces over 15 mm, across fruiting head generally over 15 mm. Leaves generally greater than 12 × 6 cm. Stipules large, generally longer than 10 mm. Continental Asia, Malesia, Australia **1. N. orientalis**
b. Diameter of flowering heads across calyces up to 10 mm, across fruiting head 10—15 mm. Leaves generally less than 12 × 6 cm. Stipules small, generally up to 10 mm long. New Guinea . . . . . **2. N. tenuiflora**
3a. Calyx lobes glabrous, sometimes sparsely hairy or ciliate; inside of calyx tube glabrous. 7
b. Calyx lobes mediumly to densely pubescent; inside of calyx tube pubescent 4

* The African species are included in the key but are not considered further.

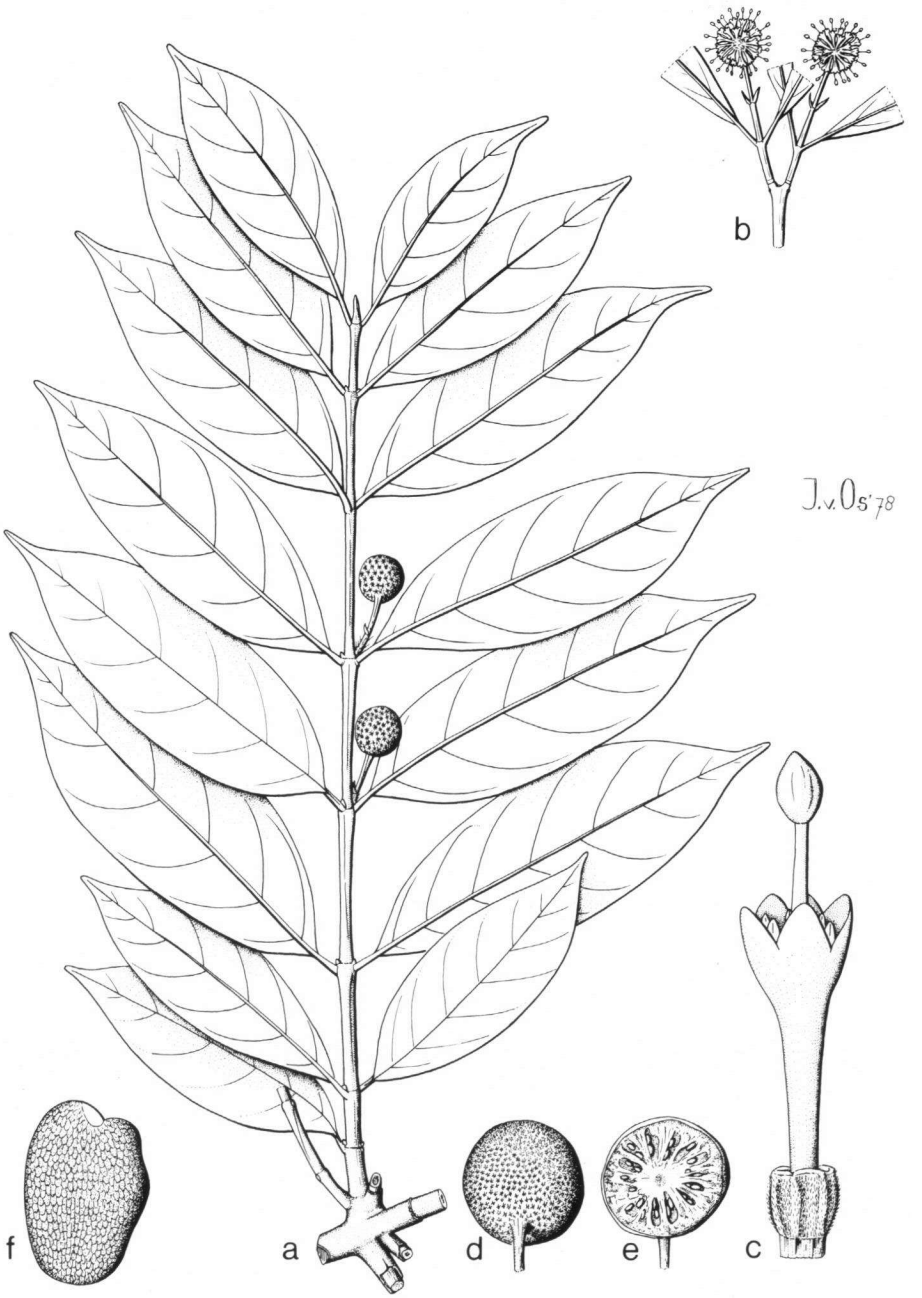

Fig. 4. *Nauclea parva* — a. habit, $\times \frac{1}{2}$; b. flowering heads, $\times \frac{1}{2}$; c. flower at anthesis, $\times 7$; d. fruit external view, $\times 1$; e. fruit in section, $\times 1$; f. seed, $\times 14\frac{1}{2}$. (a—c. *Anderson 8061*; d—f. *Anderson 7941*).

4a. Corolla throat densely pubescent; corolla lobes densely pubescent inside. Diameter of flowering heads across calyces over 10 mm. Africa **N. diderichii**

b. Corolla throat more or less glabrous; corolla lobes usually glabrous, sometimes sparsely pubescent inside. Diameter of flowering heads across calyces less than 10 mm. Asia and Malesia 5

5a. Syncarp fleshy, not woody. Terminal vegetative bud somewhat conical, but stipules adpressed and strongly keeled. Stipules, young parts, petiole, and midrib densely finely fulvously pubescent. Young stems light brown. Leaves drying with an ochre tint . . . . . **3. N. parva**

b. Syncarp woody. Terminal vegetative bud strongly flattened; stipules adpressed, sometimes slightly keeled. Stipules, young parts, petiole, and midrib usually glabrous, sometimes slightly hairy or pubescent and then not fulvous and young stems and leaves drying black 6

6a. Stipules obtuse, usually not keeled. Young stems of the current seasons growth drying light brown. Flowering heads in groups of 2—5, rarely solitary. Corolla hypocrateriform, tube conspicuously narrowed. Leaves generally greater than 12 × 8 cm, drying flavescent, rarely brunescent, glabrous . **4. N. officinalis**

b. Stipules elliptic, narrowed at the base, usually keeled. Young stems of current seasons growth drying black. Flowering heads solitary. Corolla somewhat infundibular, tube not conspicuously narrowed. Leaves generally less than 12 × 8 (exceptionally up to 20 × 8) cm, usually drying nigrescent, less frequently brunescent, glabrous, or hairy or pubescent and then stems and stipules not fulvously pubescent . . . . . **5. N. subdita**

7a. Diameter of flowering heads across calyces 5—7 mm, across corollas 15—20 mm. Philippines . . . . . **6. N. robinsonii**

b. Diameter of flowering heads across calyces over 8 mm, across corollas over 25 mm. Africa 8

8a. Leaves pubescent below, at least on the veins. . . . . **N. xanthoxylon**

b. Leaves glabrous below 9

9a. Diameter of flowering heads across corollas 40—60 mm, corolla lobes glabrous inside . . . . . **N. vanderguchtii**

b. Diameter of flowering heads across corollas up to 40 mm, corolla lobes with 1—3 lines of hairs inside. . . . . **N. gilletii**

1. Nauclea orientalis (L.) L.

[*Cephalanthus foliis oppositis* L., Fl. Zeyl. (1748) 22 no. 53]. — *Cephalanthus orientalis* L., Sp. Pl. ed. 1 (1753) 95. — *N. orientalis* L., Sp. Pl. ed. 2, 1 (1762) 243; Ridsdale, Blumea 23 (1976) 184—186, for discussion of typification. — *Bancalus orientalis* O.K., Rev. Gen. Pl. 1 (1891) 277. — *Sarcocephalus orientalis* Merr., Philipp. J. Sc. 3 (1908) Bot. 436. — Lectotype (Merrill, 1915): *Plate 338 in Hermann's Herb.* (BM) (Not *Osbeck s.n.* in LINN, *lect. rej.*).

N. coadunata Roxb. *ex* J. E. Smith in Rees, Cyclop 24 (1813) Nauclea no. 6. — *Sarcocephalus coadunatus* Druce, Rep. Bot. Exch. Club. Brit. Is 4 (1917) 644 (as '*Sarcocephalis*'). — Type: *Roxburgh s.n., Herb. Smith 316/4* (LINN).

N. cordata Roxb. [Hort. Beng. (1814) 14, *nom. nud.*] Fl. Ind. ed. 1, 2 (1824) 118. — *Platanocarpum cordatum* Korth., Obs. Naucl. Ind. (1839) 19. — *Sarcocephalus cordatus* Miq., Fl. Ind. Bat. 2 (1856) 133. — Type: *Roxburgh s.n. (n.v.)*, Cult. Hort. Calcutta from seed sent from Ceylon (probably the same type as *N. coadunata* Sm.).

N. undulata Roxb. [Hort. Beng. (1814) 14, *nom. nud.*] Fl. Ind. ed. 1, 2 (1824) 117. — *Sarcocephalus undulatus* Miq., Fl. Ind. Bat. 2 (1856) 133. — Type: *Roxburgh s.n.*, Cult. Hort. Calcutta since 1789, provenance Moluccas.

N. macrophylla Bl., Bijdr. (1826) 1010, *nom. illeg., non* Roxb. 1821. — *N. grandifolia* DC., Prodr. 4 (1830) 345, *nom. illeg., non* Spreng. 1827. — *Bancalus grandifolius* O.K., Rev. Gen. Pl. 1 (1891) 277. — Syntypes: *Blume s.n.*, Java, Bantam and Rembang (both L).

N. glaberrima Bartl. in DC., Prodr. 4 (1830) 344. — *Sarcocephalus glaberrimus* Miq., Fl. Ind. Bat. 2 (1856) 133. — Type: in *Herb. Haenke (n.v.)*.

[*N. stipulacea* Wall., Cat. 6090 D] — *N. roxburghii* G. Don, Gen. Hist. 3 (1832) 469. — Type: *Wallich Cat. 6090 D* (K).

N. wallichiana R. Br. [Wall., Cat. 6098] *ex* G. Don, Gen. Hist. 3 (1832) 466. — Type: *Wallich Cat. 6098* (K).

Cadamba nocturna Ham. *ex* Hensch., Vita Rumph. (1833) 156, *nom. illeg.*

N. lutea Blanco, Fl. Filip. ed. 1 (1837) 141. — Type: unknown.

N. leichhardtii F. v. M., Essay Pl. Coll. Sm. Exp. Est. Burdek (1860) 12, *pro parte*. — Type: not traced.

Sarcocephalus buruensis Miq., Ann. Mus. Lugd. Bat. 4 (1869) 179. — *Sarcocephalus undulatus* Roxb. var. *buruensis* Havil., Journ. Linn. Soc. Bot. 33 (1897) 29. — Syntypes: *Teysmann s.n.*, Kajeli, Boeroe L; iso BO); *Forsten s.n., 7/9/1840*, Likupang, Celebes (U; iso BO).

Sarcocephalus macrocephalus K. Schum. in E. & P., Nat. Pfl. Fam. ed. 1, 4, 4 (1891) 59, *nom. nud.*

Sarcocephalus bartlingii auct. non Miq.: Bailey, Queensl. Fl. 3 (1900) 745, *non N. bartlingii* DC.

Sarcocephalus cordatus var. *mollis* Koord. & Val., Bijdr. 8 (1902) 15. — Type: *Zollinger 2752* (BO).

Sarcocephalus ovatus Elm., Leafl. Philip. Bot. 1 (1906) 33. — *N. elmeri* Merr., J. Wash. Acad. Sc. 5 (1915) 535. — Type: *For. Bur. 3150 (Ahern's collector)* (BO, K, SING).

Sarcocephalus annamensis Dub. & Eberh., Bull. Mus. Hist. Nat. Paris 15 (1909) 493. — *N. annamensis* Merr., J. Wash. Acad. Sc. 5 (1915) 535. — Type: *Eberhard s.n.*, Hue.

[*N. minahassae* Koord.-Schum., Syst. Verz. 3 (1914) 120, *nom. nud.*]

Sarcocephalus papagola Domin., Biblioth. Bot. 22 (1929) 1168. — Syntypes: *Domin s.n.*, Walsh R., Queensland; Yarrabu Queensland (*n.v.*).

Distribution: Ceylon, Burma (Upper & Lower), Thailand, throughout Malesia to New Guinea, N. and NE. Australia.

2. Nauclea tenuiflora (Havil.) Merr.

N. subditus auct. non Steud.: K. Schum. & Hollr., Fl. K. Wilhelmsl. (1889) 127. — *Sarcocephalus tenuiflorus* Havil., J. Linn. Soc. Bot. 33 (1897) 32. — *N. tenuiflora* Merr., J. Wash. Acad. Sc. 5 (1915) 537. — Type: *Hollrung 829* (K).

Distribution: New Guinea.

3. Nauclea parva (Havil.) Merr. — Fig. 4.

Sarcocephalus parvus Havil., J. Linn. Soc. Bot. 33 (1897) 31. — *N. parva* Merr., J. Wash. Acad. Sc. 5 (1915) 536. — Type: *Haviland 1892* (K).

Distribution: Borneo.

4. Nauclea officinalis (Pierre *ex* Pitard) Merr. & Chun.

Sarcocephalus junghuhnii auct. non Miq.: King, J. As. Soc. Beng. 72, ii (1903) 121. — *Sarcocephalus officinalis* Pierre *ex* Pitard, Fl. Gén. I.-C. 3 (1922) 26. — *N. officinalis* Merr. & Chun, Sunyatsenia 5 (1940) 188. — Syntypes: *Pierre s.n. (605)*, Mt. Knang-krepeu, Thepong Prov., Cambodia; *Pierre s.n.*, Mt. Dinh, Baria Prov., S. Vietnam (P).

N. brunnea Craib, Kew Bull. Misc. Inf. (1931) 208. — Type: *Kerr 15572* (K).

Distribution: China (Kwangtung), Hainan, N. and S. Vietnam, Cambodia, Laos, Thailand, Malay Peninsula, Sumatra, Borneo.

5. **Nauclea subdita** (Korth.) Steud.

Platanocarpum subditum Korth., [Obs. Naucl. Ind. (1839) 19, *nom. nud.*]; Verh. Nat. Gesch. Ned. Bot. (1842) 153, t. 32. — *N. subditum* Steud., Nom. Bot. ed. 2, 2 (1841) 186. — *Sarcocephalus subditum* Miq., Fl. Ind. Bat. 2 (1856) 133. — Type: *Korthals s.n.* (L).

Sarcocephalus horsfieldii Miq., Fl. Ind. Bat. 2 (1856) 134. — *N. horsfieldii* Bremekamp, Blumea 5 (1942) 248, *in obs.* — Type: *Horsfield s.n.*, Soerakarta, Java (K).

Sarcocephalus junghuhnii Miq., Fl. Ind. Bat. 2 (1856) 134 — *N. junghuhnii* Merr., J. Wash. Acad. Sc. 5 (1915) 536. — Type: *Junghuhn s.n.*, Angkola, Sumatra (L).

Sarcocephalus dasyphyllus Miq., Sum. (1861) 214, 538. — *N. dasyphylla* Merr., J. Wash. Acad. Sc. 5 (1915) 535. — Syntypes: *Diepenhorst s.n.* Prieman, Sumatra; *Teysmann s.n.*, Duku, Sumatra (BO).

Sarcocephalus mitragynus Miq., Ann. Mus. Bot. Lugd. Bat. 4 (1869) 180. — *N. mitragyna* Merr., J. Wash. Acad. Sc. 5 (1915) 536. — Syntypes: *Teysmann & De Vriese s.n.*, Ceram; *Teysmann s.n.*, Ceram (L).

Sarcocephalus hirsutus Havil., J. Linn. Soc. Bot. 33 (1897) 32. — *N. hirsuta* Merr., J. Wash. Acad. Sc. 5 (1915) 530. — Type: *Haviland 3406* (K).

Sarcocephalus pubescens Val., Bot. Jahrb. 44 (1910) 550. — *N. pubescens* Merr., J. Wash. Acad. Sc. 5 (1915) 535. — Type: *Winkler 2214* (L).

Sarcocephalus multicephalus Elm., Leafl. Philip. Bot. 5 (1913) 1896. — *N. multicephala* Merr., J. Wash. Acad. Sc. 5 (1915) 536. — Type: *Elmer 13877* (iso in L).

Distribution: India (Assam, Meghalaya), Malay Peninsula, Sumatra, Java, Borneo, Philippines, Moluccas, Lesser Sunda Is, Celebes.

Note: The records from Assam, based on *T. R. Chand 6173* and *W. N. Koelz 30594*, are exceptional as I have seen no material from intermediate areas.

6. **Nauclea robinsonii** Merr.

Sarcocephalus pubescens C. B. Robinson, Philip. J. Sc. 6 (1911) Bot. 225, *nom. illeg.*, *non* Val. 1910. — *N. robinsonii* Merr., J. Wash. Acad. Sc. 5 (1915) 537. — Type: *Bur. Sc. 6917 (n.v.)*.

Distribution: Philippines.

DUBIOUS SPECIES OF NAUCLEA

1. [*N. pendula* Griff., Journ. (1847) 191, *nom. nud.*]

EXCLUDED FROM NAUCLEA

1. *N. digitata* Blanco, Fl. Filip. ed. 2 (1845) 102 = **Cephalosche**ff**lera blancoi** Merr.
2. *N. pacifica* (Reinecke) Merr., J. Wash. Acad. Sc. 5 (1915) 536 = **Sarcopygme pacifica** Setch. & Christoph.
3. *N. ramosa* (Laut.) Merr., o.c. 537 = **Sarcopygme ramosa** Setch. & Christoph.

Transferred or reduced to **Adina:**

N. adina Sm., *N. adinoides* Lindl., *N. nipponica* Masamune, *N. pilulifera* Baill., *N. rubella* Nakai.

Transferred or reduced to **Adinauclea:**
N. fagifolia Havil.

Transferred or reduced to **Anthocephalus:**
N. cadamba Roxb., *N. elegans* T. & B., *N. macrophylla* Roxb.

Transferred or reduced to **Breonadia:**
N. microcephala Del., *N. verticellata* Baill.

Transferred or reduced to **Breonia:**
N. citrifolia Poir., *N. cuspidata* Baker.

Transferred or reduced to **Cephalanthus:**
N. stellata (Lour.) Wall. *ex* G. Don, *N. tetrandra* Roxb.

Transferred or reduced to **Diyaminauclea:**
N. peduncularis Thw., *N. triflora* Moon, *N. zeylanica* Hook.*f.*

Transferred or reduced to **Haldina:**
N. cordifolia Roxb., *N. sterculiaefolia* A. Rich.

Transferred or reduced to **Ludekia:**
N. bernardoi Merr.

Transferred or reduced to **Metadina:**
N. aralioides Miq., *N. capitellata* Voigt, *N. microcephala* Wall. *ex* Voigt, *N. trichotoma* Zoll. & Mor.

Transferred or reduced to **Mitragyna:**
N. adina Blanco, *N. africana* Willd., *N. bracteosa* Welw., *N. brunonis* Wall. *ex* G. Don, *N. diversifolia* Wall. *ex* G. Don, *N. inermis* Walp., *N. korthalsii* Steud., *N. luzoniensis* Blanco, *N. macrophylla* Perr. & Lepr., *N. 'parviflora Pers.'*, *N. parvifolia* Roxb., *N. platanocarpa* Hook. *f.*, *N. rotundifolia* Roxb., *N. speciosa* Miq., *'N. stipulacea G. Don'*, *'N. stipulata Benth.'*, *N. stipulosa* DC., *N. tubulosa* Arn.

Transferred or reduced to **Myrmeconauclea:**
N. rheophila Steen.

Transferred or reduced to **Neonauclea:**
N. affinis Miq., *N. angustifolia* Havil., *N. ategii* Elm., *N. bartlingii* DC., *N. blancoi* Vidal, *N. callophylla* Bl. *ex* Miq., *N. calycina* Bartl., *N. calycina* Blanco, *N. celebica* Havil., *N. chalmersii* F. v. M., *N. cordata* Bl., *N. cordatula* Merr., *N. cumingiana* Vidal, *N. cyclophylla* Miq., *N. cyrtopoda* Miq., *N. cyrtopodioides* Wernh., *N. dahlii* Val., *N. excelsa* Bl., *N. formicaria* Elm., *N. forsteri* Seem., *N. gageana* King, *N. gigantea* Val., *N. glaberrima* Blanco, *N. glabra* Blanco, *N. glabra* Roxb., *N. glandulosa* Blanco, *N. gordoniana* F. M. Bail., *N. gracilis* Vidal, *N. gracilis* Havil., *N. grashoffii* Val., *N. griffithii* Havil., *N. hagenii* Laut. & K. Schum., *N. havilandii* Koord., *N. imbricata* Bl. *ex* Miq., *N. jagori* Merr., *N. kentii* Merr., *N. lanceolata* Blanco, *N. lanceolata* Bl., *N. latifolia* Blanco, *N. malaccensis* Gand., *N. maluensis*

Val., *N. media* Havil., *N. megaphylla* S. Moore, *N. mindanaensis* Merr., *N. mollis* Bl., *N. moluccana* Miq., *N. monocephala* Merr., *N. morindaefolia* Bl., *N. nicobarica* Havil., *N. nitida* Havil., *N. obtusa* Bl., *N. obversifolia* Val., *N. orientalis* Forst., *N. ovata* Merr., *N. pallida* Reinw. *ex* Havil., *N. papuana* Val., *N. peduncularis* Wall. *ex* G. Don, *N. philippinensis* Havil., *N. puberula* Merr., *N. purpurascens* Korth., *N. purpurea* Roxb., *N. reticulata* Havil., *N. rivularis* Becc., *N. rotundifolia* Guill., *N. rotundifolia* Hook. & Arn., *N. schlechteri* Val., *N. sericea* Wall. *ex* G. Don, *N. sericea* Spanogh., *N. sessilifolia* Roxb., *N. sumatrana* Gandog., *N. superba* S. Moore, *N. synkorynes* Korth., *N. tenuis* Havil., *N. truncata* Hayata, *N. venosa* Merr., *N. vestita* Zipp. *ex* Spanogh., *N. vidalii* Elm.

Transferred or reduced to **Ochreinauclea:**
N. elliptica Dalz. & Gibs., *N. maingayi* Hook. *f.*, *N. missionis* Wight & Arn., *N. oblonga* Miq. *ex* Hohenacker.

Transferred or reduced to **Pertusadina:**
N. oxyphylla Miq.

Transferred or reduced to **Sarcocephalus:**
N. esculenta Merr., *N. latifolia* Sm., *N. pobeguinii* Merr., *N. russegeri* Schw., *N. sambucina* Winterb.

Transferred or reduced to **Sinoadina:**
N. racemosa Sieb. & Zucc., *N. taiwaniana* Hayata, *N. transversa* Hayata.

Transferred or reduced to **Uncaria:**
N. acida Hunt., *N. aculeata* Willd., *N. africana* Walp., *N. appendiculata* Walp., *N. attenuata* Walp., *N. callophylla* Walp., *N. canescens* Bartl., *N. canescens* Walp., *N. cinchonae* DC., *N. cirrhiflora* Dietr., *N. clavisepala* Merr., *N. dasyoneura* Walp., *N. elliptica* Walp., *N. ferrea* Bl., *N. ferruginea* Bl., *N. formosana* Matsum., *N. gambir* Hunt., *N. glabrata* Bl., *N. grandifolia* Spreng., *N. guianensis* Poir., *N. haenkeana* Steud., *N. hallii* Walp., *N. insignis* Dietr., *N. laevigata* Walp., *N. lanosa* DC., *N. lanosa* Poir., *N. longiflora* Poir., *N. luzoniensis* Dietr., *N. macrophylla* Spreng., *N. nemorosa* Walp., *N. ovalifolia* Spreng., *N. pedicellata* Bl., *N. pilosa* Spreng., *N. polycephala* A. Rich., *N. rhynchophylla* Miq., *N. rotundifolia* Bartl., *N. roxburghiana* Walp., *N. scandens* Sm., *N. sclerophylla* Hunt., *N. sessilifructus* Dietr., *N. sessilis* Spreng., *N. setigera* Bl., *N. setiloba* Walp., *N. silhetiana* Dietr., *N. sinensis* Oliv., *N. speciosa* Walp., *N. tomentosa* Willd., *N. uncaria* Dietr., *N. wallichiana* Spreng.

5. OCHREINAUCLEA Ridsd. & Bakh. *f.*, *gen. nov.*

Arbores. *Gemmae terminales vegetativae* conicae usque pyramidales. *Stipulae* anguste triangulares, obvolutae, (semi-)persistentes. *Folia* opposita raro ternata. *Capitula florifera* terminalia. Axes floriferae solitariae, haud ramosae, stipulis et foliis ad nodos parvis, interdum stipulis bracteas aemulantibus, capitula florifera initio haud includentibus. *Flores* 5-meri, receptaculo subsessiles; receptaculo glabrescente, bracteolis interfloralibus nullis. *Hypanthia* inter sese ad apices connata, tubo calycis brevis, lobis liberis, oblongis usque trigonis, persistentibus. *Corolla* hypocrateriformis, lobi imbricati. *Stamina* in parte superiore tubi inserta, filamentis brevibus, glabris, antheris basifixis, introrsis, conspicue paullo e fauce protrusis. *Stylus* exsertus, stigma fusiforme. *Ovarium* 2-loculare, placentis in medio septorum instructis, cordatis, ovulis pro loculo numerosis, divergentibus *Infructescentia* capitula fructorum proparte cohaerentium praebens, ipsa calycis lobis elongatis persistentibus obtecta, seasim in cocca semilibera dissoluta. *Semina* bilateraliter compressa, leviter alata.

T y p u s : *O. maingayi* (Hook. *f.*) Ridsd.

Trees. *Terminal vegetative bud* conical to pyramidal. *Stipules* narrowly triangular, obvolute, (semi-)persistent. *Leaves* opposite or less frequently ternate (perhaps with dimorphic branching). *Flowering heads* terminal, solitary. *Flowering axis* unbranched with one or two nodes bearing highly reduced leaves and stipules, sometimes bract-like, these not surrounding the young flowering heads. *Flowers* 5-merous, subsessile on the receptacle; receptacle more or less glabrous, interfloral bracteoles absent. *Hypanthia* mutually connate at the apices; calyx tube short, lobes free, oblong to trigonal, persistent. *Corolla* hypocrateriform; lobes imbricate; *stamens* inserted in the upper part of the tube, filaments short, anthers basifixed, introrse, conspicuously protruding from the throat. *Style* exserted, stigma spindle-shaped. *Ovary* 2-locular; placentas attached to the middle of the septum, heart-shaped; ovules numerous, spreading in all directions. *Infructescence* a head of partially cohering fruitlets, capped by the long-persistent calyx lobes, slowly breaking apart into semi-free cocci. *Seeds* bilaterally compressed, shortly winged at each end.

N o t e : The exact nature of the infructescence is difficult to ascertain. I have only once seen mature seeds in loose fruits of *O. maingayi (SAN 39746)*, where it is recorded that they were collected from the ground; all other material examined had immature seeds. I suspect that the infructescence on the tree is a pseudosyncarp with hypanthia connate the apex and that after falling from the tree the seeds mature as the pseudosyncarp disintegrates into loose or partially loose cocci. On boiling up the infructescence breaks apart into groups of cocci. Further field observations are needed to clarify these points.

KEY TO THE SPECIES

1a. Mature leaves on average over 7 cm wide; nerves thick, prominent below. Calyx lobes usually rufous pubescent, *c.* 5 mm long. Thailand, Malaya, Sumatra, Borneo . . . . . **1. O. maingayi**

b. Mature leaves on average less than 7 cm wide; nerves thin, faint below. Calyx lobes usually pallidly pubescent, 2—3 mm long. India. . . **2. O. missionis**

1. Ochreinauclea maingayi (Hook. *f.*) Ridsd., *comb. nov.* — **Fig. 3f.**

Nauclea maingayi Hook. *f.*, Fl. Brit. Ind. 3 (1880) 27. — *Bancalus maingayi* O.K., Rev. Gen. Pl. 1 (1891) 227. — *Sarcocephalus maingayi* Havil., J. Linn. Soc. Bot. 33 (1897) 33. — T y p e : *Maingay 1288 (Kew Dist. 823)* (K).

D i s t r i b u t i o n : Thailand (Peninsular), Malay Peninsula, Sumatra, Borneo.

2. Ochreinauclea missionis (Wall. *ex* G. Don) Ridsd., *comb. nov.*

Nauclea missionis Wall. [Cat. 6099 *ex* Wight & Arn., Prod. (Oct. 1834) 392, *nom. nud.*]; *ex* G. Don, Gen. Hist. 3 (Nov. 1834) 467; Steud., Nom. Bot. ed. 2, 2 (1841) 186; Walp., Rep. Bot. 2 (1843) 511; Hook. *f.*, Fl. Brit. Ind. 3 (1880) 27; Woodr., J. Bomb. Nat. Hist. Soc. 5 (1898) 644; Dalgado, Fl. Goa e Savantvadi (1898) 93; Gamble, Man. Ind. Timbers ed. 2 (1902), reprint (1972) 405; Talbot, Tr. Shr. Woody Climb. Bomb. Presid. ed. 2 (1902), reprint (1949) 277; Bourdillon, For. Fl. Trav. (1908) 210; R.

Rao, Fl. Pl. Trav. (1914) 202; Gamble & Fischer, Fl. Madras 2 (1921) 582; Somasundaram, Handb. For. S. States (1967) 249. — *Bancalus missionis* O.K., Rev. Gen. Pl. 1 (1891) 277. — *Sarcocephalus missionis* Havil., J. Linn. Soc. Bot. 33 (1897) 32; Cooke, Fl. Bomb. 1 (1903) 578; Brandis, Ind. Trees (1906) 366; Talbot, For. Fl. Bomb. & Sind (1911) 84; R. Rao, Fl. Pl. Trav. (1914) 201; Blatter, J. Bomb. Nat. Hist. Soc. 36 (1933) 781. — Lectotype: *Wight*, Travancore, in *Wallich Cat. no. 6099 B.* — Syntype: *Wallich Cat. no. 6099 A.*

[*Nauclea oblonga* Miq. *ex* Hohenacker, Flora 32 (1849) 577, *nom. nud.*]

Nauclea elliptica Dalz. & Gibs, Bomb. Fl. (1861) 118, *pro parte.*

Small to medium sized tree. *Terminal vegetative bud* pyramidal. *Stipules* 4—10 × 2—5 mm, glabrous, semi-persistent. *Leaves* not keeled, glabrous, semi-persistent, elliptic, rarely obovate, (6—)8—14(—18) × (2—)4—6(—7) cm, membranaceous to chartaceous, above and below glabrous; apex acute or rarely obtuse, base attenuate, sometimes decurrent; lateral nerves 10—12 pairs, thin, faint below, axils apparently without domatia. *Petiole* 5—15 mm long, glabrous. *Flowering axis* solitary, 2—3 cm long. Diameter of mature *flowering heads* across calyces 20—30 mm, across corollas 30—45 mm. *Hypanthia* mutually connate at apex. *Calyx* lobes 2—3 mm long, oblong to trigonal-oblong, pallidly pubescent below, summit shortly brown pubescent becoming glabrous at apex. *Corolla* infundibular, 8—10 mm long, tube 5—7 mm long, outside and inside glabrous; lobes oblong, 2—3 mm long, inside and outside sparsely to densely pubescent. *Anthers* 1 mm long. *Style* for 7—10 mm exserted. *Fruiting head* not seen.

Distribution: India (Kerala, Karnatica, Maharashtra).

6. ANTHOCEPHALUS A. Rich.

Moderate to large trees with horizontally spreading branches aranged in tiers. *Terminal vegetative bud* conical. *Stipules* narrowly triangular, obvolute, deciduous. *Leaves* opposite. *Flowering heads* terminal, solitary. *Flowering axis* unbranched, with 1—3 nodes bearing highly reduced vegetative organs, these not surrounding the inflorescence. *Flowers* 5-merous, subsessile on the receptacle; receptacle more or less glabrous, interfloral bracteoles absent. *Hypanthia* and calyx tubes free; calyx tube infundibular, lobes linear-spathulate to narrowly elliptic, outside grey pubescent, persistent. *Corolla* hypocrateriform, lobes imbricate in the bud; *stamens* inserted in the upper part of the tube, filaments short, anthers basifixed, usually protruding from the throat. *Style* exserted, stigma spindle-shaped. *Ovary* in lower part infundibular, 2-locular, upper part ovoid, globose, 2-locular or 4-locular due to the appearance of a false septum; placentas 2, attached to the upper third of the septum, undivided throughout or bifurcating and each sending two branches into the upper part. *Infructescence* composed of numerous free somewhat fleshy *fruitlets*, the upper parts of which contain 4 hollow white cartilaginous or 4 small solid hyaline structures, if hollow then containing 1—5 mature seeds and the lower part with mature or immature seeds. *Seeds* somewhat trigonal or irregular-shaped, not winged.

Type species: *A. chinensis* (Lamk.) A. Rich. *ex* Walp.

KEY TO THE SPECIES

1a. Leaves distinctly petiolate. Upper part of ovary distinctly 4-loculed with 4 hollow cartilaginous structures . . . . . **1. A. chinensis**

b. Leaves more or less sessile. Upper part of ovary 2-loculed with 4 solid small cartilaginous structures. . . . . **2. A. macrophyllus**

1. A. chinensis (Lamk.) A. Rich. *ex* Walp. — **Fig. 1c, 2a—d.**

Cephalanthus chinensis Lamk., Encycl. Méth. 1 (1785) 678. — *A. indicus* A. Rich., Mém. Fam. Rub. (1830) 157; Mém. Soc. Hist. Nat. Paris 5 (1834) 237, *nom. illeg.* — *A. chinensis* Walp., Repert. 2 (1843) 491. — *Breonia chinensis* Capuron, Adansonia II, 13 (1973) 472, *pro parte;* Ridsdale, Blumea 22 (1975) 551, for discussion and typification. — L e c t o t y p e : *Sonnerat s.n.* (*n.v.*).

Nauclea cadamba Roxb., [Hort. Beng. (1814) 14, *nom. nud.*] Fl. Ind. ed. 1, 2 (1824) 121. — *A. cadamba* Miq., Fl. Ind. Bat. 2 (1856) 135. — *Sarcocephalus cadamba* Kurz, Fl. Burm. 2 (1877) 63. — *Samama cadamba* O.K., Rev. Gen. Pl. 1 (1891) 296. — T y p e : not indicated; probably a collection made near Calcutta (not traced).

A. morindaefolius Korth., Obs. Naucl. Ind. (1839) 20; Verh. Nat. Gesch. Ned. Bot. (1842) 154, t. 48. — T y p e : *Korthals s.n.*, Melintang, Sumatra (L).

A. cadamba Miq. var. *mollis* Koord. & Val., Bijdr. 8 (1902) 10. — S y n t y p e s : *Koorders 22699*, Kediri (*n.v.*), *6729 (n.v.)*, *6592*, Besoeki (BO, L), *6595*, Besoeki (*n.v.*).

A. indicus A. Rich. var. *glabrescens* Li, J. Arn. Arb. 25 (1944) 318. — T y p e : *Wang 7864 (n.v.)*.

D i s t r i b u t i o n : S., SW., and NW. India eastwards to New Guinea.

2. Anthocephalus macrophyllus (Roxb.) Havil.

Nauclea macrophylla Roxb., [Hort. Beng. (1814) 14, *nom. nud.*] Fl. Ind. 1, 2 (1824) 120. — *Bancalus macrophyllus* O.K., Rev. Gen. Pl. 1 (1891) 277. — *A. macrophyllus* Havil., J. Linn. Soc. Bot. 33 (1897) 23, pl. 4, figs. 32—37. — T y p e : *Roxburgh s.n.*, (*n.v.*), Cult. Hort. Calcut., provenance Ambon.

[*Nauclea elegans* Teysm. & Binnend. *ex* Hassk., Abhandl. Nat. Gesellsch. Halle 9 (1886) 190, *nom. inval.*]

D i s t r i b u t i o n : Celebes, Moluccas.

7. BURTTDAVYA Hoyle

A monotypic genus restricted to SE. tropical Africa. See Ridsdale, Blumea 22 (1975) 548—549, for generic description and synoptical account.

8. LUDEKIA Ridsd., *gen. nov.*

Arbores. *Gemmae terminales vegetativae* conicae. *Stipulae* anguste triangulares oblongo-lanceolatae, adpressae, initio conico-connatae demum separatae, caducae. *Folia* opposita. *Capitula florifera* terminalia numerosa. *Axes floriferae* 1 vel 3, singulae ramis lateralibus usque 3 paribus ramosae, modo dichasii simplicis ramosae, stipulis ad nodos bracteosis involucra aemulantibus instructis, capitula florifera initio includentibus. *Flores* 5-meri, receptaculo subsessiles; receptaculo pubescente bracteolis interfloralibus defiecientibus. *Hypanthia* libera; tubo calycis brevis, lobis spathuloideis vel elliptico-lanceolatis usque ensiformibus, corollis immaturis capitula florifera juvina brevioribus. *Corolla* hypocrateriformis usque anguste infundibularis, lobi imbricati, sed apice verrucosi. *Stamina* in parte superiore tubi inserta, filamentis brevibus, pubescentibus, antheris basifixis, introrsis, paullo e fauce protrusis. *Stylus* exsertus, stigma obovoideum, longitudinaliter 7—9 costulatis. *Ovarium* 2-loculare, placentis in tertio superiore septorum instructis ovulis pro loculo numerosis, pendulis. *Infructescentiae* capita fructorum laxa formantes, fructus endocarpio duro e basi usque ad apicem septicide et loculicide in partes 4 dehiscentes, calycis residua generaliter cum pericarpio libera. *Semina* ellipsoidea, leviter bilateraliter compressa, leviter alata.

T y p u s : *L. bernardoi* (Merr.) Ridsd.

Trees. *Terminal vegetative bud* conical. *Stipules* narrowly-triangular to oblong-lanceolate, adpressed, connate into a cone and later separating, deciduous. *Leaves* opposite. *Flowering heads* usually over 5, terminal. *Flowering axes* 1 or 3(—5), each branched with up to 3 pairs of lateral branches, branched like a simple dichasium, the lateral branches unbranched and terminated by the flowering heads, the stipules at the nodes modified into a bract-like involucrum surrounding the young flowering heads. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles absent. *Hypanthia* mutually free; calyx tube short, lobes spathuloid or elliptic-lanceolate to ensiform, in the young flowering heads shorter than the immature corollas. *Corolla* hypocrateriform to narrowly infundibular; lobes imbricate, sometimes with a conspicuous thickened apical boss; *stamens* inserted in the upper part of the tube, filaments short, pubescent, anthers basifixed, introrse, protruding from the throat. *Style* exserted, stigma obovoid with 7—9 longitudinal ridges. *Ovary* 2-locular, placentas attached to the upper third of the septum, ovules numerous, pendulous. *Infructescence* a head of loose fruitlets, these with a hard endocarp, splitting septicidally and loculicidally into 4 from base to apex, detaching with the calyx remnants; central axis, formed from the septum of the ovary, persistent, later detaching from the receptacle. *Seeds* ellipsoidal, somewhat bilaterally compressed, shortly winged at both ends.

KEY TO THE SPECIES

1a. Calyx lobes elliptic-lanceolate to ensiform, somewhat broadened at the apex, subpersistent, shaft broad. Corolla tube outside glabrous. Stipules usually glabrous. Philippines . . . . . **1. L. bernardoi**

b. Calyx lobes spathuloid, deciduous, shaft filamentous. Corolla tube outside pubescent, particularly in the upper third. Stipules usually with long scattered hairs. Borneo . . . . . **2. L. borneensis**

1. Ludekia bernardoi (Merr.) Ridsd., *comb. nov.*

Nauclea bernardoi Merr., Philip. J. Sc. 10 (1915) Bot. 101. — *Neonauclea bernardoi* Merr., J. Wash. Acad Sc. 5 (1915) 539. — Type: *For. Bur. (Bernardo) 20446 (n.v.).*

Distribution: Philippines (Luzon, Masbate, Samar, Leyte, Mindanao).

2. Ludekia borneensis Ridsd., *sp. nov.* — **Fig. 5.**

Arbores grandes usque ad 35 m altae, trunco saepius longitudinaliter sulcato vel anteridibus patentissimis instructo. *Gemmae terminales vegetativae* conicae. *Stipulae* anguste lineari usque ovato-lanceolatae, (4—)10—20 × (1—)2—4 mm, haud carinatae, dorso pilis leviter aspersae. *Folia* obovata, (4—)6—12(—14) × (2—)3.5—4.5(—6) cm, chartacea usque subcoriacea, utrinque glabra, apice acuta raro obtusa, basi acuta usque attenuata, nervis lateralibus 7—10 paribus; domatia deficientia; *petioli* glabri, (5—)10—20 mm longi. *Axes floriferae* 1—3(—5) usque ad 12 cm longae, ramulis lateralibus usque ad 4 cm longis. *Capitula florifera* subplana, anthesi per calyces 5—8 mm, per corollas 10—14 mm metientia. *Hypanthia* glabra, 0.5—0.7 mm longa; calyx 1—1.5 mm longus, parte persistenti leviter pubescente, lobis 0.7—1 mm longis, caule pubescentibus, filiformibus, parte apicali parva, spathulatis usque globosis, caducis, e parte inferiore tertio caulis caducis. *Corolla* anguste infundibularis, 5 mm longa, tubo 10—12 mm longo, lobis oblongis, extus pubescentibus, intus glabris, 1—1.5 mm longis. *Antherae* 0.7—1 mm longae. *Stylus* per 3—4 mm exsertus. *Capitula fructifera* 7—10 mm diam., *fructibus* 2—4 mm longis leviter pubescentibus; calycis residua persistentia.

Typus: *SAN 37220* (L, holo).

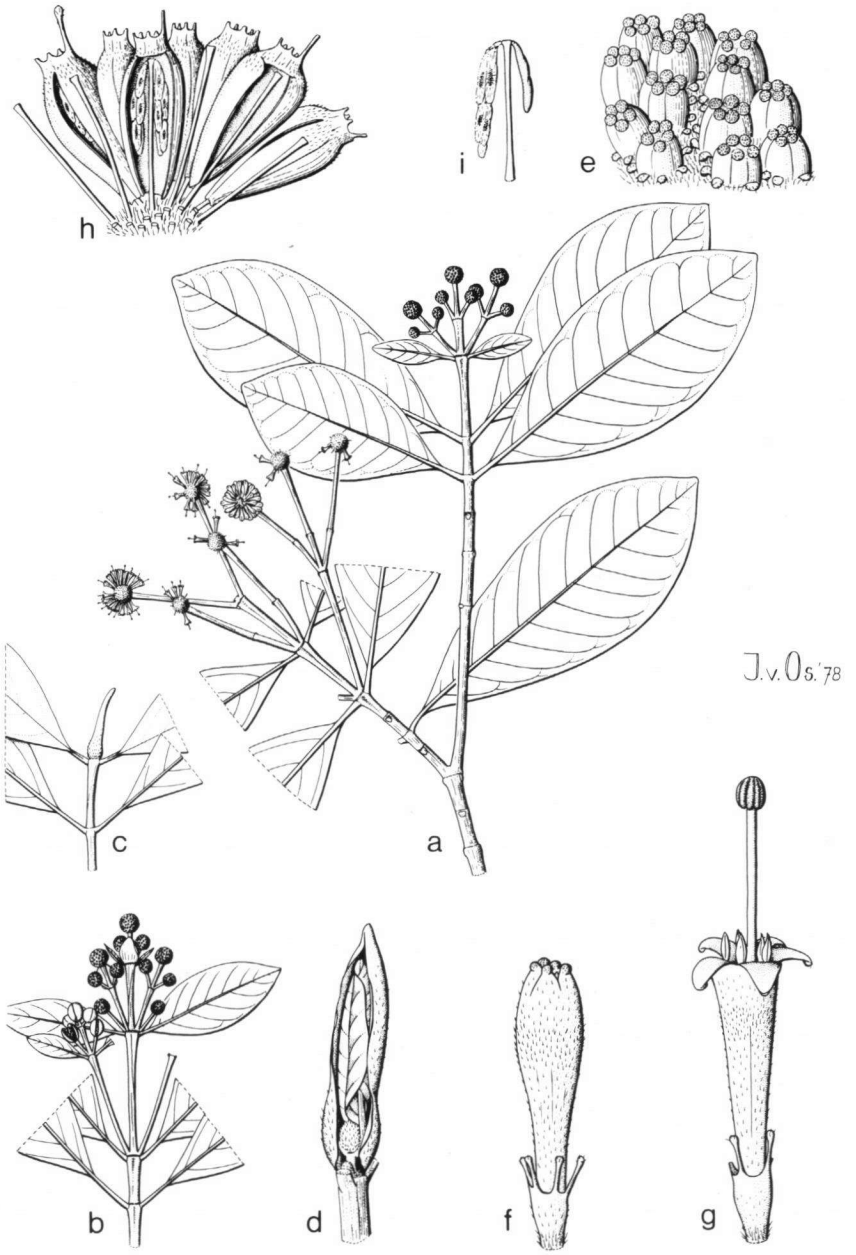

Fig. 5. *Ludekia borneensis* — a. habit, ×$\frac{1}{2}$; b. young flowering heads — note development of serial buds at 2nd node, ×$\frac{1}{2}$; c. terminal vegetative bud, ×$\frac{1}{2}$; d. idem at flush, ×7; e. immature papillate corollas, ×14$\frac{1}{2}$; f. immature flower, ×7; g. flowers at anthesis with ridged stigma, ×7; h. part of fruiting head, ×7; i. attachment of placenta and seeds, ×7. (a, f, g. *SAN 37220*; b—e. *Kostermans 6976*; h, i. *Kostermans 5501*).

Large trees attaining 35 m; bole up to 25 m, sometimes fluted or with spreading buttresses. *Stipules* narrowly linear- to ovate-lanceolate (4—)10—20 × (1—)2—4 mm, not keeled, outside with scattered long hairs. *Leaves* obovate, (4—)6—12(—14) × (2—)3.5—4.5(—6) cm, chartaceous to subcoriaceous, above and below glabrous; apex acute, rarely obtuse; base acute to atenuate; lateral nerves 7—10 pairs, glabrous, rarely pubescent, axils without domatia. *Petiole* (5—) 10—20 mm long, glabrous. *Flowering axes* 1—3(—5), up to 12 cm long, lateral axes up to 4 cm long. Diameter of mature *flowering heads* across calyces 5—8 mm, across corollas 10—14 mm. *Hypanthium* 0.5—0.7 mm long, glabrous. *Calyx* 1—1.4 mm long, glabrous, persistent part 0.3—0.5 mm, slightly pubescent; lobes 0.7—1 mm long, shaft hairy, filamentous; apical part very small, spathulate to globose, deciduous, breaking at lower third of the shaft. *Corolla* narrowly infundibular, 5 mm long, tube 4 mm, outside pubescent in the upper third, inside pubescent, particularly in the throat; lobes oblong, 1—1.5 mm long, outside pubescent, inside glabrous. *Anthers* 0.7—1 mm long. *Style* for 3—4 mm exserted. *Fruiting head* 7—10 mm diam.; *fruitlets* 2—4 mm long, slightly pubescent, crowned by calyx remnants.

Distribution: Borneo (Sarawak, Brunei, Sabah, Kalimantan).

9. NEONAUCLEA Merr.

Trees or shrubs; twigs sometimes with somewhat fusiform myrmedomous swellings. *Terminal vegetative bud* strongly flattened, rarely conical (not in Continental Asia). *Stipules* ovate, elliptic to obovate, usually with a rounded apex, or less frequently linear-oblong or narrowly triangular and then sometimes acute at apex, strongly adpressed or less frequently cohering into a cylindrical cone, deciduous or (semi-)persistent. Leaves opposite, pinnately nerved. *Flowering heads* terminal, generally 1—3, rarely 5—7. *Flowering axes* 1 or 3, unbranched, solitary or arranged like a simple dichasium, or rarely branched and each axis branched like a simple thyrse; the uppermost node(s) with stipules modified into involucre-like bracts which surround the young flowering heads and later separating, deciduous; the node below the flowering axes often bearing leaves with small dimensions. *Flowers* 5-merous, subsessile on the receptacle; receptacle usually hairy, interfloral bracteoles present or absent, if present then conical, glabrous, shiny. *Hypanthia* mutually free. *Calyx* tube short; lobes with a deciduous apical portion, lobes distinct and then attenuate into a filiform shaft, or lobes short and abruptly forming a filiform shaft; apical portion obtrigonal to spathuloid or somewhat clavate, orange or grey coloured, in the young flowering heads longer than the immature corolla, later breaking from the shaft at the apex, about the middle, or at the base. *Corolla* hypocrateriform to narrowly infundibular; lobes imbricate in the bud; *stamens* inserted in the upper part of the tube, filaments short, glabrous, anthers basifixed, introrse, partially or conspicuously protruding from the throat. *Style* exserted, stigma globose to obovoid. *Ovary* 2-locular; placentas attached to the upper third of the septum, ovules numerous, pendulous. *Infructescence* a head of loose, dehiscent *fruitlets;* these with a hard endocarp, splitting septicidally and loculicidally into 4 from base to apex and detaching with apical portion and calyx remnants; central axis, formed from septum of ovary, persisting, later detaching from the receptacle. *Seeds* ellipsoidal, somewhat bilaterally compressed, shortly winged at both ends.

Lectotype species (Bakh. *f.*, 1970): *N. obtusa* (Bl.) Merr.

KEY TO THE SPECIES OF NEONAUCLEA FROM CONTINENTAL ASIA
(* See footnotes)

1a. Interfloral bracteoles absent. In Continental Asia (but not exclusively so in Malesia) apical portion of calyx lobes conspicuously orange-coloured, papillose or microscopically finely pubescent 6
b. Interfloral bracteoles present. Apical portion of calyx lobes pallid in colour[1]), conspicuously hairy (rarely orange-coloured, but then in Malesia[2]) . . 2
2a. Diameter of flowering heads across calyces up to 8 mm, across corollas up to 15 mm, across fruiting head up to 15 mm[1]). Calyx lobes persistent without deciduous apical portion . . . . . **Diyaminauclea**
b. Diameter of flowering heads across calyces 8 mm or more, across corollas over 15 mm, across fruiting head over 15 mm[2]). Calyx lobes with a deciduous apical portion. Not in Ceylon 3
3a. Corolla lobes glabrous or with a few scattered hairs. Diameter of flowering heads across calyces up to 15 mm, across corollas usually up to 30 mm . 5
b. Corolla lobes densely sericeous. Diameter of flowering heads across calyces over 15 mm, across corollas over 30 mm 4
4a. Leaves more or less sessile. India to Vietnam. . . . . **1. N. sessilifolia**
b. Leaves distinctly petiolate. Andaman Is . . . . . **2. N. gageana**
5a. Deciduous apical portion of calyx lobes spathuloid to pyriform. S. India. **3. N. purpurea**
b. Deciduous apical portion of calyx lobes elongate-clavate. NE. India, Bhutan, Burma to China (Yunnan). . . . . **4. N. griffithii**
6a. Stipules caducous (unknown in herbarium material). Leaves (sub)coriaceous, shiny or dull above. Shrubs or trees, not rheophytic. Burma, Andaman Is., Cambodia, Thailand, Malesia . . . . . *N. **excelsa** (Bl.) Merr.
b. Stipules long-persistent. Leaves thin, pale green. Rheophytic shrubs to low trees. ?Burma, Andaman Is, Thailand, Malesia.
*N. **pallida** (Reinw. *ex* Havil.) Bakh. *f.*

1. Neonauclea sessilifolia (Roxb.) Merr.

Nauclea sessilifolia Roxb., Fl. Ind. ed. 1, 2 (1824) 124; DC., Prodr. 4 (1830) 344; Roxb., Fl. Ind. ed. 2, 1 (1832) 515; G. Don, Gen. Hist. 3 (1834) 467; Dietr., Synop. Pl. 1 (1839) 790; Steud., Nom. Bot. ed. 2, 2 (1841) 186; Drury, Handb. Ind. Fl. 1 (1864) 524; Kurz, Prelim. Rep. For. Pegu (1875) LXXVIII, 60; For. Fl. Burma 2 (1877) 65; Theobold in Mason, Burma, People & Prod. ed. 3 (1883) 405; Havil., J. Linn. Soc. Bot. 33 (1897) 51; Brandis, Ind. Tr. (1906) 368; Kanjilal & Das, Fl. Assam 3 (1939) 19; Nath, Bot. Surv. S. Shan States (1962) 159. — *Adina sessilifolia* Hook. *f.* [in Benth. & Hook. *f.*, Gen. Pl. 2 (1873) 24, *comb. illeg. in nota; ex* Brandis, For. Fl. NW. & C. India (1874) 264, *in nota*] Fl. Brit. Ind. 3 (1880) 24; Gamble, Man. Ind. Timbers ed. 2 (1902), reprint (1972) 403; Prain, Beng. Pl. 1 (1903), reprint (1963) 403; Pitard, Fl. Gén. I.-C. 3 (1922) 36. — *Neonauclea sessilifolia* Merr., J. Wash. Acad. Sc. 5 (1915) 542; Craib, Fl. Siam. En. 2 (1932) 15; How, Sunyatsenia 6 (1946) 250; Hundley & U. Chit Ko Ko, List Tr. Shr. Herbs & Climb. Burma ed. 3 (1961) 122; Anon, Ic. Corm. Sin. 4 (1975) 187, t. 5788. — T y p e : *Roxburgh s.n.*, Chittagong (*n.v.*).

*) See forthcoming treatment by Bakh. *f.*
In Malesia interfloral bracteoles are present in the following taxa:
[1]) One subspecies of *N. lanceolata* (Bl.) Merr., Philippines, New Guinea
[2]) One subspecies of *N. cyrtopoda* (Miq.) Merr., Borneo.

Nauclea sericea Wall. [Cat. 6095] *ex* G. Don, Gen. Hist. 3 (1834) 467; Steud., Nom. Bot. ed. 2, 2 (1841) 186. — T y p e : *Wallich Cat. 6095 A* (K).
Adina thanhoaensis Tran., Novit Syst. Pl. Vasc. 13 (1976) 232, plate on p. 233. — T y p e : *Takhtajan 115 (n.v.)*.

Small to medium sized trees, 7—30 m, bole 8—16 m, bark blackish, transversely fissured and cracked, inner bark brown, sometimes mottled. *Terminal vegetative bud* ellipsoidal to obovoidal, strongly flattened. *Stipules* broadly elliptic to obovate, 10—20(—30) × 5—10(—20) mm, slightly or not keeled, outside glabrous. *Leaves* elliptic to elliptic-oblong or orbicular, (5—)12—20(—30) × (3—)5—10(—15) cm, chartaceous to somewhat coriaceous, above and below glabrous; apex obtuse; base rounded, sometimes decurrent or slightly auriculate; lateral nerves 6—9, axils with domatia, these glabrous to sparsely hairy. *Petiole* 0(—5) mm long, thick, glabrous. *Flowering axes* 1—3, up to 8 cm long. Diameter of mature *flowering heads* across calyces 20—25 mm, across corollas 35—45 mm. Interfloral bracteoles 1—2(—3) mm long. *Hypanthium* 1—1.5 mm long, glabrous or with a few scattered hairs above; persistent part of *calyx* 0.5—0.8 mm long, densely pallidly hairy; lobes 5—7 mm long, shaft densely pallidly hairy, deciduous apical portion clavate, 2—3 mm long, densely pallidly hairy, summit pyramidal, dark brown to black, pubescent, hairs very short. *Corolla* hypocrateriform to narrowly infundibular, 7—10 mm long; tube 5—6 mm long, outside glabrous, at the base becoming slightly pubescent above, inside glabrous; lobes deltoid to elliptic, 2—3 mm long, inside glabrous, outside densely pallidly hairy. *Anthers* 1.5—2 mm long. *Style* for 5—6 mm exserted. *Fruiting head* (15—)25—35 mm diameter, *fruitlets* 8—10 mm long, slightly pubescent, particularly at the apex, crowned by the calyx remnants.

D i s t r i b u t i o n : India (Assam, Tripura, Manipur), Burma (Upper and Lower), Thailand (Northern, Eastern, Peninsular), Cambodia, Laos, Vietnam.

2. **Neonauclea gageana** (King) Merr.

Nauclea gageana King, J. As. Soc. Beng. 72, ii (1903) 123; Brandis, Ind. Trees (1906) 368; Parkinson, For. Fl. And. Is. (1923), reprint (1972) 186. — *Neonauclea gageana* Merr., J. Wash. Acad. Sc. 5 (1915) 540. — L e c t o t y p e : *Prain 76* (K): S y n t y p e : *King's Coll. 463* (K).

Large trees, 25—35 m, bark dark brown and fissured, inner bark pinkish turning brown on exposure, fibrous, wood yellowish brown. *Terminal vegetative bud* obovoidal, strongly flattened. Stipules obovate, *c.* 25 × 15 mm, slightly or not keeled, outside glabrous. *Leaves* (broadly) elliptic to ovate, 15—20(—30) × 9—12(—15) mm, chartaceous to subcoriaceous, above and below glabrous; apex obtuse to somewhat acute; base rounded to acute, sometimes slightly attenuate; lateral nerves 8—10, axils with domatia, these glabrous to sparsely hairy. *Petiole* 15—25 mm long, thick, black. *Flowering axes* 1 or 3, up to 6 cm long. Mature *flowering heads* with diameter across calyces 20—25 mm, across corollas 30—40 mm. Interfloral bracteoles *c.* 1 mm long. *Hypanthium* 1.5—2 mm long, densely pallidly sericeous; persistent part of *calyx* 1.5—2 mm, densely pallidly hairy; lobes 6 mm long, shaft densely sericeous, deciduous, apical part clavate, 1.5—2.5 mm long, towards the base densely sericeous, summit rounded, dark brown, sparsely pubescent, hairs short. *Corolla* hypocrateriform to narrowly infundibular, 8—9 mm long, tube 5—6

mm long, outside glabrous in the lower portion, becoming slightly pubescent above, inside glabrous to sparsely pubescent; lobes triangular to elliptic, 1.5—2 mm long, inside glabrous to sparsely pubescent, outside densely pallidly hairy. *Anthers* 1—2 mm long. *Style* for 5—6 mm exserted. *Fruiting head* not seen.

Distribution: India (Andaman Is).

3. **Neonauclea purpurea** (Roxb.) Merr.

Nauclea purpurea Roxb., Fl. Corom. 1 (1795) 41, t. 54; Willd., Sp. Pl. 1, 2 (1798) 929; Pers., Synop. Pl. 1 (1805) 201; Smith in Rees, Cyclop. 24 (1813) Nauclea sp. 2; Roxb., Hort. Beng. (1814) 14; Steud., Nom. Bot. ed. 1, 1 (1821) 123; Roxb., Fl. Ind. ed. 1, 2 (1824) 125; Spreng., Syst. Veg. 1 (1824) 750; DC., Prodr. 4 (1830) 346; Roxb., Fl. Ind. ed. 2, 1 (1832) 515; Wight. & Arn., Prodr. Fl. Ind. Or. (1834) 391; G. Don, Gen. Hist. 3 (1834) 469; Dietr., Synop. Pl. 1 (1839) 791; Graham, Cat. Pl. Bombay (1839) 87; Steud., Nom. Bot. ed. 2, 2 (1841) 186; Hassk., Cat. Pl. Hort. Bog. (1844) 114, Brandis, For. Fl. NW. & C. Ind. (1874) 262, in nota; Hook.*f.*, Fl. Brit. Ind. 3 (1880) 26; Havil., J. Linn. Soc. Bot. 33 (1897) 50; Dalgado, Fl. Goa e Savantvadi (1898) 93; Gamble, Man. Ind. Timbers ed. 2 (1902), reprint (1972) 405; Talbot, Tr. Shr. Woody Climb. Bombay Presid. ed. 2 (1902), reprint (1949) 276; Cooke, Bomb. Fl. 1 (1903) 580; Brandis, Ind. Trees (1906) 368; Haines, For. Fl. Chota Nagpur (1910) 496; Talbot, For. Fl. Bomb. 2 (1911) 89; R. Rao, Fl. Pl. Trav. (1914) 202; Haines, Bot. Bihar & Orissa 4 (1922) 422. — *Bancalus purpureus* O.K., Rev. Gen. Pl. 1 (1891) 277. — *Neonauclea purpurea* Merr., Int. Rumph. (1917) 483; Gamble & Fischer, Fl. Madras 2 (1921) 584; Blatter, J. Bomb. Nat. Hist. Soc. 36 (1933) 781; Somasundaram, Handb. For. S. States (1967) 250; K.N. Gandhi in Saldanha & Nicolson, Fl. Hassan Distr. 1 (1976) 584. — Type: *Roxburgh s.n.*, Coromandel (*n.v.*).

Nauclea elliptica Dalz. & Gibs, Bomb. Fl. (1861) 118, *p.p.*; Beddome, Icon. Pl. Ind. Or. (1874) t. 19; Fl Sylvatica (1879) cxxix, pl. 29, fig. 3 — Type: *Dalzell s.n.*, Hoolan village, Sura (*n.v.*).

Small to medium sized trees attaining 20 m; bark grey, often exfoliating in scales, inner bark yellowish, rapidly darkening on exposure, fibrous; wood yellow to pink. *Terminal vegetative bud* ellipsoidal to obovoidal, strongly flattened. *Stipules* obovate, 15—20 × 7—10 mm, slightly or not keeled, outside glabrous to slightly pubescent, particularly on the base and on the keel. *Leaves* elliptic to elliptic-oblong, 8—20 × (3—)5—10(—13) cm, chartaceous, above and below glabrous; apex acute; base obtuse to cuneate; lateral nerves 8—12 pairs, glabrous, axils with domatia, these glabrous to sparsely hairy. *Petiole* 10—20 mm long, glabrous. *Flowering axes* 1, rarely 3, up to 10 cm long. Diameter of mature *flowering heads* across calyces 8—10 mm, across corollas 20—25 mm. Interfloral bracteoles 1—1.5 mm long. *Hypanthium* 1.5—2 mm long, glabrous, less frequently the upper portion sometimes lightly pubescent; persistent part of the *calyx* 1—1.5 mm long, densely pallidly hairy, lobes 4 mm long, shaft sparsely hairy, deciduous apical portion spathuloid to pyriform, 1—1.5 mm long, mediumly to densely hairy, summit rounded to slightly pyramidal, dark brown, sparsely to mediumly pubescent, hairs short. *Corolla* infundibular 6—8 mm long, tube 5—6 mm long, outside glabrous or with a few scattered hairs, inside glabrous; lobes oblong, 1.5—2 mm long, inside glabrous, outside slightly papillose-pubescent, margin sometimes ciliate. *Anthers* 1 mm long. *Style* 7—9 mm exserted. *Fruiting head* 20—25 mm diameter, *fruitlets* 5—7 mm long with a few scattered hairs, crowned by calyx remnants.

Distribution: India (Andra Pradesh, Godaviri, Tamil Nadu, Kerala, Karnatica, Maharashtra).

Note: The original description of *Nauclea elliptica* is probably based on mixed elements. However, the type collection is described as having a round stigma. The

material later forwarded to Kew by Dalzell, representing *Ochreinauclea missionis*, cannot be considered as the type material.

4. Neonauclea griffithii (Hook. *f.*) Merr.

Adina griffithii Hook. *f.*, Fl. Brit. Ind. 3 (1880) 24; Gamble, Man. Ind. Timbers ed. 2 (1902), reprint (1972) 403; Kanjilal & Das, Fl. Assam 3 (1939) 19. — *Nauclea griffithii* Havil., J. Linn. Soc. Bot. 33 (1897) 51; Brandis, Ind. Trees (1906) 368; Hutch. in Sarg., Pl. Wils. 3 (1916) 406; Léveillé, Cat. Pl. Yunnan (1917) 247; Chung, Mem. Sci. Soc. China 1 (1924) 236; Hundley & U. Chit Ko Ko, List. Tr. Shr. Herbs & Climb. Burma ed. 3 (1961) 122. — *Neonauclea griffithii* Merr., J. Wash. Acad. Sc. 5 (1915) 540; Cowan & Cowan, Tr. N. Beng. (1929) 75; How, Sunyatsenia 6 (1946) 250; Anon., Ic. Corm. Sin. 4 (1975) 188, t. 5789. — L e c t o t y p e (Havil. 1897): *Griffith Kew Distr. 2753* (K).

Cephalanthus navillei Léveillé, Fl. Kouy Tcheou (1915) 365. — *Neonauclea navillei* Rehder, J. Arn. Arb. 16 (1935) 319; How, Sunyatsenia 6 (1946) 250. — T y p e : *Esquirol 3631* (ED).

Large trees, often buttressed, sometimes with aerial roots; bark greenish grey, vertically fissured and cracked, sometimes warty, inner bark pale brown to pink. *Terminal vegetative bud* ellipsoidal to obovoidal, flattened. *Stipules* obovate to obovate-oblong, 5—10 × 3—8 mm, slightly keeled, outside glabrous. *Leaves* obovate, less frequently elliptic (8—)10—18(—22) × (4—)6—10(—15) cm, chartaceous to subcoriaceous, above and below glabrous; apex rounded to obovate; base acute to cuneate, frequently attenuate; lateral nerves 5—7 pairs, glabrous, axils with domatia, these glabrous. *Petiole* 1—2 cm long, thick, glabrous. *Flowering axes* 1 or 3, up to 2—4(—6) cm long. Diameter of mature *flowering heads* across calyces 8—12 mm, across corollas 25—30 mm. Interfloral bracteoles 0.5—1 mm long. *Hypanthium* 1—1.5 mm long, glabrous in the lower 2/3, above pallidly pubescent; persistent part of the *calyx* 1 mm long, densely pallidly hairy; lobes 3.5—4.5 mm long, shaft densely pallidly hairy, deciduous apical portion elongate, clavate, 1.5—2 mm long, densely pallidly hairy, summit pyramidal, pallid, glabrous. *Corolla* narrowly infundibular to hypocrateriform, 7—11 mm long, tube 7—8 mm long, outside glabrous, inside glabrous to sparsely pubescent; lobes oblong, 2—3 mm long, inside and outside glabrous. *Anthers* 1 mm long. *Style* for 5—6 mm exserted. Diameter across *fuiting head* 20 mm, *fruitlets* 5—6 mm long, pubescent, particularly at apex, crowned by calyx remnants.

D i s t r i b u t i o n : India (W. Bengal, Assam, Meghalaya), Bhutan, Burma (Upper), China (Kweichow, Yunnan).

EXCLUDED FROM NEONAUCLEA

Transferred or reduced to **Adinauclea:**
N. fagifolia Merr.

Transferred or reduced to **Diyaminauclea:**
N. zeylanica Merr.

Transferred or reduced to **Gyrostipula:**
N. foveolata Capuron.

Transferred or reduced to **Janotia:**
N. macrostipula Capuron.

Transferred or reduced to **Ludekia:**
N. bernardoi Merr.

Transferred or reduced to **Myrmeconauclea:**
N. strigosa Merr., *N. rheophila* Steen.

Transferred or reduced to **Uncaria:**
N. formosana Merr.

10. MYRMECONAUCLEA Merr.

Shrubs, mostly rheophytic, rarely trees, twigs sometimes with myrmedomous swellings. *Terminal vegetative bud* strongly flattened. *Stipules* elliptic to ovate-oblong, adpressed, deciduous or semi-persistent. *Leaves* opposite. *Flowering heads* solitary, terminal on an unbranched *flowering axis* with one or several nodes, terminal node with a pair of bract-like stipules surrounding the young flowering head. Young flowering heads with free hypanthia and calices (*cf. Neonauclea*), later becoming connate at the apex of the hypanthia and base of the calices. *Flowers* 5-merous, subsessile on the receptacle; receptacle more or less glabrous, interfloral bracteoles absent. *Calyx* tube short, divided almost to the base; lobes free, apical portion obclavate to obtrigonal, deciduous, in the young flowering heads longer than the immature corollas, shaft filiform, semi-persistent. *Ovary* 2-locular; placentas attached to the upper third of the septum, ovules numerous, pendulous. *Style* exserted, stigma globose. Individual *cocci* of young fruits fused into a pseudosyncarp (externally appearing as in *Nauclea*), connate by upper part of the hypanthium, with age these tissues break apart to form a head of loose cocci (*cf. Neonauclea*). *Seeds* winged, with a long ventral tail over 5 times the length of central portion.

Type species: *M. strigosa* (Korth.) Merr.

KEY TO THE SPECIES OF MYRMECONAUCLEA

1a. Stipules and young stems densely hairy, rarely finely pubescent. Apical portion of calyx lobes obturbinate, usually strikingly orange- or pallid-coloured, papillose, rarely greyish but then somewhat papillose, or rarely nearly glabrous and not conspicuously papillose. . . . . **1. M. strigosa**

b. Stipules and young stems glabrous, rarely slightly pubescent. Apical portion of calyx lobes obclavate to obturbinate, or turbinate, dirty brown to greyish in colour 2

2a. Leaves narrowly obovate-lanceolate, apex acute to slightly acuminate. Flowering axis without conspicuous subpersistent stipules below the terminal node. Diameter of flowering heads across calyces 6—10 mm, across corollas 20—30 mm. Diameter across fruiting head 11—14 mm. Anambas Is **2. M. rheophila**

b. Leaves obovate-oblong, apex long-acuminate. Flowering axis with up to 3 pairs of conspicuous subpersistent stipules below the terminal node. Stipules of vegetative shoot subpersistent. Diameter of flowering heads across calyces 10—12 mm, across corollas *c.* 30 mm. Diameter across fruiting head 20—30 mm. Borneo. . . . . **3. M. stipulacea**

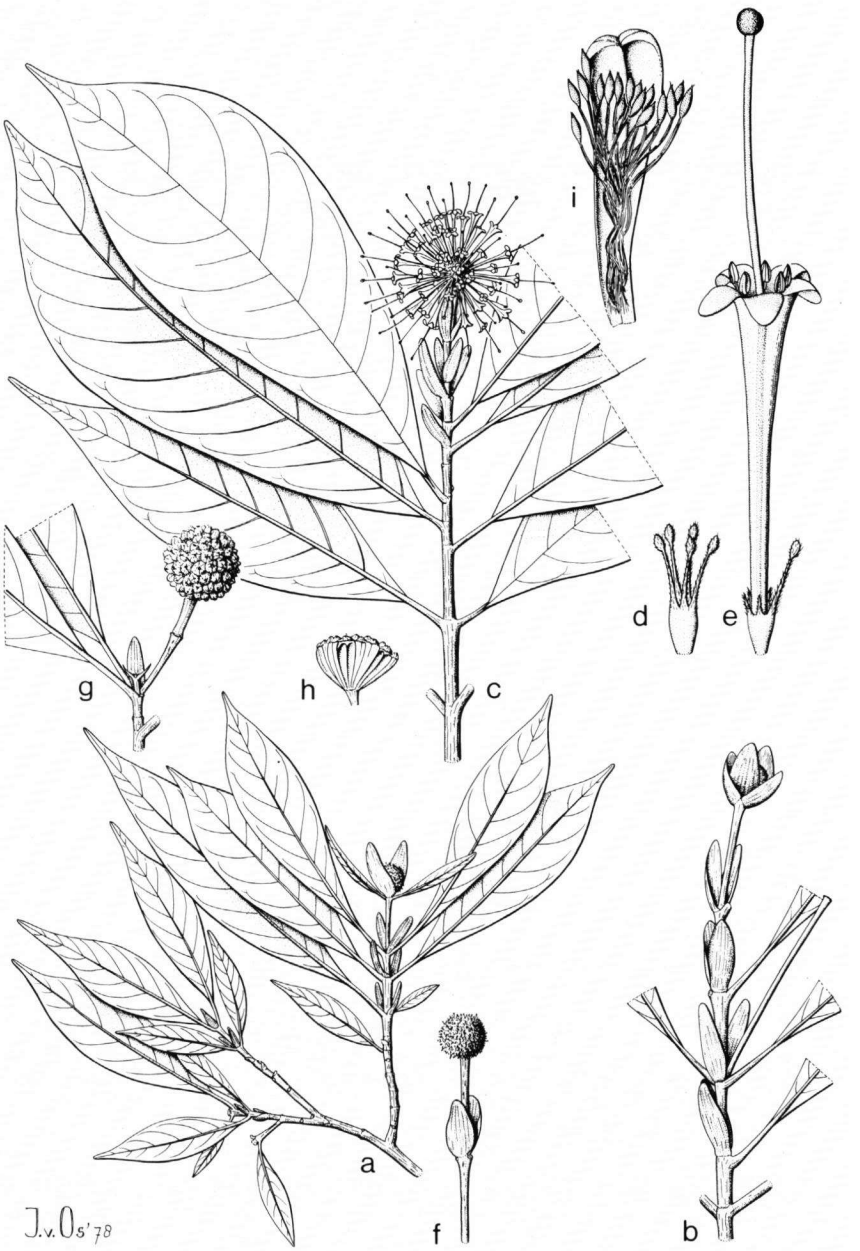

Fig. 6. *Myrmeconauclea stipulacea* — a. habit, × ½; b. part of shoot bearing a young flowering head, × ½; c. shoot with a flowering head, × ½; d. calyx, × 3½; e. flower at anthesis with detached calyx lobes, × 3½; f. old flowering head with majority of calyx lobes detached, × ½; g. pseudosyncarp, × ½; h. idem in section, × ½; i. seeds, × 3½. (a, b, g—i. *Clemens 30936*; c—f. *Clemens 32895*).

1. Myrmeconauclea strigosa (Korth.) Merr.

Nauclea strigosa Korth., Verh. Nat. Gesch. Ned. Bot. (1840) 157. — *Neonauclea strigosa* Merr., J. Wash. Acad. Sc. 5 (1915) 542. — *M. strigosa* Merr., Philip. J. Sc. 17 (1920) 375. Type: *Korthals s.n.* (L). *Sarcocephalus fluviatilis* Elm., Leafl. Philip. Bot. 4 (1912) 1357. — Type: *Elmer 12848* (L).

Distribution: Borneo, Philippines (Palawan).

2. Myrmeconauclea rheophila (Steen.) Ridsd., *comb. nov.*

Neonauclea rheophila Steen., Bull. Jard. Bot. Buitenz. III, 12 (1932) 200. — *Nauclea rheophila* Steen., o.c. 201, *nom. alt. in text.* — Lectotype: *Van Steenis 685* (BO, K). — Syntype: *Henderson SFN 20102* (BO, K).

Distribution: Anambas Is.

3. Myrmeconauclea stipulacea Ridsd., *sp. nov.* — Fig. 6.

Frutices vel arbores. *Gemma vegetativa terminalis* haud observata. *Stipulae* semipersistentes, elliptico-usque ovato-oblongae, 10—20 × 3—6 mm, haud carinatae, dorso glabrae. *Folia* obovato-oblonga, (6—)10—20(—25) × (1—)4—7(—10) cm, chartacea, utrinque glabra, subtus in sicco brunnescentia, apice longe acuminata, basi obtusa usque cuneata, interdum paullo attenuata, nervis lateralibus 7—10-paribus; domatia interdum praesentia, glabra; *petioli* glabri, (5—)10—25 mm longi. *Capitula florifera* terminalia, solitaria, axi florifera 3—6 cm, nodos usque 4 praebente, nodo apicali stipula 2 bracteas aemulante instructo, bracteis ipsis ovatis usque ad 15 × 10 mm, glabris, capitula florifera juvenilia includentibus, nodis inferioribus efoliatis stipula interdum bracteosa gerentibus. Capitula florifera subplana, anthesi per calyces 10—12 mm, per corollas 30 mm metientia. *Hypanthia* glabra, 1 mm longa; *calyx* 3.5—4.5 mm longus, usque ad basim divisus, lobis 3.5—4.5 mm longis, caducis, appendiculatis, parte apicali dilatato e parte superiore tertio caulis, obclavatis usque obturbinatis, pubescentibus, caule pubescente, 2.3—3.5 mm longo. *Corolla* hypocrateriformis, glabra, tubo 10—12 mm longo, lobis oblongis, extus glabris, 3 × 1—1.5 mm *Antherae* 1—1.5 mm longae, paullo e fauce corollae protrusae. *Stylus* per 6—10 mm exsertus; stigma globosum, 1—1.5 mm longum. *Capitula fructifera* 20—30 mm diam., *fructibus* 10—12 mm longis. *Semina* alata, ala ventrali longe caudata.

Small understorey shrubs or trees. *Terminal vegetative bud* not seen. *Stipules* semipersistent, elliptic to ovate-oblong, 10—20 × 3—6 mm, not keeled, outside glabrous. *Leaves* obovate-oblong, (6—)10—20(—25) × (1—)4—7(—10) cm, chartaceous, above and below glabrous, below drying light brown; apex long-acuminate; base obtuse to cuneate, sometimes slightly attenuate; lateral nerves 7—10 pairs, above and below glabrous; domatia sometimes present in axils, glabrous. *Petiole* (5—)10—25 mm long, glabrous. *Flowering axis* 3—6 cm long, bearing up to 4 nodes, bract-like stipules ovate, up to 10 × 10 mm, glabrous, the lower nodes leafless, bearing stipules or bract-like stipules. Diameter of mature flowering head across calyces 10—12 mm, across corollas 30 mm. *Hypanthium* 1 mm long, glabrous; *calyx* 3.5—4.5 mm long, divided to the base; lobes 3.5—4.5 mm long, appendiculate; swollen apical portion detaching from the upper third of the shaft, obclavate to obturbinate, pubescent; shaft 2.5—3.5 mm long, pubescent. *Corolla* hypocrateriform, 13—15 mm long; tube 10—12 mm long, glabrous; lobes oblong, 3 × 1—1.5 mm long, outside glabrous. *Anthers* 1—1.5 mm long, protruding from the corolla throat. *Style* for 6—10 mm exserted, stigma 1—1.5 mm. *Fruiting head* 20—30 mm diameter, *fruitlets* 10—12 mm long.

Distribution: Borneo (Sabah).

11. DIYAMINAUCLEA Ridsd., *gen. nov.*

Arbores mediocres vel grandes. *Gemmae terminales* valde complanatae. *Stipulae* ellipticae usque obovatae, adpressae, caducae. *Folia* opposita. *Capitula florifera* terminalia, 3(—9). *Axes floriferae* solitariae vel 3, modo dichasii simplicis ramosi, vel casu plus 3 capitulorum floriferum modo thyrsi simplicis ramosi, nodis superioribus stipulis bracteosis involucra aemulantibus instructis, capitula florifera juvenila includentibus diutius longitudinaliter separatis, caducis. *Flores* 5-meri receptaculo subsessiles; receptaculo pubescente, bracteolis interfloralibus conicis, nitidis, glabris. *Hypanthia* libera, calycis lobis elliptico-oblongis, persistentibus. *Corolla* hypocrateriformis usque anguste infundibularis, lobi imbricati. *Stamina* in parte superiore tubi inserta; filamentis brevibus, glabris; antheris basifixis, introrsis, paullo e fauce protrusis. Stylus exsertus, stigma globosum. *Ovarium* 2-loculare, placentis in tertio superiore instructis, ovulis pro loculo numerosis, pendulis. *Infructescentiae* capita fructorum laxa formantes; *fructus* endocarpio duro e basi usque ad apicem septicide et loculicide in partes 4 dehiscentes, calycis residua uno cum pericarpio libera, sed axi centrali ovarii persistente formanta demum libera. *Semina* ovoidea, bilateraliter compressa, leviter alata.

Monotypicus.

Medium to large sized trees. *Terminal vegetative bud* strongly flattened. *Stipules* elliptic to obovate, adpressed, caducous. *Leaves* opposite. *Flowering heads* 3(—9), terminal. *Flowering axes* 1 or 3 and branched like a simple dichasium, or if more than 3 flowering heads then branched like a simple thyrse; the uppermost nodes with stipules modified into involucre-like bracts, these surrounding the young flowering heads and later separating longitudinally, deciduous. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles conical, glabrous, shiny. *Hypanthia* mutually free; *calyx* lobes elliptic-oblong, persistent. *Corolla* hypocrateriform to narrowly infundibular, lobes imbricate. *Stamens* inserted in the upper part of the corolla tube; filaments short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted; stigma globose, smooth. *Ovary* 2-locular, placentas attached to the upper third of the septum, ovules numerous, pendulous. *Infructescence* a head of loose dehiscent *fruitlets;* these with a hard endocarp, splitting septicidally and loculicidally into 4 from the base to apex and detaching with the calyx remnants; central axis formed from the septum of the ovary persisting, later detaching from the receptacle. *Seeds* ovoidal, bilaterally compressed, short-winged at both ends.

Diyaminauclea zeylanica (Hook. *f.*) Ridsd., *comb. nov.* — **Fig. 7.**

[*Nauclea triflora* Moon, Cat. Pl. Ceylon (1824) 14, *nom. nud.*]. — *Nauclea pedunculatis* Thw., En. Pl. Zeyl. (1859) 137, *non* Wall. *ex* G. Don, 1834; Beddome, Icon. Pl. Ind. Or. (1874) 57, t. 235; Fl. Sylvat. (1879) cxxix. — *Nauclea zeylanica* Hook. *f.*, Fl. Brit. Ind. 3 (1880) 26; Havil., J. Linn. Soc. Bot. 33 (1897) 50. — *Bancalus zeylanicus* O.K., Rev. Gen. Pl. 1 (1891) 227. — *Neonauclea zeylanica* Merr., J. Wash. Acad. Sc. 5 (1915) 542; Wortington, Ceylon Trees (1959) 295. — Type: *Thwaites 2820* (B.M.).

Trees, sometimes attaining 40 m; bark cracked, inner bark mottled, wood brown. *Terminal vegetative bud* ellipsoidal. *Stipules* elliptic to slightly obovate, 5—10 × 2—4 mm, sometimes slightly keeled, outside glabrous to sparsely pubescent, particularly on the keel and veins. *Leaves* elliptic to elliptic-oblong, sometimes slightly obovate, (5—)7—10(—15) × (1.5—)2—3(—5) cm, chartaceous, above and below glabrous; apex acute to acuminate, base obtuse to cuneate; lateral nerves 6—8 pairs,

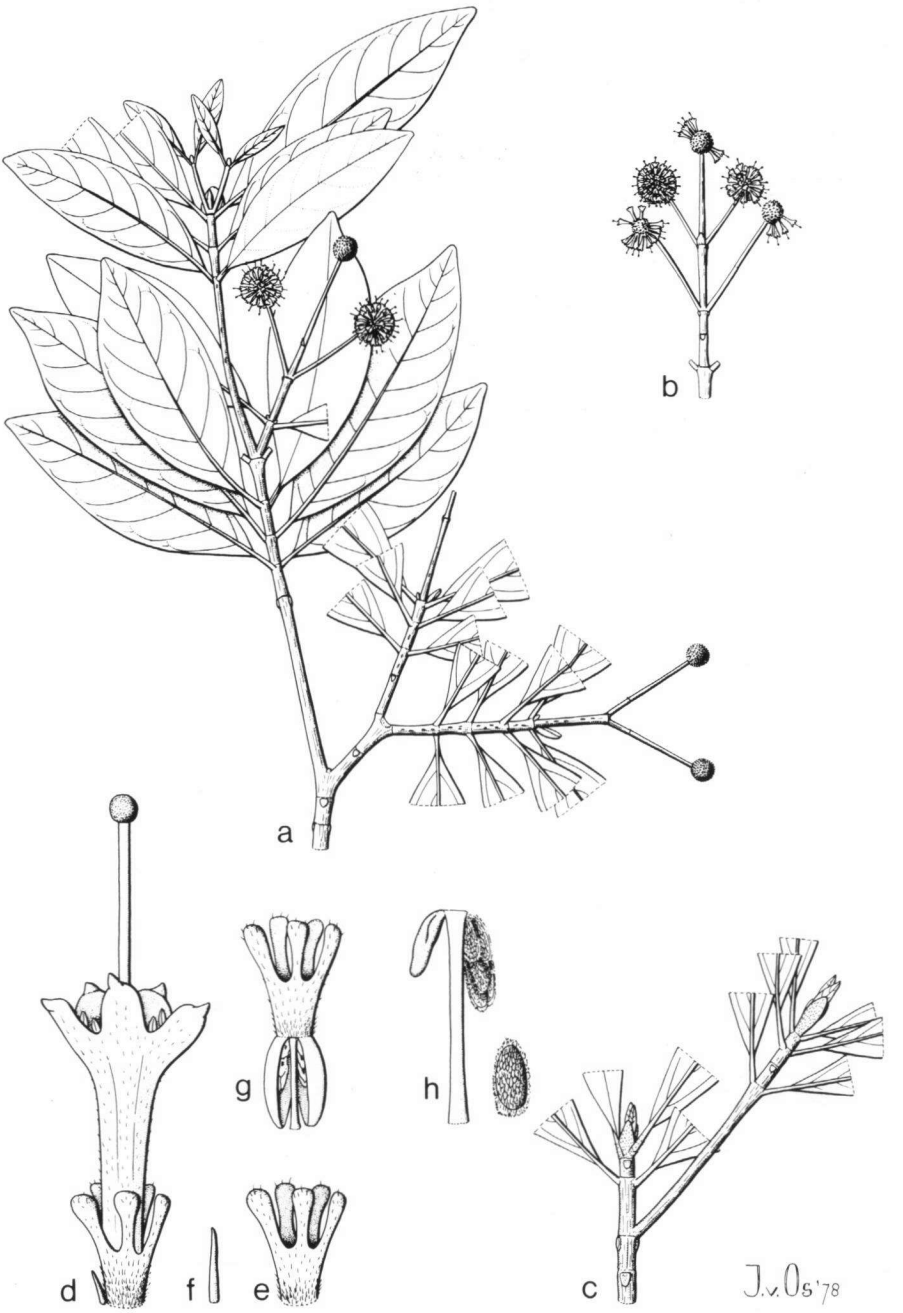

Fig. 7. *Diyaminauclea zeylanica* — a. habit, $\times \frac{1}{2}$; b. group of flowering heads, $\times \frac{1}{2}$; c. terminal vegetative buds, $\times 1$; d. flower at anthesis with bracteole, $\times 7$; e. calyx, $\times 7$; f. bracteole, $\times 14\frac{1}{2}$; g. fruitlet, $\times 7$; h. attachment of placenta, $\times 14\frac{1}{2}$; i. seed, $\times 14\frac{1}{2}$. (a, b, d—f. *Worthington 4201*; c. *Worthington 3593*; g—i. *Worthington 4209*).

axils with domatia, these sparsely hairy. *Petiole* 5—15 mm long, glabrous. *Flowering axes* 1—3, up to 4 cm long. Diameter of mature *flowering heads* across calyces 5—7 mm, across corollas 12—14 mm. Interfloral bracteoles *c.* 0.5 mm. long. *Hypanthium* 0.5 mm long, glabrous; *calyx* 0.5—0.8 mm long, pallidly hairy, lobes 0.8—1.2 mm long, apical portion trigonal-spathulate. *Corolla* 4—5 mm long, tube 3—4 mm long, outside pallidly pubescent in upper third, below glabrous, inside glabrous; lobes elliptic, 1—1.3 mm long, inside glabrous or with a few scattered hairs, outside pallidly pubescent. *Anthers* 0.8 mm long. *Style* for 2.5—3.5 mm exserted. Diameter across *fruiting head* 8—10 mm; fruitlets 2.5—3 mm long, slightly pubescent, crowned by the calyx remnants.

Distribution: Ceylon.

12. KHASIACLUNEA Ridsd., *gen. nov.*

Arbores parvae vel mediocres. *Gemmae terminales vegetativae* valde complanatae. *Stipulae* ellipticae, adpressae, caducae. *Folia* opposita *Capitula florifera* terminalia, 3—7. *Axes* floriferae solitariae, raro 3, modo thyrsi simplicis ramosi, nodis superioribus stipulis bracteosis involucra aemulantibus instructis. *Flores* 5-meri, receptaculo subsessiles; receptaculo pubescente, bracteolis interfloralibus filiformis usque filiformi-clavatis. *Hypanthia* libera, tubo calycis brevis, lobis parvis, obtusis, persistentibus. *Corolla* hypocrateriformis usque infundibularis, lobi imbricati. *Stamina* in parte superiore tubi inserta, filamentis brevibus, glabris, *antheris* basifixis, introrsis, paullo e fauce protrusis. *Stylus* exsertus, stigma globosum. *Ovarium* 2-loculare, placentis in tertio superiore septorum instructis, ovulis pro loculo 10—20, pendulis. *Infructescentiae* capita fructorum laxa formantes; *fructus* endocarpio duro e basi usque ad apicem septicide et loculicide in partes 4 dehiscentes, calycis residua cum pericarpio libera, sed axi centrali ovarii persistente formanta demum libera. *Semina* ovoidea usque tricornuta, bilateraliter compressa, leviter alata.

Monotypicus

Small to medium sized trees. *Terminal vegetative bud* strongly flattened. *Stipules* elliptic, adpressed, caducous. *Leaves* opposite. *Flowering heads* 3—7, terminal. *Flowering axes* 1 (or 3) branched like a simple thyrse, the uppermost nodes with stipules modified into involucre-like bracts, these surrounding the young flowering heads and later separating longitudinally, deciduous. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles filiform to filiform-clavate. *Hypanthia* mutually free; *calyx* tube short, lobes small, obtuse, persistent. *Corolla* hypocrateriform to narrowly infundibular, lobes imbricate. *Stamens* inserted in the upper part of the tube; *filaments* short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted, stigma globose, smooth. *Ovary* 2-locular, placentas attached to the upper third of the septum. *Ovules* 10—20, pendulous. *Infructescence* a head of loose dehiscent fruitlets; these with a hard endocarp, splitting septicidally and loculicidally into 4 from base to apex and detaching with the calyx remnants; central axis formed from the septum of the ovary persisting, later detaching from the receptacle. *Seeds* ovoidal to tricornute, bilaterally compressed, shortly winged at both ends.

Khasiaclunea oligocephala (Havil.) Ridsd., *comb. nov.* — **Fig. 8.**

Adina oligocephala Havil., J. Linn. Soc. Bot. 33 (1897) 46; Brandis, Ind. Trees (1906) 368; Kanjilal & Das, Fl. Assam 3 (1939) 22; Hundley & U Chit Ko Ko, List Tr. Shr. Herbs and Climb. Burma ed. 3 (1961) 122. — Type: *Griffith, Kew Distr. 2751* (K).

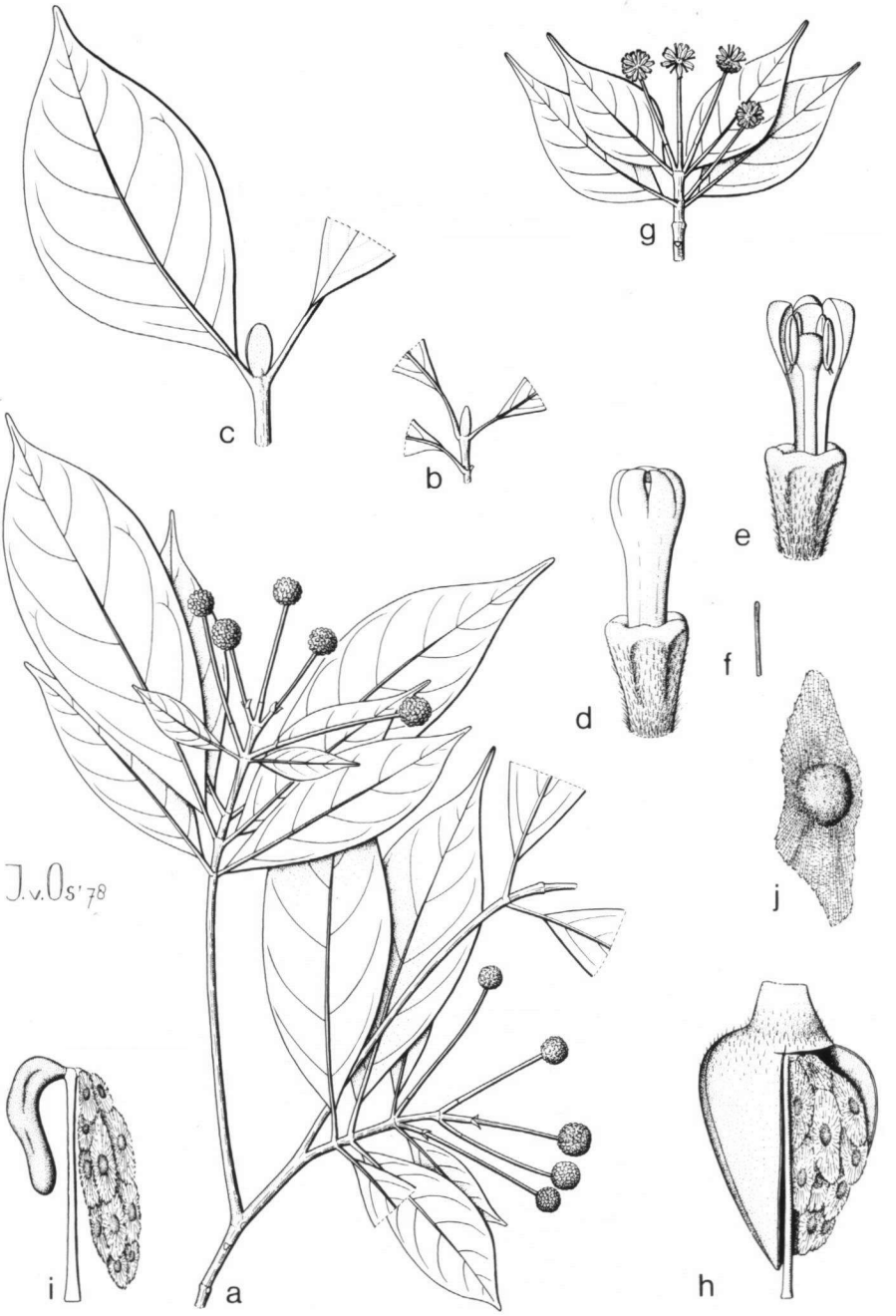

Fig. 8. *Khasiaclunea oligocephala* — a. habit, × ½; b, c. terminal vegetative bud, both × ½; d, e. flowers, e. partly dissected, both × 7; f. bracteole, × 14½; g. fruiting heads, × ½; h. fruitlet partly dissected, × 7; i. attachment of placenta and seeds, × 7; j. seed, × 14½. (a. b. *Griffith, Kew Distr. 2751*; c. *Parkinson 4999*; j. k. *Koelz 24776*).

Terminal apical bud ellipsoidal, flattened. *Stipules* (3—)5—10(—15) × (2—)4—7 mm, slightly keeled, glabrous to sparsely pubescent, particularly on the keel. *Leaves* elliptic to elliptic-oblong, sometimes slightly obovate-oblong, (4—)8—12(—18) × (2.5—)3.5—5.5(—7) cm, chartaceous, above and below glabrous; apex acute to long-acuminate, base acute to cuneate, rarely decurrent; lateral nerves 4—7 pairs, axils with domatia, these sparsely hairy. *Petiole* 5—20(—30) mm long, glabrous. *Flowering axes* up to 8 cm long. Diameter of mature *flowering heads* across calyces 5—7 mm, across corollas 12—15 mm. Interfloral bracteoles up to 2.5 mm long; *hypanthium* 0.7—1 mm long, below sparsely hairy, above densely pallidly hairy; *calyx* 1.3 mm long, inside glabrous, outside sparsely pallidly hairy, lobes 0.3 mm long, slightly farinose-papillose, somewhat ochraceous. *Corolla* 3—5 mm long, tube 3—4 mm long, inside and outside glabrous; lobes elliptic, 1—1.5 mm long, conspicuously thickened along the longitudinal axis, apex with a thickened boss, conspicuous in the bud, outside somewhat ochraceous-farinose. *Anthers* 1 mm long *Style* for 3—4 mm exserted. Diameter across *fruiting head* (8—)10—15 mm; *fruitlets* 3—5 mm long, pubescent, calyx remnants inconspicuous.

Ecology: Reported to grow on limestone.

Distribution: India (Assam, Meghalaya, Manipur), Burma (Upper), probably also China.

Note: *Khasiaclunea* in many respects is intermediate between *Neonauclea* and *Adina s.l.* The flattened stipules, imbricate corolla lobes, and the mode of dehiscence of the fruit resemble *Neonauclea*. The form of the calyx which lacks a caducous apical part, the presence of filiform interfloral bracteoles, and the form of the seeds resemble *Adina s.l.* This combination of characters places the taxon in a rather isolated position in any of the established genera. Therefore, I have raised it to generic status. The name is derived from an anogram of Khasia and *Nauclea*. Superficially it is remarkably similar to *Diyaminauclea zeylanica*, particularly in vegetative characteristics, but this species has conical interfloral bracteoles, so far only otherwise known in *Neonauclea*, and persistent elliptic-oblong calyx lobes.

13. ADINAUCLEA Ridsd., *gen. nov.*

Arbores grandes. *Gemmae terminales vegetativae* complanatae. *Stipulae* ovato-ellipticae, raro obovatae, adpressae, caducae. *Folia* opposita. *Capitula florifera* terminalia, 1 vel 3. *Axes floriferae* 1 vel 3, modo dichasii simplicis ramosi, stipulis ad nodos parvis, bracteas aemulantibus, capitula florifera haud includentibus. *Flores* 5-meri, receptaculo subsessiles; receptaculo pubescente, bracteolis interfloralibus spathulatis usque spathulato-clavatis. *Hypanthia* libera, tubo calycis brevis, lobis elliptico-oblongis, parte apicali caduco deficiente. *Corolla* infundibularis, lobi valvati sed apice subimbricati. *Stamina* in parte superiore tubi inserta, filamentis brevibus, glabris, *antheris* basifixis, introrsis, paullo e fauce protrusis. *Stylus* exsertus, stigma globosum. *Ovarium* 2-loculare, placentis in tertio superiore septorum instructis, ovulis pro loculo usque ad 10, pendulis. *Infructescentiae* capita fructorum laxa formantes; *fructus* endocarpio duro e basi usque ad apicem septicide et loculicide in partes 4 dehiscentes; calycis residua generaliter cum pericarpio libera, sed axi centrali ovarii persistente formanta demum libera. *Semina* ovoidea, bilateraliter compressa.

Monotypicus.

Large trees. *Terminal vegetative bud* flattened. *Stipules* ovate-elliptic, rarely obovate, adpressed, caducous. *Leaves* opposite. *Flowering heads* 1 or 3, terminal. *Flowering axes* 1 or 3, arranged like a simple dichasium, the uppermost nodes with

stipules modified into bracts; these apparently not surrounding the young flowering heads. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles spathulate to spathulate-clavate. *Hypanthia* mutually free; *calyx* tube short, lobes elliptic-oblong without deciduous apical part. *Corolla* infundibular, lobes valvate but subimbricate at the apex; *stamens* inserted in the upper part of the tube, filaments short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted, stigma globose, smooth. *Ovary* 2-locular; placentas attached to the upper third of the septum, ovules up to 10, pendulous. *Infructescence* a head of loose *fruitlets*; these with a hard endocarp splitting septicidally and loculicidally into 4 from base to apex and detaching with calyx remnants; central axis formed from the septum of the ovary persistent, later detaching from the receptacle. *Seeds* ovoidal, bilaterally compressed.

Adinauclea fagifolia (Teysm. & Binnend. *ex* Havil.) Ridsd., *comb. nov.*

{*Ulassium mas* Rumph., Herb. Ambon. 3 (1743) 45, t. 23].
Nauclea fagifolia Teysm. & Binnend., [Cat. Hort. Bog. (1866) 117, *nom. nud.*] *ex* Havil., J. Linn. Soc. Bot. 33 (1897) 63. — *Neonauclea fagifolia* Merr., J. Wash. Acad. Sc. 5 (1915) 539. — *Adina fagifolia* Val. *ex* Merr., Int. Rumph. (1917) 481. — Type: *Teysmann s.n.* (BO, L).

Distribution: Celebes, Moluccas.

14. METADINA Bakh. *f.*

Medium sized to large trees. *Terminal vegetative bud* pyramidal to conical. *Stipules* deltoid to narrowly triangular, obvolute, deciduous. *Leaves* opposite. *Flowering heads* terminal, numerous. *Flowering axes* 1—3, each branched like a compound thyrse, stipules at the various nodes bract-like, not surrounding the young flowering heads. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles filiform to filiform-clavate. *Hypanthia* mutually free; *calyx* tube short, lobes elliptic oblong, persistent, without a deciduous apical portion. *Corolla* hypocrateriform to narrowly infundibular, lobes in the bud valvate but subimbricate at the apex; *stamens* inserted in the upper part of the tube, filaments short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted; stigma globose to clavate, smooth. *Ovary* 2-locular; placentas attached to the upper third of the septum, ovules 4—12 per locule, pendulous. *Infructescence* a head of loose, dehiscent *fruitlets;* these with a hard endocarp splitting septicidally and loculicidally into 4 from base to apex; calyx remnants attached to the central axis formed from the septum of the ovary, not usually detaching with the fruit wall, remaining attached to the central axis, persistent, later detaching. *Seeds* trigonal, slightly bilaterally compressed, not winged.

Monotypic.

Metadina trichotoma (Zoll. & Mor.) Bakh. *f.*

Nauclea polycephala Wall. [Cat. 6100] *ex* G. Don, Gen. Hist. 3 (1834) 467, *nom. illeg., non* A. Rich (1830). — *Adina polycephala* Benth., Fl. Hongkong (1861) 146. — Type: *Wallich Cat. 6100* (K). [*Nauclea microcephala* Wall. *ex.* Voigt., Hort. Sub. Calcut. (1845) 375, *pro syn.* — *Nauclea capitellata* Voigt., l.c., *nom. nud.*] — *Nauclea trichotoma* Zoll. & Mor., Syst. Verz. (1846) 61. — *Adina polycephala*

var. *macrophylla* Hook.*f.*, Fl. Brit. Ind. 3 (1880) 25. — *Adina trichotoma* Benth. & Hook.*f. ex* Hook.*f.* & Jackson, Ind. Kew. 1 (1895) 346. — *M. trichotoma* Bakh.*f.*, Taxon 19 (1970) 472. — T y p e : *Zollinger 613* (L).

Cephalanthus aralioides Zoll. & Mor., Syst. Verz. (1846) 61. — *Nauclea aralioides* Miq., Fl. Ind. Bat. 2 (1856) 346. — *Adina polycephala* var. *aralioides* Miq. o.c. 344, in note. — T y p e : *Zollinger 1509* (L).

Adina zschokkei Elm., Leafl. Philip. Bot. 3 (1911) 987. — T y p e : *Elmer 12176* (L).

Adina parvula Geddes, Kew Bull. Misc. Inf. (1928) 10. — T y p e : *Winit 657* (K).

Adina polycephaloides Craib, Kew Bull. Misc. Inf. (1931) 209. — T y p e : *Winit 675* (K).

Adina polycephala var. *noe* Craib, Fl. Siam. En. 2 (1932) 10. — T y p e : *Noe 16486 (n.v.)*.

D i s t r i b u t i o n : India (Meghalaya, Assam, Manipur), Burma (Upper & Lower), Thailand (Northern, Northeastern, Eastern, Peninsular), Cambodia, Vietnam (Annam), Malay Peninsula, Sumatra, Java, Borneo, Philippines.

EXCLUDED FROM METADINA

Transferred to **Pertusadina:**

M. multifolia Ridsd.

15. SINOADINA Ridsd., *gen. nov.*

Arbores parvae vel mediocres. *Gemmae terminales vegetativae* haud observatae. *Stipulae* anguste triangulares, obvolutae, caducae. *Folia* opposita. *Capitula florifera* terminalia, generaliter 7—11. *Axes floriferae* solitariae, raro 3, modo thyrsi simplicis ramosi, stipulis ad nodos parvis, bracteas aemulantibus, capitula florifera initio haud includentibus. *Flores* 5-meri receptaculo subsessiles; receptaculo pubescente, bracteolis interfloralibus filiformis usque filiformi-clavatis. *Hypanthia* libera, tubo calycis brevis, lobis obtusis, persistentibus, parte apicali caduco deficiente. *Corolla* hypocrateriformis usque anguste infundibularis, lobi valvati sed apice subimbricati. *Stamina* in parte superiore tubi inserta, filamentis brevibus, glabris, *antheris* basifixis, introrsis, paullo e fauce protrusis. *Stylus* exsertus, stigma obovoideus. *Ovarium* 2-loculare, placentis in tertio superiore septorum instructis, ovulis pro loculo 4—12, pendulis. *Infructescentiae* capita fructorum laxa formantes; *fructus* endocarpio duro e basi usque ad apicem septicide et loculicide in partes 4 dehiscentes; calycis residua generaliter initio haud uno cum pericarpio libera, sed exi centrali ovarii persistente formata adhaerentia, denum libera. *Semina* trigona usque tricornuta, leviter bilateraliter compressa, exalata.

M o n o t y p i c u s .

Small to medium sized trees. Mature *terminal vegetative bud* not seen. *Stipules* narrowly triangular, obvolute, rarely present on herbarium specimens. *Leaves* opposite. *Flowering heads* generally 7—11, terminal, *flowering axes* 1, rarely 3, branched like a simple thyrse; stipules at the nodes bract-like, not surrounding the young flowering heads. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles filiform to filiform-clavate. *Hypanthia* mutually free; *calyx* tube short, lobes obtuse, persistent, without a deciduous apical portion. *Corolla* hypocrateriform to narrowly infundibular, lobes valvate but subimbricate at the apex; *stamens* inserted in the upper part of the tube, filaments short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted, stigma obovoid, smooth. *Ovary* 2-locular; placentas attached to the upper third of the septum, ovules 4—12 per locule, pendulous. *Infructescence* a head of loose *fruitlets*, these with a hard endocarp, splitting septicidally and loculicidally into 4 from base to apex, calyx remnant not usually detaching with the fruitwall, remaining attached to the central axis; this persisting, later detaching. *Seeds* trigonal to tricornute, slightly bilaterally compressed, not winged.

Sinoadina racemosa (Sieb. & Zucc.) Ridsd., *comb. nov.*

Nauclea racemosa Sieb. & Zucc., Abh. Bayer Akad. Wiss. Math. Phys. Cl. 4 (1846) 178; Nakai, Tr. Shr. Japan ed. 2, 1 (1927) 513, f. 234; Masam., Mem. Fac. Sc. Agric. Tachoku Imp. Univ. 11 (1934) 416. — *Adina racemosa* Miq., Ann. Mus. Bot. Lugd. Bat. 3 (1867) 184; Maxim., Mel. Biol. 9 (1873) 270; Franchet & Savatier, En. Pl. Japan. 1 (1875) 206; Forbes & Hemsley, J. Linn. Soc. Bot. 23 (1888) 370; Havil., J. Linn. Soc. Bot. 33 (1897) 43; Makino, Bot. Mag. Tokyo 14 (1900) 127; Pritzel, Bot. Jahrb. 29 (1901) 580; Dunn & Tutcher, Kew Bull. Misc. Inf. Add. Ser. 10 (1912) 124; Makino, Index Pl. Japan (1912) 584; Hayata, Ic. Pl. Form. 2 (1912) 79; Hutch. in Sarg., Pl. Wils. 3 (1916) 390; Hayata, Ic. Pl. Form. 9 (1920) 52; Nakai, Tr. Shr. Japan ed. 1, 1 (1922) 130; Chung, Mem. Sc. Soc. China 1 (1924) 235; Rehder, J. Arn. Arb. 16 (1935) 319; Lee, For. Bot. China (1935) 950, pl. 271; Hand.-Mazz., Symb. Sin. 7 (1936) 1017; How, Sunyatsenia 6 (1946) 240; Hara, En. Sperm. Japan 2 (1952) 1; Steward, Man. Vasc. Pl. Lower Yangtse (1958) 366; Liu, Illustr. Native & Intro. Lign. Pl. Japan 2 (1962) 1097, pl. 916; Li, Woody Fl. Taiwan (1963) 846, f. 340; Ohwi, Fl. Japan (1965) 823; Hatusima, Fl. Ryukyus (1971) 568; Anon., Ic. Corm. Sin. 4 (1975) 184, t. 5782. — Type: *Siebold Cat. no. 601* (L, holo).

Nauclea taiwaniana Hayata, J. Coll. Sc. Univ. Tokyo 30 (1911) 139; Icon. Pl. Form. 2 (1912) 79; o.c. 9 (1919) 51. — Type: *Kawakami 1654 (n.v.).*

Nauclea transversa Hayata, J. Coll. Sc. Univ. Tokyo 30 (1911) 139; Ic. Pl. Form. 2 (1912) 80. Type: *Nagasawa 601 (n.v.).*

Cornus esquirolii Léveillé, Fedde Rep. Sp. Nov. 13 (1914) 257; Fl. Kouy-Tchéou (1914) 116, Lauener, Notes Royal Bot. Gdn. Edinb. 32 (1972) 97, 103. — Type: *Esquirol 407 (n.v.).*

Adina indivisa Lace, Kew Bull. Misc. Inf. (1915) 115; Hundley & U. Chit Ko Ko, List Tr. Shr. Herbs. & Climb. Burma ed. 3 (1961) 122. — Syntypes: *Lace 5262, 5852, 6151; Maung Po Kyaw 34* (all K).

Adina mollifolia Hutch. in Sarg., Pl. Wils. 3 (1916) 391; Léveillé, Cat. Pl. Yunnan (1917) 244; Chung, Mem. Sc. Soc. China 1 (1924) 235; How, Sunyatsenia 6 (1946) 242. — Type: *Henry 11888* (K).

Adina asperula Hand.-Mazz., Sitzgsanz. Akad. Wiss. Wien 58 (1921) 232; Lee, For. Bot. China (1935) 948; Hand.-Mazz., Symb. Sin. 7 (1936) 1018; How, Sunyatsenia 6 (1946) 239. — Type: *Ten 218 (n.v.).*

Adina nobilis Geddes, Kew Bull. Misc. Inf. (1928) 240; Craib, Fl. Siam. En. 2 (1932) 9. — Type *Kerr 5767* (K).

Trees, 4—12 m. Immature *terminal vegetative bud* pyramidal to conical. *Stipules*, (5—)10—15 × 2—5 mm, not keeled, glabrous to slightly pubescent. *Leaves* broadly ovate to ovate-oblong, less frequently elliptic, (4—)9—15(—25) × (3—)5—10(—18) cm, chartaceous, above glabrous or less frequently sparsely hairy, below glabrous to pubescent; apex acute to acuminate; base cordate to obtuse, sometimes unequal; lateral nerves 6—12 pairs, glabrous to sparsely hairy, axils and sometimes axils of tertiary nerves with domatia, these glabrous to densely hairy. *Petiole* (1—)3—6(—8) cm long, glabrous to pubescent. *Flowering axis* up to 15 cm long. Diameter of mature *flowering heads* across calyces 4—7 mm, across corollas 15—20 mm. Interfloral bracteoles 0.7—1.5 mm long. *Hypanthium* 0.7—1 mm long, densely pallidly villous; *calyx* 1—1.5 mm long, densely finely villous, lobes 0.5 mm long. *Corolla* 5—7 mm long, tube (3—)4—5 mm long, outside densely pallidly puberulous, inside pubescent; lobes deltoid, 0.5—1 mm long, inside puberulous along the midrib, outside densely finely woolly puberulous. *Anthers* 0.7—1 mm long. *Style* for 4—6 mm exserted. Diameter across *fruiting head* 11—15 mm, *fruitlets* 5—7 mm long, sparsely hairy.

Distribution: Japan (Shikoku, Kyushu, Ryu Kyu Is.), Taiwan, China (Kwangtung, Kwangsi, Kweichow, Chekiang, Kiangsu, Anhwei, Hupeh, Yunnan, Szechuan), Thailand (Northeastern), Burma (Upper).

16. PERTUSADINA Ridsd., *gen. nov.*

Arbores grandes, trunco saepius longitudinaliter sulcato vel pertuso. *Gemmae terminales vegetativae* conicae. *Stipulae* anguste triangulares, interdum ipso apice filiformes bifidae, obvolutae, caduceae. *Folia* opposita. *Capitula florifera* lateralia, raro terminalia. *Axes floriferae* solitariae vel 3, modo dichasii simplicis ramosae, vel haud ramosae, raro formae thyrsi simplicis formatae, stipulis ad nodos parvis, bracteas aemulantibus, capitula florifera initio includentibus. *Flores* 4—5-meri, in receptaculo pubescenti subsessiles, bracteolis interfloralibus spathulatis usque filiformi-spathulatis. *Hypanthia* libera, tubo calycis brevis, lobis obtusis, deltoideis usque elliptico-oblongis, persistentibus, parte apicali caduco deficiente. *Corolla* hypocrateriformis usque anguste infundibularis; lobi valvati, sed apice subimbricati. *Stamina* in parte superiore tubi inserta, filamentis brevibus, glabris, *antheris* basifixis, introrsis, paullo e fauce protrusis. *Stylus* exsertus; stigma globosum usque obovoideum. *Ovarium* 2-loculare, placentis in tertio superiore instructis, ovulis pro loculo usque ad 10, pendulis. *Infructescentiae* capita fructorum laxa formantes; *fructus* endocarpio duro, e basi usque ad apicem septicide et loculicide in partes 4 dehiscentes; calycis residua generaliter initio haud uno cum pericarpis libera, sed axi ovarii persistente formata adhaerentia, demum libera. *Semina* ovoidea usque trigona, paullo bilateraliter compressa, laeviter alata.

Typus: *P. eurhyncha* (Miq.) Ridsd.

Large trees, boles often fluted or latticed, rarely shrubs. *Terminal vegetative bud* conical. *Stipules* narrowly triangular, sometimes filiformly bifid at ultimate apex, obvolute, deciduous. *Leaves* opposite. *Flowering heads* lateral, rarely terminal (particularly on shorter shoots). *Flowering axes* solitary or 3, unbranched or branched like a simple dichasium rarely like a simple thyrse; stipules at the nodes small, bract-like, not surrounding the young flowering heads. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles spathulate to filiform-spathulate. *Hypanthia* mutually free; *calyx tube* short, lobes obtuse, deltoid to elliptic-oblong, persistent, without deciduous apical portion. *Corolla* hypocrateriform to narrowly infundibular; lobes in the bud valvate but subimbricate at the apex; stamens inserted in the upper part of the tube, filaments short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted, stigma globose to obovoidal. *Ovary* 2-locular; placentas attached to the upper third of the septum, ovules up to 10 per locule, pendulous. *Infructescence* a head of loose *fruitlets;* these with a hard endocarp splitting septicidally and loculicidally into 4 from base to apex; calyx remnants not usually detaching with fruit wall, remaining attached to the central axis formed from the septum of the overy this persisting, later detaching. *Seeds* ovoidal to trigonal, slightly bilaterally compressed, slightly winged.

KEY TO THE SPECIES

1a. Corolla tube and lobes densely mealy pubescent; calyx lobes short, deltoid to obtuse. Diameter of flowering heads across corollas over 10 mm. Malay Peninsula to New Guinea 3
b. Corolla tube and lobes not densely mealy pubescent; calyx lobes deltoid to linear-oblong. Diameter of flowering heads across corollas where known up to 10 mm (or c. 15 mm and then in China). 2
2a. Corolla lobes sparsely hairy; calyx lobes deltoid to elliptic-oblong. Stipules of unfolding bud filiformly bifid at apex. Malay Peninsula to Borneo. **1. P. eurhyncha**
b. Corolla lobes glabrous; calyx lobes linear-oblong. Stipules of unfolding bud entire or rarely slightly notched at apex. Continental Asia. **2. P. hainanensis**

3a. Flowering axis mealy pubescent. Corolla tube c. 4 mm. Malay Peninsula **3. P. malaccensis**

b. Flowering axis glabrous. Corolla tube less than 3 mm. Philippines to New Guinea . . . . . **4. P. multifolia**

1. Pertusadina eurhyncha (Miq.) Ridsd., *comb. nov.* — **Fig. 1f.**

Uncaria eurhyncha Miq., Sum. (1860), reprint (1862) 539. — T y p e : *Teysmann s.n.*, Djebus, Banka (K, L).
Nauclea oxyphylla Miq., o.c. 538. — T y p e : *Teysmann s.n.*, Kebang, Lampong, Sumatra (K, L).
Adina rubescens Hemsl., J. Bot. 35 (1887) 204. — — T y p e : *Wray 539* (K).
Adina minutiflora Val., Icon. Bogor. 4 (1914) 273, t. 390. — T y p e : *Van Rossum s.n.*, Billiton (L).

D i s t r i b u t i o n : Malay Peninsula, Sumatra, Borneo.

2. Pertusadina hainanensis (How) Ridsd., *comb. nov.*

Adina hainanensis How, Sunyatsenia 3 (1946) 240, f. 29; Anon., Ic. Corm. Sin. 4 (1975) 185, t. 5784. — T y p e : *How 73659 (n.v.)*.
Adina affines How, o.c. 239, f. 28. — T y p e : *Chun 10036 (n.v.)*.
Adina polycephala Benth. var. *glabra* How, o.c. 246. — L e c t o t y p e : *Tso 20919* (K).
Adina pubicostata auct. non Merr.: How, o.c. 246.
Adina metcalfii Merr. *ex* Li, J. Arn. Arb. 24 (1943) 454. — T y p e : *W. T. Tsang 27683* (A).

Shrub to large tree attaining 30 m. *Stipules* linear-oblong to subulate, 4—6 × 1—2 mm, in unfolding bud entire, rarely notched at apex, not keeled, glabrous. *Leaves* elliptic to elliptic-oblong, (4—)7—10(—12) × (1.5—)2—3(—3.5) cm, chartaceous, above and below glabrous or pubescent; apex acuminate; base cuneate; lateral nerves 7—10 pairs, below glabrous, departing from the midrib at an angle of 20°—40°(—50°), axils with domatia, these glabrous to sparsely hairy; tertiary and ultimate nerves not conspicuously raised. *Petiole* 3—10(—25) mm, glabrous or pubescent. *Flowering axes* solitary and unbranched or less frequently branched like a simple dichasium, 2.5—5 cm long. Diameter of mature *flowering heads* across calyces 6—8 mm, across corollas about 15 mm. Interfloral bracteoles filiform-clavate to filiform-spathuloid, 0.5—1 mm long, shaft ciliate. *Hypanthium* glabrous to sparsely hairy, usually with long hairs at the base, 0.5—0.7 mm long; *calyx* 1.5—2 mm long, inside and outside sparsely hairy, tube short or almost absent, lobes linear-oblong, 1.2—1.6 mm long. *Corolla* hypocrateriform, 3—3.5 mm long, tube 2—2.5 mm long, inside and outside glabrous, lobes deltoid, 0.7—1 mm long. *Anthers* 0.8—1 mm long. *Style* for 7—8 mm exserted, stigma obovoid. Diameter across *fruiting head* 4—6 mm, *fruitlets* 1.5—2.5 mm long, sparsely pubescent.

D i s t r i b u t i o n : China (Hainan, Kwangtung), Hongkong.

N o t e : How had not seen the type specimen of *A. pubicostata* and included pubescent material of *P. hainanensis* under *A. pubicostata. Pételot 3751* bears deeply bifid reduced stipules on the flowering axis whilst in *Tsang & Fung 573* the stipules from the same positions are entire. Although the material previously referred to *A. affinis*, *A. metcalfii*, *A. polycephala* var *glabra* shows minor differences, I believe that only one species is involved. In *Adina pilulifera* stipules are nearly always present in herbarium specimens; *P. hainanensis* is usually easily separable from this species by the lack of stipules.

Fig. 9. *Pertusadina malaccensis* — a. habit, × ½; b, c. terminal vegetative bud, both × 3½; d. bract of first node below flowering head, × 3½; e. bracteole, × 14½; f. young corolla and bracteole, × 7; g. corolla showing pubescence, × 7; h. idem in section, × 7. (all *Henderson SFN 23813*).

3. Pertusadina malaccensis Ridsd., *spec. nov.* — Fig. 9.

Arbores usque ad 30 m altae. *Gemmae terminales vegetativae* conicae. *Stipulae* anguste triangulares, 5—9 × 2—3.5 mm, haud carinatae, glabrae, caducae. *Folia* elliptica usque leviter obovata, 7—15 × 3—6 cm, chartacea, utrinque glabra, apice acuminata, basi cuneata interdum leviter decurrentia, nervis lateralibus 6—9 paribus a costa angulo 30—50(—55)° abeuntibus; domatia pubescentia; petioli 10—20 mm longi. *Axes floriferae* solitariae, haud ramosae, 3—8 mm longae. *Capitula florifera* subplana anthesi per calyces 4—5 mm, per corollas 12—15 mm metientia. Flores receptaculo subsessila, bracteolis interfloralibus filiformibus usque filiformi-clavatis, 0.5 mm longis, caulea ciliatis. *Hypanthia* dense pubescentia, 0,5 mm longa; *calyx* extus glabra, intus dense pubescens, tubo brevi vel nullo, lobis 4 deltoideis utrinque glabris 0.2–0.3 mm longis. *Corolla* hypocrateriformis usque anguste infundibularis, extus dense farinosa, intus leviter pubescens, 5—6 mm longa, tubo 4 mm longo, lobis 4 deltoideis 0.3—0.5 mm longis. *Antherae* 0.8 mm longae. *Stylus* per 4—5 mm exsertus. *Capitula fructifera* 10—12 mm diam., *fructibus* 2—4 mm longis.

Typus: *SFN (Henderson) 23813* (L; iso K).

Trees, up to 30 m. Stipules narrowly triangular, 5—9 × 2—3.5 mm, not keeled, glabrous. *Leaves* elliptic to slightly obovate, 7—15 × 3—6 cm, chartaceous, above and below glabrous; apex acuminate; base cuneate, sometimes slightly decurrent; lateral nerves 6—9 pairs, below glabrous, departing from the midrib at an angle of 30°—50°(—55°), axils with domatia, these hairy. *Petiole* 10—20 mm long. *Flowering axis* solitary, unbranched, 3—8 cm long, mealy pubescent. Diameter of mature *flowering heads* across calyces 4—5 mm, across corollas 12—15 mm. Interfloral bracteoles filiform to filiform-clavate, 0.5 mm long, shaft ciliate. *Hypanthium* densely pallidly hairy, 0.5 mm long; *calyx* 0.5 mm long, outside glabrous, inside densely hairy, tube short to absent, lobes 4, deltoid, 0.2—0.3 mm long, outside and inside glabrous. *Corolla* hypocrateriform to narrowly infundibular, outside densely mealy pubescent, inside slightly pubescent, 5—6 mm, tube 4 mm, lobes 4, deltoid, 0.3—0.5 mm long, outside densely mealy pubescent, inside slightly pubescent along the midrib. *Anthers* 0.8 mm long. *Style* for 4—5 mm exserted. *Fruiting head* 10—12 mm diam, *fruitlets* 2—4 mm long.

Distribution: Peninsular Thailand (Surat Thani), Malay Peninsula.

4. Pertusadina multifolia (Havil.) Ridsd., *comb. nov.*

[*Adina polycephala auct. non* Benth.: F.-Vill., Novis. App. (1880) 104].

Adina multifolia Havil., J. Linn. Soc. Bot. 33 (1897) 45; Elmer, Leafl. Philip. Bot. 1 (1906) 13 (as '*multiflora*'). — *Metadina multifolia* Ridsd., Gard. Bull. Sing. 25 (1970) 250. — Type: *Vidal 2948* (K, holo).

Adina garciae Elm., Leafl. Philip. Bot. 3 (1911) 986. — Type: *Elmer 12051* (L, iso).

Distribution: Philippines, Moluccas, New Guinea.

17. ADINA Salisb.

Shrubs or small trees. *Terminal vegetative bud* inconspicuous, loosely surrounded by the stipules. *Stipules* narrowly triangular, deeply bifid over 2/3 of the length, more or less free, somewhat persistent. *Leaves* opposite. *Flowering heads* terminal or lateral, or both. *Flowering axes* 1—3, unbranched, or branched like a simple dichasium, or like a simple thyrse, stipules at the nodes small, bractlike, not surrounding the young flowering heads. *Flowers* (4- or) 5-merous, sub-

sessile on the receptacle; receptacle hairy, interfloral bracteoles linear to linear-spathulate. *Hypanthia* mutually free; *calyx* tube short, lobes filiform to filiform-clavate or spathulate, persistent, without deciduous apical portion. *Corolla* hypocrateriform to infundibular, lobes in bud valvate, subimbricate at the apex; *stamens* inserted in the upper part of the tube, filaments short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted, stigma globose. *Ovary* 2-locular; placentas attached to the upper third of the septum; ovules up to 4 per locule, pendulous. *Infructescence* a head of loose *fruitlets*, these with a hard endocarp splitting septicidally and loculicidally into 4 from base to apex; calyx remnants not usually detaching with the fruit wall, remaining attached to the central axis formed from the septum of the ovary, this persisting and later detaching. *Seeds* ovoidal to trigonal, bilaterally flattened, slightly winged particularly apically.

Type species: *A. globiflora* Salisb.

KEY TO THE SPECIES

1a. Flowering heads strictly lateral, rarely terminal. Leaves petiolate **1. A. pilulifera**

b. Flowering heads terminal, or predominantly terminal and also lateral. Leaves petiolate or sessile 2

2a. Flowering heads solitary, flowering axis unbranched. Leaves sessile. China, Korea . . . . . **2. A. rubella**

b. Flowering heads (1—)3—7, flowering axis branched like a simple thyrse. Leaves petiolate. Thailand. . . . . **3. A. dissimilis**

1. **Adina pilulifera** (Lamk.) Franchet *ex* Drake — **Fig. 1d, 3h**

Cephalanthus pilulifera Lamk., Enc. Méthod. Bot. 1 (1785) 678. — *A. pilulifera* Franchet *ex* Drake, Morot J. de Bot. 9 (1895) 207; Merr., Lign. Sc. J. 5 (1927) 173; Rehder & Wilson, J. Arn. Arb. 8 (1927) 196; Lee, Forest Bot. China (1935) 949; Hand.-Mazz., Symb. Sinica 8 (1936) 1018; Beih. Bot. Centralbl. 57 (1937) 464; How, Sunyatsenia 6 (1946) 242; Hara, En. Sperm. Jap. 2 (1952) 1; Ohwi, Fl. Japan (1965) 823; Horikawa, Atlas Jap. Fl. (1972) 350; Anon., Ic. Corm. Sin. 4 (1975) 185, t. 5783. — Type: *Sonnerat s.n.* (P-LA).

A. globiflora Salisb., Parad. Lond. (1807) t. 115; DC., Prodr. 4 (1830) 349; G. Don, Gen. Hist. 3 (1834) 472; Benth., Fl. Hongk. (1861) 146; Hemsl., J. Linn. Soc. Bot. 23 (1888) 370; Havil., J. Linn. Soc. Bot. 33 (1897) 44; Shirasawa, Ic. Ess. For. Jap. 2 (1908) t. 72, f. 11—20; Matsumara, Ind. Pl. Japan 2 (1912) 584; Dunn & Tutcher, Kew Bull. Misc. Inf. Add. Ser. 10 (1912) 124; Chung, Mem. Sc. Soc. China 1 (1924) 235; Chittenden, Dict. Gard. 1 (1951) 48. — *Nauclea adina* Smith in Rees, Cycl. 24 (1813), *nom. illeg.*; Steud., Nom. Bot. ed. 1, 1 (1821) 550; Lindl., Bot. Reg. 11 (1825) t. 895; Spreng., Syst. Veg. 4 (1827) Cur. Post. 80 — Type: *J. Robertson s.n.*, Wampu (Whampoa), Canton, China (BM).

Nauclea adinoides Lindl., Bot. Reg. 11 (1825) t. 895, *nota in text;* Spreng., Syst. Veg. 4 (1827) Cur. Post. 80. — *Nauclea peduncularis* DC., Prodr. 4 (1830) 349, *nom. illeg.*; *N.* '*pedunculata*' Benth., Fl. Hongk. (1861) 146. — Type: not indicated.

A. globiflora auct. non Salisb.: Maxim in Engl., Bot. Jahrb. 6 (1885) 67. — *A. globiflora* var. *macrophylla* Nak. in Nak. & Koidz., Tr. Shr. Japan ed. 2 (1927) 511, f. 533; Masamune, Prel. Rep. Veg. Yak. (1929) 121; Mak. & Nem., Fl. Japan ed. 2 (1931) 1121. — *Nauclea nipponica* Masamune, Mem. Fac. Sc. & Agric. Taihoku Imp. Univ. 11 (1934) 415. — Type: *Tachiro s.n.*, Kiushu (*n.v.*).

A. globiflora var. *tonkinensis* Pitard, Fl. Gén. I.-C. 3 (1922) 39. — *Adina pilulifera* var. *tonkinensis* Merr. *ex* Li, J. Arn. Arb. 25 (1944) 317. — Syntypes: *Bon s.n.*, Ninh-Binh, Tonkin; *Simond*

s.n., Long-Tcheou, Tonkin; *Harmand s.n.*, between Hue and Mekong R., Annam; *Eberhardt s.n.*, Hai-mit, Annam; *Poilane s.n.*, Phu-son, Annam (all P).

A. pubicostata Merr., J. Arn. Arb. 21 (1942) 385. — Type: *Pételot 3571* (P).

Cephalanthus orientalis auct. non L. (1753): Osbeck, Dagbok Ostind. Resa (1757) 221, 242; L., Syst. Nat. ed. 10 (1759) 887. — *Nauclea orientalis auct. non* L. (1762): L., Gen. Pl. ed. 6 (1764) 90 no. 223. — *A. orientalis* Lindeman [Ark. f. Bot. 9 (1909) 16, *nom. prov.*] *ex* Bakh. *f.*, Taxon 19 (1970) 476; Hansen & Maule, Bot. J. Linn. Soc. 67 (1973) 202, pl. 5. — Type: *Osbeck s.n. Savage Cat. 226, 1* (LINN), lectotype by Bakh. *f.* of *Cephalanthus ortentalis* L. rejected.

Small to large shrubs, rarely small trees, 1—4(—10) m. *Terminal vegetative bud* ill defined, loosely surrounded by the spreading stipules. *Stipules* (2—)3—6(—10) × (1.5—)2—4(—6) mm, glabrous to sparsely pubescent. *Leaves* elliptic to elliptic-lanceolate, or sometimes obovate-oblong to obovate-lanceolate (1.5—)4—10(—15) × (0.5—)1.5—2.5(—4) cm, chartaceous, above glabrous, below glabrous or sometimes sparsely pubescent; apex acute to acuminate; base obtuse to cuneate, sometimes attenuate; lateral nerves 6—12 pairs, departing from the midrib at an angle of (35°—)45°—60°, axils with domatia, these sparsely hairy. *Petiole* 2—6(—10) mm long, glabrous or pubescent. *Flowering heads* strictly lateral, rarely terminal on shorter shoots. *Flowering axis* solitary, unbranched, (1.5—)2—4(—5) cm long. Diameter of mature *flowering heads* across calyces 4—6 mm, across corollas 8—12 mm. Interfloral bracteoles linear to linear-clavate, 1.3—1.8 mm long, glabrous. *Hypanthium* 0.5—1 mm, with hairs at the base and a few scattered hairs in the upper portion. *Calyx* 1.2—2 mm long, tube almost absent, lobes clavate to spathulate, 1—1.8 mm long, glabrous or with a few scattered hairs. *Corolla* 3—5 mm long, tube 2—3 mm long, inside and outside glabrous; lobes deltoid, 0.5 mm long, inside glabrous, outside somewhat glandular to slightly farinose. *Anthers* 0.5—1 mm long. *Style* for 3—5 mm exserted. Stigma small, globose to obovoidal. Diameter across *fruiting head* (6—)8—10 mm; *fruitlets* 2—4 mm long, glabrous or with a few scattered hairs.

Distribution: Japan (Kyushu), China (Kwangtung, Hainan, Kwangsi, Fukun, Kungesi, Chekiong, Kweichow, Shensi), Hongkong, N. & S. Vietnam.

2. Adina rubella Hance

A. rubella Hance, J. Bot. 6 (1868) 114; Maximowicz, Mel. Biol. 9 (1873) 270; Bull. Acad. Sc. St. Petersb. 19 (1874) 286; Hemsl., J. Bot. 14 (1876) 208; J. Linn. Soc. Bot. 23 (1888) 371; O. Kuntze, Rev. Gen. Pl. 1 (1891) 276; Havil., J. Linn. Soc. Bot. 33 (1897) 44; Pritzel, Bot. Jahrb. 29 (1901) 580; Pamp., Nuovo Giornale Bot. Ital. N.S. 17 (1910) 718; Dunn & Tutcher, Kew Bull. Misc. Inf. Add. Ser. 10 (1912) 124; Hutch. in Sarg., Pl. Wils. 3 (1916) 390; Nakai, Fl. Sylv. Korea 14 (1923) 89, t. 20; Chung, Mem. Sc. Soc. China 1 (1924) 235; Rehder & Wils., J. Arn. Arb. 8 (1927) 196; Lee, Forest Bot. China (1935) 950; Hand.-Mazz., Symb. Sin. 7 (1936) 1018; Beih. Bot. Centralbl. 56 (1937) 464; Rehder, J. Arn. Arb. 18 (1937) 247; How, Sunyatsenia 6 (1946) 248; Anon., Ic. Corm. Sin. 2 (1975) 186, t. 5786. — Type: *Sampson & Hance 11229* (K).

A. fauriei Léveillé, Fedde Rep. Sp. Nov. 8 (1930) 283. — Lectotype: *Taquet 1366* (K). — Syntype: *Faurie 701 (n.v.)*.

Small shrub, 1—3(—6) m high. *Terminal vegetative bud* ill defined, loosely surrounded by the spreading stipules. *Stipules* 2—3 × 1.5—2 mm, sparsely pubescent. *Leaves* ovate-oblong to ovate-lanceolate, (1.5—)2—3.5(—5) × (0.5—)1—1.5(—2) cm, chartaceous, above and below glabrous to sparsely pubescent; apex acute to acuminate; base obtuse to rounded; lateral nerves 5—7 pairs, departing

from the midrib at an angle of 60—85°, sparsely to densely pubescent; axils with domatia, these sparsely to densely hairy. *Petiole* 0(—1) mm long. *Flowering heads* strictly terminal or both terminal and lateral. *Flowering axis* terminal, solitary, unbranched, 2—5 cm long. Diameter of mature *flowering heads* across the calyces 4—5 mm, across the corollas 10—12 mm. Interfloral bracteoles linear to linear-clavate, 1—1.5 mm long, shaft and apical portion with a few scattered hairs. *Hypanthium* sparsely pubescent, 0.5 mm long; *calyx* 1—1.25 mm long, tube short or almost absent, lobes spathulate to spathulate-clavate, sparsely pubescent. *Corolla* 3—3.5 mm long, tube 2—2.5 mm long, outside and inside glabrous; lobes deltoid, 0.7—1 mm long, outside glandular, coloured purple-red. *Anthers* 0.5 mm long. *Style* for 3—4 mm exserted. Diameter across *fruiting head* 8—12 mm; *fruitlets* 3—4 mm long, glabrous or with a few scattered hairs.

Distribution: China (Kiangsu, Chekiang, Hunan, Kwangtung, Kwangsi, Szechuan), Korea.

3. **Adina dissimilis** Craib

A. dissimilis Craib, Kew Bull. Misc. Inf. (1931) 208; Fl. Siam. En. 2 (1932) 9. — Type: *Kerr 18977* (K).

Small tree. *Terminal vegetative bud* ill defined, loosely surrounded by the spreading stipules. *Stipules* 5—7 mm, divided almost to the base, glabrous. *Leaves* elliptic, (6—)8—14 × (1—)2.5—4(—5) cm, chartaceous, above and below glabrous; apex acuminate; base obtuse to cuneate, sometimes slightly unequal; lateral nerves 8—10 pairs, departing from the midrib at an angle of 45°—50°; axils with domatia, these hairy. *Petiole* (6—)10—15 mm long, glabrous. *Flowering axis* branched like a simple thyrse, bearing 3—7 flowering heads, densely pubescent, 2—8 cm long, with up to three pairs of lateral branches, these up to 3 cm long, rarely also with a few solitary unbranched flowering axes. Diameter of mature *flowering heads* across calyces 3—4 mm, across corollas 7—9 mm. Interfloral bracteoles linear to linear-clavate, 1—1.2 mm long, glabrous. *Hypanthium* 0.5—0.8 mm long, with a few scattered hairs, particularly at the base. *Calyx* 1—1.2 mm long, tube short, lobes clavate to clavate-spathulate, 0.8—1 mm long, glabrous. *Corolla* hypocrateriform to infundibular, 3—4 mm long, tube 1.8—2 mm long, inside and outside glabrous; lobes oblong, 1 mm long, inside glabrous, outside somewhat glandular to slightly papillose-farinose. *Anthers* 0.5 mm long. *Style* for 4—6 mm exserted, stigma small, globose to obovoidal. Diameter across *fruiting head* 5—6 mm; *fruitlets* 1.5—2 mm long, glabrous or with a few scattered hairs.

Distribution: Thailand (Peninsular).

EXCLUDED FROM ADINA

Transferred or reduced to **Adinauclea:**

A. fagifolia Val. *ex* Merr.

Transferred or reduced to **Breonadia:**
A. galpinii Oliv., *A. lasiantha* K. Schum. (incl. var. *parviflora* Hochr., Ann. Cors. Jard. Bot. Genève 11, 1908: 95), *A. microcephala* Hiern, *A. spathellifera* Oliv.

Transferred or reduced to **Haldina:**
A. cordifolia Hook. *f.*

Transferred or reduced to **Khasiaclunea:**
A. oligocephala Havil.

Transferred or reduced to **Metadina:**
A. aralioides Benth. & Hook. *f.*, *A. parvula* Geddes, *A. polycephala* Benth., *A. polycephaloides* Craib, *A. trichotoma* Benth. & Hook. *f.*, *A. zschokkei* Elm.

Transferred or reduced to **Mitragyna:**
A inermis Roberty, *A. ledermannii* Krause, *A. rubrostipulata* K. Schum., *A. stipulosa* Roberty.

Transferred or reduced to **Neonauclea:**
A. griffithii Hook. *f.*, *A. philippinensis* Vidal, *A. polycephala* Vidal, *A. sessilifolia* Hook. *f.*

Transferred or reduced to **Pertusadina:**
A. affinis How, *A. garciae* Elm., *A. metcalfii* Li, *A. minutifolia* Havil., *A. polycephala* var. *glabra* How, *A. rubescens* Hemsl.

Transferred or reduced to **Sinoadina:**
A. asperula Hand.-Mazz., *A. indivisa* Lace, *A. mollifolia* Hutch., *A. nobilis* Geddes, *A. racemosa* Miq.

18. HALDINA Ridsd., *gen. nov.*

Arbores grandes. *Gemmae terminales vegetativae* complanatae. *Stipulae* ovato-oblongae, integrae, adpressae. *Folia* opposita. *Capitula florifera* lateralia, per nodos 2—4(—10). *Axes floriferae* solitariae, haud ramosae, stipulis ad nodos parvis, bracteas aemulantibus, capitula florifera initio haud includentibus. *Flores* 5-meri, receptaculo subsessiles; receptaculo pubescente, bracteolis interfloralibus spathulatis usque spathulato-clavatis. *Hypanthia* lkibera, tubo calycis brevis, lobis oblongis, persistentibus, parte apicali caduco deficiente. *Corolla* hypocrateriformis, lobi valvati, sed apice valde subimbricati. *Stamina* in parte superiore tubi inserta, filamentis brevibus, glabris, *antheris* basifixis, introrsis, paullo e fauce protrusis. *Stylus* exsertus, stigma globosum. *Ovarium* 2-loculare, placentis in tertio superiore septorum instructis, ovulis pro loculo numerosis, pendulis. *Infructescentiae* capita fructorum laxa formantes; *fructus* endocarpio duro e basi usque ad apicem septicide et loculicide in partes 4 dehiscentes, calycis residua generaliter initio haud uno cum pericarpio libera, sed axi centrali ovarii persistente formata adhaerantia, demum libera. *Semina* ovoidea, leviter bilateraliter compressa, leviter alata.

Monotypicus.

Large trees. *Terminal vegetative bud* flattened. *Stipules* ovate-oblong, entire, adpressed. *Leaves* opposite. *Flowering heads* lateral, 2—4(—10) per node; *flowering axis* solitary, unbranched, stipules at the node bract-like, not surrounding

the young flowering head. *Flowers* 5-merous, subsessile on the receptacle; receptacle hairy, interfloral bracteoles spathulate to spathulate-clavate. *Hypanthia* mutually free; *calyx* tube short, lobes oblong, persistent, without a deciduous apical portion. *Corolla* hypocrateriform, lobes valvate but strongly imbricate at the apex; *stamens* inserted in the upper part of the tube, filaments short, glabrous; *anthers* basifixed, introrse, protruding from the throat. *Style* exserted, stigma ovoid to subglobose. *Ovary* 2-locular; placentas attached to the upper third of the septum, ovules numerous, pendulous. *Infructescence* a head of loose dehiscent *fruitlets;* these with a hard endocarp splitting septicidally and loculicidally into 4 from base to apex; calyx remnants not usually detaching with the fruit wall, remaining attached to the central axis, persisting, later detaching. *Seeds* ovoidal, slightly bilaterally compressed, shortly winged.

Haldina cordifolia (Roxb.) Ridsd., *comb. nov.*

Nauclea cordifolia Roxb., Pl. Corom. 1 (1795) 40, t. 53; Willd., Sp. Pl. 1, 2 (1798) 929; Pers., Synop. Pl. 1 (1805) 202; Smith in Rees, Cyclop. 24 (1813) Nauclea no. 12; Roxb., Hort. Beng. (1814) 14; Steud., Nom. Bot. ed. 1, 1 (1821) 550; Roxb., Fl. Ind. ed. 1, 2 (1824) 122; Spreng., Syst. Veg. 1 (1824) 750; DC., Prodr. 4 (1830) 345; Roxb., Fl. Ind. ed. 2, 1 (1832) 514; Wight & Arn., Prodr. (1834) 391; G. Don, Gen. Hist. 3 (1834) 468; Dietr., Synop. Pl. 1 (1839) 791; Graham, Cat. Pl. Bombay (1839) 87; Steud., Nom. Bot. ed. 2, 2 (1841) 186; Voigt, Hort. Sub. Calcut. (1845) 375; Mason, Burmah, People & Nat. Prod. ed. 1 (1851) 597; ed. 2 (1860) 785; Dalz. & Gibson, Bomb. Fl. (1861) 118; Balfour, Timb. Trees Ind. (1862) 177; Drury, Handb. Ind. Fl. 1 (1864) 523; Kurz, Prelim. Rep. For. Pegu (1875) lxxix, 60; For. Fl. Burma 2 (1877) 66; Beddome, Fl. Sylvat. 1 (1879) t. 33; W. Theobold in Mason, Burma, People & Prod. ed. 3, 2 (1883) 405. — *Adina cordifolia* Hook. *f.* [in Benth. & Hook. *f*, Gen. Pl. 2 (1873) 31] *ex* Brandis, For. Fl. N.W. & C. India (1874) 263; Hook. *f.*, Fl. Brit. Ind. 3 (1880) 24; Nair, Fl. Pl. W. Ind. (1894) 142; Cameron, For. Tr. Mysore & Coorg. ed. 3 (1894) 156; Trimen, Handb. Fl. Ceylon 2 (1894) 293; Havil., J. Linn. Soc. Bot. 33 (1897) 47; Dalgado, Fl. Goa e Santvadi (1898) 93; Gamble, Man. Ind. Timbers ed. 2 (1902), reprint (1972) 401; Talbot, Tr. Shr. Woody Climb. Bomb. Presid. ed 2 (1902), reprint (1949) 274; Prain, Beng. Pl. 1 (1903), reprint (1963) 403; Cooke, Bomb. Fl. 1 (1903) 581; Gage, Rec. Bot. Surv. Ind. 3 (1904) 65; Duthie, Fl. Up. Gangetic Pl. 1 (1905) 407; Brandis, Ind. Trees (1906) 368; Bourdillon, For. Fl. Trav. (1908) 212; Haines, For. Fl. Chota Nagpur (1910) 497; Kanjilal, For. Fl. Siwalik Jaunsar Div. Unit. Prov. ed. 2 (1911) 238; Partridge, For. Fl. Nizams Dom. Hyderabad-Deccan (1911) 216; Talbot, Forest Fl. Bomb. & Sind 2 (1911) 85, f. 334; R. Rao, Fl. Pl. Trav. (1914) 201; Hutch. in Sarg., Pl. Wils. 3 (1916) 390; Léveillé, Cat. Pl. Yunnan (1917) 244; Gamble & Fischer, Fl. Madras 2 (1921) 584; Cox, Ind. For. Dept. For. Bull. 42 (1921) 1—23; Haines, Bot. Bihar & Orissa (1922) 421; Pitard, Fl. Gén. I.-C. 3 (1922) 38; Chung, Mem. Sc. Soc. China 1 (1924) 235; Parker, For. Fl. Punjab, Hazara & Dehli (1924) 281; Osmaston, For. Fl. Kumaon (1927) 287; Craib, Fl. Siam. En. 2 (1932) 9; Blatter, J. Bomb. Nat. Hist. Soc. 36 (1933) 781; Lee, Forest Bot. China (1935) 248; Kanjilal & Das, Fl. Assam 3 (1939) 20; How, Sunyatsenia 6 (1946) 240; Kitamara in Kihara, Fauna & Fl. Nepal Himal. 1 (1955) 229; Worthington, Ceylon Trees (1959) 292; Hundley & U. Chit Ko Ko, List. Tr. Shr. Herbs. & Climb. Burma ed. 3 (1961) 122; Somasundaram, Handb. For. S. States (1967) 250; K.N. Gandhi in Saldanha & Nicholson, Fl. Hassan Dist. (1976) 572. — Type: *Roxburgh s.n.* (*Herb. Smith 316/5*, LINN).

Nauclea sterculiaefolia A. Rich., Mém. Fam. Rub. (1830) 209; Mém. Soc. Hist. Nat. Paris 5 (1834) 289. — Type: *Leschenault s.n.*, Courtallum (P).

Deciduous tree, 7—30(—40) m tall, bole often buttressed and fluted; bark reddish brown, scalloped, inner bark wine-coloured to brown. Young saplings with horizontal branches, mature trees with strong sympodial branching; branchlets with conspicuous petiolar scars. *Stipules* (6—)10—20 × 5—10 mm, strongly keeled, pubescent. *Leaves* broadly ovate, (5—)8—16(—25) × (5—)8—16(—20) cm, subcoriaceous, above sparsely hirsute, usually drying chocolate brown, below densely pubescent, usually drying pallid to yellowish green; apex

slightly acute; base cordate; lateral nerves 6—10 pairs, usually divaricately branched half way along the length; axils with domatia, these hairy. *Petiole* 2—12 cm long, densely pubescent. *Flowering axes* 2—6(—10), up to 10 cm long. Diameter of mature *flowering heads* across calyces 5—8 mm, across corollas about 20 mm, flowering heads yellowish. Interfloral bracteoles 2 mm long, apical portion swollen, pubescent, shaft narrow, more or less glabrous. *Hypanthia* 1—2 mm long, densely hairy; *calyx* 1.5—2 mm long, tube short or absent; lobes 1.3—1.8 mm long, at base ovate, attenuate into filiform shaft; apical portion linear-oblong to clavate. *Corolla* 7—9 mm long, tube 5—6 mm long, outside densely finely hairy, lobes oblong 1—2 mm long outside densely hairy, inside somewhat papillose. *Anthers* 1—2 mm long. *Style* for 5—7 mm exserted, stigma ovoid to subglobose. Diameter across *fruiting head* 10—15 mm; *fruitlets* 4—5 mm long, pubescent. *Seeds* ovoidal to tricornute, bilaterally flattened, basally with a short wing, apically with 2 claw-like short projections.

Ecology: Deciduous forest.
Distribution: Ceylon, India, eastwards to S. China, Vietnam, southwards to Peninsular Thailand (Surat Thani).

19. BREONADIA Ridsd.

A monotypic genus restricted to Continental tropical Africa and Madagascar. See Ridsdale, Blumea 22 (1975) 549, for generic description and synoptical account.

20. GYROSTIPULA Leroy

A genus restricted to Madagascar. See Ridsdale, Blumea 22 (1975) 549—550, for generic description and synoptical account.

21. JANOTIA Leroy

A monotypic genus restricted to Madagascar. See Ridsdale, Blumea 22 (1975) 550, for generic description and synoptical account.

DUBIOUS GENUS

Cephalina Thonner in Schum., Beskr. Guin. Pl. 1 (1827) 125. This is generally assumed to be conspecific with *Sarcocephalus*.

EXCLUDED FROM NAUCLEEAE

1. *'Conophora'* Endl. *ex* Korth. See Bakh. *f.*, Taxon 19 (1970) 471—472. A misspelling of *Canephora* Juss. See Wernh., J. Bot. 49 (1911) 77—82, for discussion of this genus.

2. **Cephalanthus** L. (incl. *Acrodryon* Spreng., *Axolus* Rafin., *Eresimus* Rafin.) transferred to *Cephalantheae* H. B. K. See Ridsdale, Blumea 22 (1975) 543; 23 (1976) 177—188.

3. **Gilipus** Rafin. Identity unknown. See Ridsdale, Blumea 23 (1976) 183, for discussion.

4. **Mitragyna** Korth. (incl. *Hallea* Leroy, *Mamboga* Blanco, *Paradina* Havil., *Stephegyne* Korth.) transferred to *Cinchoneae* subtribe *Mitragyninae*. See Ridsdale, Blumea 22 (1975) 543.

5. **Paracejpaelis tiliacea** Baill., Adansonia 12 (1879) 316; Arenas, Not. Syst. 16 (1960) 7, fig. 1, 1—7. — T y p e : *Pervillé 633* (P; iso K, L).
   This plant is definitely not a member of the *Naucleeae*. I have not examined the collection *Perrier 13452*, which is also discussed by Arenas, and have relied on the isotype in Leiden and the published description and illustration by Arenas for details of the corolla, etc.
   I have not observed raphides in the material examined nor have I seen conspicuous markings on the walls of the rather young ovules. From the form of the ovules one would expect the seeds to be discoidal with a narrow marginal wing. This feature combined with the form of placentation is often found in the *Hedyotideae*, a position precluded by the lack of raphides. The form of the placenta and of the seed coat differ from the *Cinchoneae*. Arenas (l.c.) has transferred the genus to the *Gardenieae*. The absence of a woody pericarp and a gelatinous endocarp, and the form of the seeds excludes the genus from the *Gardenieae s.s.* I am not able to suggest a better disposition of the genus which apparently occupies a rather aberrant position in the family.

6. **Sarcopygme** Setch. & Christoph. A Pacific genus probably belonging to the *Morindeae*.

7. **Silambus** Rafin. Not *Rubiaceous*, identity unknown. See Ridsdale, Blumea 23 (1976) 186—187, for references.

8. *Symphyllarion* Gagnep.
   Gagnepain placed this monotypic supposedly Indo-chinese genus in the *Naucleeae* solely on the basis of the capitulate inflorescence. Its herbaceous nature and median placenta bearing many ovules exclude it from this tribe. The important characters of the genus are: stipules ovate-acute, denticulate; inflorescence axillary, densely glomerate, globose, *c.* 2 cm diameter; calyx lobes 4, free, up to 7 mm long; ovary 2-locular; placenta medianly inserted on the septum; ovules numerous; fruit a capsule, longitudinally dehiscent. I have examined the type material and the plant belongs to the genus *Hedyotis* probably sect. *Diplophragma*, apparently a new species with glomerate inflorescences and exceptionally long calyx lobes.

   Hedyotis symphyllarionoides Ridsd., *nom. nov.*
   Symphyllarion herbaceum Gagnep., Bull. Soc. Bot. Fr. 95 (1948) 32. — T y p e : *Poilane 16148* (P).

9. **Uncaria** Shreb. (incl. *Agylophora* Neck., *Ourouparia* Aubl., *Restiaria* Lour., *Uruparia* Rafin.), transferred to *Cinchoneae* subtribe *Mitragyninae*. See Ridsdale, Blumea 22 (1975) 543.

INDEX TO SCIENTIFIC NAMES

Accepted names are in plain type, synonyms in *italics*, new names in **bold type.** Numbers refer to the number of the accepted genus and species; dub., excl., dubious and excluded respectively.

Sarcocephalus
horsfieldii Miq. 4: 5
junghuhnii auct. 4: 4
junghuhnii Miq. 4: 5
leichhardtii F. v. M. 3: excl. 3
macrocephalus K. Schum. 4: 1
maingayi Havil. 5: 1
missionis Havil. 5: 2
mitragynus Miq. 4: 5
multicephalus Elm. 4: 5
officinalis Pitard 4: 4
orientalis Merr. 4: 1
ovatus Elm. 4: 5
ovoideus Pitard 4: 1
pacificus Reinecke 3: excl. 1
papagola Domin 4: 1
parvus Havil. 4: 3
pubescens C. B. Rob. 4: 6
pubescens Val. 4: 5
ramosus Laut. 3: excl. 2
Sarcocephalus
subditus Miq. 4: 5
tenuiflorus Havil. 4: 2
undulatus Miq. 4: 1
var. *buruensis* Havil. 4: 1
Sarcopygme Setch. & Christoph.: excl. 6
mayorii Setch. & Christoph. 1: excl. 1
pacifica Setch. & Christoph. 4: excl. 2; 3: excl. 1
ramosa Setch. & Christoph. 3: excl. 2; 4: excl. 4
Silambus Rafin: excl. 7
Sinoadina Ridsd.: 15
racemosa Ridsd. 15: 1
Symphyllarion Gagnep.: excl. 8
herbaceum Gagnep.: excl. 8
Ulassium mas Rumph. 13: 1
Uncaria Schreb.: excl. 5
eurhyncha Miq. 16: 1

APPENDIX

Haviland placed *Anthocephalus* and *Sarcocephalus* in the subtribe *Anthocephalinae*.In his concept of *Sarcocephalus* he also included the type species of *Nauclea* L. The name of the subtribe is illegitimate as it includes the types of subtribes *Naucleinae* and *Sarcocephalinae*, previously published by De Candolle. *Nauclea* and *Sarcocephalus* are here transferred to the subtribe *Naucleineae* and the genus *Anthocephalus* is considered to form a monotypic subtribe. All synonyms of *Anthocephalus* are superflous names published by O. Kuntze. Therefore, a new subtribe *Anthocephalinae* Ridsd. is described based on the same type as the illegitimate subtribe of Haviland. This is the only name available and is considered to be a legitimate homonym which is not in contravention with Article 64 of the Code.

ANTHOCEPHALINAE Ridsd., *subtribus nov.*

Subtribe *Anthocephalinae* Havil., J. Linn. Soc. Bot. 33 (1897) 21 (as subtribe '*Anthocephalidae*'), *nom. illeg., pro parte* (excl. *Nauclea* and *Sarcocephalus*).

Gemmae terminales vegetativae conicae. Hypanthia et fructices liberi, calycibus liberis. Bracteolae interflorales nullae. Ovarium biloculare, vel inferne biloculare, superne 4-locellatum, placentis obovoideis in tertio parte septorum instructis. Corolla hypocrateriformis, lobi imbricati. Stigma fusiforme. Semina angulata.

Type genus: *Anthocepahlus* A. Rich.