A Synoptical Key to the Genera of the Rubiaceae of Thailand

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SUMMARY

A synoptic key to 68 genera of the Rubiaceae so far known from Thailand is provided similar to those in Backer and Bakhuizen van den Brink's Flora of Java. In this way a short summary of the most important characters is given for each genus.

Under this treatment five rubiaceous genera not yet hitherto recorded from Thailand are also included in the belief that they may turn up when thorough collections have been made; to denote these an asterisk is affixed to generic names appended in the Index.

INTRODUCTION

From February to September 1973, I had the honour to act as a Visiting Professor of Botany in the Botanisk Institut, Nordlandsvej 68, Risskov, Aarhus, Denmark, following an invitation of its Director, Professor Kai Larsen. Besides teaching advanced students of botany, my task consisted of constructing a comprehensive key to the genera of Rubiaceae in Thailand.

The material studied belonged to the rich Thai and other continental and west-Malesian collections in the herbaria of Aarhus and Copenhagen, altogether counting about 5000 sheets. The list of Rubiaceae in W.G. Craib, Florae Siamensis Enumeratio 2 (1932 & 1934): 5–233 served as a starting point of my investigations.

My key deviates from the more conventional short-lined ones, in that the distinguishing characters are supplemented with other features, as also was done in keys to the species in Backer and Bakhuizen van den Brink's Flora of Java. In this way a short summary of the most important characters is given for each genus. This method was necessary, because it would be extremely difficult, if not impossible with our present knowledge, to separate all taxa using few key characters only. Moreover, it would have been impossible to fit the data on so much material into the classical shape of a concise key with an additional enumeration of generic diagnoses and relevant references in the short time available for this project.

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As flowers and fruits are frequently not represented together in one specimen, partly due to the circumstance that they are available only at different seasons, I have constructed a key in which a number of important features were added to the differentiating characters. Occasional leads for flowering and fruiting specimens have been incorporated with regard to some groups of genera. Moreover, the disposal of certain vegetative and generative stages is indispensable for a clear understanding of the taxonomy of some groups (e.g. *Naucleeae*). The additional features are uniformly mentioned for all genera. In this way it must be possible to identify all Thai Rubiaceae to the genus, as far as known at the present. However, in connection herewith I have to state that in my opinion the Thai rubiaceous flora is still underinvestigated. More collections are greatly wanted from many areas, especially from Peninsular Thailand. I might point to the fact, that several genera which are not rarely found in Malay Peninsula, are completely lacking from areas just beyond the border, according to herbarium collections (*Aleisanthia*, *Coptophyllum*, *Jackia*, *Lecananthus*, *Myrmecodia*, *Pleiocarpidia*, *Xanthophytum*).

The next genera have been found in Vietnam, but not in Thailand: *Alleizettella*, *Asperula*, *Hymendocarpum*, and the endemic *Leptomischus* and *Mouretia*. *Xanthophytum* is known from Malay Peninsula and Vietnam, but is lacking in the Thai collections. *Spermatodictyon* (*Hamiltonia*) occurs in the Himalaya-Burma region as well as in Vietnam, but is not known from Thailand, while *Polyura* is restricted to Upper Burma.

As for the terms used in the key, the conventional ones were employed. Likewise I want to clarify the concepts axillary and terminal. An inflorescence or flower is called axillary when the appertaining stem or branch is terminated by a vegetative terminal bud. Terminal is the case in which a stem or branch ends in an inflorescence or flower. Further, I am convinced that true capsules are not found in Rubiaceae. The rubiaceous 'capsules' distinctly possess a (very) thin, often leathery endocarp. For that reason I propose to distinguish two main types of fruits in Rubiaceae: pyreniferous and non-pyreniferous. The pyreniferous fruits may be subdivided into pachypericarpous (having a thick, fleshy pericarp, known as 'drupe') and leptopericarpous [having a (very) thin, dry, often leathery pericarp, so-called 'capsule']. Non-pyreniferous fruits are conventionally termed 'berry'.

For convenience sake, however, I maintained the conventional terms : berry, drupe and capsule.

In constructing the key, I followed K. Schumann's system of Rubiaceae, as published in Engler & Prantl, Die natürlichen Pflanzenfamilien ed. 1, IV, 4 (1891) 16–156. Though at present this system is often qualified as unnatural

and unpractical, I am not convinced that this is so. The subdivision of the Rubiaceae into two groups based on whether each ovary cell contains only a single ovule ['*Coffeoideae*' (*Rubioideae*)], or more than one ovule ('*Cinchonoideae*'), is in my opinion more fundamental than one would admit at first sight, how unnatural it may seem. I think that a subdivision of the Rubiaceae into two main groups may be more basic than the distinction of three categories, as proposed by B. Verdcourt (Bull. Jard. Bot. Et. Bruxelles 28: 250–253. 1958). Anyway, in my experience the ovule character works reasonably well in practice, by reason of which I have not hesitated to make use of it in constructing the key. As to the leads of the key, I have placed the differentiating character first, followed by a hyphen (—), and then an enumeration of a number of important characters. Features not known to me are always specially indicated as such.

The characterization of the genera is not limited to Thai species, but comprises in principle species from the entire south-Asiatic area, especially Malesia. Synonyms, where recommendable, are always given; in any case those generic names that, so far as known to me, are reduced here for the first time. The addition of 'syn. nov.' seems irrelevant to me inconnection with the shape of a comprehensive key.

Craib mentions 71 genera (incl. cultivated and naturalized *Coffea*, *Hamelia* and *Vangueria*), and 557 species (excl. infraspecific taxa) in his Enumeratio. The number of genera in this revision amounts to 68 (incl. alien *Coffea* and *Hamelia*). An estimation of the total number of Thai species is very difficult mainly because of the strongly opposing views concerning specific delimitation, especially in complex groups like *Hedyotis*, *Mussaenda*, *Ophiorrhiza* and *Psychotria*, or little studied large genera like *Canthium*, *Gardenia*, *Ixora*, *Lasianthus*, *Morinda*, *Pavetta*, *Randia*, and *Tarenna*. Though I have not seriously attempted to distinguish the numerous species, I am convinced that too many species have been described in *Gardenia* and *Ophiorrhiza*.

In this introduction I will not go into a discussion on the actual generic delimitation in Rubiaceae, undoubtedbly the most crucial problem in this huge family, which, according to Airy Shaw—Willis (1967), numbers up to 500 genera and 6000 species, which estimation may, in my opinion, even be too low.

It is very difficult to construct a key to the genera of Rubiaceae from a large area like e.g. Thailand or Malesia, because of the complex generic characterizations. However, about 20 years of experience in pre-identifying Malesian Rubiaceae have taught me that recognizing the numerous genera is not such an impossible task as is often presumed, if only one accepts a not too narrow generic concept.

This surely holds for much discussed groups like *Hedyotis*, *Randia* and *Urophyllum*. As for *Psychotria*, one will get into serious trouble only when dealing with New Guinean and SW. Pacific psychotrioid taxa. However, the *Naucleeae* require an entirely new subdivision; the conventional delimitations do not work at all. There is no recent world-wide enumeration since Hooker f.'s eminent, though now rather out of date treatment in Bentham and Hooker, Genera plantarum 2 (1873) : 7–151. In the past century, so much new material has been collected and such strongly opposing views on generic and specific delimitation have been published, that a critical new overall survey on the generic level is urgently needed.

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Synoptical key to the genera

1a. Flowers collected into globose, very dense stalked heads strongly conspicuous by the long-exserted styles of the mature flowers, 4–6, usually 5-merous, the corolla tube (narrowly) cylindric-infundibuliform, the lobes valvate or imbricate in bud, bisexual. Receptacles conspicuous, woody, convex.— Ovaries free, or (*Nauclea*) entirely connate, (excl. *Anthocephalus*) 2-celled, usually with numerous ovules in each cell, rarely ovules 1 to several. Fruits collected into (sub) globose heads, either free, leptopericarpous (capsular), dehiscent by 2 valves or indehiscent, connate into fleshy syncarps. Seeds usually numerous, often winged. Stipules interpetiolar, strongly flattened, mostly relatively large, early caducous. Terminal vegetative bud (strikingly) flat or conoid (cigar-like involuted). Leaves usually decussate, rarely verticillate. Inermous trees or erect shrubs, or (*Uncaria*) vines with woody climbing-hooks (modified floriferous branchlets) 80

1b. Flowers in strongly various inflorescences, but rather infrequently collected into head-like aggregates, in latter case not with conspicuously exserted styles. Receptacle not woody, (excl. *Morinda*) usually inconspicuous.— Ovaries usually free. Fruits either pyreniferous, and pachypericarpous (drupaceous) or leptopericarpous (capsular), or nonpyreniferous (baccate). Styles usually included or slightly exserted, or (*Ixora, Pavetta, Tarenna*) styles strikingly exserted. Leaves decussate, opposite or verticillate. Trees shrubs, climbers, herbs, rarely epiphytic, sometimes spiny 2

2a. Leaves actually decussate, but seemingly 4–10-verticillate because of 1–3 persistent stipules of same shape and size as the leaves on each side of palmately or pinnately nerved leaf, without domatia, with or without cystoliths. — Flowers in axillary and terminal cymes, often combined into panicles, on articulated pedicels, bisexual, 3–6-merous, minute, greenish-yellowish, white or pink. Calyx teeth minute or obsolete, caducous. Corolla tube very short, limb stellate, lobes valvate in bud. Stamens 3–6, in corolla tube, exserted, filamented. Disk annular. Ovary inferior, ± globose, 2-celled, with 1 ovule in each cell attached to the septum in lower half or nearly so. Homostylous, perhaps also heterostylous in *Rubia*; style deeply bifid, minute, stigma capitate. Fruit subdidymous or globose, 1–2-seeded, seeds adhering to pericarp. Annual or perennial herbs, often with minute bristles or hooked hairs along the quadrangular stems 3

2b. Leaves decussate, rarely opposite or ternate, or (*Argostemma*, partly) pseudo-verticillate by the strongly approximated nodes. Stipules usually small, never of same shape and size as the leaves, interpetiolar or (not in Thailand),

intrapetiolar, either entire and usually ± ovate-triangular, or apically incised or narrowly laciniate, caducous or persistent.— Flowers axillary or terminal, solitary to variously combined, usually on inarticulate pedicels, mostly bisexual, sometimes unisexual or doubtfully bisexual, usually small to medium-sized, of various colours, whether or not bracteate or bracteolate. Calyx tube usually ± ovoid, whether or not prolonged into widened, truncate or dentate limb, or calyx lobes distinct, minute to large, often ovate-triangular Corolla tube usually cylindric or infundibuliform, short or long, aestivation various. Stamens often in throat, exserted or enclosed, mostly filamented, anthers dorsifixed or basifixed, usually longitudinally dehiscent, connective only occasionally thickened or elongate. Disk various. Ovary inferior or semi-inferior, or (*Gaertnera*) superior, seemingly half-inferior, 2–several-celled, rarely (incompletely) 1-celled, with 1 to many ovules in each cell on variously attached placentas. Homostylous or heterostylous, heterostyly still insufficiently observed; style simple or branched, stigmas not or slightly widened or capitate. Fruits and seeds strongly various in shape, size, locules dehiscence, texture and number. Leaves usually petioled and pinnately nerved, not rarely with acarodomatic in nerve-axils on lower surface, occasionally with bacteriodomatia inside parenchyma, without raphids 4

3a. Leaves sessile or short-petioled, seemingly (3–) 4–10-verticillate, 1–3-nerved. Fruit leptopericarpous (capsular), greenish. Flowers 3–4-merous, ebracteate. Prostrate or scrambling herbs **Galium** L.

3b. Leaves long-petioled, seemingly 4-verticillate, 3–7-nerved. Fruit pachypericarpous (baccate), ripe (in Thailand) black. Flowers usually 5-merous, bracteate. Climbing herbs **Rubia** L.

4a. Stems and branches not entirely woody, usually compressible, sometimes firm and hard in lower half: herbs, usually much less than 1 m tall.—Fruit leptopericarpous or drupaceous. Ovary 2-celled, 1–numerous ovules in each cell. Flowers inodorous. Domatia absent 5

4b. Stems and branches entirely woody, hard, not compressible: trees, shrubs, undershrubs, rarely creeping-rooting subherbaceous dwarf shrubs, or sometimes woody climbers, vines or root-climbers, or (*Hydnophytum*) unarmed epiphyte with tuberlike swollen stem-base, the inside of which showing a labyrinth of scaly, ant-infested canals.— Fruit leptopericarpous, drupaceous or baccate. Ovary with various number of ovary cells, 1–numerous ovules in each cell. Flowers inodorous or fragrant. Domatia absent or present 14

5a. Ovary cells many-ovuled. Fruit leptopericarpous. Aestivation various 6

5b. Ovary cells 1-ovuled. Fruit leptopericarpous or drupaceous. Aestivation valvate. Leaves decussate 10

6a. Flowers solitary, in one axil of a pair of leaves, and in the forks of the branches, flower-bearing nodes alternating with nodes without flowers, 5-merous, bisexual, white, pedicelled. Calyx tube and capsule globose, densely covered with long, many-celled glassy white, non-viscous hairs, rarely glabrous; limb tubular, deeply lobed, persistent.— Corolla tube infundibuliform, long-hairy inside, lobes apically 2–3-fid, rarely entire, induplicate-valvate in bud. Stamens 5, in lower half of corolla tube, enclosed. Placenta in the middle of the septum, globose. Style bifid, enclosed. Capsule indehiscent, colour unknown. Seeds numerous, angular. Stipules shortly adnate to petiole, broadly ovate-semiorbicular, scarious, shorter than petioles, ± caducous. Leaves decussate. Creeping-rooting, much-branched (very) small herbs, normally forming dense cushions **Dentella** J.R. & G. Forst.

6b. Flowers in terminal or axillary, variously cymose, usually dichasially branched, but sometimes conspicuously cincinnate inflorescences, sometimes solitary by reduction. Large glassy hairs absent. Not forming dense cushions (but *Hedyotis*, partly, may have crowded prostrate small stems) 7

7a. Corolla rotate or campanulate, tube short and broad, glabrous inside, lobes 4–5, usually stellate and large, imbricate in bud. Anthers mostly connate into a tube around the style, rarely free, large, usually opening with 1–2 apical pores, rarely with longitudinal slit, exserted; filaments 4–5, inserted at base of corolla tube.— Flowers in terminal, peduncled involucrate umbels or cymes, rarely solitary, bisexual, white. Calyx tube ovoid-campanulate, lobes 3–7, usually 5, ovate triangular. Placenta in the middle of the septum, (sub) globose. Homostylous; style with capitate or clavate stigma, exserted. Capsule globose, tardily apically dehiscent, or operculate; colour unknown. Seeds very numerous, angular-compressed, testa granulate or reticulate. Stipules entire, usually caducous. Leaves decussate, rarely pseudo-verticillate. Ascending-erect or creeping herbs, often fleshy, not rarely tuberous at base (in herbarium specimens mostly absent because of inaccurate collecting), mostly with thin-fleshy leaves **Argostemma** Wall.

7b. Corolla otherwise; tube mostly elongate, cylindric or nearly so, rarely (*Ophiorrhiza*, partly) urceolate; lobes usually shorter than tube, small, (induplicate-) valvate in bud. Anthers free.— Style bifid or 2-lobed. Leaves decussate 8

Note: the next three genera are gross-morphologically only to be distinguished by the shape of the ripe fruit.

8a. Capsule when mature obcordate, strongly laterally compressed, loculicidally dehiscent by two gaping valves, globose when young, green or violet-tinged. — Flowers subsessile, in terminal, peduncled, usually bracteate, whether or not involucrate, cymes combined into umbelliform-corymbiform, rarely subpaniculiform inflorescences, with spiciform-cincinnate axes usually short at anthesis, elongated afterwards, 5-merous, bisexual, white, pink or greenish. Calyx tube turbinate, lobes minute, persistent. Corolla tube long or short, cylindrical, rarely urceolate, hairy (? always) inside, lobes valvate in bud, bud longitudinally grooved by the cohering lobes. Stamens 5, inserted near the middle of corolla tube or subbasal, included or exserted. Placenta basal. Heterostyly frequent; style bifid, sometimes stigma seemingly clavate by the coherence of the stigmatic lobes. Seeds very numerous, angular, testa crustaceous. Stipules entire or bilobed, caducous to long-persistent. Prostrate to erect herbs, not rarely with firm stems in lower half, sometimes suffrutescent (? *Clarkella* Hook.f.,— *Notodontia* Pitard) **Ophiorrhiza** L.

Note: I have not seen any specimen of *Clarkella*, but I think both the Indian and Thai species might be merged in *Ophiorrhiza*.

8b. Capsule variously shaped, but not obcordate. Ovules and seeds numerous to (rarely) one 9

9a. Capsule narrowly cylindric, loculicidally dehiscent by 2 valves, colour unknown.— Flowers in erect spiciform cincinni on (sub) terminal, simple or apically forked, thin, usually rather long peduncles, sessile, 5-merous, bisexual, white. Calyx tube tubular, lobes persistent. Corolla tube elongate-campanulate, glabrous or apically pubescent inside, lobes induplicate-valvate in bud. Stamens 5, inserted about halfway in corolla tube, enclosed. Placenta near the middle of the septum. Disk large, lobed. Style with bilobed stigma, ± exserted. Seeds numerous, angular, testa pitted. Stipules entire, subulate-acuminate, long-persistent. Ascending low herbs

Spiradiclis Bl.

9b. Capsule (sub) globose or strongly laterally compressed, (sub) didymous or not, with strongly protruding-tumid apex or not so, loculicidally and/or septicidally 2-valved, or rarely indehiscent or nearly so, colour unknown. — Flowers 3–6, usually 4-merous, bisexual, white, pink or blue-purple, mostly in cymes combined into variously compound, usually paniculiform inflorescences, more rarely solitary, fascicled or head-like clustered; inflorescences terminal or axillary, peduncled or sessile, dichasially branched, showing all transitions towards the situation in which the upper branches have become strongly elongated, with monochasial arrangement of the flowers (resembling *Spiradiclis* in this respect), bracteate to involucrate. Calyx lobes usually persistent. Corolla tube short or long, glabrous or hairy inside, lobes valvate in bud. Stamens 3–6, in throat or in corolla tube, exserted or enclosed. Ovary 2–4-, usually 2-celled, with 2–numerous ovules in each cell, very rarely ovules solitary (? not in Thailand). Placenta in the middle of the septum

or (sub) basal. Disk large or inconspicuous. Style bifid, with 2–4 stigmas, long-exserted or hardly protruding. Seeds usually numerous, but not infrequently several, rarely one (? also in Thailand), variously shaped: globose, ellipsoid, plan-convex, cymbiform, peltate or not, sometimes narrowly winged, with smooth or pitted testa. Stipules usually pectinate-laciniate, rarely entire or nearly so, persistent. Erect or prostrate, rarely straggling or climbing herbs, sometimes suffrutescent (*Anotis* auct. non DC.,— *Neanotis* W.H. Lewis,— *Oldenlandia* L.) **Hedyotis** L. emend. Lamk.

Note : ovaries containing solitary ovules and fruits with single seeds, are very rare exceptions. In my opinion they are cases of extreme reduction of the number of ovules and seeds which may strongly vary in the same species. The 1-seeded situation is certainly not of specific value. I likewise doubt whether exclusively 1-ovuled ovaries (unknown to me !) are specific.

10a. Ovule basal, erect. Fruit drupaceous. Creeping, profusely rooting herbs 11

Note: if ovule is (sub) basal, but the fruit capsular, see under 9b. *Hedyotis*.

10b. Ovule attached to the septum or apical. Fruit capsular. Creeping-rooting or prostrate to erect, usually (short-) hairy herbs, with pinnately nerved leaves 12

11a. Leaves palmately 5–9-nerved, not very numerous, ovate, cordate or reniform, medium-sized, on usually longish petioles.— Flowers bisexual, 4–7-merous, subsessile, on terminal, peduncled head-like, few-flowered umbels, white. Calyx tube obovate, limb deeply divided, persistent. Corolla tube cylindric-infundibuliform, with hairy throat. Stamens 4–7, inserted in the middle of the corolla tube, enclosed, anthers dorsifixed. Style bifid, enclosed. Disk thick, entire or lobed. Drupe globose to ellipsoid, mature red, orange or black, rather small. Pyrenes 2, bony or crustaceous, ribbed or smooth. Seeds plan-convex. Stipules oval or reniform, entire, persistent. Glabrous, hairy or papillose small herbs (*Carinta* W.F.Wight,— *Geocardia* Standley) **Geophila** D.Don nom.cons.

11b. Leaves pinnately nerved, (very) numerous, cordate to ovate-triangular, (very) small, shortly petioled.— Flowers dioecious, or (not in Asia) bisexual, 4-merous, terminal or seemingly axillary, sessile, solitary, hidden by the uppermost leaves, greenish or pinkish. Calyx tube cylindric, limb subtruncate. Corolla tube infundibuliform, glabrous inside. Stamens 4, inserted in lower half of corolla tube, anthers basifixed, exserted. Style bifid, short, stigmas strongly accrescent at anthesis, much exserted. Disk hardly

developed. Drupe globose, mature red or orange, rarely black, rather small. Pyrenes 2, thin-walled. Seeds plan-convex. Stipules triangular-oblong, entire, long-persistent. Glabrous small herbs
Nertera Banks & Soland. ex Gaertn. nom.cons.

12a. Ovule apical, pendulous.— Flowers subsessile or shortly pedicelled, in terminal corymbiform, umbelliform or subcapitate many-flowered inflorescences with cincinnate ultimate axes, pink, purplish, blue or white, small. Calyx tube minute, lobes 4 (-6), minute, unequal, caducous. Corolla tube widened toward apex, densely hairy inside, lobes 4. Stamens 4, inserted near hairy throat or lower, enclosed or exserted, anthers (sub) basifixed or medifixed. Disk cushion-shaped. Heterostyly observed; style bifid, enclosed or exserted. Ripe fruit brown or mixed with green or purple, detaching from the needle-like column, and either dicoccous from base towards apex or indehiscent, or falling off together with the column, indehiscent. Seeds compressed, testa membranous. Stipules divided into lobes, or subulately fimbriate, adnate to base of petiole into a short sheath, persistent. Stems usually angular. Erect, sometimes rather firm herbs, rarely slightly over 1 m tall
Knoxia L.

12b. Ovule attached to the septum.— Flowers in terminal and/or axillary small clusters, or solitary 13

13a. Capsule splitting into 2 mericarps of various dehiscence, dry, crowned by the small calyx lobes, laterally compressed or not, small, ripe brown or mixed with green or purple.— Flowers in terminal and axillary clusters, white or pale purple, small. Calyx lobes 2–8, small, persistent. Corolla tube infundibuliform, campanulate or urceolate, hairy inside, lobes 4. Stamens 4, inserted in corolla tube or in throat, enclosed or exserted. Disk indistinct. Placenta attached to middle of the septum. Style bifid or bilobed, enclosed or exserted. Seeds plan-convex, with a ventral longitudinal groove, largish, testa often granular. Stipules adnate to petioles, forming a sheath apically divided into narrow lobes, persistent. Erect, prostrate or creeping, usually short-hairy herbs, with angular stems (*Spermacoce* auct. non L.)
..... **Borreria** C.F.Mey nom.cons.

13b. Capsule indehiscent, corky, crowned by the enlarged calyx lobes, (ex herb.) strongly compressed-quadrangular, conspicuously longitudinally 8-ribbed, largish, colour unknown. — Flowers solitary, axillary, light purple, largish. Calyx tube quadrangular, lobes 4, persistent. Corolla tube urceolate-funnelshaped, hairy inside, lobes 4. Stamens 4, inserted in corolla tube, exserted. Style simple, exserted, stigma ± bilobed. Disk indistinct.

Placentas peltate, attached near the middle of the septum. Seeds narrowly ellipsoid, testa smooth. Stipules broad, adnate to petioles, forming an entire or dentate sheath, persistent. Creeping succulent glabrous herbs, with terete branches **Hydrophylax** L.f.

14a. Ovary cells 1–5, usually 2, 2–many-ovuled.— Seeds several to very numerous, (excl. *Scyphiphora*) not enclosed within pyrenes. Ovaries and fruits free. Fruits baccate, or capsular by 2 valves, or (*Diplospora*, *Scyphiphora* and *Xantonnea*) drupaceous 15

14b. Ovary cells 2–12, usually 2, 1-ovuled.— Seeds 1–12, usually 1–2, either enclosed within distinct, hard or crustaceous pyrenes, or free. Fruits usually drupaceous, or (*Leptodermis*) capsular dehiscent by 5 valves, or (*Duperrea*, *Hypobathrum*, and *Tarenna*) baccate. Ovaries and fruits free, or (*Morinda*, *Rennellia*) connate 48

15a. Inflorescences or solitary flowers terminal [i.e. terminating normal leafy branches or lateral (leafy) short-shoots]. Leaves decussate, without domatia 16

15b. Inflorescences and solitary flowers axillary [i.e. not terminating normal leafy branches or lateral (leafy) short-shoots], extra-axillary or leaf-opposed. Fruits usually baccate or (*Scyphiphora*) drupaceous 37

16a. Creeping-rooting small dwarf shrubs, with hairy stems, or undershrub with long-peduncled (sub) involucrate heads and long narrow calyx lobes; fruit a capsule 17

16b. Trees, erect shrubs or woody climbers. Inflorescence non-capitate, or (*Lucinaea*) flowers in peduncled heads usually umbellately arranged, with (sub) entire calyx limb; fruit a berry 18

17a. Flowers in long peduncled (sub) involucrate bracteate usually dense heads, hidden between the bracts, probably polygamous, small, greenish, bluish, purple or red.— Involucral bracts few, long, mostly (semi) persistent. Bracts (broadly) spatulate, semipersistent. Calyx lobes 5–6, oblong-spatulate to linear, long, persistent. Corolla equalling the bracts, usually much shorter than calyx lobes, tube short, with dense ring of protruding white hairs below throat, lobes 5, valvate in bud. Stamens 5, inserted at base or near apex of corolla tube. Disk lobed. Ovary 2-celled, ovules numerous on mid-septal globose placenta. Style short, enclosed, stigma bilobed or subcapitate. Capsule with thin to thick, hard endocarp, greenish or black.

Seeds numerous, rounded-angular, densely tessellate. Stipules entire, bifid or multipartite, usually largish, caducous or semipersistent. Low shrublet, stems without spongy bark (*Myrioneuron* auct. non R.Br. ex Kurz) **Keenania** Hook. f.

17b. Flowers solitary, rarely several together, unisexual, white, large.— Calyx lobes 5(–7), unequal, persistent. Corolla tube narrowly cylindric, straight below, distinctly S-shaped above, hairy inside, lobes 5, well-developed, valvate in bud. Male flower: stamens 5, inserted in middle of corolla tube, enclosed. Pistillodium with distinct style. Female flower: staminodes with well-developed sterile anthers. Style bifid, slightly exserted. Ovary 2-celled, many-ovuled. Placenta in middle of septum. Disk annular. Berry ellipsoid-ovoid, fleshy, apically 2-valved, largish, colour unknown. Seeds numerous, black, testa densely verruculate. Stipules narrow, long-persistent. Creeping-rooting, small, probably dioecious dwarf shrub; with hairy stems (*Mussaenda uniflora* Wall. ex G.Don) **Aphaenandra** Miq. emend. Bremek.

18a. Key based on fruiting specimens 19

18b. Key based on flowering specimens. Flowers bisexual 25

19a. Fruit capsular (pyreniferous), dehiscent by 2 (–3) valves.— Ovaries 12–celled, or (*Wendlandia*, partly) 3-celled, many-ovuled. Flowers bisexual 20

19b. Fruit baccate (non-pyreniferous), indehiscent or irregularly and tardily rupturing or apically slightly 2-valvate.— Ovaries 1–5-celled, usually many-ovuled. Flowers bisexual, rarely functionally unisexual 30

20a. Seeds conspicuously winged, imbricate. Capsules rather large, at least 7 mm long 21

20b. Seeds narrowly or hardly rimmed, not imbricate. Capsules minute, not over 3 mm, globose, very numerous, greenish. Trees or shrubs 24

21a. One or two bracts enlarged into leafy, very conspicuous, persistent long-stalked decoy-leaf 22

21b. All bracts inconspicuous 23

22a. Inflorescence simply or compound spicate, long-peduncled, large. Capsule not crowned by calyx lobes, loculicidally 2-valved, cylindric, grey.— Seeds flat, winged all-round, wings membranous, veined. Stipules broad, upper part usually bifid, strongly reflexed, caducous. Leaves pinnately nerved, caducous, the floral ones crowded at stem-apices, large, with domatia. Deciduous tree **Hymenodictyon** Wall.

22b. Infructescence cymose, long-peduncled. Capsule crowned by the long, persistent calyx lobes, septicidally 2-valved, turbinate, colour unknown. — Seeds flat, long- and narrowly winged at both ends, veined. Disk very large, ± conoid. Stipules large, entire, apically reflexed, persistent. Leaves pinnately nerved, crowded at stem-apices, large, without domatia. Epiphytic shrublet **Hymenopogon** Wall.

23a. Capsule loculicidally 2-valved, coriaceous, subglobose-didymous, slightly flattened, with a longitudinal groove, (ripe) black.— Infructescence paniculate, large. Seeds numerous, orbicular, broadly winged all-round, wings strongly denticulate, veined. Stipules triangular, entire, small, caducous. Leaves pinnately nerved, with domatia. Woody climber (*Coptospelta* sphalm.) **Coptosapelta** Korth.

23b. Capsule septicidally 2-valved, ± woody, obovoid, not flattened, colour unknown.— Infructescence corymbose, large. Seeds numerous, minute, long-winged at both ends, denticulate, testa rough. Stipules triangular, entire, small, caducous. Leaves pinnately nerved, with domatia. Tall shrub **Luculia** Sweet

24a. Infructescence (very) large, with cymose side-axes. Seeds very numerous, compressed, reticulately veined.— Stipules ovate-triangular, or ± cordate, entire, acute or acuminate, long-persistent. Leaves pinnately nerved, with domatia. Trees or shrubs **Wendlandia** Bartl. nom.cons.

24b. Infructescence largish, with conspicuously cincinnate side-axes, sometimes, however, in poorly developed specimens, the scorpioid nature of the axes may slightly be obscured, but is still easily to be recognized by the one-sided arrangement of the fruits. Seeds very numerous, ± angular, areolate.— Stipules elongate-ovate, entire, ± acuminate, long-persistent. Leaves pinnately nerved, without domatia. Shrubs or small trees **Greenea** W. & A.

25a. Inflorescence simply or compound spicate, long-peduncled, large.— One or two bracts enlarged into leafy, very conspicuous, persistent, long-stalked white decoy-leaves. Calyx lobes 5–6, caducous. Corolla small, white, tube cylindric, glabrous inside, lobes 5, valvate in bud. Stamens 5, inserted in throat, basifixed, ± enclosed. Disk tubular. Placenta near base of septum. Style simple, long-exserted, stigma fusiform. Stipules broad, upper part bifid, strongly reflexed. Floral leaves crowded at stem-apices, with domatia. Deciduous tree **Hymenodictyon** Wall.

25b. Inflorescence not simply or compound spicate. Evergreen shrubs or trees

26a. Inflorescence with cincinnate side-axes, paniculiform.— Bracts small. Calyx lobes 4–5, persistent. Corolla greenish, white or pinkish, small, tube swollen at base, cylindric upwards, inside with ring of hairs, throat glabrous. Stamens 4–5, in throat, enclosed. Disk annular. Style bifid, exserted. Placenta inserted in the middle of the septum, large. Stipules elongate-ovate, entiral. Leaves without domatia. Shrubs or small trees **Greenea** W. & A.

26b. Inflorescence with cymose side-axes, paniculiform or corymbiform 27

27a. Bracts leafy, very conspicuous, large, long-stalked, white. Corolla lobes 4–5, valvate in bud, tube cylindric, long, hairy in throat.—Inflorescence corymbiform, long-peduncled. Flowers white, large. Calyx lobes 4–5, large, persistent. Stamens 4–5, in widened part of corolla tube, enclosed, dorsifixed. Placenta inserted in the middle of the septum, large. Style bifid, enclosed. Stipules entire, apically reflexed, large, persistent. Leaves crowded at stem-apices, without domatia. Epiphytic, occasionally terrestrial shrublet **Hymenopogon** Wall.

27b. Bracts inconspicuous, small. Corolla lobes imbricate, contorted or replicate-valvate.— Shrubs or trees 28

28a. Flowers minute, very numerous, fragrant, white or pink. Corolla tube less than 5 mm, cylindric from swollen base, hairy inside, lobes 4–5, imbricate in bud.— Inflorescence paniculiform, (very) large. Bracts persistent, small. Calyx lobes 4–5, inequal, persistent. Stamens 4–5 in throat, exserted, anthers dorsifixed. Disk annular, large. Placenta inserted along septum, globose. Heterostyly observed; style with bifid or entire stigma, exserted. Stipules ovate-triangular, or ± cordate, entire. Leaves decussate or (not in Thailand) ternate, with domatia. Trees or shrubs **Wendlandia** Bartl. nom. cons.

28b. Flowers large or medium-sized, not very numerous, fragrant or not. Corolla tube c. 1–3 cm or more.— Bracts caducous, small 29

29a. Corolla tube c. 1 cm, shorter than lobes, glabrous inside, lobes 5, linear, contorted in bud, white turning orange-yellowish; fragrant.— Disk cushion-shaped. Style with entire stigma, exserted. Stamens 5, in throat, exserted, anthers dorsally hairy, finally twisted. Inflorescence paniculiform. Calyx lobes 5, minute, persistent. Placenta inserted in the middle of the septum. Stipules triangular, entire. Leaves with domatia. Woody climber (*Coptospelta* sphalm.) **Coptosapelta** Korth.

29b. Corolla tube c. 2–3 cm, longer than lobes, hairy in lower half inside, lobes 5, oblong, tuberculate at base, imbricate in bud, fragrant, white or pink.—Disk slightly convex. Style with bifid stigma, exserted. Stamens 5, in corolla tube, enclosed, anthers glabrous, not twisted. Inflorescence corymbiform. Calyx lobes 5, large, narrow, longer than narrow tube. Placenta inserted ± in the middle of the septum. Stipules elongate-ovate, entire, caducous. Leaves with domatia **Luculia** Sweet

29c. Otherwise 30

30a. Flowers arranged in peduncled involucrate heads, peduncles solitary, subumbellate or (not in Thailand) panicled, bisexual, white, greenish or pink, fragrant.— Calyx tube turbinate, with (sub) entire persistent limb. Corolla tube funnel-shaped, hairy inside, lobes 4(–6), valvate in bud. Stamens 4(–5), in corolla tube, anthers enclosed. Disk large, conoid. Ovary 2-celled, many-ovuled. Placenta inserted along septum, peltate. Style bifid, exserted. Berries crowded, turbinate, areolate, green or yellowish. Seeds numerous, compressed, testa smooth. Stipules triangular, entire, caducous. Leaves coriaceous, shining, without domatia. Glabrous or subglabrous (epiphytic) climber or terrestrial shrub **Lucinaea** DC.

Note : Probably congeneric with *Lecananthus* Jack, which name has priority.

30b. Flowers in peduncled involucrate heads. Calyx lobes large. Berry white see under 31a. **Mycetia** Reinw.

30c. Flowers not in heads 31

31a. Vegetative branches very soon with a conspicuous, soft, spongy-swollen, pale corky bark. Berry globose, (ripe) white, spongy, cells surrounded by 2 or 4 crescent-shaped air-chambers, indehiscent or irregularly dehiscent. — Inflorescence corymbiform or paniculiform, shortly peduncled, often with stalked glands in floral parts. Bracts whether or not involucrate, glandular or not. Flowers bisexual, not fragrant. Calyx lobes 4–6, persistent, whether or not glandular, sometimes with additional lobes. Corolla largish, yellow to white, tube cylindric, glabrous or hairy inside, lobes 4–6, induplicate-valvate in bud. Stamens 4–6, usually near base of corolla tube, less often near the middle of the corolla tube or subapical, shortly filamented, anthers ± basifixed, enclosed. Disk annular. Style usually bifid, enclosed or nearly so. Ovary 2 (–?3–5)- celled, many-ovuled. Placenta in the middle of the septum or lower, peltate. Seeds (very) numerous, cuneiform. Stipules elongate, entire, rather large, tardily caducous. Leaves without domatia. Erect usually low shrub (*Adenosacme* Wall.,— *Myrioneuron* R.Br. ex Kurz, non auct.) **Mycetia** Reinw.

31b. Branches solid, hard. Berry not white-spongy, cells not surrounded by air-chambers.— Inflorescence without stalked glands on floral parts 32

32a. Ovary 5-celled , many-ovuled.— Inflorescence cymose, ultimate axes cincinnate, with distinct coiled apex. Bracts small. Flowers bisexual. Calyx lobes 5, small, persistent. Corolla orange, largish, tube cylindric from widened base, glabrous inside, lobes 5, imbricate in bud. Stamens 5, in widened subbasal part, anthers basifixed, enclosed. Disk conoid, large. Style with fusiform stigma, enclosed. Placenta along the whole septem. Berry 4-celled, ellipsoid, crowned by disk, black-red. Seeds numerous, angular, testa foveolate. Stipules elongate, caducous. Leaves pinnately nerved, 3–4-verticillate, with domatia. Erect shrublet. Native of southern United States and tropical northern South America, naturalized in Thailand **Hamelia** Jacq.

32b. Ovary 1–2-celled, usually many-ovuled, rarely (*Randia* and *Tarenna*, partly) ovules several to one 33

33a. (Thai species) Calyx tube and fruit narrowly oblong-linear, 5-costate.— Flowers bisexual, 5-merous, greenish, or (not in Thailand) white, orange, yellow or blue, nodding, in 5–20-flowered cymes. Bracts small, persistent. Calyx lobes linear, accrescent, long, persistent. Corolla tube cylindric-campanulate, glabrous inside, lobes valvate in bud, rather small. Stamens 5, near base of corolla tube, long-filamented, filaments shortly connate, anthers basifixed, enclosed, coherent around stigma. Style striate, stigma fusiform, enclosed. Ovary at first 1-celled, afterwards 2-celled by 2 intruding placentas, many-ovuled. Disk annular. Berry indehiscent, green or yellowish green. Seeds numerous, ± ellipsoid, testa reticulate-tuberculate. Stipules ± triangular, apically slightly dentate, tardily caducous. Leaves pinnately nerved, without domatia. Erect shrub **Acranthera** Arn. ex Meissn. nom. cons.

33b. Calyx tube and fruit (sub) globose to broadly ellipsoid 34

34a. Calyx lobes 5, unequal, long-persistent, falling off entirely in fruit, 1–2 of them, rarely 5 or none, at anthesis developed into stalked, large, white, long persistent decoy-leaves (in badly collected herbarium specimens these not rarely absent, then giving rise to misidentifications). Corolla lobes 5, re plicate-valvate in bud.— Inflorescence corymbiform, medium-sized. Bracts small. Flowers unisexual, seemingly bisexual, fragrant (? always). Calyx tube longer or shorter than lobes. Corolla largish, lobes orange or yellow. rarely red, tube widened in upper half, yellowish or whitish, hairy inside. Stamens 5, at base of widened part of corolla tube, anthers enclosed. Disk

large. Ovary 2–3-celled, ovules numerous on thick placenta inserted along septum. Heterostylous; style bifid, short or long, exserted or enclosed. Berries rather large, ellipsoid, conspicuously lenticellate, indehiscent, (? always) green, mottled. Seeds numerous, angular, reticulately ribbed. Stipules elongate, entire or bilobed, early or tardily caducous. Leaves without domatia (? always). Inermous climbing or straggling, rarely erect shrub **Mussaenda** L.

34b. Calyx lobes never developed into decoy-leaves. Corolla lobes distinctly contorted in bud. —Ovules sunk in fleshy placenta. Seeds whether or not embedded in pulpy placenta. Flowers bisexual 35

35a. Style-stigma complex enclosed to slightly exserted.— Flowers often on short shoots, solitary, fasciculate, cymose or combined into short-peduncled, (rather) small paniculiform-corymbiform inflorescences the terminal axes of which are cincinnate. Branching systems of stems, especially in *Randia*, strongly various, possibly of subgeneric importance 36

35b. Style-stigma complex conspicuously long-exserted.— Flowers in cymes combined into normally medium-sized to large shortly to moderately long-peduncled many-flowered corymbs, usually 5, occasionally 4 or 6-merous. Bracts small. Calyx lobes minute, persistent or ± caducous. Corolla white, tube cylindric, short or long, glabrous inside, lobes elongate. Stamens inserted about the throat, anthers dorsifixed, slightly protruding. Disk cushion-shaped. Ovary 2-celled, usually many-ovuled. Stigma bifid, by coherence of the stigmatic branches seemingly fusiform. Berry (sub) globose, small, black. Seeds usually numerous, usually angular, not embedded in pulpy placenta, testa various. Leaves opposite, usually with domatia. Stipules rather high-connate with entire apex, midrib whether or not bifid towards base, tardily caducous. Inermous erect shrubs or small trees (*Chomelia* L. nom.prius,— *Stylocoryna* auct. plur. non Cav.,— *Webera* Schreb., non J.F.Gmel.) **Tarenna** Gaertn.

36a. Terminal vegetative buds and young shoots resinous. Ovary 1-celled, many-ovuled.— Flowers solitary on short shoots, usually large, white or yellow, fragrant (? always), bisexual, rarely (? also in Thailand) polygamous. Calyx tube often cylindric, ribbed, limb terminating into mostly 5–6, usually large persistent lobes. Corolla tube long, pubescent inside, lobes 5–12. Stamens 5–12, inserted in throat, anthers dorsifixed, protruding. Placentas 2–8, along the septum, thick. Style with clavate or shortly bifid stigma, exserted. Disk (±) annular. Berry large, often coriaceous, irregularly

dehiscent, black, brown, or green (ripe ?). Seeds embedded in pulpy placentas, compressed or swollen, numerous, testa areolate or not. Stipules connate into amplexicaul ochrea, with entire apex, caducous. Leaves decussate or 3-verticillate, with domatia, usually glossy. Erect shrubs or small trees, (? always) inermous **Gardenia** L. emend. Bakh.f.

36b. Terminal vegetative buds and young shoots non-resinous. Ovary 2, rarely incompletely 1-celled, or (? not in Thailand) occasionally 3–4-celled, usually many-ovuled.— Flowers fasciculate, cymose or combined into short-peduncled, (rather) small paniculiform-corymbiform inflorescences, the terminal axes of which are cincinnate, or (in depauperate specimens) occasionally solitary; often on short shoots, small or medium-sized, white or yellowish, fragrant (? always), bisexual. Calyx tube globose or ellipsoid, limb tubular or campanulate-cupular, 5–10-dentate or -lobed, ± persistent. Corolla tube short or long, with ring of hairs in throat, lobes 5–10. Stamens inserted near throat, 5 (–8), anthers dorsifixed, enclosed or protruding. Placenta mid-septal, or several ones along septum, thick. Style short or long, entire or bifid, exserted. Disk annular. Berry globose or ellipsoid, usually small, indehiscent or rupturing, black or yellow. Seeds often embedded in pulpy placentas, angular, usually numerous, testa not reticulate (? always). Stipules free or shortly connate, entire, caducous. Leaves decussate or 3-verticillate, often at top of short shoots, with or without domatia. Erect shrubs, small trees or woody climbers, inermous or thorny, with strongly various branching systems of stems (*Stylocoryna* Cav.,— *Webera* auct. plur. non Schreb.) **Randia** L.

Note: *Randia* L. is accepted here in the widest sense. No attempt has been made by me to segregate this very complex group, which may consist of a few distinct genera. I do not agree with the vigorous splitting up of the genus as recently proposed by botanists dealing with the taxonomy of the African *Randia*-complex.

37a. Ovules and especially seeds imbricate. Seeds flat or strongly compressed, usually largish, numerous, rarely few to one.— Placentas (sub) apical or distinctly septal. Fruit baccate. Style or stigmas usually short-hairy. Corolla lobes contorted in bud. Inermous erect shrubs or small trees 38

Note: the following genera belong to an Afro-asiatic group of probably close alliance, the delimitation of which still deserves a detailed study.

37b. Ovules and seeds not imbricate. Seeds angular to slightly compressed, usually small, numerous, rarely few to one.— Placentas distinctly septal. Fruit baccate, or (*Scyphiphora*) drupaceous 42

38a. Flowers bisexual or polygamo-dioecious, in small fascicles or cymes, or spicately arranged, bracteolate, bracteoles free or cupular. Peduncles, if any, firm, short, up to 1 cm long. Erect inermous shrubs 39

38b. Flowers unisexual, dioecious, in spicately arranged, up to 12-flowered, supra-axillary, bracteate small groups, or ♀ flowers sometimes solitary, white. Peduncles very slender, 2–4(–8) cm, in both leaf-axils, in ♀ sometimes shorter. — ♂: calyx lobes 4-5, minute. Corolla campanulate, tube hairy in throat, lobes 4–5. Stamens 4–5, in throat, hardly protruding. Pistillode large with bifid style. ♀: calyx lobes 4, persistent. Corolla same as ♂, lobes 4. Staminodes 4, in throat. Disk annular. Ovary 2-celled, many-ovuled. Placentas along septum. Style short, stigmas 2, very large and flat, slightly exserted. Berry ripe sublinear, largish, indehiscent, longitudinally ribbed, (ripe) green tinged with purple. Seeds numerous. Stipules ovate, entire, persistent. Leaves without domatia. Erect shrub **Morindopsis** Hook.f.

39a. Fruit drupaceous, pyrenes inconspicuous. Flowers fasciculate or cymose, polygamo-dioecious, 4-merous. Placentas (sub) apical or septal 40

39b. Fruit baccate. Flowers fasciculate, cymose, or (sub) spicately arranged, bisexual. Placenta (sub) apical 41

40a. Placenta (sub) apical, large.—Flowers in small, subsessile cymes, white, fragrant. Calyx lobes minute, persistent. Corolla tube cylindric, hairy near apex. Stamens 4, in throat, anthers exserted. Ovary 2-celled, ovules 3–4 in each ovary cell, collateral. Disk annular. Style bifid, short, slightly protruding. Drupe (sub) globose, small, purple. Seeds 2–4, testa striate. Stipules shortly connate, ovate, cuspidate, semipersistent. Leaves thin-coriaceous, with domatia. Young twigs dried pale or yellowish. Erect shrub **Xantonnea** Pierre ex Pitard

40b. Placenta distinctly septal.— Flowers fasciculate, white, greenish, or ? also yellow. Calyx lobes minute, persistent or absent. Corolla tube cylindric or widened, short, glabrous or pubescent inside. Stamens 4, in throat, anthers exserted. Disk annular. Ovary 2-celled, ovules 2–8 in each ovary cell. Style bifid, short or long, exserted. Drupe globose-ellipsoid, blackish, red or orange-yellowish. Seeds solitary to several. Stipules shortly connate, triangular, usually setaceously acuminate, entire, small, usually long-persistent. Leaves thin-coriaceous, often glossy, without domatia. Young twigs dried whether or not yellowish. Erect shrubs or trees (*Tricalysia* auct. non A.Rich.) **Diplospora** DC.

Note: a satisfactory characterization of this genus (and allied genera) is still badly needed, partly due to usually incomplete collections, partly as the reproductive features show a great diversity, and are seemingly doubtfully constant. Sometimes considered congeneric with *Tricalysia* A. Rich. from tropical Africa.

41a. Anthers glabrous.—Flowers fasciculate (actually minutely spicate), or distinctly (sub) spicately arranged on firm peduncles up to 1 cm long, in 2–4 series of densely bracteate (minute) cymes, 4-merous, white or greenish, small. Bracts triangular, acute, ± carinate. Calyx lobes minute, persistent. Corolla tube short, barbate in throat. Stamens 4, in throat or somewhat lower, anthers subbasifixed, enclosed. Disk annular. Ovary normally 2-celled, ovules 1–7 in each ovary cell. Style bifid, exserted. Berry ellipsoid or subglobose, orange. Seeds 1–14, testa fibrous. Stipules triangular, entire, inserted above base of petiole, caducous. Leaves with domatia. Erect shrubs or small trees (*Petunga* DC.) **Hypobathrum** Bl.

41b. Anthers hairy at base.—Flowers in sessile, profusely bracteate fascicles, white, small. Bracts triangular, long-acuminate, dorsally strongly carinate. Calyx lobes 4–5, narrow, persistent. Corolla tube short, hairy inside. Stamens 4–5, in throat, anthers enclosed. Disk annular. Ovary 2-celled, ovules 6–10 in each ovary cell. Style bifid, ± enclosed. Berry ellipsoid, crowned by persistent calyx lobes, green (? ripe). Seeds c. 4, testa fibrous. Stipules triangular, acuminate, carinate, entire, caducous. Leaves without domatia. Erect shrubs **Hyptianthera** W. & A.

Note: for convenience sake I maintain the two genera, though they might perhaps better be united.

42a. Flowers arranged in peduncled heads, peduncles solitary or subumbellate. Usually climbing shrubs. For further details see under 30a **Lucinaea** DC.

42b. Flowers not in heads 43

43a. Branches very soon with a conspicuous, soft, spongy-swollen, pale corky bark. Berry globose, white, spongy, cells surrounded by 2 or 4 crescent-shaped air-chambers.—Inflorescence often with stalked glands in floral parts. Corolla yellow to white, lobes induplicate-valvate in bud. Erect shrubs. For further details see under 31a **Mycetia** Reinw.

43b. Branches solid, hard, not spongy. Fruit not white-spongy, cells without air-chambers 44

44a. Ovules 2, inserted in the middle of the septum, above each other, one ascending, the other hanging. Drupe with 2, 8–10-longitudinally grooved pyrenes, corky, very narrow when young, afterwards obconical-subcylindric, green when ripe. — Flowers in many-flowered, shortly peduncled, supra-axillary cymes, 4–5-merous, bisexual, white-pinkish, small. Calyx narrowly ob-

conical, limb shortly tubular, denticulate, persistent. Corolla tube cylindric, hairy at apex. Stamens in throat, anthers dorsifixed, exserted. Disk annular. Ovary 2-celled. Style bifid, exserted. Seeds 2 in each pyrene, separated by transverse false septum, testa membranous. Stipules connate into a truncate ring, long-persistent. Leaves without domatia. Erect shrub, growing along the beach **Scyphiphora** Gaertn.

44b. Ovules numerous. Fruit baccate.— Flowers bisexual or unisexual. Stipules not annular 45

45a. Inflorescence simply or compound umbelliform, often involucrate, involucral bracts free or connate. Ovary 4–7, usually 5-celled, with the ovules along septum on prominent placentas. Corolla lobes valvate in bud.— Flowers unisexual, dioecious, rarely monoecious, seemingly bisexual, white, yellow or greenish. Calyx limb strongly widened, dentate or lobed, usually (sub) persistent. Stamens or staminodes in throat, throat with several tufts of hairs. Heterostylous; style with several stigmatic branches, enclosed to slightly exserted. Stylodium minute, sunk at apex of thick disk. Berry globose, several-celled, orange-yellow. Seeds numerous, roundish, testa crustaceous. Stipules smaller or large, caducous. Leaves opposite in two rows, often sericeous beneath, without domatia. Erect shrubs or small trees **Urophyllum** Wall.

45b. Inflorescence not umbelliform. Ovary 1–2-celled. Corolla lobes contorted in bud.— Flowers bisexual or unisexual. Calyx limb tubular or campanulate, terminated by teeth or lobes 46

46a. Terminal vegetative buds and young shoots resinous. Ovary 1-celled.— Flowers solitary on short shoots, usually large. Calyx lobes persistent, large. Fruit large or largish. For further details see under 36a. **Gardenia** L.

46b. Terminal vegetative buds and young shoots non-resinous. Ovary usually 2-celled, sometimes incompletely 1-celled.— Flowers usually in paniculiform-corymbiform inflorescences, less often solitary or fasciculate, usually small to medium-sized 47

47a. Flowers unisexual, dioecious, long-pedicelled, 5-merous, small, in ± paniculiform, small to medium-sized inflorescences in the axil of a leafless node ("leaf-opposed").— Bracts triangular or linear, minute or small. Calyx limb ± campanulate, 5-dentate, persistent. Corolla tube cylindric-campanulate, glabrous inside. Stamens 5, in throat; enclosed. Disk cupular in ♂, small in ♀. Ovary 2-celled, many-ovuled. Placenta large, swollen, inserted

in the middle of the septum. Style ± bifid, enclosed. Berry ellipsoid, crowned by the calyx limb, colour unknown, small. Seeds numerous, cuneate, compressed, reticulate. Stipules ovate-triangular, acuminate, persistent. Leaves without domatia. Inermous shrubs or small trees

Brachytome Hook.f.

47b. Flowers bisexual, usually in distinct inflorescences with cincinnate side-axes, rarely solitary on short shoots, or fascicled, small to largish, subsessile to pedicelled.— Seeds usually numerous, not reticulate (? always). Erect shrubs, small trees or woody climbers, inermous or thorny. For further details see under 36b **Randia** L.

Note: for convenience sake I maintain the two genera, but I think there will be no serious objection in uniting them.

48a. Calyx tubes and (excl. *Morinda angustifolia* Roxb., in which the drupes are free) fruits to the number of 2 to rather numerous entirely connate or nearly so into terminal or axillary, head-like or spicately arranged syncarps.— Corolla lobes valvate in bud. Ovules inserted about the middle of the septum. Inermous shrubs or small trees 49

48b. Calyx tubes and fruits not connate, not forming syncarps 50

49a. Calyx tubes and fruits to the number of 2 to rather numerous connate into irregularly globose-broadly ellipsoid, small or medium-sized peduncled heads; peduncles solitary to umbellate, rarely panicled, terminal or terminating short-shoots, in latter case seemingly axillary, or truly axillary.— Flowers 4–7-merous, bisexual or unisexual, white, often fragrant. Calyx limb (very) short, subtruncate or dentate, caducous, sometimes with 1–2 teeth strongly enlarged into white leaf-like decoy-leaves, Corolla tube short or long, hairy inside. Stamens in throat or slightly lower, anthers dorsifixed, exserted. Disk distinct. Ovary 2, or incompletely 4-celled, ovule subbasal. Heterostyly observed; style bifid, enclosed or exserted. Drupe 1-pyrenous, 1-seeded. Syncarps fleshy, white, yellowish, orange or black. Seed obovoid or reniform, testa membranous. Stipules connate, sheathing, usually largish, entire or 2-lobed, often tardily caducous. Leaves decussate or sometimes 3-verticillate, with acarodomatia, sometimes with bacteriodomatia in tissue on upper side. Leafless nodes not rare. Inermous erect shrubs, small trees or woody climbers **Morinda** L.

49b. Calyx tubes and fruits to the number of 3–6 connate into (very) small, sessile or shortly stalked syncarps, syncarps few to several arranged into spikes, or (so far not in Thailand) in panicles.— Flowers 4–5-merous, bisexual, white or violet, fragrant. Calyx limb truncate, without decoy-leaves. Corolla tube cylindric-swollen, throat glabrous. Stamens in corolla tube, anthers enclosed. Disk fleshy. Ovary 2-celled, ovule inserted about the middle of the septum. Homostylous; style bifid, enclosed. Drupe 1-pyrenous, 1-seeded. Syncarps (very) small, yellowish, white, purple or greenish. Seeds orbicular, dorsally flattened. Stipules hardly connate, not sheathing, usually apically bilobed, small, Leaves decussate, without domatia. Inermous erect or straggling shrub, or small tree **Rennellia** Korth.

Note: probably rightly considered distinct from allied *Morinda* L.

50a. Inflorescences axillary, peduncled, cymose with (soon) distinctly cincinnate ultimate axes, or female flowers 1–3 together.— Flowers bisexual or unisexual (male or female). Funicle thickened. Drupe 4–15-celled. Ovule (sub) apical. Inermous shrubs or trees 51

Note: the three genera mentioned under this heading fairly resemble each other in habit and inflorescence. Though *Guettardella* (51c.) does not belong to item 50a., but to 50b., it has been incorporated also under 50a. because of possible confusion in case only young inflorescences are available in which the cincinnoid character of the ultimate axes has not yet become obvious.

50b. Inflorescences terminal or axillary, not or very rarely with distinct cincinnate ultimate axes, or female flowers solitary.— Flowers bisexual or unisexual (male or female). Fruit usually a drupe mostly 2–5 (–6)-celled or (*Lasianthus*) up to 9-celled, rarely capsular or baccate. Ovule (sub) basal or (sub) apical 52

Note: in very young inflorescences of *Guettarda* (51a.) and *Timonius* (51b.) the cincinnoid character of the ultimate axes may be obscured, giving rise to confusion.

51a. Flowers bisexual, uniform, numerous, mostly subsessile, white to light yellow. Calyx limb campanulate, minutely dentate, circumsciss at the base after flowering.— Corolla tube cylindric, differing in length, hairy in throat, lobes 4–9, imbricate in bud. Stamens 4–9, inserted near throat, anthers enclosed. Disk annular, lobulate within. Ovary 4–9-celled, ovule apical. Style filiform, with large globose stigma. Drupe globose or obovoid, not crowned by calyx limb, green, 1-pyrenous, pyrene woody, irregularly lobed, formed by the coalescence of the separate pyrenes, 4–6-celled, with 1 seed in each apically perforated cell. Seeds curved, testa membranous. Stipules ovate, entire, caducous. Leaves crowded at stem-apices, usually obovate with a broad base, mostly large, with domatia, firm. Unarmed erect shrubs or trees of sandy or rocky beaches **Guettarda** L.

51b. Flowers unisexual, dimorphous, ♀ 1–3, large, ♂ numerous, small, subsessile, white or yellow. Calyx tube poorly developed in ♂, limb campanulate or tubular, 4–5-dentate, or subtruncate, persistent.— Corolla tube cylindric, glabrous or hairy inside, lobes 4-12, imbricate or subvalvate in bud. ♂: Stamens 4–12, near or distinctly below throat, exserted. Pistillode with short style. ♀: Ovary 4–12 (–? 30)-celled, cells divided into 1-ovuled and empty locules by longitudinal, transverse or oblique septa, ovule apical. Disk annular. Style with many-lobed stigma, exserted or enclosed. Drupe depressed-globose to (broadly) ellipsoid, medium-sized to largish, crowned by calyx limb, red or blackish purple, with many 1-seeded pyrenes. Seeds cylindric, testa membranous. Stipules ovate, entire, caducous. Leaves arranged along the branches, variously shaped, with domatia, (thinly) coriaceous or thick. Dioecious, inermous erect shrubs or trees
Timonius DC. nom. cons.

51c. Other plants. Flowers polygamous (bisexual or female). Calyx lobes persistent, linear. (So-far known in Thailand). Female flowers solitary, on long very slender pedicel (? peduncle). Drupe small, (in *Guettardella chinensis* Champ. ex Benth., the only fruiting species so far known from Thailand) narrowly ellipsoid with parallel sides. Leaves herbaceous or firmish. Polygamo-dioecious. For further details see under 72a
Guettardella Champ. ex Benth.

52a. Stigma very conspicuous, very large, solid, shortly lobed, slightly exserted. — Inflorescences axillary or on short shoots. Flowers bisexual and unisexual. Calyx limb widened, denticulate. Corolla tube urceolate or infundibuliform, lobes valvate in bud. Disk annular. Ovule apical. Erect, straggling or climbing, often thorny shrubs or trees 53

52b. Stigma not striking, 2–9-branched, rarely fusiform or capitate, with entire or dentate apex.— Inermous shrubs or trees, or (*Damnacanthus*) spiny shrub 54

53a. Ovary 2-celled. Pyrenes 1–2, often rugulose.— Flowers fascicled, cymose or, rarely, solitary, on short shoots or not, 4–6-merous, usually small, white or greenish. Calyx limb caducous to subpersistent. Corolla tube urceolate or infundibuliform. Stamens in throat, exserted. Drupe often didymous, compressed, black or yellow. Seeds oblong, testa membranous. Stipules free, triangular, acuminate, caducous to long-persistent. Leaves decussate, with domatia. Inermous or thorny erect, straggling or climbing shrubs, or trees (*Plectronia* auct. non L.) **Canthium** Lamk.

53b. Ovary 4–6-celled. Pyrenes 4–5(–6).— Flowers fascicled on leafy or leafless short, shoots, 4–5-merous, greenish, small. Calyx limb finally caducous. Corolla tube urceolate, with ring of hairs in throat. Stamens in throat, exserted. Drupe depressed-globose, brownish green. Seeds compressed, testa membranous. Stipules connate at base into a ring, subulately acuminate. Leaves decussate, rarely 3-verticillate, with domatia. Erect, usually thorny shrubs (*Vangueria* auct. non Juss.) **Meyna** Roxb. ex Link

54a. Flowers in largish heads entirely or partly surrounded by usually conspicuous, sometimes slightly developed involucrum; heads terminal or axillary, most peduncled, basically consisting of a 3-axial branching system. Involucrum composed of 4 shortly connate bracts, when young usually enveloping the inflorescence, afterwards largely shed. Drupes conspicuously flattened, black.— Flowers proper 4–5-merous, bisexual, not or inconspicuously pedicelled, white, greenish, yellowish or purplish. Calyx limb truncate, minutely dentate, finally caducous. Corolla tube very slender, partly hairy inside, throat widened campanulately, lobes valvate in bud. Stamens in throat, enclosed or exserted. Disk bilobed. Style exserted, stigma 2-lobed. Ovary 2-celled, ovule basal. Pyrenes 2. Seeds plan-convex, testa membranous. Stipules oblong-orbicular, entire, lower part becoming pale and corky, long-persistent. Leaves without domatia, long-petioled, usually obovate and distinctly decurrent towards base. Shrublets, usually with fleshy, little-branched stems **Cephaelis** L.

54b. Flowers not in largish, peduncled involucrate heads. Fruits usually drupaceous, drupes not flattened, rarely capsular or baccate 55

55a. Ovule (sub) basal, erect.— Flowers bisexual, or (*Leptodermis*) unisexual. Corolla lobes valvate or imbricate in bud. Fruit drupaceous or (*Leptodermis*) capsular 56

55b. Ovule inserted about the middle of the septum, or (*Guettardella* and *Hypobathrum*) (sub) apical.— Flowers bisexual or unisexual. Corolla lobes valvate or contorted in bud 67

56a. Flowers a few together on hardly developed peduncles emerging from shallow, cup-shaped cavities ("alveoles") in strongly thickened nodes of the stem, (sub) sessile; axes of peduncles (? not in Thailand) sometimes spicately elongated. Stems quadrangular, fleshy, a few together arising from strongly tuber-like swollen common base, the inside of which with a complex system of anastomosing vessels inhabited by ants, outside entirely spineless.— Flowers proper bisexual, homostylous or heterostylous, dimorphic or not,

4-merous, white, small. Calyx limb truncate or denticulate, persistent. Corolla tube cylindric, throat annulate, with 4 tufts of hairs, lobes valvate. Stamens in throat, ± enclosed. Disk annular. Ovary 2-celled. Style bifid, protruding slightly. Drupe narrowly constricted at apex, pulpy, orange, white or red, with 1–2 pyrenes, pyrenes acute or acuminate. Seeds oblong, plan-convex, testa thin. Stipules interpetiolar, seemingly intrapetiolar, entire, caducous. Leaves fleshy, without domatia. Epiphytic shrublets **Hydnophytum** Jack

Note: *Myrmecodia* Jack, thusfar not found in Thailand, may easily be distinguished by having the tubers densely covered with hard black long straight spines, and by its intrapetiolar stipules.

56b. Flowers not borne in cavities of stem-nodes, terminal or axillary, whether or not in distinct inflorescences. Tubers absent.— Corolla lobes valvate or imbricate in bud. Small trees, shrubs, vines or root-climbers 57

57a. Ovary 3–9-celled. Flowers axillary, solitary, fascicled or in distinct inflorescences.— Corolla lobes valvate or imbricate in bud 58

57b. Ovary 2-celled. Flowers terminating normal branches or whether or not leafy axillary short-shoots, or (*Serissa*, *Saprosma*, partly, *Psychotria* occasionally) axillary; solitary, a few together or in distinct inflorescences, bisexual or (*Gaertnera*, partly) unisexual.— Corolla lobes valvate in bud 60

58a. Flowers unisexual, fasciculate, not borne on tubercles, sessile, 5-merous, pink, violet or white, small. Fruit capsular, 5-celled, dehiscent from apex downwards by 5 valves, colour unknown.— Bracts 2, connate. Calyx tube elongate, lobes broad, persistent. Corolla tube cylindric, short-hairy inside, lobes valvate. Stamens in throat, exserted. Staminodes enclosed. Disk annular. Ovary 5-celled. Stigmas 2–5-branched, exserted in ♀. Seeds linear, testa membranous. Stipules smallish, entire, acuminate, persistent. Leaves very small, without domatia. Inermous erect low fetid shrubs **Leptodermis** Wall.

58b. Flowers bisexual, usually borne on tubercles, rarely non-tuberculate. Fruit drupaceous. Seeds more or less similar in shape to the pyrenes. Ovary 3–9-celled. Shrubs or small trees 59

59a. Flowers 1–3 at apex of very slender peduncle, only in one axil of each pair of leaves, 4(–3)-merous, white. Stigma subglobose, shortly 4(–3)-dentate. — Bracts minute. Calyx limb shortly dentate, tardily caducous. Corolla tube urceolate, hairy especially in throat, lobes imbricate in bud. Stamens

in throat, anthers enclosed. Disk large. Ovary 4-celled. Heterostyly observed; style short, enclosed. Drupe broadly obovoid, blue. Pyrenes 4(–3), 1–2-celled, crustaceous. Stipules with divided, ciliate-setose margins, membranous, long-persistent. Leaves opposite in two rows, very small, without domatia. Inermous erect non-fetid shrubs **Litosanthes** Bl.

59b. Flowers 1–several, usually borne on tubercles, mostly sessile, very rarely in peduncled much-branched inflorescences, (? always) in both leaf-axils, 3–9-merous, white or purple. Stigma 3–9-branched. — Bracts absent to largish. Clayx limb truncate-denticulate, or with well-developed lobes, persistent. Corolla tube cylindric, short or long, inside in upper half or in throat only hairy, or entirely glabrous, lobes valvate in bud. Stamens in throat, anthers enlosed or exserted. Disk well-developed. Ovary 3–9-celled. Style well-developed, exserted. Drupe variously shaped, yellow, orange, white, blue, red-orange or black. Pyrenes 2–9, usually 5–6, variously shaped, usually ribbed, mostly woody, 1–2-celled. Stipules triangular to linear, entire, herbaceous, caducous or persistent. Leaves opposite, mostly all in one plane, without domatia, often fetid when bruised. Inermous erect shrubs or small trees (*Mephitidia* Bl. nom.prius) **Lasianthus** Jack

60a. Drupe brittle due to the papery-thin pericarp, globose, 10-nerved. Stigmas 2-branched, branches twisted, enclosed.— Inflorescence paniculiform, widely branched. Bracts small or absent. Flowers 4–5-merous, white or purple. Calyx limb truncate or shortly lobed, persistent. Corolla cylindric, hairy inside. Stamens at different levels in corolla tube, anthers enclosed. Disk small. Drupe globose or flattened, orange-yellow. Pyrenes 2, concave-convex or compressed, winged or not. Seeds strongly flattened, testa thin. Stipules triangular, entire, caducous. Leaves decussate or 3-verticillate, with domatia, strongly fetid when bruised. Dextrorsely twining shrubs, sometimes subherbaceous **Paederia** L.

60b. Drupe usually hard due to the woody endocarp, sometimes pergamentaceous due to the thin endocarp, but never brittle. Stigma 2-branched, branches straight.— Inermous erect shrubs or small trees, sometimes scandent, but not dextrorsely twining 61

61a. Flowers usually glomerulate or solitary on stem apices or in leaf-axils, rarely (*Saprosma*, partly) in small, axillary few-flowered cymes 63

61b. Flowers in terminal, or, extremely rarely (? not in Thailand) axillary, peduncled, many-flowered, usually paniculiform inflorescences with basically 3 main axes, rarely combined into spikes, heads or cincinni, 4–6, usually 5-merous, bisexual, white, pinkish or greenish 62

62a. Ovary and fruit distinctly inferior, 2-celled. Disk present, almost always cushion-shaped, large. Albumen mostly ruminate.— Bracts small. Calyx limb widened or tubular, truncate or denticulate, often persistent. Corolla tube usually short, straight, rarely curved, inside glabrous or hairy, throat usually densely barbate, lobes valvate in bud. Stamens at various levels in corolla tube, enclosed or exserted. Heterostyly observed; style bifid at various levels, enclosed or exserted. Drupe not flattened, globose or ellipsoid, usually crowned by persistent calyx, dry mostly conspicuously longitudinally ribbed and sulcate, black, orange, yellow, red or purple. Seeds plan-convex. Pyrenes 1–2, very different in shape and external texture, 1-celled, usually hard, sometimes crustaceous. Stipules entire or with divided apex, small to largish, rarely forming an ochrea, never with ribs, ridges or wings on the ochrea and/or around the petiole-bases, sometimes becoming pale corky, caducous to long-persistent. Leaves decussate, rarely verticillate, with or without domatia, rarely with bacteriodomatia in tissue, often with marginal nerve and ± straight side-nerves, non-fetid, sometimes leafy nodes alternating with leafless ones. Inermous erect shrubs, small trees, vines or root-climbers, or (in sect. *Streblosa*) dwarf shrubs (*Chassalia* Comm. ex Poir.,— *Grumilea* auct. asiat. non Gaertn.,— *Streblosa* Bl.) **Psychotria** L. nom.cons.

Note: *Psychotria* with capitate inflorescences may be distinguished from *Cephaelis* by its terete drupes, while in *Cephaelis* the drupes are strongly laterally compressed.

62b. Ovary superior, often quasi half-inferior, but only adherent to the torus and easily removable from this, 2-celled. Fruit distinctly superior. Disk absent, but upper part of ovary swollen and possibly functioning as a disk.— Stipules always connate into a long or short, often conspicuous ochrea, whether or not cleft, persistent or soon marcescent and wearing off, mostly with a few ribs or ridges which often form ridges or wings all around the petiole-bases. Leaves decussate, very rarely ternate, with side-nerves always ascending, never closing into a marginal nerve., (? always) with domatia. Drupe black when ripe. Otherwise having the same characters as *Psychotria*. Inermous erect shrubs or small trees **Gaertnera** Lamk. nom.cons.

63a. Ochrea. Ovary superior, often quasi half-superior, but only adherent to the torus and easily removable from this. See under 62b. **Gaertnera** Lamk.

63b. Never ochrea. Ovary inferior to semi-inferior 64

64a. Flowers in axillary, rarely terminal few-flowered cymes. Leaves 3-verticillate (? always) **Saprosma** Bl.

Note: for further details see under 65a.

64b. Flowers in terminal or axillary glomerules, or solitary by reduction, or a few together 65

65a. Glomerules formed by 2 or more whorls of involucral, whether or not subspinescent bracts which become smaller and narrower towards the centre. All involucral bracts soon withering and corky, pale, conspicuous.— Flowering shoots usually with 2 nodes, the lower leafless. Flowers 4-merous, bisexual, white or yellow. Calyx limb widened, truncate or denticulate, usually persistent. Corolla tube short, straight, throat pubescent, lobes clawed inside at the top, valvate in bud. Stamens in throat, anthers medifixed, exserted. Disk cushion-shaped large. Ovary 2-celled. Style bifid, enclosed. Drupe subglobose or ellipsoid, (blackish) blue. Pyrenes 1–2, 1-celled, thin. Seeds ellipsoid or plan-convex. Stipules shortly connate, entire to multifid, caducous. Leaves decussate, rarely ternate, with or without domatia, fetid when bruised. Inermous erect shrubs or small trees **Saprosma** Bl.

65b. Flowers not glomerate by whorls of merely involucral bracts, solitary or a few together 66

66a. Bracts more or less connate, bifid with 2 long teeth, together with 2–7-bristled usually long-persistent stipules and much reduced leaves forming a crowded unit. Leaves opposite (in one plane), without domatia, distinctly pubescent on the nerves, often with pinky-silvery gloss when dry, at least 2 cm long, 1 cm wide, non-fetid.— Flowers solitary or in pairs, terminating reduced short shoots or normal branches, 4-merous, bisexual, white. Calyx tube obconical, lobes unequal, persistent. Corolla tube short, hairy inside in upper half, lobes valvate in bud. Stamens in throat, anthers dorsifixed, exserted. Disk semiglobose. Ovary 2(–3)-celled. Style bifid, enclosed. Drupe globose or ellipsoid, red or blue. Pyrenes 2, plan-convex, cartilaginous. Seeds plan-convex. Erect non-fetid shrub, up to 2 m **Amaracarpus** Bl.

66b. Bracts connate, multifid, not forming a unit with plurifid, connate persistent stipules, and leaves. Leaves decussate (not in one plane), without domatia, glabrous, not silvery when dry, very numerous, very small, fetid when bruised. — Flowers solitary or a few together, terminating short shoots, 4–6-merous, bisexual, white or pinkish. Calyx tube obconical, lobes persistent. Corolla tube infundibuliform, hairy inside, lobes valvate in bud. Stamens in throat or lower, anthers linear, enclosed. Disk annular. Ovary 2-celled. Heterostyly observed; style bifid, exserted or enclosed. Drupe ± globose, colour unknown. Pyrenes 2. Inermous fetid dwarf shrubs, native of China and Japan **Serissa** Commers. ex Juss.

Note: the characters of fruit and seeds are apparently very insufficiently known.

67a. Flowers or flower groups umbellately arranged, seemingly bisexual, but they may functionally be unisexual.— Drupe, with 2–4 pyrenes or (*Prismatomeris*) with thin hard endocarp 68

67b. Flowers variously arranged, but not umbel-like so, usually bisexual or (*Prismatomeris*) perhaps functionally unisexual.— Drupe or berry. Shrubs or small trees, inermous or (*Damnacanthus*, partly) spiny 69

68a. Scandent shrub. Peduncles (in Thailand) not elongated, enveloped by broad, corky, subimbricate bracts. Bracteoles forming a herbaceous-membranous involucre below the flower. Corolla lobes valvate in bud.— Flowers in axillary umbellate-glomerate cymes, 4–5-merous, white. Pedicells strongly accrescent after anthesis. Calyx tube turbinate, limb annular, dentate, finally caducous. Corolla tube short, glabrous within, throat pilose. Stamens 4–5, in throat, exserted. Disk annular. Ovary 4-celled, ovule inserted below the middle of the septum. Style bifid or simple, in full flower unknown. Drupe globose, white, blue-green or blackish. Pyrenes 2–4, dorsally compressed, thin-walled. Seeds compressed. Branches and leaves usually drying black, branches terete. Stipules entire, becoming corky, caducous. Leaves with domatia, and bacteriodomatia in tissue **Gynochthodes** Bl.

68b. Erect shrub. Involucral bracts absent. Corolla lobes contorted in bud. —Flowers usually at apex of short shoots, white, fragrant. Calyx tube campanulate, limb truncate or dentate, usually subpersistent. Corolla tube cylindric, glabrous inside. Stamens 4–5, slightly below throat, enclosed. Disk cushion-shaped. Ovary 2-celled, ovule inserted about the middle of the septum. Style bifid, exserted. Drupe depressed-globose, with thin hard endocarp, black, 1–2-seeded. Seeds globose. Branches and leaves not drying black. Ultimate branchlets acutely margined towards next node, when dried conspicuously shining pale orange-yellow. Stipules becoming corky at the base, entire, cuspidate or bidentate, caducous. Leaves with domatia **Prismatomeris** Thw.

69a. Flowers solitary or in pauciflorous groups on terminal or axillary peduncles, or on short shoots, bisexual or unisexual. Drupe or (*Hypobathrum*) berry 70

69b. Flowers (rather) numerous, combined into peduncled, branched, distinct inflorescences, bisexual. Corolla contorted in bud 76

70a. Ovule and seed flat 71

70b. Ovule and seed angular 72

71a. Berry. Ovule (sub) apical. For further details see under 41a
Hypobathrum Bl.

71b. Drupe. Ovule distinctly inserted on the septum. For further details see under 40b **Diplospora** DC.

72a. Female flowers on very long slender pedicels, solitary in both leaf-axils. Ovule apical.— Flowers polygamous (bisexual or female), with 1–2 linear bracteoles. Bisexual flowers in short- or long-peduncled simple or compound dichasia, 3 or several together. Calyx tube obconical, lobes 4, linear, persistent. Corolla tube narrowly cylindrical, glabrous inside, lobes 4, subvalvate. Stamens 4, near throat, slightly protruding. Disk large, hairy. Ovary 2–3-celled. Style bifid, included. Drupe narrowly ellipsoid, with ± parallel sides, slightly ribbed, crowded by the narrow calyx lobes, ripe red. Pyrenes 2–3. Stipules ovate, entire, narrowly long-acuminate, caducous. Leaves decussate, with few domatia, with very numerous fine parallel venation. Polygamo-dioecious erect shrubs [*Antirhea* auct. non Commers. ex Juss.,— *Antirrhoea* (sphalm.) auct.] **Guettardella** Champ. ex Benth.

Note: a revision of the *Timonius-Antirhea*-complex is badly needed. The species of this group are very similar concerning habit and inflorescence.

72b. All flowers on (very) short pedicels, or on terminal or axillary short-shoots, solitary or a few together. Ovule inserted about the middle of the septum. 73

73a. Ultimate branchlets acutely margined towards next node, dried conspicuously pale orange-yellow.— Corolla contorted in bud. Ovule inserted about the middle of the septum. For further details see under 68b
Prismatomeris Thw.

73b. Branchlets teret, dried not pale orange-yellow 74

74a. Terminal vegetative bud solid, linear-conoid, long. Leaves oblanceolate, very large, up to 30 cm long, 8 cm wide, pale glossy, without domatia, coriaceous. Fruit leathery fleshy-corky, oval-ellipsoid, dried 10-ribbed, with subtruncate-convex apex crowned by enlarged incurved calyx lobes, ripe black-purple or brown. Stamens near base of corolla tube, enclosed.— Flowers solitary or a few in axillary clusters, ebracteate, 5-merous, bisexual, pinkish, fetid. Calyx tube cylindric, small, with patent persistent lobes. Corolla tube cylindric, glabrous inside, lobes imbricate in bud. Disk cushion-shaped. Style short, enclosed, stigma fusiform, ribbed. Ovary 2-celled. Seeds strongly flattened. Stipules lanceolate, entire, caducous. Inermous erect shrub **Gardeniopsis** Miq.

Note: the ovule is said to be inserted mid-septally, if so then seemingly attached with a long base, so far as I can observe. The seeds are strongly coherent, with the septum in-between, as to form one compact mass.

74b. Terminal vegetative bud otherwise, small, inconspicuous. Leaves elliptic-oblong, small to medium-sized, up to 12 cm long, 5 cm wide, herbaceous to firm. Ovule inserted about the middle of the septum. Fruit not fleshy-corky, subglobose or didymous, not with enlarged incurved calyx lobes. Stamens ± in throat of corolla 75

75a. Corolla lobes contorted in bud. Bracteoles connate into a cup ("calyculus"). — Flowers solitary or a few together at apex of short shoots, subtended by a few subulate-acuminate bracts, (4–)5-merous, bisexual, white, fragrant, medium-sized. Calyx limb shortly lobed, with dentate apex, or subtruncate, with or without minute glands, ± persistent. Corolla tube infundibuliform, glabrous inside, throat glabrous. Stamens 5, in throat or lower, exserted. Disk swollen. Ovary 2-celled. Style short, bifid, enclosed. Drupe didymous or globose, blackish purple. Pyrenes 2, wall of pyrene very thin. Seeds 1–2, plan-convex, slightly grooved. Stipules triangular or roundish, dorsally strongly carinate, entire, setaceous, persistent. Leaves usually without domatia. Normally branched, inermous medium-sized shrubs (*Coffea* auct. asiat. non L.) **Paracoffea** Leroy

75b. Corolla lobes valvate in bud. Bracteoles not calyculate.— Flowers 1–2 on axillary short shoots, 4–5-merous, bisexual, white, small, scent unknown Bracts small. Calyx lobes triangular, persistent. Corolla tube cylindric, pubescent in upper half, throat hairy. Stamens near throat, exserted or enclosed. Ovary 2–4-celled. Disk annular. Style with 2–4 stigmas, exserted. Drupe subglobose, red. Pyrenes 1–4, wall of pyrene chartaceous, hard. Seeds subglobose, peltate. Stipules minute, 3-dentate, caducous. Leaves without domatia. Strongly dichotomously branched shrublet, (in Thai species) with axillary straight pale usually long spines **Damnacanthus** Gaertn. f.

Note: doubtfully recorded for Thailand.

76a. Stigma globose, large.— Cymes corymbosely arranged, leaf-opposed. Bracts linear. Flowers white. Calyx lobes 5(–6), linear, long, long-persistent. Corolla tube cylindric, long, glabrous inside, lobes 5. Stamens 5, in throat, ± exserted. Disk indistinct. Ovary 2-celled. Style long, exserted. Berry subdidymous, black. Seeds 2, plan-convex. Stipules narrow, slightly sheathing, entire, setaceously acuminate, long-persistent. Leaves without domatia **Duperrea** Pierre ex Pitard

76b. Stigma 2-branched or fusiform 77

77a. Fruit a berry.— Corolla lobes 5. Flowers in terminal, many-flowered small corymbs, white, 5-merous. Seeds roundish-ellipsoid. Erect shrubs **Tarenna** Gaertn. (sect. *Pseudoixora*)

Note: for further details see under 35b. *Tarenna*.

77b. Fruit a drupe.— Corolla lobes 4 or (*Coffea*) 5–8 78

78a. Bracteoles connate into a cup ("calyculus"). Corolla lobes 5–8. Flowers in axillary, strongly branched, usually conferted cymes, with numerous acute bracts, medium-sized.— Calyx limb truncate, with glandular appendages, ± caducous. Corolla tube trumpet-shaped, glabrous inside. Stamens inserted near base of corolla tube, (±) exserted. Disk annular. Ovary 2-celled. Ovule not embedded in fleshy placenta. Style bifid, (±) exserted. Drupe usually ellipsoid, (sub) didymous, black, rarely red or yellow, smallish. Pyrenes 2(–1), rather hard. Seeds plan-convex, grooved ventrally. Stipules entire, largish, semipersistent. Leaves usually with domatia. Young vegetative buds and flowers vernicose. Cultivated inermous shrubs or small trees, native of tropical Africa **Coffea** L.

78b. Bracteoles not calyculate. Corolla lobes 4. Flowers in terminal or axillary, not strikingly bracteate corymbs or panicles, 4-merous, largish.— Ovule embedded in fleshy placenta. Inermous erect shrubs or small trees, native, but also not rarely cultivated as an ornamental 79

79a. Style much exserted from corolla tube, the exserted part much longer than corolla lobes. Stigma fusiform, apically shortly dentate.— Inflorescence terminal or axillary, base of peduncles and of stem-apices without cataphylls. Flowers white or pinkish. Calyx limb dentate, ± persistent. Corolla tube trumpet-shaped, inside pubescent or glabrous. Stamens in throat, anthers linear, twisted after the pollen are shed, exserted. Disk annular. Ovary 2-celled. Drupe globose or subdidymous, black, 2-seeded. Pyrenes 1, thin-walled. Seeds plan-convex. Stipules basally connate into short sheath, triangular, entire, abruptly acuminate, caducous to long-persistent. Leaves drying black (? always), with domatia, usually with bacteriodomatia in tissue. Inermous erect shrubs or small trees **Pavetta** L.

79b. Style slightly exserted from corolla tube, the exserted part at most as long as corolla lobes. Stigma 2-branched.— Inflorescence terminal, base of peduncles and of stem-apices with very acute cataphylls. Flowers white or orange-red. Calyx limb dentate or shortly lobed, persistent. Corolla tube trumpet-shaped, inside glabrous or hairy in or near throat. Stamens in throat, anthers linear, not or hardly twisted after the pollen are shed, (slightly)

exserted. Disk small. Ovary 2(–3)-celled. Drupe globose or subdidymous, red or black, 1–2-seeded. Pyrenes 1–2, thin-walled. Seeds plan-convex. Stipules basally connate into a short sheath, entire, subulately acuminate, caducous to long-persistent. Leaves opposite, rarely 3-verticillate, mostly not drying black, rarely with domatia and acarodomatia. Inermous erect shrubs or small trees, rarely dwarfy **Ixora** L.

80a. Inermous erect usually tall shrubs or (big) trees. Flowers subsessile 81

80b. Stout lianas, with axillary woody hook-shaped tendrils without involucrum. Flowers usually distinctly pedicelled, 5-merous.— Heads solitary, terminating axillary peduncle-like leafless brachyblasts, articulated with it, subtended by an involucre of 4 caducous bracts, whether or not combined into a terminal leafy inflorescence. Interfloral bracts ("bracteoles") absent or minute. Calyx tubes often spindle-shaped, limb usually campanulately widened, lobes alternating with accessory smaller ones, or the latter absent, persistent. Corolla tube glabrous inside, lobes (sub)-orbicular-elliptic, very small, valvate in bud. Stamens 5, at apex of corolla tube, exserted. Disk small. Ovaries 2-celled, ovules numerous, ascending. Placenta along septum, prominent. Style glabrous, stigma entire, ± ellipsoid. Capsule fusiform, septicidally 2-valved, valves splitting into 2 valves, usually long-pedicelled, usually pubescent, concolorous. Seeds numerous, winged at both ends, minute. Stipules often triangular, entire or (deeply) incised, caducous. Leaves decussate, with domatia. Terminal vegetative bud very flat

Uncaria Schreb. nom. cons

81a. Key based on characters of the vegetative bud 82

81b. Key based on flowering and fruiting specimens 87

82a. Terminal vegetative bud solid, broadly to narrowly conical, (very) acute. — Seeds numerous 83

82b. Terminal vegetative bud flat, tongue-shaped to obovate, with obtuse-rounded apex.— Ovary 2-celled. Seeds usually numerous 84

83a. Terminal vegetative bud broadly conical, short, dry. Ovary 2-celled throughout. Seeds imbricate, strongly flattened, not winged, very acute at one end, very numerous or rather numerous.— Calyx tubes and likewise the capsules entirely free. Corolla lobes valvate in bud. Heads numerous, dry, peduncled, peduncles non-articulate, combined into terminal leafless panicles. Flowers (in Thailand) on a bristly receptacle, each surrounded by distinct, linear interfloral bracts, 4–6-merous, white. Calyx lobes persistent. Corolla tube glabrous inside. Disk indistinct. Placentas subapical, pendulous.

Stigma clavate or globose. Capsules obpyramidal, sessile, dry, dicoccous, introrsely dehiscent, cocci detaching from the axis which is crowned by the stellate calyx lobes, entire or divided into 2 halves, greenish-brownish. Stipules triangular, early caducous. Leaves decussate, with domatia, mostly small to medium-sized. Inermous tall trees (*Adina* auct. non Salisb.) **Metadina** Bakh.f.

Note : *Adina* Salisb., as commonly understood, is a very heterogenous assembly of afroasiatic naucleoids, the taxonomy of which still badly needs investigation on a wide scale. In a strict sense it represents medium-sized shrubs of the habit of North American *Cephalanthus* L., possessing flat terminal vegetative buds, and native to eastern Indochina, southeastern China and Japan.

83b. Terminal vegetative bud narrowly conical, long, sticky. Ovary 2-celled in lower half, 4-celled in upper half. Seeds cylindric, wingless, numerous. — Calyx tubes and likewise the capsules more or less strongly coherent (not connate!). Corolla lobes valvate in bud. Flowers without interfloral bracts, 5-merous, orange, scented at night. Heads dry, solitary, peduncle articulate, with a pair of leaves at the articulation. Calyx lobes persistent. Corolla tube glabrous inside. Stamens 5, in throat, exserted. Disk indistinct. Placentas inserted ± in the middle of the septum, downwards adnate to the septum, upwards 2-lobed, with the branches ascending into the cells. Stigma fusiform. Capsules ± obconoid, sessile, dry, membranous at base, 2-celled, divided at apex into 4 downwardly opening cocci, ripe orangish. Stipules lanceolate, large, early caducous. Leaves decussate, without domatia, usually (very) large. Inermous trees, may become very tall with sufficient age and suitable soil conditions **Anthocephalus** A.Rich. emend. Havil.

84a. Heads many, in triads, combined into terminal leafy, more or less corymbose inflorescences, dry; each triads with the central head very shortly stalked, the 2 other heads long-peduncled, each head just below subtended by 2 distinctly stalked leafy long-persistent bracts of more or less the same shape as the leaves but smaller, and with many parallel straight suberect nerves.— Flowers 5-merous, white. Interfloral bracts ± linear, small. Calyx tubes and likewise the capsules entirely free, limb (in Thailand) distinctly tubular, truncate or minutely dentate, persistent. Corolla tube glabrous inside, throat long-hairy. Stamens 5, in throat, exserted. Disk convex, largish. Placentas subapical, pendulous or (sect. *Paradina*) basal. Stigma (in Thailand) cylindric-mitre-shaped, rather large. Capsules sessile, (broadly) ellipsoid-obconoid, many-ribbed, splitting into 2 cocci remaining attached to the common axis, dehiscing with a wide slit at apex, dry, blackish. Seeds many, imbricate, winged all round. Stipules entire, early caducous. Leaves decussate, with domatia. Inermous trees (*Paradina* Pierre ex Pitard.— *Stephegyne* Korth.) **Mitragyna** Korth. nom. cons.

84b. Heads on (rather) long peduncles, not with subtending leafy conspicuously nerved bracts.— Calyx limb not tubular. Stigma (sub) globose or ellipsoid, entire or bidentate, small. Capsules ± obpyramidal 85

85a. Ovaries with 1 ovule in each cell, ovule inserted slightly below apex of ovary cell, hanging. Stamens 4.— Heads 1–9, peduncled, dry. Interfloral bracts linear. Flowers 4-merous, white, fragrant. Calyx lobes 4, alternating with black gland persistent. Corolla tube pubescent inside, lobes 4, imbricate. Stamens in throat, exserted. Disk indistinct. Ovaries partly adnate to the receptacle. Placentas (sub) apical. Stigma ellipsoid, minute. Capsules partly adnate to the receptacle, dry, (ex Pitard) indehiscent or dehiscent at base, colour unknown. Seeds oblong, wingless. Stipules triangular, entire, finally caducous. Leaves 3-verticillate or decussate, without domatia. Inermous erect medium-sized shrubs (*Cephalanthus* auct. asiat. non L.)
Acrodryon Spreng.

85b. Ovaries with numerous ovules in each ovary cell. Stamens 5–6.— Corolla lobes imbricate in bud. Leaves decussate 86

86a. Calyx tubes and likewise the capsules entirely connate. Heads a syncarp, fruiting ones fleshy-juicy, orangish when ripe, solitary, rarely in triads.— Interfloral bracts absent. Flowers white or yellowish, fragrant. Calyx limb 4–6-dentate, teeth obtuse or acute, persistent. Corolla tube glabrous inside, or hairy in throat, lobes 5–6. Stamens 5-6, in throat, ± enclosed. Disk indistinct. Placentas adnate to the septum or (sub) apical. Stigma capitate or fusiform, entire or 2-dentate, minute. Seeds rather numerous or several, ± ellipsoid, wingless. Stipules ovate, obovate, obtuse, usually early caducous. Leaves with or without domatia. Inermous erect tall shrubs to big trees (*Sarcocephalus* Afz. ex Sabine) **Nauclea** L. sensu Merr.

86b. Calyx tubes and likewise the capsules entirely free. Heads not syncarpous, dry, usually solitary or in triads, rarely more together, in a young stage with the not expanded corollas fully covered by the trigonous, erect, (in Thailand) dried orangish calyx appendage, the immature heads then resembling miniature durian fruits, or, only in one species, with the calyces more or less hidden between the young corollas.— Interfloral bracts (in Thailand) absent. Flowers white or reddish, 5-merous. Calyx limb 5–6-lobed, lobes consisting of a persistent lower part, and a caducous upper part terminating into a solid, trigonous, (in Thailand) orangish appendix. Corolla tube glabrous or nearly so inside, glabrous in throat. Stamens in throat or slightly lower, exserted or enclosed. Disk indistinct. Placentas (sub) apical, hanging. Stigma globose or elliptic, entire, minute. Capsules 2-valved, finally entirely

falling off together with the calyx limb, the remaining central axes giving the heads the appearance of squarrose ceiling-mops, greenish-brownish. Seeds very numerous, ± flat, imbricate, narrowly winged at both ends. Stipules usually tongue-shaped, mostly early caducous. Leaves with or without domatia. Inermous erect shrubs to very tall trees (*Nauclea* auct. non L.) **Neonauclea** Merr.

87a. Ovary 2-celled throughout. Seeds flat, winged or not, minute 88

87b. Ovary 2-celled in lower half, 4-celled in upper half. Seeds cylindric, exalate, large. See under 83b. **Anthocephalus**

88a. Calyx tubes entirely connate, heads consisting of permanently connate capsules. Calyx not appendaged, persistent. Seeds flat, exalate. See under 86a. **Nauclea**

88b. Calyx tubes free, heads consisting of free capsules, or (*Acrodryon*) ovaries and capsules partly adnate to the receptacle 89

89a. Ovaries with 1 ovule in each cell, partly adnate to the receptacle as are the capsules. Seeds exalate. See under 85a. **Acrodryon**

89b. Ovaries with numerous ovules in each cell, not adnate to the receptacle as are the capsules. Seeds alate or (*Metadina*) exalate 90

90a. Calyx lobes prolonged each into a very striking appendage, which is filiform below, triangular-oblong and solid at apex. See under 86b. **Neonauclea**

90b. Calyx lobes inappendiculate 91

91a. Heads combined into inconspicuously bracteate panicles. Stigma clavate or globose. Capsules obpyramidal, angular. See under 83a. **Metadina**

91b. Heads combined into conspicuously bracteate corymbs, bracts large, leafy, strikingly parallel-nerved. Stigma mitriform. Capsules (broadly) ellipsoid, many-ribbed. See under 84a. **Mitragyna**

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