Engler A. 1889. Olacaceae. Pages 231-242 in Engler A, Prantl K, eds. Die Natürlichen Planzenfamilien. Leipzig: Wilhelm Engelmann. Translation D. L. Nickrent.

OLACACEAE

by

A. Engler.

With 44 single images in 8 figures.
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Most important literature. Mirbel, Bull. Philom. n. 75 (1813). 377. – De Candolle, Prodr. I. 534. – Endlicher, Gen. pl. 1041. Baillon, in Adansonia III. 420. – Observations on the affinities of the Olacaceae, in Contributions to botany I. 21-46. – Bentham et Hooker, Genera plant. I. 342, Trib. I. II. – Engler, in Fl. bras. XII. 2 (1872). – Miers, On the Schoepfieae und Cervantesieae, in Journ. of the Linn. Soc. XVII (1880). 68-78 – Edelhoff, Vergleichende Anatomie des Blattes der Familie der Olacineen, in Engler Bot. Jahrh. VIII. 102.

Features. Flowers mostly ☿, radiate. Calyx small, usually with indistinct, 4-, 5-6-toothed border, with its cup-shaped base free or adnate to the disc or the ovary, often significantly enlarged when ripe and enveloping the fruit. Petals 4-6, free or connate, in the bud stage valvate, only exceptionally imbricate. Stamen either only in front of the petals or in front of the same and the gaps between them, but twice as much, sometimes even 3 times as much, rarely as much as the petals and alternating with them, mostly all fertile, sometimes transformed into staminodes; Anthers ovate to oblong, with 2-fold thecae opening through longitudinal slits. Ovary free or at the base enclosed by the cup-shaped floral axis, unilocular below or rarely up to 2-5 locular at the apex, with mostly a free placenta, of which mostly 1 (rarely 2) thin, long, upturned ovules with inverted micropyle hanging down, rarely 1 locular with 1 hanging or 1 upright ovule, style with a small stigma. Fruit mostly a drupe or nut-like and enclosed by the enlarged calyx, always 1 seeded; the placenta is often sunk into a furrow of the seeds. Seeds with a thin testa and abundant endosperm, in whose apex the small embryo is embedded, rarely the embryo almost as long as the endosperm. - Shrubs or trees, rarely subshrubs, with alternate, exceptionally opposite, simple, entire leaves and usually small flowers.

Vegetative organs and anatomical behavior. The Olacaceae show no outstanding peculiarities in their vegetative organs. Twigs and flowers are only slightly hairy when young, later mostly glabrous. The leaves are always entire and have a half terete, often twisted petiole. It is striking that one genus, *Heisteria*, is characterized by the presence of unorganized laticifer tubes in the spongy tissue of the leaves, while most other genera from the Olaceae, the Anacoloseae and the Schoepfieae groups have cell groups with silicified walls in the mesophyll and under the epidermis. The genera of the Opilieae and Agonandreae, on the other hand, are characterized by cystolith-like deposits of calcium carbonate in the mesophyll or pallisade tissue. In the Icacinaceae, which according to the author should be excluded from Olacaceae, none of the peculiarities mentioned can be found. (Cf. Edelhoff, op. Cit.) The wood has so far only been examined in a few Olacaceae; so far as those that have been examined (*Olax, Cansjera, Opilia, Cathedra, Heisteria*), they have vascular walls with bordered pits and simple pits; the transverse walls have scalariform perforations in *Heisteria* and simple perforations in the others.

Floral conditions. The calyx is of outstanding interest. It usually shows an indistinctly structured limb; if the cup-shaped basal part, as in *Schoepfia*, is now combined with the sunken ovary, then it shows a very great correspondence with the cup-shaped structure, which includes the ovary in the Loranthaceae and which we conceived there as the flower axis; in the Olacaceae we are prevented from having the same view by the fact that in individual genera, such as the flowers in *Tetrastylidium*, a bell-shaped axis between the calyx and ovary can be seen, and the fact that in many cases the calyx limb grows significantly after fertilization and even the fruit not infrequently protrudes considerably, especially in *H. Kappleri*. However, since these genera with an enlarged calyx are connected to the others by numerous features, the calyx of which remains rudimentary, and also in the anatomy of the flowers, there is a need for the cup-shaped structure, even where a calyx limb is barely perceptible to be understood as a calyx or as a union of calyx with the flower axis. The extreme case is with *Schoepfia*. In the latter genus, the cup-shaped structure appearing below the flower, but unevenly serrated, has been thought of as a calyx, but it would be more logical to see in it a fused product of an uplifted bract and two bracteoles, as occurs with several Loranthaceae, since there is no bract at the base of the pedicel. With regard to the position of the stamen in the flower, reference should be made to the individual generic diagnoses. In the Schoepfieae, Opilieae, Anacoloseae, Agonandreae the position of the stamens to the flowers at anthesis is as in Loranthaceae or Proteaceae and can be explained in the same way. In the Olaceae group, however, there are twice and three times as many stamens as the petals; sometimes, as with *Ptychopetalum*, the stamens alternating with the petals are longer than those in front of them, but sometimes the reverse is also the case (as with *Ctenolophon*). The position of the stamens in *Scorodocarpus*, where there is a petals on both edges of it, is worth noting, while in the very close genus *Ximenia*, the stamens are inserted half in front of the center of the petals and half in front of the sepals. The position of the stamen and staminodes in *Olax* and *Liriosma* is striking. Stamens are present in front of all petals, also in 3 places where each touch, typically in 6-merous and 3-merous perianths the stamens in front mostly become staminodes, the others fertile; however, the reverse is also the case with some species of *Olax*. A developmental history of these flowers is desirable.

The gynoecium is usually made up of 3 carpels, less often 4 and 5, the ovary is mostly loculate only at the bottom, the basal partitions merge into a placenta in the middle, which in many cases does not touch the vertex of the ovary. An ovule usually hangs in each compartment, as is the case with the Santalaceae. Here as there and as with individual Loranthaceae (*Elytranthe globosa* according to Treub), each carpel has 1 ovule. With *Ctenolophon* there are 2 ovules per 1 carpel. With Opilieae and Agonandreae only 1 ovule is developed; the simplicity of the ovary probably rests on the abortion of the locules developed in the other genera. As fresh or alcohol-preserved Olacaceae flowers have not yet been examined, nothing is known about the nature of the ovules.

Fruit and seeds. While the flowers of Olacaceae show various differences, the fruit and seed are very similar. Whether a false fruit with the involvement of the flower axis or a real fruit is developed, the end product is always quite similar, a juicy outer layer, which is sometimes formed by the cup-shaped disc, now belongs to the pericarp, and a crusty inner layer, sometimes the whole pericarp, sometimes only representing its inner layer. Only 1 seed is always developed, regardless of whether there were 3 or 1 ovules. The seed coat is always thin. The

placenta also grows in length with the seed and is often sunk into or attached to the seed as a thin thread.

Geographical Distribution. The family is almost exclusively tropical. It is noteworthy that the genera *Heisteria* and *Ptychopetalum* are only represented in South America and West Africa, *Heisteria* with only 1 species in West Africa, *Ptychopetalum* with only 1 species in South America.

Kinship Relationships shown between Olacaceae and both the Loranthaceae and the Santalaceae. The genus *Schoepfia* could be placed quite well with the Loranthaceae if the placenta with the freely hanging ovules were not so clearly developed and if the false fruit had a layer of viscin. Due to the position of the ovules, the Olacaceae also closely follow the Santalaceae; but they are distinguished from these by the presence of a calyx, which is often reduced. The association of the Icacinaceae and Olacaceae, which some authors still maintain, has completely failed. These have either a 3-locular ovary (*Emmotum*) or a locule that corresponds to a compartment of a completely multi-locular ovary.

Utility of Olacaceae is through their hard wood and their sometimes edible fruit (*Ximenia*).

Classification of the Family

A. Ovary with 2 or more seeds
  a. Stamens as many as the peranth members, standing in front of them.
    α. Calyx united with the cup-shaped flower axis; a calyx limb is not clearly perceptible. (The floral bract is usually fused with the bracteole to form a cup-shaped, permanent husk.).....**I. Schoepfieae**.
    β. Calyx limb clear, usually enlarged when ripe on fruit..... **II. Anacoloseae**.
  b. Stamens twice or 3 times as many as the petals, rarely more, all or only partially fertile; even less than twice as many, if just as many, then alternating with the petals ..... **III. Olaceae**.
B. Ovary with only 1 seed.
  a. Flowers ☿, with indistinctly limbed calyx.....**IV. Opilieae**.
  b. Flowers unisexual and dioecious, ♀ flower without whorls.....**V. Agonandreae**.

I. **Schoepfieae**.

Calyx not perceptible, but (if at all present) fused with the cup-shaped, shortened flower axis. (Flora bract [Sometimes moved up on the stem] fused with the bracteole to form a cup-shaped husk.) Ovary, with the exception of its uppermost part, 3-locular, with 3 seeds.

1. **Schoepfia** Schreb. (*Codonium* Vahl, *Haenkea* Ruiz et Pav. [Partly], *Diplocalyx* A. Rich.) Flower axis fused to the ovary. Petals 4-6, often with a tuft of hair in the middle, united into a tubular-bell-shaped crown, bent back with the tips free. Filament united with the petals members, narrow, somewhat free above; Anthers extrorse, sessile, ovoid. Ovary with a fleshy, epigynous disc, with 3 ovules hanging from the top of the central placenta. Style thin, filiform, with a 3-lobed stigma. False fruit drupe-like, with crusty or parchment-like inner layer. Seed with a very

small embryo at the top of the endosperm. - Glabrous shrubs and trees with entire, leather-like leaves and rather large, fragrant, white or yellow flowers in short, axillary racemes (Fig. 148).

12 species in the tropical countries of the Old and New world. - A. Style, very short. Species of the new world: *S. arborescens* Röm. et Schult. and *S. chrysophylloides* (A. Rich.) Planck. in the Greater Antilles. Also 1 species in the Andes of Peru, 1 in Mexico, 4 in Brazil. B. Style thin, reaching to the throat of the petals tube. *Schoepfiopsis* Miers. 4 species from Asia, 2 from the Himalayas (*S. fragrans* Wall., Fig. 148 A-C), 4 from China, *S. jasminodora* Sieb. et Zum in southern Japan, the latter distinguished by flowers, which sit in the axils of the bract without bracteoles.

Fig. 148. A-C *Schoepfia fragrans* Wall. A piece of a branch; B a flower after removal of half the flowering (*i* the involucre); C longitudinal section through the ovary - D false fruit from *Sch. obliquifolia* Turcz. (After nature)

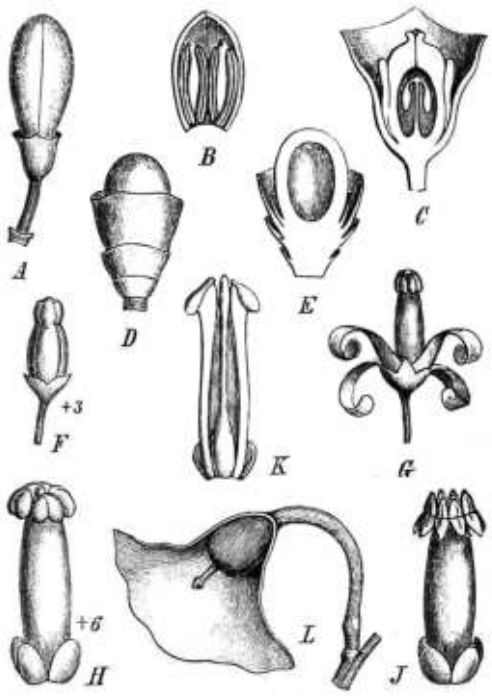

Fig. 149. A-C *Tetrastylidium brasiliense* Engl. A bud; B 2 flower with 2 stamens; C Longitudinal section through the calyx and the gynoecium. D, E *Cathedra Gardneriana* Miers, D fruit with 4 husks, the interpretation of which is still doubtful, E the same in longitudinal section. - F-K *Aptandra tubicina* Benth. F bud; G flower open; H the androecium with 4 glands at the bottom; J the same with open anthers; K the same in longitudinal section with pistil. - L *Aptandra liriosmoides* Spruce. Fruit (After nature and Miers.)

II Anacoloseae.

Calyx more or less clearly, mostly (not with *Anacolosa* and *Stolidia*?) enlarged when ripe. Stamen as many as the petals and standing in front of it. Ovary 1-locular or incompletely loculate, with 2-5 hanging ovules in a fruit enclosed either by the enlarged cup-shaped flower axis or the calyx tube.

A. Stamens not united below.
a. Calyx not enlarged when mature; but the disc (the flower axis) enlarged and fused with the fruit ..... **2. Anacolosa**.
b. Calyx limb on the mature fruit indistinguishable, the calyx tube is enlarged..... ..... **3. Tetrastylidium**.
c. Calyx limb on the mature fruit very enlarged.
α. Filament very long, filiform ..... **4. Chaunochiton**.
ß. Filament short and wide.
I. Calyx and disc free, forming double cups around the drupe. Ovary 2-locular below **5. Cathedra**.
II. Calyx intimately united with the fruit.
1. Ovary almost to te apex 3-5-locular. Trees ..... **6. Strombosia**.
2. Ovary 4-locular. Stems climbing, with inflorescence tendrils .... **7. Erythropalum**.
3. Probably the not well-known genus comes here..... **8. Stolidia**.
B. Stamens united below into a tube. Calyx limb very enlarged in the mature fruit **9. Aptandra**.

2. **Anacolosa** Blume. Calyx small, cup-shaped, weakly serrated. Disc hypogynous, united with the ovary, enlarged when ripe. Petals 6, on the edge of the disc, thickly fleshy, concave below, enclosing the stamens in the cavity, hardened above the cavity and with a 3-sided tip. Stamens 6 with flat filaments and an ovate anther enlarged on the inside of the stamen and hairy at the apex. Ovary 1-locular or incompletely divided, with 2-3 ovules hanging from the tip of the central placenta. Style conical. False fruit drupe-like, with crusty inner layer. Seeds hanging from the apex of the placenta rising from the bottom; embryo almost nothing, cylindrical, short, with a thick stem that surpasses the cotyledons in thickness, at the apex of the fleshy endosperm. - Shrubs with alternate, leather-like, entire-margined leaves and very small, flowers, crowded together in the leaf axils.

7 species, 3 in the upper Indian region, 3 in the lower Indian region, 1 in Java.

3. **Tetrastylidium** Engl. Calyx cup-shaped, with a 4-toothed limb, its tube fused with the cup-shaped disc enclosing the ovary. Petals 4, very thick, leathery. Stamens 4, united at the base with the petals, with elongated, very widened, almost sessile connective and linear. anther. Ovary oblong, up to 4- locular up to the middle, linear-elongated ovules. Style 4, short cylindrical. False fruit a drupe. - Trees with thin, elongated-elliptical, pointed leaves and short-pedicellate flowers in the leaf axils.

2 species in southern Brazil; *T. brasiliense* Engl. (Fig. 149 A-C) between Victoria and Bahia; *T. Engleri* Schwacke (Tatú), characterized by a petals with white-hairs on the inside, in Minas Geraes, supplies timber, which is easily destroyed by termites.

4. **Chaunochiton** Benth. Calyx small, cup-shaped, 5-toothed, enclosing and loosely enveloping the mature fruit. Petals 5, very narrow, linear-spatula-shaped, hairy almost the entire length inside. Disc small. Stamens almost as long as the petals, filiform, with small, almost spherical anther. Ovary oblong, almost 5-edged, 2- locular, with 2 ovules hanging in the compartments. Style long, with a capitate, 5-lobed stigma. Fruit a drupe, 5-edged, 1- locular, with crusty endocarp. Seeds spherical with a thin coat and very small seedling lying in the top of

the endosperm. - Tall tree with bare elliptic, petiolate leaves and short petiolate, attractive flowers, in axillary composite panicles.

1 species, *Ch. Loranthoides* Benth., In Brazil on the upper Amazon river.

5. **Cathedra** Miers (*Diplocrater* Benth.). Flower ☿. Calyx fleshy, cup-shaped, shortly hairy, indistinct 5-6 toothed, enlarged when ripe. Petals 5-6, fleshy, oblong, short glandular, hairy in the middle. Stamens 5-6, half as long as the petals, with very short, thick, broad stamens and almost 4-edged anther. Disc hypogynous, fleshy, as long as the calyx, completely free. Ovary free, almost stalked, obovate-conical, glabrous at the bottom, fleshy above, grooved and somewhat hairy, 2- locular at the bottom, with hanging ovules. Style short, upright, with an elongated, inverted conical, almost 3-lobed stigma. Fruit below from the cup-shaped, only slightly enlarged disc, the greatly enlarged calyx and sometimes also cup-shaped prophyll included, with thin, fleshy exocarp and crusty endocarp. - Trees with reddish bark, leathery, short-petiolate leaves and small flowers grouped in clusters (Fig. 1 D, E).

4 species in Brazil.

6. **Strombosia** Blume. Calyx small, bowl-shaped, with 5 broad sections, the calyx tube free or attached to the ovary, enlarged when ripe and united with the fruit. Petals 5, upstanding or sloping, with tips turned back. Filament fused with the petals above the middle; the anther attached to the back, ovate. Ovary surrounded by a 3-5 lobed disc, almost 3-5- locular almost to the top, with 3-5 ovules hanging in the locule; Style short, with indistinct 3-5-lobed stigma. Drupe with a crusty or hard pit, crowned by the calyx limb at the apex. Seed with small embryo at the apex of the fleshy endosperm. - Glabrous trees with entire, leathery and shiny leaves. Flowers small in axillary, short-stalked umbels or in glomerules.

According to Bentham et Hooker 6 species in the Indian-Malaysian area.

Sect. I. *Eustrombosia* Mart. Ovary free. *S. javanica* Blume, from the back of India to the greater Sunda islands. Here probably also 4 species by Fernando Po.

Sect. II. *Lavallea* Baill. (as Gatt.) Ovary, more or less connected with the calyx tube. *S. ceylanica* Gardn. (*Sphaerocarya leprosa* Dalz.), In upper India and Ceylon.

7. **Erythropalum** Blume (*Mackaya* Am., *Modecopsis* Griff., *Balingaytem* Blanco?). Calyx with 5 broad, almost imbricate sections and a short tube that is larger when the fruit is ripe and includes the fruit (flowering area?). Stamen 5, with short, flat, campanulate, deeply lobed flowering filaments that have grown to the base; anthersa ovate, with thick connective. Staminodes (?) standing in front of the stamen at the throat. Ovary 1- locular, with 2-3 hanging ovules. Style very short, conical. False fruit drupe-like, elongated, crowned by the limb of the calyx at the crown and with a crusty endocarp, the calyx enveloping the fruit finally tearing in 3-5 bent back flaps. Hanging seeds, with a small embryo on the top of the fleshy endosperm. - Climbing, glabrous shrubs with long-stalked, alternate, entire-edged, 3-nerved leaves and very small flowers in loose umbels, as well as with some petioles transformed into tendrils.

3 species. *E. scandens* Blume, with ovate or oblong-lanceolate leaves, from Silhet to Java; *E. vagum* (Griff.) Mart. with elongated ovate, basically cordate leaves, from the tropical Himalayas to Malacca.

8. **Stolidia** Baill. Calyx cup-shaped, blunt 5-lobed. Petals 5, free (imbricate?). Stamen with short stems and erect anther. Ovary free, 4-5- locular below, with 4-5 hanging ovules – shrub with leather-like leaves covered below by rust-colored hair and panicles composed of umbels.

1 species in Mauritius. Position of the genus uncertain because the fruit is unknown.

9. **Aptandra** Alters. Calyx very small, plate-shaped, 4-toothed, fleshy, enlarged when ripe, funnel-shaped or cup-shaped, including the fruit. Petals 4, fleshy, linear-tongue-shaped, concave, with inwardly curved tip, last rolled back .. Flower axis with 4 thick, scaly glands between the flower base and. Stamen stamens 4, fused in a cylindrical tube enclosing the ovary, thickened at the top, with elongated antherd fursed into a ring, the thecae of which each open with 4 flaps that fold back downwards. Ovary oblong-conical, somewhat compressed, below 2- locular, with 2 hanging, ovate ovules. Style filiform, thickened at the end. Drupe with woody endocarp. Seed with small embryo at the apex of the fleshy endosperm. Embryo with short stems and roundish cotyledons – trees with thin, elongated-elliptical, pointed leaves and small, short or long pedicellate flowers at the end of the branches of simple or compound axillary panicles (Fig. 149 F-L).

3 species in northern Brazil, in the Amazon River area.

III. Olaceae.

A. Stamens all fertile, petals free.
  a. Calyx not enlarged.
    α. Stamens twice as many as the petals.
      I. Leaves alternate. Petals ragged.
        1. Stamens free ..... **10. Ximenia**.
        2. Stamens fused to the petals ..... **11. Scorodocarpus**.
      II. Leaves opposite. Petals members imbricate ..... . **12. Ctenolophon**.
    β. Stamens three times as many as the petals or more.
      I. Calyx with entire margin ..... **13. Coula**.
      II. Calyx 4-5 toothed.
        1. Petals glabrous. Stamens flat ..... **14. Petalinia**.
        2. Petals hairy. Stamens auricular ..... **15. Ochanostachys**.
  b. Calyx enlarged ..... **16. Heisteria**.
B. Stamens all fertile or partly sterile, petals fused, limbs free. Calyx not enlarged .... **17. Ptychopetalum**.
C. Stamens partly fertile, partly sterile. Calyx enlarged.
  a. The enlarged calyx enclosing the fruit, but free..... **18. Olax.**
  b. The enlarged calyx fused with the fruit ..... **19. Liriosma**.

10. **Ximenia** Plum. (*Heymassoli* Aubl., *Rottboellia* Scop., *Tetanosia* Rich.) Calyx petals linear, densely bearded on the inside with reddish-brown hair, at the end with a bent back tip. Stamens 8-10, with thin, filiform filaments and linear anthers. Ovary oblong-conical, 4- locular, above the central, 4 hanging ovules. Placenta with an annular ridge. Style as long as the ovary with a small stigma. Drupe ovoid or spherical, with thin exocarp and crusty endocarp. Seed with mall embryo at the apex of the fleshy endosperm. - Shrubs or trees with twisted branches, glabrous, elongated or oblong-ovate, blunt, short-shoot leaves, and whitish, pedicellate flowers,

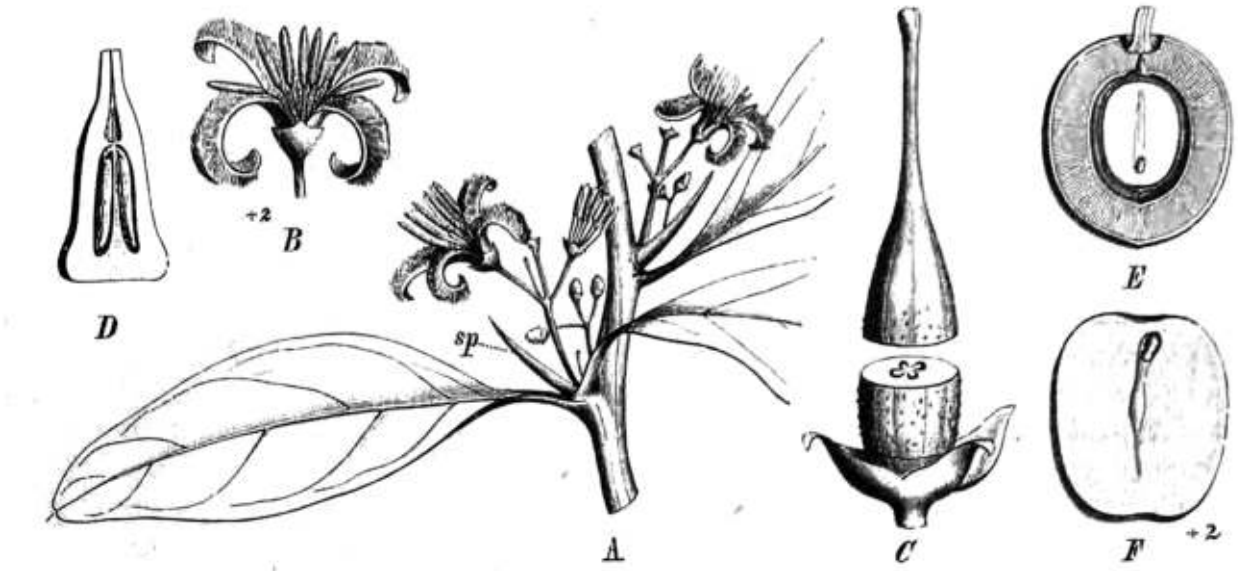

Fig. 150. *Ximenia americana* L. A Shoot with axillary inflorescences, bei sp Dorn; B. Flower; C Calyx and pistil, latter in cross-section; D Longitudinal section through the ovary; E Fruit in longitudinal section; F the seed with the embryo (A, B After nature, C-F after Beccari)

which are borne either individually or 2-3 in shortened axillary shoots forming umbels or at the bottom of small thorny shoots.

About 5 species that are very close to each other, including *X. americana* L. (Espinha de meicha or Ameixero in Brazil, Heymassoli in Guiana, Croc on S. Domingo) widespread in the savannas of America, tropical Africa and tropical Asia, often with thorny branches. More localized species are *X. coriacea* Engl. In Brazil, *X. caffra* Sond. in. South Africa, *X. elliptica* Forst. in New Caledonia.

The useful plant is *X. americana* L. (Fig. 150), the hard wood of which is used in the East Indies like sandalwood and whose fruit can be enjoyed.

12. **Ctenolophon** Oliv. Calyx with 5 elongated, imbricate lobes. Petals 5, oblong, imbricate. Stamens 10, the longer standing in front of the petals; Anthers rounded with a small tip. Ovary on a short gynophore, imperfectly 2- locular; with 2 ovules hanging in each locule; Style cylindrical with 2-lobed stigma. Fruit with a leathery or crusty wall that pops up on one side and 1 seed hanging from the tip of the free placenta, which is provided with a comb-shaped arillar bulge on the back. - Trees with opposite, leathery leaves.

2 species in Malacca.

13. **Coula** Baill. Calyx very small, with entire margins. Petals 4-5, thick, softly hairy. Stamens 12-20, free, with a filiform filaments. Ovary inferior 3-4-locular, running into a short style, with a hardly broadened stigma; 3-4 hanging ovules. Drupe almost spherical, with a very hard endocarp. Seeds spherical with fleshy endosperm. Embryo small, with circular cotyledons - tree with alternate, leather-like, entire leaves and flower standing in composite, axillary racemes. The young parts of the plants with rust-colored hair.

1 species, *C. edulis* Baill., In Upper Guinea.

14. **Petalinia** Becc. Calyx small, cup-shaped, 4-5 toothed. Petals 5, glabrous, valvate. Stamens 15 with flat, linear filaments and spherical anthers. Ovary 3-locular, with 3 ovules hanging from the apex of the free placenta. Style conical, short, with 3 small stigmas. Drupe globular, with thin exocarp and thin woody endocarp. —Tree with bare, leathery, egg-shaped leaves and small flowers in long racemes.

1 species, *P. bancana* Becc. (Petaling of the Malays), on the island of Banca.

15. **Ochanostachys** Mart. Calyx small, cup-shaped, 4-5 toothed. Petals 5, hairy on the inside. Stamens 12-15, with a filiform filament and small, spherical anther. Disc narrow, ring-shaped. Ovary ovoid, imperfectly 3- locular, with 3 ovules. Stigma cylindrical, with, small, indistinct 3-lobed stigma. Fruit not known. —Tree, with glabrous, elongated, pointed leaves and numerous small flowers in long axillary spikes.

1 species, *O. amentacea* Mart., in Malacca and Borneo.

The previous one may possibly be associated with this genus.

16. **Heisteria** Jacq. (*Rhaptostylum* Humb. et Bonpl., *Acrolobus* Klotzsch, *Hesioda* Vett) Calyx small, 5-6-toothed or lobed, enlarged when fruit is ripe and including, protruding or rolled back, wavy or lobed. Petals 5-6, hairy on the inside. Filament 10-12, rarely only 5-6 alternating with the petals, filiform or flat, with spherical anthers. Ovary almost spherical, 3-locular up to the middle, with 3 ovules hanging from free placenta. Style short, with a small 3-lobed stigma. Drupe globular or oblong, yellowish or reddish, with thin exocarp and crusty endocarp. Seed coat thin. Embryo in the apex of the endosperm, small, with circular, leaf-like cotyledons. – Trees with glabrous, ovate or oblong or oblong-lanceolate, pointed leaves and very small, axillary clusters of flowers (Fig. 151.)

24 species, mostly in South America, 1 in Central America, 4 in West Africa.

Sect. I. *Aulacocarpae* Engl. Drupe truncate, in the middle with a small tip and with 20 thin longitudinal ribs. Calyx very large when ripe, horizontally spread, 8 cm in diameter, thin-skinned. —Here only *H. Kappleri* Sagot.

Sect. II. *Leiocarpae* Engl. Drupe spherical or ovate, smooth. Calyx in the ripe fruit membranous or leathery. – A. Flower with 10 (rarely 12) stamens. Here 5 species of northern Brazil and Guianas with spherical fruit, and 10 species of Brazil and Guianas with ovoid fruit. *H. brasiliensis* Engl. (Fig. 151 F) with elongated, pointed leaves is of the latter, short-petioled flowers, crimson, 5-lobed fruit cup, common in Brazil. Also included here is *H. parvifolia* Smith, which occurs in Upper Guinea. - B. flower with 5 (rarely 6) stamens. B. *H. pentandra* (Benth.) Engl. In northern Brazil.

17. **Ptychopetalum** Benth. (*Athesiandra* Miers). Calyx small, cup-shaped, indistinct 4-6 toothed. Petals 4-6, more or less hairy on the inside, initially joined, later separated. Stamens rarely 10, mostly 8-5, 5 short in front of the petals, the others, alternating with the petals, longer; Anther elongated. Ovary free, solid at the bottom, only at the apex. with a small cavity in which 2 very small ovules hang from the free placenta. Style long, with 3-lobed stigma. Drupe ovoid, with thin exocarp and crusty endocarp. Very small embryo, at the apex of the endosperm (Fig. 152).

3 species, 2 in tropical West Africa, 4, *Pt. olacoides* Benth. (Fig. 152), in tropical America, in Guiana and northern Brazil, all very close to each other.

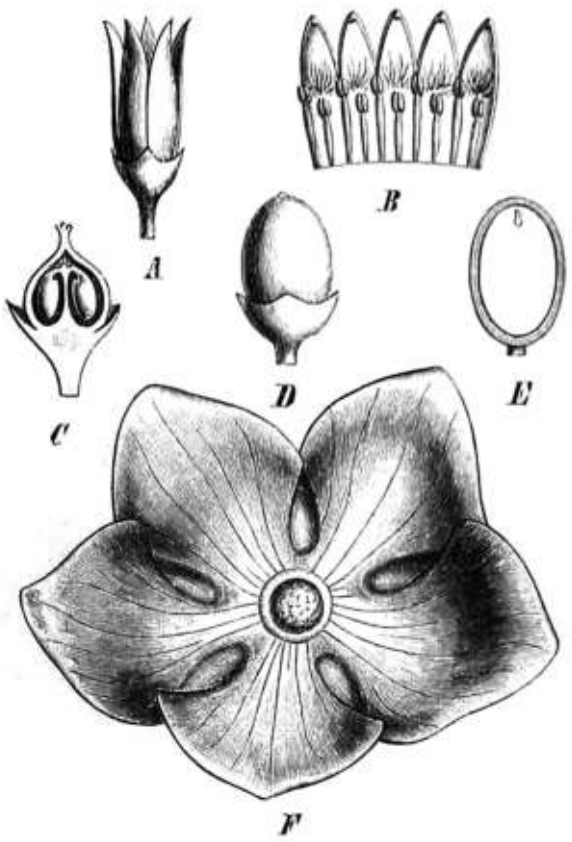

Fig. 151. A-E *Heisteria densifrons* Engl. A flower enlarged; B unrolled petals, with the stamens; C longitudinal section through the pistil; D the fruit with the calyx; E the fruit in longitudinal section. F *Heisteria brasiliensis* Engl. var. *Blanchetiana* Engl., the enlarged calyx after removing the fruit. Natural size (After nature.)

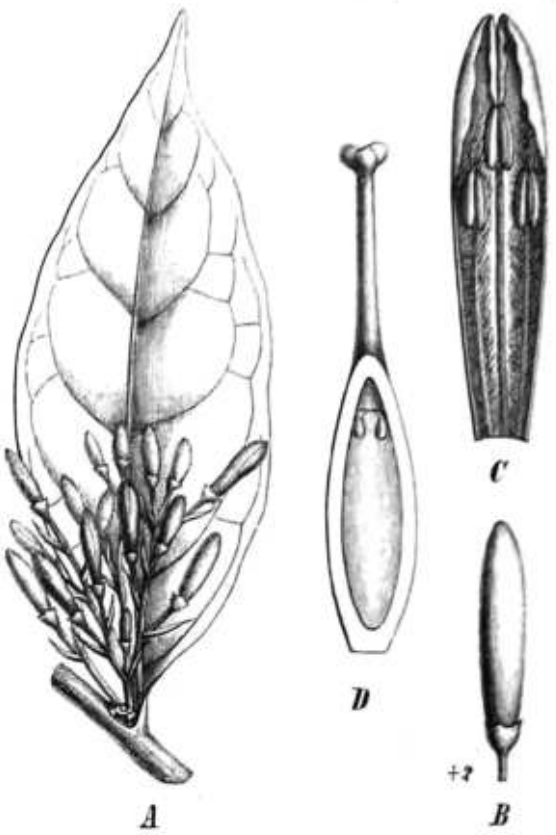

Fig. 152. *Plychopetalum olacoides* Benth. from Brazil. A branch with flowers and inflorescence; B bud: C 2 flower base with 3 stamens; D longitudinal section, showing the placenta with the small ovules almost completely filling the ovary. (After nature and after Miers.)

18. **Olax**. L. (*Spermaxyrum* Labill., *Fissilia* Comm., *Lopadocalys* Klotzsch). Calyx small, cup-shaped, truncate, very enlarged on ripe fruit and loosely surrounding the fruit. Petals 6, more rarely 5, standing on a round, disc-free calyx, free or somewhat fused. Stamens 9-12, rarely less, mostly 3 fertile, between 2 petals each with flat filaments that lie against the petals and elongated anther, mostly 6 sterile, converted into often partial or double-lobed staminodes or vice versa. Ovary free, 1-locular or 3-locular at the base, with 3 ovules hanging from the free placenta. Drupe spherical or elongated, enclosed almost to the top by the enlarged calyx. Seeds hanging on the filiform placenta, with a very small embryo at the apex of the fleshy endosperm. – Glabrous trees, shrubs or subshrubs, sometimes climbing, with double-rowed, entire, sometimes very small leaves and small flowers that stand alone or in short spikes or clusters.

About 30 species in the Old world tropical countries. - A. 3 fertile stamens in the gaps in front of the petals, 5 staminodes in front of the petals - A a. Flowering in racemes: *O. scandens* Roxl. (Fig. 153), climbing, but with a trunk as thick as a man and large, curved spines, with yellowish-green, oblong-ovate or oblong-lanceolate leaves and small, white flowers in upright clusters; distributed in the upper and lower India, as well as on Ceylon and Java. – *O. Wightiana* Wall., Shrub or small tree with elongated egg-shaped leaves and hanging grapes; on Ceylon and

Malacca. – A b. Individual flowers: *O. nana* Wall., Semi-shrubby, without a stem that actually trod above the ground, with rod-shaped branches and elongated lanceolate leaves; in the western Himalayas, Voli Nepal to Punjab. – This section also includes the *O. Benthamiana* Miq shrub, which is hardly 4 m high and occurs in Northern, Southern and Western Australia, with linear or narrow-elongated leaves and *O. aphylla* R. Br. from North Australia with numerous branches covered by small scaly leaves on the rocky coast of North Australia. – Of African species belongs here among others: *O. viridis* Oliv., a small shrub with elliptical, rather blunt leaves and short-stemmed flowers in two-rowed clusters; in Upper and Lower Guinea. – B. 5-6 fertile stamens in front of the petals, 3 staminodes in front of the gaps between the petals - here species from tropical Africa and Madagascar.

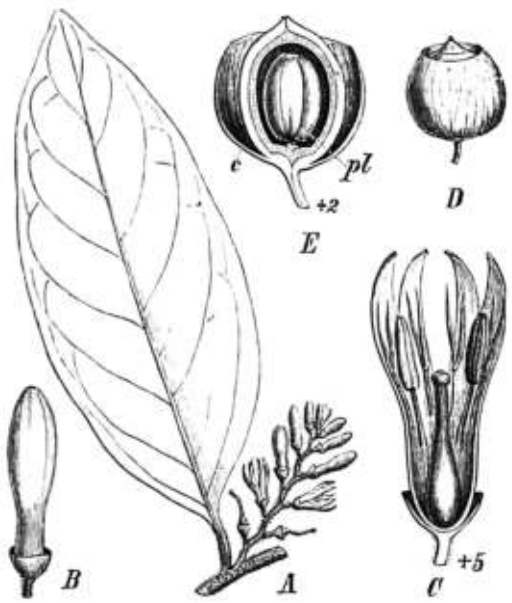

Fig. 153. *Olax scandens* Roxb. A branch pieces with leaves and inflorescence; B bud; C flowers after removal of half a calyx, two petals, a stamen and two staminodes; D fruit; E same in longitudinal section, but without injury to the seed and placenta (pl). c the enlarged calyx. (After nature.)

Fig. 154. A-C *Liriosma Poliliana* Engl. A branch; B longitudinal section through the flower; C Longitudinal section through the ovary - D *L. acuta* Miers, false fruit in longitudinal section, without injury to the seed and placenta (pl). c the calyx, fr the fruit wall [pericarp]. (After nature.)

19. **Liriosma** Pöpp. et Endl. (*Hypocarpus* A. DC., *Dulacia* Vell.) Calyx small, truncated in a cup-shaped manner, combined with the cup-shaped disc, closely surrounding the false fruit when ripe. Petals 6, flap-like, connected in pairs up to the middle. 3 fertile stamens in front of the junction of two petals, with flat, long hairy stamens and elongated ovoid anthers. Staminodes 6 in front of the individual petals, spatulate, with two columns at the apex. Ovary densely hairy, 3-locular at the base, with 3 ovules hanging from the central placenta. Style long, with 3-lobed stigma. False fruit with a fleshy outer layer and crusty pericarp. Seeds with a very thin coat, hanging from the placenta that has sunk into them. Embryo in the apex of the fleshy endosperm

with small, ovoid cotyledons – trees and shrubs with thin, yellow, rod-shaped branches, thin, ovate or ovate-lanceolate leaves and small, short-pedicellate flowers (Fig. 154.)

About 44 species in tropical South America, most not widely distributed.

Opilieae.

Calyx very small, mostly with indistinct limb, not enlarged when ripe. Stamens as many as petals and standing in front of them. Ovary loculate, with 1 (hanging) ovule. Bracts imbricate covering the flowers in racemes or spikes.

A. Stamen filiform.
   a. Petals free ..... **20. Opilia**.
   b. Petals fused in a short 4-lobed whorl ..... **21. Cansjera**.
B. Stamen with short, flat filament ..... **22. Lepionurus**.

22. **Opilia** Roxb. (*Groutia* Guill. et Perr.) Flowers ☿. Calyx small, indistinct 4-5 toothed. Petals 4-5. Stamen 4-5 with filiform filaments and ovate anthers attached to the base and bending. Disc fleshy, starting in 5 thick glands that alternate with the petals. Ovary with 1 ovule hanging from the crown. Style short, with a blunt stigma. Drupe with thin exocarp and crusty endocarp. Embryo linear and almost as long as the endosperm. - Almost climbing, glabrous or somewhat felty shrubs with two-ranked, leathery leaves and axillary racemes of small flowers, which are initially covered by the rounded, shield-shaped bracts, cone-like, but then soon lose the bracts.

Only 4 species, *O. amentacea* Roxb., with oblong-ovate or ovate-lanceolate leaves, well known and widespread in tropical Africa, in the upper and in lower India, on the islands of the Indian archipelago, New Guinea, as well as in tropical Australia. Other species insufficiently known.

21. **Cansjera** Juss. Flower ☿. Calyx very small and indistinctly 4-toothed. Petals 4-5, united in a short 4-5-lobed tube. Stamens fused at the base of the thickened flower axis and alternating with 5 ovate or triangular fleshy disc configurations; filament thin; anthers small, elongated. Ovary ovoid-conical, with 1ovule hanging from the apex of the locule. Drupe with a thin outer layer and crusty endocarp. Small embryo, in the upper part of the fleshy endosperm, with 3 long, flat convex cotyledons – climbing, sometimes thorny shrubs with alternate, short-petioled leaves and small flowers in dense, axillary spikes.

3-4 species in tropical Asia and Australia. Very common from the Middle East to Hong Kong and northern Australia is *C. Rheedii* Gmel., a climbing, evergreen shrub, with sometimes thorny branches, short-stemmed, ovate-lanceolate leaves, yellow flowers, and ellipsoidal, orange-red fruits.

22. **Lepionurus** Blume. Flower ☿. Calyx small, fused with the cup-shaped flower axis, without a clear limb (or is it not there at all?). Petals 4, forming an urceolate tube below on the edge of the disc, glabrous. Stamens with short, flat filaments and ovate anthers located at the base. Ovary with hanging ovules and sessile, 4-furrowed stigma. Drupe with crusty endocarp. Embryo small, many times shorter than the seed, with 3 cotyledons – glabrous shrub with large, elongated, almost sedentary leaves and short racemes standing in axillary clusters, which when

young are cone-like due to the imbricate supporting bracts (similar to 21). Flowers very small, 3 in the axil of the bract.

4 species, *L. oblongifolius* Mast., From eastern Bengal, Khasia and Assam through India to Sumatra.

V. Agonandreae.

Flowers dioecious. ♂ flower with as many stamens as petals. ♀ flower without petals. Ovary with 1 ovule.

23. **Agonandra** Miers. Calyx very small, cup-shaped, short, 4-5 lobed. Flowers with 4-5 thick, glandular outside vested petals and 4-5 stamens in front of them. Filaments filiform; Anthers ovate. Disc with thick, scaly lobes between the stamens. ♀ Flower with scale-shaped disc surrounding the ovary. Ovary ovate, with a thick, disc-shaped stigma – tree with hanging branches, thin, elliptical, pointed leaves and small flowers, which are combined in pairs to form racemes. (Fig. 155.)

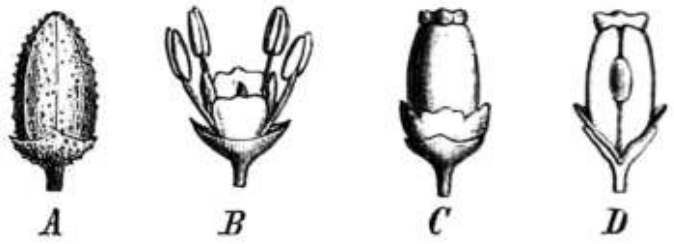

Fig. 155. *Agonandra brasiliensis* Miers. A bud; B ♂ flower after removal of the petals; C ♀ flower. D the same in longitudinal section. (After nature and Miers.)

4 species, *A. brasiliensis* Miers (Páo d'alho do campo) in the Dampos of the Brazilian provinces of Ceara, Minas Geraës and San Paolo.

Addendum.

24. **Harmandia** Baill. Flowers unisexual. Calyx cup-shaped, with entire margins or with 4 small teeth, protruding when ripe. Petals (in the ♀ flowers 6-8), fused into a bell-shaped tube. Flower axis with ring-shaped, notched disc. Stamen 4, as in genus 9 united in a tube. Ovary with 2 or 1 ovules hanging from the short placenta. Stigma 3-lobed. Drupe elongated, with woody endocarp Seeds with thin integument and small embryo at the top of the endosperm. - Tree with petiolate, lanceolate leaves that stand in 2 rows (with stipule) and flowers that stand in short, axillary racemes (see Bulletin de la soc. Linn. De Paris No. 7.)

1 species, *H. mekongensis* Baill., in Laos, in West Africa.

25. **Endusa** Miers. Flower ♂. Calyx small, 5-6 toothed, by stellate hairs shortly felty. Petals 5-7 fused into a bell-shaped tube. Stamens 10-14, fused with the tube; Filaments filiform, half as long as the sections of the tube; Anthers wider than long, with almost spherical pollen grains. Disc indistinct. Ovary almost disc-shaped, 3-5-locular, with imperfect partitions and 1 ovule hanging in each compartment, fruit unknown. – Shrub with milky sap, with short, red-felted vestiture of the young parts, with petiolate, leathery leaves and small, short pedicellate flowers, which are in clusters that are combined into small racemes.

2 species in Peru.

This genus belongs near 17.

Compare several of the species by Th. Valeton (critical overzicht der Olacineae, Groningen 1886) and other genera related to the Olacaceae in the Icacinaceae.