
Sapindaceae

Sapindaceae Juss., Gen.: 246 (1789), nom. cons., "Sapindi".

Aceraceae Juss. (1789), nom. cons.

Hippocastanaceae A. Rich. (1823), nom. cons.

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Trees, treelets, shrubs, lianas or herbaceous climbers; cork superficial; stems of climbing species (i.e., *Serjania*, *Paullinia*, *Urvillea*, *Houssayanthus*, and *Thinouia*) usually with multiple vascular cylinders. Leaves pinnately or ternately compound or palmate, or rarely simple, alternate, rarely opposite; proximal leaflets seldom reduced, reflexed, and covering the stem to resemble a pair of stipules (pseudostipules), distal leaflet in most arboreal and shrubby species rudimentary; stipules present only in climbing species, minute to large. Inflorescences axillary, terminal, pseudo-terminal, cauliflorous or ramiflorous, thyrsopaniculate, racemose, spicate, or fasciculate, or flowers solitary. Flowers 5-merous, regular, or less often 4-merous and obliquely zygomorphic, bisexual or more often functionally unisexual by reduction (plants monoecious or rarely dioecious); sepals distinct or connate at base; petals usually white or light yellow, rarely 0, usually ornamented by an adaxial appendage; appendages variously shaped, mostly petaloid, simple, bifurcate, or hood-shaped, basally adnate to the petal or just a prolongation of petal margins, concealing the nectary; disk extrastaminal, annular or unilateral, often lobed, cup-shaped or dish-shaped, very rarely on both sides of the stamens or intrastaminal; stamens (3-)5-8(-30); filaments distinct or connate at base, equal or unequal in length; anthers dorsifixed or basifixed, introrse, opening by longitudinal slits; sterile stamens present in pistillate flowers; gynoecea syncarpous, (1-)3(-8)-carpellate; carpels with 1, 2, or exceptionally many (7-8 in *Xanthoceras*, 8 in *Magonia*) ovules; style terminal or exceptionally gynobasic (*Deinbollia*), 2-3-branched, or with simple, 2-3-lobed, capitate stigma, sometimes (*Acer*) the style branches elongate and the style nearly 0; pistil usually rudimentary in staminate flowers. Fruit

a septifragal or loculicidal capsule, a schizocarp with winged or non-winged mericarps, baccate or rarely a drupe. Seeds sessile or exceptionally (*Distichostemon*) subtended by a funiculus, variously shaped, exalate or rarely winged, naked, with a partial to complete sarcotesta, or an arillode (arising from the integuments); embryo oily or starchy, lacking endosperm, notorhizal or lomatohizal with straight, curved or plicate, fleshy cotyledons, the radicle often separated by a deep fold in the testa that forms a radicular pocket.

Mostly tropical or subtropical, with a few genera extending to sub-temperate zones; 141 genera and about 1,900 species.

VEGETATIVE MORPHOLOGY. Most genera of Sapindaceae are predominantly medium-sized to large emergent trees or erect shrubs, less often they are tendrilled lianas or understory palm-like treelets, exceptionally sub-shrubs or scandent shrubs. The arboreal and fruticose habits are widespread throughout the distributional range of Sapindaceae, while treelets, lianas, and sub-shrubs are restricted to the tropics. There are about 500 species of lianas, all of which are exclusive to the Neotropics (with the exception of several species found in the Paleotropics), particularly to tribe Paullinieae (*Cardiospermum*, *Houssayanthus*, *Lophostigma*, *Paullinia*, *Serjania*, *Urvillea*, and *Thinouia*), accounting for ca. 60% of the Sapindaceae species in the Neotropics. Sub-shrubs are rare and are known to occur in dry vegetation subject to periodic fires. In the Paleotropics, a few species of *Allophylus*, *Laccodiscus*, and *Lepisanthes* are known to be scandent shrubs, not showing any active mechanism for ascending the host plants.

Exudates for the most part are odorless and colorless. However, exudates are red in *Pometia*,

or white in numerous species of *Paullinia* and *Serjania*.

Stems are for the most part terete and smooth. However, many of the climbing species have stems that are deeply furrowed, or sharply to obtusely angled, and a few have thorny stems.

Bud scales are present in a few taxa, being predominant in subfamily Hippocastanoideae. These are simple and accrescent with the growing buds. Bud scales have also been reported for a few tropical genera, including *Exothea*, *Melicoccus*, *Talisia*, and *Sapindus* that bear minute scales, or *Talisia* (Fig. 84B) and *Pseudopteris* that bear large leaf-like cataphylls. Cataphylls are clustered at the ends of branches, on axillary buds, and at the base of inflorescences. Their size and form vary considerably. In some species they can be up to 25 cm long, while in others they are pinnatifid and a few cm in length.

Leaves are predominantly spirally arranged, and variously compound, less often opposite, simple or digitate. Compound leaves include the following types: palmate, pinnate, bipinnate, tripinnate, trifoliolate, biternate, triternate, or a combination of these. A peculiar character of numerous Sapindaceae with pinnately compound leaves is the presence of a single terminal rudimentary leaflet or process (Fig. 85A). At first glance, this structure may be confused with an undifferentiated leaflet primordium present in other families such as the Meliaceae. However, in Meliaceae, this structure is produced in pairs, and slowly developed into new leaflets. Leaflets are predominantly entire, but there is variation, with some genera having entire, crenate or serrate leaflets. Venation is variable and represented by brochidodromous, cladodromous, craspedodromous, mixed-craspedodromous, semi-craspedodromous, and palinactinodromous types (Hickey 1979). Stipules are largely absent in Sapindaceae, and restricted to the genera of the Paullinieae. Pseudostipules are present in a few species of the paleotropical genera *Alectryon*, *Blighiopsis*, *Chouxia*, *Cupaniopsis*, *Eriocoelum*, *Glennia*, *Haplocoelopsis*, *Laccodiscus*, *Lepisanthes*, *Macphersonia*, *Otonophelium*, *Placodiscus*, and *Pometia* (Weberling 1976). Although superficially similar to stipules, these are in reality proximal leaflets reduced in size, which often clasp the stem. Petioles and leaf rachises are terete, angled, carinate, sulcate, and sometimes narrowly

to broadly winged. The base of petioles and the petiolules are more often enlarged, with the adaxial portion very often depressed or furrowed, or only very rarely nearly cylindrical.

Tendrils are found only in genera of the Paullinieae. They are opposite and coiled, and seem to be homologous to the proximal pair of cincinni (or drepania) of their thyrsoid inflorescences. Very often, the portion of the inflorescence above the tendrils is aborted, resulting in a short axillary branch that produces a pair of opposite tendrils in its distal portion.

The indumentum in the family is quite variable. Plants are either glabrous or exhibit several different kinds of indumentum, which are predominantly composed of simple, erect or curly, non-glandular trichomes. Less frequently, the indumentum may include multicellular-glandular, papilliform, fasciculate, stellate trichomes, or peltate scales. Trichomes occur as a pure stand or as a mixture of different types, and are often classified as puberulent, appressed-pubescent, tomentose, tomentulose, sericeous, velutinous, setiferous, hirsute, woolly, pilose, pilosulous, or furfuraceous. Stiff, irritating hairs occur on the outer surface of fruits of *Cnesmocarpon* and *Jagera* species.

VEGETATIVE ANATOMY. A detailed anatomical survey of Dodonaeoideae and Sapindoideae, which covers both vegetative and reproductive organs, was presented by Radlkofer (1890) and used in explaining his classification. Among other things, Radlkofer described carefully the location and structure of secretory cells that contain saponins and mucilaginous cells, which occur in the leaf epidermis. An important trait discovered by Radlkofer is the constant presence of a cylinder of sclerenchyma in the pericycle, which consists of phloem fibers and stone cells. This structure was observed in all genera of Sapindaceae as circumscribed by Radlkofer (1890) (=Dodonaeoideae + Sapindoideae), with the notable exception of *Xanthoceras* and *Valenzuelia* (the latter renamed as *Guindilia*), in which the ring of sclerenchyma is not continuous; incidentally, *Guindilia* has opposite leaves. The sclerenchyma cylinder is also constantly present in tribe Hippocastaneae, whereas in tribe Acereae sometimes (e.g., *Acer negundo*) it is well developed but sometimes (*A. pseudoplatanus*,

Dipteronia) it is represented only by isolated strands of fibers.

Nodes of Sapindaceae are trilacunar, rarely also 5-lacunar in Hippocastaneae. The vessel segments usually have simple perforation; scalariform perforation is rarely seen in Sapindoideae, and more often in Hippocastaneae. Rays are mostly 1-seriate, but in Acereae mixed 1- and pluriseriate rays are found. A comprehensive study of wood anatomy of Dodonaeoideae and Sapindoideae was published by Klaassen (1999).

Numerous woody vines of the Sapindoideae present anomalous secondary thickening of their stems. The most salient feature of this anomalous

thickening can be described as multistelate, where the stem has a single central stele surrounded by three, five, or up to ten peripheral steles. Anomalous secondary thickening is predominant in *Serjania* (Fig. 76A, D) and *Paullinia* (Fig. 76B), where 58% and 12%, respectively of the species show some kind of anomaly (Acevedo-Rodríguez 1993).

INFLORESCENCES. The inflorescences in Sapindaceae are variously shaped thyrses with lateral dichasia, cincinni, drepania, or reductive forms thereof (for details, see Radlkofer 1890: 178 seq.). They are axillary, distal, cauliflorous, or

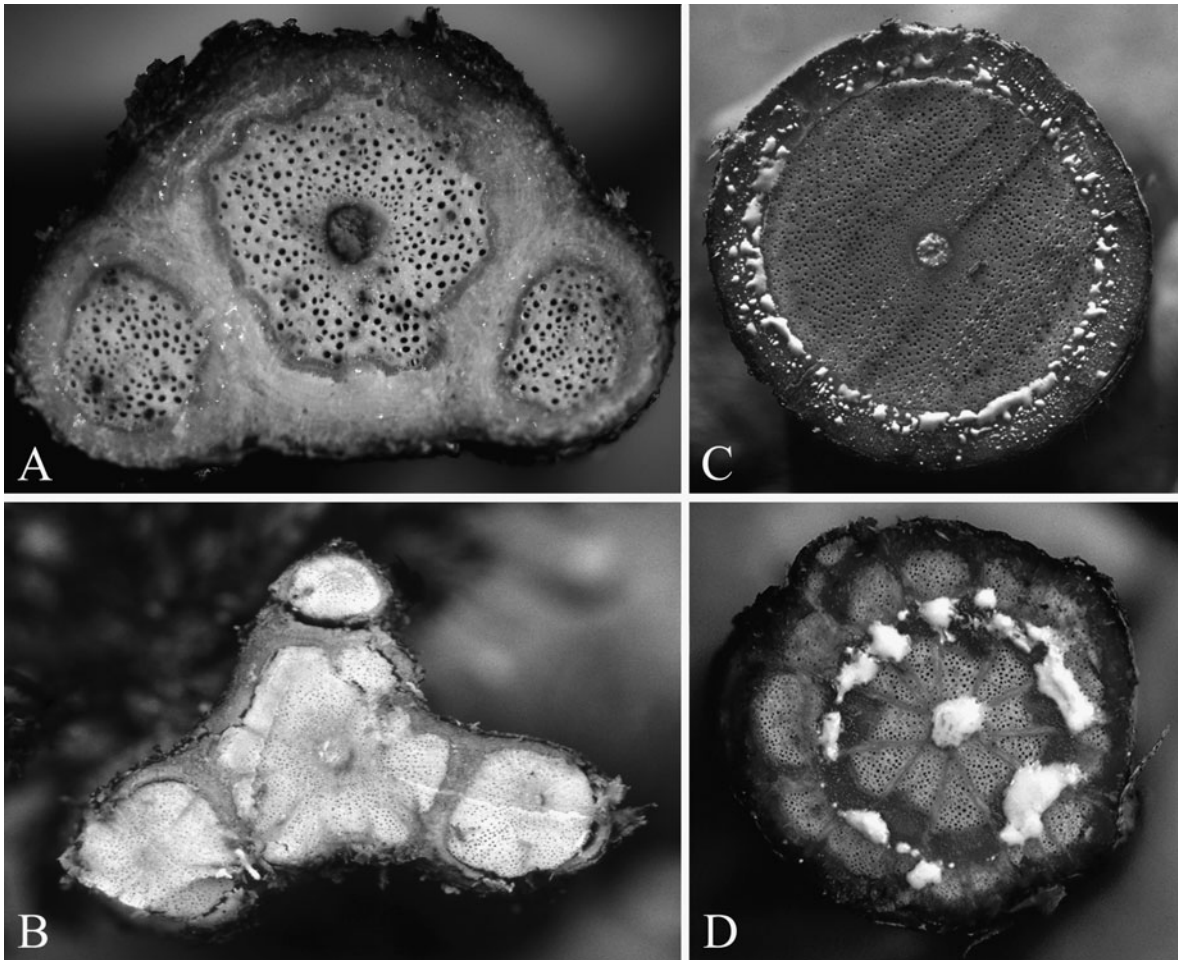


Fig. 76. Sapindaceae. Stem cross sections of Sapindaceae vines. **A** *Serjania* sp., stem with a central stele and two smaller peripheral steles. **B** *Paullinia alata*, stem with a central stele and three smaller peripheral steles. **C** *Paullinia ingifolia*, stems with single stele

and white latex. **D** *Serjania grandifolia* Radlk., vascular tissue produced in alternate concentric layers alternating with connective tissue; note the white latex. (orig.)

supra-axillary, solitary or fasciculate. Some genera have racemes that seem to be derived from thyrsoid ancestors. The flowers within the inflorescences are predominantly unisexual or bisexual, but with a strong tendency for one sex to predominate.

FLOWERS. Pedicels are usually conspicuous, and have an abscission zone or articulation anywhere from base to near the apex, less often they are inconspicuous or non-articulated. The perianth is more often 5-merous, but there is considerable variation in the number of parts. Sepals are distinct (Figs. 77, 78) to completely connate (Fig. 86A, D), and may be as few as three or as many as ten. They are usually of similar size and shape, or less often dimorphic. The petals are distinct, with imbricate aestivation, inserted on the base of an extrastaminal nectary disk. Their number varies from four to six, in addition to the 5-merous corolla. However, there are numerous genera or species that completely lack a corolla. Petals are erect (Fig. 83C) or reflexed (Fig. 78), those of Sapindoideae with an adnate adaxial petaloid appendage (Figs. 83, 84), or with extended inrolled basal margins lacking appendages, or lacking appendages and inrolled margins altogether (Fig. 86E). The petaloid appendages are simple (Fig. 84D, G), bifid, hood-shaped (Fig. 83D), or corniform, and very often sericeous or tomentose. Leinfellner (1958) analyzed these appendages, emphasizing their peltate nature. The disk is extrastaminal, annular (Fig. 77), more rarely amphistaminal (Fig. 80A, B) or intrastaminal, cup-shaped, 2-, 4-, 5(-8)-lobed (Fig. 83C), of elongated corniform lobes, unilateral and semi-annular, or rudimentary, with various indumenta, or glabrous altogether. In many genera, nectar is produced as a reward for pollinators. The number of stamens is more often eight but there is considerable variation, with genera containing from five to eight or from eight to ten. Stamens are sometimes as few as four in *Cupania* or *Dictyoneura*, or as many as 20 in *Hornea*, 30 in *Deinbollia*, and 74 in *Distichostemon*. Filaments are glabrous or variously pubescent, of equal or unequal lengths, erect, spreading, or sigmoid. Anthers are basifixed or dorsifixed, oblong to linear or elliptic to ovate with an obtuse, apiculate or retuse apex, opening along longitudinal slits. The ovary is

syncarpous and usually 3-carpellate. However, there are numerous genera possessing 2-carpellate ovaries in addition to the 3-carpellate ones. *Bloomia* and sometimes *Alectryon* and *Nephelium* have unicarpellate gynoecia. *Chytranthus* and *Radlkofera* have gynoecia with up to eight carpels. The septae are complete, with the ovary containing the same number of locules as carpels, except in *Melicoccus* (Fig. 77) and *Zollingeria*, where the septae are partially developed, resulting in a unilocular ovary. Ovules are anatropous, hemitropous, or campylotropous, one per carpel in subfam. Sapindoideae, or two per carpel in subfam. Dodonaeoideae, and 7–8 in *Magonia* (Dodonaeoideae) and *Xanthoceras* (Xanthoceroideae); placentation is axile, commonly in the middle or less often basal, or apical. The style is terminal and simple in all Sapindaceae except for *Deinbollia*, which has a gynobasic or a subterminal style; in *Dipteronia* and some *Acer*, the style can be very short, or lacking, and has two prominent stigmatic style branches (Fig. 80C, H). The stigmatic surface is variable, very often represented by a line along the stigmatic branches, or by as many lines as carpels along the distal portion of a simple style. Stigmas are sometimes capitate, elongated-cylindrical, or lobed.

For the aspect of oblique floral monosymmetry, see the ontogenetic studies of *Koelreuteria* by Ronse Decraene et al. (2000).

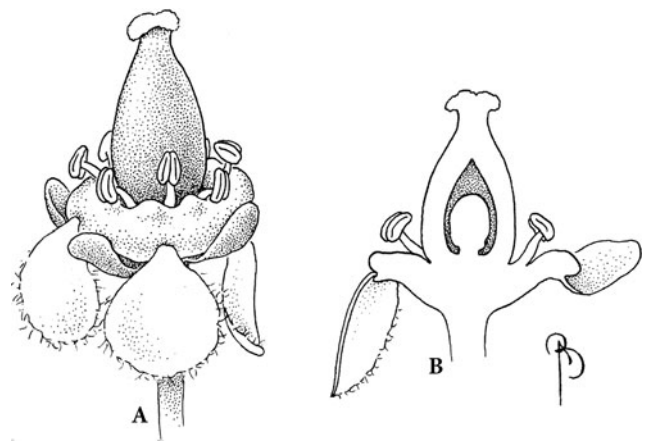


Fig. 77. Sapindaceae. *Melicoccus bijugatus* Jacq. A Pistillate flower. B Ditto, longitudinal section. (Acevedo-Rodríguez 1996; reproduced with permission of the artist Bobbi Angell)

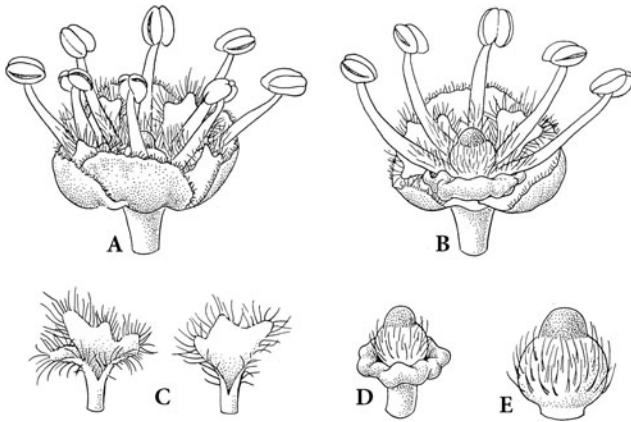


Fig. 78. Sapindaceae. *Vouarana anomala*. A, B Male flowers. C Petals, ventral view. D Pistillode with subtaining annular disk. E Pistillode. (Acevedo-Rodríguez 1997; drawn by Alice Tangerini)

SEX DISTRIBUTION. Functionally bisexual flowers are rare among Sapindaceae; they are known from *Acer*, *Aesculus*, *Bizonula*, *Dodonaea*, *Exothea*, and *Handeliidendron*. Most Sapindaceae are usually labeled as polygamous, and there is evidence for a wide distribution within the family of a particular sexual system, duodichogamy, which has been unveiled in such distantly related taxa as *Cupania* (Bawa 1976), *Acer*, *Dipteronia*, *Hippocastanum*, *Deinbollia*, and *Koelreuteria* (de Jong 1976), *Sapindus* (Subba Reddi et al. 1983), *Serjania* (Acevedo-Rodríguez 1993), *Talisia* (Acevedo-Rodríguez 2003), and *Paullinia* (Somner, unpubl. data).

Duodichogamy implies a sequence of three distinct phases of flowering in which all flowers of a given individual are in the same phase. During the first phase, male flowers release functional pollen; they have a reduced pistil. When they are dropped, female flowers appear on the same inflorescence, which have a well-developed pistil and short stamens with indehiscent anthers. These phases may overlap for a few days. After fertilization of the female flowers (from flowers of an individual that is in a different phase), in a third phase hermaphrodite flowers with well-developed stamens and pistils appear but usually are effectively only male. Sometimes, as in *Acer*, the third phase may be female when the first female phase is repressed for some reason. In many Sapindaceae, the first or usually the last phase may be missing, so that the reproductive system is dichogamous. Since self-incompatibility

seems to be frequent in Sapindaceae, (duo) dichogamy acts as a barrier against selfing. Most genera and species of the family share the possession of male and apparently hermaphrodite but functionally female flowers, and it is likely that they are dichogamous; in the absence of experimental data, however, this remains unproven. In the generic descriptions, these cases are labeled “falsely polygamous”. True dioecy is more rarely documented in the family, as for instance for some *Acer*, *Xerospermum noronhianum*, and some *Nephelia* (van Welzen 1989). It is likely that duodichogamy is basal in the family (de Jong 1976), and van Welzen (1989) supposes that it is symplesiomorphic.

POLLINATION. The open, white, fragrant, and nectar-secreting flowers of tribe Hippocastaneae appear primarily bee-pollinated, such as several *Aesculus*, among which the colored spot on the petals functions as a nectar guide. Nevertheless, such flowers can also be attractive to other kinds of pollinators including Lepidoptera, and species of *Aesculus* sect. *Pavia*, particularly the red-flowered *Ae. pavia*, are pollinated by humming birds. Similarly, in *Billia* the white-flowered *B. columbiana* is probably bee-pollinated, whereas the red flowers of *B. hippocastanum* suggest bird pollination (Forest et al. 2001). In *Acer*, the transition from entomogamy to anemophily is accompanied by one from dichogamy to dioecy (de Jong 1976; Hesse 1979). In Sapindoideae, apart from nectar also pollen appears to be an important reward, because male flowers are not only much more abundant than functionally female flowers, but they also have a longer duration and are much more visited than the females (van Welzen 1989), which implies that the anthers in the female flowers act as mimics.

POLLEN MORPHOLOGY. The literature on pollen morphology of Sapindaceae is quite extensive. The most complete work at the family level is that of Muller and Leenhouts (1976; including 78% of genera), where pollen types were evaluated in regard to their systematic significance. More recent progress has been made by several workers (van der Ham 1990; Acevedo-Rodríguez 1993; Ferrucci and Anzótégui 1993), but their analyses apply only to some of the genera. The present overview is based on pollen data for

137 of the 141 genera currently recognized in Sapindaceae.

Sapindaceae pollen grains are usually isopolar or subisopolar monads. Tetrads occur only in *Magonia* (Fig. 79F). Several genera of Paullinieae (see below) have distinctly heteropolar grains (Fig. 79G, I). Pollen grain size is usually between 20 and 30 μm , and the grains are oblate to prolate in shape. Colporate pollen is usually suboblate to prolate (Fig. 79A–E), whereas pollen with small apertures (porate, brevicolporate) or with connected apertures (syncolporate, parasyncolporate) has a more oblate shape (Fig. 79G–L). The equatorial outline is almost circular (Fig. 79C, D) to bluntly triangular (Fig. 79G–L); the meridional outline is almost circular to more or less elliptic (Fig. 79B, E, H).

Generally, Sapindaceae pollen is 3-aperturate (Fig. 79A–L), but often small percentages of 2- and 4-aperturate grains co-occur. Colporate pollen (Fig. 79A–C, E, F) is the commonest, being known from many genera in all four subfamilies. It is a relatively basic type found in many other angiosperm families. Several other types are more restricted. Syncolporate (Fig. 79J) and parasyncolporate pollen (Fig. 79K), with and without apocolpial fields, respectively, are known only in subfamily Sapindoideae, being present in most Cupanieae, *Alectryon*, *Schleichera*, *Castanospora*, *Tristira*, and *Tristiropsis*. Parasyncolporate and syncolporate are not clear-cut character states. Moreover, several genera (e.g., *Alectryon*, *Arytera*, and *Cupania*) possess both colporate and (para)syncolporate pollen, and often intermediates as well (van der Ham 1990; van Bergen et al. 1995). Small ectoapertures occur in brevicolporate and porate pollen found in a

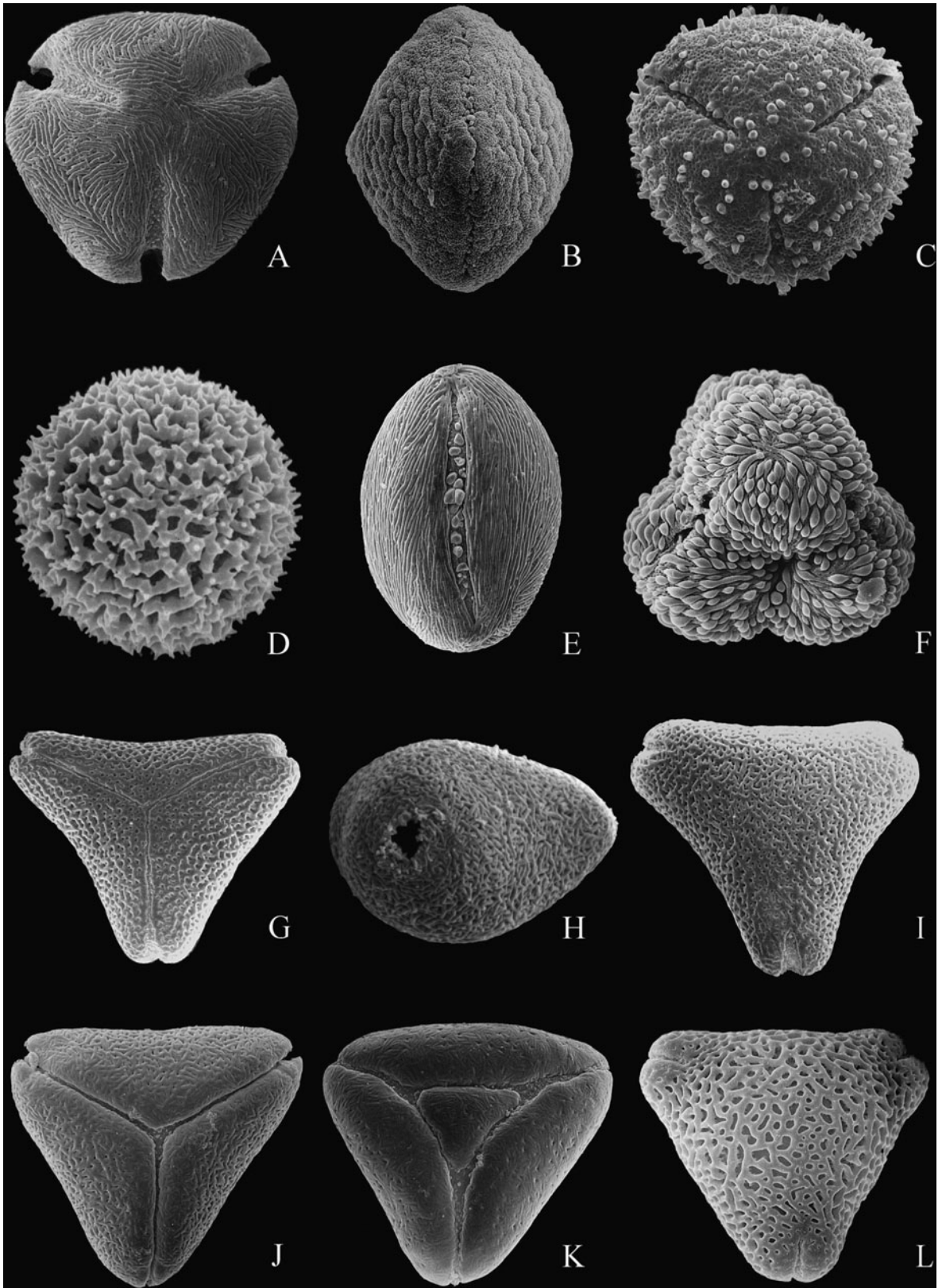
few species of *Allophylus* (Fig. 79H), *Lepisanthes*, *Pometia* (Fig. 79L), *Talisia*, and tribe Paullinieae. Pollen of several Paullinieae is heteropolar with a demisyncolporate aperture system. *Cardiospermum* pollen has short demicolpi on the proximal side of the pollen, whereas pollen of several related genera has a demisyncolporate aperture system, and a few species of *Serjania* and *Urvillea* (Fig. 79G, I) have a syncolporate aperture system proximally with short demicolpi distally. *Distichostemon* pollen has indistinct ectoapertures, and a few species of *Harpullia* have pollen without recognizable ectoapertures (cryptoaperturate; Fig. 79D). Sapindaceae pollen grains nearly always have lalongate, elliptic to subcircular endoapertures, though usually hidden by the ectoaperture margins. *Acer* pollen may have apertures without or with indistinct endoapertures.

The exine is usually clearly stratified, showing a tectum, a columellate infratectal layer, and a nexine. In *Diplopeltis*, *Distichostemon*, and *Dodonaea*, the infratectal layer is granular/columellate, which might relate to wind-pollination. Mostly, the nexine consists of a distinctly delimited foot layer and endexine. The endexine is thin in non-apertural parts, thickens toward the apertures, and is maximal along and under the apertures.

The ornamentation of the exine shows much variation. Striate (Fig. 79A, E), rugulate (Fig. 79H, J), perforate (Fig. 79G), and intermediate types are most common; verrucate (Fig. 79C), scabrate (Fig. 79B), and reticulate (Fig. 79D, L) types are less frequent. In subfamilies Xanthoceroideae, Hippocastanoideae, and Dodonaeoideae, rugulate pollen is rare and psilate pollen entirely absent. In subfamilies Hippocastanoideae and Sapindoideae, verrucate and scabrate ornamentation are absent

Fig. 79. Sapindaceae. Pollen micrographs. A, G–L Subfam. Sapindoideae. B–D, F Subfam. Dodonaeoideae. E Subfam. Hippocastanoideae. All micrographs in polar view, except for B, E, and H, which are in equatorial view. A *Erythrophysopsis aesculina*, colporate, striate pollen grain, $\times 2,100$. B *Dodonaea truncatialis*, colporate, scabrate pollen grain (prolate equatorial view) with mesocolpial scabrae in a coarser pattern, $\times 1,500$. C *Exothea copalillo*, colporate, loosely scabrate-verrucate pollen grain, $\times 3,150$. D *Harpullia crustacea*, cryptoaperturate, reticulate (muri with scabrae) pollen grain, $\times 2,500$. E *Handeliendron bodinieri*, colporate, striate pollen grain (prolate equatorial view) showing verrucate colpus

membrane, $\times 2,000$. F *Magonia pubescens*, pollen tetrad (upper pollen grain in polar view) with striate-gemmate ornamentation, $\times 900$. G, I *Urvillea ulmacea*, heteropolar, demisyncolporate, perforate-reticulate pollen grains, with proximal view showing long, fused demicolpi (G), and distal view showing short demicolpi (I), $\times 1,800$. H *Allophylus quercifolius*, porate rugulate pollen grain, equatorial view showing one of the three pores, $\times 2,000$. J *Cupania belizensis*, syncolporate, rugulate pollen grain, $\times 1,900$. K *Matayba apetala*, parasyncolporate, perforate-indistinctly rugulate pollen grain, $\times 2,250$. L *Pometia pinnata*, brevicolporate, reticulate pollen grain, $\times 1,500$. (Photos R. van der Ham)



or rare (present only in some *Acer* species, and in the Malesian genera *Cubilia*, *Dimocarpus*, *Jagera*, and *Trigonachras*), but it is common in *Xanthoceras* and *Dodonaeoideae* (e.g., *Dodonaea*, *Exothea*, *Filicium*, *Ganophyllum*, and *Zanha*). The tectum is usually perforate, but less densely and less distinctly so toward the apertures. Perforate types are linked with more or less reticulate types. Simple reticulate ornamentation is rare (e.g., *Pometia*; Fig. 79L). Striate ornamentation is often associated with a colporate aperture system (Fig. 79A, E), and rugulate with a (para)syncolporate aperture system (Fig. 79J, K), which probably reflects a functional, harmomegathic relation. Ornamentation often varies within genera, while, e.g., *Dimocarpus longan* shows remarkable infraspecific variation: striate, perforate, scabrate, and intermediates thereof (van der Ham 1990).

Muller and Leenhouts (1976) recognized 12 pollen types, which were based largely on ectoaperture features and pollen grain shape. The colporate spheroidal type A (Fig. 79A–C, E), found in most genera, was considered basic. Type B1 and type B2 (Fig. 79J, K; many genera) include spheroidal to oblate pollen with a (para)syncolporate aperture system. These types intergrade and are combined here (type B1/2). This applies also to the brevicolporate oblate types A1 and C1 (Fig. 79L; 8 genera; type A1/C1). Type C2 (Fig. 79G, I; 4 genera) includes oblate pollen with a heteropolar aperture system, and type C3 (Fig. 79H; 2 genera) oblate pollen with porate apertures. Type D was described as 2-porate. However, of the two genera mentioned, *Lophostigma* has 4-aperturate pollen, while the very rare 2-porate *Allophylus* pollen is probably a variant of the normal 3-porate type (Fig. 79H). Type E (Fig. 79F) represents the tetrad pollen of *Magonia*. Type F includes colporate (per)prolate, equatorially constricted pollen, and is found only in *Diplopeltis huegelii*. Type G was described as spheroidal pollen with protruding endoapertures without ectoapertures, occurring in *Distichostemon*. However, indistinct ectoapertures appeared to be present; therefore, this pollen type is considered here as a variant of the basic colporate type. Type H (Fig. 79D) includes the spheroidal cryptoaperturate pollen occurring in a few *Harpullia* species. As far as possible, brief pollen descriptions are indicated in the generic descriptions below.

Comparison with the molecular phylogenetic trees of 64 genera by Harrington et al. (2005) suggests that the colporate spheroidal type A is indeed basal in the Sapindaceae, subfamilies Xanthoceroideae, Hippocastanoideae, and Dodonaeoideae being characterized or heavily dominated by this pollen type. Pollen types E, F, and H are each restricted to one or a few species of Dodonaeoideae. In subfamily Sapindoideae, the commonest pollen types A and B1/2 occur largely clustered—for example, type A in clade A (Lepisantheae-Sapindeae) and clade B (Nephelieae), and type B1/2 in clade C (Cupanieae), whereas type A1/C1 is found in a few isolated taxa. Pollen types C2 and C3 are restricted to clade D (Paullinieae-Thouinieae).

EMBRYOLOGY. Pollen grains are 2-celled when shed. The ovule is anatropous to hemitropous or campylotropous (at least after fertilization), bitegmic, crassinucellate, and the micropyle is formed by both integuments or rarely only by the inner one. The chalazal megaspore develops into a Polygonum type embryo sac. The endosperm is nuclear, and the tissue is digested before it becomes cellular (Davis 1966; Johri et al. 1992).

FRUIT AND SEED. The vast majority of Sapindaceae genera have trilocular fruits, although many also have bilocular, unilocular, or sometimes quadrilocular fruits. In addition, fruits of several genera are predominantly unilocular due to the abortion of carpels, but sometimes they may develop more than one locule. Partly trilocular fruits are produced in *Koelreuteria* and *Euphorianthus* because of their distally incomplete septa. Fruits of *Chytranthus* and *Radlkofera* contain up to 8 locules. Fruits are either indehiscent or dehiscent. Indehiscent fruits are baccate with a leathery to crustose pericarp, or exceptionally a drupe with a stony (*Tristiropsis*) or woody (*Hypelate*) endocarp. Indehiscent fruits are either unlobed, deeply lobed, or made of monocarps, these of the same number as the carpels or less, due to abortion. Dehiscent fruits are capsular or schizocarpic. The former are predominantly loculicidal and early dehiscent, or less often septicidal, septifragal, calyptrate, tardily dehiscent, or incompletely dehiscent. Their texture varies from woody, coriaceous to papery or membranous. Schizocarpic fruits are predominantly

made of samaroid mericarps, and less often of sub-globose, unwinged mericarps.

Seeds are ellipsoid to sub-globose or less often lenticular or flattened, exalate or exceptionally winged (*Diplokeleba* and *Magonia*), glabrous or less often pubescent, the testa totally dry (scleroidal), with fleshy portions, or completely fleshy (sarcotestal), the scleroidal testa totally naked or partially to completely covered by an arillode (of integumental origin), which sometimes bears a funiculus-like basal projection (e.g., *Guioa*, *Mischocarpus*, and *Sarcopteryx*). Scleroidal seeds sometimes bear a small to large hilum. The embryo is usually fleshy, oily or starchy, lacking endosperm, notorhizal or lomatorhizal with straight, curved or plicate, fleshy cotyledons, the radicle often separated by a deep fold in the testa that forms a radicular pocket.

PHYTOCHEMISTRY. (based on Hegnauer 1973, 1990) A large amount of quebrachitol, a monomethyl ether of 1-inositol, occurs in leaves, barks, flowers, and fruits of the whole family. Cyanogenic glucosides are widely distributed in the family (but not in Hippocastanoideae); they are distributed throughout the plant body, including ripe seeds. There they are often replaced by cyanolipids, which in part also are very toxic. Polyphenolics are found in Sapindaceae mainly as coumarins, flavonoids, and proanthocyanidins. Condensed tannins, based on proanthocyanidins, can occur in large quantities, amounting to 15–20% of the dry bark in Sapindoideae. Gallotannins and their derivatives (bergenin) are also present. The family is also rich in saponins, which are contained in idioblasts within the vegetative tissues and very often in the seeds. These compounds include mono- and bidesmosidic saponins with triterpene sapogenins, and some have prominent ichthyotoxic and detergent properties. The resinous exudates of Dodonoideae are based on diterpenes and triterpenes. Non-proteinogenic amino acids of the hypoglycin type with branched carbon chains of 6 or 7 C-atoms occur free or as glutamyl peptides in the seeds, and are known from the whole family. Unspecific alkaloid tests have been positive for a large number of species of the family, but specific compounds rarely have been isolated and characterized. An exception are the purine bases

(caffeine, theobromine, theophylline), which are accumulated in large amounts in the seeds and other plant parts of *Paullinia cupana* and related species, from which in Amazonia a stimulating drink (“guaraná”) is prepared since time immemorial.

DISPERSAL. Wind-dispersed fruits consist of samaroid mericarps (Figs. 82, 83F) that are straw-colored at maturity. The genera *Diplokeleba* and *Magonia* have capsules with winged seeds that may also be dispersed by wind. Capsular fruits have green, red, orange, or yellow pericarps, with seeds that are either sarcotestal or arillate, and presumably dispersed by birds. Indehiscent baccate fruits have green, yellow, or red pericarps, and usually contain sarcotestal seeds very likely dispersed by mammals such as monkeys or bats. Several genera with inflated capsules seem to lack dispersal mechanisms; in these, fruit walls usually disintegrate, and the seeds are ultimately released by the effect of gravity.

FOSSILS. *Acer* fruits first occur in the late Paleocene of North America, and in the Eocene and later Tertiary the genus is well represented there but also in Europe and Asia (Manchester 1999). The early occurrence of *Acer* in North America with the coeval appearance of *Dipteronia* (McClain and Manchester 2001) and the related extinct Eocene fruit, *Deviacer*, may point to a North American origin of the group. Leaves and fruits of *Aesculus* are on record from the Maastrichtian to early Eocene of North America (Manchester 2001), and also from the Paleogene of Spitsbergen and Kamtchatka (Budantsev 1983), whereas in Europe the genus does not appear before the Miocene (see also Harris et al. 2009). Fossil seeds attributable to Sapindoideae (from genus *Sapindospermum* Reid & Chandler) are known from the Cretaceous of North America, Greenland, Europe, and Siberia, and fossil wood (*Sapindoxylum* Kräusel) has been recovered from Cretaceous beds in Egypt (Knobloch and Mai 1986). Sapindaceous flowers are reported from the middle Eocene of British Columbia (Erwin and Stockey 1990). *Koelreuteria* has an ample fossil record in the northern hemisphere that extends back to the middle Eocene (Manchester 1999).

The fossil pollen record of the family begins in the Cretaceous, represented mainly by the pollen

genus *Cupanieidites*, which corresponds to the extant genus *Cupaniopsis* and several related genera (see Cookson and Pike 1954). *Cupanieidites* appeared first in the Coniacian and Santonian of Gabon, and in the Senonian of India and Brazil, became more frequent during the Maastriichtian in North America, and appeared during the Paleocene in Australia and was abundant there in the Eocene (see Muller 1981).

FAMILY CLASSIFICATION. Sapindaceae were first proposed by Jussieu in 1789 in his *Genera Plantarum* as a family distinct from Aceraceae (including *Aesculus*). This concept of Sapindaceae has been followed by numerous workers such as de Candolle (1824, who proposed Hippocastanaceae as a separate family), Cambessèdes (1829), and Don (1831). Later workers, such as Reichenbach (1834), Lindley (1862), Bentham and Hooker (1862), Baillon (1874), and Blume (1878), included Aceraceae, Hippocastanaceae, and various genera currently recognized in other families such as Staphyleaceae, Sabiaceae, and Melianthaceae within Sapindaceae.

The concept of Sapindaceae held by the end of the 19th century and through most of the 20th century as a family distinct from Aceraceae and Hippocastanaceae is the result of the monumental work of Radlkofer (1888, 1890, 1931). He provided the first worldwide system of classification for the family, recognizing two subfamilies and 14 tribes, and although outdated, his work is still a useful framework for the identification of taxa and the understanding of phylogenetic relationships within Sapindaceae. His system considered the uniovulate Sapindaceae to be the most basic members within the family. In 1964, Scholz provided modern names for the two recognized subfamilies (i.e., Dodonaeoideae and Sapindoideae), and inverted their sequence, i.e., considering the multiovulate Dodoneoideae as basal within the family. This rearrangement was followed by Capuron (1969), who in addition, modified some of the generic concepts. Muller and Leenhouts (1976) independently proposed a rearrangement to Radlkofer's system that agreed with Scholz's general rearrangement but proposed more substantial changes. They reduced tribe Aphanieae into Lepisantheae, and suggested the inclusion of families Aceraceae and Hippocastanaceae into subfamily Dodonaeoideae,

Aceraceae in its own tribe, and Hippocastanaceae as part of tribe Harpullieae.

The inclusion of Aceraceae and Hippocastanaceae by Muller and Leenhouts (1976) was slowly to be adopted. Thorne (1976), Cronquist (1981), and Takhtajan (1997) continued recognizing Aceraceae and Hippocastanaceae as distinct families. At the same time, floristic works were not confronted with this dilemma, because Sapindaceae s.s. are predominately tropical, while Aceraceae and Hippocastanaceae are largely temperate. More recently, researchers are following the suggestions of Muller and Leenhouts to include Aceraceae and Hippocastanaceae within Sapindaceae. Judd et al. (1994, 1999), who did a cladistic analysis based on morphological characters, supported the inclusion of both families within Sapindaceae. Savolainen et al. (2000), Soltis et al. (2000), and Johnson and Chase (in Klaassen 1999), from results of studies based on DNA sequence data for a small number of taxa, found Hippocastanaceae and Aceraceae to be sister groups and to be nested within Sapindaceae.

In a later study, Harrington et al. (2005), using sequencing data from two plastid genes (*matK* and *rbcL*) for 64 genera of Sapindaceae, Aceraceae, and Hippocastanaceae, found strong support for the recognition of four major clades. Their analyses show weak support for a Hippocastaniodeae clade (Aceraceae and Hippocastanaceae) being sister or basal to the remaining Sapindaceae, which could be interpreted as support for the recognition of Aceraceae and Hippocastanaceae as distinct families. They, however, opted for the recognition of four subfamilies within Sapindaceae (i.e., Xanthoceroideae, Hippocastanoideae, Dodonaeoideae, and Sapindoideae), instead of four or five closely related families. The acceptance of four subfamilies within Sapindaceae seems to be gaining support even in the absence of strong cladistic evidence. Thorne and Reveal (2007) modified their concept of Sapindaceae to recognize four subfamilies as suggested by Harrington et al. In a more recent study, Buerki et al. (2009), using sequence data from eight plastid and nuclear genes for 104 genera of Sapindaceae s.l., found ample support for the recognition of four clades within Sapindaceae, as proposed by Harrington et al., but like these authors, they could not place the Xanthoceroideae clade with certainty among the

remaining clades, but left room for the interpretation of Aceraceae and Hippocastanaceae as a clade closely related to Sapindaceae s.str. The current treatment follows the approach of Harrington et al. (2005) in recognizing four subfamilies within Sapindaceae, instead of multiple families.

TRIBAL CLASSIFICATION. Radlkofer (1931) recognized 14 tribes within Sapindaceae based mostly on flower symmetry and fruit type. His system remained largely unchanged until Muller and Leenhouts (1976) cast doubts on the monophyly of the Melicocceae, and the validity of the Cupanieae as distinct from the Schleichereae and Nephelieae. They ultimately suggested the possibility of reducing the latter three tribes into one. In a more recent cladistic analysis based on morphological data, Acevedo-Rodríguez (2002) cast further doubts on the validity of the tribe Melicocceae, suggesting the genera *Castanospora*, *Tristira*, and *Tristiropsis* not to belong there. Leenhouts (1978) evaluated the tribe Nephelieae, but did not address the limits of the closely related Cupanieae and Schleichereae. These studies were followed by those of Johnson and Chase (in Klaassen 1999) who analyzed many more genera (40) than did previous authors. Their studies, although including few genera, suggest clades that conflict with the current tribal classification, except for the Paullinieae-Thouinieae clade. Their analysis also suggests Paullinieae and Thouinieae to be sister groups of a larger clade. These results contrast with those of Acevedo-Rodríguez (1993), Harrington et al. (2005), and Buerki et al. (2009) where the genera of Paullinieae are nested within the Thouinieae, therefore calling for the merging of the Paullinieae and Thouinieae tribes.

The work of Harrington et al. (2005) found support for various lineages within their proposed four subfamilies. Some of these lineages are strongly supported, while others are only weakly so. In summary, they found support for the Acereae and Hippocastaneae clades within subfamily Hippocastanoideae; a dehiscent fruit clade and an indehiscent fruit clade within subfamily Dodonaeoideae; clade Lepiantheae-Sapindeae, clade Nephelieae, clade Cupanieae, and clade Paullinieae-Thouinieae within subfamily Sapindoideae. Buerki et al. (2009) found strong support for the topologies obtained by

Harrington et al. (2005) for the first three subfamilies, but differ by proposing 10 groups within subfamily Sapindoideae. Buerki et al.'s results provide strong support for the *Paullinia*, *Melicoccus*, *Tristiropsis*, *Macphersonia*, *Sapindus*, *Schleichera*, and *Delavaya* groups, and only weak support for the *Blomia*, *Cupania*, and *Koelreuteria* groups. However, the relationship among these clades is not well supported in their analyses. Some of the proposed topologies seem inconclusive, since some of the morphologically well-defined genera are suggested to be either paraphyletic or polyphyletic, and many topologies are only weakly supported. With exception of Paullinieae (expanded to include Thouinieae), which has support from various analyses, the tribal classification in Sapindaceae is still largely unresolved.

In the present treatment, we follow Harrington et al. (2005) in recognizing four subfamilies and four tribes within subfamilies Hippocastanoideae and Dodonaeoideae. With regards to subfamily Sapindoideae, we will not make an attempt to divide it into tribes, as most relationships suggested by previous workers are either not supported by molecular data or are inconclusive (Harrington et al. 2005; Buerki et al. 2009). Instead, we will recognize only the tribes Paullinieae (including Thouinieae) and Melicocceae (excluding *Tristira*, *Tristiropsis*, *Castanospora*, and *Dilodendron*) for which there seems to be strong support from either morphology or DNA sequencing data; the remaining genera will be treated alphabetically as incertae sedis within subfamily Sapindoideae. We also follow Harrington et al. (2005) in including *Koeleuteria* and *Ungnadia* within subfamily Sapindoideae.

AFFINITIES. An early, very extensive study on the relationship of Sapindaceae with other families, involving molecular data, was that of Gadek et al. (1996). They analyzed *rbcl* sequence data for representatives of all putative sapindalean families. Their results identified a sapindalean clade sister to representatives of Malvales. This premise supports a broader concept of Sapindales similar to that of Cronquist (1981) but with the exclusion of some families. More recent work has fully confirmed the work of Gadek et al. (1996); see INTRODUCTION TO SAPINDALES in this volume.

ECONOMIC IMPORTANCE. Sapindaceae are the source of numerous products, some of which are economically important, either globally or locally. Among the most important ones, fruit crops are high on the list. These include edible fruits such as litchi (*Litchi sinensis*), longan (*Dimocarpus longan*), rambutan (*Nephelium lappaceum*), and pulasan (*N. ramboutan-ake*) at a global level, and the mamoncillo or keneep (*Melicoccus bijugatus*), pitomba (*Talisia esculenta*), and cutuplií o guaya (*T. olivaeformis*) at a local level. The arillodes of *Blighia sapida* are the source of the nutritious ackee, widely consumed in Jamaica, but highly toxic when eaten unripe (Rashford 2001). Numerous species of *Paullinia* have been reported to be useful in the preparation of medicines, caffeine-rich beverages, binding and weaving material, and for fish, human and arrow poisoning (Beck 1990). The seeds of *Paullinia cupana* are the source of the important Brazilian crop guaraná, a source of caffeine and flavoring of soft drinks. Almost all Sapindaceae are used around the tropics for fish poisoning (Acevedo-Rodríguez 1990). The wood of some species of *Euphorianthus*, *Harpullia*, and *Schleichera* are used in the construction of houses. Numerous genera are grown as ornamentals—e.g., *Acer*, *Aesculus*, *Arfeuillea*, *Allophylus*, *Cardiospermum*, *Filicium*, *Harpullia*, *Koelreuteria*, *Sapindus*, and *Xanthoceras*. Minor products include oils from *Pappea* and *Schleichera*, and arrow poison from *Paullinia pinnata*.

KEY TO THE GENERA

1. Carpels multiovulate 2
 - Carpels uniovulate 41
2. Leaves simple or unifoliolate 3
 - Leaves compound or palmately lobed 8
3. Leaves opposite; carpels 2; fruits of 2 indehiscent, distally winged mericarps 2. *Acer* (in part)
 - Leaves alternate; carpels 3 or more numerous, sometimes 2 but then fruits capsular 4
4. Petals absent 5
 - Petals present 7
5. Floral disk unilateral 17. *Llagunoa* (in part)
 - Floral disk obsolete or absent 6
6. Plant often viscid; sepals 3–7; stamens 5–15, in one row 13. *Dodonaea* (in part)
 - Plant not viscid; sepals 5–8; stamens 8–74, usually in two or more rows 12. *Distichostemon*
7. Plant with glandular and simple trichomes; inflorescence a thyrse, with numerous flowers; sepals of

- similar size; fruit a schizocarp of 3 indehiscent obovoid cocci or a crustose capsule 11. *Diplopeltis*
- Plants without glandular trichomes; inflorescence racemose, 1–3-flowered; outer two sepals smaller; fruit an inflated capsule 124. *Stocksia*
8. Leaves opposite or subopposite 9
 - Leaves alternate 16
 9. Leaves digitate or trifoliolate 10
 - Leaves pinnate 14
 10. Leaves trifoliolate 11
 - Leaves digitate 12
 11. Corolla zygomorphic, usually of only 4 petals; petals clawed, crested above the claw; carpels (2)3(4); stigma unlobed; fruit a loculicidal, unwinged capsule 5. *Billia*
 - Corolla actinomorphic, of 5 petals; petals not clawed nor crested; carpels 2; stigmas two; fruit of two indehiscent, distally or dorsally winged mericarps 2. *Acer* (in part)
 12. Fruit of two indehiscent, distally or dorsally winged mericarps 2. *Acer* (in part)
 - Fruit a loculicidal, unwinged capsule 13
 13. Sepals connate half or more of their length 4. *Aesculus*
 - Sepals distinct to the base 6. *Handeliidendron*
 14. Ovary 3(5)-carpellate; fruit capsular 13. *Dodonaea* (in part)
 - Ovary 2(3)-carpellate; fruit schizocarpic, of 2 winged mericarps 15
 15. Mericarps completely surrounded by a wing 3. *Dipteronia*
 - Mericarps with a distal wing 2. *Acer* (in part)
 16. Leaves trifoliolate 17
 - Leaves pinnate 20
 17. Plant bearing stellate hairs 9. *Cossinia* (in part)
 - Plant glabrous or with simple hairs 18
 18. Petals 0; floral disk unilateral 17. *Llagunoa* (in part)
 - Petals 5; floral disk annular 19
 19. Fruit indehiscent, 1-locular, baccate; petals lacking appendages 27. *Hypelate*
 - Fruit a dehiscent, 2–3-coccate, loculicidal capsule; petals with marginal appendages 64. *Delavaya*
 20. Plant bearing stellate hairs 21
 - Plant glabrous or with simple hairs, lacking stellate hairs 25
 21. Floral disk with 5 elongated, horn-like lobes; leaflet margins serrate; fruit thick woody, with corky endocarp 1. *Xanthoceras*
 - Floral disk unilateral, semi-annular or annular, without horn-like lobes; leaflets entire or crenate; fruit crustose or papery to woody but not corky 22
 22. Seeds with white or red sarcotesta on lower half or base 16. *Harpullia* (in part)
 - Seeds without sarcotesta (seed coat black or dark brown) 23
 23. Abaxial surface of leaflets densely stellate pubescent; seeds glabrous 9. *Cossinia* (in part)
 - Abaxial surface of leaflets sparsely stellate pubescent; seeds hispidulose 24

24. Disk semi-annular, or nearly complete, formed by two semi-annular halves; fruits papery
 7. *Arfeuillea*
 – Disk annular or semi-annular, dish-shaped to pentagonal; capsules crustose
 20. *Majidea*
25. Corolla 0 or rudimentary 26
 – Corolla present 29
26. Fruit a dehiscent, loculicidal capsule
 8. *Averrhoidium*
 – Fruit indehiscent, baccate 27
27. Fruit 2-locular 25. *Ganophyllum*
 – Fruit 1-locular 28
28. Leaf rachis winged; inflorescences of axillary, glomerate cymes; stamens not coiled in bud
 21. *Doratoxylon*
 – Leaf rachis naked; inflorescences of thyrses; stamens coiled in bud
 28. *Zanha*
29. Petals lacking appendages 30
 – Petals bearing appendages 36
30. Pollen dispersed as tetrads; ovules 7–8 per locule; seeds winged 19. *Magonia*
 – Pollen dispersed as monads; ovules 2(3) per locule; seeds unwinged 31
31. Leaf rachis winged 26. *Hippobromus*
 – Leaf rachis unwinged 32
32. Petals suborbiculate, sessile 22. *Euchorium*
 – Petals ovate or clawed 33
33. Carpels 2; fruit baccate, indehiscent 23. *Exothea*
 – Carpels 3(4); fruit capsular, loculicidal 34
34. Floral disk unilateral, double, the inner lobe concave, 4-dentate; sepals fimbriate-glandular; ovary with stipitate glands 18. *Loxodiscus*
 – Floral disk annular, lobed; sepals not fimbriate nor glandular; ovary lacking stipitate glands 35
35. Floral disk simple; capsule fleshy, 1(3)-coccate
 15. *Eurycorymbus*
 – Floral disk double, the central rim tubular sometimes elongated into a gynophore; capsule membranous, with more or less compressed locules
 59. *Conchopetalum*
36. Fruits indehiscent 72. *Erythrophysopsis*
 – Fruits dehiscent 37
37. Fruits coriaceous or woody 38
 – Fruits membranaceous, or chartaceous 39
38. Seeds pubescent 71. *Erythrophysa* (in part)
 – Seeds glabrous 138. *Ungnadia*
39. Sepals imbricate; disk semi-annular; seeds pubescent 71. *Erythrophysa* (in part)
 – Sepals valvate; disk annular; seeds glabrous 40
40. Petals yellow; appendages formed by the fimbriate margins of the sagittate blade base; floral disk elevated on a short androgynophore; stamens straight in bud; distal leaflet fully developed; capsules with incomplete septa 82. *Koelreuteria*
 – Petals white; appendages formed by a narrow marginal flap; floral disk sessile; stamens geniculate in bud; distal leaflet rudimentary; capsule with complete septa 120. *Sinoradlkofera*
41. Leaves unifoliolate or simple 42
 – Leaves compound 50
42. Calyx and corolla actinomorphic 43
 – Calyx and corolla zygomorphic 46
43. Fruit indehiscent 44
 – Fruit dehiscent 45
44. Corolla of 4 or 5 petals, anthers dorsifixed; sarcotesta 0 115. *Sapindus* (in part)
 – Corolla 0; anthers basifixed, sarcotesta present 73. *Glennia* (in part)
45. Fruit a 1-locular (by abortion), loculicidal capsule; seed with lobed arillode 100. *Pappea*
 – Fruit 1–3-coccate, septicidal or loculicidal-calyprate; seed with granular sarcotesta 44. *Alectryon* (in part)
46. Fruit indehiscent 47
 – Fruits schizocarpic 48
47. Calyx 4-merous; fruit of 1–2 rounded cocci
 29. *Allophylus* (in part)
 – Calyx 5-merous; fruit of 3, ellipsoid, apically keeled cocci 95. *Namataea*
48. Mericarps sub-globose, exalate 34. *Guindilia*
 – Mericarps winged 49
49. Calyx 5-merous; mericarps with a dorsal wing 31. *Bridgesia*
 – Calyx 4-merous; mericarps with a distal wing 40. *Thouinia* (in part)
50. Distal leaflet well-developed 51
 – Distal leaflet rudimentary 61
51. Trees or shrubs, exceptionally climbing shrubs; stipules absent 52
 – Vines, lianas or climbing shrubs, sometimes not climbing in early stages; stipules minute, or exceptionally large and early deciduous 55
52. Leaves pinnate 53
 – Leaves trifoliolate 54
53. Fruit schizocarpic; mericarps winged; leaves once pinnate 30. *Athyana*
 – Fruit a loculicidal capsule; leaves bipinnate 66. *Dilodendron* (in part)
54. Fruit schizocarpic, of 3 winged mericarps 40. *Thouinia* (in part)
 – Fruits indehiscent, of 1(2) unwinged monocarps 29. *Allophylus* (in part)
55. Fruits schizocarpic, splitting into 3 1-winged mericarps 56
 – Fruit capsular, winged or not winged 59
56. Flowers actinomorphic 39. *Thinouia*
 – Flowers zygomorphic 57
57. Mericarps with a dorsal wing surrounding the coccus 35. *Houssayanthus*
 – Mericarps with a proximal wing 58
58. Stamens with filaments of similar length; pollen cylindrical 36. *Lophostigma*
 – Stamens with filaments of unequal lengths; pollen triangular 38. *Serjania*
59. Capsules woody, coriaceous or crustaceous, not inflated; pollen 3-porate 37. *Paullinia*
 – Capsules papery, inflated or nearly so; pollen 3-(demi)(syn)colporate 60
60. Capsules not winged or only narrowly so 32. *Cardiospermum*
 – Capsule dorsally winged 41. *Urvillea*
61. Leaves bipinnate or tripinnate 62

- Leaves once pinnate 66
- 62. Leaves tripinnate 133. *Tripterodendron*
- Leaves bipinnate 63
- 63. Sepals valvate 50. *Bizonula*
- Sepals imbricate 64
- 64. Anthers basifixed; placentation axile; fruit a loculicidal capsule 66. *Dilodendron* (in part)
- Anthers dorsifixed; placentation basal; fruit indehiscent, baccate or nearly so 65
- 65. Stigma capitate, sessile; aril and sarcotesta present 90. *Macphersonia* (in part)
- Stigma of 3 elongated branches; aril or sarcotesta absent 135. *Tristiropsis*
- 66. Calyx zygomorphic 67
- Calyx actinomorphic (slightly zygomorphic in *Tinopsis*) 96
- 67. Sepals connate to form a tubular or urceolate calyx 68
- Sepals distinct 81
- 68. Calyx bilabiate 111. *Pseudopancovia*
- Calyx of (4)5(–7) lobes, not bilabiate 69
- 69. Calyx urceolate 70
- Calyx tubular 71
- 70. Fruit 5–8-locular, not ribbed; inflorescence of densely packed flowers; bracts longer than the flowers 113. *Radlkofera*
- Fruit 3–8-locular, longitudinally ribbed; inflorescence with loosely spaced flowers; bracts shorter than the flowers 57. *Chytranthus*
- 71. Petals 4; disk unilateral; stamens (6)8; style terminal 99. *Pancovia*
- Petals 5; disk annular; stamens (8)12–30; style gynobasic or sub-terminal 63. *Deinbollia*
- 72. Fruit indehiscent 73
- Fruit dehiscent 76
- 73. Fruit deeply lobed or lobed-coccate 87. *Lepisanthes* (in part)
- Fruit ovoid, obovoid or ellipsoid, not lobed 74
- 74. Fruit locules unwinged 87. *Lepisanthes* (in part)
- Fruit with 3 dorsal wings 75
- 75. Corolla 0; disk annular; fruit trilocular 134. *Tristira*
- Corolla of 4–5 petals; disk unilateral, flattened; fruit unilocular 140. *Zollingeria*
- 76. Fruit schizocarpic, splitting into indehiscent mericarps 77
- Fruit capsular 83
- 77. Mericarps unwinged 78
- Mericarps winged 80
- 78. Seeds covered with sticky, saponiferous pulp 115. *Sapindus* (in part)
- Seeds not surrounded by a sticky or saponiferous pulp 79
- 79. Mericarp membranaceous, bladderly 109. *Porocystis*
- Mericarps woody, not bladderly 119. *Scyphonychium*
- 80. Mericarps with a proximal wing 131. *Toulicia*
- Mericarps with a distal or dorsal wing 81
- 81. Calyx 4-merous; corolla zygomorphic 33. *Diatenopteryx*
- Calyx 5-merous; corolla actinomorphic 82
- 82. Leaves with 10–12 leaflets; disk annular or semiannular; stamens 8; ovary 3-carpellate; fruits of 3 mericarps 48. *Atalaya*
- Leaves with 2–4 leaflets; disk 5-lobed; stamens 18–24; ovary bicarpellate; fruits of 2 mericarps 80. *Hornea*
- 83. Corolla absent 65. *Dictyoneura* (in part)
- Corolla present 84
- 84. Corolla zygomorphic; capsule echinate or muricate 85
- Corolla actinomorphic; capsules smooth 86
- 85. Capsules echinate; petal appendages marginal 121. *Sisyrolepis*
- Capsules muricate; petal appendage basal, simple 104. *Phyllotrichum*
- 86. Capsules 1-locular 96. *Neotina*
- Capsules 2- or 3-locular 87
- 87. Seeds winged, non-arillate 10. *Diplokeleba*
- Seeds, ellipsoid, sub-globose, unwinged, arillate 88
- 88. Gynoecium 2-carpellate 89
- Gynoecium (2)3(4)-carpellate 90
- 89. Leaflets entire; anthers retuse at apex 138. *Vouarana* (in part)
- Leaflets serrate or crenate-serrate; anthers apiculate at apex 128. *Tina* (in part)
- 90. Arillode basal or lateral 91
- Arillode partially to nearly completely covering the seed 92
- 91. Arillode basal, surrounding the hilum; disk annular 114. *Rhysotoechia*
- Arillode at base of seed but not covering the hilum; disk pentagonal 110. *Pseudima*
- 92. Petal appendages absent 93
- Petal appendages present or sometimes rudimentary 94
- 93. Petals more or less cuneate at base; inflorescence axillary; arillode fimbriate at apex 94. *Molinaea* (in part)
- Petals clawed at base; inflorescence cauliflorous; arillode open but not fimbriate at apex 74. *Gloeocarpus*
- 94. Arillode with a basal funiculus-like appendage (rudimentary in one species) 77. *Guioa*
- Arillode lacking a basal funiculus-like appendage 95
- 95. Petals with one or two basal appendages 62. *Cupaniopsis*
- Petals with marginal appendages or without appendages 94. *Molinaea* (in part)
- 96. Petals absent 97
- Petals present 118
- 97. Fruits indehiscent or tardily dehiscent (pseudodehiscent) 98
- Fruits dehiscent 107
- 98. Sepals connate into a cupular or urceolate calyx 99
- Sepals distinct or connate only at base 101
- 99. Fruit tardily dehiscent (pseudodehiscent), usually 1-coccate, the pericarp smooth 123. *Stadmania* (in part)

- Fruit indehiscent, 3-locular, or if 1-coccate, then with muricate pericarp 100
100. Gynoecium 3-carpellate; fruit usually 3-locular, 3-sulcate or 3-lobed 105. *Placodiscus*
- Gynoecium bicarpellate; fruit usually 1-coccate (1 coccus rudimentary), indehiscent, baccate; muricate 88. *Litchi*
101. Seeds exarillate 73. *Glenniea* (in part)
- Seeds arillate 102
102. Gynoecium 2-carpellate; arillode basal 103
- Gynoecium 3(4)-carpellate; arillode nearly covering the entire seed 104
103. Pseudostipules present; floral disk glabrous 98. *Otonephelium*
- Pseudostipules 0; floral disk pubescent 67. *Dimocarpus* (in part)
104. Arillode with a dorsal split 79. *Haplocoelum*
- Arillode covering the seed completely (no dorsal split) 105
105. Sepals connate at base (1/4 of their length); floral disk unlobed; anthers dorsifixed 118. *Schleichera*
- Sepals distinct to base; floral disk lobed; anthers basifixed 106
106. Sepals 5; stamens 8; cotyledons smooth 84. *Lecaniodiscus*
- Sepals (5)6 or 7(8); stamens 6–8(10); cotyledons with brain-like appearance (cerebriform) 49. *Beguea*
107. Calyx with imbricate aestivation 108
- Calyx with valvate aestivation 111
108. Pseudostipules present; anthers basifixed; fruits 1-locular 52. *Blighiopsis*
- Pseudostipules 0; anthers dorsifixed; fruits (1)3(4)-locular 109
109. Leaflets serrate 65. *Dictyoneura* (in part)
- Leaflets entire 110
110. Aril with a basal funiculus-like appendage; inflorescences of thyrses or panicles 93. *Mischocarpus* (in part)
- Aril lacking a basal funiculus-like appendage; inflorescences of racemes 51. *Blighia*
111. Fruit with circumscissile dehiscence 112
- Fruit with loculicidal dehiscence 113
112. Seed with a dorsal, white arillode 107. *Podonephelium*
- Seeds with red sarcotesta on lower half 44. *Alectryon* (in part)
113. Seeds naked (without arillode or sarcotesta); endotesta ruminately grown together with embryo 76. *Gongrospermum*
- Seeds arillate or sarcotestal 114
114. Seeds arillate 136. *Tsingya*
- Seeds sarcotestal 115
115. Sepals distinct to the base 116
- Sepals connate at least half way to form cupular or acetabuliform calyx 117
116. Gynoecium unicarpellate; stigma capitate 53. *Blomia* (in part)
- Gynoecium (1)2(–4)-carpellate; stigmata 2(3), elongated, and usually coiled 97. *Nephelium* (in part)
117. Fruit warty, spiny or echinate 97. *Nephelium* (in part)
- Fruit smooth 44. *Alectryon* (in part)
118. Fruits indehiscent 119
- Fruits dehiscent 133
119. Seeds laterally flattened, with a longitudinal ventral hilum 106. *Plagioscyphus*
- Seeds variously shaped, hilum if present restricted to the basal-ventral part 120
120. Gynoecium 2(3)-carpellate 121
- Gynoecium 3-carpellate 128
121. Stamens 5(–7) 122
- Stamens (6–)8(–10) 125
122. Seeds exarillate 24. *Filicium*
- Seeds completely covered by an arillode 123
123. Sepals connate half of their length 108. *Pometia*
- Sepals distinct 124
124. Cataphylls present; petals lacking appendages 112. *Pseudopteris*
- Cataphylls absent; petals bearing basal or marginal appendages 129. *Tinopsis*
125. Testa fleshy (sarcotestal) 126
- Testa not fleshy 127
126. Fruit ellipsoid or globose, smooth; carpels with incomplete septa 42. *Melicoccus*
- Fruit 1–2-coccate, warty or spiny; carpels with complete septa 139. *Xerospermum*
127. Seed exarillate; calyx aestivation valvate; fruit smooth 55. *Castanospora*
- Seed arillate; calyx aestivation imbricate; fruit smooth to echinate 67. *Dimocarpus* (in part)
128. Sepals connate into a cup-shaped calyx 123. *Stadmania* (in part)
- Sepals distinct, or if connate, then the calyx tubular 129
129. Filaments coiled in bud 130
- Filaments short, not coiled in bud 131
130. Petal appendages marginal 90. *Macphersonia* (in part)
- Petal appendages basal 56. *Chouxia*
131. Seeds naked (not arillate nor sarcotestal) 115. *Sapindus* (in part)
- Seeds arillate or sarcotestal 132
132. Seeds sarcotestal 43. *Talisia*
- Seeds completely covered by a translucent arillode 54. *Camptolepis*
133. Fruit schizocarpic, splitting into winged mericarps 127. *Thouinidium* (in part)
- Fruit capsular 134
134. Fruit echinate, warty or with hispid or setaceous hairs 135
- Fruit smooth or scrobiculate, glabrous or variously pubescent 138
135. Fruit a 1- or 2-coccate, warty or echinate capsule; petals lacking appendages 60. *Cubilia*
- Fruit a 3-locular, trigonous or trilobed, hispid capsule; petals with appendages 136
136. Disk cupular; sepals valvate; seeds arillate at base; fruits without irritating hairs 70. *Eriocoelum*

- Disk annular; sepals imbricate; seeds non-arillate, with hilar sarcotesta; fruit with irritating hairs 137
- 137. Fruit locules not winged **81. *Jagera***
- Fruit locules winged on lower dorsal portion **58. *Cnesmocarpon***
- 138. Capsules 1-locular 139
- Capsules 2- or 3-locular 143
- 139. Seed naked (not arillate nor sarcotestal), with large white hilum **101. *Paranephelium***
- Seed arillate or sarcotestal, with small hilum 140
- 140. Seed arillate, the arillode with dorsal split **75. *Gongrodiscus***
- Seed sarcotestal 141
- 141. Fruit smooth 142
- Fruits tuberculate to echinate **97. *Nephelium*** (in part)
- 142. Seed black with partial red sarcotesta **44. *Alectryon*** (in part)
- Seed completely covered by a brownish sarcotesta **53. *Blomia*** (in part)
- 143. Petals lacking appendages 144
- Petals bearing appendages 148
- 144. Sepals connate; seeds exarillate **122. *Smelophyllum***
- Sepals distinct; seeds arillate 145
- 145. Capsule obovoid or trigonous 146
- Capsule deeply 2- or 3-lobed 146
- 146. Seeds sarcotestal at its base or lower half, not fimbriate at apex **16. *Harpullia*** (in part)
- Seeds arillate, arillode covering at least lower half, fimbriate at apex **94. *Molinaea*** (in part)
- 147. Arillode ventrally split and fimbriate **125. *Storthocalyx***
- Arillode ventrally attached, covering whole seed, not fimbriate **85. *Lepiderema***
- 148. Calyx with valvate aestivation 149
- Calyx with imbricate aestivation 155
- 149. Sepals distinct 150
- Sepals connate at least at base 153
- 150. Petals with a single ventral appendage 151
- Petals with marginal appendages 152
- 151. Gynoecium 3-carpellate; capsule (1–2)3-cocccate, wider than long **45. *Amesiodendron***
- Gynoecium 2-carpellate; capsule 2-lobed or elliptic, longer than wide **86. *Lepidopetalum***
- 152. Seeds sarcotestal; gynoecium bicarpellate **46. *Aporrhiza***
- Seed arillate; gynoecium tricarpellate **91. *Matayba***
- 153. Sepals connate at base 154
- Sepals connate at least half of their length **44. *Alectryon*** (in part)
- 154. Petals with marginal appendages; fruit locules not winged dorsally **92. *Mischarytera***
- Petals with ventral, bifid appendage; fruit locules with a narrow dorsal wing **116. *Sarcopteryx***
- 155. Petals with marginal appendages 156
- Petals with ventral appendages 166
- 156. Seeds sarcotestal 157
- Seeds arillate 159
- 157. Pubescence of stellate hairs **16. *Harpullia*** (in part)
- Pubescence of simple hairs 158
- 158. Pseudostipules 0; sarcotesta cupular **117. *Sarcotoechia***
- Pseudostipules present; sarcotesta completely covering the seed **83. *Laccodiscus***
- 159. Arillode basal 160
- Arillode covering at least lower half of the seed 163
- 160. Petals longer than the sepals, with crested appendages **130. *Toechima***
- Petals shorter than the sepals, with non-crested appendages 161
- 161. Petals clawed at base **69. *Elattostachys***
- Petals not clawed at base 162
- 162. Pericarp woody; seeds arillate at base, lacking a funiculus-like appendage **138. *Vouarana*** (in part)
- Pericarp coriaceous; seeds completely covered by an arillode, with a funiculus-like appendage **93. *Mischocarpus*** (in part)
- 163. Capsule dehiscent by a loculicidal calypra or septicidal **47. *Arytera***
- Capsules loculicidal 164
- 164. Seeds lenticular **68. *Diploglottis***
- Seeds obovoid or ellipsoid 165
- 165. Gynoecium bicarpellate; stigma an invaginate prolongation of the style **128. *Tina*** (in part)
- Gynoecium tricarpellate; stigma simple, with three stigmatic lines **61. *Cupania***
- 166. Petal bearing a single appendage 167
- Petals bearing 2 appendages 171
- 167. Sepals connate at base 168
- Sepals distinct to base 169
- 168. Seed exarillate **102. *Pavieasia***
- Seed sarcotestal **89. *Lychnodiscus***
- 169. Petals clawed at base **132. *Trigonachras*** (in part)
- Petals cuneate at base 170
- 170. Gynoecium 3-carpellate; disk 7- or 8-lobed; ovary hirsute **103. *Pentascyphus***
- Gynoecium 2-carpellate; disk annular; ovary glabrous **78. *Haplocoelopsis***
- 171. Petals not clawed; appendage crested **126. *Synima***
- Petals clawed, appendage not crested 172
- 172. Seed with a 2- or 3-lobed sarcotesta around the hilum **14. *Euphorianthus***
- Seed not sarcotestal (naked) **132. *Trigonachras*** (in part)

SUBFAMILIES, TRIBES, AND GENERA
OF SAPINDACEAE

I. SUBFAM. XANTHOCEROIDEAE Thorne & Reveal
(2007).

Leaves alternate; petals without appendages; ovules 7–8 per locule; disk with orange horn-like appendages.

1. *Xanthoceras* Bunge

Xanthoceras Bunge, Mem. Sav. Etr. Acad. Petersb. 2: 85 (1834).

Falsely polygamous trees. Leaves alternate, imparipinnate, with stellate pubescence; leaflets serrate; distal leaflet rudimentary; stipules 0. Inflorescences terminal racemose thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, distinct; petals 5, with darker coloration at base, clawed; disk with 5 erect corniform lobes, alternating with the petals; stamens 8; pollen colporate, loosely verrucate; ovary 3-carpellate, with 7–8 ovules per carpel; style filiform with capitate, 3-sulcate stigma. Fruit a 3-locular, woody loculicidal capsule, with corky endocarp. Seeds exarillate. $2n=30$.

A single species, *X. sorbifolia* Bunge, endemic to China, and commonly cultivated as an ornamental tree.

II. SUBFAM. HIPPOCASTANOIDEAE Burnett (1835).

Leaves opposite; ovules 2 per locule.

1. Tribe Acereae (Durande) Dumort. (1827).

Flowers actinomorphic; petals without appendages; disk annular.

2. *Acer* L.

Acer L., Sp. Pl. 1054 (1753); de Jong, Meded. Landbou. Wageningen Nederl. 72: 1–201 (1976).

Duodichogamous or dioecious trees or shrubs. Leaves opposite, simple, unlobed, palmately lobed to deeply dissected, or trifoliolate, palmately compound or imparipinnate, margins entire, dentate, serrate or lobed; petioles usually long; stipules 0 or rarely present. Inflorescences terminal or axillary, corymbose-thyrsoïd, racemose or fasciculate. Flowers unisexual or bisexual, actinomorphic; sepals (4)5, distinct or less often connate, imbricate; petals 4–5 or 0, white or greenish, not clawed; disk extrastaminal or less often intrastaminal, amphistaminal or 0, annular or annular-lobed, glabrous or pubescent; stamens (5)8 (10, 12), the filaments equal or unequal; pollen colpate or colpate(oid)ate, striate, rugulate or reticulate, sometimes scabrate; ovary 2(3, 5, 8)-carpellate, with 2 ovules per carpel; style branches stigmatic, 2; style sometimes very short. Fruits schizocarpic, splitting into 2 samaroid, 1-seeded, mericarps, each with a long, dorsal or distal wing. Seed laterally compressed, with papery testa.

Sixteen sections and about 126 species, northern Asia, Japan, Europe, and North America.

Fig. 80A–I



Fig. 80. Sapindaceae. A–C *Acer platanoides*. A Leaf. B Male flower. C Female flower. D *Acer laurinum*, part of infructescence. E *Acer carpiniifolium*, part of infructes-

cence. F–J *Acer negundo*. F Leaf. G Male flower. H Female flower. I Fruit. J *Dipteronia sinensis*, fruit. (Takhtajan 1981; drawn by A. Schischtkin)

3. *Dipteronia* Oliver

Fig. 80J

Dipteronia Oliver, Hooker's Icon. Pl. t. 1898. (Oct 1889).

Duodichogamous trees. Leaves opposite, imparipinnate; leaflets 9–17, with serrate margins; terminal leaflet fully developed; stipules 0. Inflorescences terminal, thyrsoïdate. Flowers functionally unisexual, actinomorphic; sepals 5, distinct; petals 5, cream or greenish, clawed; disk extrastaminal, annular-lobed, stamens 6–8, the filaments of equal length; pollen colpiate, striate; ovary 2-carpellate, with 2 ovules per carpel; stigmata 2, connate at base. Fruits seemingly schizocarpic, of 2 suborbicular, samaroid mericarps, each with a wing completely surrounding the seed locule. Seeds exarillate.

A single species, *D. sinensis* Oliver, endemic to China.

2. Tribe Hippocastaneae (DC.) Dumort. (1827).

Flowers zygomorphic; petals usually with appendages; disk unilateral.

4. *Aesculus* L.

Aesculus L., Sp. Pl.: 344. (1753).
Hippocastanum Miller (1754).

Trees or shrubs. Leaves opposite, palmately-compound; petioles usually long; stipules 0. Inflorescences terminal thyrses or racemes. Flowers bisexual or functionally staminate, zygomorphic; sepals 5, imbricate, connate to form a tubular or campanulate calyx; petals 4(5), equal or unequal, clawed; appendages 0 or minute and placed above the claw; disk unilateral, 4-lobed; stamens (5)6–8, the filaments of unequal length; pollen colpiate, finely striate, sometimes scabrate, usually with heavily verrucate colpus membranes; ovary (2)3(4)-carpellate, with 2 ovules per carpel; style with punctiform or obscurely 3-lobed stigma. Fruit usually a 1-seeded loculicidal capsule, smooth or echinate. Seeds exarillate, with a large, pale hilum.

Thirteen species, southeastern Europe, Asia, Japan, and North America.

5. *Billia* Peyritsch

Billia Peyritsch, Bot. Zeit. 16: 153 (1858).

Trees. Leaves opposite, trifoliolate; margins entire; petioles long; stipules 0. Inflorescences of

terminal panicles bearing bisexual and unisexual flowers. Flowers zygomorphic; sepals 5, imbricate, distinct, unequal; petals 4(5), red or white, unequal, clawed; appendages minute, two or a single bifid or dissected, ventral on the claw; disk unilateral, 4-lobed; stamens 6–8, the filaments of unequal length; pollen colpiate, finely striate, with heavily verrucate colpus membranes; ovary (2)3(4)-carpellate, with 2 ovules per carpel; style with punctiform stigma. Fruit usually a 1-seeded, loculicidal capsule, smooth. Seeds exarillate, with a small, pale hilum.

Two species, from southern Mexico to northern South America.

6. *Handeliodendron* Rehder

Handeliodendron Rehder, J. Arnold Arb. 16: 65 (1935).

Trees. Leaves opposite, digitate. Inflorescence of terminal panicles. Flowers zygomorphic, bisexual; sepals 5, distinct, imbricate; petals 4–5, clawed, with 2 marginal appendages above the claw; disk unilateral, lobed; stamens (7)8, unequal; pollen colpiate, striate, with heavily verrucate colpus membranes (Fig. 79E); ovary 3-carpellate, stipitate, with 2 ovules per carpel; style short, stigma capitate. Fruit a (1–)3-locular, stipitate, coriaceous, loculicidal capsule. Seeds with a double arillode at base.

A single species, *H. bodinieri* (Lév.) Rehder, endemic to China.

III. SUBFAM. DODONAEOIDAE Burnett (1835).

Leaves alternate; petals usually without appendages.

3. Tribe Dodonaeae Kunth ex DC. (1824).

Disk (semi)annular; ovules (1)2(3 or 8) per locule; fruits dehiscent.

7. *Arfeuillea* Pierre ex Radlk.

Arfeuillea Pierre ex Radlk. in Engl. & Prantl., Nat. Pflanzenfam. III, 5: 362 (1895); Radlk. in Engl., Pflanzenr. 98: 1467 (1933); Welzen in Santisuk & Larsen, Fl. Thailand 7: 185, 186 (1999).

Falsely polygamous trees with simple and stellate hairs. Leaves alternate, paripinnate; leaflets crenate or entire; distal leaflet rudimentary.

Inflorescences axillary or terminal thyrses, with foliaceous bracts. Flowers zygomorphic, pistillate or staminate on same inflorescence; sepals 5, petal-like, distinct, imbricate; petals 4, without appendages; disk semi-annular, or nearly complete, formed by two semi-annular halves; stamens (6) 7–8(9); pollen colporate, striate; ovary 3-carpellate, with 2 ovules per carpel. Fruit a 3-locular, loculicidal, papery capsule. Seed one per carpel, obovoid, exarillate.

A single species, *A. arborescens* Pierre ex Radlk., from Thailand and Laos, cultivated throughout the tropics as an ornamental. Doubtfully distinct from *Majidea*.

8. *Averrhoidium* Baill.

Fig. 81

Averrhoidium Baill., *Adansonia* 11: 244 (1874).

Dioecious trees. Leaves alternate, paripinnate; leaflets serrate or entire; distal leaflet rudimentary; stipules 0. Inflorescences axillary thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, distinct, imbricate; petals 0 or rudimentary, 1–4, without appendages; disk annular-lobed; stamens (7)8; pollen colporate, striate; ovary 3-carpellate, with 2 ovules per carpel; style filiform, with 3 stigmatic grooves. Fruit a 1-locular, loculicidal, crustose capsule. Seeds 1–2 per fruit, with sarcotesta.

Four species, one in Mexico, the remaining from tropical South America.

9. *Cossinia* Commers. ex Lam.

Cossinia Commers. ex Lam., *Encycl.* 2: 132 (1786). [also spelled *Cossignia*]

Falsely polygamous trees or shrubs, with stellate pubescence. Leaves alternate, trifoliolate or imparipinnate, terminal leaflet well-developed. Inflorescences terminal paniculate or corymbose thyrses. Flowers actinomorphic or zygomorphic, bisexual or functionally unisexual; sepals 5, imbricate; petals 4–5, without appendages; disk annular or semi-annular; stamens 5–6(–8); pollen colporate, with clearly scabrate mesocolpia and indistinctly scabrate to perforate apocolpia; ovary 3-carpellate, with 2 ovules per carpel; stigma subcapitate. Fruit a septicial, 3-locular, crustose capsule. Seeds globose, exarillate.

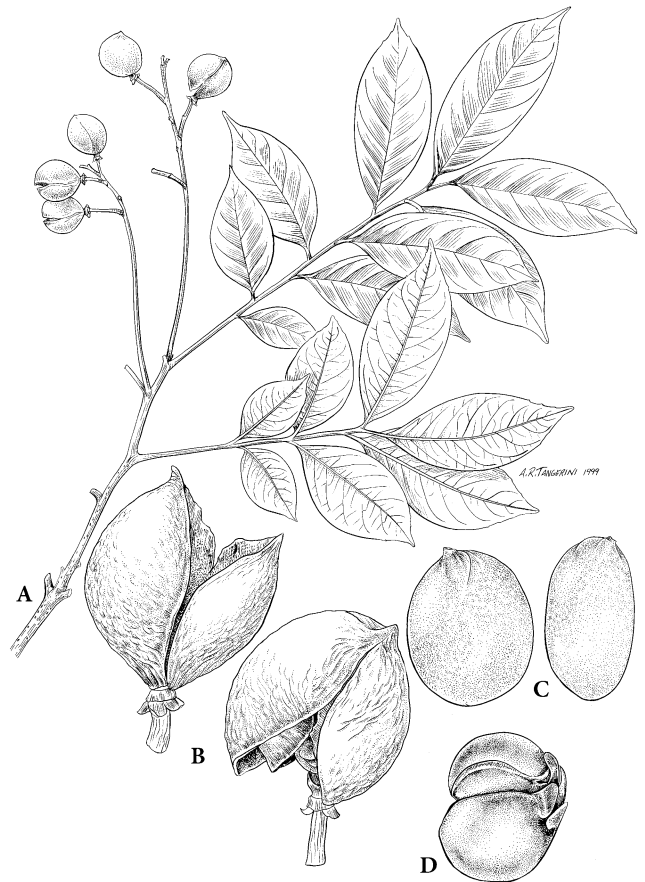


Fig. 81. Sapindaceae. *Averrhoidium dalyi*. A Fruiting branch. B Fruits showing apical (left) and basal (right) dehiscence. C Seed, lateral view (left) and ventral view (right). D Embryo, lateral view. (Drawn by A. Tangerini)

Three species, two from Mauritius and one from New Caledonia.

10. *Diplokeleba* N.E. Brown

Diplokeleba N.E. Brown, *Trans. & Proc. Bot. Soc. Edinburgh* 20: 50 (1894).

Falsely polygamous trees. Leaves paripinnate; leaflets entire or undulate; distal leaflet rudimentary. Inflorescences terminal, corymbose thyrses. Flowers functionally unisexual; calyx zygomorphic, the sepals 5, imbricate, outer sepals smaller; petals 5, without appendages; disk annular, cup-shaped, crenulate; stamens 8; pollen colporate, irregularly striate to rugulate; ovary 3-carpellate, with a single ovule per carpel; style filiform, with 3 stigmatic lobes. Fruit a 3-locular, woody loculicidal capsule. Seeds winged.

Two species, southern South America.

11. *Diplopeltis* Endl.

Diplopeltis Endl. in Endl. et al., Enum. Pl. Hugel.: 13 (1837).

Monoecious sub-shrubs. Leaves alternate, simple; stipules 0. Inflorescences terminal thyrses. Flowers zygomorphic; sepals 5, imbricate; petals 4(5), clawed, without appendages; disk unilateral, lobed, erect; stamens 8; pollen colpi, loosely to densely scabrate to finely striate; ovary 3-carpellate, with 2 ovules per carpel; style filiform. Fruit a 3-locular, loculicidal, crustose capsule or a schizocarp of 3 indehiscent cocci. Seeds arillate, ovoid, 1 or 2 per locule.

Five species, Australia.

12. *Distichostemon* F. Muell.

Distichostemon F. Muell., Hooker's J. Bot. Kew Gard. Misc. 9: 306 (1857).

Falsely polygamous trees. Leaves alternate, simple, entire, serrate or crenate; stipules 0. Inflorescences axillary or terminal. Flowers actinomorphic, functionally unisexual; sepals 5–8, imbricate; petals 0; disk rudimentary; stamens 8–74; pollen colpi with indistinct colpi, finely scabrate; ovary 3(–6)-carpellate, with 2 ovules per carpel; style filiform, with 3 stigmatic lobes. Fruit a 3(–6)-locular, septifragal, marginicidal, capsule, the locules dorsally or distally winged, inflated or flattened. Seeds exarillate, subtended by a conspicuous funiculus, with a conspicuous annular ring around the hilum, 2 per locule.

Six species, Australia.

13. *Dodonaea* Miller

Fig. 82

Dodonaea Miller, Gard. Dict. Abr. ed.: 4 (1754); Leenhouts, Blumea 28: 271 (1983), reg. rev.; West, Brunonia 7: 18 (1984), reg. rev.

Dioecious or falsely polygamous-dioecious shrubs or trees, with viscous glandular hairs. Leaves alternate or rarely opposite, simple or paripinnate; distal leaflet fully developed or rudimentary. Inflorescences axillary or terminal racemes or thyrses. Flowers actinomorphic, unisexual or bisexual; sepals (3–)5(–7), imbricate or valvate; petals 0; disk 0 or rudimentary in pistillate flowers; stamens 5–15; pollen colpi, finely to coarsely scabrate, with scabrae often in coarse patterns (Fig. 79B); ovary (2)3–5(6)-carpellate, with 2 ovules per carpel; style filiform;

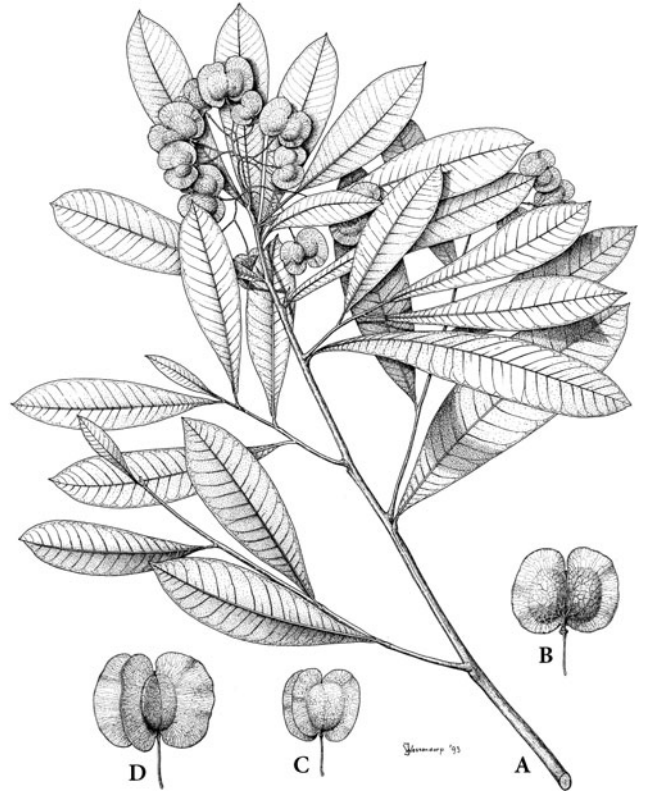


Fig. 82. Sapindaceae. *Dodonaea viscosa* Jacq. A Fruiting branch. B Capsules. C *D. angustifolia*, fruit. D *D. polyantra*, fruit. (Adema et al. 1994; drawn by J. Wessendorp)

stigma grooved or divided. Fruit a 2–6-locular, septifragal or septicidal capsule, the locules dorsally winged. Seed exarillate, on enlarged placenta. $2n = 28, 30, 32$.

Primarily Australian with 59 endemic species and 8 pantropical species.

14. *Euphorianthus* Radlk.

Euphorianthus Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 673 (1879); Leenhouts, Blumea 33: 198 (1988), rev.

Falsely polygamous trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary to pseudo-terminal thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, distinct, imbricate; petals 5, clawed, with a pair or woolly appendages above the claw; disk annular; stamens (6)7–8; pollen paracyncolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style filiform; stigma

grooved to slightly lobed. Fruit an incompletely 3-locular, sub-globose, velvety, fleshy, loculicidal capsule, the endocarp sericeous. Seeds with a 2(3)-lobed sarcotesta around the hilum.

A single species, *E. euneurus* (Miq.) Leenh., found in eastern Malesia, from the Philippines and Celebes to Vanuatu. The wood is used in the construction of houses.

15. *Eurycorymbus* Hand.-Mazz.

Eurycorymbus Hand.-Mazz., Akad. Wiss. Wien. Math. Naturwiss. Kl. Anz. 59: 104 (1922).

Dioecious trees. Leaves alternate, paripinnate; leaflets serrate; distal leaflet rudimentary. Inflorescences axillary, corymbose thyrses. Flowers actinomorphic, unisexual; sepals 5; petals 5, spatulate, without appendages; disk annular, dish-shaped-crenate; stamens 8; pollen colporate, striate; ovary 3(4)-carpellate, with 2 ovules per carpel; style filiform, with 3 stigmatic branches. Fruit a 1(3)-coccate, fleshy, loculicidal capsule. Seeds exarillate, sub-globose, puberulent, one per locule, persistent on receptacle.

A single species, *E. austrosinensis* Hand.-Mazz., from China.

16. *Harpullia* Roxb.

Harpullia Roxb., Fl. Ind. 2: 441 (1824); Leenhouts & Vente, Blumea 28: 1 (1982), rev.

Falsely polygamous shrubs or trees. Indumentum of stellate hairs. Leaves alternate, paripinnate; distal leaflet rudimentary; petiole and rachis winged or unwinged. Inflorescences axillary, terminal, ramiflorous, or cauliflorous thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, distinct, imbricate; petals 5, clawed, with 2 marginal appendages above the claw or the petals sessile without appendages; disk annular; stamens 5–8; pollen colporate, sometimes cryptoaperturate, striate, striate-rugulate, rugulate, reticulate with scabrae or coarsely reticulate with finely striate to scabrate muri (Fig. 79D); ovary 2–3(4)-carpellate, with 1 or 2 ovules per carpel; style with 2 or 3 stigmatic lines. Fruit a 2–3-locular, chartaceous to woody loculicidal capsule. Seeds with an orange sarcotestal ring around the hilum or completely covered by an aril that is basally adnate to the testa. $2n=30$.

About 26 species from India, Sri Lanka, southeastern China, Malesia, Australia to New Caledonia and Tonga. Several species are cultivated for their wood or as ornamentals.

17. *Llagunoa* Ruiz & Pavón

Llagunoa Ruiz & Pavón, Prodr.: 126 (1794).

Falsely polygamous shrubs or trees. Leaves alternate, simple or trifoliolate. Flowers solitary or in axillary cymes. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, imbricate; petals 0; disk unilateral, semi-annular; stamens 8; pollen colporate, striate; ovary 3-carpellate, with 2 ovules per carpel; style subulate; stigma subcapitate. Fruit a 3-locular, 3-lobed, crustose, loculicidal capsule. Seeds exarillate. $2n=20$.

Three or four species from the Andean highlands of South America.

18. *Loxodiscus* Hook. f.

Loxodiscus Hook. f., Hooker's J. Bot. Kew Gard. Misc. 9: 200 (1857).

Falsely polygamous shrubs or trees. Leaves alternate, imparipinnate; leaflets serrate; distal leaflet rudimentary. Inflorescences terminal thyrses. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, imbricate, with fimbriate-glandular margins; petals 4(5), clawed, without appendages; disk semi-annular, double, the inner lobe concave, 4-dentate; stamens 7–8; pollen colporate, striate; ovary 3-carpellate, with stipitate glands and 2 ovules per carpel; style subulate; stigma obtuse. Fruit a 3-locular, loculicidal, membranous capsule. Seeds exarillate.

A single species, *L. coriaceus* Hook. f., from New Caledonia.

19. *Magonia* St. Hil.

Magonia St. Hil., Bull. Sci. Soc. Philom. Paris 1824: 78 (1824); Joly et al., Brittonia 32: 380–386 (1980).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary. Inflorescences axillary or terminal thyrses. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, distinct, imbricate; petals 5, without appendages; disk complete, half of one side consisting of 4 short glands, the other half of two

concentric erect, fleshy laminae, the outer one taller; stamens 8; pollen grains in tetrads, colporate (6 pairs of colpi per tetrad), striate-gemmate (Fig. 79F); ovary 3-carpellate, with 8 ovules per carpel; style short, stigma capitate, sub-3-lobed. Fruit a large, 3-locular, trigonous, woody loculicidal capsule. Seeds flattened, surrounded by a wing. $2n=30$.

One species, *M. pubescens* St.-Hil., from Brazil, Bolivia, and Paraguay.

20. *Majidea* Kirk ex D. Oliver

Majidea Kirk ex D. Oliver, Hooker's Icon. Pl. tab. 78, 1097 (1871).

Falsely polygamous trees. Indument of fasciculate stellate hairs. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary or terminal thyrses. Flowers actinomorphic or zygomorphic, bisexual or functionally unisexual; sepals 5, imbricate; petals 0 or only 1–2 or 4; disk annular or semi-annular, dish-shaped to pentagonal; stamens 7–8; pollen colporate, striate; ovary 3-carpellate; with 2 ovules per carpel; style elongated with punctiform stigma. Fruit a 3-locular, deeply lobed, loculicidal capsule, with crustose pericarp. Seeds exarillate. $2n = 24$.

Four or five species from Africa and Madagascar.

4. Tribe Doratoxyleae Radlk. (1890).

Disk annular; ovules (1)2(3) per locule; fruits indehiscent.

21. *Doratoxylon* Thouars ex Hook. f.

Doratoxylon Thouars ex Hook. f. in Benth. & Hook. f., Gen. 1: 408 (1862).

Falsely polygamous-dioecious shrubs or treelets. Leaves alternate, paripinnate or imparipinnate; leaflets entire or crenate; distal leaflet rudimentary; rachis narrowly winged; stipules 0. Inflorescences axillary, glomerate cymes. Flowers actinomorphic, functionally unisexual or bisexual; sepals 5, imbricate; petals 0; disk annular-5-lobed; stamens 5(6–7), the anthers dorsifixed; pollen colporate, scabrate to coarsely verrucate with striate to rugulate verrucae; ovary 2-carpellate, with 2 ovules per carpel; style short; stigma capitate. Fruits baccate, indehiscent, 1-locular. Seed ellipsoid, exarillate.

Six species, one from Mauritius and five from Madagascar.

22. *Euchorium* Ekm. & Radlk.

Euchorium Ekm. & Radlk., Repert. Spec. Nov. Regni Veg. 21: 230 (1925).

Dioecious trees. Leaves alternate, paripinnate; distal leaflet rudimentary; stipules 0. Inflorescences of axillary racemes. Flowers unisexual; calyx zygomorphic, sepals 5, imbricate, the outer two smaller; petals 5, without appendages; disk annular; stamens 8; pollen unknown; ovary 3-carpellate, with 2 ovules per carpel; style filiform, obtuse. Fruits unknown.

A single species, *E. cubense* Ekm. & Radlk., endemic to western Cuba.

In the absence of information on fruits, this genus is included in tribe Dodonaeae because of its resemblance to *Exothea*.

23. *Exothea* Macfad.

Exothea Macfad., Fl. Jamaica 1: 232 (1837).

Falsely polygamous dioecious trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary or sub-terminal corymbose thyrses. Flowers bisexual or functionally unisexual; calyx zygomorphic, sepals 5, imbricate, the outer two smaller; petals 5, without appendages; disk annular, dish-shaped-crenate; stamens (7)8 (–10); pollen colporate, loosely scabrate to verrucate (Fig. 79C); ovary 2-carpellate, with 2 ovules per carpel; style elongated; stigma capitate. Fruits 1(2)-locular, globose, baccate, indehiscent. Seeds with coriaceous-fleshy testa.

Three species, distributed throughout the West Indies, Mexico, Guatemala, Colombia, and Ecuador.

24. *Filicium* Thwaites ex Hook. f.

Filicium Thwaites ex Hook. f. in Benth. & Hook. f., Gen. Pl. 1: 325. (1862); Thwaites, Enum. Pl. Zeyl.: 58, 408 (1864); Welzen in Fl. Males. I, 11: 754 (1994); Welzen in Fl. Thailand 7: 198, 199 (1999).

Falsely polygamous trees. Leaves alternate, paripinnate; distal leaflet rudimentary; rachis (broadly) winged. Inflorescences axillary or pseudo-terminal thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, distinct, valvate; petals 5,

without appendages; disk annular, 5-lobed, woolly; stamens 5; pollen colporate, loosely scabrate; ovary 2-carpellate, with a single pendant ovule per carpel; style short; stigma lobed. Fruits 1–2-locular, baccate, indehiscent, smooth, glabrous, the pericarp fleshy. Seeds exarillate. $2n = 32$.

Three or four species, mainly in east Africa and Madagascar, one extending to India and Sri Lanka, and widely cultivated as an ornamental throughout the tropics.

The taxonomic placement of *Filicium* has been much debated over decades. It was originally described as an Anacardiaceae, and later transferred into Sapindaceae. In 1862, it was transferred into Burseraceae by Hooker f., followed by a transfer back into Sapindaceae by Baillon in 1874. In 1890, *Filicium* was placed by Radlkofer into the tribe Doratoxyleae of the subfamily Dodonaeoideae, in spite of its uniovular carpels; this position is supported by Harrington et al. (2005).

25. *Ganophyllum* Blume

Ganophyllum Blume, Mus. Bot. Lugd.-Bat. 1: 230 (1850) [1851]; Radlk. in Engl., Pflanzenreich 98: 1423 (1933); Leenhouts in Fl. Males. I, 11: 538 (1994).

Dioecious trees. Indument of glandular scales. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers actinomorphic; calyx cup-shaped, (4)5(–7)-lobed, valvate; petals 0; disk annular-lobed; stamens 5(–7); pollen colporate, irregularly verrucate; ovary 2(3)-carpellate, with 2 ovules per carpel; style short; stigma indistinctly lobed. Fruits indehiscent, 2-locular, ovoid, baccate, with papery endocarp and leathery mesocarp. Seeds exarillate.

One or two species, from western and central Africa, Andaman and Nicobar Islands, throughout Malesia to northeastern Australia, New Guinea, and the Solomons.

26. *Hippobromus* Ecklon & Zeyher

Hippobromus Ecklon & Zeyher, Enum.: 151 (1836).

Falsely polygamous dioecious trees. Leaves alternate, paripinnate; leaflets serrate; distal leaflet rudimentary; rachis winged. Inflores-

cences axillary thyrses. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, connate at base, imbricate; petals 5(6), shorter than the sepals, without appendages; disk annular, pentagonous; stamens 8; pollen colporate, rugulate; ovary 3-carpellate, with 2 or less often 3 ovules per carpel; style short; stigma decurrent. Fruits 1-locular, indehiscent, baccate. Seeds exarillate.

A single species, *H. alatus* Ecklon & Zeyher, Africa.

27. *Hypelate* P. Browne

Hypelate P. Browne, Civ. Nat. Hist. Jamaica: 208 (1756).

Falsely polygamous shrubs or trees. Leaves trifoliolate; stipules 0. Inflorescences axillary or terminal thyrses. Flowers bisexual or functionally unisexual; calyx zygomorphic, sepals (4)5, imbricate, the outer two smaller; petals (4)5, without appendages; disk annular, obsolete 5-lobed; stamens (7)8; pollen colporate, loosely verrucate; ovary 3-carpellate, with 2 ovules per carpel; style short; stigma capitate. Fruit a 1-locular, indehiscent drupe with woody endocarp and fleshy mesocarp and exocarp. Seeds exarillate, with papery testa.

A single species, *H. trifoliata* Sw., endemic to the West Indies and the southeastern United States (Florida).

28. *Zanha* Hiern

Zanha Hiern, Cat. African Pl. 1: 128 (1896).

Dialiopsis Radlk. (1902) [nomen nudum] and in Engl. & Prantl., Nat. Pflanzenfam., Nachtr. 3: 207 (1907).

Dioecious trees. Leaves alternate, paripinnate; leaflets 3–7 pairs, entire or serrulate; distal leaflet rudimentary; stipules 0. Inflorescences distal, short thyrses. Flowers actinomorphic, functionally unisexual; sepals 4–5(6), imbricate, connate on lower 1/3–1/2; petals 0; disk annular or funnel-shaped; stamens (3)4–5, coiled in bud; pollen colporate, loosely scabrate; ovary 2-carpellate, with 2 ovules per carpel; style short, filiform, stigmas 2-lobed. Fruit 1-locular, indehiscent, with fleshy mesocarp and coriaceous endocarp. Seed 1 per fruit, with coriaceous or slightly fleshy testa.

Three species from southern Africa and Madagascar. Fruits of *Z. suaveolens* Capuron are said to be edible.

IV. SUBFAM. SAPINDOIDEAE

Leaves alternate; petal appendages usually present; disk annular or unilateral; carpels uniovulate.

5. Tribe Paullinieae Kunth ex DC. (1824).

Tribe Thouinieae Blume (1847).

Herbaceous vines, shrubs or small trees, often stipulate; leaves imparipinnate; flowers zygomorphic.

29. *Allophylus* L

Allophylus L., Sp. Pl. 348 (1753); Leenhouts, Blumea 15: 301–358 (1967); Fritsch, Kulturpfl. 18: 194 (1970); Ferrucci, Bol. Soc. Argentina Bot. 24: 200–202 (1985).

Duodichogamous or dioecious shrubs or trees, or less often scandent shrubs. Leaves alternate, trifoliolate or less often unifoliolate or digitate (in a few Asian collections); leaflets serrate, dentate or entire; petioles elongated; stipules 0. Inflorescences axillary racemes, panicles or thyrses. Flowers zygomorphic, 4-merous, functionally pistillate or staminate; sepals distinct, imbricate, the outer distinctly smaller than the inner; petals with a single, 2-lobed appendage or 2 marginal appendages; disk unilateral; stamens 8; pollen brevicolporate to porate, rugulate, sometimes striate, reticulate or psilate; ovary 2(3)-carpellate, with a single ovule per carpel; style with 2–3 stigmatic branches. Fruit an indehiscent drupe, 1–2-coccate, with crustose endocarp and fleshy exocarp. Seeds exarillate, with papery testa. $2n = 28$.

Depending on circumscription, a single species or about 250 species with circumtropical distribution. Several species are planted as ornamentals.

The notorious difficulties in species delimitation in *Allophylus* led Leenhouts (1967) to revise the status of the genus, which he found to be dominated by an enormous degree of clinal variation and intergradation among regional populations. As a consequence, he suggested to treat *Allophylus* as a single polymorphic species with the possibility of adding existing species names for informally characterizing local races. Since then, however, no progress in an understanding of the systematic structure of *Allophylus*

has been made, and most botanists still continue recognizing regional populations as species.

30. *Athyana* (Griseb.) Radlk.

Athyana (Griseb.) Radlk. in T. Durand, Index Gen. Phan.: 73 (1887) [1888].

Monoecious trees. Leaves alternate, imparipinnate; leaflets serrate; distal leaflet fully developed; rachis winged; stipules 0. Inflorescences axillary or pseudo-terminal thyrses. Flowers zygomorphic, functionally unisexual; sepals 5, of similar size, valvate; petals 4, of same length, with a single petaloid hood-shaped appendage; disk semi-annular-lobed; stamens (7)8; pollen colporate, finely perforate; ovary 3-carpellate, with a single ovule per carpel; stigma capitate. Fruit schizocarpic, splitting into 3 samaroid mericarps with a distal wing. Seed exarillate.

A single species, *A. weinmannifolia* Radlk., southern South America (Peru, Bolivia, Argentina).

31. *Bridgesia* Bertero ex Cambess., nom. cons.

Bridgesia Bertero ex Cambess., Nouv. Ann. Mus. Hist. Nat. 3: 234 (1834), non Hook. (1831).

Falsely polygamous shrubs. Leaves alternate, simple, lobed or serrate; stipules 0. Inflorescence a short, axillary cyme or flowers solitary. Flowers zygomorphic, unisexual or bisexual; sepals 5, imbricate; petals 4, with a single cucullate, crested appendage; disk semi-annular, 4-lobed; stamens 8; pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; style filiform with 3 stigmatic branches. Fruit schizocarpic, splitting into 3 samaroid, papery mericarps with a short dorsal wing. Seed exarillate.

A single species, *B. incisifolia* Bertero & Cambess., from Andean Chile.

32. *Cardiospermum* L.

Cardiospermum L., Sp. Pl.: 366 (1753).

Monoecious herbaceous vines. Leaves alternate, ternately compound or biternate; stipules minute. Inflorescences axillary thyrses bearing tendrils at base of rachis. Flowers zygomorphic, functionally staminate or pistillate; sepals 4–5, unequal, imbricate; petals 4, with a basal, hood-shaped appendage; disk unilateral, 2-lobed; stamens 8; pollen heteropolar, demi(syn)colporate proximally,

perforate to reticulate; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic branches. Fruit a septifragal, marginicidal, inflated, capsule with thin-membranous walls. Seeds black, with a small, heart-shaped arillode surrounding the micropyle. $x=10, 11$.

About 15 species native to the Neotropics, 3 of which are widely distributed throughout the tropics. Two species are cultivated as ornamentals.

33. *Diatenopteryx* Radlk.

Diatenopteryx Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. Münch. 8: 284 (1878); Ferrucci, Sapindaceae in Spichiger & Ramella, Flora del Paraguay (1991).

Falsely polygamous shrubs or trees. Indumentum of simple hairs and scales. Leaves alternate, imparipinnate; leaflets dentate or serrate; distal leaflet rudimentary or fully developed; stipules 0. Inflorescences axillary thyrses. Flowers zygomorphic, functionally unisexual; sepals 4, distinct, imbricate; petals 4, with a basal hood-shaped, crested appendage; disk semi-annular, lobed; stamens (6–)8; pollen colporate, rugulate; ovary 2-carpellate, with a single ovule per carpel; style filiform; stigma subcapitate. Fruits schizocarpic, splitting into 2 samaroid mericarps with a long distal wing. Seed exarillate.

Two species from southern South America (Brazil, Bolivia, Paraguay, and Argentina).

34. *Guindilia* Gilles ex Hook. & Arn.

Guindilia Gilles ex Hook. & Arn., Hooker's Bot. Misc. 3: 170 (1833).

Valenzuelia Bert. ex Cambess. (1834), non Mutis (1810).

Falsely polygamous trees. Leaves alternate, simple, opposite, entire or tridentate at apex; stipules 0. Inflorescences axillary cymes. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, imbricate; petals 4(5), with a hood-shaped, crested, ventral appendage; disk unilateral, modified into a 2-lobed mount; stamens 8; pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; style filiform; stigma 3-lobed. Fruit schizocarpic, splitting into (1–)3 sub-globose, crustose mericarps. Seed exarillate.

Three species from southern South America.

35. *Houssayanthus* Hunziker

Houssayanthus Hunziker, Kurtziana 11: 17 (1978); Ferrucci, Bonplandia 5 (19): 164–174 (1981); Ferrucci, Candollea 41: 218 (1986) and ibid. 42: 805–807 (1987); Rzedowski & Calderón de Rzedowski, Acta Bot. Mexicana 76: 89–98 (2006).

Woody vines. Cross section of stem simple or with a central and three peripheral vascular cylinders. Leaves trifoliolate, 5-pinnately compound, or biternate; stipules minute. Inflorescences axillary thyrses with a pair of tendrils at base of rachis. Flowers zygomorphic, functionally unisexual; sepals 4 or 5, unequal, imbricate; petals 4, with a basally adnate hood-shaped appendage; disk unilateral, 4-lobed; stamens 8; pollen heteropolar, demisyncolporate, perforate; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic branches. Fruit a schizocarp splitting into 3 mericarps with a short dorsal wing. Seeds lenticular, exarillate. $2n = 24$.

Five species, two from Mexico, one from Venezuela, and two from Brazil, Bolivia, Paraguay, and northeastern Argentina.

36. *Lophostigma* Radlk.

Lophostigma Radlk. in Engl. & Prantl, Nat. Pflanzenfam., Nachtr. 1: 228 (1897); Acevedo-Rodríguez, Syst. Bot. 18: 379–388 (1993), rev.

Woody vines. Cross section of stem with a single vascular cylinder. Leaves alternate, trifoliolate; stipules minute. Inflorescences axillary thyrses with a pair of tendrils at base of rachis. Flowers zygomorphic, functionally unisexual; sepals 5, unequal, imbricate; petals 4, much shorter than the sepals, with 2 basally adnate digitate appendages; disk unilateral, 4-lobed; stamens 8, with short filaments; pollen cylindrical-ellipsoid, 4-aperturate, possibly a lengthy variant of heteropolar 3-demisyncolporate Paullinieae pollen (e.g., *Serjania*); ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic branches. Fruit a schizocarp splitting into 3 mericarps with an elongated proximal wing. Seeds lenticular, exarillate.

Two species, one from Ecuador and Peru, the other from Bolivia.

37. *Paullinia* L.

Paullinia L., Sp. Pl.: 365 (1753); Radlkofer, Monogr. Paullinia (1895); Simpson, Fieldiana Bot. 36: 125–164 (1976), reg. rev.

Woody vines, usually producing milky sap. Cross section of stem with a central and 3–5 peripheral vascular cylinders, or with a single vascular cylinder. Leaves alternate, trifoliolate, pinnate (5-pinnate), bipinnate, biternate, or variously dissected; stipules minute to large. Inflorescences axillary thyrses with a pair of tendrils at base of rachis, or cauliflorous thyrses without tendrils. Flowers zygomorphic, functionally unisexual; sepals 4–5, unequal, imbricate; petals 4, with a basally adnate hood-shaped appendage; disk unilateral, 4-lobed; stamens 8; pollen porate, perforate; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic branches. Fruit a 1–3-locular, septifragal-marginicidal capsule, the locules dorsally winged or exalate, exceptionally spiny. Seeds globose, oblong or ellipsoid, with a partial to nearly complete sarcotesta. $2n=24$.

About 190 species native to the Neotropics, one species extending into Africa. Numerous species are used as fish poisons; *P. cupana* Kunth is the source of the economically important “guaraná” used in the confection of a stimulating drink or soft drinks in Brazil.

38. *Serjania* Plum. ex Miller

Fig. 83

Serjania Plum. ex Miller, Gard. Dict. Abr. ed. 4 (1754); Acevedo-Rodríguez, Mem. New York Bot. Gard. 67: 1–93 (1993).

Chimborazoa H.T. Beck (1994); Acevedo-Rodríguez, Novon 8: 106 (1998).

Duodichogamous woody or herbaceous vines, often producing milky sap. Cross section of stem with a single or multiple vascular cylinders, usually 3, but also 8 or 10. Leaves alternate, ternately compound (ternate, biternate, or triternate) or 5-pinnately compound; stipules small and early deciduous. Inflorescences axillary or terminal thyrses. Flowers zygomorphic, functionally unisexual; sepals 4–5, unequal, imbricate; petals 4, with a basally adnate hood-shaped appendage; disk unilateral, 2- or 4-lobed; stamens 8; pollen heteropolar, demi(syn)colporate proximally, sometimes with short distal demicolpi as well, perforate, sometimes reticulate, psilate or faintly rugulate; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic branches. Fruit schizocarpic, splitting into three samaroid mericarps, each with a proximal wing. Seeds lenticular to globose, exarillate. $2n=24$.

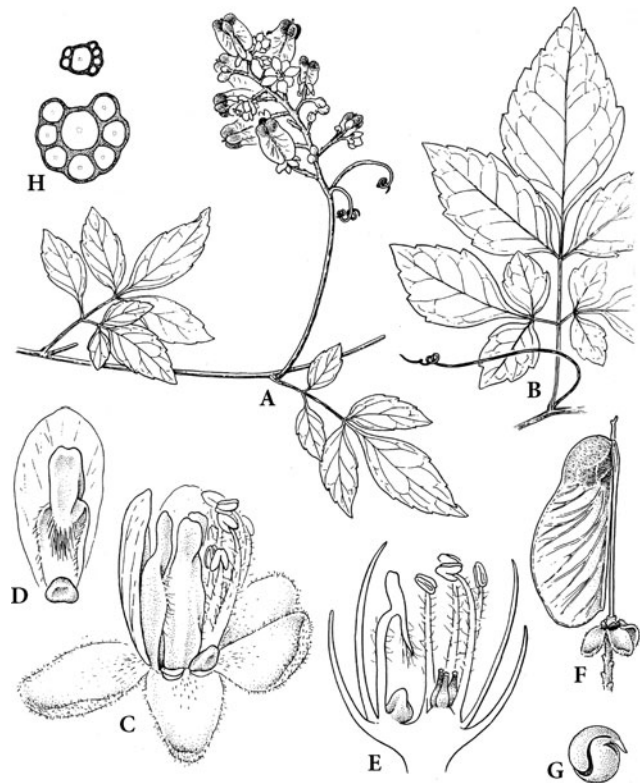


Fig. 83. Sapindaceae. *Serjania polyphylla*. A Fertile branch. B Biternate leaf with tendril. C Male flower. D Petal with adnate hood-shaped appendage. E Longitudinal section of male flower. F Winged mericarp attached to floral axis. G Embryo. H Cross section of stem showing numerous vascular cylinders. (Acevedo-Rodríguez 1996; reproduced with permission of the artist Bobbi Angell)

About 230 species native to tropical and subtropical America.

39. *Thinouia* Triana & Planchon

Thinouia Triana & Planchon, Ann. Sci. Nat. Bot. IV, 18: 368 (1862).

Allosanthus Radlk. (1933).

Lianas. Secondary growth of stems with numerous cortical steles. Leaves alternate, trifoliolate; stipules minute. Inflorescences umbelliform thyrses, seldom bearing tendrils, axillary or aggregate into terminal thyrsoid inflorescences. Flowers actinomorphic, bisexual, 5-merous; calyx cup-shaped, the sepals valvate; petals obovate to spatulate, with a pair of short, marginal appendages; disk annular; stamens 6–8; pollen colporate, striate; ovary 3-carpellate, with a single

ovule per carpel; style elongated with 3 stigmatic branches. Fruit schizocarpic, splitting into 3 mericarps, each with a distal wing. Seeds nearly spherical, exarillate.

About 12 species from Central and South America.

40. *Thouinia* Poit., nom. cons.

Thouinia Poit., Ann. Mus. Natl. Hist. Nat. 3: 70 (1804), non L. f. (1782), nom. rej.; Votava, Taxonomic revision of the genus *Thouinia* (Sapindaceae). Ph.D. dissertation, Columbia University, New York, 235 pp. (1973), rev.

Falsely polygamous shrubs or trees. Leaves alternate, trifoliolate or unifoliolate; stipules 0. Inflorescences axillary, racemose thyrses. Flowers zygomorphic, functionally unisexual; sepals 4, imbricate; petals 4, with a ventral, bifid appendage; disk unilateral, lobed; stamens 8; pollen brevicolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style filiform, with 3 stigmatic branches. Fruit schizocarpic, splitting into 3 samaroid mericarps, each bearing a distal wing. Seeds exarillate.

About 30 species from Central America and the West Indies.

41. *Urvillea* Kunth

Urvillea Kunth in H.B.K., Nov. Gen. Spec. 5: 105 (1821).

Herbaceous to woody vines. Stems terete and lenticellate, becoming trilobate at age, producing milky sap. Leaves alternate, trifoliolate or biternate; stipules minute, deciduous. Inflorescences axillary thyrses. Flowers zygomorphic, bisexual; sepals 5, unequal, imbricate; petals 4, spatulate, with an adnate hood-shaped appendage on adaxial surface; disk unilateral, 4-lobed, receptacle enlarged into a short androgynophore; stamens 8; pollen heteropolar, demisyncolporate proximally, often with short distal demicolpi as well, perforate, indistinctly rugulate or reticulate (Fig. 79G-I); ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic branches. Fruit a 3-locular, thin, papery, semi-inflated capsule, with a narrow, marginal (septal) wing. Seeds sub-globose, with a heart-shaped or reniform, white arillode around the hilum. $2n=22$.

About 15 species from Central and South America.

6. Tribe Melicocceae Blume (1847).

Flowers actinomorphic; fruits indehiscent, usually single seeded; seeds with sarcotesta.

42. *Melicoccus* P. Browne

Fig. 77

Melicoccus P. Browne, Hist. Jamaica: 210 (1756); Acevedo-Rodríguez, Moscosoa 9: 58–61 (1997); Acevedo-Rodríguez, Fl. Neotrop. 87 (2002), rev.

Melicocca L. (1762), nom. illeg.

Dioecious or monoecious trees. Leaves alternate, paripinnate; leaflets 1–2 pairs; distal leaflet rudimentary, 0 or exceptionally present; rachis usually winged; stipules 0. Inflorescences terminal panicles or racemes. Flowers actinomorphic, functionally pistillate or staminate. Calyx cup-shaped, sepals 4(5), equal, imbricate; petals 4(5) erect or reflexed; appendages 0 or rudimentary; disk annular, slightly lobed; stamens 8; pollen colporate, striate; ovary 2-carpellate, unilocular, with a single ovule per carpel; style obsolete; stigmatic surface lobed, subcapitate. Fruit indehiscent, with leathery pericarp, sub-globose or ellipsoid. Seeds 1(2) with edible sarcotesta. $2n = 32$.

Ten species, native to South America and Dominican Republic. *Melicoccus bijugatus* Jacq. is widely cultivated in the Neotropics for its edible, tasty fruits.

43. *Talisia* Aublet

Fig. 84

Talisia Aubl., Hist. Pl. Guiane 1: 349 (1775); Mennega, Acta Bot. Neerl. 21: 578–586 (1972); Acevedo-Rodríguez, Fl. Neotrop. 87: 1–179 (2003), rev.

Tapirocarpus Sagot (1882).

Duodichogamous unbranched shrubs or small to large trees. Leaves alternate, paripinnate or imparipinnate; leaflets entire; distal leaflet rudimentary. Inflorescences axillary, terminal or cauliflorous thyrses. Flowers 5-merous, actinomorphic, staminate or pistillate; calyx usually cup-shaped, sepals imbricate or valvate, equal or unequal in size; petals reflexed or ascending, with marginal appendages or with a basal, petaloid, sericeous appendage; disk annular, 5–8-lobed; stamens 5–8; pollen either colporate, striate, or brevicolporate, psilate; ovary 3-carpellate, with a single ovule per carpel; style subulate, crowned by a capitate to cylindrical stigma.

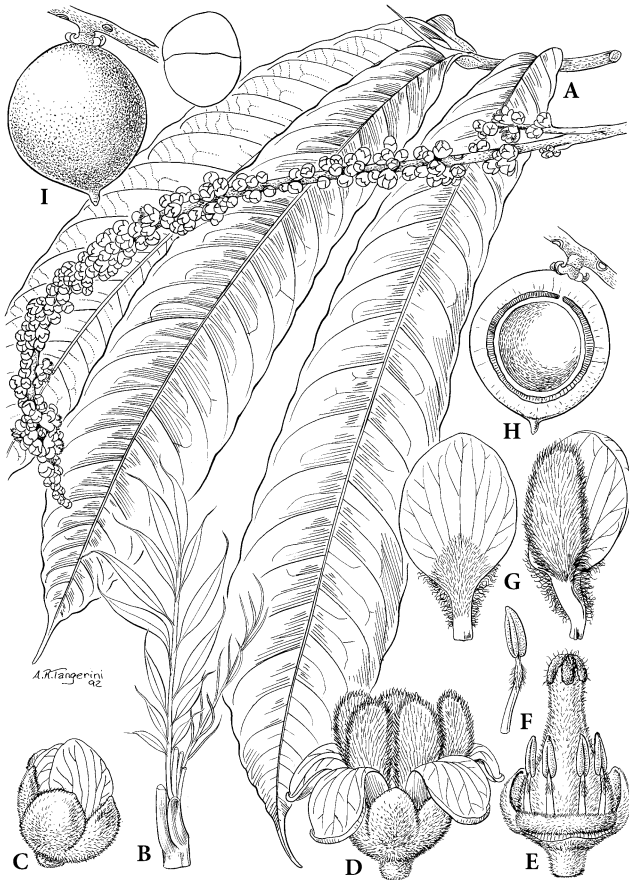


Fig. 84. Sapindaceae. *Talisia princeps* Oliver. A Distal portion of pinnate leaf and inflorescence. B Cataphylls. C Flower bud. D Pistillate flower. E Ditto, perianth removed to show disk, sterile stamens and pistil. F Stamen. G Abaxial and adaxial views of petal with adnate appendage. H Longitudinal section of fruit showing mesocarp and seed. I Fruit and ventral view of embryo. (Acevedo-Rodríguez 2003; drawn by A. Tangerini)

Fruit 1(–3)-seeded, indehiscent, with leathery or less often woody pericarp. Seeds entirely covered with a sarcotesta.

Fifty two species predominantly from South America, some occurring in Central America and southern Mexico.

Genera 44–140: Incertae Sedis

44. *Alectryon* Gaertn

Alectryon Gaertn., Fruct. Sem. Pl. 1: 216, pl. 46 (1788); Reynolds, *Austrobaileya* 2: 332–338 (1987); Leenhouts, *Blumea* 33: 313–327 (1988), reg. rev.

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate or less often unifoliolate; leaflets serrate or entire; distal leaflet rudimentary; lower pair of leaflets (pseudostipules) sometimes clasping the stem. Inflorescences axillary thyrses or panicles. Flowers actinomorphic; calyx acetabuliform, sepals 4–5(6), valvate or sub-imbricate; petals 0 or 4–5, shortly clawed, the appendages apparently of marginal origin, connate to form a funnel-shaped structure with the petal; disk annular-lobed, glabrous; stamens (5–)8, the filaments subequal, inserted on the disk; pollen colporate to parasyncolporate, striate to rugulate; ovary (1)2–4(5)-carpellate, with a single ovule per carpel; stigma grooved or lobed. Fruits capsular, 1–3-coccate, lobed or unlobed, circumscissile or dehiscent septifragally along septum. Seed with a partial granular, red sarcotesta. $2n = 32$.

About 25 species in eastern Malesia, Australia, New Zealand, New Caledonia, and extending into the Pacific to Samoa and the Sandwich Islands. Two subgenera: *Synalectryon* and *Alectryon*.

45. *Amesiodendron* Hu

Amesiodendron Hu, Bull. Fan. Mem. Inst. Biol. 7, Bot.: 207 (1936); Lo, *Acta Phytotax. Sin.* 17: 36, f. 3 (1979); Leenhouts in *Fl. Males. I*, 11: 465 (1994).

Polygamous monoecious trees. Leaves alternate, once pinnate, paripinnate; leaflets serrate; distal leaflet rudimentary. Inflorescences axillary or terminal panicles. Flowers actinomorphic; sepals 5, distinct, valvate; petals 5, with a single basal appendage; disk annular, bowl-shaped, forming a ring on upper portion; stamens (6)7–8(9); pollen syncolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style with two stigmatic lines. Fruits loculicidal capsules, 3-coccate, sometimes 1 or 2 cocci rudimentary. Seeds with sarcotestal ring around hilum.

One to three species, from Indochina, southern China, peninsular Malaysia, and Sumatra.

46. *Aporrhiza* Radlk.

Aporrhiza Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer Akad. Wiss. München 8: 338 (1878).

Falsely polygamous trees or shrubs. Leaves alternate, once pinnate, paripinnate; terminal leaflet rudimentary. Inflorescences terminal, axillary or cauliflorous thyrses. Flowers actinomorphic,

functionally unisexual; sepals 5, distinct, valvate; petals 5, clawed, with a pair of appendages formed by the inflexed margin above the claw; disk annular, sub-lobed; stamens 6–8; pollen colporate, perforate; ovary 2-carpellate, with a single ovule per carpel; style short; stigma 2-lobed. Fruit a 2-locular, loculicidal capsule. Seeds with a sarcotesta on lower half. $2n = 28$.

Four to six species from tropical Africa.

47. *Arytera* Blume

Fig. 85

Arytera Blume, Rumphia 3: 169 (1847); van der Ham, Blumea 23: 289–300 (1977); Turner, Blumea 38: 137–144 (1993); van Bergen et al., Blumea 40: 195–209 (1995).

Trees or shrubs. Leaves alternate, once pinnate, paripinnate; leaflets usually with domatia; distal leaflet rudimentary. Inflorescences axillary or pseudo-terminal thyrses. Flowers actinomorphic,

functionally unisexual; sepals 5, connate to nearly distinct, valvate to imbricate; petals (2–)5(6), with 2 marginal appendages, sometimes clawed; disk annular, lobed; stamens (5–)7–8(–10); pollen colporate to parasyncolporate, rarely syncolporate, rugulate to striate-rugulate; ovary (1)2–3-carpellate, with a single ovule per carpel; style filiform, with 2–3 stigmatic lines or 2–3-lobed. Fruit a 1–3-coccate, loculicidal capsule. Seeds with basal arillode, apically open, covering half to nearly the entire seed.

About 28 species in northeast India and southeast Asia, throughout Malesia, and Australia, Solomon Islands and Pacific Islands.

Section *Arytera* has simple hairs, sepals externally pubescent, and 2–3-lobed ovaries; Section *Azarytera* has glandular-scaly indument, glabrous sepals, and 2-lobed ovaries.

48. *Atalaya* Span. ex Blume

Atalaya Span. ex Blume, Rumphia 3: 186 (1847); Radlk. in Pflanzenreich 98: 605 (1932); Reynolds, Austrobaileya 1: 398–406 (1981), reg. rev.; Leenhouts in Fl. Males. I, 11: 479 (1994), reg. rev.

Falsely polygamous trees or shrubs. Leaves alternate, once pinnate, paripinnate or less often imparipinnate, up to 6-jugate; distal leaflet rudimentary; rachis sometimes winged. Inflorescences terminal or axillary thyrses. Flowers unisexual or bisexual; calyx slightly zygomorphic, sepals 5, distinct, imbricate, the outer 2 smaller; petals (4)5, clawed, with a pair of appendages formed by the inflexed margins above the claw; disk annular or semi-annular; stamens 8; pollen colporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; placentation axile; style conical with 3 stigmatic lines. Fruits schizocarpic, splitting into (1–)3 divaricate, samaroid mericarps, each with a long, dorsal wing. Seed exarillate, laterally compressed, with papery testa.

Twelve species, mostly from northern and eastern Australia, also in the Lesser Sunda Islands, southeastern New Guinea, and South Africa.

49. *Beguea* Capuron

Beguea Capuron, Mem. Mus. Natl. Hist. Nat., B, Bot. II, 19: 105 (1969).

Dioecious trees. Leaves alternate, paripinnate; leaflets 3–7 pairs, opposite or alternate, entire;



Fig. 85. Sapindaceae. *Arytera multijuga*. A Flowering branch. B Male flower. C Petal. (Adema et al. 1994, drawn by J. Wessendorp)

distal leaflet rudimentary; stipules 0. Inflorescences axillary racemes or thyrses. Flowers actinomorphic, unisexual; sepals (5)6–7(8), distinct, valvate; petals 0; disk annular-lobed; stamens 6–8 (–10); pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; style filiform with 3 stigmatic branches. Fruit indehiscent, crustose, 1-seeded. Seeds arillate, cotyledons cerebriform (brain-like).

A single species, *B. apetala* Capuron, endemic to Madagascar.

50. *Bizonula* Pellegrin

Bizonula Pellegrin, Bull. Soc. Bot. France 71: 299 (1924).

Hermaphroditic trees. Leaves bipinnate; distal leaflet rudimentary; stipules 0. Inflorescences terminal thyrses. Flowers actinomorphic, bisexual; sepals 5, distinct, valvate; petals 5, with a basal appendage forming a pocket; disk annular, double; stamens 12–13; pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; style elongated, weakly lobed. Fruit not known.

A single species, *B. le-testui* Pellegrin, from Gabon, Africa.

51. *Blighia* Koenig

Blighia Koenig, Ann. Bot. 2: 571 (1806).

Falsely polygamous-dioecious, usually trees or shrubs. Leaves alternate, paripinnate; leaflets 1–5 pairs, entire; distal leaflet rudimentary; stipules 0. Inflorescences axillary racemose thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, valvate; petals 5, connate along appendage margins to form a pouch; disk annular, 8-lobed; stamens 8–10; pollen colporate, striate; ovary 3(4)-carpellate, with a single ovule per carpel; style elongated-conical. Fruit a 3(4)-locular, loculicidal, capsule. Seeds with a basal arillode. $2n = 32$.

Three species from tropical Africa. *Blighia sapida* Koenig is widely cultivated for its edible arillodes in Jamaica and as an ornamental in Africa, the West Indies, and areas of the Neotropics.

52. *Blighiopsis* van der Veken

Blighiopsis van der Veken, Bull. Jard. Bot. État. 30: 413 (1960).

Dioecious trees. Leaves alternate, paripinnate; leaflets opposite or alternate, entire; distal leaflet rudimentary; pseudostipules small. Inflorescences thyrsoid. Flowers actinomorphic, unisexual; sepals (4)5(7), slightly imbricate, distinct to base; petals 0; disk annular; stamens 5(7), anthers basifixed; pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; style short, crowned by a trigonous stigma. Fruit a tardily loculicidal, 1-locular, coriaceous capsule. Seed solitary, with basal arillode.

A single species, *B. pseudostipularis* van der Veken, Central Africa.

53. *Blomia* Miranda

Blomia Miranda, Annales Inst. Biol. Univ. Nac. Mexico 24: 82 (1953).

Tikalía Lundell (1961).

Falsely polygamous-dioecious trees. Leaves alternate, paripinnate; leaflets crenate, 1–4 pairs; distal leaflet rudimentary; stipules 0. Inflorescences axillary thyrses. Flowers actinomorphic, unisexual or bisexual; sepals 5, distinct, valvate; petals 0 or vestigial, with a pair of minute marginal appendages; disk annular-lobed; stamens 5–6; pollen colporate, striate; ovary 1-carpellate, with a single ovule per carpel; style short; stigma capitate. Fruit a 1-locular, tardily loculicidally dehiscent, coriaceous, red capsule. Seeds with thin sarcotesta.

A single species, *B. cupanioides* Miranda, in Mexico, Guatemala, and Belize.

54. *Camptolepis* Radlk.

Camptolepis Radlk. in Engl. & Prantl., Nat. Pflanzenfam., Nachtr. 2–4, 3: 207 (1907); Capuron, Mem. Mus. Natl. Hist. Nat. B, Bot. II, 19: 1–189 (1969).

Hypseloderma Radlk. (1932) [1933].

Dioecious trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary; stipules 0. Inflorescences ramiflorous, short thyrses. Flowers actinomorphic, unisexual; sepals 5, distinct, imbricate; petals 5, with a single basal, short appendage; disk annular-lobed; stamens (10–)12; pollen colporate or brevicolporate, perforate; ovary 3-carpellate, with a single ovule per carpel; style elongated; stigma 3, ellipsoid. Fruit indehiscent, (1–)3-locular. Seeds completely covered by a translucent arillode.

Four species from tropical east Africa and Madagascar.

55. *Castanospora* F. Muell.

Castanospora F. Muell., Fragm. 9: 92 (1875); Reynolds, *Austrobaileya* 2: 34–35 (1984).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets entire, alternate or subopposite; distal leaflet rudimentary; stipules 0. Inflorescences axillary racemes or thyrses, with lateral dichasia. Flowers actinomorphic, functionally staminate or pistillate; calyx cup-shaped, sepals 5, ovate, sub-valvate; petals 5, with 2 minute basal appendages; disk annular-lobed; stamens 8; pollen parasyncolporate, striate-rugulate; ovary 2-carpellate, with a single ovule per carpel; style short, with 2 reflexed stigmatic branches. Fruit indehiscent, crustose-fleshy, bicoccate, sometimes with a thin septa. Seeds large, chestnut-like, brown, exarillate.

A single species, *C. alphandi* F. Muell., eastern Australia.

56. *Chouxia* Capuron

Chouxia Capuron, Mem. Mus. Natl. Hist. Nat., B, Bot. II, 19: 130 (1969); Schatz et al., *Adansonia* III, 21: 51–62 (1999), rev.

Dioecious or monoecious trees. Leaves alternate, paripinnate; leaflets opposite or subopposite, entire; distal leaflet rudimentary; stipules 0. Inflorescences cauliflorous racemes or thyrses. Flowers actinomorphic, staminate or pistillate; sepals (4)5(6), distinct, imbricate; petals 5, with a simple basal appendage; disk annular; stamens (7)8(–10); pollen colporate, striate-reticulate; ovary (2)3-carpellate, with a single ovule per carpel; style elongated; stigma 3. Fruit 1–3-locular, indehiscent, baccate. Seeds arillate.

Six species endemic to Madagascar.

57. *Chytranthus* Hook. f.

Chytranthus Hook. f. in Benth. & Hook. f., Gen. Pl. 1: 403 (1862).
Glossolepis Gilg (1897).

Falsely polygamous dioecious treelets. Leaves alternate, paripinnate, terminal leaflet rudimentary; stipules 0. Inflorescences cauliflorous, fasciculate, racemose thyrses. Flowers zygomorphic,

functionally staminate or pistillate; calyx urceolate, sepals 5, connate at base, imbricate; petals 4(5–7), with a basal, simple or hood-shaped and sometimes crested appendage; disk semi-annular or reniform; stamens 7–8(9–11); pollen colporate of brevicolporate, striate; ovary 3–8-carpellate, with a single ovule per carpel; style subulate. Fruit indehiscent, 3–8-locular, deeply ribbed, fleshy. Seeds with sarcotesta. $2n = 32$.

Twenty-six to 29 species from west tropical Africa.

58. *Cnesmocarpon* Adema

Cnesmocarpon Adema, *Blumea* 38: 195–201 (1993).

Trees. Leaves alternate, paripinnate; leaflets papillate beneath; distal leaflet rudimentary. Inflorescences axillary or ramiflorous thyrses. Flowers actinomorphic; sepals 5, imbricate, slightly unequal; petals 5, with 2 marginal appendages, or less often lacking appendages; disk annular or semi-annular; stamens 8; pollen syncolporate or parasyncolporate, psilate or indistinctly rugulate; ovary 3-carpellate, with a grains single ovule per carpel, style with 3 stigmatic lines. Fruit a 3-locular, fleshy, loculicidal capsule, the locules basally winged, covered with irritating hairs. Seeds obovoid, testa shiny black, with carunculoid sarcotesta at the base.

Four species in Australia and Papua New Guinea, occurring in primary lowland to montane forest.

59. *Conchopetalum* Radlk.

Conchopetalum Radlk. in T. Durand, Index Gen. Phan.: 81 (1887) [1888].

Shrubs or trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary; stipules 0. Inflorescences axillary or ramiflorous, fasciculate, pseudo-umbelliform cymes. Flowers actinomorphic, functionally unisexual; sepals 5, connate at base, imbricate; petals 5, red, without appendages; disk annular, double, the central rim sometimes tubular resembling an androgynophore; stamens 8, exerted; pollen colporate, striate-rugulate; ovary 3-carpellate, with 2 ovules per carpel; style elongated, the stigma punctiform. Fruit a 3-locular, chartaceous capsule. Seeds with brown sarcotestal ring around the hilum.

Two species endemic to Madagascar.

60. *Cubilia* Blume

Cubilia Blume, Rumphia 3: 100 (1847); Leenhouts, Blumea 24: 297 (1978).

Falsely polygamous trees. Leaves alternate, paripinnate; terminal leaflet rudimentary. Inflorescences terminal or pseudo-terminal, thyrsoid or corymbiform. Flowers actinomorphic; calyx urceolate, with a narrow opening and 5 minute lobes; petals 5, shorter than the calyx, without appendages; disk annular, fleshy; stamens 5 (or 6); pollen grains small ($12 \times 13 \mu\text{m}$), colpiate, scabrate; ovary 2-carpellate, with a single ovule per carpel; stigma short, with 2 stigmatic lobes. Fruit a 1–2-cocccate, loculicidal, echinate, woody capsule. Seeds with a large round hilum, arillate on lower half or third.

A single species, *C. cubili* (Blanco) Adelb., from eastern Borneo, the Philippines, Celebes, and the western Moluccas Islands.

61. *Cupania* L.

Cupania L., Sp. Pl.: 200 (1753).

Duodichogamous or dioecious trees. Leaves alternate, paripinnate or imparipinnate; leaflets

Fig. 86

mostly serrate; stipules 0. Inflorescences axillary or terminal thyrses or racemes. Flowers actinomorphic, functionally unisexual; sepals 5, short, imbricate; petals 5, with a pair of marginal tomentose appendages; disk annular-lobed; stamens (4, 6) 8; pollen syncolporate (Fig. 79J) or parasyncolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style elongated; stigma conical. Fruit a 2- or 3-locular, woody or leathery, loculicidal capsule. Seeds with a cupular arillode at base. $2n = 32$.

About 50 species from tropical and subtropical America.

62. *Cupaniopsis* Radlk.

Cupaniopsis Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. Münch. 9: 483, 498, 584 (1879); Adema, Leiden Bot. Series 15: 75 (1991), rev.

Shrubs or treelets, pubescence of simple or glandular trichomes, or scaly. Leaves alternate, paripinnate; leaflets entire or less often dentate or serrate; distal leaflet rudimentary; stipules 0. Inflorescences axillary or cauliflorous thyrses.

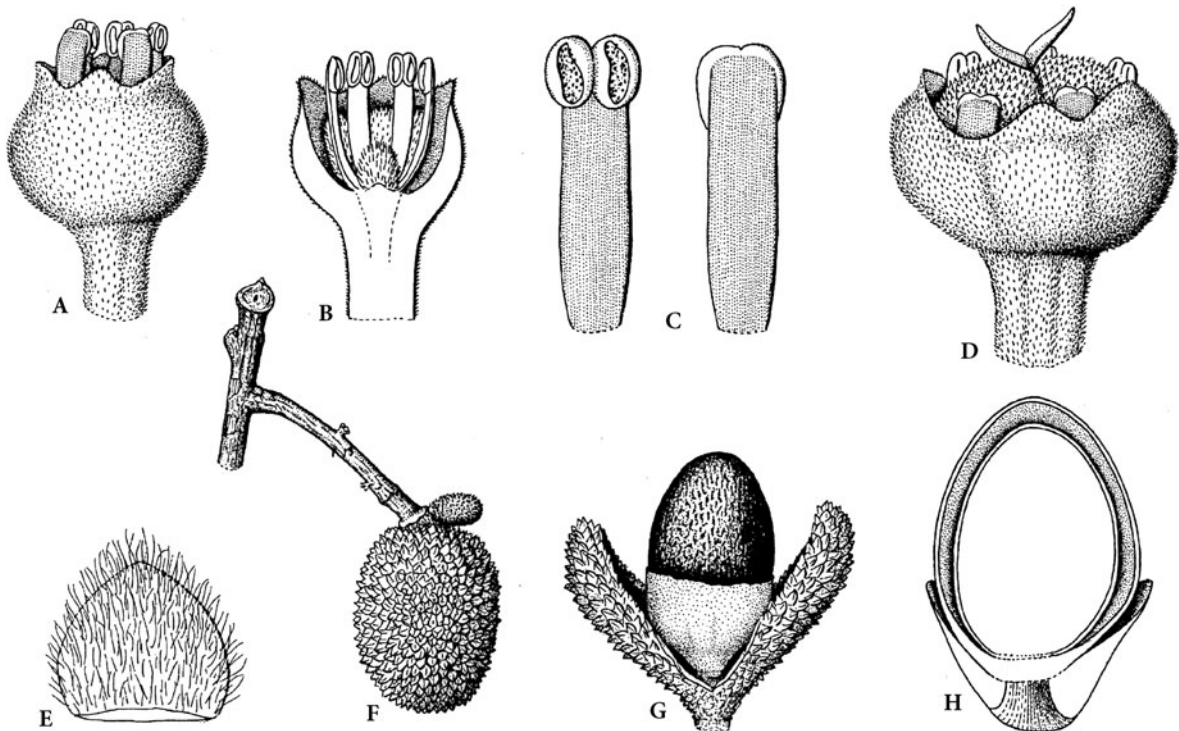


Fig. 86. Sapindaceae. *Cubilia cubili*. A Male flower. B Longitudinal section of male flower. C Anthers, ventral and dorsal views. D Female flower. E Petal. F Capsule. G

Dehiscent capsule showing seed with arillate base. H Longitudinal section of seed. (Adema et al. 1994, drawn by J. van der Os)

Flowers unisexual; calyx zygomorphic, sepals (4)5 (–7), distinct, imbricate, the outer two distinctly smaller; petals (4)5, with 1 or 2 basal appendages; disk annular-lobed; stamens (5)–8–14; pollen syncolporate or parasyncolporate, sometimes colporate, rugulate, striate-reticulate, reticulate or perforate, sometimes verrucate; ovary (2)3 (4)-carpellate, with a single ovule per carpel. Fruit a (1)2–3-locular, dehiscent, fleshy capsule. Seeds with basal arillode, covering half to nearly the entire seed, or exceptionally naked and sarcotestal.

Sixty species from eastern Malesia, Caroline Islands, northern and eastern Australia, and from Solomon Islands to Samoa including New Caledonia.

63. *Deinbollia* Schumach.

Deinbollia Schumach., Beskr. Guin. Pl.: 242 (1827).

Falsely polygamous or dioecious, shrubs or trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary; stipules 0. Inflorescences axillary or terminal thyrses. Flowers functionally unisexual; calyx zygomorphic, sepals 5, imbricate, the outer two smaller; petals 5, with a basal, deeply bilobed appendage; disk annular, cup-shaped or vase-shaped; stamens (8)–12–30; pollen colporate, perforate; ovary (2)3(5)-carpellate, with a single ovule per carpel; style gynobasic or sub-terminal, filiform. Fruits of (1)2–3(–5) indehiscent, fleshy cocci. Seeds exarillate. $2n=30$.

About 38 species from southern Africa, Madagascar, and Mascarene Islands.

64. *Delavaya* Franch.

Delavaya Franch., Bull. Soc. Bot. France 33: 462 (1886).

Falsely polygamous shrubs or trees. Leaves alternate, trifoliolate; leaflets serrate-denticulate; stipules 0. Inflorescences terminal thyrses. Flowers functionally unisexual; calyx zygomorphic, sepals 5, imbricate, the outer two smaller; petals 5, with a pair of marginal appendages; disk pulvinate, nearly shortly tubular; stamens 8; pollen colporate, striate; ovary 2–3-carpellate, with 2 ovules per carpel; style subulate. Fruits 2–3-coccate, loculicidal capsules. Seeds exarillate.

A single species, *D. yunnanensis* Franch., China.

65. *Dictyoneura* Blume

Dictyoneura Blume, Rumphia 3: 163 (1847); van Dijk, Blumea 31: 437–449 (1986).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; leaflets serrate to lobed; distal leaflet rudimentary; stipules 0. Inflorescences axillary, spicate or racemose thyrses. Flowers unisexual; sepals (5)6, imbricate, of same length in actinomorphic calyx or the inner and/or the outermost sepals smaller in zygomorphic calyx; petals 0; disk annular; stamens (4)5(6); pollen colporate, rugulate; ovary 2(3)-carpellate, with a single ovule per carpel; style short, with 2(3) stigmatic grooves. Fruit a 2(3)-locular, sub-fleshy capsule, endocarp granular. Seeds with a partial cupular, ventral or nearly complete sarcotesta.

Two or three species from eastern Borneo, the Philippines, Celebes, Moluccas, and New Guinea.

66. *Dilodendron* Radlk.

Dilodendron Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 355 (1878); Gentry & Steyermark, Ann. Missouri Bot. Gard. 74: 533–538 (1987), rev.

Falsely polygamous-dioecious trees. Leaves alternate, bipinnate or sub-tripinnately compound; distal leaflets on rachises fully developed or rudimentary; secondary rachises marginate, alternate; stipules 0. Inflorescences terminal thyrses. Flowers 5-merous, functionally staminate or pistillate; calyx slightly zygomorphic with one sepal larger than the others, aestivation imbricate; petals much shorter than sepals, with narrow, marginal appendages; disk annular and flattened; stamens 6–8(9); pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; style short with 3 stigmatic lobes. Capsule loculicidal, 2–3-locular, woody. Seeds exarillate.

Three species from tropical continental America.

67. *Dimocarpus* Lour.

Dimocarpus Lour., Fl. Coch.: 233 (1790); Leenhouts, Blumea 19: 113–131 (1971), rev.; van der Ham, Palynosciences 2: 239–254 (1993).

Falsely polygamous trees or shrubs; indumentum of simple and stellate hairs. Leaves

alternate, paripinnate, rarely unifoliolate; leaflets serrate or entire; distal leaflet rudimentary. Inflorescences terminal or less often axillary thyrses. Flowers actinomorphic, functionally unisexual; sepals 5–6, imbricate, connate at base or distinct; petals 5(6) or 0, without appendages; disk annular, 5-lobed, pubescent; stamens (6–)8(–10); pollen colporate, striate to perforate, sometimes scabrate or rugulate; ovary 2(3)-carpellate, with a single ovule per carpel; style filiform, with 2–3 stigmatic spreading lobes. Fruits of 1(2) indehiscent, or tardily dehiscent, warty, smooth or spiny mericarps. Seeds with a thin, translucent-white, fleshy arillode around the hilum. $2n = 30$.

Six species in southern and southeastern Asia from Sri Lanka and India to eastern Malesia and Australia. *Dimocarpus longan* Lour. is widely cultivated as the source of the tropical fruit Longan.

68. *Diploglottis* Hook. f.

Diploglottis Hook. f. in Benth. & Hook. f., Gen. Pl. 1: 395 (1862); Reynolds, *Austrobaileya* 1: 390 (1981); Reynolds, *Austrobaileya* 2: 328 (1987), reg. rev.; Leenhouts in *Fl. Males. I*, 11: 520 (1994), reg. rev.

Falsely polygamous trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary or pseudo-terminal thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, imbricate; petals 4–5, clawed, with a pair of appendages formed by the inflexed margin above the claw, these sometimes crested; disk annular or semi-annular, lobed; stamens 6–9; pollen parasyncolporate, rugulate or psilate; ovary 2–3-carpellate, with a single ovule per carpel; style filiform, with 3 stigmatic grooves. Fruit a 2–3-locular, loculicidal capsule, coccate, deeply lobed or ovoid. Seeds with 2-lobed arillode covering most of the seed.

Twelve species from northeastern Australia and Papua New Guinea.

69. *Elattostachys* (Blume) Radlk.

Elattostachys (Blume) Radlk., *Actes Congr. Bot. Amsterdam* 1877: 101 (1879); Adema in *Fl. Males. I*, 11: 527 (1994).

Falsely polygamous trees or shrubs. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences (supra)axillary thyrses. Flowers

actinomorphic, bisexual or functionally unisexual; sepals 5, valvate to slightly imbricate; petals 5, clawed with 2 marginal appendages; disk annular, dish- or cup-shaped; stamens 8; pollen parasyncolporate or colporate, striate to rugulate; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic lines. Fruit a 3-locular, woody, loculicidal capsule. Seeds completely arillate or only so at base.

About 20 species, from Malesia, Australia, Solomon Islands, New Hebrides, New Caledonia, Fiji, Samoa, and Tonga.

70. *Eriocoelum* Hook. f.

Eriocoelum Hook. f. in Benth. & Hook. f., Gen. Pl. 1: 400 (1862).

Monoecious or falsely polygamous trees or shrubs. Leaves alternate, paripinnate; leaflets 2–5 pairs; distal leaflet rudimentary; pseudostipules usually present. Inflorescences axillary, spicate, racemose or thyrsoid. Flowers actinomorphic, functionally unisexual; sepals 5, distinct, valvate; petals 5, with a short, pubescent ventral appendage; disk annular, cupular, 8–10-lobed-crenate; stamens 8–10; pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; style filiform, with 3 stigmatic lobes. Fruit a 3-locular, woody, loculicidal capsule, sometimes with setaceous-hispid pubescence. Seeds with an arillode at base.

About 10 species from tropical Africa.

71. *Erythrophysa* E. Meyer ex Arnold

Erythrophysa E. Meyer ex Arnold, *J. Bot. (Hooker)* 3: 258 (1841) (as *Erythrophila*, corr. Sonder in Harvey & Sonder, *Fl. Cap.* 1: 237 (1860).

Falsely polygamous shrubs or trees. Leaves alternate, imparipinnate; distal leaflet fully developed. Inflorescences axillary or terminal thyrses. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, imbricate; petals 4(5), with a pair or digitiform, simple or dissected appendages above the claw; disk semi-annular; stamens 8; pollen colporate, striate; ovary 3-carpellate, with 2 ovules per carpel; style elongated, filiform; stigma punctiform. Fruit a 1–3-locular, membranous, inflated, loculicidal capsule. Seeds globose, exarillate, sparsely pubescent, the testa delineating the contour of cotyledons.

Five species from South Africa and Madagascar.

72. *Erythrophysopsis* Verdc.

Erythrophysopsis Verdc., J. Linn. Soc. Bot. 58: 202 (1962).

Polygamous shrubs or trees. Leaves alternate, imparipinnate; distal leaflet fully developed. Inflorescences axillary or terminal thyrses. Flowers zygomorphic, functionally unisexual; sepals 5, distinct, imbricate; petals 4, with a pair or digitiform, simple or dissected appendages above the claw; disk unilateral, 4-lobed; stamens 8; pollen colporate, striate (Fig. 79A); ovary 3-carpellate, with 2 ovules per carpel; style elongated, filiform; stigma punctiform. Fruits indehiscent, 1–3-locular, woody or crustose. Seeds 1–3 per fruit, sub-globose, exarillate, woolly pubescent, the testa delineating the contour of cotyledons.

A single species, *E. aesculina* (Baill.) Verdc., Madagascar.

73. *Glenniea* Hook. f.

Glenniea Hook. f. in Benth. & Hook. f., Gen. Pl. 1: 404 (1862); Leenhouts, Blumea 21: 91–103 (1973) and 22: 411–414 (1975).

Melanodiscus Radlk. (1887) [1888].

Hedyachras Radlk. (1920).

Falsely polygamous-dioecious or monoecious trees or shrubs; indumentum of simple or stellate hairs. Leaves alternate, unifoliolate or paripinnate; leaflets entire; distal leaflet rudimentary; pseudostipules sometimes present. Inflorescences terminal, thyrsoid. Flowers actinomorphic, functionally unisexual; sepals (3)4–5, imbricate or valvate, distinct; petals 0; disk patelliform or annular-lobed; stamens 4–8; pollen colporate, striate to striate-reticulate; ovary 2(3)-carpellate, with a single ovule per carpel; stigma lobed. Fruits indehiscent, crustose or baccate. Seed exarillate.

Eight species, 3 in tropical Africa, 1 in Madagascar, 1 in Sri Lanka, and 3 in Indochina and Malesia.

74. *Gloeocarpus* Radlk.

Gloeocarpus Radlk., Philipp. J. Sci. 8, Bot.: 464 (1914); Welzen, Blumea 35: 389 (1991), rev.

Trees; indument of glandular hairs. Leaves alternate, paripinnate; leaflets serrate; distal leaflet rudimentary. Inflorescences ramiflorous thyrses. Flowers functionally unisexual; calyx

zygomorphic, sepals 5, distinct, imbricate, outer 2 smaller; petals 5, with 2 marginal appendages; disk annular; stamens 7; pollen syncolporate or parasyncolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style short, filiform; stigma not lobed. Fruit a 3-locular, woody, deeply lobed, loculicidal capsule. Seeds completely covered with a thin arillode.

A single species, *G. patentivalvis* (Radlk.) Radlk., endemic to the Philippines.

75. *Gongrodiscus* Radlk.

Gongrodiscus Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 503, 607 (1879); Turner & van der Ham, Bull. Mus. Natl. Hist. Nat. Paris IV, 18: 339–349 (1996).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary, thyrsoid. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, distinct, valvate; petals 5, with 2 marginal appendages; disk annular, 5-lobed; stamens (7) 8; pollen parasyncolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style short; stigma sub-trilobed. Fruit a 1-locular (incomplete septa), fleshy, tardily dehiscent capsule. Seeds arillate along ventral portion.

Three species endemic to New Caledonia.

76. *Gongrospermum* Radlk.

Gongrospermum Radlk., Philipp. J. Sci. 8, Bot.: 469 (1914); Welzen, Rheedeia 1: 60 (1991), rev.

Trees. Leaves alternate, paripinnate; leaflets papillate on lower surface; distal leaflet rudimentary. Inflorescences axillary, simple or thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, valvate, distinct; petals 0; disk sub-cupular, 5-lobed; stamens 8; pollen syncolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style pyramidal. Fruit a 1-locular, leathery, loculicidal capsule. Seeds exarillate, endotesta ruminately grown together with embryo.

A single species, *G. philippinense* Radlk., Philippines.

77. *Guioa* Cav.

Guioa Cav., Icon. 4: 49, t. 373 (1798); Welzen, Leiden Bot. Ser. 12: 146 (1989), rev.

Shrubs, trees, or treelets. Leaves alternate, paripinnate; leaflets entire or less often crenate or serrate; distal leaflet rudimentary; rachis terete or winged. Inflorescences axillary or terminal thyrses. Flowers functionally unisexual; calyx zygomorphic, sepals 5(6), imbricate, petaloid, outer 2 smaller; petals 5(6), usually clawed, with two marginal or ventral appendages that are usually crested; disk annular or semi-annular; stamens (7)8; pollen syncolporate or parasyncolporate, rarely colporate, rugulate to perforate or psilate; ovary 3-carpellate, with a single ovule per carpel; style apical, pyramidal, with 3 stigmatic lines. Fruit a 3-locular, obcordate, deeply 3-lobed to coccate, leathery, loculicidal capsule. Seeds almost entirely covered by an arillode that has a basal projection.

About 64 species ranging from southeastern Asia, throughout Malesia to Australia, New Caledonia, and Samoa.

78. *Haplocoelopsis* Davis

Haplocoelopsis Davis, Kew Bull. 52: 231 (1997).

Monoecious shrubs or small trees. Leaves alternate, paripinnate or imparipinnate; leaflets entire; distal leaflet rudimentary; pseudostipules present. Inflorescences axillary, racemose thyrses. Flowers actinomorphic, unisexual; sepals 5, distinct, imbricate; petals 5, with a short, bilobed ventral appendage; disk annular; stamens 8–9; pollen unknown; ovary bilobed, 2-carpellate, with a single ovule per carpel; style with 2 stigmatic lobes. Fruit a 2-locular, circular, laterally compressed, loculicidal capsule. Seeds not known.

A single species, *H. africana* Davies, from central and east Africa.

79. *Haplocoelum* Radlk.

Haplocoelum Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 336 (1878).

Falsely polygamous-dioecious trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescence a congested axillary polychasium. Flowers actinomorphic, functionally unisexual; sepals 5–6, distinct, narrowly imbricate; petals 0 or less often present; disk annular; stamens 5–6, inserted on the disk; pollen colporate, rugulate; ovary (2)3-carpellate, with a single ovule per carpel;

style with 3 stigmatic lobes. Fruit 1–2-locular, indehiscent, baccate. Seeds ellipsoid or laterally compressed, with a dorsally or distally split arillode.

About 7 species from tropical Africa and Madagascar.

80. *Hornea* Baker

Hornea Baker, Fl. Mauritius: 59 (1877).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; leaflets 2 or 4, entire; distal leaflet rudimentary. Inflorescences terminal, corymbose or thyrsoid. Flowers bisexual or functionally unisexual; calyx zygomorphic, sepals 5, orbicular, concave, distinct, imbricate, the 2 outer sepals smaller; petals 5, clawed, with 2 ventral appendages above the claw; disk 5-lobed; stamens 18–24; pollen colporate, rugulate; ovary 2-carpellate, with a single ovule per carpel; style short; stigma punctiform. Fruits of 2 mericarps with a dorsal wing. Seeds exarillate.

A single species, *H. mauritiana* Baker, endemic to Mauritius.

81. *Jagera* Blume

Jagera Blume, Rumphia 3: 155 (1847); Leenhouts in Fl. Males. I, 11: 614 (1994).

Falsely polygamous, often pachycaulous trees or shrubs. Leaves verticillate, sometimes opposite or spirally arranged, paripinnate; leaflets serrate; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, slightly connate at base, imbricate; petals 5, with marginal or ventral appendages; disk annular; stamens (7)8(–10); pollen syncolporate or parasyncolporate, perforate or reticulate with often finely tapering scabrae; ovary 3-carpellate, with a single ovule per carpel; style filiform with 3 stigmatic lines. Fruit a 3-locular, woody, loculicidal capsule, with stiff, irritating hairs. Seeds with a small sarcotesta around the hilum.

Two species in the Moluccas, New Guinea, and eastern Australia.

82. *Koelreuteria* Laxm.

Koelreuteria Laxm., Nov. Comm. Acad. Petrop. 16: 562, t. 18 (1772); Meyer, J. Arnold Arb. 57: 129–166 (1976); Adema in Fl. Males. I, 11: 755 (1994).

Duodichogamous trees. Leaves alternate, once or twice pinnate, imparipinnate; leaflets entire, serrate or crenate; terminal leaflet well-developed. Inflorescences terminal thyrses. Flowers zygomorphic; sepals 5, valvate; petals 4, yellow, clawed, with fimbriate involute base of lamina forming an appendage; disk annular, undulate, on a short stipe; stamens (5–)8; pollen colporate, striate; ovary 3-carpellate, with 2 ovules per carpel, the septa incomplete on distal portion; stigma entire or trifid. Fruit a 3-locular, papery, inflated, loculicidal capsule with incomplete septa; seeds 2 per locule, exarillate. $2n = 22, 30, 32$.

About four species native to Japan, southern China, Taiwan, and perhaps indigenous to Fiji. *Koelreuteria paniculata* Laxm. and *K. bipinnata* Franchet are cultivated worldwide in temperate areas as ornamentals.

83. *Laccodiscus* Radlk.

Laccodiscus Radlk., Sitzungsber. Math-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 496 (1879).

Falsely polygamous trees or scandent shrubs. Leaves alternate, paripinnate; distal leaflet rudimentary; pseudostipules present. Inflorescences axillary or terminal thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, connate at base, imbricate; petals 5, with short marginal appendages; disk annular-lobed or 5-lobed; stamens 8–10; pollen colporate, perforate; ovary 3-carpellate, with a single ovule per carpel; style curved; stigma papillose. Fruit a 3-locular, woody, 3-lobed, loculicidal capsule. Seeds arillate (fide Fouilloy and Hallé 1973a).

About six species native to West Africa.

84. *Lecaniodiscus* Planch. ex Benth.

Lecaniodiscus Planch. ex Benth. in Hook., Niger Fl.: 250 (1849).

Chiarinia Chiov. (1932).

Falsely polygamous-dioecious shrubs or trees. Leaves alternate, paripinnate; leaflets 3–7 pairs; distal leaflet rudimentary; stipules 0. Inflorescences axillary, racemose or thyrsoid. Flowers actinomorphic, functionally unisexual; sepals 5, imbricate, distinct; petals 0 or 5, with 2 minute basal appendages; disk annular, lobed; stamens 8; pollen colporate, striate; ovary (2)3-carpellate,

with a single ovule per carpel; style short, stigma subsessile and 3-lobed or with 2 reflexed stigmatic branches. Fruits crustose, 1-locular or bicoccate, indehiscent or tardily splitting from the base. Seeds nearly entirely covered by an arillode.

Two species native to tropical Africa.

85. *Lepiderema* Radlk.

Lepiderema Radlk., Actes Congr. Bot. Amsterdam 1877: 250 (1879); Reynolds, Austrobaileya 1: 488 (1982), reg. rev.; Schot, Blumea 36: 235 (1991), reg. rev.

Falsely polygamous shrubs or trees; indument of lepidote scales. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary, ramiflorous, or pseudo-terminal racemose thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, petaloid, distinct, imbricate; petals 5, shortly clawed, without appendages; disk annular; stamens (6–)8; pollen syncolporate, parasyncolporate or colporate, rugulate-reticulate; ovary 3-carpellate, with a single ovule per carpel; style spirally twisted; stigma lobed. Fruit a 3-locular, trigonous, stipitate, woody, loculicidal capsule. Seed basally arillate.

Eight species, 6 in Australia and 2 in New Guinea.

86. *Lepidopetalum* Blume

Lepidopetalum Blume, Rumphia 3: 171 (1847); Welzen, Piskaut & Windadri, Blumea 36: 452 (1992), rev.

Falsely polygamous trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences ramiflorous, axillary or pseudo-terminal thyrses. Flowers actinomorphic, functionally unisexual; calyx shortly cupular, sepals 5(6), distinct, valvate; petals 5(–7), shorter than the sepals, with a single basal appendage bigger than the blade; disk annular or semi-annular; stamens (7)8(–10), the filaments nearly equal, the anthers dorsifixed; pollen colporate, striate to striate-reticulate; ovary 2-carpellate, with a single ovule per carpel; stigma sessile, fleshy, of two elongate lobes adnate to the distal portion of ovary. Fruit a 2-locular, leathery or woody, glabrous, loculicidal capsule. Seed with a basal to complete, orange sarcotesta.

Six species throughout Malesia and north-eastern Australia.

87. *Lepisanthes* Blume

Lepisanthes Blume, Bijdr. Fl. Nederl. Ind. 5: 237 (1825);
Leenhouts, Blumea 17: 33–91 (1969).

Aphania Blume (1825).

Erioglossum Blume (1825).

Otophora Blume (1847).

Hebecoccus Radlk. (Radlk. (1878).

Thraulococcus Radlk. (1878).

Aphanococcus Radlk. (1887) [1888].

Manongarivea Choux. (1927).

Sapindopsis How & Ho (1955), non Fontaine (1889).

Howethoa Rauschert (1982).

Monoecious trees, shrubs, or climbing shrubs. Leaves alternate, (im)paripinnate, sometimes unifoliolate; terminal leaflet rudimentary; pseudostipules sometimes present. Inflorescences terminal, axillary, ramiflorous or cauliflorous thyrses. Flowers bisexual or functionally unisexual; calyx zygomorphic, the sepals 5, imbricate, the outer 2 distinctly smaller; petals (2–)4(5), with marginal or ventral appendages; disk semi-annular or annular, 5-lobed or crenate; stamens (4–)8 (–18); pollen colporate or brevicolporate, rarely syncolporate, rugulate to reticulate, rarely psilate; ovary 2–3(4)-carpellate, sessile or stipitate, with a single ovule per carpel; style short, apical; stigma capitate, sometimes sessile. Fruits indehiscent, 2–3-lobed, sub-fleshy, sometimes deeply lobed or coccate with distinct monocarps. Seeds ellipsoid, obovoid to sub-globose, exarillate. $2n = 26, 28, 30$.

About 24 species in tropical Africa, Madagascar, southern and southeastern Asia from Sri Lanka to Hainan, Malesia, and northwestern Australia.

Four subgenera: subgen. *Lepisanthes*: Leaves paripinnate, without pseudostipules; petiole and rachis not winged; outer sepals sericeous outside; petals longer than sepals; fruits usually only slightly lobed, septa continuous; subgen. *Otophora*: leaves pari- or imparipinnate, without pseudostipules; petiole winged or not; outer sepals glabrous or hairy outside; petals shorter than the sepals; fruits not or slightly lobed, septa often \pm interrupted; subgen. *Erioglossum*: Leaves paripinnate, without pseudostipules; petiole and rachis not winged; outer sepals glabrous outside; petals longer than the sepals; fruits lobed, septa complete; subgen. *Aphania*: Leaves paripinnate, sometimes simple, sometimes with pseudostipules (petiole and rachis winged); outer sepals glabrous; petals as long as sepals; fruits lobed, septa complete.

88. *Litchi* Sonn.

Litchi Sonn., Voy. Ind. Or. Chine 2: 230, t. 129 (1782);
Leenhouts, Blumea 24: 398 (1978).

Euphoria Commers. ex Juss. (1789).

Duodichogamous trees; indument of 2-branched hairs. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences terminal and axillary thyrses. Flowers actinomorphic bisexual or functionally unisexual; calyx cup-shaped, with 4–5 equal, minute lobes; petals 0; disk annular; stamens (6)7(–11); pollen colporate, striate; ovary 2-carpellate, with a single ovule per carpel; stigma of 2 elongated, spreading or coiled lobes. Fruit 1-coccate (1 coccus rudimentary), indehiscent, with leathery, muricate pericarp. Seeds partly or completely covered by a translucent, fleshy, convolute arillode. $2n = 28, 30$.

A single species, *L. chinensis* Sonn., from southeastern China, Indochina, Malay Peninsula, Java, Borneo, and the Philippines. Widely cultivated in subtropical regions for its edible fruits, commonly known as *Litchi*.

89. *Lychnodiscus* Radlk.

Lychnodiscus Radlk., Sitzungsber. Math-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 332 (1878).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences axillary or terminal thyrses or panicles. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, connate at base, imbricate; petals 5, with a single ventral appendage; disk annular; stamens 10–12; pollen colporate, striate; ovary 3-carpellate, with a single ovule per carpel; stigma clavate. Fruit a (1–)3-locular, 3-lobed, loculicidal capsule; seeds sarcotestal.

About seven species from tropical Africa.

90. *Macphersonia* Blume

Macphersonia Blume, Rumphia 3: 156 (1847).

Dioecious trees. Leaves alternate, bipinnate, or once pinnate; distal leaflet rudimentary. Inflorescences axillary, racemose or spicate, or rarely thyrsoid. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, distinct, imbricate; petals 5, clawed, with appendages formed by the inflexed margins above the claw; disk annular, dish-shaped; stamens 8; pollen colporate, striate; ovary (2)3-carpellate, with a single ovule per

carpel; stigma sessile, capitate or trigonous. Fruit 1–2-locular, indehiscent or tardily dehiscent, sub-fleshy. Seeds completely covered by a translucent arillode.

About eight species from Aldabra, Madagascar, and west tropical Africa.

91. *Matayba* Aublet

Fig. 79K

Matayba Aublet, Hist. Pl. Guiane 1: 331 (1775).

Falsely polygamous-dioecious, large or small trees. Leaves alternate, paripinnate or imparipinnate; leaflets entire; distal leaflet rudimentary. Inflorescences axillary or terminal thyrses. Flowers 5-merous, actinomorphic, bisexual or unisexual; sepals short (less than 2 mm long), distinct, valvate; petals as long as the sepals or longer, with a pair of marginal tomentose appendages; disk annular, usually lobed; stamens (4–6)8; pollen syncolporate or parasyncolporate, sometimes colporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; stigma trilobed or trifid. Fruit a 2- or 3-locular, trigonous or lobed, woody or leathery, loculicidal capsule. Seeds nearly globose or ellipsoid, arillate at base or seldom nearly entire.

About 50 species from tropical and subtropical America.

92. *Mischarytera* H. Turner

Mischarytera H. Turner, Blumea Suppl. 9: 210 (1995), rev.

Trees. Leaves paripinnate; distal leaflet rudimentary. Inflorescences axillary to pseudo-terminal thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, connate at base, valvate; petals 5, clawed, with appendages formed by the inflexed margins above the claw, or these 0; disk annular, unlobed or lobed; stamens 7–8; pollen parasyncolporate, sometimes colporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; stigma shortly 3-lobed. Fruit a 3-locular, loculicidal or loculifragal capsule. Seeds arillate.

Three species in eastern Australia and Papua New Guinea.

93. *Mischocarpus* Blume, nom. cons.

Mischocarpus Blume, Bijdr. 1825: 238 (1825); van der Ham, Blumea 23: 251 (1977).

Pedicellia Loureiro (1790), nom. rej.

Mischocodon Radlk. (1913).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences pseudo-terminal, axillary or ramiflorous thyrsoids. Flowers actinomorphic, bisexual or functionally unisexual; sepals imbricate, distinct or connate into a crateriform calyx, crowned by 5 subequal lobes; petals 0, reduced or slightly longer than the sepals, with marginal appendages; disk annular or semi-annular; stamens (5–)8(9); pollen syncolporate or parasyncolporate, sometimes colporate, rugulate to rugulate-reticulate; ovary (2)3(4)-carpellate, with a single ovule per carpel; stigma 3-lobed. Fruit a (1)2-locular, coriaceous, loculicidal capsule. Seeds completely covered by an arillode with a basal, funiculus-like appendage.

About 15 species from southeastern Asia, throughout Malesia to Australia.

94. *Molinaea* Commers. ex Juss.

Molinaea Commers. ex Juss., Gen. Pl.: 248 (1789).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; leaflets entire or serrate, distal leaflet rudimentary. Inflorescences axillary, simple or paniculate thyrses. Flowers bisexual or functionally unisexual; calyx zygomorphic, sepals 5, distinct, imbricate, the outer two smaller; petals 5, with marginal appendages or without appendages; disk annular or semi-annular; stamens 8; pollen parasyncolporate, rarely syncolporate or colporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style short; stigma 3-gonous, grooved. Fruit a 3-locular, loculicidal capsule. Seeds arillate.

About ten species from Madagascar, Mauritius, and Mascarene Islands.

95. *Namataea* D.W. Thomas & D.J. Harris

Namataea D.W. Thomas & D.J. Harris, Kew Bull. 54: 951 (1999).

Seemingly dioecious shrub. Leaves alternate, simple; stipules 0. Inflorescences cauliflorous, ramiflorous or less often axillary, racemes. Flowers unisexual; calyx zygomorphic, urceolate, the sepals 5, connate at lower quarter or third, slightly imbricate, third and fifth sepals slightly longer than remaining sepals; petals 4, a basal hood-shaped, crested appendage (the crest infundibuliform); disk reniform; stamens 7; pollen not

known; ovary 3-carpellate, with a single ovule per carpel; style stout. Fruit fleshy, indehiscent, of 3 ellipsoid, cocci, each with an apical beak.

A single species, *N. simplicifolia* D.W. Thomas & D.J. Harris, Cameroon.

96. *Neotina* Capuron

Neotina Capuron, Mem. Mus. Natl. Hist. Nat. B, Bot., II, 19: 174 (1969).

Monoecious or dioecious trees. Leaves alternate or subopposite, paripinnate; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers unisexual; calyx zygomorphic, the sepals 5, imbricate, outer two sepals smaller; petals 4–5, with 2 marginal or ventral appendages; disk annular; stamens 5(6–8); pollen parasyncolporate or colporate, rugulate to rugulate-reticulate; ovary 2-carpellate, with a single ovule per carpel; style elongated, with 2 stigmatic lines. Fruit a 1-locular, sub-fleshy, loculicidal capsule. Seeds with red or orange arillode for 2/3 of their length.

Two species from Madagascar.

97. *Nephelium* L.

Nephelium L., Syst. Nat. ed. 12, 2: 623 (1767); L., Mantissa Pl.: 18 (1767); Leenhouts, Blumea 31: 373–436 (1986).

Falsely polygamous or dioecious trees or less often shrubs. Leaves alternate, paripinnate; leaflets distinctly glaucous beneath; distal leaflet rudimentary. Inflorescences axillary, pseudo-terminal or terminal (in *N. cuspidatum* Blume also rami- and cauliflorous) thyrses. Flowers actinomorphic; calyx cup-shaped, crowned by 4–6 subequal, valvate lobes; petals 0 or 4–6, clawed, with a bilobed appendage; disk annular; stamens 4–10; pollen colporate, striate; ovary (1)2 (–4)-carpellate, with a single ovule per carpel; style elongated; stigma usually 2-lobed. Fruits 1(2)-coccate, tardily loculicidally dehiscent, the pericarp warty to spiny, coriaceous or less often woody or corky. Seeds completely covered by edible sarcotesta. $2n=22$.

About 16 species from southeastern Asia in Yunnan and Assam to Hainan and Malesia. *Nephelium lappaceum* L. (the Rambutan) and *N. ramboutan-ake* (Labill.) Leenh. (the Pulasan) are widely cultivated for their edible fruits.

98. *Otonephelium* Radlk.

Otonephelium Radlk, Sitzungsber. Math-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 253, 288 (1890).

Falsely polygamous trees. Leaves alternate, paripinnate; distal leaflet rudimentary; pseudostipules present. Inflorescences terminal or axillary thyrses. Flowers actinomorphic bisexual or functionally unisexual; sepals 5, imbricate, distinct; petals 0; disk annular, glabrous; stamens 5–9; pollen colporate, striate, sometimes irregularly striate or rugulate; ovary 2-carpellate, with a single ovule per carpel; stigma bifid. Fruit 1-coccate, with rudimentary cocci at base, indehiscent, baccate-crustose, with soft spines. Seeds arillate.

A single species, *O. stipulaceum* Radlk., western India. Doubtfully different from *Dimocarpus* by its glabrous disk and the presence of pseudostipules.

99. *Pancovia* Willd., nom. cons.

Pancovia Willd., Sp. Pl. 2: 285 (1799); non Fabricius (1759), nom. rej.

Falsely polygamous or dioecious, trees or shrubs. Leaves alternate, paripinnate; leaflets 2–12 pairs; distal leaflet rudimentary. Inflorescences axillary or cauliflorous, fasciculate, racemose or thyrsoid. Flowers zygomorphic, functionally unisexual; sepals 4–5, imbricate or sub-valvate; petals 3–4, clawed, with 2 inflexed or dissected appendages above the claw; disk semi-annular, unilateral; stamens (6–)8; pollen colporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style subulate; stigma sub-clavate. Fruit indehiscent, 3-locular, with fleshy to woody pericarp. Seeds exarillate, laterally compressed. $2n=32$.

Ten to 12 species native to west tropical and subtropical Africa.

100. *Pappea* Eckl. & Zeyh.

Pappea Eckl. & Zeyh., Enum. Pl. Afr. austr. extratrop. 1: 53 (1834–1835).

Dioecious trees or shrubs. Leaves alternate, simple. Inflorescences axillary, racemose or thyrsoid. Flowers actinomorphic, functionally unisexual; sepals 5, valvate; petals (4)5(6), with a pair of marginal, hairy appendages; disk

annular; stamens 8(–10); pollen colpore, striate; ovary 3-carpellate, with a single ovule per carpel; style short; stigma sub-lobed. Fruit a 1-locular, fleshy, loculicidal capsule. Seeds with a lobed arillode.

One to four species native to southern Africa. The fruit of *P. capensis* (Spreng.) Eckl. & Zeyh. is said to be edible, a bland oil is expressed from the seeds (Harvey and Sonder 1894).

101. *Paranephelium* Miq.

Paranephelium Miq., Fl. Ind. Bat. Suppl. 509 (1861) [1860]; Davids, Blumea 29: 425 (1984), rev. *Mildea* Miquel (1867), non Griseb. (1866). *Scyphopetalum* Hiern (1875).

Falsely polygamous trees. Leaves alternate, mainly imparipinnate; distal leaflets rudimentary or well-developed. Inflorescences ramiflorous or terminal thyrses. Flowers actinomorphic; calyx shortly cupular, the sepals (4)5(–7), mainly equal, distinct or connate at base, valvate; petals (4)5(–7), often clawed, with a single appendage; disk annular, 5-lobed, cup-shaped; stamens 5–9; pollen syncolporate or parasyncolporate, rugulate; ovary mainly 3-carpellate; with a single ovule per carpel; stigma usually lobed. Fruits 1 (–3)-locular, globular, smooth to densely spiny, woody, loculicidal capsules or dehiscent randomly. Seeds exarillate, with an enlarged white, round hilum.

Four species in southeast Asia from Yunnan, Myanmar, and Indochina to Sumatra, Borneo, and the Philippines.

102. *Pavieasia* Pierre

Pavieasia Pierre, Fl. Forest. Cochinch.: t. 317 (1894).

Falsely polygamous trees or shrubs. Leaves alternate, paripinnate; distal leaflet rudimentary. Inflorescences terminal thyrses. Flowers actinomorphic, bisexual or functionally unisexual; calyx shortly cupular, sepals 5, connate at base, imbricate; petals 5, with a single basal appendage; disk annular; stamens 8; pollen syncolporate, striate; ovary 3-carpellate, pilose, with a single ovule per carpel; style filiform; stigma obscurely 3-lobed at apex. Fruit a 3-locular, loculicidal capsule. Seeds exarillate.

One to three species endemic to China.

103. *Pentascyphus* Radlk.

Pentascyphus Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 472, 495, 539 (1879).

Falsely polygamous trees or shrubs. Leaves alternate, paripinnate; leaflets alternate, entire; distal leaflet rudimentary; stipules 0. Inflorescences terminal or axillary thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5, distinct, imbricate; petals 5, obovate to cuneate, with a single short, basal appendage connate to petals' margins; disk annular, 7–8-lobed; stamens 8; pollen syncolporate or parasyncolporate, rugulate; ovary 3-carpellate, hirsute, with a single ovule per carpel. Fruit unknown.

A single species, *P. thyrsiflorus* Radlk., in French Guiana, Surinam, and Brazil (Amazonas).

104. *Phyllotrichum* Thorel ex Lecomte

Phyllotrichum Thorel ex Lecomte, Notul. Syst. (Paris) 2: 8 (1911).

Falsely polygamous trees. Leaves alternate, paripinnate, with 5–6 pairs of leaflets; distal leaflets rudimentary. Inflorescences ramiflorous, racemose thyrses. Flowers zygomorphic; sepals 5, distinct, imbricate; petals 4, with a single basal appendage; disk unilateral, semi-annular; stamens 8(9); pollen syncolporate or parasyncolporate, striate; ovary 3-carpellate, densely pubescent, with a single ovule per carpel; style nearly trigonous; stigma nearly 3-lobed. Fruit a 3-locular, loculicidal, muricate capsule. Seeds ovoid, exarillate.

A single species, *P. mekongense* Thorel ex Lecomte, endemic to Laos.

105. *Placodiscus* Radlk.

Placodiscus Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 332 (1878).

Falsely polygamous trees or shrubs. Leaves alternate, paripinnate, with 2–9 pairs of leaflets; distal leaflets rudimentary; pseudostipules sometimes present. Inflorescences cauliflorous, spicate thyrses. Flowers actinomorphic; calyx urceolate or turbinate, crowned by 5 valvate or narrowly imbricate sepals; petals 0; disk annular, dish-shaped; stamens 8; pollen colpore, striate; ovary 3-carpellate, tomentose, with a single ovule per carpel; style short; stigma minute.

Fruits baccate, 1–3-locular, 3-sulcate or 3-lobate, indehiscent. Seeds exarillate.

About ten species native to tropical Africa.

106. *Plagioscyphus* Radlk.

Plagioscyphus Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 335 (1878).

Cotylodiscus Radlk. *ibid.* 8: 334 (1878).

Strophiodiscus Choux (1926).

Poculodiscus Danguy & Choux (1927).

Falsely polygamous shrubs. Leaves alternate, paripinnate; leaflets 1–5 pairs, serrate; distal leaflets rudimentary. Inflorescences axillary, racemose thyrses. Flowers actinomorphic; sepals 5, distinct or connate at base, imbricate; petals 4–5, the appendages 2 and marginal or single and basal; disk annular, vase-shaped, or unilateral, semi-annular or semi-vase-shaped; stamens (7)8; pollen colpi orate or brevicolpate, perforate to reticulate; ovary 2–3-carpellate, tomentose, with a single ovule per carpel; stigma apiculate. Fruits baccate, 1–3-locular, indehiscent. Seeds arillate, with a longitudinal ventral hilum.

About ten species native to Madagascar.

107. *Podonephelium* Baill.

Podonephelium Baill., *Adansonia* 11: 245 (1874).

Falsely polygamous-dioecious shrubs. Leaves alternate, paripinnate, with 3–6 pairs of leaflets; distal leaflets rudimentary. Inflorescences axillary thyrses. Flowers actinomorphic; calyx crateriform, with 4–7, valvate lobes; petals 0; disk cup-shaped, 8-crenate; stamens (5–)8; pollen colpi orate, striate; ovary 3-carpellate, tomentose, with a single ovule per carpel; stigma 3-lobed. Fruit a 1(2)-coccate, crustose, circumscissile dehiscent capsule. Seeds with white arillode mostly along dorsal portion.

Four species native to New Caledonia.

108. *Pometia* Forst. & Forst.

Pometia Forst. & Forst., *Char. Gen. Pl.*: 55, t. 55 (1775); Jacobs, *Reinwardtia* 6: 109–144 (1962).

Falsely polygamous trees, producing red exudates. Leaves alternate, paripinnate; leaflets entire or serrate, often with large orbicular glands beneath; distal leaflet rudimentary; pseudostipules present. Inflorescences terminal or axillary

thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, connate at base to half of their length, valvate; petals 5 without appendages; disk annular or semi-annular; stamens 5(6); pollen brevicolpate, reticulate (Fig. 79L); ovary 2(3)-carpellate, with a single ovule per carpel; style filiform; stigma obtuse, emarginate. Fruits 1(2)-locular, indehiscent, with fleshy mesocarp. Seeds fully covered by an arillode.

Two species found in Sri Lanka, Andaman and Nicobar Islands, Indochina, Taiwan, Malaysia, Fiji, Samoa, and Tonga. The wood of *P. pinnata* Forst. is used as firewood in the Pacific Islands.

109. *Porocystis* Radlk.

Porocystis Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 353 (1878).

Falsely polygamous trees. Leaves alternate, paripinnate or imparipinnate; leaflets entire; distal leaflet rudimentary or exceptionally fully developed. Inflorescences terminal or axillary thyrses. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, distinct, imbricate; petals 4, clawed, with a bifid appendage above the claw; disk unilateral, semi-annular to 4-lobed; stamens 8; pollen colpi orate, rugulate-reticulate; ovary 3-carpellate, with a single ovule per carpel; style short, with 2 recurved, stigmatic branches. Fruit a 3-locular schizocarp, splitting into 3 membranous, inflated, wrinkled mericarps. Seeds exarillate.

Three species, 2 from Brazil (Amazonas) and 1 from French Guiana.

110. *Pseudima* Radlk.

Pseudima Radlk., *Nouv. Giornale Bot. Ital.* 10: 108 (1878).

Falsely polygamous-dioecious, small to large trees. Leaves alternate, pinnately compound; distal leaflet rudimentary; stipules 0. Inflorescences axillary or terminal thyrses. Flowers bisexual or unisexual; calyx zygomorphic, sepals 5, imbricate, concave, the outer 2 sepals shorter; petals 5, longer than the sepals, lacking appendages; disk annular, 5-lobed; stamens 8 or 10, shorter than the petals; pollen colpi orate, perforate; ovary 2(3)-carpellate, with a single ovule per carpel; style filiform; stigma obtuse. Fruit a 2(3)-coccate, loculicidal, leathery capsule, the

cocci equally developed or one of them rudimentary. Seeds large, arillate.

One species from the lowlands of tropical continental America.

111. *Pseudopancovia* Pellegr.

Pseudopancovia Pellegr., Bull. Soc. Bot. France 102: 228 (1955).

Falsely polygamous-dioecious, shrubs. Leaves alternate, paripinnate; distal leaflet rudimentary; stipules 0. Inflorescences axillary, spicate thyrses. Flowers zygomorphic, bisexual or unisexual; calyx 2-lipped, 4–5-lobed; petals 3–4, clawed, with a basal appendage forming a pocket; disk unilateral; stamens 7; pollen colporate, rugulate; ovary 3-carpellate, with a single ovule per carpel. Fruit unknown.

A single species, *P. heterophylla* Pellegr., endemic to west equatorial Africa.

112. *Pseudopteris* Baill.

Pseudopteris Baill., Adansonia 11: 243 (1874).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets opposite or alternate, entire or crenate-serrate; distal leaflet rudimentary; stipules 0. Inflorescences of axillary racemose thyrses. Flowers actinomorphic, bisexual or unisexual; sepals 5, distinct, imbricate; petals 5, smaller than the sepals, cucullate, without appendages; disk 5-lobed; stamens 5; pollen colporate, striate; ovary 2–3-carpellate, with a single ovule per carpel. Fruit baccate, 1–3-locular, indehiscent. Seeds sub-globose, completely covered by an arillode.

Three species endemic to Madagascar.

113. *Radlkofera* Gilg

Radlkofera Gilg, Bot. Jahrb. Syst. 24: 300 (1897).

Falsely polygamous unbranched trees. Leaves alternate, paripinnate, with 13–20 pairs of leaflets; distal leaflet rudimentary; stipules 0. Inflorescences axillary, racemose thyrses, with elongated bracteoles. Flowers zygomorphic, bisexual or unisexual; calyx urceolate, sepals 5, connate at base, imbricate; petals 4, with a ventral appendage; disk unilateral; stamens 7–8; pollen colporate, indistinctly rugulate; ovary 5–7(8)-carpellate,

tomentose, with a single ovule per carpel; style elongated. Fruit indehiscent, 5–8-locular, fusiform, with fleshy mesocarp. Seeds exarillate, orange.

A single species, *R. calodendron* Gilg, western Africa.

114. *Rhysotoechia* Radlk.

Rhysotoechia Radlk., Actes Congr. Bot. Amsterdam 1877: 131 (1879); Etman, Blumea 39: 41 (1994).

Falsely polygamous trees or shrubs. Leaves alternate, paripinnate. Flowers seemingly bisexual; calyx zygomorphic, the sepals 5, distinct, imbricate, 2 outer sepals smaller; petals 5, clawed, with marginal appendages or these 0; disk annular; stamens (7)8; pollen syncolporate or parasyncolporate, rugulate to perforate, sometimes psilate; ovary (2)3-carpellate, with a single ovule per carpel; style with 3 stigmatic lines. Fruit a (2)3-locular, sub-globose, obovoid, or subcordate, loculicidal capsule. Seeds with a cup-shaped arillode at base.

About 14 species from Australia, Borneo, Philippines, Sulawesi, Moluccas, and New Guinea.

115. *Sapindus* Plum. ex L.

Sapindus Plum. ex L., Sp. Pl.: 367 (1753); Radlkofer in Pflanzenreich 98: 630 (1932); Leenhouts in Fl. Males. I, 11: 713 (1994).

Duodichogamous trees. Leaves alternate, paripinnate or unifoliolate; leaflets 2–8 pairs, often falcate; distal leaflet rudimentary. Inflorescences terminal, thyrses. Flowers actinomorphic or partly zygomorphic, functionally pistillate or staminate; sepals 5, distinct, imbricate, the outer 2 smaller; petals 4 or 5, with a single large appendage, a transverse ridge, or a pair reduced marginal appendages; disk annular or cup-shaped; stamens 8; pollen colporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style short, stigma capitate or with 3 conivent stigmatic branches. Fruit schizocarpic, 1(2)-coccate, with 2(1) rudimentary cocci, separating into indehiscent globose mericarps, with fleshy pericarp containing much saponin. Seeds globose, exarillate. $n = 11, 15, 18$.

About ten species with tropical to subtropical distribution. Several species used as ornamentals.

116. *Sarcopteryx* Radlk.

Sarcopteryx Radlk. Actes Congr. Bot. Amsterdam 1877: 127 (1879); Reynolds, *Austrobaileya* 2: 53 (1984), reg. rev.; Welzen, *Blumea* 36: 91 (1991), reg. rev.

Falsely polygamous shrubs or trees. Indumentum of simple hairs and red glandular hairs. Leaves alternate, paripinnate; leaflets 1–5 pairs, entire; distal leaflet rudimentary. Inflorescences axillary or terminal, simple or thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, connate at base, valvate; petals 5, clawed, with 2 dissected or crenate appendages above the claw, these sometimes crested; disk annular; stamens 8; pollen syncolporate or parasyncolporate, rugulate to rugulate-reticulate; ovary 3-carpellate, with a single ovule per carpel; style filiform. Fruit a 3-locular, loculicidal, leathery-woody, capsule, each locule with a narrow, dorsal wing. Seeds completely covered by dorsally opened arillode with a basal funiculus-like appendage, the testa papery.

Twelve to 13 species, from eastern Australia, Moluccas, and New Guinea.

117. *Sarcotoechia* Radlk.

Sarcotoechia Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 501 (1879); Leenhouts, *Blumea* 33: 198 (1988).

Falsely polygamous trees. Leaves alternate, paripinnate or unifoliolate; leaflets serrate or entire; distal leaflets rudimentary. Inflorescences axillary, or ramiflorous thyrses. Flowers actinomorphic; sepals 5, distinct, slightly imbricate; petals 5, shorter than the sepals, with a pair of seemingly marginal appendages; stamens (5–)7(8); pollen parasyncolporate, rugulate; ovary 2–3-carpellate, with a single ovule per carpel; style apical; stigma slightly lobed. Fruit a 2–3-locular, 2–3-lobed, fleshy, loculicidal capsule. Seeds with a cupular or reduced sarcotesta.

About 11 species from Australia (northern Queensland), Papua New Guinea, and Moluccas.

118. *Schleichera* Willd., nom. cons.

Schleichera Willd., Sp. Pl. 4, 2: 1096 (1806); Leenhouts in *Fl. Males. I*, 11: 727 (1994).

Falsely polygamous trees, with glandular indument. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary. Inflorescences

axillary, racemose or thyrsoid. Flowers actinomorphic, functionally unisexual; sepals 4–6, equal, valvate, connate at base; petals 0; disk annular, dish-shaped; stamens 5–9; pollen parasyncolporate, striate; ovary 2–4-carpellate, with a single ovule per carpel; stigma lobed. Fruits 1-locular, indehiscent, coriaceous, usually with a spiny pericarp. Seed completely covered by an arillode. $2n=30, 32$.

A single species, *S. oleosa* (Lour.) Oken, distributed from Sri Lanka and India to Indochina, Malesia east to the Moluccas and Lesser Sunda Islands. The seeds are the source of macassar oil widely used as hair ointment; the wood is used as construction material.

119. *Scyphonychium* Radlk.

Scyphonychium Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 473, 495, 519 (1879); Ferrucci, *Bonplandia* 6: 117–124 (1989).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary. Inflorescences terminal thyrsoids. Flowers functionally unisexual; calyx zygomorphic, sepals 5, distinct, imbricate, the outer 2 smaller; petals 5, clawed, twice as long as the sepals, with a bilobed minute appendage forming a pocket above the claw; disk annular, cup-shaped, 5-lobed; stamens 8; pollen colporate, perforate; ovary 2-carpellate, with a single ovule per carpel; stigma shortly bifid. Fruit, (1)2-coccate, woody, schizocarpic. Seeds exarillate.

A single species, *S. multiflorum* Radlk., native to northern and eastern Brazil, and French Guiana.

120. *Sinoradlkofera* F. Meyer

Sinoradlkofera F. Meyer, *J. Arnold Arb.* 58: 183 (1977). *Boniodendron* Gagnep., nom. inval.; Leenhouts, *Blumea* 28: 45 (1982).

Falsely polygamous trees. Leaves paripinnate; leaflets serrate; distal leaflet rudimentary. Inflorescences terminal thyrses. Flowers sub-actinomorphic; sepals 5, valvate; petals 5, white, clawed, appendages marginal or 0; disk annular; stamens 8, geniculate in bud; pollen colporate, striate; ovary 3-carpellate, with 2 ovules per carpel; style subulate. Fruits 3-locular, inflated, loculicidal capsules. Seeds exarillate.

A single species, *S. minor* (Hemsley) F. Meyer, native to China.

121. *Sisyrolepis* Radlk.

Sisyrolepis Radlk. in F. N. Williams, Bull. Herb. Boiss. II, 5: 222 (1905); Leenhouts, Blumea 23: 336 (1977); Welzen in Santisuk & Larsen, Fl. Thailand 7: 243 (1999).
Delpya Pierre ex Radlk. (1910).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; leaflets crenate; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers zygomorphic; sepals 5, distinct, imbricate; petals 4(5), with a pair of marginal appendages; disk semi-annular, lobulate; stamens 8(9); pollen syncolporate, finely striate; ovary 3-carpellate, with a single ovule per carpel; stigma not lobed. Fruit a 3-locular, echinate, loculicidal capsule. Seeds exarillate.

A single species, *S. muricata* (Pierre) Leenh., Thailand and Cambodia.

122. *Smelophyllum* Radlk.

Smelophyllum Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 330 (1878).

Falsely polygamous shrubs. Leaves alternate, paripinnate; leaflets 3–4 pairs; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers actinomorphic; calyx cupular, sepals 5, connate, imbricate; petals 5, without appendages; disk annular, 5-lobed; stamens 8; pollen colporate, striate; ovary (2)3-carpellate, with a single ovule per carpel; style thickened. Fruit a (1)2(3)-coccate, chartaceous capsule. Seeds exarillate.

A single species endemic to South Africa.

123. *Stadmania* Lam.

Stadmania Lam., Tabl. Encycl. 2: 443 (1793); reg. rev.; Capuron, Mem. Mus. Natl. Hist. Nat. B, Bot. II, 19: 151–160 (1969).
Pseudolitchi Dand. & Choux (1926).

Dioecious or monoecious trees. Leaves alternate, paripinnate; leaflets (1)3–5 pairs, serrate; distal leaflet rudimentary. Inflorescences terminal or axillary, racemose thyrses. Flowers actinomorphic, functionally unisexual; calyx cupular, sepals 5, valvate; petals 5, sometimes clawed, 0 in one species; appendages simple, crested or

dissected, basal or above the claw; disk annular to 5-crenate; stamens (6–)8; pollen colporate, striate or perforate, sometimes irregularly striate or rugulate; ovary 3-carpellate, with a single ovule per carpel; style short. Fruit a 1(3)-coccate, indehiscent. Seeds covered with a translucent arillode.

Six species from Mauritius, Madagascar, and eastern tropical Africa.

124. *Stocksia* Benth.

Stocksia Benth., Hooker's J. Bot. Kew Gard. Misc. 5: 304 (1853).

Polygamous spiny shrubs. Leaves simple, fasciculate on short branches axillary to the spines; stipules 0. Inflorescences axillary, racemose thyrses. Flowers zygomorphic, functionally unisexual; sepals 5, imbricate, distinct, the outer smaller; petals 5, clawed, without appendages; disk annular-lobed; stamens 7–8; pollen colporate, striate; ovary 3-carpellate, with 2 ovules per carpel; style distal; stigma minute. Fruit a 3-locular, membranous, inflated, loculicidal capsule. Seeds exarillate.

A single species, *S. brahuica* Benth., from Persia and Afghanistan.

125. *Storthocalyx* Radlk.

Storthocalyx Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 499, 660 (1879).

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate, with 2–10 leaflets; distal leaflet rudimentary; stipules 0. Inflorescences axillary, spicate or thyrsoid. Flowers actinomorphic, functionally unisexual; sepals 5, distinct, narrowly imbricate or valvate; petals 5, without appendages; disk annular; stamens 8; pollen syncolporate, perforate; ovary 3-carpellate, with a single ovule per carpel; style subulate; stigma minute. Fruit a 3-locular, trigonous or pyriform, corticose-woody loculicidal capsule. Seeds with a ventrally split, fimbriate arillode.

Four species from New Caledonia.

126. *Synima* Radlk.

Synima Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. Münch. 9: 501 (1879); Leenhouts & Adema in Fl. Males. I, 11: 730 (1994).

Monoecious trees. Leaves alternate, paripinnate; leaflets crenate-denticulate, without domatia or glands; distal leaflet rudimentary. Inflorescences axillary, together sometimes pseudo-terminal. Flowers actinomorphic; calyx shortly cupular, sepals 5, short, distinct, narrowly imbricate; petals 5, rhomboidal, with a pair of recurved, woolly or ciliate appendages, usually distinctly crested; disk annular; stamens 8; pollen parasyncolporate, rugulate-reticulate; ovary 3-carpellate, with a single ovule per carpel; style apical; stigma slightly lobed. Fruit a 3-locular, trigonous, loculicidal capsule. Seeds with basal or dorsal sarcotesta.

Two species; Australia (N Queensland) and southeast New Guinea. Lowland and montane rain forest, mossy oak forest, up to 900 m.

127. *Thouinidium* Radlk.

Thouinidium Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 284 (1878).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets 2–8 pairs, serrate or entire; distal leaflet rudimentary; stipules 0. Inflorescences terminal thyrses. Flowers functionally unisexual; calyx actinomorphic or slightly zygomorphic, sepals 5, distinct, imbricate; petals (4)5, clawed, with an appendage above the claw forming a pocket; disk cup-shaped; stamens 6–8(–10); pollen colporate, perforate; ovary 3-carpellate, with a single ovule per carpel; style short, subulate. Fruit schizocarpic, splitting into 3, distally winged, samaroid mericarps. Seeds exarillate.

Six species from Mexico, Central America, and some islands in the Greater Antilles.

128. *Tina* Schult., nom. cons. prop.

Tina Schult. in Roem. & Schult., Syst. Veg. 5: XXXII, 414 (1819–1820) ('1819').

Gelonium Gaertn., Fruct. Sem. Pl. 2: 271, fig. 139 n. 8 (1791), nom. rej. prop.

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate, with 2–6 pairs of leaflets; leaflets serrate or crenate-serrate; distal leaflet rudimentary; stipules 0. Inflorescences axillary thyrses. Flowers functionally unisexual; calyx actinomorphic or zygomorphic, sepals (3–)5, distinct, imbricate, in two series; petals 5, with 2 marginal appendages; disk annular; stamens (6–)8; pollen syncolporate or parasyncolporate,

rugulate; ovary 2(3)-carpellate, with a single ovule per carpel; style subulate; stigma a invaginate prolongation of the style. Fruit a 2-locular, loculicidal capsule. Seeds arillate.

Six species from Madagascar.

129. *Tinopsis* Radlk.

Tinopsis Radlk. in T. Durand, Index Gen. Phan.: 78 (1887) [1888].

Bemarivea Choux (1927).

Falsely polygamous-dioecious trees. Leaves alternate, paripinnate, with 2–4 pairs of leaflets; distal leaflet rudimentary; stipules 0. Inflorescences axillary or terminal thyrses. Flowers actinomorphic, functionally unisexual; calyx slightly zygomorphic, the sepals 5, imbricate, distinct; petals 5, with a single appendage forming a pocket or with 2 marginal appendages; disk annular, slightly sulcate; stamens 5(7); pollen colporate, rugulate to rugulate-reticulate; ovary 2-carpellate, with a single ovule per carpel. Fruit a 2-locular, indehiscent or less often tardily and incompletely dehiscent capsule, usually 1-seeded. Seed arillate.

Eleven species from Madagascar.

130. *Toechima* Radlk.

Toechima Radlk., Actes Congr. Bot. Amsterdam 1877: 130 (1879); Reynolds, Austrobaileya 2: 176 (1985); Leenhouts, Blumea 33: 203 (1988); Leenhouts in Fl. Males. I, 11: 732 (1994).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets entire to serrate. Inflorescences axillary thyrses. Flowers actinomorphic; sepals 5, equal, valvate to narrowly imbricate; petals 5, clawed, with a single crested appendage; disk annular; stamens 8; pollen parasyncolporate, rugulate to rugulate-reticulate; ovary 2–3-carpellate, with a single ovule per carpel; stigma lobed. Fruit a 2–3-locular, fleshy, loculicidal capsule. Seed with a basal placentar arillode.

About eight species distributed in Australia and New Guinea.

131. *Toulicia* Aublet

Toulicia Aubl., Hist. Pl. Guiane 1: 359 (1775).

Falsely polygamous-dioecious, small, unbranched trees. Leaves imparipinnate; leaflets usually falcate, opposite or alternate; distal leaflet rudimentary.

Inflorescences terminal or axillary thyrses. Flowers zygomorphic, staminate or pistillate; sepals 5, unequal, imbricate; petals 4, with a petaloid, bifid ventral appendage or with 2 marginal appendages; disk unilateral, semi-annular; stamens 8; pollen colporate, perforate; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic branches. Fruits schizocarpic, splitting into three, samaroid mericarps, each with a proximal wing and a papery, inflated locule. Seeds exarillate.

About 12 species from the lowlands of South America.

132. *Trigonachras* Radlk.

Trigonachras Radlk., Actes Congr. Bot. Amsterdam 1877: 116 (1879); Leenhouts, Blumea 33: 204 (1988).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets entire, often with glands below; distal leaflet rudimentary. Inflorescences axillary or terminal thyrses or panicles. Flowers actinomorphic, bisexual or unisexual; sepals 5, distinct, narrowly imbricate (sub)equal; petals 5, clawed, with (1)2 appendages above the claw; disk annular; stamens (7)8(9); pollen syncolporate or parasyncolporate, perforate to scabrate with often finely tapering scabrae; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic lines. Fruit a 3-locular, fleshy, loculicidal capsule. Seeds exarillate.

About eight species, occurring throughout Malesia, but absent from Java and the Lesser Sunda Islands.

133. *Tripterodendron* Radlk.

Tripterodendron Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 290 (1891).

Falsely polygamous-dioecious trees. Leaves alternate, tripinnate; leaflets denticulate or serrate; distal leaflet rudimentary; stipules 0. Inflorescences axillary thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 5–6, valvate; petals clawed, 5(6–8), with a pair of appendages above the claw; disk annular; stamens 8; pollen colporate, striate; ovary 2-carpellate, with a single ovule per carpel; style short, with a marginal stigmatic line. Fruit a 2-locular, fleshy, loculicidal capsule. Seeds arillate.

A single species endemic to east-central Brazil.

134. *Tristira* Radlk.

Tristira Radlk., Actes Congr. Bot. Amsterdam 1877: 133 (1879); Leenhouts in Fl. Males. I, 11: 740 (1994).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets opposite or alternate, entire or dentate; distal leaflets rudimentary. Inflorescences terminal or axillary thyrses. Flowers bisexual or functionally unisexual; calyx zygomorphic, sepals 5, distinct, imbricate, the outer two smaller; petals 0; disk annular, lobed; stamens 8(9); pollen parasyncolporate, rugulate; ovary 3-carpellate, with a single ovule per carpel; style subulate, with 3 stigmatic lines. Fruits 3-locular, indehiscent drupes, with slightly fleshy exocarp and stony endocarp, each locule with a dorsal wing. Seeds exarillate.

A single species, *T. triptera* (Blanco) Radlk., eastern Philippines, Celebes, and Moluccas.

135. *Tristiropsis* Radlk.

Tristiropsis Radlk. in T. Durand, Index Gen. Phan.: 76 (1887)[1888]; Leenhouts in Fl. Males. I, 11: 742 (1994), rev. *Palaoea* Kanehira (1935).

Falsely polygamous trees. Leaves alternate, bipinnate; leaflets entire; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers bisexual or functionally unisexual; calyx zygomorphic, sepals 5, imbricate, the outer 2 smaller; petals 0 or 5, the appendages either forming a pocket, or a folded marginal outgrowth; disk annular; stamens 8(–13); pollen parasyncolporate, rugulate; ovary 3(–5)-carpellate, with a single ovule per carpel; stigma not lobed, grooved. Fruit a (2)3-locular, indehiscent drupe, with slightly fleshy exocarp and stony endocarp; seeds exarillate.

Three species from Borneo, the Philippines and throughout eastern Malesia to northeastern Australia, the Solomons, Marianas, and Christmas Islands in the Pacific.

136. *Tsingya* Capuron

Tsingya Capuron, Mem. Mus. Natl. Hist. Nat., B, Bot. II, 19: 104 (1969).

Monoecious trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary; stipules 0. Inflorescences axillary racemose thyrses. Flowers actinomorphic, functionally unisexual; sepals 5, valvate; petals 0; disk annular, pulvinate; stamens

8–10; pollen colpi striate; ovary 3-carpellate, with a single ovule per carpel; style with 3 stigmatic lines. Fruit (immature) unilocular by abortion. Seed one per locule, arillate, with long ventral hilum.

A single species, *T. bemarana* Capuron, endemic to Madagascar.

137. *Ungnadia* Endl.

Ungnadia Endl., *Atakta Bot.* t. 36 (1835) [1833].

Falsely polygamous shrubs or trees. Leaves alternate, paripinnate; leaflets serrate; distal leaflet fully developed; stipules 0. Inflorescences axillary or ramiflorous, pseudo-umbelliform. Flowers zygomorphic, bisexual or functionally unisexual; sepals 5, imbricate, 3 distinct, 2 connate; petals 4–5, clawed, with a tuft of filiform appendages above the claw; disk unilateral, undulate, with androgynophore; stamens (7)8(–10); pollen colpi striate, finely striate; ovary 3-carpellate, stipitate, with 2 ovules per carpel; style filiform with punctiform stigma. Fruit a 3-locular, 1–2-seeded, loculicidal, coriaceous capsule. Seeds exarillate, with large white hilum. $2n=32$.

A single species, *U. speciosa* Endl., Mexico and southern United States (Texas).

138. *Vouarana* Aubl.

Fig. 78

Vouarana Aubl., *Pl. Guiane* 2: (Suppl.) 12, fig. 374 (1775).

Falsely polygamous medium-sized trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary. Inflorescences axillary or terminal thyrses. Flowers 4–5-merous, actinomorphic or zygomorphic, bisexual or unisexual; sepals distinct, unequal, concave, imbricate; petals rhombic, shorter than the sepals, with two marginal appendages; disk annular and lobed; stamens 6–8; pollen parasyncolporate, rugulate; ovary 2-carpellate, with a single, basal ovule per carpel; stigma subulate and papillose. Fruit a 1–2-seeded, woody, loculicidal capsule. Seeds ellipsoid with a large basal arillode.

Two species from Costa Rica to northern Brazil.

139. *Xerospermum* Blume

Xerospermum Blume, *Rumphia* 3: 99 (1847); Leenhouts, *Blumea* 28: 389 (1983), rev.

Falsely polygamous or dioecious trees. Leaves alternate, paripinnate; leaflets entire, abaxially with flat, orbicular glands toward proximal portion of blade; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers actinomorphic, bisexual or functionally unisexual; sepals 4–5, \pm equal, imbricate; petals 4–5, sessile to clawed, without appendages; disk annular or semi-annular; stamens 7–9; pollen colpi striate to psilate, sometimes irregularly striate or rugulate; ovary 2 (3)-carpellate, with a single ovule per carpel; stigma lobed. Fruit indehiscent, 1–2-coccate, coriaceous to woody, granular to shortly spiny. Seed with complete, thin, sarcotesta. $2n = 32$.

Two species from Bangladesh, Indochina and western Malesia. *X. noronhianum* Blume is dioecious.

140. *Zollingeria* Kurz, nom. cons.

Zollingeria Kurz, *J. Asiat. Soc. Bengal*, 41, 2: 303 (1872), non Schultz.-Bip. (1854), nom. rej.; Adema, *Blumea* 37: 73 (1992); Welzen in *Fl. Thailand* 7: 248 (1999).

Falsely polygamous trees. Leaves alternate, paripinnate; leaflets entire; distal leaflet rudimentary. Inflorescences axillary thyrses. Flowers actinomorphic or zygomorphic; sepals 5, distinct, slightly to distinctly unequal, usually imbricate; petals 4–5, with or without appendages; disk annular or semi-annular; stamens 8; pollen colpi striate, irregularly striate; ovary 3-carpellate, unilocular, with a single ovule per carpel; stigma 3-lobed, or 3 stigmatic lines. Fruit 1-locular, 3-winged, coriaceous, indehiscent. Seed exarillate, flattened, elongated.

Three or four species from Myanmar, Laos, Thailand, and Borneo.

Insufficiently Known Genus:

141. *Chonopetalum* Radlk.

Chonopetalum Radlk., *Bot. Jahrb. Syst.* 56: 258 (1920).

Falsely polygamous trees. Leaves alternate, paripinnate; distal leaflet rudimentary; stipules 0. Inflorescences axillary thyrses. Flowers actinomorphic, functionally staminate or pistillate; calyx cup-shaped, sepals 5, distinct, imbricate; petals 5, with a single basal appendage as long as the petal; disk annular; stamens 8; pollen

unknown; ovary 3-carpellate (as inferred from the pistillodes; pistillate flower not known). Fruit not known.

One species, *Ch. stenodictyum* Radlk., known only from the type collection from Equatorial Guinea, Africa.

Doubtful Genus:

Hirania Thulin

Hirania Thulin, Nord. J. Bot. 24(5): 510 (2007).

Dioecious ? shrubs. Leaves simple, alternate on long shoots, or congested in short, lateral shoots; stipules 0. Inflorescences terminal thyrses. Flowers zygomorphic; sepals 5, partially imbricate; petals 4, clawed, without appendages, pink; disk unilateral, of two erect segments; stamens 8.

A single species recently described from Somalia based on a specimen bearing only pistillate flowers.

We have not seen any material of this putative Sapindaceous genus, and since the original description portrays the floral disk as intrastaminal, we wonder if it really belongs in Sapindaceae or not. Additional material would be necessary to place this genus in the right family.

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