**OPILIACEAE** (P. Hiepko, Berlin)

Small evergreen trees, shrubs or lianas; two genera (*Cansjera* and *Opilia*) are known to be root-parasites. *Leaves* distichous, simple, usually extremely variable in form and size, entire, exstipulate, pinnately veined; dried leaves mostly finely tubercled by cystoliths located in the mesophyll. *Inflorescences* axillary or cauliflorous, panicle-like, racemose, umbellate (in Africa) or spicate; bracts narrowly ovate or scale-like, in *Opilia* peltate, often early caducous. *Flowers* small, (3—)4—5 (—6)-merous, mainly bisexual, sometimes unisexual and plants then dioecious (*Gjellerupia*, *Melientha*, and *Agonandra*) or gynodioecious (*Champereia*). Perianth with valvate, free or sometimes partly united tepals (in ♀ flowers of *Gjellerupia* wanting). *Stamens* as many as and opposite to the tepals (in ♀ flowers only small staminodes); anthers introrse, 2-celled, longitudinally dehiscent. *Disk* intrastaminal, lobed (lobes alternating with the stamens), annular, or cupular. *Ovary* superior, 1-celled; style short or none, stigma entire or shallowly lobed. Ovule 1, pendulous from the apex of a central placenta, anatropous, unitegmic and tenuinucellar. *Fruit* drupaceous, pericarp rather thin, mesocarp ± fleshy-juicy, endocarp woody or crustaceous. *Seed* large, conform to the drupe, without testa; hilum basal, often in a funnel-shaped cavity. *Embryo* terete, embedded in rich, oily endosperm, nearly as long as the seed or shorter, with 3—4 linear cotyledons, radicle often very short.

**Distribution.** There are 9 genera with about 30 spp., widespread in the tropics. *Rhopalopilia* is restricted to Africa and Madagascar, *Agonandra* to South and Central America. In Malesia: 7 genera, 5 of these only known from the eastern Old World (1 endemic: *Gjellerupia* in New Guinea); *Opilia* and *Urobotrya* occur also in tropical Africa.

**Ecology.** Some species of *Opiliaceae* occur as undergrowth in evergreen forest, primary and secondary, *e.g.* *Lepionurus sylvestris* is in Java an indicator of everwet climate [cf. *VAN STEENIS in Back. & Bakh.*. *f. Fl. Java* 2, 1965, (70)]. Other species tolerate or prefer a more seasonal climate and are constituents of deciduous forest. *Cansjera* and *Opilia* often occur in beach forest.

As to the altitude the species of *Opiliaceae* are usually found at low and medium altitude below 1000 m, only some species ascend with several collections up to 1600 or even 2000 m (*Lepionurus* in Sumatra).

Some species are mainly growing on sandy soil, others are more often found on limestone.

**Habit.** Most species are small trees of about 3—8 m, sometimes gregariously growing (*Urobotrya* spp.) or tiny shrubs (*Lepionurus* often less than 1 m high); only *Champereia* and *Melientha* can attain sizes of more than 10 m. The lianas (*Cansjera* and *Opilia*) are climbing up to 30 m, but they are often recorded as erect shrubs, too. The stem of a young *Cansjera rheedii* is growing in an inclined position and the branches are spreading ([cf. *HIEPKO & WEBER*, Willdenowia 8, 1978, 354, f. 1); if there is no tree for climbing up it becomes an erect shrub.

**Pollination.** The flowers of all species of this family possess nectar-secreting disks; some flowers are fragrant. They are evidently entomophilous. The inflorescences of *Champereia manillana* are often visited by ants.

**Dispersal.** The fruits of *Opiliaceae* are drupaceous and vary in size from less than 1 cm long (*Champereia*) to 4 cm (*Melientha*). *Champereia* it is reported that the fruits are eaten by birds.

**Galls.** Galled fruits (or flowers?), in form and size like peas, have been observed in some specimens of *Opilia amentacea* (in N. Borneo, Philippines, and New Guinea).

**Parasitism.** Root-parasitism has been proved to occur in *Cansjera leptostachya*, *C. rheedii* and *Opilia amentacea* (see under these species). According to *HIEPKO & WEBER* (l.c.), *Cansjera rheedii*
forms 4 morphologically different types of haustoria. The largest type of haustoria is formed in the root hair zone and may grow up to 1 cm or more in diameter. Selfparasitism is common in this species, and it was shown that it is also mycotrophic (cf. Weber, Naturwissenschaften 64, 1977, 640 f.).

Morphology. The panicle-like inflorescences of Champereia and Melientha are irregularly branched (fig. 2, 5), the flowers are pedicelled or sessile. In the racemose inflorescences of some genera the pedicelled flowers are arranged in ternate groups (in the axil of each bract) along the rachis, showing that these inflorescences are not genuine racemes but more complex types of inflorescences. Occurrence of bracteoles in some species of Urobotrya stresses this opinion.

The perianth of Opiliaceae was often described as composed of a ‘minute and inconspicuous’ calyx and ± free petals. Other authors use these terms only for the description of Opilia, whereas the flowers of the other genera are called monochlamydeous (e.g. Back. & Bakh. f. Fl. Java 2, 1965, 66). Since the flowers of Opilia show solely a slightly cupuliform torus which hardly can be called calyx, I use the terms perianth and tepals for the entire family.

Anatomy. Wood. Most Opiliaceae are wood anatomically rather homogeneous. The light coloured wood shows often faint to distinct growth rings. The vessels are predominantly solitary, but up to 40–80% in radial multiples and tangential groups in Lepionurus and Urobotrya latissquama. The shrubby specics show small vessels, the lianas have vessel diameters up to 200 μm. Fibres are often thick-walled, with minutely bordered pits in Gjellerupia and Lepionurus, and bordered pits up to 4–6 μm in the other genera. The rays are 2–6-seriate mingled with few uniseriates; ray cells are weakly procumbent and square/upright, except in Agonandra, Opilia, Champereia, and Melientha, where the rays are composed of clearly procumbent cells. With the exception of Agonandra, all genera show cystoliths of calcium carbonate in enlarged ray cells. The presence or absence of stalks and the size and shape of the cystoliths seem to have diagnostic value. Parenchyma strands are apotracheal, diffuse or diffuse-inaggregate.

Leaves. Cystoliths occur in all representatives, commonly in pairs of clusters in enlarged mesophyll cells or ray cells of the vascular tissue. Size, shape and refractive properties seem to be taxonomically relevant. Within the family, uniseriate and branched hairs (the last mentioned in species of Opilia, Rhopalopilia and Cansjera) are found. They may cover leaf surfaces, or may be restricted to midrib and veins, or are lacking. Stomata are paracytic with two to several subsidiary cells. Some variation in differentiation of the mesophyll is found: either a homogeneous tissue of cubic cells, or two layers of palisade parenchyma and spongy parenchyma, with or without a hypodermis.

Both wood and leaf characters point to a very close relationship between Champereia and Melientha. Of the other Malayan taxa, Gjellerupia, Lepionurus, and Urobotrya are very similar. Opilia and Cansjera, as well as the African Rhopalopilia and the neotropical Agonandra, seem to have a slightly isolated position.


Embryology. Detailed embryological investigations on members of this family are very rare. Only in Cansjera rheedii (Swamy, 1960) and Opilia amentacea (Shaman, 1955; Swamy & Rao, 1963) the male and female gametophyte have been studied. In the tetrasporangiate anther a glandular tapetum with 2–4-nucleate cells is developed. The pollen grains are 2-celled when shed.

The anatropous ovule is unitegmic and has a much reduced nucellus. The nucellar tissue and the integument collapse in later stages of ovular development (therefore the ovules often have been described as ategmic). The chalazal megaspore of the linear tetrad develops into a Polygonum type embryo sac. A chalazal caecum grows down into the solid part of the gynoeicum and so the embryo sac becomes U-shaped at maturity. The endosperm is cellular. Its chalazal chamber grows towards the base of the ovary forming a 1-nucleate haustorium which in Opilia amentacea
reaches the pedicle of the flower. In *Cansjera rheedii* the haustorium is branched and secondary haustoria are developed. The embryogeny has not yet been studied.


**Palynology.** The first detailed palynological survey of *Opiliaceae* (together with the other families of Olacales) was given by Reed (1955). The results of my own studies during the last years have not yet been published.

The pollen grains of *Opiliaceae* (in Mal.) are always simple, spherical or suboblate (*Gjellerupia, Lepionurus*), and mostly distinctly tricolporate. The ectoaperture is a furrow bordered by a smooth margin (*Urobotrya* and *Opilia*). In *Lepionurus* the ectoapertures are very short and distinct. If the pollen is reticulate, the meshes are interrupted by the colpi (*Champerea, Gjellerupia, Melientha, and Urobotrya*) or closed by a murus (*Lepionurus*).

The apertural membrane is granulate only on the endoaperture in *Cansjera, Champerea, and Gjellerupia*, but on the whole surface of the furrow in *Opilia* and *Urobotrya*.

The exine consists of tectum, infratectal layer and foot-layer. The tectum varies in thickness and may be smooth, perforate, echinulate (*Agonandra*) or reticulate, sometimes with crested muri (*Champerea, Lepionurus, and Melientha*), while in some genera the meshes are not closed (e.g. *Gjellerupia*). The infratectal layer is columellate, except in *Cansjera* in which it is granular. The foot-layer is often sculptured on the inner side of the apertural margin. Endexine is generally present.

The pollen of *Opiliaceae* is similar to the pollen of Olaceae (Lobreau-Callem, 1980) where we also find many suboblate grains. It also resembles pollen of Icacinaceae. The pollen grains of *Cansjera* are similar to those of certain genera of Santalaceae (Scleropyrum, Pyrularia, etc.) and to those of Octoknemaceae. These families have an endosculptate foot-layer and an ornamented apertural membrane (except many Icacinaceae).


**Chromosomes.** Chromosome numbers of 3 spp. have been recorded, two of these species occur in Malesia: *Lepionurus sylvestris* (n = 10) and *Opilia amentacea* (= *O. celtidifolia*, 2n = 20, African material counted). The neotropical *Agonandra racemosa* has the same chromosome number (n = 10).


**Phytochemistry.** Hegnauer (1969) stressed the paucity of phytochemical information on *Opiliaceae*. The most interesting feature then known was the presence of acetylenic fatty acids in the lipids of roots, stem and leaves of *Cansjera leptostachya* BTH. This connects *Opiliaceae* biochemically with *Olaceae* and Santalaceae. In the meantime phytochemical screenings of some medicinally used African *Opiliaceous* plants demonstrated the presence of saponins in two Madagascan species of Rhopalopilia (Debray c.s., 1971), in *Rhopalopilia pallens* Pierre (Boquet, 1970) and in *Opilia celtidifolia* (Guill. & Perr.) Endl. (Haerdi, 1964, *l.c.* sub 'Uses'; Boquet & Debray, 1974; Shihata c.s., 1977). Alkaloid-like substances were also detected in the Madagascan *Rhopalopilia pallens*, *in Rhopalopilia pallens* and in *Opilia celtidifolia*, but confirmation of the presence of true alkaloids by isolation and characterization is still lacking. Saponins of the bark of *Opilia celtidifolia* have triterpenic sapogenins, *i.e.* oleanolic acid and hederagenin, according to Shihata c.s. (1977). This is in line with the saponins of African Olaceae which have recently been shown to have mainly oleanolic acid and hederagenin as sapogenins.


Taxonomy. Before VALETON (1886) established the Opiliaceae as a distinct family the genera of this group have been placed by different authors in several other families. BENTHAM &Hooker (1862) e.g. treated the tribe Opilieae (Lepionurus, Cansjera, Opilia, and Agonandra) as a part of their Olacineae, whereas Champereia was a member of their Santalaceae (B. & H., 1883). In the treatment of BAILLON (1892) the Opilieae (including Opilia, Lepionurus, Champereia, Melientha, Agonandra, and Cansjera) made part of the family Loranthaceae, which included also the Olacaceae, Santalaceae and several other groups today mostly considered to form distinct families. ENGler (1889) treated Champereia also as a genus of Santalaceae; the other genera of our Opilieae were placed in two different tribes of the family Olaceae, namely the Opilieae (Opilia, Cansjera, and Lepionurus) and Agonandreae (Agonandra).

In 1897 ENGler accepted the family Opilieae as established by VALETON (l.c.) and transferred Champereia according to the treatment of VALETON from Santalaceae to the tribe Opilieae of this family. In the classification of SLEUMER (1935) the same two tribes are set down: Opilieae and Agonandreae. The second tribe is composed of the genera Gjellerupia and Agonandra. Since Gjellerupia is, with respect to morphological, anatomical, and palynological characters, obviously more closely allied to Urobohrya and Lepionurus it has also to be included in the Opilieae.

Most present-day authors consider Opilieae in our circumscription as a distinct family placed along with Olaceae and Santalaceae in the order Santalales (or Olacales). THORNE (1981) very recently included this family in the rank of a subfamily in his Olaceae.

Uses. Young leaves and inflorescences (incl. young fruits) of Champereia manillana and Melientha suavis are frequently used as a vegetable. The fruits (juicy mesocarp) of some species are also eaten locally and occasionally: Cansjera leptostachya (Northern Australia), Champereia manillana (in many parts of the range), Melientha suavis (in Thailand), and Opilia spp. (in Northern Australia and different parts of Africa).

Some species are used in local folk medicine (pounded or as a decoction): Champereia manillana (leaves and roots applied for ulcers, rheumatism, headache, and stomachache); Lepionurus sylvestris (roots or whole plant applied for fever or headache); Opilia amentacea (roots and/or leaves are in Africa applied for fever, headache, or intestinal parasites; in W. Africa the plant is said to have a purgative, diuretic, and abortive action); Urobohrya siamensis (in Thailand used for a medicine against intestinal parasites, in large amount a deadly poison).

The wood of Melientha suavis is often used for charcoal in Thailand.


Uses. Young leaves and inflorescences (incl. young fruits) of Champereia manillana and Melientha suavis are frequently used as a vegetable. The fruits (juicy mesocarp) of some species are also eaten locally and occasionally: Cansjera leptostachya (Northern Australia), Champereia manillana (in many parts of the range), Melientha suavis (in Thailand), and Opilia spp. (in Northern Australia and different parts of Africa).

Some species are used in local folk medicine (pounded or as a decoction): Champereia manillana (leaves and roots applied for ulcers, rheumatism, headache, and stomachache); Lepionurus sylvestris (roots or whole plant applied for fever or headache); Opilia amentacea (roots and/or leaves are in Africa applied for fever, headache, or intestinal parasites; in W. Africa the plant is said to have a purgative, diuretic, and abortive action); Urobohrya siamensis (in Thailand used for a medicine against intestinal parasites, in large amount a deadly poison).

The wood of Melientha suavis is often used for charcoal in Thailand.


**KEY TO THE GENERA**

1. Inflorescence a panicle or panicle-like, in axils of leaves, often also on older branches and on the main trunk.
2. Shrub or small tree, polygamous (gynodioecious). Flowers distinctly pedicelled. Drupe ellipsoid, 8–16 mm long. .................................................. 1. Champereia
2. Small tree. Flowers unisexual, sessile, the female flowers often with a very short pedicel, elongated in fruiting state. Drupe ellipsoid, 2.3–4 cm long .................................. 2. Melientha
Opiliaceae

1. Inflorescence a raceme or spike, in axis of leaves, rarely on older branches or on the trunk.
2. Flowers in racemes, mostly 3 per bract. Bracts broadly ovate to ovate or cordate, caducous before anthesis. Tepal free or united at the base only (rarely female flowers without perianth).
3. Shrub or small tree. Rachis of raceme glabrous or puberulous, pedicels glabrous. Bracts basally attached, not peltate. Drupe usually less than 1.5 cm long.
4. Flowers bisexual. Raceme at least 2.5 cm, mostly longer. Drupe ellipsoid.
5. Tepal free, recurved. Stamens exceeding the perianth. Disk annular. Drupe 8–16 mm

3. Urobotrya

6. Tepal united at base, tube cupular, lobes spreading. Stamens not exceeding the perianth. Disk cupular with irregularly lobed margin. Drupe 9–16 mm long, resting on the thickened disk

4. Lepionurus

5. Plant dioecious. Raceme 1–2 cm long. Female flowers without perianth, male flowers with free tepals. Drupe ± orbicular

5. Gjellerupia

4. Liana, sometimes an erect shrub. Rachis of raceme and pedicels densely covered with brownish hairs. Bracts peltate. Drupe ellipsoid, 1.5–3 cm long

6. Opilia

3. Flowers in spikes, each flower in the axil of a small (c. 1 mm long) persistent bract. Tepal united, tube urceolate, lobes shorter than the tube

5. Cansjera

1. CHAMPEREIA


Shrubs or small trees; branchlets glabrous. Leaves coriaceous-fleshy. Plants polygamous with ♀ or ♂ flowers in panicles. Panicles axillary, often also on older branches or on the main trunk. Inflorescences with ♀ flowers widely branched; ♂ inflorescences more dense with stout branches, rachises sometimes finely puberulous. Flowers 5- (sometimes 4- or 6-) merous, with pedicels, solitary or fascicled along the branches of the inflorescence; bracts minute, fugacious. — ♀ Flowers: tepals reflexed; filaments filiform; ovary small, conical, half immersed in the fleshy, annular disk; stigma sessile. — ♂ Flowers: tepals adjacent to the ovary; stamens rudimentary; disk lobed. Drupe shortly pedicelled, ellipsoid; pericarp thin, 0.8–1.2 mm thick, mesocarp fleshy, endocarp woody. Embryo nearly as long as the seed, radicle small, with 3 long cotyledons.

Distr. One variable species: Andamans, Burma, Thailand, Vietnam, Taiwan, and Malesia. Fig. 3. Ecol. Open evergreen forest and dry monsoon forest, from lowland up to c. 1600 m, mostly below 900 m.

Fig. 1. Champereia manillana (BL.) Merr. a–b. ♂ Flower, c. ♂ flower, d. ♂ flower, two tepals removed (a–b Geesink & Hiepko 7823, c–d Hiepko 364). After Hiepko, 1979.

Small tree, mostly 4–8 m, sometimes up to 20 m, or shrub; stem 5–12 (–35) cm; bark smooth, pale. Slash wood white to cream. Leaves glabrous, ovate, oblong, or lanceolate, (4.5–) 6–18 (–25) by (1.5–) 2–8 (–11) cm; apex slightly acuminate or acute; base shortly attenuate to attenuate, rarely rounded; mid-
rib above prominulous; nerves 5–7 (–8) pairs; midrib and nerves prominent beneath; petiole 3–5 (–8) mm. Panicles solitary or in groups of 2–4; main rachis up to 20 cm long; bracts ovate, acute, 0.5–1 mm long. — Q Flowers: pedicels 2–5 mm, thickened upwards; tepals yellowish green, 1–1.5 mm, oblanceolate, acute; stamens as long as the tepals, anthers yellow, oval, 0.3 mm long; disk green, annual, crenulate; ovary green, 0.5 mm long. — 9 Flowers green; pedicels c. 0.5 mm long; tepals c. 0.5 mm, acute; staminodes minute, 0.2 mm long, scaly; disklobes smaller than staminodes; ovary cylindric to ovoid, c. 0.5 mm long; stigma sessile, cushion-shaped. Drupe orange-red, (8–) 10–12 (–15) by 7–9 mm; pedicels c. 1.5–2 (–4) mm.

Distr. Andamans and SE. Asia to Taiwan, throughout Malesia to NW. New Guinea. Fig. 3.

Ecol. In open evergreen forest, primary and secondary, and in dry monsoon forest. Mostly at low and medium altitudes, from sea level up to 700 m, sometimes to 900 m (Malay Peninsula) or even 1600 m (N. Borneo). Fl. fr. Jan.–Dec., only in the northern part of the area of distribution (e.g. Luzon) more concentrated: fl. Dec.–April, fr. Jan.–May.

Inflorescences are frequently visited by ants. Fruits eaten by birds.

Uses. Young leaves and young fruits are eaten as vegetables; according to BURKILL (Dict. 1935, 520) and many labels; BURKILL (l.c.) and many collectors recorded the fruits to be eaten in Thailand, Malaya, the Kangean Is., Flores, N. Borneo, and the Philippines (Luzon, Palawan). Leaves and roots are pounded to make a poultice for ulcers, and the boiled root is used for rheumatism in Malaya (BURKILL, l.c.). Mindanao: leaves pounded and applied for headache and stomachache (fide FRAKE in sched.).

Vern. Malay Peninsula: belkan (sakai), chemperei, chimpri, chipreh, poko kuching-kuching, shar- ing some of these names with Lepionurus sylvestris; Sumatra (Simalur): tutup-mateh; Flores: sasang, suli; Philippines (MERR. En. Philip. 2, 1923, 116): garimo, liongliong, luinguing, malakabuan, malalukban, malardyp, marispáris, Tag., ichikamanok, Tagb., panalayápin, Ilk., panalayápon, Sbl., sulamanok, Sub., talaminuk, Iv.; the main name in Luzon: malalukban; Palawan: duro-manok, laniti; Mindanao: gelenjup, getipun; Celebes: borongbenisi, kajuwatu; Talaud Is.: amaloma, aramalu; Amb. bina: sayor garing.

Notes. The species is extremely variable in vegetative characters, especially in form and size of leaves. The greatest variation is found in N. Borneo and the Philippines. Specimens from Luzon (and Taiwan) often have relatively small leaves; the largest
leaves are found in Samar and N. Borneo. But leaves of similar extreme sizes occur in other localities, too, and the number of main side-nerves is rather constant. Therefore it is impossible to accept the species described and named by Merrill.

The flowers are rather uniform. The ovary of the ♂ flowers obviously develops rarely into a fruit. The variation of the size of the fruits is considerable, but the extreme forms are irregularly scattered over the whole area of distribution, e.g. relatively large fruits occur at the western (Andamans) and at the northeastern border (Samar) of this area.

2. MELIENTHA


Small trees; branchlets glabrous. Leaves glabrous, coriaceous-fleshy, in dry state hard and brittle. Plants dioecious. Flowers in panicle-like branched inflorescences; rachises minutely papillate to puberulous. Inflorescences mostly on the main trunk but also on branches and even in the axils of the uppermost leaves. Flowers 4- or 5-merous. — ♂ Flowers sessile, solitary or in groups of 3–5 (mainly at the end of the rachises) in the axil of a minute bract. Tepals reflexed. Filaments very short, attached to the base of the tepals; anthers relatively
large. Disk lobes fleshy, as large as the rudimentary ovary. — *F* *lowers* solitary per bract, sometimes in groups of 3–4, with very short pedicels. Tepals adjacent to the ovary; the small staminodes alternating with broad disk lobes. *Drupe* pedicelled, ellipsoid to slightly ovoid or obovoid; pericarp thin, 1.5–2 mm thick, mesocarp fleshy-juicy, endocarp woody. *Embryo* nearly as long as the seed, with small radicle (2 mm) and 3–4 long, narrow cotyledons.

**Distr.** Monotypic, SE. Asia (Indochina, Thailand) and West Malesia: Malaya, Borneo, and the Philippines. Fig. 6.

**Ecol.** Primary, mostly deciduous forest, from the lowland up to 1500 m.

1. *Melientha suavis* PIERRE, Bull. Soc. Linn. Paris 1 (1888) 763; Fl. Coch. fasc. 17 (1892) t. 264B; GAGNEP. Fl. Gênéral 1. C. 1 (1911) 802, f. 89; *ibid.* Suppl. 1 (1948) 731; HIEPKO, Willdenowia 9 (1979) 23. — *M. acuminata* MERR. Philip. J. Sc. 29 (1926) 477. — **Fig. 4, 5a.**

Small tree up to 13 m. *Leaves* lanceolate, elliptic to ovate (or rarely obovate), (4–) 6–12 (–16) by 2.5–5 (–7) cm; apex obtuse- or reute-mucronulate, sometimes acute to acuminate; base cuneate-attenuate; nerves 5–6 (–8) pairs; hardly prominulous on both sides; petiole 1–5 mm. *Inflorescences* often in groups on swellings at the trunk or solitary on branches and in axils of leaves; main rachis up to 15 cm, in fruiting state up to 20 cm; bracts ovate, acute, c. 0.5 mm long. *Flowers:* see under the subspecies. *Drupe* yellow, 2.3–4 by 1.5–2 cm; pedicels 3–7 mm.
**KEY TO THE SUBSPECIES**

1. Drupe ellipsoid or slightly ovoid, 2.3–3 cm long
   a. *ssp. suavis*
   b. *ssp. macrocarpa*

*a. ssp. suavis.*

Small tree up to 11 m; bark grey, smooth or fissured; wood white. *Leaves:* see under the species; petiole 1–2 mm. Main rachis of the infructescence up to 5 mm. — *♂ Flowers:* tepals greenish, c. 1.5 mm, oblong, acute; anthers yellow, almost sessile, oval, 1–1.5 mm long. Disk lobes and rudiment of ovary thick, irregularly angular, c. 0.5 mm long. — *♀ Flowers* green; pedicels less than 0.5 mm; tepals c. 1 mm, acute; staminodes shorter than 0.5 mm; disk lobes as long as the staminodes, but much broader. Ovary globose, c. 1 mm, stigma sessile. *Drupe* ellipsoid or ± ovoid, 2.3–3 by 1.5–1.7 cm; in herb. usually yellowish brown; pedicels 3–5 mm.

Distr. Thailand, Laos, Vietnam, Cambodia; in Malesia: Malay Peninsula and Philippines (Mindanao). Fig. 6.

**Uses.** Young shoots and inflorescences are eaten after boiling as a vegetable (notes of many collectors). Fruits edible.


Note. *Melientha suavis ssp. suavis* varies considerably in leaf characters. The apex of the leaves is often obtuse-micronulate but more or less acuminate leaves are to be found at several points of the range of the subspecies.


Small tree up to 13 m, girth of the stem up to 45 cm; bark smooth, grey; wood white. *Leaves* lanceolate, elliptic or slightly obovate, 8–15 by 2.3–4.5 cm; apex shortly acuminate; base cuneate-attenuate; petiole 2–5 mm long. *Flowers* not seen (according to KEP 80403 the inflorescences are attached to the stem and the flowers are 'apetalous, 4 green sepals, 4 stamens'). Main rachis of the infructescence up to 7 mm. *Drupe* ellipsoid to ± ovoid, 3.5–4 by 2 cm, in herb. dark brown; pedicels 7 mm long.

Distr. *Malesia:* N. Borneo (Mt Kinabalu: Kota Belud). Fig. 6.

Ecol. In primary forest up to 1500 m, on black rocky soil. Fr. July and Aug.

Vern. *Tangal.*

Note. The fruits of this subspecies differ considerably in form and size, the structure of the pericarp and of the seed corresponds to that of *M. suavis ssp. suavis.*

---

Fig. 5. *Melientha suavis* PIERRE ssp. *suavis.* a. Infructescences. — *Champereia manillana* (BL.) MERR. b. Infructescence developed from an inflorescence with *♀ flowers* (a MAXWELL 75-452, b HARDIAL & SAMSURI 226). After HIEPKO, 1979.

---

3. **UROBOTRYA**


![Diagram of Urobotrya parviflora](image)

Fig. 7. *Urobotrya parviflora* HIEPKO. a. Flower-bud, b. bract (with 3 buds), c. flower, one stamen cut off, d. LS of pistil and disk, e. flower, tepals and stamens removed, f. pistil with disk, after flowering, g. fruit, h. LS of seed (a, c, e NEDI 738, holotype, b SAN 35987, d KOSTERMANS 21116, f KOSTERMANS 21069, g AMDJAH 370, h WOOD 1273). After HIEPKO, 1979.
Section Lepionuroides


Shrubs or small trees, twigs glabrous or puberulous. Leaves glabrous or midrib hairy, thinly-coriaceous. Flowers bisexual, in racemes, usually three pedicelled flowers per bract; rachis of inflorescence slender, glabrous or puberulous. Bracts broad, green, with hyaline ciliate margin, densely imbricate, caducous before anthesis, only some basal (smaller) bracts persistent. Flowers 3- or 4 (-5) -merous. Tepals free, oblong, acute. Stamens exceeding the perianth. Disk annular, fleshy. Ovary conical to cylindrical; stigma sessile. Drupe ellipsoid, mesocarp thinly-fleshy; embryo with 3 long cotyledons.

Distr. The range of this section: 5 spp. in Thailand, S. Burma, Laos, S. China, Vietnam; in Malesia: 2 spp. in Borneo and Flores. Fig. 8.

Ecol. Evergreen (in Thailand rarely deciduous) forest, from the lowland up to c. 550 (-1000) m.

Uses. Leaves and/or fruits of U. siamensis HIEPKO in Thailand locally used as a medicine against intestinal parasites, in large amounts a deadly poison.

Taxon. The genus was originally restricted to western tropical Africa (Urobotrya sect. Urobotrya with 2 spp.). This section is characterized by much longer racemes with small, narrowly triangular bracts.

Two species from Indochina were originally described under Lepionurus. The young inflorescences are indeed very similar to those of that genus, but the structure of the flowers differs considerably (cf. HIEPKO, Ber. Deut. Bot. Ges. 84, 1972, 661-663). Anatomical and palynological data support the opinion that Urobotrya and Lepionurus are closely allied mutually and to Gjellerupia.

KEY TO THE SPECIES

1. Racemes 4.5-5.5 cm long, rachis glabrous. Tepals mostly 3. Drupe 14-16 by 7 mm 1. U. floresensis
   1. Racemes 8-12 cm long, rachis densely puberulous. Tepals mostly 4. Drupe 13 by 8.5 mm
   2. U. parviflora

1. Urobotrya floresensis HIEPKO, Willdenowia 9 (1979) 32.

Small treelet, up to 3 m. Twigs puberulous. Leaves glabrous, only the midrib underneath with short hairs; ovate to elliptic, (5-) 8-12 (-16) by (2-) 3-4.5 (-6.5) cm; apex shortly acuminate, base rounded to cuneate; nerves 7-8 on each side of the midrib; petiole 1-2 mm. Inflorescences axillary, solitary; rachis (3-) 4.5-5.5 cm, glabrous. Bracts broadly ovate, apiculate, 2.5-3 by 2.5-3 mm. Flowers 3 per bract, without bracteoles; pedicels 1.5 mm. Tepals 3, rarely 4, c. 1 mm. Stamens white, filament c. 1 mm. Disk cup-shaped, up to nearly half the length of the ovary. Ovary cylindrical to conical, 0.7 mm long; stigma tripartite. Drupe 14-16 by 7 mm; pedicel 3 mm.

Distr. Malesia: Lesser Sunda Is. (W. Flores: Manggarai), 5 collections. Fig. 8.

Ecol. From the lowland up to 800 m, according to SCHMUTZ (in sched.) gregarious (like in U. siamensis).

Vern. Sasang manuk (cf. Opilia amentacea).

Note. This species is distinguished by several

Fig. 8. Range of Urobotrya STAFF sect. Lepionuroides HIEPKO: U. floresensis HIEPKO (rhomb), U. latissquama (GAGNEP.) HIEPKO (triangles), U. longipes (GAGNEP.) HIEPKO (star), U. parviflora HIEPKO (squares), U. siamensis HIEPKO (dots). After HIEPKO, 1979.
characters partly typical for some other species of the genus: puberulous twigs, relatively small flowers, and large fruits (like *U. parviflora*), glabrous and comparatively short rachis (like *U. siamensis*). A unique character of *U. floresensis* is the trimerous flower, not only with three tepals and stamens, but also showing a tripartite stigma.

2. *Uroborota parviflora* HIEP. KO, Willdenowia 6 (1972) 474; *ibid*. 9 (1979) 34. — *Cansjera sp.?* MERR. Un. Cal. Publ. Bot. 15 (1929) 57. — Fig. 7.

Shrub, 1–5 m, twigs puberulous. Leaves glabrous, but midrib pilose on both sides, elliptic to broadly ovate or lanceolate, (6–) 8–13 (–17) by (1–) 2.5–5 (–7) cm; apex shortly acuminate, base rounded or cuneate; midrib prominent and rounded, nerves less prominent beneath, 6–8 pairs; petiole 1–3 (–5) mm long. Inflorescences axillary, usually solitary, rarely in twos; rachis 8–12 cm long, densely puberulous. Bracts broadly ovate, acuminate, 3–4 by 4 mm, finely hairy on both sides. Flowers 3 per bract, without bracteoles; pedicels 1–1.5 mm. Tepals (3–) 4 (–5), whitish, c. 1 mm. Stamens white, filaments c. 1 mm, anthers elliptic, c. 0.5 mm long. Disk annular, low. Ovary conical, c. 0.5 mm long. Drupe slightly apiculate, red, mesocarp juicy, 13 by 8.5 mm; pedicels up to 2.5 mm.

Distr. Malesia: Borneo (Brunei, Sabah, N. & NE. Kalimantan). Fig. 8.


Note. Form and size of the leaves are extremely variable; besides rather broadly ovate leaves narrowly lanceolate leaves are found (KOSTERMANS 21116: 12 by 1 cm). Inflorescences, flowers and fruits are fairly uniform.

4. **LEPIONURUS**


Shrubs, erect or straggling, usually glabrous, sometimes young twigs with short hairs. Leaves glabrous, thinly coriaceous. Flowers bisexual, in axillary racemes, three flowers per bract; rachis of inflorescence slender, glabrous. Bracts broad scaly, pale green, with hyaline, shortly ciliate margin, densely imbricate, caducous before anthesis (lowermost bracts smaller, sterile and persisting). Flowers (3–) 4 (–5)-merous. Perianth united, deeply lobed. Stamens not exceeding the perianth, filaments flattened. Disk cupular, with irregularly lobed margin. Ovary ovoid-conical; stigma ± sessile, entire or shallowly 4-lobed. Drupe ellipsoid to somewhat ovoid or obovoid; pericarp thin, mesocarp juicy, endocarp crustaceous. Embryo nearly as long as the seed, radicle small, with 3–4 long, linear cotyledons.

Distr. Monotypic. SE. Asia (Nepal to Vietnam) and *W. Malesia*: Sumatra, Malaya, Java, Borneo. Fig. 11.

Ecol. Undergrowth in evergreen forest, from the lowland up to 1250 (–2000) m.


Shrub, usually less than 2 m, rarely up to 6 m. Leaves extremely variable in shape, (5.5—10—16 (-25) by (1.5—3—7 (-9) cm, ratio 2—4 (-10), widest above, at, or below the middle: obovate, oblong, lanceolate or ovate; apex acutely acuminate, base shortly attenuate or attenuate; (5—8—10 (-13) pairs of nerves, midrib and side-nerves often prominent beneath; petiole 1—5 (-8) mm. Racemes 1—8 (-17) per axil; rachis erect, drooping or pendulous, 2—5 cm (in fruit up to 6 cm). Bracts broadly ovate, acuminate or apiculate, 4—5 (-7.5) by 3—5 (-8) mm. Flowers 3 per bract, on a tubercle, without bracteoles; pedicels 1—2 mm. Tepals united, tube 0.5 mm long, resting on the cupular hypanthium. Perianth yellowish, 2—4.5 mm across; segments patent, ovate, acute. Stamens inserted below the margin of the disk, as long as the perianth tube; anthers oval, 0.5 mm long. Pistil c. 1 mm long. Drupe resting on the thickened disk, orange-red, 9—16 by 6—10 mm; pedicel 2—2.5 mm, thick, seemingly longer through the enlarged tubercle on the thickened rachis. Embryo nearly as long as the seed, radicle about half as long as the cotyledons.

Distr. Nepal, Sikkim, Assam, Burma, S. China, Thailand, and S. Vietnam; in Malesia: Sumatra, Malay Peninsula (common), W. Java (common), rarely in Central Java, Borneo (Sarawak, Sabah, Kalimantan). Fig. 11.

Ecol. Usually in evergreen forest, locally common undergrowth, from sea level up to 1250 m, rarely up to 2000 m (Sumatra). Fl. fr. Jan—Dec.

Razi (Lloydia 20, 1958, 238) mentioned Lepionurus in his list of phanerogamic parasites, but he does not give any evidence as proof of this statement.

Uses. In Peninsular Thailand the roots are locally used for a medicine against fever. In Pahang (Malaya) a poultice of the plant or of the root is applied for headache (Burkill, 1935).
Notes. As already pointed out by Valeton (Crit. Overz. Olacin. 1886, 152) the leaves of L. sylvestris are extraordinarily variable in shape and size. Extremely narrow leaves (ratio about 10) are especially striking, but such forms occur sporadically in all parts of the range of the species next to plants with a more common leaf shape (Burma, Thailand, Malaya, Sumatra).

The number of inflorescences per axil is also very variable. Whereas in the greater part of the range 1–8 racemes are found, one third of the specimens from Assam show in part more than 10 racemes per axil.

The size of the flowers and the differentiation of the rim of the disk are variable as well. Since this variability is quite irregular it is impossible to distinguish varieties.

5. GJELLERUPIA


Shrubs or small trees, twigs puberulous. Leaves glabrous, but midrib hairy above, coriaceous. Plants dioecious. Flowers in racemes, 1–3 pedicelled flowers per bract; rachis of inflorescence slender, glabrous, rarely with some scattered hairs. Bracts broadly cordate, green, with hyaling ciliate margin, densely imbricate, caducous before anthesis, only some basal (smaller) bracts persistent. — ⊙ Flowers (3–) 4 (–5)-merous. Tepals free, oblong, acute, reflexed. Stamens...
exceeding the perianth. Disk annular, fleshy. Pistil rudimentary. — ♀ Flowers without perianth and stamens. Disk annular, thinly-fleshy. Ovary ± conical; stigma sessile. Drupe almost globular, mesocarp juicy, endocarp thinly crustaceous; embryo nearly as long as the seed, with 3–4 long, linear cotyledons.


**Ecol.** Undergrowth in high evergreen forest, often on limestone ridges, from the lowland up to 200 m.

**Note.** *Gjellerupia* was reduced by Hatusima (Bot. Mag. Tokyo 65, 1952, 110) to *Lepionurus sylvestris* Bl., but van Steenis (l.c.) pointed out that the observations and conclusions of Hatusima are erroneous and that *Gjellerupia* is a distinct genus. It is closely allied to *Urobotrya*. The male flowers of *Gjellerupia* show a striking similarity with those of *Urobotrya siamensis*. Furthermore the pollen type (Lobreau-Callen, pers. comm.) and the placentation are the same in both genera.


Shrub or small tree up to 6 m, with few horizontal branches. Bark light grey, smooth. Wood hard, straw coloured. Leaves ovate to narrowly lanceolate, 5–15 (–17) by 1.5–4 (–5.5) cm; apex acute to acuminate, base attenuate to rounded; lateral nerves 8–15 pairs, midrib prominent beneath; petiole 1–4 mm. Inflorescences axillary, usually solitary, rarely 2 or 3 together; rachis 1–2 cm long (in fruiting state up to 2.5 cm). Bracts 2–3 by 2–3.5 mm. — ♀ Flowers 1–3 per bract; pedicels 1.5–4 mm long. Tepals 1.5–2 mm long. Stamens 1.5–2.5 mm; anthers subcordate, 0.3 mm long. Disk undulate. Rudimentary pistil cylindric, up to c. 1 mm long, spindly. — ♀ Flowers 1–3 per bract. Tepals and stamens 0. Disk 0.5 mm. Ovary conical, 1 mm long. Drupe red, 10–12 mm ø; pedicel 5–7 mm long, often bent.

**Distr.** Malesia: New Guinea (Geelvink Bay, Yapura, West Sepik & Sepik Distr.).

**Ecol.** Locally common as undergrowth in high evergreen forest, often on limestone ridges; from sea level up to 200 m. Fl. fr. Jan.–Dec.

**Vern.** Maroa, Orne lang.

**Note.** The species is rather variable in form and size of the leaves; flowers and fruits are fairly uniform.

## 6. OPILIA


Lianas, sometimes erect shrubs, root parasites; young branchlets glabrous or tomentose to puberulous. Leaves coriaceous. Flowers bisexual, in axillary racemes, three per bract. Rachis of racemes and pedicels densely covered with brownish or yellowish hairs. Bracts peltate, broadly ovate, densely imbricate, caducous before anthesis. Tepals free, 5–4, recurved. Stamens exceeding the perianth. Disk lobed, with 5–4 thick and fleshy, irregularly toothed lobes alternating with the stamens. Ovary cylindric to ellipsoid, stigma sessile. Drupe ellipsoid, puberulous, mesocarp fleshy, endocarp thin, woody. Embryo nearly as long as the seed, radicle extremely small (c. 0.5 mm), with 3 cotyledons.
Distr. In tropical Africa 2 spp., O. amentacea also from India through Burma, Thailand, Indochina, and Malesia to the Solomon Is. and N. Australia. Fig. 13.

Ecol. In dry deciduous forest, often in beach forest, from the lowland up to 600 (-1200) m.


Liana up to 30 m or erect shrub; bark smooth or fissured, pale to dark grey, branches glabrous or glabrescent. Leaves mostly glabrous, ovate, oblong, or lanceolate, 5–14 (–16) by 2–5 cm; apex acuminate, acute, or obtuse; base attenuate, sometimes rounded; midrib prominent beneath; nerves (6–) 7–9 (–11) pairs; petiole 3–7 (–10) mm. Racemes 1–5 in the axil of one leaf, 1.5–3.5 cm long when flowering; bracts 2–3 mm a, with ciliate margin. Pedicels of 1.5–2 mm. Tepals yellowish green, oblong with a short inflexed top, shortly pubescent out-
side, c. 1.5 mm long. *Filaments* filiform, 1.5 mm; anthers oval, 0.3 mm long. Disk lobes subclavate, green, c. 0.5 mm long. *Ovary* c. 1 mm long. *Drupe* orange-yellow, 1.5–3 by 1.25–1.75 cm; pedicels thickened upwards, 5–7 mm.

**Distr.** Tropical Africa, and from India and Sri Lanka through Burma, Thailand, Indochina, and *Malaysia* to the Solomon Is. and Australia. Fig. 13.

**Ecol.** In dry deciduous forests or thickets (in New Guinea in light rain-forest), often on seashore or along streams; on limestone, sandstone, or volcanic tuff; from sea level up to 600 m (in New Guinea up to 1000 m). *Fl.* Jan.–Dec. Flowers sweet scented.

The root-parasitism was studied by Barber (Proc. Cambridge Phil. Soc. 14, 1907, 246–256).

Pea-shaped galled flowers have been observed in some specimens from the Philippines, N. Borneo, and from New Guinea.

**Uses.** The fleshy mesocarp of the fruit is edible, but it is only reported from different parts of Africa and N. Australia that the fruits are eaten.

**Vern.** Philippines: agarotol, P. Bis., aratig, campenaya, tooolang, Tagb.; Komodo: landa; Flores: sasang manuk (cf. *Urobotrya floresensis*).

**Note.** Like the other members of *Opiliaceae* this species is extremely variable in vegetative characters. Form, size, and texture of the leaves vary considerably as well as the measurements of the fruits, but the geographical distribution of these differences is irregular. The differences in the indumentum of the young twigs are also irregularly distributed. Inflorescences and flowers are uniform.

### 7. CANSJERA


---

Lianas or erect shrubs, root parasites; branches often conspicuously zigzag; twigs densely covered with mostly upcurved hairs. Leaves herbaceous to thinly-fleshy or coriaceous, glabrous or hairy. Flowers bisexual, in axillary spikes, each flower in the axil of a small persisting bract. Rachis of spike and bracts densely hairy, perianth pilose. Tepals united; the urceolate or campanulate perianth with 4, small, recurved lobes, exceptionally 5-lobed. Stamens not exceeding the perianth tube; filaments filiform. Disk scales alternating with the stamens. Ovary ovoid to cylindric; style short, not or hardly exceeding the perianth tube; stigma capitate, ± 4-lobed. Drupe ± ellipsoid, sessile on the lacerated perianth; 1 or 2 drupes per infructescence; mesocarp fleshy-juicy, endocarp thin, brittle. Embryo much shorter than the seed, with 3–4 cotyledons.

Distr. 3 spp., from India and Sri Lanka to S. China, Malesia, and N. Australia. Fig. 15.
Ecol. In evergreen and deciduous forest, from the lowland up to 1000 m, in S. China up to 1400 m.
1. Leaves ovate to broadly lanceolate (or elliptic), ± acuminate. Perianth tube (2−) 2.5−3.5 mm long

1. C. rheedii


Liana, climbing up to 8 (−11) m, with hanging branches, or erect shrub with spiny stem. Leaves coriaceous and brittle in dry state, glabrous, ovate to lanceolate or elliptic, 3−5−9−13 cm; apex ± acuminate; base shortly attenuate to attenuate, rarely rounded; midrib and nerves sometimes prominent beneath, nerves 5−7 pairs; petiole 3−5 mm, densely hairy. Spikes 1−3 (−5) in the axil of one leaf, 1.3−2.5−4 cm long when flowering; bracts ovate to triangular, acute, 1 mm long. Perianth urceolate, greenish yellow, tube (2−) 2.5−3 mm long, lobes recurved, 0.5 mm. Filaments c. 2 mm; anthers broadly oval, reaching as far as the throat of the perianth tube. Disk scales slightly fleshy, ovate, acute, irregularly toothed, c. 0.75 mm long. Ovary ± cylindric, c. 1 mm long; style c. 1 mm, long persistent; stigma 4-lobed. Drupe orange, 10−13 (−15) by 7−9 (−12) mm. Seed with deeply sunken basal hilum; embryo about 1/3 as long as the seed.

Distr. From Nepal, India, and Sri Lanka to S. China and western Malesia: Sumatra (East Coast, Palembang), Malaya (mostly southern half), Borneo (NW. Kalimantan, Sarawak, Sabah), Philippines (Mindoro, Cebu, Sulu Is.). Fig. 15.

Ecol. In deciduous and evergreen forest, often in beach forest, from sea level up to 1000 m, in S. China up to 1400 m. Often on sandy soil. Fl. Jan.—Dec.


Vern. Malay Peninsula: buah champerei; Sandakan: tomou.

Form, size, and venation of the leaves are variable. Often a pair of arcuate side-nerves shortly above the base are nearly as strong as the midrib; such 3-nerved forms have been named C. zizyphifolia. The flowers are fairly uniform, but the fruits vary in size and form (sometimes more globular).


Liana, up to 6 m, branches hanging, or erect shrub; young twigs puberulous, often soon becoming glabrous. Leaves herbaceous in dry state, glabrous, ovate-lanceolate, long-narrowed, 4–9 (–11) by (1–) 1.5–4 cm; apex acute or ± acuminate; base attenuate to shortly attenuate; midrib and main lateral nerves rarely somewhat prominent beneath, (6–) 7–9 pairs of mostly inconspicuous nerves; petiole (2–) 4–6 mm, hairy. Spikes 1–4 (–5) in the axil of one leaf, (1–) 2–3 cm long when flowering; bracts lanceolate, 0.5–1 mm long. Perianth urceolate, greenish yellow or white, tube c. 1.5 mm long, lobes recurved. Stamens as long as the perianth tube. Disk scales slightly fleshy, oblong, apex 3-toothed, c. 0.5 mm long. Ovary ovoid, c. 1 mm long; style c. 0.5 mm long; stigma shallowly 4-lobed. Drupe orange-red, ellipsoid to nearly globular, 11–15 by 9–13 mm.

Distr. Northern Australia; in Malesia: New Guinea (incl. Bismarcks), Moluccas (Key and Sula Is.), Lesser Sunda Is. (Sumba, Alor, Timor), and E. Java (Surabaya). Fig. 15.

VALETON (c. 1886, 159) mentioned ‘Nova Zealandia’, but this is obviously an error for ‘Nova Guinea’.

Ecol. In evergreen forest or in semi-deciduous thickets, often climbing on the edge of woods; from sea level up to 700 m; on calcareous rocks (Java) or on sandy soil. According to Stauffer (in sched.) parasitic on Leguminosae and Sapindaceae. Fl. Jan.–Dec. Flowers with sweet scent.


Vern. Lesser Sunda Is.: kema raberii, Sumba, kape bila, Alor; Moluccas: mëo menumpang, Sula Is.

Note. Cansjera leptostachya is undoubtedly closely allied to C. rheedii. But since it differs from this species in several floral and vegetative characters (inflorescences more lax, perianth tube clearly shorter; leaves smaller, lanceolate, and more herbaceous; spines never reported) I prefer to maintain C. leptostachya as a distinct species.
Excluded

Cansjera grossularioides BLCO, Fl. Filip. (1837) 73 ('Cansiera') = Antidesma ghaesemilla GAERTN. (Euphorbiaceae).

Cansjera pentandra BLCO, l.c. = Antidesma pentandrum (BLCO) MERR. (Euphorbiaceae).

Cansjera rheedii BLCO, l.c., non J.F. GMELIN = Antidesma pentandrum (BLCO) MERR. (Euphorbiaceae).
