

## PROTEACEAE (H. Sleumer, Leyden)

Trees or shrubs. Leaves spiral or in pseudo-whorls, sometimes subopposite, generally coriaceous, simple or pinnatisect, often dimorphous, entire or toothed, sometimes spiny. Stipules 0. *Inflorescences* mostly axillary or rami- or cauliflorous, or terminal. *Bracts* (potentially) present but mostly small, often minute and very early caducous or barely visible, sometimes large, accrescent and woody (in cone-like spikes). Bracteoles 0-2, small. *Flowers* in racemes, umbels or spikes, the latter sometimes cone-like, not rarely inserted in twos; pedicels of the pairs sometimes connate to various degree. *Flowers* choripetalous (though segments sometimes remain connate or partly so, sometimes with a spathaceous corolla), actinomorphic, sometimes zygomorphic (by one-sided saccate corolla base, oblique torus, disk glands, stigma), mostly bisexual, rarely only seemingly so and in fact unisexual and dioecious. *Buds* generally cylindrical, straight or curved, more or less dilated towards the base, with a mostly clavate or globular apex. *Perianth segments (tepals)* valvate, with a distinctly broadened apex (here called: *limb*), in flower recurved, adhering to each other in the lower portion to various degree, at length mostly entirely free. Torus flat or oblique. *Stamens* 4, epitepalous; filaments connate with the tepals to various degree, sometimes very short; anthers erect, basifixed, 2-celled, introrse, dehiscent lengthwise, connective often prolonged. *Disk* an annular or horseshoe-shaped, flat or oblique gland, or consisting of 4 free or variously united hypogynous glands alternating with the stamens, rarely absent. *Ovary* superior, 1-celled, sessile or stipitate, often oblique; style terminal, thickened at the tip; stigma mostly small, terminal or lateral. *Ovules* solitary or geminate, either orthotropous and pendulous from or nearly from the top of the cell, or anatropous, ascending, inserted at the base of the cell or laterally at the wall, or ovules  $\infty$ , biseriate. *Fruit* dehiscent, *i.e.* a coriaceous or woody follicle or a  $\pm$  dry fruit the pericarp of which splits irregularly into halves to various depth, or indehiscent, *i.e.* a nut or a true drupe, or a  $\pm$  dry fruit with coriaceous pericarp. *Seeds* solitary or in pairs, or  $\infty$  biseriate, sometimes winged; testa membranous, or coriaceous, sometimes stony; albumen 0; cotyledons thin or thick and fleshy, often unequal; radicle short; inferior.

*Distr.* About 60 genera, with at least 1300 *spp.* in mostly tropical or subtropical Africa (incl. Madagascar *c.* 350 *spp.*), Central and S. America (*c.* 90 *spp.*), Asia (20 *spp.*), Malaysia (incl. Palau Isl., New Ireland, New Britain, and the Solomon Isl. *c.* 80 *spp.*, 5 of which also in Australia), Australia (*c.* 750 *spp.*, chiefly in W. Australia, 5 of which also represented in New Guinea), New Caledonia (*c.* 50 *spp.*), New Hebrides (2 *spp.*), extending to New Zealand (2 *spp.*), Fiji and Samoa (2 *spp.*), but not represented in Polynesia proper east of the 'Andesite-line'.

In Micronesia (Palau) there is only one species (the widest distributed one) of the genus *Finschia*.

The family is subdivided in *Persoonioideae* and *Grevilleoideae*, the first of which is restricted to Africa and Australia.

All Malaysian representatives belong to *Grevilleoideae*, a subfamily absent from Africa.

Genera are restricted to one continent with the exception of five genera. *Helicia* is centering in Malaysia but possesses species both in SE.-E. Asia and Australia in a continuous generic area. Four others have disjunct areas and occur both in the SW. Pacific area and in South America, *viz* *Gevuina*, *Oreocallis*, *Orites* and *Lomatia* (fig. 1).

There is very little doubt that *Proteaceae* are among the most ancient of Australian dicotyledonous families and it is tempting to accept the summaries by BERRY (U.S. Geol. Surv., Prof. Pap. 91, 1916, 1-353) and HIRMER (Bot. Jahrb. 72, 1942, 424, 502, 528) who suggest that this family was also common on the northern hemisphere at the close of the Lower Cretaceous, becoming practically cosmopolitan in the Upper Cretaceous, and still maintaining this position in many Tertiary floras.

There seems, however, no unanimity of opinion about the exact identification of many fossils assigned

to the *Proteaceae*, the factual basis on which the discussion of the geographical history of the family should be based. Modern exact methods may yield interesting results.

Of the 9 genera of the family localized in Malaysia none is endemic.

*Helicia* is a Malaysian-centered genus extending southeastwards to E. Australia and northwestwards far into SE. and E. Asia, westwards as far as Ceylon and the Western Ghats, northwards to S. Japan.

*Heliciopsis* occurs in SE. Asia and in W. Malaysia.

*Banksia* is primarily an Australian genus of which one Australian species is known to occur in New Guinea and the S. Moluccas (Aru Isl.).

*Grevillea*, *Macadamia* and *Stenocarpus* occur in E. Malaysia, Australia, and New Caledonia.

*Finschia* with its center of distribution in New Guinea (fig. 7) is apparently absent from Australia, but radiates to the Palau Islands in the north and to the Aru and Solomon Islands and the New Hebrides in the south.

*Oreocallis* is represented in New Guinea (incl. the Aru Isl.), NE. Australia, Ecuador, and Peru.

*Gevuina* occurs in NE. Australia, N. New Guinea, and Chile. The latter two both indicate a very old Austral-American connection as do the genera *Orites* and *Lomatia*, which are absent from Malaysia (fig. 1).

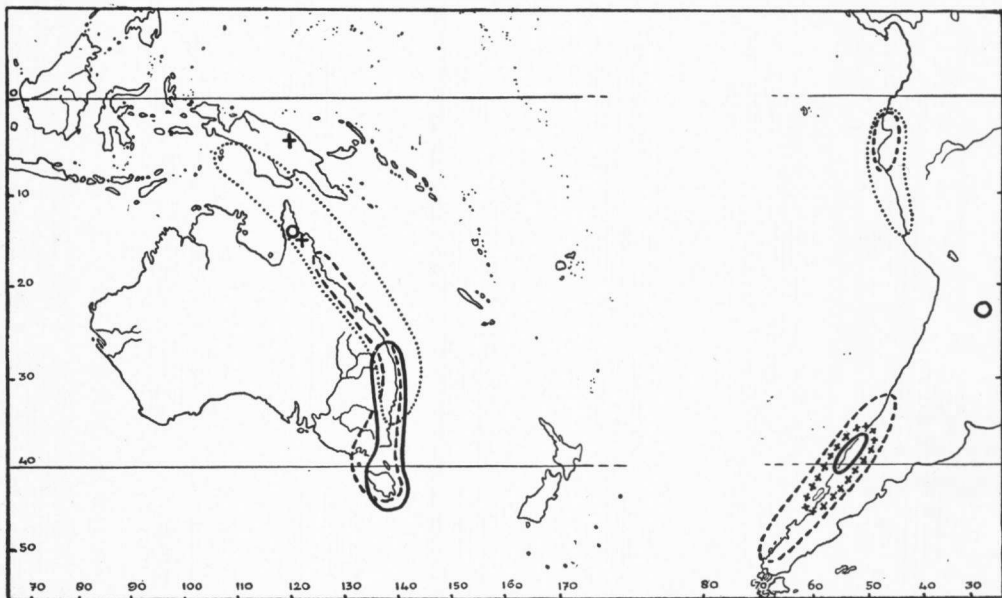


Fig. 1. Distributional areas of the bicontinental Proteaceous *Orites* (—), *Gevuina* (++++), *Lomatia* (---), and *Oreocallis* (.....). For convenience part of the Central Pacific is contracted. See for *Helicia* fig. 12-13.

The alliance of Malaysian *Proteaceae* to those of Australia and SE. Asia is not restricted to the generic level, but shows also a few intimate connections to both areas in certain species. *Banksia dentata*, *Grevillea glauca*, *G. pinnatifida*, *Stenocarpus sinuatus*, and *S. moorei* occur both in NE. Queensland and in New Guinea, *Banksia dentata* occurs moreover in Aru. These species are savannah constituents and their occurrence in the drier parts of New Guinea may be due to a relatively recent dispersal. A similar crossing of the Torres Straits line must be assumed for the genus *Gevuina*, of which two rain-forest trees viz *G. bleasdalei* of NE. Queensland and *G. papuana* once found in N. New Guinea, are closely related to each other.

Malaysian *Proteaceae* are connected with those of SE. Asia by two *Helicias*, viz *H. robusta* and *H. excelsa* which range from the Western Ghats respectively E. Bengal through Burma, Indo-China, and Siam as far as the Philippines respectively Borneo. Being true forest elements which presumably cannot migrate over large distances as quickly as savannah-types apparently are able to perform, we must conclude, that their present area indicates a connection of the SE. Asiatic and Malaysian *Proteaceae* in remote epochs as early as the Lower Eocene, when these countries were still coherent.

The majority of the Malaysian *Proteaceae* as far as they occur in forests, seems to have rather limited areas and are scarce; about 40% have been collected only once. Examples of species with a wide range of distribution, apart from *Helicia robusta* and *H. excelsa* mentioned above, are *Finschia chloroxantha* (Palau Isl.—Aru Isl.—New Guinea—Solomon Isl.—New Hebrides), *Helicia attenuata* (S. Lower Burma—

S. Siam-Malay Peninsula-Sumatra-Java-Bali-Borneo), and *Helicia serrata* (Malay Peninsula-Sumatra-Java-Borneo-Ambon).

Ecology. Although *Proteaceae* show a rather great ecological variability both in many genera and in certain species—a fact which facilitates their cultivation—most Malaysian *Proteaceae* are restricted to climatically wet or everwet areas, i.e. in primary or secondary rain-forests, where they occur usually scattered and belong to the substage of the forest. Species of dry savannah land, as those mentioned above, are sometimes more frequent locally. This agrees with practically all South African *Proteaceae* and the vast majority of the Australian ones, which are markedly xerophytic.

No Malaysian species is known to reach large dimensions.

As to altitude, most genera and most of the species occur below 2400 m altitude in the tropical and montane zones, the highest altitudes being reached by some species of *Helicia*: 2600 m in Celebes, 2650 m in Java, 2840 m in New Guinea, and 3350 m on Mt Kinabalu in N. Borneo.

Some species as *Finschia chloroxantha*, *Oreocallis brachycarpa*, and some *Helicias* are restricted to the tropical lowland.

Species restricted to the seasonal (monsoon) forest area are *Banksia dentata*, *Grevillea glauca*, *G. elbertii*, *G. pinnatifida*, and *Stenocarpus sinuatus*.

Drought-resisting xerophytic *Proteaceae* often show a marked resistance against fire by which they may gain dominance in the savannahs; in Malaysia this has been demonstrated for *Banksia dentata* (fig. 26, 27).

Dispersal. Little is known about the dispersal of fruits or seeds in Malaysian *Proteaceae*. Most of the fruits are rather heavy. Species with edible seeds normally have a hard endocarp (*Finschia*) or stone-hard testa (*Macadamia spp.*). Fruits with holes gnawed in these stony shells by birds or mammals in search for the seed are found in the herbarium. The winged seeds of *Oreocallis brachycarpa*, *Banksia dentata*, and *Stenocarpus spp.* may allow a farther dispersal by wind.

Galls. No galls specific for a distinct genus or species are hitherto known from Malaysian *Proteaceae*, according to DOCTERS VAN LEEUWEN (The Zooecidia of the Netherlands East Indies 1926, 164–168). He described galls from 3 *Helicias*, some causing deformed flowers, others situated on the leaves or the bark of the twig. Nearly all are formed by *Psyllidae*; the galls show peculiar purple and blue shades such as are rarely met with in cecidology.

Floral morphology. The flowers are mostly bisexual. In *Heliciopsis* they are only seemingly so but in fact unisexual, the plant being dioecious; in that case the ovules are not well developed in the ♂ flowers and the ovary is not swollen as is the case in bisexual flowers; in the ♀ flowers the anthers do not contain pollen, although they seem to be perfect in shape and size.

Detailed observations on the morphology of the peculiar flower structure in *Proteaceous* plants have been made and pictured by BENTHAM (J. Linn. Soc. Bot. 13, 1871, 58–64). Unfortunately very few additional observations have been made in nature to verify the effect of these structures in flower-biological respect. Experiments are badly needed in order to discriminate between the agents which are necessary for pollination and those which are accidental. There seems to be a most fascinating and promising field for observation here, which may throw some light on the remarkable fact that the number of fruits set per inflorescence is generally very small as compared with the number of flowers present.

The flowers are similar in general appearance in all genera concerned and are mostly arranged in spike-like racemes, rarely in umbels (fig. 23). Cone-like inflorescences are represented in the Malaysian region only in *Banksia*. Variation in the structure of the flowers concerns the presence or absence of a gynophore, the shape and position of the receptacle and the disk, and the number and position of the ovules. The distinction of the Malaysian genera of *Proteaceae* is mainly based on these characters and the nature of the fruit.

Pollination. The flowers generally contain nectar, sometimes even in abundance. The flowers of all species concerned seem to be typically protandrous, the granular pollen being fully mature in bud and temporarily deposited on the upper part of the style or on the not yet receptive stigma, by which self-fertilization is avoided.

Very little is known about the opening mechanism of the flower. In many genera (not in *Helicia*, except the Australian *H. youngiana*!) the style expands as an elastic bow through a lateral slit of the perianth of the mature bud, the stigma still being held in the limb.

In opened flowers the perianth segments are mostly strongly reflexed and the structure strongly reminds of that in the *Loranthaceae* where actually buds open explosively on touch (or pressure by the beak of honey birds) and the granular pollen is dispersed in the act of explosion. The situation in *Proteaceae* is apparently different in degree, as the opening of the bud goes too slowly to call it really explosive, at least in *Grevillea* (cf. VOGEL, in TROLL & GUTTENBERG, Bot. Stud. 1954, p. 178 and confirmed by Dr L. VAN DER PUIJL).

Flowers in *Grevillea* and some other genera are clearly negative geotropical, and nectar is of thin consistency.

Animals visiting the flowers are apparently sometimes insects (bees, butterflies), but predominantly birds and specially adapted arboreal marsupials (*Phalangeridae*). As far as known to us no detailed observations have been made in Malaysia on any native species. PORCH summarized data on the birds visiting the mostly conspicuously coloured *Proteaceous* flowers (Biol. Gener. 7, 1931, 656; Jahrb. Wiss. Bot. 70, 1929, 190) comprising members of the *Nectariniidae*, *Zosteropidae* and *Meliphagidae*.

A good concise view on the flower biology and pollination (mostly by honey-birds) of West Australian *Proteaceae* was given by O. H. SARGENT (Ann. Bot. 32, 1918, 220–222). He also points attention to the relatively few number of seeds produced per shrub as compared e.g. with *Eucalyptus*. He calls *Banksia* a very shy seeder.

PORSCH (Biol. Gener. 10, 1934, 673–679) also recorded observations on arboreal dwarf marsupials ('honey-mouse') visiting species of *Banksia*, *Grevillea*, *Melaleuca*, *Eucalyptus*, etc. Representatives of this group are distributed from New Guinea through Australia to Tasmania. Though very small as compared with the average size of mammals, they are for flower visitors of a coarse stature. With their thin, terete tongue they are wholly adapted to feed on honey (and insects for proteins like the honey-birds?). Recently they have been observed on New Guinean *Banksias* (see p. 205 and fig. 28).

In Malaysia frequent visits by several kinds of honey-sucking birds were observed on the cultivated *Grevillea banksii* (DOCTERS VAN LEEUWEN, Verh. Kon. Ak. Wet. A'dam sect. 2, 31, 1933, 113; VAN DER PIIL, Met open ogen door stad en land 1950, 84). According to the latter buds elastically open on touch by these birds, and he suggests a special opening mechanism in which the style acts as a spring. In S. America colibris frequent Proteaceous flowers.

It is most remarkable that the number of fruits set per inflorescence is generally very small as compared with the number of flowers and their visitors. Growth of seed and pericarp is apparently correlated and simultaneous; also young fruits are filled by the seed.

Wood Anatomy. BEEKMAN, Med. Proefstat. Boschw. 5 (1920) 156: *Helicia serrata* BL.; DEN BERGER, Determinatietabel van Malesië, Veenman, Wageningen (1949) 52, Med. Proefstat. Boschw. 13 (1926) 25: *Helicia serrata* BL. (hand lens); BAKER, Hardwoods of Australia, Techn. Ed. Ser. 3 (1919) 348, J. Proc. R. Soc. N.S.W. 52 (1918) 364: *Grevillea robusta* A. CUNN.; METCALFE & CHALK, Anat. Dic. 2 (1950) 1165; MOLL & JANS. Mikr. 5 (1934) 380.—JANSSONIUS *l.c.* reports large differences between the 3 *Helicia* spp. examined by him, and *Heliciopsis incisa* (K.&V.) SLEUM. (*Helicia incisa* K.&V.) and *Heliciopsis lanceolata* (K.&V.) SLEUM. (*Helicia lanceolata* K.&V.) which facts lend support to the taxonomic recognition of the genus *Heliciopsis*.—C.A.R.—G.

Uses. On account of their showy inflorescences several *Proteaceae* are used as ornamentals in tropical and subtropical countries, but the everwet Malaysian climate is not very well adapted for growing them. *Grevillea banksii* and *Stenocarpus sinuatus* do very well as ornamental shrubs or small trees. BACKER (Bekn. Flora Java em. ed. 4a, 1942, fam. 79) mentions two other cultivated species viz *Grevillea thelemanniana* v. HÜGEL ex ENDL. and *Petrophila sessilis* SIEB. ex R. & S. I have seen no material from these in Java except from the Botanic Gardens, Bogor. They have apparently been distributed by the Botanic Gardens and occur in the dispatch lists which BACKER accepts as the basis for treating them in his Flora. A few odd specimens therefore, may be found in cultivation, but apparently they have never gained the status of an appreciated garden plant.

Some of the *Proteaceae* possess edible seeds. The Queensland nut, *Macadamia ternifolia* and *M. tetraphylla*, is a good example; it is cultivated in Malaysia and elsewhere. The native *M. hildebrandii* from Celebes may prove to produce also edible seeds. *Finschia chloroxantha* is reported to be cultivated locally by the natives of Bougainville for its edible seeds.

GRESHOFF reported (Kew Bull. 1909, 397–418) the occurrence of cyanogenic substances (glucosides) in seeds of *Macadamia* and SMITH & WHITE (Proc. R. Soc. Queensl. 30, 1918, 87–89) have added positive data from the tissues of other Australian *Proteaceae*. They report that the seeds of *Macadamia whelani*, which are powerfully cyanogenic, are used as food by the aborigines of N. Queensland only after careful preparation. In a later paper (*op. cit.* 32, 1930, 89–91) additional data are communicated; in several species hydrocyanic acid was found to occur in flowers.

From the foresters' point of view *Proteaceae* are not an important family, neither in the composition of the forest nor in yield of timber or adaptability for reafforestation. The only tree used in reafforestation is *Grevillea robusta*; this is also a well-known roadside tree. Some other *Grevilleas* occurring in New Guinea belong to the group called in Australia the 'silky oaks', yielding a valuable timber there.

From Sorong there has been once a rumour that the seeds of *Finschia* would constitute a valuable medicine against leprosy, but no investigations have followed.

The dried leaves of quite a number of Malaysian representatives show distinct yellowish or greenish tinges, characters which are peculiar to aluminium-accumulating plants, and some *Helicias* have in addition blue fruits as found by HALLIER *f.* and later elaborated by E. M. CHENERY (Ann. Bot. n.s. 12, 1948, 121–136; Kew Bull. 1948, 173–183). Flush and galls also show peculiar purple and blue shades.

Taxonomy. The family is divided into two sub-families viz the *Persoonioideae* (Africa and Australia) and the *Grevilleoideae* (SE. Asia–Malaysia–Australia–S. America). All Malaysian *Proteaceae* thus belong to the *Grevilleoideae*. This subfamily is further divided into 3 tribes viz the *Grevilleae* with 6 Malaysian genera (*Finschia*, *Gevuina*, *Grevillea*, *Helicia*, *Heliciopsis*, *Macadamia*), the *Embothriaceae* with 2 Malaysian genera (*Oreocallis*, *Stenocarpus*) and the *Banksieae*, in Malaysia only with *Banksia*.

No precursory work on Malaysian *Proteaceae* as a whole has been done; for New Guinea revisions have been published subsequently by LAUTERBACH (Bot. Jahrb. 50, 1913, 328), DIELS (*l.c.* 54, 1916, 198) and myself (*l.c.* 70, 1939, 125). The genus *Finschia* was recently revised by WHITE (Pac. Sc. 3, 1949, 187). In connection with the present work a revision of the generic status of all Proteaceous taxa reported from regions adjacent to Malaysia has been undertaken (Blumea 8, 1955, 2–95).

The treatment given here should be regarded as tentative due to inadequate data and material, which in turn is partly caused by the apparently rare occurrence of many species. This is illustrated by the fact that 31 species are known from one specimen only; 27 species have been reduced, 16 have been recognized as new. Critical comparison of closely allied species proved often difficult as in many collections fruits are absent. Adequate field notes are also scarce in the herbarium and in several instances the variation of the leaves, specially in those species with dimorphous foliage, can hardly be ascertained from herbarium specimens. Attention of collectors is drawn to the desirability of collecting complete material and making ample notes.

## SCIENTIFIC KEY TO THE GENERA

1. Flowers nearly always pedicelled, in racemes or umbels, spaced on a rather slender rhachis. Styles not hardened and pin-like. Infructescence not cone-like. Bracts small, often caducous or almost absent, never woody with age.
2. Ovary (in *Mal. spp.*) with 2 ovules close together. Fruit globular, ovoid or ellipsoid, with 1-2 seeds, these either or not winged all round (GREVILLEAE).
3. Receptacle very oblique. Disk unilateral, thick,  $\pm$  horseshoe-shaped, entire or 2-lobed.
4. Ovary sessile. Ovules orthotropous and pendulous from or nearly from the top of the cell. Fig. 3.
  1. *Gevuina*
4. Ovary (in *Mal. spp.*) stipitate. Ovules anatropous, ascending, laterally attached to the wall of the cell.
  5. Fruit indehiscent (drupe). Leaves simple. Nerves c. 12-20 pairs, oblique, straight, parallel, ladder-like connected by a distinct, looped intramarginal nerve. Fig. 8 . . . . . 3. *Finschia*
  5. Fruit dehiscent (follicle). Leaves simple or pinnate. Nerves flabellate or pinnate, ascending, otherwise. Fig. 6 . . . . . 2. *Grevillea*
3. Receptacle transverse. Disk actinomorphic, consisting of 4 thick glands either free (distant or approximate) or connate in a cup.
  6. Ovules anatropous and ascendent, inserted at the base of the cell or laterally on the wall. Fruit mostly indehiscent, rarely tardily dehiscent  $\pm$  lengthwise, pericarp not or very rarely differentiated into 2 strata, then showing an outer part (exocarp), which may be  $\pm$  fleshy, and an inner one, which is coriaceous or hard (endocarp). Fig. 15-16 . . . . . 4. *Helicia*
  6. Ovules orthotropous, hanging from, or nearly from, the top of the cell. Fruit various.
    7. Flowers unisexual; plants dioecious. Pollen-exine strongly reticulate when 500  $\times$  enlarged. Drupe; exocarp leathery, rather thin and early dissolved; mesocarp formed by numerous radial  $\pm$  soft fibres; endocarp hard, woody, irregularly reticular-lacunose outside. Fig. 17-18.
      5. *Heliciopsis*
    7. Flowers bisexual. Pollen-exine smooth or nearly so when 500  $\times$  enlarged. Fruit dry, mostly splitting  $\pm$  irregularly lengthwise, then showing the seed which may have a thick stone-hard testa; pericarp not or not distinctly differentiated into 2 strata, the inner one never woody. Fig. 20.
      6. *Macadamia*
2. Ovary with several ovules superposed in 2 rows. Fruit narrow-oblong, with 4 or more seeds, these  $\pm$  overlapping each other with their long unilateral wings (EMBOTHRIAE).
8. Flowers in manifestly peduncled umbels. Fig. 22-23 . . . . . 7. *Stenocarpus*
8. Flowers in racemes. Fig. 24 . . . . . 8. *Oreocallis*
1. Flowers sessile in closely packed, very rich-flowered thick spikes with a stout rhachis, each flower subtended by a broad, hard, persistent bract. Styles hard, pin-like. Infructescence cone-like by thickened woody bracts (BANKSIAE). Fig. 25 . . . . . 9. *Banksia*

ARTIFICIAL KEY TO THE GENERA<sup>1</sup>

1. Leaves with a spiny serrate-dentate margin, simple; underside white-arachnoid-tomentose. Flowers in very dense, erect spikes with persistent, pin-like, wiry styles and hard, persistent, woody bracts. Fig. 25 . . . . . 9. *Banksia*
1. Leaves either not spiny-dentate or the underside not white arachnoid-tomentose. Bracts not persistent and woody-acrescent.
  2. Leaves at least in part in whorls of 3-7. Fig. 20 . . . . . 6. *Macadamia*
  2. Leaves not in whorls, only the uppermost ones of a shoot sometimes rather close.
  3. Flowers in peduncled umbels. Leaves simple or dimorphous, either penninerved or flabellinerved. Fig. 22-23 . . . . . 7. *Stenocarpus*
  3. Flowers in racemes, not in umbels.
    4. Leaves in the pinnate state with a winged rhachis contracted near the insertion of the leaflets. Leaflets sharply dentate, densely ferruginous-pubescent underneath. Fig. 3 . . . . . 1. *Gevuina*
    4. Leaves simple or, if pinnatifid, the pinnation not contracted at the rhachis nodes, hence the rhachis not winged.

(1) It is not possible to frame a satisfactory artificial key to the Malaysian genera on vegetative characters only.

5. Leaves simple, with c. 12–20 pairs of oblique, straight, parallel nerves more or less ladder-like connected by one distinct, looped, intramarginal nerve. Fruit indehiscent. Fig. 7 . . . 3. *Finschia*
5. Leaves simple or pinnatifid, either flabellinerved or penninerved, either with less nerves or these not all distinctly straight, oblique and parallel and ladder-like connected by one distinct, looped, intramarginal nerve.
6. Tepals cohering in opened flowers. Pedicels 2–3 cm. Capsule with 2 series of unilaterally winged seeds. Leaves simple. Fig. 24 . . . . . 8. *Oreocallis*
6. Tepals free, at least in the lower part. Pedicels at most 15 mm. Fruit 1–(2)-seeded. Seed either not winged or wing surrounding the seed. Leaves simple or pinnatifid.
7. Receptacle very oblique. Disk unilateral. Seeds flat, surrounded by a wing. Leaves silky-tomentose underneath, simple and/or pinnatifid. Fig. 6 . . . . . 2. *Grevillea*
7. Receptacle transverse, flat. Disk not unilateral. Seeds thick, not winged. Leaves not silky-hairy underneath.
8. Ovules anatropous, inserted basally or laterally. Pericarp not differentiated in an exo- and endocarp.<sup>1</sup> Leaves always simple. Flowers bisexual. Fig. 15–16 . . . . . 4. *Helicia*
8. Ovules orthotropous, inserted near or at the apex of the ovary, pendulous. Pericarp consisting of three layers. Leaves often (always?) dimorphous. Flowers unisexual. Fig. 17–18.

5. *Heliciopsis*

## 1. GEVUINA

MOLINA, Saggio Chile ed. 1 (1782) 184, 353; LAMK, Dict. 2 (1788) 712 (*Gevina*); JUSS. Gen. (1789) 424; PERS. Ench. 1 (1805) 118 (*Guevina*); ENDL. Gen. 1 (1837) 340 (*Guevinia*); SLEUM. Bot. Jahrb. 76 (1954) 184; Blumea 8 (1955) 5.—*Quadria* R. & P. Fl. Per. Chil. Prod. (1794) 16, t. 33.—*Bleasdalea* F.v.M. Fragm. 5 (1865) 91, *nom. altern.*; DOMIN, Bibl. Bot. 89 (1921) 32.—*Adenostephanus* (non KL.) BENTH. Fl. Austr. 5 (1870) 416.—Fig. 2–3.

Trees or shrubs. *Leaves* spiral, simple or imparipinnate (sometimes with transitions on the same specimen), leaflets dentate. *Flowers* in axillary bracteate racemes or panicles, bisexual, sessile in pairs on a stalk (2 fused pedicels); receptacle (torus) oblique, with a broad unilateral, semi-annular, sometimes nearly 2-lobed disk on the lower side. *Perianth* tubular, manifestly recurved at the globular limb, segments revolute, free to the base. *Stamens* sessile or nearly so, connective not or very slightly produced beyond the anther. *Ovary* subsessile, continuous with a very short stipe as thick as is the ovary; style recurved, clavate, with the stigma in the centre of a large lateral swelling. *Ovules* 2, orthotropous, pendulous from the top of the cell. *Fruit* indehiscent, pericarp hard, leathery or corky. Seed mostly solitary, subglobose; testa nearly crustaceous.

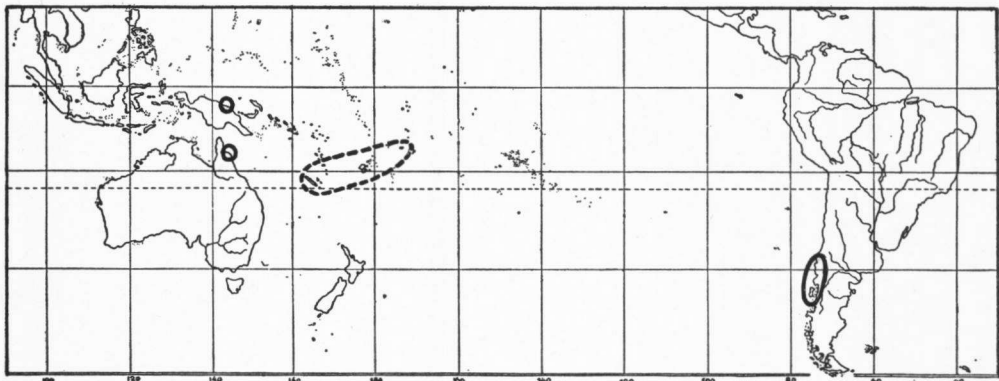


Fig. 2. Distributional area of the genus *Gevuina* MOLINA (—) and the closely allied genus *Kermadecia* BRONGN. & GRIS (---).

(1) Except in *Helicia uganensis* DIELS.

Distr. Three *spp.*, *G. avellana* MOL. in Chile, *G. bleasdalei* (F.v.M.) SLEUM. in NE. Queensland, in *Malaysia* one species. Fig. 1-2.

Note. The distinction between *Gevuina* MOL. and *Kermadecia* BRONGN. & GRIS is based on minor characters only, i.e. the not or slightly recurved perianth limb and the apparently terminal stigma of the latter. The area of *Kermadecia* with 7 *spp.* in New Caledonia, 1 *sp.* in the New Hebrides, 2 *spp.* in Fiji (one of them also in Samoa) is situated between the two partial areas of *Gevuina*, as shown in Fig. 2.



Fig. 3. *Gevuina papuana* (DIELS) SLEUM. a. Habit,  $\times \frac{2}{3}$ , b. pair of flowers, the left one without perianth, the right one complete,  $\times 4$ , c. pair of flowers after anthesis showing the pistils,  $\times 4$ , d. insertion of ovary with disk gland,  $\times 14$ , e. the same, lateral view, f. apex of perianth segment (limb) with stamen,  $\times 10$  (after LEDERMANN 8412).

1. *Gevuina papuana* (DIELS) SLEUM. *Blumea* 8 (1955) 6.—*Euplassa papuana* DIELS, Bot. Jahrb. 54 (1916) 200; SLEUM. *l.c.* 70 (1939) 126, *in nota*; *ibid.* 76 (1954) 195.—*Bleasdalea papuana* (DIELS) DOMIN, Bibl. Bot. 89 (1921) 586 *in nota*.—Fig. 3.

Slender tree, 15–20 m; bark brown. Branchlets dark ferruginous-tomentose. *Leaves* simple near the base of the branchlets, 10–15 by 3–4 cm (*ex* DIELS), higher ones imperfectly 3-lobed, the upper imparipinnate with 4–5, oblong-lanceolate, acuminate leaflets 6–8 by 1½–2½ cm, terminal leaflet 13 by 4 cm, basal leaflets 2 mm petioled, upper leaflets sessile; rhachis winged between the leaflets; pinnate leaf incl. petiole 22–25 cm long, densely ± appressed rusty-tomentulose beneath in mature specimens, initially so above but very soon glabrescent except the midrib, sharply serrate; lateral nerves (6–)8–10(–12) pairs, ascending and obscurely inarched along the edge, slightly prominent above, distinctly so beneath; veins ± densely

reticulate, little raised on both faces. *Racemes* solitary, axillary, erect, 8–9 cm, the rather stout rhachis, the pedicels and perianth densely ferruginous-tomentose. Bracts small, ± caducous, ± 1 mm. Fused pedicels 2½–3 mm each bearing a very oblique, not thickened torus at the top. *Perianth* 9–10 mm, brownish-yellow, limb globose, recurved, 1½ mm across. Anthers ovate, 1 mm, whitish. Disk 2-lobed. Ovary and style glabrous, blackish when dry. Style 8 mm. Fruit unknown.

*Distr. Malaysia*: N. New Guinea (Sepik region: Hunstein Mts), once found.

*Ecol.* Open mountain-forest with many epiphytic ferns, 1050 m. *Fl.* Aug.

*Note.* Certainly close to *G. bleasdalei* (F.v.M.) SLEUM. from NE. Queensland, which differs by its always pinnate leaves, an entire disk and a shorter ± crisped tomentum.

On the only specimen still in existence in the Berlin Herbarium no simple leaves are present.

## 2. GREVILLEA

R.BR. *ex* KNIGHT, Prot. (1809) 120 (*Grevillia*); Trans. Linn. Soc. 10 (1810) 167.—Fig. 4–6.

Trees or shrubs. *Leaves* spiral, simple or pinnate, various in shape, sometimes in one specimen. *Racemes* mostly in a terminal or axillary panicle, or solitary; indumentum consisting of appressed hairs attached in the centre, rarely with spreading hairs forked at the base or clustered. Bracts minute, mostly early caducous, sometimes apparently absent. *Flowers* solitary or in pairs, on free pedicels along the rhachis. *Perianth* tube mostly recurved under the limb or straight, limb ± globular, usually oblique, segments coherent at the limb long after the tube has slit open. *Anthers* ovate, sessile in the base of the limb, *i.e.* in the concave upper part of the segments; connective not or scarcely produced beyond the anthers. Disk annular or semi-annular, mostly entire, sometimes ± bilobed. *Ovary* stipitate or rarely sessile, with 2 anatropous *ovules* laterally attached about the middle of the cell; style filiform, usually long and protruding from the slit on the lower side of the perianth tube before the apex is free from the limb, accrescent during and after anthesis, ultimately straightened and erect, ± dilated at the top into a straight, oblique or lateral disk-like apex bearing the small stigma in its centre. *Fruit* a follicle, usually oblique, coriaceous to nearly woody and opening along the adaxial (ventral) margin, rarely opening in 2 almost free valves. *Seeds* 1 or 2, flat, orbicular or oblong, mostly bordered all round by a membranous wing.

*Distr.* About 170  *spp.*, mostly in Australia, 9 in New Caledonia, in *Malaysia* 4 native  *spp.*, 2 of which endemic, the 2 others also represented in Australia.

*Ecol.* In Australia mainly xerophytic shrubs or small trees; a few are large trees found in the rain-forests of subtropical and tropical E. Australia. The Malaysian representatives occur both in rain-forests and in dry savannah-forests, from the lowland up to 1600 m.

*Use.* The timber of some species which reach large dimensions in the NE. Australian rain-forests is known as 'silky oak'. See further under *G. robusta*.

*Note.* KNIGHT derived his text from the MS of R. BROWN and wrote consistently *Grevillia*; R. BROWN himself, a year later corrected this to *Grevillea* and as an author he had the right to do so.



## KEY TO THE SPECIES

1. Ovary hairy.
2. Ovary densely villous. Leaves deeply pinnatifid or pinnate with 3–11 broadly linear or lanceolate segments. Perianth c. 2 cm long . . . . . 1. *G. banksii*
2. Ovary silvery-silky. Leaves simple, 3–5-plinerved, in young specimens or coppice shoots 3–5-lobed. Perianth 6–8 mm long. . . . . 2. *G. papuana*
1. Ovary glabrous.
3. Leaves greyish to silvery permanently dense-silky on *both* faces . . . . . 3. *G. glauca*
3. Leaves glabrous or laxly hairy, finally glabrous above.
4. Leaves always pinnate, c. 11–21 pinnatifid, their ultimate segments up to 1½ cm wide. . . . . 4. *G. robusta*
4. Leaves simple, if pinnatifid the ultimate segments at least 2½ cm wide.
5. Leaves lanceolate, acute. Fruit c. 1½–2 cm long. Perianth lobes not carinate, 6–7 by 1½ mm. Inflorescence evenly silky. Bud terete 1 mm diam. at the base . . . . . 5. *G. pinnatifida*
5. Leaves elliptic-oblong to obovate, blunt, rounded to emarginate. Fruit c. 2½–3 cm long. Perianth lobes distinctly carinate, c. 10–12 by 1¼ mm at the base. Inflorescence with rusty peltate hairs sprinkled on the silky pubescence. Buds angular and nearly 2 mm diam. at the base. 6. *G. elbertii*



Fig. 4. *Grevillea banksii* R.BR. Flowering and fruiting in the Mountain Garden, Tjibodas, W. Java, Oct. 1936.

1. *Grevillea banksii* R.BR. Trans. Linn. Soc. 10 (1810) 176; BENTH. Fl. Austr. 5 (1870) 434; BAIL. Queensl. Fl. 4 (1901) 1336; BUYSMAN, Flora 106 (1913) 11; DEN BERGER, Trop. Natuur 6 (1917) 102, f. 3; CORNER, Ways. Trees 1 (1940) 518, f. 175; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 79, p. 3; BRUGGEMAN, Ind. Tuinb. (1940) 240, f. 241.—Fig. 4.

A tall shrub or slender tree (1½–)3–8 m; crown lax; branches and inflorescences softly ferruginous-tomentose. Leaves coriaceous, deeply 1-pinnatifid or 1-pinnate (but here and there a small leaf undivided) with 3–11 broadly linear to lanceolate segments, obtuse or mucronate, with re-

curved margins, glabrous above, ferruginous-silky underneath, the whole leaf 10–25 cm long incl. the petiole 3–5 cm, segments 5–10 by 1½–2/3 cm, midrib prominent, nerves pinnate, rather obscure. Racemes terminal, erect, dense, secund, 5–10 cm, solitary or 2–3 on a terminal leafless peduncle. Flowers yellowish or almost white, then yellowish near the top, sometimes greenish or red. Pedicels tomentose as is the rachis, (4–)6–8(–10) mm. Perianth tomentose outside, glabrous inside, tube 13–20 by 3–4 mm, contracted under the limb, the segments finally revolute. Torus transverse or nearly so. Disk prominent, semi-annular, ± lobed. Ovary sessile, densely villous; style ± 2½ cm at

anthesis, accrescent up to 5 cm, glabrous, clavate under the very oblique or laterally convex disk-like stigma. *Fruit* obliquely ovoid, compressed, almost acute,  $1\frac{1}{2}$ – $2\frac{1}{2}$  cm long. *Seeds* narrowly winged.

*Distr.* A native of Queensland, cultivated in Java and the Malay Peninsula as an ornamental or as a shade tree, 250–2000 m. *Fl.* Jan.–Dec.

*Notes.* DEN BERGER says that the shade given by *G. banksii* is too light for cultures of coffee and thatalang grass grows well under it, becoming long and soft. Cyanophoric glucosides are found in the perianth segments, ovaries and capsules.

2. *Grevillea papuana* DIELS, Bot. Jahrb. 54 (1916) 205.—*G. subargentea* WHITE, Proc. R. Soc. Queensl. 34 (1922) 24; J. Arn. Arb. 10 (1929) 209; SLEUM. Bot. Jahrb. 70 (1939) 128.

Shrub to medium-sized tree, 7–20 m, with a large, dense crown and erect branches; bark thin, grey or light brown with small brown pustules or vertical fissures; branchlets terete, appressed whitish- or greyish-pubescent at the tips. *Leaves* on coppice shoots or young specimens deeply pinnatifid into 3–5 lobes, c. 30 cm long, lobes  $1\frac{1}{4}$ – $2\frac{1}{2}$  cm broad; blades of adult trees simple or slightly lobed, narrow-oblong to lanceolate or lanceolate-elliptic, sometimes slightly falcate, long-acuminate, tipped by a minute gland, tapering at the base into a somewhat flattened petiole  $1\frac{1}{2}$ – $2$  (– $2\frac{1}{2}$ ) cm long, 10–20 by  $2\frac{1}{2}$ – $5$  (– $7$ ) cm, coriaceous to subcoriaceous, glabrous, shining, and green-olivaceous above, the undersurface rufous-silky initially, changing greyish or whitish with age, hairs  $\pm$  long and appressed, flabelli-5-nerved, veins  $\pm$  long and appressed, flabelli-5-nerved, veins and veinlets very oblique and prominent-reticulate on both faces. *Panicle* terminal, 10–16 (–20) cm, consisting of several greyish-sericeous, upwards curved peduncled racemes 6–8 cm long. Bracts minute, pubescent, caducous. Pedicels mostly in twos, 3–5 mm. Torus slightly oblique. *Perianth* tubular, globose at the limb ( $1\frac{1}{2}$  mm), densely silvery appressed-pubescent outside, glabrous inside except the velutinous base, incl. the limb 6–8 mm, sulphur-yellow to greenish-white or cream. Disk semi-annular, glabrous. Ovary up to 1 mm stipitate, densely whitish-silky, nearly tomentose; style slender, curved, glabrous. *Fruit* compressed-ellipsoid, inequilateral, crowned by the style-base, glabrous, 3–5 mm pedicelled, when ripe c.  $2\frac{1}{2}$  by  $1\frac{1}{2}$ – $1\frac{4}{5}$  cm.

*Distr. Malaysia:* New Guinea (not yet found in the Vogelkop).

*Ecol.* In mountain-forest or in second-growth on rocky, deforested slopes or dry ridges, also in dry savannah-forests, occasionally common in grasslands, 500–1600 m, descending along stony river-banks of the Rouffaer River to 350 m, once found on coastal sands. *Fl.* (Jan.–)Aug.–Nov.

*Use.* Wood white to pale straw or pink; rays conspicuous.

3. *Grevillea glauca* KNIGHT, Prot. (1809) 121; SLEUM. Bot. Jahrb. 70 (1939) 128; RAND & BRASS, Bull. Am. Mus. Nat. Hist. 77 (1940) 358.—*G.*

*gibbosa* R.BR. Prod. (1810) 380; Trans. Linn. Soc. 10 (1810) 177; BENTH. Fl. Austr. 5 (1870) 463; F.v.M. Fragm. 6 (1868) 210; HEMSL. Bot. Chall. 1 (1885) 186; F.v.M. Descr. Not. 2 (1886) 29; BAIL. Fl. Queensl. 4 (1901) 1344; LAUT. Bot. Jahrb. 50 (1913) 329.

Tall shrub or small tree, 4–8 m; bark hard, rough, blackish; all parts soft-tomentose by very short hairs, silky on the young shoots and persistently so on both faces of the leaf. *Leaves* simple, entire, ovate-lanceolate, acuminate, obtuse at the very apex by a terminal gland, tapering into the petiole, brown when young, grey when adult, in dry state between brown and grey, dull, (8–)10–15 by ( $2\frac{1}{2}$ –)3– $4\frac{1}{2}$  cm; midrib somewhat prominent on both faces, nerves pinnate 10–15 pairs, straight, ascending and  $\pm$  parallel to each other, with numerous oblique indistinct primary veins on both faces; petiole 1– $1\frac{1}{2}$  cm, pubescent. *Racemes* dense, 7–15 cm, shortly peduncled, usually 3 together at the end of the branches, forming a loose,  $\pm$  erect panicle; rachis slender. Pedicels partly in pairs, 2–3 mm. Bracts narrow, minute, early caducous. *Perianth* tube slender, revolute under the globular limb, yellowish to greenish-white, 4–5 mm long. Torus small. Disk very prominent, semi-cupular, truncate,  $\pm$  2-lobed. Ovary glabrous, shortly stipitate; style 6–7 mm, filiform; stigma conical, straight. *Fruit* globular or nearly so, oblique, somewhat applanate, ( $2\frac{1}{2}$ –)3– $4\frac{1}{2}$  by 3 cm, dehiscing with 2 woody, hemispherical valves. *Seeds* 1 or 2, broadly winged,  $2\frac{1}{2}$  cm diam.

*Distr.* NE. Queensland; in *Malaysia:* NW. and S. to SE. New Guinea, Moluccas (Aru Islands).

*Ecol.* In open savannahs of low *Melaleuca*, often associated with *Banksia dentata*, apparently more common in the savannah-forest substage, occasionally common on sour grey soils, at low altitudes. *Fl. fr.* Jan.–Dec.

*Uses.* Wood dark brown, prettily marked, close-grained and hard, of a greasy nature which prevents it shining when polished.

*Vern. Kawoj*, NW. New Guinea.

4. *Grevillea robusta* CUNN. ex R.BR. Prot. Nov. (1830) 24; BENTH. Fl. Austr. 5 (1870) 459; BAIL. Fl. Queensl. 4 (1901) 1342; DOMIN, Bibl. Bot. 89 (1921) 35; HEYNE, Nutt. Pl. (1927) 588; BURK. Dict. (1935) 1111; CORNER, Ways. Trees 1 (1940) 518; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 3; FRANCIS, Austr. Rain-forest Trees (1951) 97.—Fig. 5.

Handsome tree, 10–25 (–40) m, with robust trunk when old; bark greyish-brown, rugged, fissured; young branches rusty-tomentose. *Leaves* pinnate with about (4–)10–20 pinnatifid pinnae, fern-like, the secondary lobes or segments entire or again lobed, lanceolate or rarely linear, terminal one mostly longer than  $2\frac{1}{2}$  cm, margins recurved, upper surface glabrous or sprinkled with appressed hairs and obscurely veined, undersurface brownish-, later whitish-silky; the whole leaf 15–20 cm long and nearly as wide, the  $1\frac{4}{5}$ –7 cm long petiole included. *Racemes* secund, many-flowered, 7–12 cm, solitary or short-paniculate on very short,

leafless, tomentulose branches on the old wood; rhachis stoutish, glabrous. Pedicels slender, c. 1 cm long, glabrous. *Perianth* glabrous in- and outside, tube c. 6–9 mm, scarcely dilated at the base, revolute under the 3 mm ovoid limb, orange to golden-yellow or golden-brown in colour. Torus slightly oblique. Disk prominent, semi-annular. Ovary glabrous, stipitate; style c. 1½ cm, the stigmatic disk somewhat oblique with a central cone. *Fruit* broad, very oblique, boat-shaped, pointed, ± 1½ cm long. *Seeds* winged all round.

strong evaporation. On the whole it does best under seasonal conditions at average altitude, preferably 500–1600 m, though cultivation is possible from low altitude to c. 2000 m; reported to be frost-resistant on Mt Tengger at 2000 m. Seeds should be soaked one day before being sown to speed up germination which follows in c. 2–3 weeks, without soaking beforehand it takes 1½–2 months (DE VOOGD *l.c.* 31, 1938, 241). Growth is quick according to JAPING *c.s.* (*l.c.* 29, 1936, 424–428), depending on the quality of the soil



Fig. 5. *Grevillea robusta* CUNN. as a roadside tree along the boundary of a montane plantation (photogr. W. F. WINCKEL).

**Distr.** A native of E. Australia (Queensland and N. New South Wales), commonly planted all over the tropics and subtropics as roadside or ornamental tree, as a shade-tree and wind-break in tea- or coffee-estates, and in reforestation.

**Ecol.** Already long ago introduced in Malaysia and used as a roadside tree. It was formerly also used rather extensively as a shade-tree in tea- and coffee-plantations, but this practice has been abandoned as it is assumed that the roots and stumps left after felling disperse dangerous root fungi. It shows a rapid growth and some resistance against wind which capacities are used by the Forestry Service for reforestation on bad, bare or eroded soils in the montane zone, either in pure or mixed stands. Results in Bali were rather promising (DE VOOGD, *Tectona* 28, 1935, 461). The species shows a great adaptability to various climates; COSTER (*Tectona* 30, 1937, 16) says that whereas it stands severely in Australia it grows also under tropical everwet conditions; at Bogor it was classified as a plant with a rather

seedlings reach about 14–20 m in 9–11 years. In Djakarta it fails to flower. *Fl.* Jan.–Dec., *fr.* Sept.–Jan.

**Uses.** Wood with prominent rays, of a light pinkish colour to reddish-brown, light, elastic, durable, easy to work, used for tea-boxes and cabinet-work, excellent for staves of casks, not resistant to termites.

**Vern.** *Silky oak*, Australia, *salamandar*, S.

**Note.** Cyanophoric glucosides have been found in the pistil, ovary, and seed.

5. *Grevillea pinnatifida* BAIL. *Occas. Pap. Queensl. Fl.* (1886) 6; *Syn. Queensl. Fl. Suppl.* 2 (1888) 52; *Queensl. Fl.* 4 (1901) 1343, t. 58; WHITE, *Proc. R. Soc. Queensl.* 34 (1922) 24; J. Arn. Arb. 10 (1929) 209; *Contr. Arn. Arb.* 4 (1933) 21; SLEUM. *Bot. Jahrb.* 70 (1939) 128; FRANCIS, *Austr. Rain-forest Trees* (1951) 389, 394.—*G. edelfeltii* F.v.M. *Descr. Not.* 2 (1885) 9, *nom. nud.*; LAUT. *Bot. Jahrb.* 50 (1913) 329.—*Kermadecia pinnatifida* BAIL. *Cat. Queensl. Woods*



Fig. 6. *Grevillea elbertii* SLEUM. a. Habit,  $\times \frac{2}{3}$ , b. bud,  $\times 5$ , c. flower,  $\times 3$ , d. stamen in bud,  $\times 10$ , e. pistil,  $\times 3$ , f. apex of the style with punctiform stigma,  $\times 8$ , g. capsule, slightly less than nat. size (a-f. after bb. 19710, g. after ELBERT 3475).

(Lond. Colon. Ind. Exhib. 1886) 69.—*Grevillea* sp. F.v.M. Vict. Nat. 1 (1885) 168, *nota*.

Medium-sized tree, up to 15 m; bark grey, hard, scaly; branches erect, the tips subangular and velvety with rusty brown hairs. *Leaves* at the twigs simple, lanceolate, acute or bluntish-emarginate, tapering into the petiole, c. 12–15 by 2½–3½ cm, glabrous above, rusty to dark greyish or silky beneath, with c. 10–15 straight, ascending, pairs of nerves prominent reticulate specially beneath; petiole c. 1½–2 cm. *Panicle* silky-white, 7–12 cm long; racemes 3–9 cm, bearing 2 mm pedicelled, greenish-white, fragrant solitary or geminate flowers. Bracts not seen, apparently very early caducous. Torus slightly oblique. *Perianth* silky outside, glabrous inside, 6–7 mm, segments ½ mm broad, linear, limb globose. Disk broad. Ovary 1 mm stipitate, glabrous. Style filiform, stigma lateral, somewhat dilated. Follicle oblong, coriaceous, 1½–2 by 1–1¼ cm, compressed, tipped by the style-base. *Seeds* 2, oblong, bordered all round by a membranous wing.

Distr. NE. Queensland; in *Malaysia*: SE. New Guinea (Astrolabe Range; Wassi Kussa River).

Ecol. Both in primary and secondary rain-forest fringing rivers and in dry savannah-forest, common, up to 300 m. *Fl.* Dec., *fr.* Dec.–Jan.

Uses. Wood of a pinkish colour, close in grain and very prettily marked, useful to coopers and cabinet-makers, the larger trees used commercially in NE. Queensland.

Note. BAILEY *l.c.* described from Queensland besides the simple leaves also pinnatifid leaves from young plants and barren shoots with 1–4 pairs of lobes and often exceeding 45 cm in length. These have not yet been collected in New Guinea.

6. *Grevillea elbertii* SLEUM. *Blumea* 8 (1955) 2.—Fig. 6.

Tree 10–17 m. Branchlets terete, ferruginous-sericeous at the tips. *Leaves* simple, obovate-oblong or obovate or oblong-elliptic, ± rounded at the apex, sometimes retuse, with a terminal, minute gland, cuneate and tapering into the petiole, coriaceous, glabrous and greenish-olivaceous above when dry, younger ones golden-ferruginous silky beneath, partially glabrescent at full maturity and then brownish beneath, entire, undulate at the margin, (5–)6–12(–18) by 2½–7 cm, midrib prominent on both sides specially beneath; main nerves 7–9(–10) pairs, rather straight, ascending, anastomosing near the edge, prominent on both faces, additional intermediate ones less distinct, veins and veinlets very oblique, forming a slightly prominent net on both surfaces; petiole stoutish, 1–1½ cm. *Panicles* terminal, short-peduncled, c. 12–15 cm, consisting of several divaricate many-flowered short-peduncled racemes, inferior ones of which 6–8(–10) cm, greyish silky sprinkled with additional, peltate, rusty hairs. Bracts minute, very early caducous. Pedicels stoutish, solitary or in twos, 2–3 mm. Torus slightly oblique. *Perianth* light-greenish, greyish-sericeous outside, papillose inside, c. 10–12 mm incl. the globose limb, manifestly recurved below the limb, angular by the carinate segments, 1¼ mm broad at the base. Disk semi-annular. Gynophore stout, 3 mm, glabrous as are the ovary and the style; style rather slender, bearing a large, lateral stigma. *Follicle* compressed, obliquely ellipsoid, c. 3 by 2 cm, on a 3–5 mm stoutish stipe; fruit-pedicel 4–5 mm.

Distr. *Malaysia*: SE. Celebes (P. Kabaena) and E. Central Celebes (Malili).

Ecol. In dry bush-formation on crystalline slate, from the sea-shore up to 900 m, on hilly ground, said to be scattered and rare. *Fl.* *fr.* Oct., June.

Uses. The fruit is said to have a bitter taste. Vern. *Lampia*, Luwu language, Malili.

### 3. FINSCHIA

WARB. Bot. Jahrb. 13 (1891) 297; WHITE, Pac. Sc. 3 (1949) 187.—Fig. 7–11.

Trees, trunk buttressed, often raised on stilt-roots. *Leaves* simple, entire, nerves pinnate, ± straight, parallel, rather numerous, distinctly connected by a ± looped intramarginal vein. *Racemes* axillary or ramiflorous. Pedicels solitary or in twos, free or united in the lower half. Bracts minute, mostly very early caducous. *Perianth* segments soon free, curved, limb subglobose. Stamens sessile or nearly so in the concave limb; connective broad, not produced beyond the anther-cells, the latter slightly divergent towards the base. Torus oblique. Disk fleshy, entire, horseshoe-shaped or nearly annular. Ovary stipitate. Style slender or narrowly clavate, usually long and protruding from the slit in the abaxial side of the perianth tube in the later bud-stage, stigma terminal, pyramidal. Ovules 2, anatropous, laterally attached to the protruding wall. *Fruit* an oblique-globular or compressed-globular drupe; exocarp rather thin, fleshy; endocarp thick, bony, rough. Cotyledons 2, thick and fleshy.

Distr. With 4 *spp.* centering in New Guinea, one extending from the S. Moluccas (Aru Isl.) through New Guinea to Micronesia (Palau) and Melanesia (Solomon Isl. and New Hebrides). Fig. 7.

Note. The genus combines the characters of the flower of *Grevillea* with those of the fruit of *Helicia* sect. *Cyanocarpus*.

KEY TO THE SPECIES

- 1. Leaves rufous-tomentose underneath.
- 2. Inflorescence rather lax and ± interrupted. Flowers incl. pedicel 16–18 mm long. Petiole rather thick and short, 1–1½(–2) cm by 3–4 mm, nearly winged to the base by the decurrent blade. Intermediate nerves rather distinct . . . . . 1. *F. rufa*
- 2. Inflorescence dense, not interrupted. Flowers incl. pedicel 10–12 mm long. Petiole relatively slender, (1½–)2–3 cm by c. 2½ mm, only winged by the decurrent blade in the upper half. Intermediate nerves indistinct or absent . . . . . 2. *F. carrilii*
- 1. Leaves glabrous from the beginning or nearly so.
- 3. Flowers and pedicels ferruginous-tomentose. Ovary densely hairy . . . . . 3. *F. ferruginiflora*
- 3. Flowers and pedicels laxly ferruginous-silky in the bud-stage, glabrescent when fully developed. Ovary glabrous . . . . . 4. *F. chloroxantha*

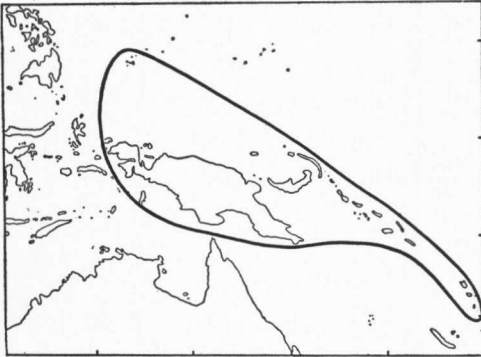


Fig. 7. Distribution of the genus *Finschia*.

1. *Finschia rufa* WARB. Bot. Jahrb. 13 (1891) 298; K. SCH. & LAUT. Fl. Schutzgeb. (1901) 297; LAUT. Bot. Jahrb. 50 (1913) 334; DIELS, *l.c.* 54 (1916) 205; WHITE, Pac. Sc. 3 (1949) 188.—*Grevillea rufa* SLEUM. Bot. Jahrb. 70 (1939) 128.—Fig. 8.

Tree c. 15–18 m high; branches terete, densely rufous-tomentose at the tips. *Leaves* broadly oblong to obovate-oblong, obtuse to nearly rounded at the apex, broadly attenuate at the base and almost decurrent to the base of the petiole, coriaceous or subcoriaceous, glabrous except the midrib and greenish-olivaceous above when dry, ± densely rufous-tomentose all over the undersurface specially on the midrib and the nerves, (25–)28–35 by (8–)11–13(–17) cm; midrib very prominent beneath, slightly so above, nerves 15–20(–25) pairs, somewhat prominent above, distinctly raised beneath, with more less distinct ones between them, veins ± oblique or irregular, a little prominent underneath, veinlets dense finely reticulated above; petiole thick (3–4 mm across), rufous-tomentose, 1–1½(–2) cm. *Racemes* pendulous, axillary, mostly ramiflorous, 17–40 cm incl. the 3–4 cm long peduncle, all over rufous-tomentose. Bracts minute, ovate-acuminate, tomentose, subsistent. *Flowers* laxly, ± interruptedly arranged. Pedicels at anthesis 7–8 mm. *Perianth* golden yellowish-brownish when fresh, glabrous inside, the tube at anthesis 9–10 mm incl. the globose limb (2 mm). Ovary laterally

inflated, seated obliquely on a 3–5 mm long stipe, rufous-tomentose as are the stipe and the lower half of the style. Style 7 mm, straight, club-shaped, respectively apically dilated into a straight cone, with a terminal minute stigma. Disk horseshoe-shaped. Fruit unknown.

Distr. *Malaysia*: N. New Guinea (Morobe Distr.: Mt Sattelberg).

Ecol. In forest or open bush, c. 840 m. *Fl.* March–April.

Note. Though this species is very close to the next one, the 4 collections known agree exactly.

2. *Finschia carrilii* (SLEUM.) WHITE, Pac. Sc. 3 (1949) 188.—*Grevillea carrilii* SLEUM. Bot. Jahrb. 70 (1939) 128.

Tree 12–14 m; bark grey-brown, fissured vertically; branchlets terete, the tips rusty-tomentose. *Leaves* obovate-oblong, ± rounded at the apex, cuneate at the base, but not decurrent on the petiole, subcoriaceous to firmly chartaceous, glabrous above except the midrib, ± dark rufous-tomentose beneath specially on the midrib and the nerves, dark olivaceous above when dry, (13–)18–28 by 6–9(–10½) cm, midrib thick and prominent underneath, a little raised above, nerves 14–24 pairs, veins and reticulate veinlets clearly discernible in dried specimens, all slightly prominent above, more manifestly so beneath; petiole tomentose, (1½–2)–3 cm by c. 2–3 mm. *Racemes* mostly ramiflorous, very densely flowered, 24–30 cm incl. a 2–3 cm long peduncle, all over rufous-tomentose. Pedicels mostly in pairs, slender, 4–5 mm. *Flowers* golden-yellow tipped brownish-orange when fresh. *Perianth* segments 7–8 mm long, glabrous inside. Disk very prominent, horseshoe-shaped or almost annular, nearly glabrous. Ovary densely rather long rufous-hairy, on top of a glabrescent 3 mm long stipe. Style glabrous, grooved, gradually thickened towards the top, said to be bright yellow-green when fresh; stigma obtusely pyramidal, deep green alive. *Fruit* ovoid-compressed when nearly ripe, green, ± 3 by 2½–3 cm, c. 2 cm thick, on a stout stipe 3 by 2 mm; pedicel 8–10 by 2½ mm.

Distr. *Malaysia*: SE. New Guinea (Koitaki near Port Moresby, and Milne Bay).

Ecol. In rain-forest at c. 450 m. *Fl.* April.

Use. Wood creamish to straw-coloured.

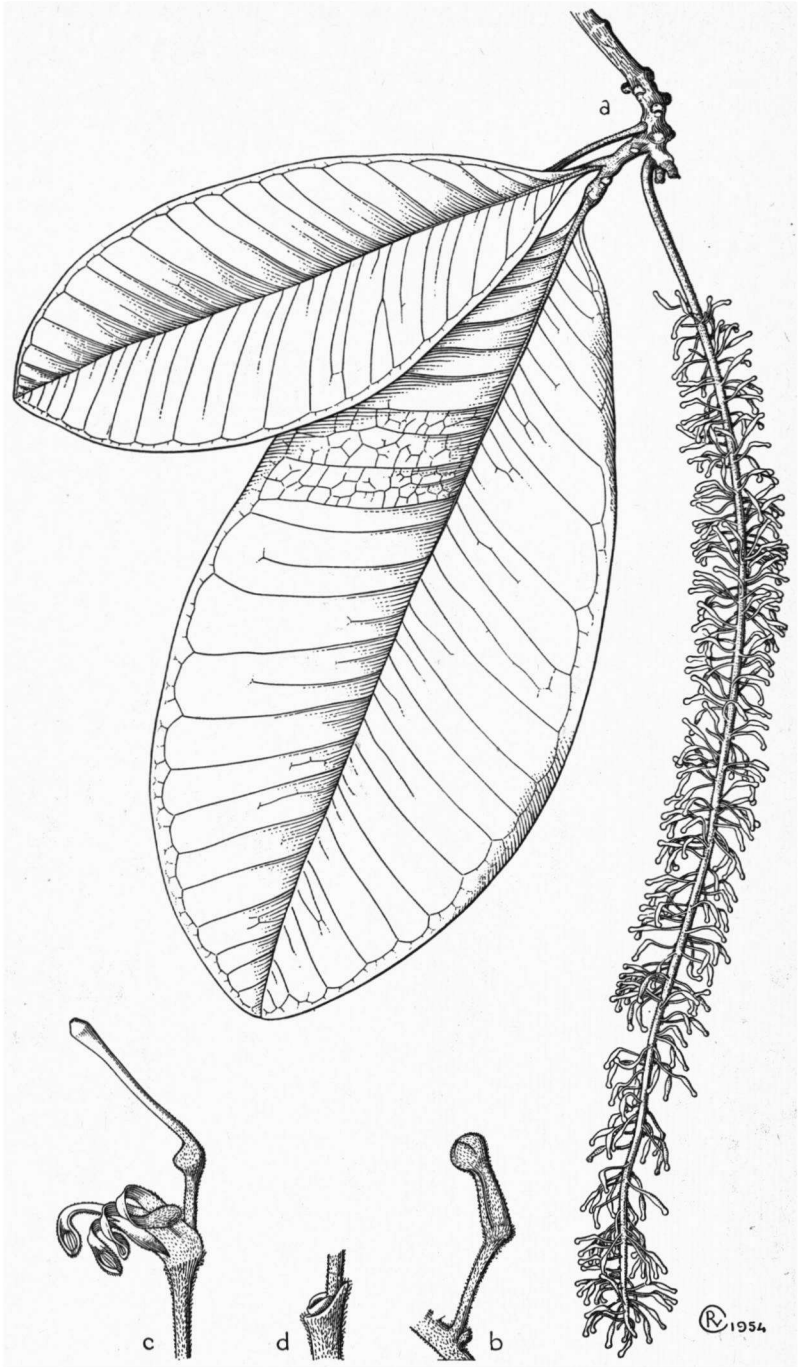


Fig. 8. *Finschia rufa* WARB. a. Habit,  $\times 2/5$ , b. bud,  $\times 2$ , c. open flower,  $\times 2$ , d. torus with disk,  $\times 3$  (after CLEMENS 2234).

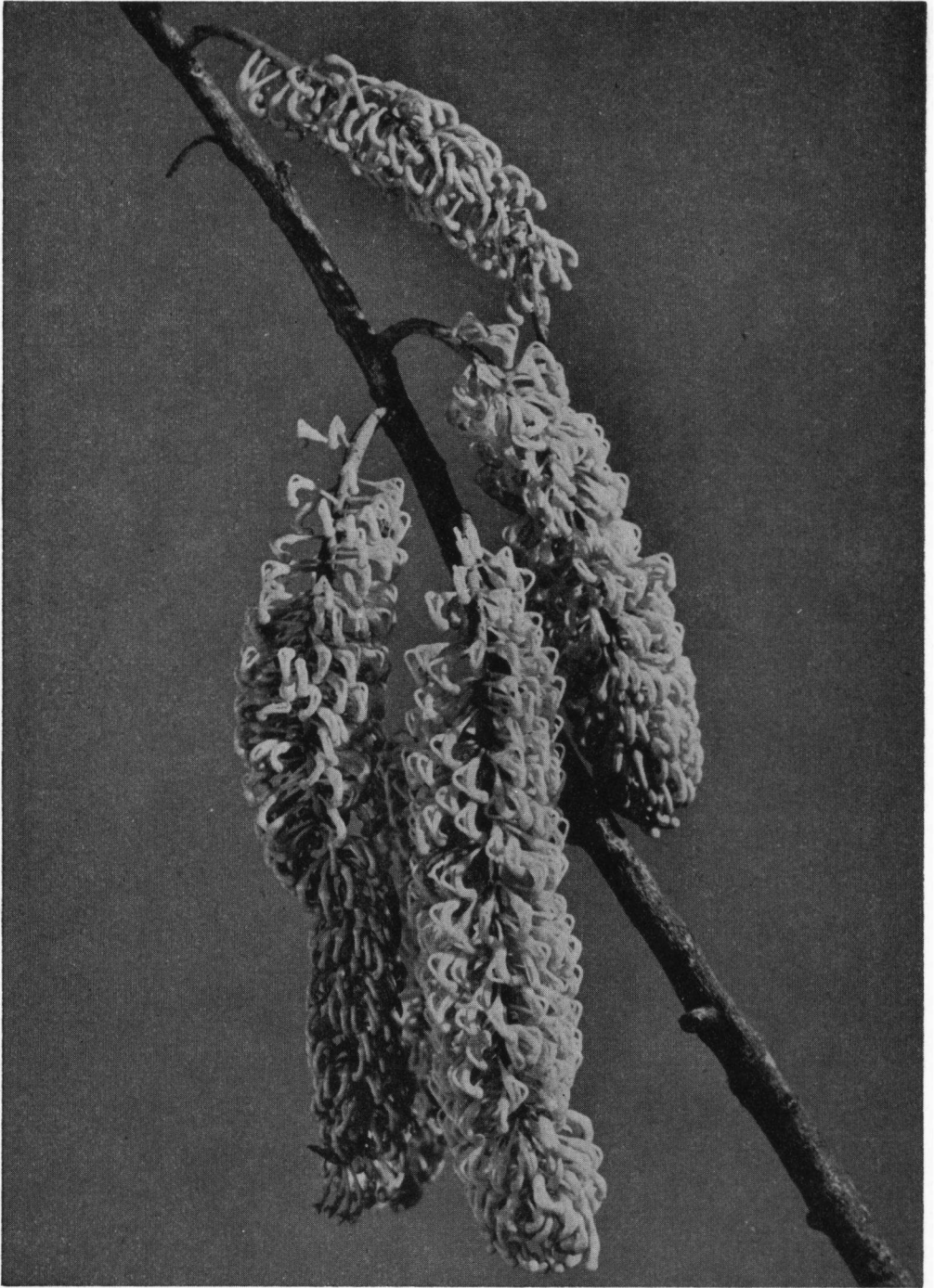


Fig. 9. *Finschia chloroxantha* DIELS var. *macrocarpa* SLEUM. Racemes in anthesis, flowers orange-yellow (Cult. Hort. Bog. XVI.I.J.4-4a, Jan. 1955).



3. *Finschia ferruginiflora* WHITE, Pac. Sc. 3 (1949) 190, f. 1.

Tree 30 m, with adventitious roots up to 1½ m above the soil; bark brownish, slightly dotted with pustular lenticels which are sometimes arranged in short longitudinal rows, or bark very finely longitudinally cracked with a few, small, corky scaled patches; innovations ferrugineous-pubescent, soon glabrous. *Leaves* narrow-obovate, rounded at the apex, cuneate at the base, but not decurrent on the stout petiole, subcoriaceous, glabrous, glossy-green above with veins slightly prominent and yellowish when fresh, paler beneath, in dry specimens green above, greyish below, 14–23(–28) by 3½–5(–7) cm; midrib prominent beneath, nerves 18–20 pairs prominent on both faces, veins and veinlets laxly reticulate and somewhat raised above, more distinctly so beneath; petiole 1–1½(–2) cm by 2–2½ mm, glabrous. *Racemes* dense-flowered, axillary, often ramiflorous, incl. the short peduncle 13–20 cm long, ferrugineous-tomentose all over. Pedicels c. 1 cm by 1 mm. Disk horseshoe-shaped. *Flowers* rusty-brown when fresh. *Perianth* segments 7–8 mm. Ovary rufous-pilose, on a very or rather short stipe; stipe and style glabrescent. Style and stigma green when fresh. *Fruit* globular, brownish, c. 5 cm diam., suture visible; exocarp thin; endocarp bony, 7–8 mm thick. *Seed* 1, round, compressed, c. 3 by 1–1½ cm.

Distr. *Malaysia*: NE. New Guinea (Central Highlands: Aiyura).

Ecol. In rain-forest, 1500–1800 m alt. *Fl.* fr. Oct.

Uses. The seeds are cooked and eaten by the natives.

Vern. *Koparu*, *Anona*, *miu*, Aiyura.

4. *Finschia chloroxantha* DIELS, Bot. Jahrb. 54 (1916) 204; WHITE, Pac. Sc. 3 (1949) 190, f. 2 & 3.—*Grevillea densiflora* WHITE, Proc. R. Soc. Queensl. 34 (1922) 25; LANE-POOLE, For. Res. (1925) 85; WHITE & FRANCIS, Proc. R. Soc. Queensl. 38 (1927) 228; SLEUM. Bot. Jahrb. 70 (1939) 129.—*Grevillea* sp. HEMSL. Bot. Chall. 13 (1885) 186, t. 65G.—*Grevillea elaeocarpifolia* GUILLAUMIN, J. Arn. Arb. 13 (1932) 87.—*Helicia micronesica* KANEH. Fl. Micron. (1933) 95, japon., f. 23 (fol., fr.); Bot. Mag. Tokyo 47 (1933) 669, lat.; En. Micron. Pl. (1935) 311.—*F. waterhousiana* BURTT, Kew Bull. (1936) 465.—*F. micronesica* KANEH. Bot. Mag. Tokyo 52 (1938) 241, f. 72 (fl.).—*Grevillea micronesica* SLEUM. Bot. Jahrb. 70 (1939) 129 (*micronesiaca*).—*F. densiflora* WHITE ex F. S. WALKER, For. Br. Solomon Isl. Prot. (1948) 155.

var. *chloroxantha*.

Tree 5–25(–30) m; trunk buttressed, often raised on stilt-roots; bark grey to light-brown, usually marked with pustules in longitudinal lines; branchlets and innovations densely clothed with a tawny or ferruginous appressed pubescence. *Leaves* mostly narrow-elliptic or -obovate (oblanceolate), or lanceolate, apex acute or blunt,

base cuneate, chartaceous to subcoriaceous, somewhat shining or dull above, greenish-olivaceous to brownish when dry, paler beneath, glabrous or practically so, variable in size, 9–40 by 3½–13 cm; midrib stoutish, prominent beneath, nerves c. 12–30 pairs rather or not distinct, reticulations mostly rather visible; petiole rather slender, semi-terete, glabrous or slightly appressed-pubescent, 1–2½

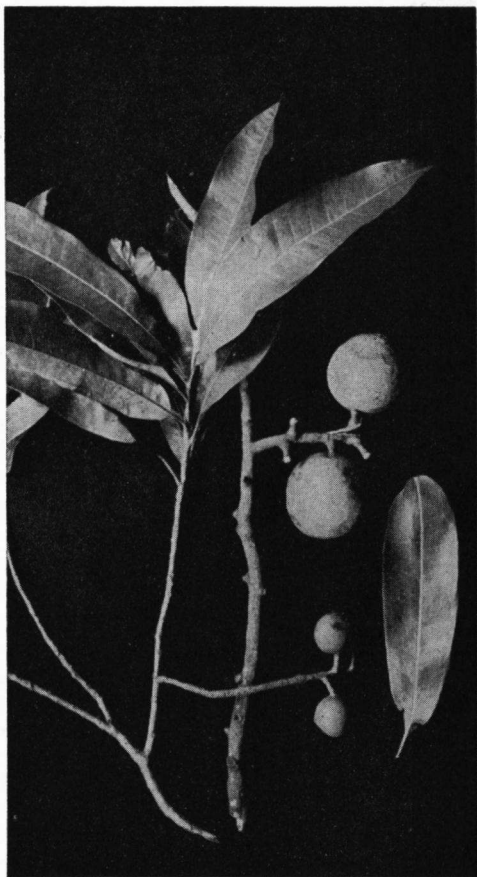


Fig. 10. *Finschia chloroxantha* DIELS var. *macrocarpa* SLEUM., fruiting (as fig. 11, Sept. 1954), × 1/5.

cm by c. 2 mm. *Racemes* many-flowered, solitary, axillary or ramiflorous, incl. the short peduncle up to 30 cm; rachis appressed-ferruginous-pubescent, 1½–3 mm diam. Bracts subulate or linear, 1 mm, very early caducous. Pedicels in twos, free, 3–12 by ½ mm. Torus very oblique, c. 2½ mm diam. *Flowers* yellow-green to bright golden yellow when fresh, nigrescent, pedicels and perianth segments ± laxly clothed with brown hairs. *Perianth* segments (4)–6–8(–9) mm. Disk prominent, horseshoe-shaped or nearly annular. Ovary glabrous, c. 2–5 mm long stiped. Style

narrowly clavate, minutely greyish-puberulous or papillate or glabrous, up to 1½ cm; stigma terminal, short-conical. *Fruit* green-yellow when quite ripe, compressed, oblique, 2½–3 cm diam., 2–2½ cm thick, on a stout 2–3(–5) by 2½ mm stipe; pedicel 8–10 by 2–3 mm; exocarp rather thin, dissolved in later stages; endocarp bony, rough, 4–5 mm across.

*Distr.* Micronesia (Palau Isl.: Babeltaop), Melanesia (New Britain: Heath Isl. near Gazelle Peninsula; New Hebrides: Tanna, Eromanga; Solomon Isl.: Ysabel, S. Christoval, Malaita, Bougainville; New Georgia: Kolumbangara), and *E. Malaysia*: New Guinea and Aru Isl.

*Ecol.* In primary and secondary rain-forest, also in swamp-forest, but apparently on non-inundated ground, scattered although locally common, from the lowland up to 1800 m. *Fl.* Dec.–March, *fr.* March–Aug.

*Uses.* Fruit with an edible, pleasantly flavoured kernel. Apparently planted on the New Hebrides as the seed is quite an important food-nut there. The seeds are also eaten in Bougainville. The reddish timber is said to have a nice grain.

*Vern. Sauge*, New Guinea: Menari, *akama*, Malaita, *toqtua*, Bougainville, *tarroo*, Rabaul.

*var. macrocarpa* SLEUM. *var. nov.*—Fig. 9–11. *Fructibus majoribus diversa*. Fruit globose or only very slightly laterally compressed, 5–5½ by c. 5 by c. 4½ cm; exocarp 2 mm, endocarp bony 6–10 mm thick. Seeds 2, c. 3½ by 3 by 2 cm; testa pale, thin, its inner layer jelly-like, blood-red; cotyledons white.

*Distr. Malaysia*: W. New Guinea (Sorong) and introduced from N. New Guinea into the Botanic Gardens, Bogor (*no* XVI.I.J. 4–4a, *type*).

*Uses.* Said to be useful against leprosy at Sorong.

*Vern. Mbrein*, Sorong, Biak dial.

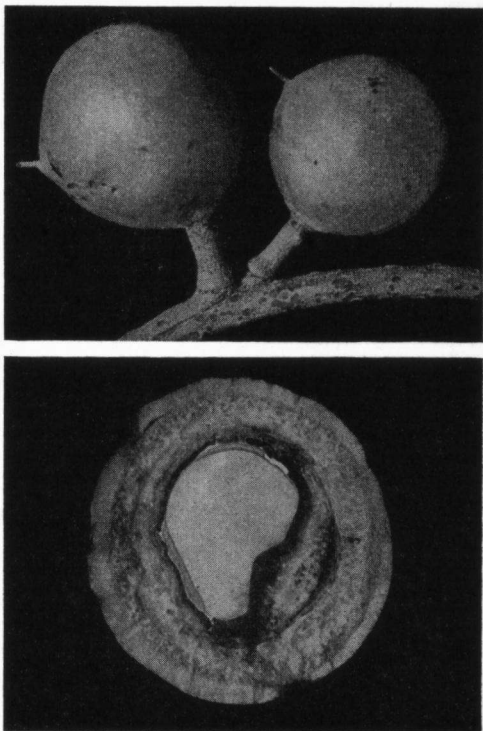


Fig. 11. *Finschia chloroxantha* DIELS *var. macrocarpa* SLEUM. Above 2 young fruits, nat. size, below fruit in section,  $\times \frac{8}{11}$  (Sept. 1954).

#### 4. HELICIA

LOUR. *Fl. Cochinch.* 1 (1790) 83; SLEUM. *Blumea* 8 (1955) 7–79.—*Helittophyllum* BL. *Bijdr.* (1825) 652.—*Castronia* NORONHA, *Verh. Bat. Gen. K.W.* 5 (1827) 65, *nom. nud.*, *cf.* HASSK. *Cat. Hort. Bog.* (1844) 317.—*Cyanocarpus* F. M. BAILEY, *Rep. Exp. Bell.-Ker* (1889) 55.—Fig. 12–16.

Trees, rarely shrubs. *Leaves* mostly spiral, rarely subopposite or 3–4-verticillate, simple, entire or dentate (serrate), sessile or petiolate. *Racemes* simple, many-flowered, axillary or ramiflorous, very rarely subterminal. Flowers bisexual. Bracts small, ovate-acuminate to subulate, in *Mal. spp.* subsistent or caducous. Bracteoles minute. Pedicels mostly in twos, or solitary, free or connate in their lower part, rarely entirely connate. *Perianth-tube* (in *Mal. spp.*) straight, slender, with a clavate to subglobose limb, somewhat swollen at the base, limb straight, segments 4, becoming free and revolute in anthesis. *Stamens* 4, nearly sessile, inserted at the inner base of the limb; anthers oblong, connective apiculate; exine smooth. *Ovary* ovoid or globose, sessile; ovules 2, anatropous, ascendent, inserted at the base of the ovary or laterally attached to the wall on the ventral suture. Style slender, clavate towards the apex; stigma punctiform. Disk glands

free (spaced or approximate) or  $\pm$  connate into a cup. *Fruit* nut- or drupe-like; pericarp mostly thick-coriaceous and rather hard when dry, when fresh apparently its outer part sometimes somewhat fleshy, the inner part drier and hard, rarely with a clear differentiation in endocarp and exocarp, mostly indehiscent, sometimes very tardily splitting irregularly along the ventral (raised or sulcate) suture when dry. *Seeds* 1-2, subglobose respectively hemispheric. Testa thin. Cotyledons fleshy, rugulose in the upper part.

*Distr.* About 87 spp. in S. India (Southwestern Ghats), and Ceylon through SE. Asia to SE. China, Hainan, S. Japan, Formosa, throughout *Malaysia*, extending to Melanesia (New Ireland & New Britain), and NE. Australia. Fig. 12-13.

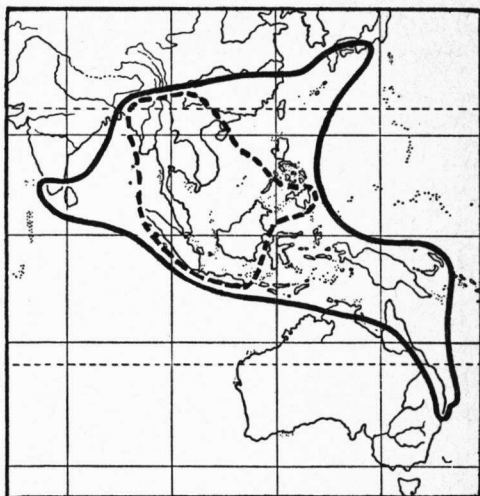


Fig. 12. Distributional area of the genera *Helicia* LOUR. (—) and *Heliciopsis* SLEUM. (- - -).

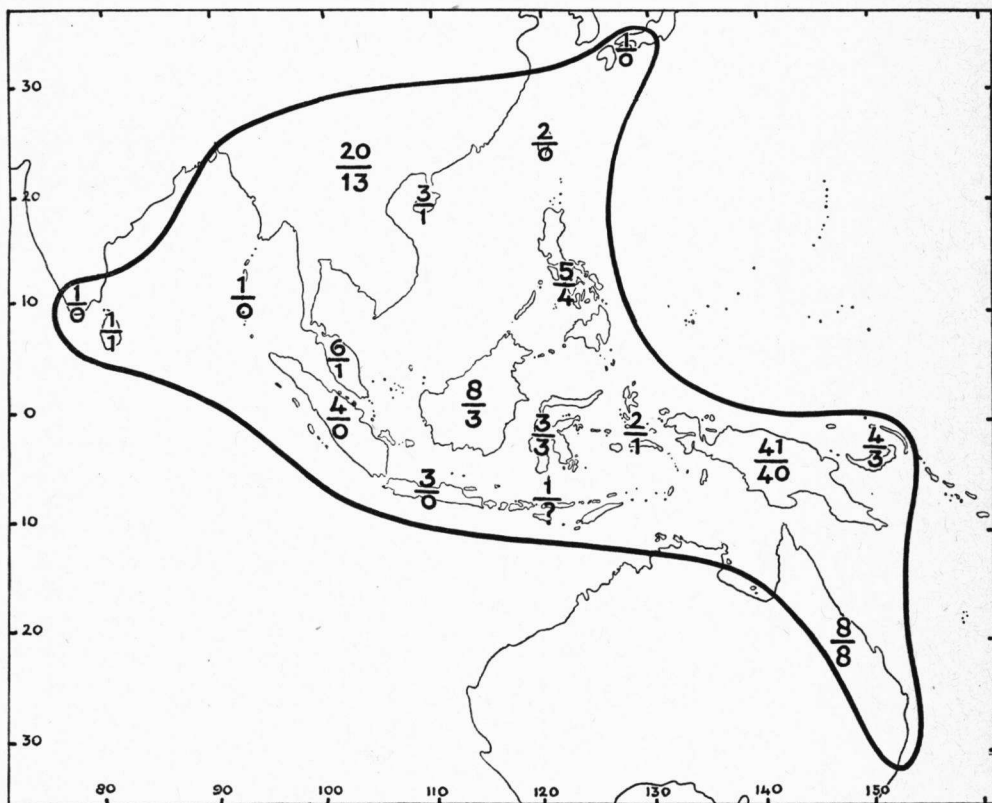


Fig. 13. Distribution of the genus *Helicia* in which are indicated for each subarea the total number of species (above the line) and the number of endemic species (below the line). The genus comprises 87 species in all.

Ecol. Most species are confined to the substage of the non-seasonal rain-forest, though some are apparently adapted to a more or less seasonal climate. None is known to occur gregariously. Though most species occur in the montane zone between 500 and 2400 m, the total range is from sea-level to c. 3350 m on Mt Kinabalu, 2600 m in Central Celebes, and 2650 m in Java.

Uses. Timber is mostly of small size and specimens occur scattered so that the commercial value of this genus is of minor importance.

Notes. I have subdivided the genus into 3 sections.

*Sect. Macadamioopsis* SLEUM. is characterized from the other sections by perulate inflorescences. It contains only *H. youngiana* MOORE & F.V.M. from Queensland & New South Wales.

*Sect. Cyanocarpus* (BAILEY) SLEUM. is characterized by drupes (a distinct hard endocarp); it comprises 7 spp. in E. Australia and *H. uganensis* DIELS in Melanesia. Possibly *H. acutifolia* SLEUM. from Port Moresby belongs also to this section.

*Sect. Helicia* with undifferentiated pericarp comprises the bulk of the species. I have not been able to subdivide it further. It is a solid mass of rather closely, often reticulately allied species.

Specific distinction in *Helicia* has been based mainly on the sizes of petioles, pedicels, and perianths, on various types of indument, on nervation, and similar minor vegetative characters. All sizes have been measured in dry material, and the key is, therefore, not fit for identification of living material.

Specific distinction has proved difficult; this is partly caused by the inadequate materials at hand; hardly any specimens have both flowers and ripe fruits. Besides, there are many (31!) specimens which, though singles, have here been accepted as representing distinct species, as intermediates with allied species are absent. Much more material would be needed to establish the range of variability in many species and to go beyond the present tentative revision, in which 27 species have been reduced and 16 have been recognized as new.

KEY TO THE SPECIES

1. Ovary laxly or densely hairy.
2. Leaves entire or nearly so.
3. Perianth 5 (rarely up to 6) mm. Flowers nearly sessile . . . . . 1. *H. sellae-montis*
3. Perianth 7 mm or more in length. Flowers mostly manifestly pedicelled.
4. Perianth (7-)8-12 mm.
5. Nerves 14-17 pairs.
6. Leaves very broadly attenuate towards the base, the very base obtuse or mostly ± rounded. Perianth 9 mm . . . . . 2. *H. amplifolia*
6. Leaves cuneate towards the base, the very base ± acute. Perianth 11(-12) mm. . . . . 3. *H. platyphylla*
5. Nerves up to 12 pairs.
7. Reticulations dense and very prominent on both faces of the leaves.
8. Branchlets of the past year very early glabrescent, the flower-bearing ones glabrous or nearly so. The entire-leaved form of . . . . . 23. *H. excelsa*
8. Branchlets of the past year (mostly bearing the inflorescences) persistently tomentose or very tardily glabrescent.
9. Perianth 7-8(-9) mm. Fruit c. 1-1½(-1¼) by (¾)-¾-1½ cm, pericarp ± ⅓ mm thick.
10. Leaves ± obovate or oblong-obovate, rarely oblong, broadly attenuate towards the obtuse or rounded apex, distinctly petioled; blade c. 2 times as long as broad. 4. *H. loranthoides*
10. Leaves oblong-lanceolate, gradually and ± long acuminate towards the subacute apex, subsessile; blade c. 3-4 times as long as broad . . . . . 5. *H. celebica*
9. Perianth (10-)11-12 mm. Fruit (1¼)-2-3 by c. 2 cm, pericarp c. 2 mm thick.
11. Pedicels 1-2 (the lowest ones rarely up to 3) mm. Fruit ovoid-ellipsoid, ± persistently rufous-tomentose, 2½-3 by 2 cm . . . . . 6. *H. fuscotomentosa*
11. Pedicels 3-5 mm. Fruit subglobose, glabrous, c. 2 cm across . . . . . 7. *H. rigidiflora*
7. Reticulations ± lax and little or not prominent on both faces of the leaves.
12. Undersurface of the leaves initially ± densely covered with ± crisp hairs, tardily glabrescent.
13. Leaves subsessile . . . . . 8. *H. uganensis*
13. Petiole (1-)1½-3(-5) cm . . . . . 9. *H. rufescens*
12. Undersurface of the leaves initially ± laxly covered by ± appressed hairs, soon glabrescent, or glabrous from the beginning.
14. Racemes 17-27 cm, incl. the peduncle 4-5 cm . . . . . 10. *H. longespicata*
14. Racemes 5-15 cm, incl. the peduncle 1-1½ cm.
15. Ovary obovoid-globose, laxly hairy. Fruit up to 1½ by 1-1½ cm . . . . . 11. *H. kjellbergii*
15. Ovary oblong-ovoid, densely hairy. Fruit (2½)-3-4(-5) by 1½-2(-2½) cm. The entire-leaved form of . . . . . 24. *H. serrata*
4. Perianth exceeding 13 mm in length.
16. Perianth limb gradually clavate, 5-6 mm long . . . . . 12. *H. carrii*
16. Perianth limb rather abruptly ellipsoid, 2-3 mm long.
17. Pedicel 5-8 mm . . . . . 13. *H. purpurascens*
17. Pedicel 1-2(-3) mm.

18. Leaves  $\pm$  chartaceous, 2-3 $\frac{1}{2}$ (rarely up to 4) cm wide; nerves not impressed in dry specimens.
19. Perianth 13-15 mm . . . . . 14. *H. torricellensis*
19. Perianth c. 25 mm . . . . . 15. *H. schlechteri*
18. Leaves subcoriaceous or coriaceous, wider than 4 cm; nerves mostly manifestly impressed in dry specimens.
20. Petiole 4-6 by 2 $\frac{1}{2}$ -4 mm. Inflorescence very lax . . . . . 16. *H. lauterbachiana*
20. Petiole 15-25 by 1 $\frac{1}{2}$ -2 mm. Inflorescence rather dense . . . . . 17. *H. oreadam*
2. Leaves manifestly dentate or serrate at least in their upper half.
21. Nerves very markedly impressed above in dry specimens . . . . . 18. *H. stelechantha*
21. Nerves slightly or not impressed above in dry specimens.
22. Leaves up to 2 $\frac{1}{2}$  cm wide . . . . . 19. *H. microneura*
22. Leaves (3-)<sup>3</sup> $\frac{1}{2}$ -6 $\frac{1}{2}$ (-12) cm wide.
23. Rhachis very slender in anthesis, c.  $\frac{1}{2}$ - $\frac{3}{5}$  mm across.
24. Leaves shortly obtusely attenuate at the apex . . . . . 20. *H. dentellata*
24. Leaves rather abruptly subcaudate-acuminate, not rarely subfalcate, subacute.
25. Leaves rather light greenish-olivaceous when dry, with a few  $\pm$  irregular teeth, densely reticulate above. Petiole 1-2 cm . . . . . 21. *H. ledermannii*
25. Leaves  $\pm$  blackish-brown when dry,  $\pm$  regularly serrate, rather laxly reticulate above. Petiole c. 5 mm . . . . . 22. *H. arguta*
23. Rhachis stoutish in anthesis, c. 1-1 $\frac{1}{2}$  mm across.
26. Leaves mostly yellowish-greenish and shining when dry; reticulations dense and manifestly raised on both faces. Ovary rusty-villous. Fruit 1-1 $\frac{1}{5}$ (-1 $\frac{1}{2}$ ) by  $\frac{4}{5}$ -1 $\frac{1}{5}$  cm . . . . . 23. *H. excelsa*
26. Leaves olivaceous to brownish when dry, somewhat shining above,  $\pm$  dull beneath; reticulations less dense and less or obscurely raised on both faces. Ovary  $\pm$  densely rufous-sericeous. Fruit (2 $\frac{1}{2}$ -)3-4(-5) by 1 $\frac{1}{2}$ -2(-2 $\frac{1}{2}$ ) cm . . . . . 24. *H. serrata*
1. Ovary entirely glabrous.
27. Leaves peltate . . . . . 25. *H. peltata*
27. Leaves not peltate.
28. Leaves up to 3 by 1 $\frac{3}{5}$  cm.
29. Disk glands distinctly rather long-ciliate. Perianth ferruginous-tomentose. . . . . 26. *H. microphylla*
29. Disk glands glabrous. Perianth glabrous or nearly so . . . . . 27. *H. cameronii*
28. Leaves larger.
30. Pedicels with mostly two distinct membranous wings when dry . . . . . 28. *H. pterygota*
30. Pedicels not winged.
31. Perianth densely ferruginous-tomentose, hairs  $\pm$  distinctly spreading . . . . . 29. *H. microcarpa*
31. Perianth laxly to rather densely hairy by  $\pm$  appressed hairs or perianth glabrous.
32. Leaves sessile or subsessile, or at least distinctly decurrent to or nearly to the base of the petiole.
33. Perianth 5-12(rarely up to 13) mm.
34. Nerves (at least the upper ones) distinctly straight and  $\pm$  parallel to each other in their lower  $\frac{2}{3}$ , then curved upwards to the edge.
35. Leaves thick-coriaceous, very stiff, rounded to cordate at the base. . . . . 30. *H. maxwelliana*
35. Leaves chartaceous to firmly subcoriaceous, cuneate-attenuate or rarely subrotundate at the base.
36. Perianth 5(-6) mm. Nerves 8-10(-12) pairs . . . . . 31. *H. olivacea*
36. Perianth 9-12 (rarely up to 13) mm.
37. Nerves 16-20 pairs . . . . . 32. *H. commutata*
37. Nerves up to 12 pairs.
38. Leaves averagely larger, (8-)10-15(-19) by (3 $\frac{1}{2}$ -)4-7(-10) cm.
39. Pedicels 3-4 mm. Cf. . . . . 36. *H. saruwagedica*
39. Pedicels (6-)7 mm. Cf. . . . . 40. *H. peekelii*
38. Leaves averagely smaller, 4-8 by 2-3 $\frac{1}{2}$  cm.
40. Rhachis terete. Limb of the perianth abruptly ellipsoid, 2 mm in length. . . . . 33. *H. odorata*
40. Rhachis distinctly angular. Limb of the perianth gradually clavate, 3 mm in length. . . . . 34. *H. teysmanniana*
34. Nerves all curved-ascending over their entire length.
41. Pedicels 2-3(-4) mm.
42. Leaves lanceolate or oblong-lanceolate, up to 2 $\frac{4}{5}$  cm wide . . . . . 35. *H. acutifolia*
42. Leaves various in shape, 3 $\frac{1}{2}$ -11 cm wide.
43. Perianth 10-12(-13) mm. Fruit obliquely narrow ellipsoid, markedly beaked. . . . . 36. *H. saruwagedica*
43. Perianth 7-8(-9) mm. Fruit (as far as known) ovoid to ellipsoid.
44. Leaves distinctly appressed rufous-pilose underneath. Nerves 18-20 pairs. . . . . 37. *H. saurauoides*
44. Leaves glabrous. Nerves 6-10(-12) pairs.

45. Fruit 1<sup>1</sup>/<sub>2</sub> by 1–1<sup>1</sup>/<sub>3</sub> cm when ripe . . . . . 11a. *H. kjellbergii* var. *calva*  
 45. Fruit 2<sup>1</sup>/<sub>2</sub>–3(–5) by 1<sup>1</sup>/<sub>2</sub>–2<sup>1</sup>/<sub>2</sub> cm when ripe.
46. Leaves 5–8 by 4–6 cm (coriaceous, elliptic or ovate-elliptic), rather inconspicuously reticulated. The glabrescent form of . . . . . 24a. *H. serrata* var. *oreophila*  
 46. Leaves (9–)12–23 by 5–8(–11) cm, finely reticulated on both faces.
47. Leaves broadly elliptic-oblong, coriaceous, always entire. Nerves 6–7 pairs. (Fruit 3–4 by c. 2<sup>1</sup>/<sub>2</sub> cm . . . . . 38. *H. latifolia*  
 47. Leaves oblong or elliptic-oblong, sometimes lanceolate-oblong, rarely obovate, subcoriaceous, entire to serrate. Nerves 8–10(–12) pairs . . . . . 39. *H. moluccana*
41. Pedicels 6–7 mm.  
 48. Nerves 6–7 pairs . . . . . 40. *H. peekelii*  
 48. Nerves c. 14 pairs . . . . . 41. *H. neglecta*
33. Perianth exceeding 13 mm in length.
49. Nerves (certainly the upper ones manifestly) straight in their lower <sup>2</sup>/<sub>3</sub> and ± parallel to each other, curved upwards towards the edge.
50. Reticulations deeply impressed above . . . . . 42. *H. retevenia*  
 50. Reticulations not or very slightly impressed above.
51. Nerves c. 7 pairs, steeply ascending from the midrib . . . . . 43. *H. macrostachya*  
 51. Nerves in (9–)10–11 pairs, coming from the midrib at a ± right angle.
52. Leaves obovate, entire . . . . . 44. *H. obtusata*  
 52. Leaves elliptic or oblong-elliptic, denticulate . . . . . 45. *H. archboldiana*
49. Nerves all curved-ascending over their entire length.
53. Main nerves markedly impressed above in dry specimens . . . . . 46. *H. wollastonii*  
 53. Main nerves flat or mostly somewhat raised above in dry specimens.
54. Perianth 14–15 mm . . . . . 47. *H. affinis*  
 54. Perianth exceeding 16 mm in length.
55. Limb of the perianth gradually clavate, 6–7 mm long.  
 56. Leaves obovate, distinctly obtuse or truncate at the base, c. 1<sup>1</sup>/<sub>2</sub>–2 times as long as broad. . . . . 48. *H. clemensiae*
56. Leaves obovate-oblong, subacute at the base, c. 3 times as long as broad. 49. *H. forbesiana*
55. Limb of the perianth ± abruptly ellipsoid to subglobose, ± 3 mm long.  
 57. Perianth 16–17 mm . . . . . 50. *H. finis-terrae*  
 57. Perianth (20–)25–28 mm.
58. Fruit subglobose, slightly or not apiculate. Leaves first laxly covered beneath with minute rufescent appressed hairs, glabrescent with age . . . . . 51. *H. robusta*  
 58. Fruit attenuate at apex and base or at least distinctly apiculate. Leaves glabrous from the beginning.
59. Leaves firmly chartaceous to subcoriaceous, greenish or yellowish or dilutely brownish when dry. Perianth slender. Fruit with 6 ± distinct longitudinal ribs. . . . . 52. *H. attenuata*
59. Leaves rigidly subcoriaceous to coriaceous, dark brown to blackish-brown when dry. Perianth stoutish. Fruit not ribbed . . . . . 57a. *H. petiolaris* var. *kingiana*
32. Leaves distinctly petioled, not decurrent or only slightly so in the upper part of the petiole only.
60. Nerves all or at least the upper 3–4 pairs straight and ± parallel to each other in their lower <sup>2</sup>/<sub>3</sub>, then curved upwards to the margin.
61. Veins and veinlets distinctly impressed above in dry specimens.  
 62. Perianth c. 16 mm . . . . . 53. *H. bullata*  
 62. Perianth c. 30 mm . . . . . 54. *H. insculpta*
61. Veins not or very slightly, veinlets not impressed above in dry specimens, mostly prominent.
63. Perianth ± densely covered by appressed, rufescent or ferruginous hairs.  
 64. Leaves green-olivaceous or yellowish in dry specimens. Perianth 17–18(–20) mm. . . . . 55. *H. hypoglauca*
64. Leaves dark brown in dry specimens. Perianth 25 mm . . . . . 56. *H. albiflora*
63. Perianth very sparsely hairy or glabrous.
65. Rhachis stout, c. 2<sup>1</sup>/<sub>2</sub>–3 mm diam. Leaves slightly or not reticulated above. . . . . 57. *H. petiolaris*  
 65. Rhachis slender, 1–1<sup>1</sup>/<sub>2</sub> mm diam. Leaves distinctly densely and prominently reticulated above.
66. Leaves dark to blackish-brown when dry. Nerves 4–5 pairs . . . . . 58. *H. paucinervia*  
 66. Leaves dilutely greenish-olivaceous when dry. Nerves 7–8 pairs . . . . . 59. *H. pallescens*
60. Nerves all curved-ascending over their whole length.
67. Inflorescence very slender and lax. Rhachis <sup>1</sup>/<sub>2</sub>–0.7 mm diam. Perianth slender, tube <sup>2</sup>/<sub>5</sub> mm diam. . . . . 60. *H. graciliflora*
67. Inflorescence stoutish, rather dense. Rhachis 1<sup>1</sup>/<sub>2</sub>–2<sup>1</sup>/<sub>2</sub> mm diam. Perianth thicker, tube <sup>4</sup>/<sub>5</sub>–1 mm diam.
68. Petiole <sup>1</sup>/<sub>2</sub>–1 cm. Leaves elliptic-oblong or elliptic . . . . . 61. *H. biformis*  
 68. Petiole 1<sup>1</sup>/<sub>2</sub>–2<sup>1</sup>/<sub>2</sub>(–3) cm. Leaves oblong or lanceolate-oblong . . . . . 55. *H. hypoglauca*

1. *Helicia sellae-montis* SLEUM. Bot. Jahrb. 70 (1939) 142; Blumea 8 (1955) 21.

Small tree; branchlets terete, fulvous-tomentose at the tips, glabrous and greyish elsewhere. *Leaves*  $\pm$  narrow-oblong, gradually acuminate and subacute at the apex, cuneate towards the base into a rather thick *c.* 3 mm long, tomentose petiole, subcoriaceous, mostly nigrescent above when dry, paler beneath, glabrous and shining above, rufous-tomentose beneath specially on midrib and nerves, somewhat glabrescent on the intervenium with age, entire, (11-)12 $\frac{1}{2}$ -15 by 4 $\frac{1}{2}$ -6 cm; midrib prominent specially beneath, nerves 9-10 pairs, subarcuate and obscurely joined along the edge, flat and  $\pm$  pale above, a little raised beneath, reticulations rather obscure. *Racemes* ramiflorous, in flower 9-11, in fruit up to 18 cm, rufous-tomentose all over; rhachis slender. *Flowers* sessile or nearly so. Bracts lanceolate, minute. *Perianth* 5 (rarely up to 6) mm, yellowish or white, limb 1 mm diam. Anthers *c.* 1 $\frac{1}{2}$  mm. Disk glands minute, connate up to their middle. *Ovary* rufous-pilose; style slender, glabrous. *Fruit* ellipsoid, dilutely brownish-velutinous, 5 $\frac{1}{2}$  by 2 $\frac{1}{2}$ -3 cm, pericarp somewhat crustaceous *c.* 2 mm; pedicel rather stout, 1-1 $\frac{1}{2}$  mm.

Distr. *Malaysia*: NE. New Guinea (Morobe Distr.: Sattelberg region and Cromwell Range).

Ecol. In open forest on hilly ground, 900-1500 m. *Fl. fr.* Jan.-Apr.

2. *Helicia amplifolia* SLEUM. Bot. Jahrb. 70 (1939) 143; Blumea 8 (1955) 21.

Tree; trunk 15-20 cm diam.; branchlets stout, subterete, rufous-tomentose at the tips, glabrescent elsewhere. *Leaves* broadly oblong to elliptic, gradually broadly acuminate and  $\pm$  obtuse at the apex, very broadly attenuate or  $\pm$  rounded at the base, stiffly chartaceous, initially laxly covered with ferrugineous hairs specially on the midrib, but soon glabrescent and of a dark brownish-olivaceous colour above,  $\pm$  dark rufous-velutinous or rufous-pilose underneath, entire, (20-)23-40 by (10-)14-19 cm; midrib somewhat prominent above, strongly so beneath, nerves 14-15 pairs, curved upwards and ending very near to the margin, markedly prominent beneath only, reticulations lax, slightly raised beneath only; petiole rufous-tomentose, 7-9 by 3-4 mm. *Racemes* ramiflorous, dense-flowered, rufous-tomentose all over, 7-8 cm; rhachis nearly villous, *c.* 2 mm across. Bracts subulate, 1 mm. Pedicels free, *c.* 1 mm. *Perianth* pale yellow, 9 mm, limb 1 $\frac{1}{2}$  mm diam. Anthers *c.* 2 mm. Disk glands free, broadly oblong. *Ovary* rufous-hirsute; style filiform, glabrous. *Fruit* ellipsoid, 4 $\frac{1}{2}$  by *c.* 3 cm, pericarp crustaceous 4 mm.

Distr. *Malaysia*: NE. New Guinea (Morobe Distr.: Sattelberg region).

Ecol. In hill forest, 900-1050 m. *Fl. fr.* Jan.-Febr.

3. *Helicia platyphylla* SLEUM. Bot. Jahrb. 70 (1939) 144; Blumea 8 (1955) 22.

Small tree; branchlets rufous-tomentose at the tips, glabrous elsewhere. *Leaves* few at the ends of

the branchlets, broad-oblong, gradually or  $\pm$  abruptly acuminate and subacute at the apex, cuneate into the petiole,  $\pm$  acute at the very base, rigidly chartaceous to subcoriaceous, dark red-brown when dry, glabrous and shining above, rufous-tomentose on the whole undersurface specially on the midrib and the nerves, entire, (30-)40-45 by (13-)16-20 cm; midrib prominent above, more strongly so beneath, nerves 15-17 pairs, curved towards and along the edge, flat or somewhat impressed above, prominent beneath, reticulations lax, slightly raised beneath; petiole rufous-tomentose, *c.* 1 cm by 3-4 mm. *Racemes* ramiflorous, rufous-tomentose, dense-flowered, 8-11 cm; rhachis 2 mm diam. Bracts minute. Pedicels mostly in twos, 1-2 mm, stoutish, connate up to the middle. *Perianth* pale pink, 11(-12) mm, limb *c.* 1 $\frac{1}{2}$  mm across. Anthers *c.* 3 mm. Disk glands  $\pm$  quadrangular, free. *Ovary* rufous-hirsute; style slender, glabrous. Fruit not known.

Distr. *Malaysia*: SE. New Guinea (Lower Fly River), once found.

Ecol. Rain-forest on ridges at low elevation, said to be common in underbrush. *Fl.* Oct.

4. *Helicia loranthoides* PRESL, Epim. (1851) 247; MEISN. Prod. 14 (1856) 438; MIQ. Fl. Ind. Bat. 1, 1 (1858) 984; F.-VILL. Nov. App. (1880) 182; VIDAL, Phan. Cuming. (1885) 140; Rev. Pl. Vasc. Filip. (1886) 229; MERR. En. Philip. 2 (1923) 99 *pr. p.*; SLEUM. Blumea 8 (1955) 22.

Slender tree, 3-10 m by 10-25 cm; tips of the branchlets deep ferrugineous-tomentose, glabrescent. *Leaves* obovate or oblong-obovate, rarely oblong, mostly broadly obtusely attenuate to rounded at the apex, cuneate into the petiole and  $\pm$  decurrent at the base, coriaceous, yellowish-green and shining, greyish- or brownish-dull beneath when dry, initially both faces with a dense ferrugineous  $\pm$  appressed tomentum, but soon glabrescent above, less quickly so beneath, at last glabrous, entire, rarely subdentate, (5-)6-8(-10, rarely up to 14) by (2 $\frac{1}{2}$ -)2 $\frac{4}{5}$ -4(-5 $\frac{1}{2}$ ) cm; midrib  $\pm$  flat above, prominent beneath, nerves 5-7 pairs, straight in their lower half, curved upwards in the upper part and  $\pm$  joined along the margin, slightly prominent on both faces, reticulations rather dense, raised on both faces; petiole  $\pm$  flattened, initially tomentose, glabrescent,  $\frac{4}{5}$ -1 $\frac{1}{2}$ (-2) cm. *Racemes* solitary or rarely in twos in the uppermost axils, densely brown tomentose, finally somewhat glabrescent at the flower-tips, dense-flowered nearly to the base, 8-17 cm, mostly exceeding the leaves; rhachis stoutish, 1 $\frac{1}{2}$ -2 mm diam. Bracts narrow-ovate,  $\pm$  acute, 1-2 mm. Pedicels mostly in twos,  $\pm$  stoutish, free or connate up to the middle, *c.* 2-3 mm in anthesis, somewhat accrescent in fruit. *Perianth* (7-)8-9 mm, white or yellowish, tube  $\frac{3}{5}$ -1 (rarely up to 1 $\frac{1}{2}$ ) mm diam., limb *c.* 1 $\frac{1}{2}$  mm diam. Anthers 1 $\frac{2}{3}$  mm. Disk glands small, free, approximate. *Ovary* ferrugineous-villous; style slender, glabrous. *Fruit* ovoid-ellipsoid, blackish when dry, glabrous, minutely verruculose, *c.* 1 (rarely up to 1 $\frac{1}{2}$ ) by (3 $\frac{1}{5}$ -)4 $\frac{1}{5}$ -1 cm, pericarp *c.* 3 $\frac{1}{5}$  mm.

Distr. *Malaysia*: Philippines (Luzon, Catanduanes, Leyte, Mindanao, Palawan).

Ecol. In mountain- or moss-forest, 1150–1850 m. *Fl.* May, *fr.* July–Sept.

Uses. Wood heavy, sappy, white, close-grained.

Vern. *Anaping-labláb*, Buk., *tarangsi*, Bag.

5. *Helicia celebica* SLEUM. *Blumea* 8 (1955) 23.—*H. excelsa* (ROXB.) BL. *var.* KOORD. Minah. (1899) 576.—*H. excelsa* (ROXB.) BL. *var. celebica* KOORD. in KOORD.-SCHUM. *Syst. Verz.* 3. Abt. (1914) 38, *nom. nud.*—*Finschia excelsa* (ROXB.) BL. *ex* BOERL. *Handl.* 3, 1 (1900) 151 *var.* (Celebes), *err. pro H. excelsa*; DE CLERCQ, *Nieuw Plantk. Woordenb.* (1909) 242.

Tree up to 24 m by c. 30 cm; branchlets ferruginous-tomentose at the tips, tardily glabrescent. *Leaves* oblong-lanceolate, gradually acuminate and subacute at the apex, cuneate towards the base and  $\pm$  distinctly decurrent along the petiole, subsessile, the very young ones ferruginous-tomentose on both faces, quickly glabrescent, mature ones subcoriaceous and glabrous, midrib and petiole excepted, yellowish-green and shining above when dry, dull beneath, entire, 8–15 by  $2\frac{1}{2}$ –4 cm; midrib distinctly raised beneath, nerves 6–8 pairs curved-ascending,  $\pm$  manifestly inarched along the edge, pale and nearly flat above, prominent beneath, reticulations rather dense and raised on both faces; petiole stout, averagely 2–3 mm, in less decurrent leaves slightly longer. *Racemes* in the uppermost axils, solitary, or rarely in twos, rather dense-flowered, rufous-ferruginous-tomentose, 8–15 cm; rhachis  $1\frac{1}{2}$ –2 mm diam. Bracts ovate-acuminate, c.  $1\frac{1}{5}$  mm, subpersistent as are the bracteoles. Pedicels mostly in twos, free or connate up to the middle, rather thick, 3–4 mm in anthesis, somewhat accrescent in fruit. *Perianth* dilutely green, c. 8 mm, swollen both at the apex and the base, tube 1 mm diam. in the middle. Anthers c.  $1\frac{1}{2}$  mm. Disk glands very short, truncate, free. *Ovary* rufous-villous; style slender, glabrous. *Fruit*  $\pm$  oblique, ovoid-ellipsoid, very shortly contracted at the base, dirty green, finally blackish when fresh, black when dry, minutely verruculose, glabrous,  $1\frac{1}{2}$ – $1\frac{4}{5}$  by  $1\frac{1}{5}$ – $1\frac{1}{2}$  cm, pericarp  $\pm$   $\frac{3}{5}$  mm.

Distr. *Malaysia*: NE. Celebes (Manado).

Ecol. In rain-forest on sandy soil, 450–1600 m. *Fl.* *fr.* Apr.

Vern. *Mowésem*, Tt.

Note. Closely related to the previous species.

6. *Helicia fuscotomentosa* SUESSENG. *Mitt. Bot. Staatssamml. Münch.* 2 (1950) 61; in Fedde, *Rep.* 54 (1951) 225; SLEUM. *Blumea* 8 (1955) 24.

Tree 10–15 m; branchlets rather stout, densely and  $\pm$  persistently dark rufous-tomentose at the tips, more greyish- to yellowish-tomentose below in the older parts, finally glabrescent. *Leaves* elliptic to oblong-elliptic, gradually or rather abruptly acuminate and subacute at the apex, cuneate into the petiole, the very young ones rufous-tomentose

on both faces, soon glabrescent, mostly entirely glabrous at flowering time midrib and petiole excepted, subcoriaceous, yellowish-green to yellowish-olivaceous when dry, entire, (5–)8–12(–18), in suckers or seedlings up to 26) cm by ( $3\frac{1}{2}$ –)4–6 (–8–11) cm; midrib slightly raised above, very distinctly so beneath, nerves (5–)6–8(–9) pairs, curved-ascending, rather obscurely inarching along the edge, prominent on both faces, reticulations rather dense and raised on both faces; petiole 1–2 cm by  $1\frac{1}{2}$ –2(– $2\frac{1}{2}$ ) mm. *Racemes* axillary, solitary, rather dense-flowered, 6–8 cm, rufous- nearly villous-tomentose; rhachis  $1\frac{1}{2}$ –2 mm across. Bracts ovate-acuminate, 1– $1\frac{1}{2}$  mm. Pedicels stoutish, 1–2 (the lowest ones rarely up to 3) mm in flower, mostly in twos and  $\pm$  connate. *Perianth* 11–12 mm, tube  $1\frac{1}{2}$  mm, limb clavate 2– $2\frac{1}{2}$  mm diam. Anthers c. 2 mm. Disk glands broadly triangular, obtuse, free, spaced. *Ovary* globose, rufous-villous; style slender, glabrous. Nearly ripe *fruit* oblique, elongate-ellipsoid to ovoid, apiculate, shortly attenuate at the base, rufous-tomentose,  $2\frac{1}{2}$ –3 by c. 2 cm, pericarp 2 mm; pedicel 2–3 mm.

Distr. *Malaysia*: Borneo.

Ecol. Mountain-forest, 350–1500 m, apparently scattered and rare on stony ridges. *Fl.* March–May, *fr.* Apr.

7. *Helicia rigidiflora* SLEUM. *Blumea* 8 (1955) 24.—*H. loranthoides* (*non* PRESL) MERR. *En. Philip.* 2 (1923) 99, *pro parte*.

Tree; branchlets rather stout, the younger parts rufous- or greyish-tomentose, glabrescent. *Leaves* obovate to oblong-obovate, shortly acuminate and subacute at the apex, cuneate at the base, and somewhat decurrent in the upper part of the petiole, firmly subcoriaceous, brownish- or greenish-yellowish when dry, very shining above, pallid and  $\pm$  dull beneath, rufous-tomentose initially both at the midrib and petiole, glabrous elsewhere, entire, (5–)6–10(–12) by 3–5(– $6\frac{1}{2}$ ) cm; midrib slightly prominent above, conspicuously raised beneath, nerves 6–8 pairs moderately curved-ascending, obscurely anastomosing near the edge, prominent on both faces, reticulations dense and distinctly elevated on both faces; petiole 1– $1\frac{1}{2}$  (– $2\frac{1}{2}$ ) cm. *Racemes* axillary from rufous-tomentose branchlets of the past year,  $\pm$  laxly set with flowers to nearly their base, 8–10 cm, rufous-tomentose; rhachis stout, c. 2 mm diam. Bracts ovate, nearly 2 mm,  $\pm$  concealed in the crisped tomentum. Pedicels stoutish, mostly in twos and connate up to their middle, 3–5 mm. *Perianth* rather thick, rigid, 10–11 mm, tube  $1\frac{1}{2}$  mm across, limb shortly clavate, 2 mm diam. Anthers c.  $1\frac{1}{2}$  mm. Disk glands oblong-ovate, free, spaced. *Ovary* globose, rufous-villous; style slender, glabrous. *Fruit* subovoid-globose, blackish when dry, glabrous, densely minutely verruculose,  $1\frac{4}{5}$ –2 cm diam., pericarp coriaceous c. 2 mm.

Distr. *Malaysia*: Philippines (Mindanao: Bukidnon, Misamis; Mindoro).

Ecol. Forests, probably in the higher regions. *Fl.* May–July, *fr.* April.



8. *Helicia uganensis* DIELS *ex* SLEUM. Bot. Jahrb. 70 (1939) 145; SLEUM. Blumea 8 (1955) 18.

Tree 5–8 m; branchlets rufous-tomentose at the tips, glabrous elsewhere, older parts thick with greyish bark. *Leaves* narrow-oblong to lanceolate, gradually acuminate and subacute at the apex, long-cuneate at the base and somewhat decurrent, subsessile, rigidly chartaceous to subcoriaceous, entire, dark glaucous-greenish or brownish and a little shining above when dry, dilutely brownish and dull beneath, glabrous above except midrib and nerves, laxly ferruginous-pilose beneath, more densely so on midrib and nerves, (13–)16–24 by (4–)5–7 cm; midrib slightly elevated above, markedly so beneath, nerves 10(–12) pairs, arcuate, distinctly raised beneath only, reticulations lax, slightly prominent beneath; petiole tomentose, 3–6 by 2–3 mm. *Racemes* ramiflorous, dense-flowered nearly to their base, slender, 11–14 cm, densely ferruginous-tomentose on the rhachis and pedicels, less so on the perianth; rhachis 1–1½ mm diam. Bracts ovate-lanceolate, 1–2 mm. Pedicels stoutish, mostly in twos and connate up to their middle, 1–1½ mm. *Perianth* yellowish-brown, c. 7 mm, tube ½ mm diam., limb 1 mm diam. Anthers 1 mm. Disk glands broadly oblong, free. *Ovary* rufous-villous; style slender, filiform. *Fruit* drupaceous, ellipsoid, 5–7 by 3½ cm, blackish when ripe; pericarp 4–5 mm, outer layer first succulent, subsequently spongy-corky, soon ± dissolute and showing a rather dense net of thicker and thinner anastomosing fibres, inner layer rather hard, lignescent, 1–1½ mm. *Seed* 1, rugulose in the upper half.

*Distr.* *Melanesia* (New Ireland, New Britain).

*Ecol.* In secondary rain-forest close to the sea-shore. *Fl.* Aug., *fr.* Oct.

*Vern.* *Lai-lai*, New Britain, Cape Hoskins.

*Note.* The special structure of the pericarp with its spongy or nearly corky outer and rather hard inner part, makes us suspect, that the fruit may be capable to drift, specially as the tree is reported to occur near the sea-shore. This is up till now the only species of *sect. Cyanocarpus* represented in *Malaysia*.

9. *Helicia rufescens* PRAIN, Kew Bull. (1912) 342; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 435; RIDL. Fl. Mal. Pen. 3 (1924) 142; BURK. Dict. (1935) 1134; SLEUM. Blumea 8 (1955) 25.

Tree 10–24 m by 60 cm; branchlets stout, dark rufous-tomentose, tardily glabrescent. *Leaves* obovate or obovate-oblong, rarely broadly oblanceolate, apex shortly attenuate, subacute to nearly rounded-obtuse, base ± long-cuneate and ± decurrent in the upper part of the petiole, subcoriaceous, dull olive-green to blackish-brown above when dry, dark rufous-tomentose on both faces when very young, gradually glabrescent, usually tomentose or hairy for a long time on the midrib above and at least on the nervation beneath, entire (serrate only in very young specimens or suckers), 15–30 by (5–)6–11 cm, upper ones smaller (those of suckers up to 40 by 13 cm); midrib elevated on both faces, nerves (8–)12 pairs, lowest ones close,

straight and parallel, upper ones spaced, curved and ± distinctly anastomosing, all slightly prominent beneath only, reticulations subinconspicuous; petiole rufous-tomentose, 3–4(–5) by 1½–1⅓ cm, more slender and shorter in the upper leaves or in mountain forms. *Racemes* axillary or ramiflorous, solitary or in twos, (10–)15–20 cm, dense-flowered, dark rufous-tomentose; rhachis 1½–2 mm diam. Bracts ovate, minute. Pedicels rather robust, mostly in twos and connate up to their middle, 1–2(–3) mm. *Perianth* 12 mm, tube ⅔ mm diam., limb clavate 1½ mm diam. Anthers c. 2 mm. Disk glands obtuse, free. *Ovary* rufous-villous; style slender, glabrous. *Fruit* subglobose, flattened laterally, broadly attenuate at both ends, or contracted at the base into a short stipe, yellowish-brown, dark brown when dry, rufous-tomentose when young, ± glabrescent at full maturity, 2½–3 by 2–2½ cm, 1½–1⅔ cm thick; pericarp coriaceous, 1 mm; pedicel 6–7 by 2 mm.

*Distr.* *Malaysia*: Malay Peninsula (Perak, Kedah, Pahang, Johore), apparently also in Sumatra (East Coast, sterile material).

*Ecol.* In open forest on hills, 150–450 m and 1200 and 1500 m (Cameron Highlands). *Fl.* Apr., *fr.* March, April, Oct.

*Uses.* Wood is reported to be very hard.

*Vern.* *Sida barak*, M.

*Note.* The mountain specimens have smaller leaves but are doubtless conspicuous.

10. *Helicia longespicata* SLEUM. Bot. Jahrb. 70 (1939) 143; Blumea 8 (1955) 26.

Tree 8 m; branchlets rufous-tomentose when very young, glabrescent. *Leaves* oblong, rounded or very broadly obtusely acuminate at the apex, attenuate at the base, inequilateral, thinly subcoriaceous, or chartaceous, brown when dry, glabrous above except the midrib, which is rufous-tomentose but glabrescent, initially rufous-tomentous beneath, glabrescent on the intervenium, entire, (8–)21–26(–33) by (6½–)9–12(–13) cm; midrib prominent on both faces, nerves c. 10 pairs, curved, more distinctly prominent beneath only, reticulations rather dense, slightly prominent on both faces; petiole rufous-tomentose, 1½–1⅔ cm by 2½ mm. *Racemes* ramiflorous, (17–)22–27 cm incl. the peduncle 4–5 cm, rufous-tomentose; rhachis slender, 1 mm diam. Bracts minute. Pedicels in twos and ± connate, 1–1½ mm. *Perianth* pale green, 8 mm, limb 1 mm diam. in nearly full-developed state. Anthers c. 1½ mm. Disk glands connate at the base. *Ovary* densely ferruginous-pilose; style glabrous, very slender. *Fruit* not known.

*Distr.* *Malaysia*: SE. New Guinea (Port Moresby), once found.

*Ecol.* In forests at c. 1500 m. *Fl.* Febr.

11. *Helicia kjellbergii* SLEUM. Blumea 8 (1955) 26. *var. kjellbergii*.

Tree 4–8(–20) m; branchlets glabrous. *Leaves* oblong, shortly obtusely acuminate at the apex, cuneate and decurrent at the base into a ± winged petiole, hence subsessile, subcoriaceous, glabrous,

dark greenish-brownish and very shining above, (9-)10-18 by  $4\frac{1}{2}$ - $6\frac{1}{2}$  cm; midrib slightly prominent above, more distinctly so beneath, nerves 8-10(-12) pairs curved-ascending, obscurely in-arching remote from the edge, slightly raised on both faces, reticulations obscure; petiole 2-3 mm. *Racemes* from the upper axils, solitary, rarely in twos,  $\pm$  ascending, rather densely set with flowers nearly to the base, 7-10 cm, elongating to 13 cm in fruit; rhachis  $1-1\frac{1}{2}$  mm diam.,  $\pm$  densely ferrugineous-tomentose as are the bracts and pedicels. Bracts subovate-lanceolate,  $1\frac{1}{2}$  mm. Pedicels mostly in twos, connate up to the middle, glabrescent in the upper third, 2-3 mm. *Perianth* whitish, 7-8 mm, laxly to subdensely covered with  $\pm$  appressed, ferrugineous hairs, tube  $\frac{1}{2}$  mm diam., limb clavate 1 mm diam. Anthers  $1\frac{1}{2}$  mm. Disk glands broadly ovate, rather thick, truncate, free, close. *Ovary* globose to  $\pm$  obovoid, laxly covered by longish  $\pm$  crisped dilutely ferrugineous hairs,  $\pm$  glabrescent; style slender, glabrous. *Fruit* (probably immature) ellipsoid, glabrous, blackish, very minutely verruculose, 9-11 by 7-9 mm, pericarp 0.7 mm.

Distr. *Malaysia*: SE. Celebes (Kendari), once found. Similar (sterile) material seen from Lesser Sunda Islands (Flores).

Ecol. In secondary thicket, 100 m. *Fl. fr.* March.

*var. calva* SLEUM. *Blumea* 8 (1955) 27.

*Leaves* lanceolate-oblong,  $3\frac{1}{2}$ - $4\frac{1}{2}$  cm wide. Inflorescence less densely ferrugineous-pilose than in the type. *Ovary* glabrous. Mature *fruit* ellipsoid, very shortly contracted at the base,  $1\frac{1}{2}$  by  $1-1\frac{1}{2}$  cm, pericarp 1 mm.

Distr. *Malaysia*: Central Celebes (Masamba).

Ecol. Rare in primary forest, 200 m.

Vern. *Rotoh*, Toradja.

12. *Helicia carrilii* SLEUM. *Bot. Jahrb.* 70 (1939) 145; *Blumea* 8 (1955) 27.—*H. brassii* SLEUM. *l.c.* 146.—*H. divaricata* SLEUM. *l.c.* 146.

Tree 5-10 m; branchlets terete, young parts rufous-ferrugineous-tomentose, glabrescent. *Leaves* oblong, lanceolate-oblong, obovate-oblong or subelliptic-oblong, gradually rather shortly acuminate at the apex, obtuse or subacute, attenuate into the petiole at the base,  $\pm$  firmly chartaceous, yellowish-green or pallid olivaceous when dry, entire or remotely subdenticulate towards the apex, glabrous, shining above, midrib tomentellous, dull beneath and densely rufous-ferrugineous-pilose on the midrib and nerves, less so on the intervenium, finally  $\pm$  glabrescent, 5-14 by ( $1\frac{1}{2}$ -) $2\frac{1}{2}$ - $5\frac{1}{2}$  cm; midrib slightly elevated above, more distinctly so beneath, nerves (6-)-7-8 (-10) pairs, curved and anastomosing near the edge, somewhat raised beneath only, reticulations rather dense, distinctly raised beneath only; petiole stoutish, tomentose ( $\frac{2}{3}$ -) $1-1\frac{1}{2}$  cm. *Racemes* ramiflorous or axillary, dense, rusty-tomentose, 8-11 cm; rhachis  $1\frac{1}{2}$ -2 mm diam. Bracts ovate-sub-acuminate,  $1-1\frac{1}{2}$  mm. Pedicels rather thick, 3-5 mm,  $\pm$  connate up to the middle when set in twos. *Perianth* brownish outside, cream or creamy-

yellow inside, (16-)-17-20 mm, tube  $1\frac{1}{5}$ - $1\frac{1}{2}$  mm, limb gradually clavate,  $\pm 2\frac{1}{2}$  mm diam. Anthers c. 3 mm. Disk glands subquadrangular,  $\pm$  connate in a ring. *Ovary* densely fulvous-ferrugineous-pilose; style slender, glabrous. Immature *fruit* subglobose, laxly rufous-pilose.

Distr. *Malaysia*: SE. New Guinea.

Ecol. In forests, 1500-2400 m. *Fl.* Nov.-Jan.

13. *Helicia purpurascens* SLEUM. *Blumea* 8 (1955) 27.

Tree up to 12 m; tips of the branchlets rusty-tomentose, glabrescent. *Leaves* oblong or lanceolate-oblong, shortly abruptly acuminate and subacute at the apex, attenuate and distinctly decurrent at the base, dilutely yellowish green and shining above, brownish-olivaceous and dull beneath when dry, firmly subcoriaceous, glabrous, entire, (9-)-10-15 by 4-5 cm; midrib slightly prominent above, strongly so beneath, nerves 10-11 (-12) pairs coming from the midrib at c. 70-80°, rather straight in the lower part, curved towards the margin and distinctly anastomosing, slightly prominent above, more distinctly so beneath, reticulations irregular and dense, raised on both faces; petiole stout,  $\frac{1}{2}$ - $1(-1\frac{1}{3})$  cm. *Racemes* ramiflorous, c. 30 cm incl. the peduncle c. 10 cm, dense-flowered, rather densely covered with longish, appressed, ferrugineous hairs; rhachis  $2-2\frac{1}{2}$  mm across. Bracts ovate-lanceolate, acute, sometimes soon glabrescent, 2-3 mm, mostly early caducous. Pedicels rather slender, mostly in twos, free or connate up to the middle. *Perianth* deep plum-red, 20-23 mm, tube  $\frac{2}{3}$  mm diam., limb ellipsoid  $2-2\frac{1}{2}$  mm diam. Anthers  $2\frac{1}{2}$  mm. Disk glands thick, connate in the lower half, minutely punctate. *Ovary* densely rufous-pilose; style slender, glabrous. Fruit not known.

Distr. *Malaysia*: Central E. New Guinea (Western & Central Highlands), c. 2350 m.

14. *Helicia torricellensis* LAUT. in K. SCH. & LAUT. *Nachtr.* (1905) 257; *Bot. Jahrb.* 50 (1913) 331; SLEUM. *Blumea* 8 (1955) 28.

Small tree; tips of the branchlets fuscous-tomentose, early glabrescent. *Leaves* lanceolate, long and gradually acuminate towards the apex, rather obtuse, cuneate towards the base and rather distinctly decurrent, thinly subcoriaceous, olivaceous-greenish when dry, shining and, the midrib excepted, glabrous above; very young ones sparsely set with subferrugineous, appressed hairs beneath, but glabrescent, finally glabrous, entire, 7-14 by  $2-3\frac{1}{2}$  cm; midrib slightly raised above, distinctly so beneath, nerves c. 10 pairs, rather straight and parallel, curved and joined together near the margin, distinctly prominent beneath only, reticulations very dense and rather prominent on both faces; petiole somewhat flattened,  $\pm$  winged, glabrous, 2-10 mm. *Racemes* ramiflorous, dense, 12-14 cm, rather densely rufous-ferrugineous hairy in all parts; rhachis  $1-1\frac{1}{2}$  mm across. Bracts ovate-lanceolate, subglabrous, c. 2 mm. Pedicels c. 2 mm, mostly in twos and connate halfway. *Perianth* white, slender, (13-)-14-15 mm,

tube  $\frac{1}{2}$  mm diam., limb ellipsoid  $1\frac{1}{2}$  mm diam. Anthers c. 2 mm. Disk glands thick, subquadragonal, free, close, forming a ring. *Ovary* rufous-tomentose; style slender, glabrous. Fruit not known.

Distr. *Malaysia*: NE. New Guinea (Torricelli Mts), once found, 1000 m. *Fl.* April.

15. *Helicia schlechteri* LAUT. in K. SCH. & LAUT. Nachtr. (1905) 256; Bot. Jahrb. 50 (1913) 333, f. 2; SLEUM. Blumea 8 (1955) 28.

Treelet; branchlets slender, very young parts appressed rufous-ferruginous-tomentose, glabrescent. *Leaves* lanceolate, gradually long acuminate towards the apex, subacute, attenuate at the base and  $\pm$  decurrent, thinly subcoriaceous or chartaceous, glabrous, a little shining above, dull beneath, dilutely olivaceous-greenish when dry, entire, 10–18 by 2– $3\frac{1}{2}$ (–4) cm; midrib prominent on both faces, nerves 8–10  $\pm$  curved and  $\pm$  distinctly anastomosing near the margin, slightly raised on both faces or impressed above, reticulations very dense, minutely prominent on both faces; petiole robust, flattened, 2–8 mm. *Racemes* axillary, lax, slender, 13–30 cm, rather densely set with very fine, appressed, rufous hairs; rhachis 1 mm diam. Bracts ovate-lanceolate, acute, 1– $1\frac{1}{2}$  mm, early caducous. Pedicels 2 mm, mostly in twos, free to entirely connate. *Perianth* white, slender, c. 25 mm, tube  $\frac{3}{5}$  mm diam., limb  $1\frac{1}{2}$  mm diam. Anthers  $1\frac{1}{5}$  mm. Disk glands free, minute, truncate. *Ovary* densely appressed rufous-pilose; style very slender, glabrous. Fruit not known.

Distr. *Malaysia*: NE. New Guinea (Torricelli Mts), once found, 600 m.

16. *Helicia lauterbachiana* SLEUM. Bot. Jahrb. 70 (1939) 147; Blumea 8 (1955) 29.—*H. grandifolia* LAUT. Nova Guinea 8 (Sept. 1910) 285; Bot. Jahrb. 50 (1913) 332, non LECOMTE (May 1910).

Treelet 3–4 m. Branchlets glabrous, the tips not seen. *Leaves* broadly lanceolate or subovate-lanceolate, gradually acuminate and obtuse at the apex, cuneate at the base and decurrent along a very short petiole, coriaceous, dilutely brown and somewhat shining when dry, glabrous, entire, slightly revolute at the margin, 20–32 by 7–11 cm; midrib thick, prominent on both faces, nerves 9–10(–11) pairs, curved-ascending, joined near the edge, mostly distinctly impressed above in dry specimens, prominent beneath, reticulations very dense, minutely raised on both faces; petiole rugose, 4–6 by  $2\frac{1}{2}$ –4 mm. *Racemes* apparently ramiflorous, slender, 25–43 cm, very laxly set with flowers, rather densely covered with long, ferruginous, appressed hairs; rhachis c. 1 mm diam. Bracts minute, lanceolate, c. 1 mm, mostly early caducous. Pedicels 2–3 mm, solitary or in twos, free or connate at the very base. *Perianth* white, 22–25 mm, tube  $\frac{1}{2}$  mm diam., limb ellipsoid,  $1\frac{1}{2}$ –2 mm diam. Anthers  $1\frac{1}{2}$  mm. Disk glands broadly ovate, free. *Ovary* subglobose, rufous-pilose. Style very slender, glabrous. Fruit not known.

Distr. *Malaysia*: S. New Guinea (Noord = Lorentz River), once found, low alt. *Fl.* July.

17. *Helicia oreadam* DIELS, Bot. Jahrb. 54 (1916) 203; SLEUM. Blumea 8 (1955) 29.—*H. phaeotricha* DIELS, l.c. 203.—*H. validinervis* WHITE, Proc. R. Soc. Queensl. 34 (1922) 26; SLEUM. Bot. Jahrb. 70 (1939) 147.

Small tree 3–6 m; tips of the branchlets fuscous-pilose, early glabrescent. *Leaves* lanceolate or narrow obovate-oblong, rather shortly and gradually acuminate at the apex, subacute,  $\pm$  broadly attenuate into the petiole, somewhat inequilateral, subcoriaceous, pale green when dry, shining on both faces, glabrous above, initially laxly, appressedly, ferruginous-pilose on the intervenium beneath, more densely so on the midrib, nerves and petiole, finally nearly completely glabrous, entire, (10–)12–22(–29) by 4–7(–9) cm; midrib robust, prominent on both faces; nerves 9–11 pairs, moderately curved and  $\pm$  parallel, arching in a mostly very distinct intramarginal vein,  $\pm$  distinctly impressed above when dry, prominent beneath, reticulations dense and conspicuously raised on both faces; petiole  $1\frac{1}{2}$ –2(– $2\frac{1}{2}$ ) cm, at the base  $1\frac{1}{2}$ –2 mm thick. *Racemes* axillary or ramiflorous, 18–28 cm, incl. the short peduncle, rather dense-flowered, fuscous-tomentose; rhachis c.  $1\frac{1}{2}$  mm diam. Bracts ovate-lanceolate, subsistent, mostly equalling the pedicels. Pedicels  $1\frac{1}{2}$ –2 mm, mostly in twos, free or connate halfway up. *Perianth* rose-red or purplish, slender, c. 18 mm, tube  $\frac{3}{5}$  mm diam., limb ellipsoid,  $1\frac{1}{2}$  mm diam. Disk glands fleshy, free, divergent. *Ovary* rufous-tomentose; style slender, glabrous. Fruit not seen.

Distr. *Malaysia*: East New Guinea (Sepik region; Central Distr.).

Ecol. In rain-forest, up to 1500 m. *Fl.* Apr.–May, Aug.–Sept.

18. *Helicia stelechantha* DIELS, Bot. Jahrb. 54 (1916) 202; SLEUM. *ibid.* 70 (1939) 135, in *clav.*; Blumea 8 (1955) 30.

Treelet 4–5 m; tips of the branchlets densely appressed rusty-pilose, glabrescent. *Leaves* elliptic or subovate-elliptic, shortly acuminate and subacute at the apex, cuneate into the petiole, slightly inequilateral, dilutely olivaceous above when dry, rather livid beneath, glabrous, remotely and rather coarsely serrate, slightly revolute at the margin, 10–24 by 5–10 cm; midrib prominent, specially beneath, nerves 8–10 pairs rather straight in the lower, curved in the upper part,  $\pm$  parallel, anastomosing, manifestly impressed above in dry specimens, strongly prominent beneath, reticulations dense and slightly raised on both faces; petiole ( $1\frac{1}{2}$ –)2–3 cm. *Racemes* slender, cauliflorous, up to 25 cm, subdensely appressedly rufous-ferruginous hairy. Bracts linear, 2– $2\frac{1}{2}$  mm. Pedicels mostly in twos, connate at the base, rather slender, 3– $4\frac{1}{2}$  mm. *Perianth* pale rose, 14–15 mm, tube  $\frac{1}{2}$  mm diam., limb  $1\frac{1}{2}$  mm. Anthers  $1\frac{1}{2}$  mm. Disk glands thick, broadly obovate, free. *Ovary* rufous-tomentose; style slender, glabrous. Fruit not known.

Distr. *Malaysia*: NE. New Guinea (Sepik River region: 'Schraderberg'), once found in mossy forest, 2070 m. *Fl.* June.

19. *Helicia microneura* WHITE, J. Arn. Arb. 10 (1929) 209; SLEUM. Bot. Jahrb. 70 (1939) 135, *in clav.*; Blumea 8 (1955) 32.

Small, slender, virgate tree; tip of the branchlets appressedly rusty-tomentose, glabrescent. *Leaves* lanceolate or oblong-lanceolate, subacutely acuminate at the apex, cuneate at the base and decurrent on the petiole, firmly subcoriaceous, olivaceous to dark brown, glabrous and somewhat shining above when dry, more dilutely so and rather dull beneath, initially sparsely pilose with appressed hairs on intervenium and midrib, early glabrescent, with 2-4 teeth in the upper part on each side, (4-)-5-7 by 2-2½ cm; midrib nearly flat above, prominent beneath, nerves c. 8 pairs, distinctly curved-anastomosing, slightly prominent on each face, reticulations very dense, minutely raised on both faces; petiole 2-3 mm. *Racemes* axillary or ramiflorous, very slender, densely appressedly rufous-pilose, 3-4½ cm, rather laxly set with flowers nearly to the base; rhachis ½ mm diam. Bracts not seen. Pedicels mostly in twos and nearly connate up to the apex. *Perianth* white, rather densely appressed-pilose in bud, glabrescent during anthesis, c. 6 mm, tube ½ mm, limb ⅔ mm diam. Anthers ¾ mm. Disk glands rather thick, broadly ovate, truncate, free, close. *Ovary* rufous-tomentose; style slender, glabrous. Fruit unknown.

Distr. *Malaysia*: SE. New Guinea (Owen Stanley Range: between Mts Brown and Clarence), once found, 900-1200 m. *Fl.* May.

20. *Helicia dentellata* SLEUM. Bot. Jahrb. 70 (1939) 147; Blumea 8 (1955) 32.

Treelet 3-4 m; tips of branchlets laxly to subdensely clothed with appressed, rufous hairs, glabrous and brownish later. *Leaves* oblong or elliptic-oblong, gradually attenuate towards the top, obtuse, broadly attenuate at the base and ± decurrent along the petiole, olivaceous-brown when dry, rather shining on both faces, stiffly chartaceous, midrib very laxly rusty-hairy on both faces, later glabrous, mostly manifestly subserrate-dentate, or sometimes with a few teeth in the upper part only, very rarely nearly entire, 7-14(-16) by 3½-5½(-6½) cm; midrib slightly elevated above, conspicuously so beneath, nerves 6-7 pairs distinctly curved-anastomosing, slightly raised beneath, reticulations rather dense and slightly raised on both faces; petiole glabrescent, 3-6(-9) mm. *Racemes* axillary, dense-flowered, 7-10 cm, slender, rather densely rufous-pilose on rhachis and pedicels; rhachis c. ⅓ mm diam. Bracts ovate-acute, 1 mm. Pedicels mostly in twos, slender, 1½-2 mm. *Perianth* yellow or greenish, laxly rufous-pilose, 7-8 mm. Anthers 1½ mm. Disk glands subquadrate, free, close. *Ovary* rufous-tomentose; style slender, glabrous. Immature fruit ellipsoid, apiculate, verruculose, laxly rufous-pilose, 8 by 6 mm.

Distr. *Malaysia*: S. and SE. New Guinea.

Ecol. Lowland rain-forest undergrowth. *Fl.* Aug.-Sept., *fr.* Dec.

21. *Helicia ledermannii* DIELS, Bot. Jahrb. 54 (1916) 204; SLEUM. Blumea 8 (1955) 33.

Shrub 1-1½ m; branchlets slender, ± densely rusty-sericeous at the innovations. *Leaves* lanceolate-ovate or oblong-ovate, 2-3 cm subcaudate-acuminate, subacute and ± falcate at the apex, attenuate into the petiole, slightly decurrent, firmly chartaceous, very young ones covered with golden silky hairs on both faces, mature ones olivaceous-greenish when dry, glabrous and almost shining above, subpersistently ± densely covered with longish, appressed, rusty hairs all over the under-surface specially on the midrib, finally glabrescent, remotely and ± irregularly serrate in the upper half by a few rather sharp teeth, 8-13 by 3½-5 cm; midrib somewhat prominent above, more distinctly so beneath, nerves 6-8 pairs, curving upwards, obscurely anastomosing near the edge, slightly prominent on both faces, reticulations dense and raised on both faces; petiole rather slender, 1-2 cm, glabrescent. *Racemes* ramiflorous, dense-flowered nearly to the base, densely appressed-rusty tomentose; rhachis ½ mm diam. Bracts narrow-lanceolate, 1-1½ mm. Pedicels 1½ mm, mostly in twos, nearly connate to the top. *Perianth* lilac-red, c. 6 mm, tube ½ mm diam., limb 1 mm diam. Anthers 1½ mm. Disk glands thick, minute, cushion-shaped, free, close. *Ovary* densely rufous-pilose; style slender, glabrous. Fruit not yet known.

Distr. *Malaysia*: N. New Guinea (Sepik River region: 'Etappenberg'), once found.

Ecol. In dense rain-forest with *Pandanus*, *Agathis* and *Freycinetia*, 850 m. *Fl.* Oct.

22. *Helicia arguta* SLEUM. Bot. Jahrb. 70 (1939) 147; Blumea 8 (1955) 33.

Shrub, c. 3½ m; tips of the branchlets rather densely appressed-rufous-tomentose, glabrescent. *Leaves* elliptic-oblong, acutely rather shortly and abruptly acuminate at the apex, narrowed into the petiole, subcoriaceous, dark green to blackish-brown and shining above when dry, rusty-hairy on the midrib, finally glabrescent, rather sharply and regularly serrate, 7-9 by 3½-4 cm; midrib more distinctly elevated beneath only, nerves 6-7 pairs curved-ascending, obscurely anastomosing, slightly prominent on both sides, reticulations ± lax above, rather dense, and finely raised beneath; petiole c. 5 mm. *Racemes* ramiflorous, very slender, rather densely fuscous-pilose, 7-8½ cm; rhachis ⅓ mm diam. Bracts ovate-acuminate, c. 1 mm. Pedicels mostly in twos and connate up to the middle, slender, fuscous-pilose, 2 mm. *Perianth* yellowish with salmon centre, c. 6 mm, laxly fuscous-pilose, or glabrescent from the top. Anthers 1½ mm. Disk glands subovate-oblong, connate at the base. *Ovary* rusty-hirsute; style glabrous. Fruit not known.

Distr. *Malaysia*: E. New Guinea (Central Distr.: Bori), once found.

Ecol. In secondary forest, 1200 m. *Fl.* Nov.

23. *Helicia excelsa* (ROXB.) BL. Ann. Sc. Nat. II, 1 (1834) 219; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84 *incl. var. α & β*; MEISN. in DC. Prod. 14 (1856) 441 *incl. var. edentata* MEISN.; MIQ. Fl. Ind.

Bat. 1, 1 (1858) 987; HOOK. f. Fl. Br. Ind. 5 (1886) 191; LECOMTE, Not. Syst. 1 (1909) 191; Fl. Gén. I.-C. 5 (1914) 162, f. 14(5); GAMBLE, J. As. Soc. Beng. 75, ii (1914) 346 incl. var. *salicifolia* (Pr.) GAMBLE, var. *forbesii* GAMBLE p. 347; MERR. J. Str. Br. R. As. Soc. no 85 (1922) 168; PARKINSON, For. Fl. Andam. Isl. (1923) 228; RIDL. Fl. Mal. Pen. 3 (1924) 143 incl. var.; BAK. f. J. Bot. 63 (1925) Suppl. 89; BURK. Dict. (1935) 1133; KANJILAL & DAS, Fl. Assam 4 (1940) 107; SUESSENG. in Fedde, Rep. 54 (1951) 226 p.p.; SLEUMER. Blumea 8 (1955) 36.—*Roupala excelsa* ROXB. (Hort. Beng. 1814, 83, *nomen*) Fl. Ind. 1 (1820) 363 (*Rhopala*); ed. CAREY 1 (1832) 365 (WALL. Cat. 1038); WIGHT, Ic. (1839) t. 190.—*H. salicifolia* PRESL, Epim. (1851) 247; MEISN. in DC. Prod. 14 (1856) 439; MIQ. Fl. Ind. Bat. 1, 1 (1858) 985; KURZ, For. Fl. Br. Burma 2 (1877) 312.—*Alseodaphne crassipes* HOOK. f. Fl. Br. Ind. 5 (1886) 146; RIDL. Fl. Mal. Pen. 3 (1924) 100, cf. SYMINGTON, Kew Bull. (1937) 319.—*H. oblancoolata* MERR. Pap. Mich. Ac. Sc. 24 (1939) 67.

Tree 15–28 m by 30–50 cm; tips of the slender branchlets rusty-tomentose, very soon glabrescent, finally glabrous. Leaves  $\pm$  narrow-oblong or oblanceolate or obovate-oblong,  $\pm$  abruptly acuminate at the apex, subacute or obtuse, cuneate into the petiole and somewhat decurrent, chartaceous to subcoriaceous, rarely coriaceous, yellow-greenish when dry, rusty-tomentose on both faces and on the petiole when very young, but soon glabrescent, entirely glabrous at maturity and mostly shining above, less so beneath, entire or mostly with some  $\pm$  coarse  $\pm$  obtuse teeth on both sides in the upper part, (8–)10–15(–24) by (3–)3 $\frac{1}{2}$ –5(–8) cm; midrib slightly raised above, distinctly so beneath, nerves (6–)7–8(–10) pairs, rather straight in their lower part, curved upwards,  $\pm$  joined along the edge, somewhat prominent on both faces, reticulations dense, slightly but well visibly raised on both faces; petiole  $\frac{3}{5}$ –1(–1 $\frac{1}{2}$ ) cm. Racemes from the upper axils, sometimes subterminal, solitary or 2–3 together, rather slender, dense-flowered nearly to their base, mostly  $\pm$  densely rusty-tomentose all over, rarely  $\pm$  glabrescent, never entirely glabrous, (5–)7–12(–15) cm; rhachis 1–1 $\frac{1}{2}$  mm diam. Bracts ovate-lanceolate, rather thin, 2–3 mm, often equalling the pedicels. Bracteoles minute, usually rather long persistent as are the bracts. Pedicels rather slender, 2–3(–4) mm in anthesis, mostly in twos, free or halfway connate. Perianth yellowish-green, fragrant, slender, rusty-tomentose or at least  $\pm$  densely pilose, rarely with only some scattered rufescent hairs, (6–)7–8 mm, tube  $\frac{1}{2}$  mm diam., limb 1 mm diam. Anthers c. 1 $\frac{1}{2}$  mm. Disk glands free, nearly rounded. Ovary ferruginous-villous; style slender, glabrous. Fruit ellipsoid or obliquely ovoid, obtuse, smooth, glabrous, bluish-nigrescent, 1–1 $\frac{1}{5}$  (–1 $\frac{1}{2}$ ) by  $\frac{4}{5}$ –1 $\frac{1}{5}$  cm; pericarp  $\frac{4}{5}$ –1 mm; pedicel 7–8 mm.

Distr. E. Bengal, Lower Burma, Indo-China, Siam; in Malaysia: Sumatra (also Simalur Isl.), Malay Peninsula, Riouw, Banka, Borneo.

Ecol. In rain-forest, on tops of low hills, jungle

ridges, often along streams, scattered, from low altitudes up to 1000 m, rarely up to 1500 m. Fl. Jan.–May, fr. Apr.–June.

Use. Wood said to be hard with a light brown colour and remarkably broad rays, which are connected by close transverse bars; useful for house-construction and mines.

Vern. *Krindjing daun, pangkat, rantu*, Palemb., *kusi*, Sum. W. Coast, *tutun lasurimanu ètem, tutunbajut ètèm, bofo ètèm, tuaro batu, bahèngeng pajo*, Simalur, *mèmbatu laiang, mata kaok, mèdang obu*, Mal. Pen.; Borneo: *hati buntal, marabomban*, Kutei, *rambai*, Sungei, *pasir-pasir*, Sandakan.

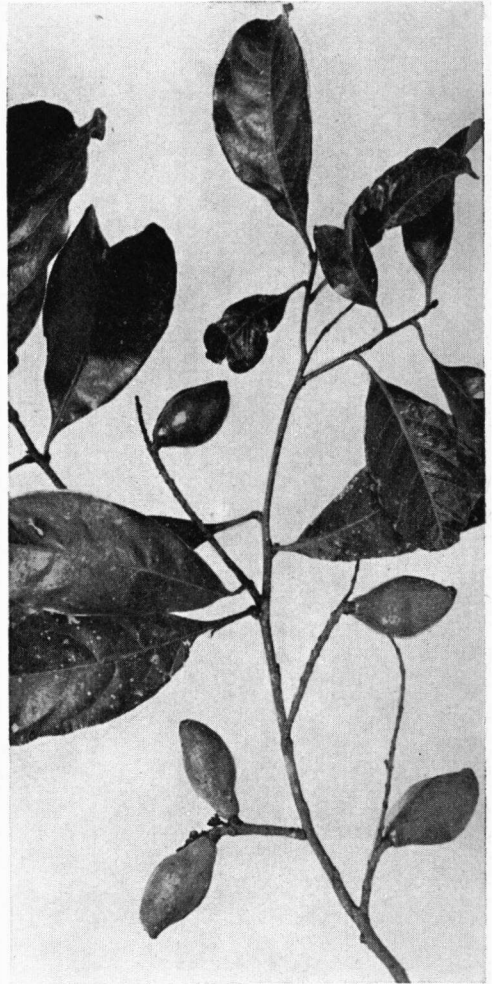


Fig. 14. *Helicia serrata* (R.Br.) BL. Habit, twig with young fruits of the nearly entire-leaved mountain-form,  $\times \frac{1}{3}$  (Cult. Tjibodas Mountain Garden no O. 20, Oct. 1954).

24. *Helicia serrata* (R.Br.) BLUME, Ann. Sc. Nat. II, 1 (1834) 215; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84; MEISN. in DC. Prod. 14 (1856) 441; MIQ. Fl. Ind. Bat. 1, 1 (1858) 987; K. & V. Bull. Inst. Bot. Btzg no 2 (1899) 10, incl. var. *petiolata* K.&V.; Bijdr. 5 (1900) 314 incl. var. *subintegra* K.&V. l.c. 315, 317; KOORD. Exk. Fl. Java 2 (1912) 154; KOORD.-SCHUM. Syst. Verz. (1913) fam. 66, p. 3; MERR. Int. Rumph. (1917) 205; KOORD. Fl. Tjib. (1923) 47; BAK. f. J. Bot. 63 (1925) Suppl. 89; HEYNE, Nutt. Pl. (1927) 588; OCHSE & BAKH. Groent. (1931) 621, f. 380; BACK.

Leaves coriaceous, ovate-elliptic to elliptic, mostly inconspicuously serrate, or entire . var. *oreophila*

var. *serrata*.—Fig. 14.

Tree 10–30 m by  $1\frac{1}{2}$ –1 m; tips of branchlets rather densely ferruginous-sericeous, soon glabrescent. Leaves elliptic or elliptic-oblong, rarely lanceolate-oblong, shortly acuminate, subacute or obtuse at the apex, attenuate into a nearly winged petiole, subcoriaceous, glabrous,  $\pm$  shining, yellowish or brownish-olivaceous above when dry, mostly dull brownish beneath when dry, initially

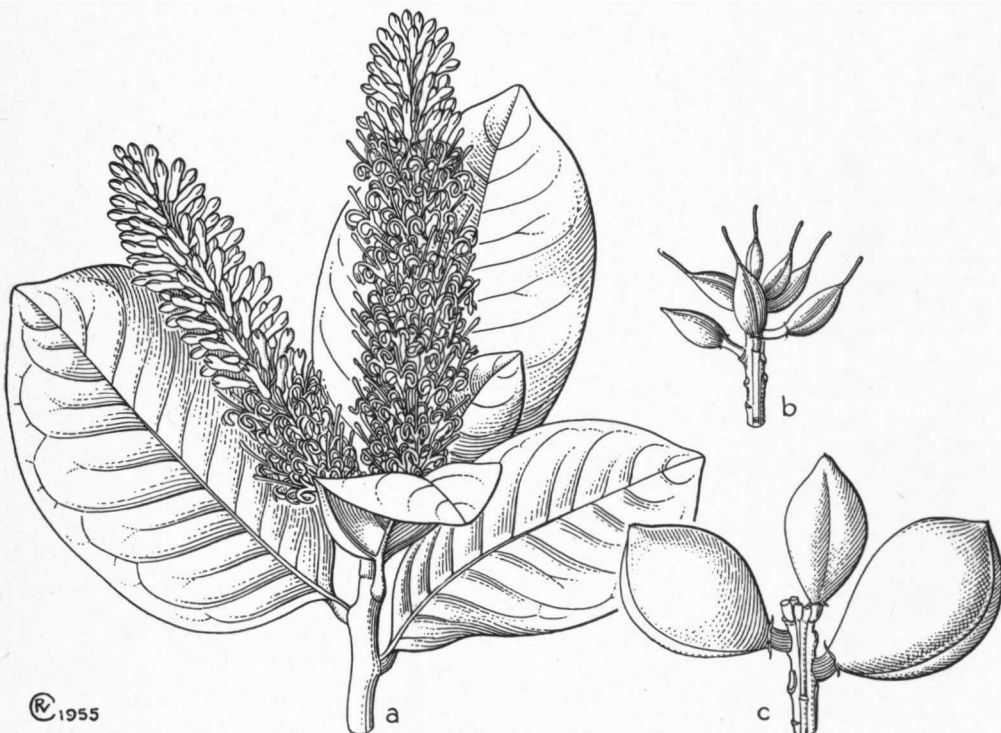


Fig. 15. *Helicia serrata* (R.Br.) BL. var. *oreophila* SLEUM. a. Habit,  $\times 2/3$ , b. developing fruits,  $\times 2/3$ , c. mature fruit,  $\times 2/3$  (after VAN STEENIS 11668 from Mt Papandajan, 2650 m alt.).

Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 4; SLEUM. Blumea 8 (1955) 34.—*Arbor vespertilionum* RUMPH. Herb. Amb. 7 (1755) 17, excl. t. 10.—*Roupala serrata* R.Br. Trans. Linn. Soc. 10 (1810) 192 (*Rhopala*); R.Br. Prod. Fl. Nov. Holl. Suppl. (1830) 32; ROXB. Fl. Ind. ed. CAREY (1832) 365.—*H. curtisii* GAMBLE, Kew Bull. (1913) 116; J. As. Soc. Beng. 75, ii (1914) 348; RIDL. Fl. Mal. Pen. 3 (1924) 142.—*H. scortechinii* GAMBLE, Kew Bull. (1913) 117; J. As. Soc. Beng. 75, ii (1914) 348; RIDL. Fl. Mal. Pen. 3 (1924) 143.—*H. brachyantha* MERR. Pap. Mich. Ac.Sc. 24 (1936) 66.—Fig. 14–15.

#### KEY TO THE VARIETIES

Leaves subcoriaceous, oblong or elliptic-oblong, rarely lanceolate-oblong, mostly manifestly serrate, rarely subentire. . . . . var. *serrata*

with fine, rufescent, appressed hairs rather densely spread all over the under-surface, tardily glabrescent, mostly  $\pm$  regularly sharply or obtusely serrate along the whole margin, rarely subserrate or entire (serrate and nearly entire leaves sometimes occurring on the same tree), (10–)12–20(–22) by (4–)5–8 $\frac{1}{2}$ (–12) cm; midrib not or slightly prominent above, distinctly so beneath, nerves 8–10 pairs, curved,  $\pm$  obsolete joined near the margin, nearly flat above, prominent beneath, reticulations lax, somewhat raised mostly beneath only; petiole (1–)1 $\frac{1}{2}$ –2 cm, glabrescent. Racemes axillary or ramiflorous, rather slender, dense, 9–15 cm, rather densely rufous-tomentellous,  $\pm$  glabrescent with age, rarely nearly glabrous, specially when attacked by galls; rhachis c. 1 mm diam. Bracts minute, ovate-acuminate. Pedicels rather slender,

mostly in twos and connate halfway, 2-3(-4) mm. *Perianth* white, changing to cream or light brown during anthesis, with an unpleasant, nauseating odour, 7-8(-10) mm, tube c. 1 mm diam., limb 1½ mm diam. Anthers 1½-2 mm. Disk glands oblong or ovate-oblong, truncate, rather thick, free and ± spaced. *Ovary* mostly densely, rarely laxly rufous-sericeous. Style slender, glabrous. *Fruit* (in Jav. specim.) ± broadly ellipsoid, somewhat oblique, shortly attenuate at the apex and base, not rarely distinctly contracted at the base, apex apiculate or obtuse, sordid-green, brown when dry, smooth, with a mostly distinctly prominent rib, (2½-3)-4(-5) by 1½-2(-2½) cm, pericarp 1-2 mm, pedicel 4-6 by 2 mm.

Distr. *Malaysia*: Sumatra, Malay Peninsula (Penang), Java, Borneo (also Karimata Isl.), Moluccas (Ambon: Nusa Laut).

Ecol. In rain-forest, in hilly country or on ridges, apparently rare in the lowland, more frequent between 1000-1600 m.

Uses. Wood honey-coloured, prettily marked by the broad yellowish medullary rays. The young shoots are eaten in Java.

Vern. *Kaju sippur*, *k.s. gading*, *k.s. tombak*, *k. si hondung*, *k. si djogar*, M (Asahan), *bareubeuj*, *këndung*, J, S, *kaju morsego* (after RUMPHIUS), *lepu punchu*, Borneo (Dusun Tambun).

Notes. The species has not been recollected in Nusa Laut and no fruits from Ambon have been accessible to me. The description above is of fruits from Java; those from Borneo and Karimata specimens differ markedly, being depressed-ovoid, smaller (2½ by 3 cm), and blue-black, with apparently thinner pericarp. It is possible that they agree with those of the Ambon tree, in which case *H. serrata* in its proper sense would occur in Borneo and Ambon. The Sumatra, Malay Peninsula, and Java specimens, although not discernible in leaf- and flower-characters, should then be regarded as a separate species and should be named *H. curtisii* GAMBLE.

*var. oreophila* SLEUM. *Blumea* 8 (1955) 35.—Fig. 15.

Small tree, 3-8 m, with dense crown. *Leaves* coriaceous, elliptic or ovate-elliptic, entire or nearly so. *Inflorescences* not rarely glabrescent. *Perianth* ± 10 mm, often glabrescent. *Ovary* laxly pilose, very rarely glabrous.

Distr. *Malaysia*: Sumatra (NW. slope of Mt Talamau), Java.

Ecol. Edge of rain-forest or subalpine brushwood, also among alang-alang in scrubs, 2000-c. 2650 m.

25. *Helicia peltata* WHITE, J. Arn. Arb. 10 (1929) 210; SLEUM. *Blumea* 8 (1955) 38.

Tree 18-24 m; branchlets dark rufous-tomentose. *Leaves* ovate to elliptic-ovate or elliptic, peltate almost 1 cm beyond the rounded base, ± coriaceous, apex broadly obtusely acuminate, dark olivaceous to blackish-brown when dry, rufous-pilose or tomentose on both faces when very young, glabrous and shining above at maturity

except the midrib and nerves which remain pubescent for a long time, dark rufous-pilose to velutinous all over the undersurface, entire or undulate, (10-)-12-24(-34) by 6-12(-17) cm; midrib prominent on both faces, nerves 12-18 pairs, rather straight and parallel, curved near the edge and inconspicuously anastomosing, nearly flat above, prominent beneath, reticulations lax, raised beneath only; petiole rufous-tomentose, 3-4 cm by 3 mm. *Racemes* ramiflorous, dense, 12-22 cm, rufous-tomentose on rachis and pedicels; rachis 2 mm diam. Bracts minute, ovate-acute. Pedicels rather robust, in twos, free or connate halfway, 3-5 mm. *Perianth* cream, 25 mm, subdensely rufous-pilose, inflated at the base (2½ mm), tube 1 mm diam., limb 2½ mm diam. Anthers 3 mm. Disk glands thick, truncate, free, close, imitating a cup. *Ovary* ovoid, glabrous; style slender. Fruit unknown.

Distr. *Malaysia*: New Guinea (Central Distr.: Bisiatabu), once found, 450 m.

Uses. Sapwood pale, heart-wood light brown. Vern. *Oraluma*.

26. *Helicia microphylla* DIEELS, Bot. Jahrb. 54 (1916) 201; SLEUM. *Blumea* 8 (1955) 39.

Tree or treelet, densely branched; tips of the branchlets ferruginous-tomentose, glabrescent. *Leaves* ovate to oblong-ovate, shortly obtusely acuminate at the apex, attenuate at the base, coriaceous, very young ones rusty-tomentose on both faces, early glabrescent above, clothed with crisp rusty hairs beneath, finally entirely glabrous, dilutely brownish when dry, shining above, dull beneath, entire, 1½-3 by 1-1½ cm; midrib impressed above, prominent beneath, nerves 4-5(-6) pairs, coming from the midrib at nearly right angles, straight in the lower part, curved distally, as the densely reticulated veins slightly impressed above, obscurely raised beneath; petiole slender, finally glabrescent, 3-5(-7) mm. *Racemes* axillary, solitary, strict, rather slender and dense-flowered, 4-7 cm, rusty-tomentose; rachis 1 mm. Bracts ovate-acuminate, c. 1 mm. Pedicels slender, mostly in twos, connate at the base, 4-5 mm. *Perianth* yellow, 14-17 mm, tube 1 mm, limb clavate 1½ mm diam. Anthers 2½ mm. Disk glands ovate, thin, rufous-pilose or -ciliate at the upper margin, close, slightly imbricate. *Ovary* glabrous. Fruit not known.

Distr. *Malaysia*: NE. New Guinea (Madang Distr.: Bismarck Mts), once found in rain-forest, 2400 m.

27. *Helicia cameronii* F.v.M. Trans. R. Soc. Vict. n.s. 12 (1889) 7; LAUT. Bot. Jahrb. 50 (1913) 330, f. 1; SLEUM. *Blumea* 8 (1955) 38.

Treelet or shrub; tips of the branchlets tomentose by crisped ferruginous or later greyish hairs, glabrescent. *Leaves* elliptic or oblong-elliptic, shortly obtusely acuminate at the apex, cuneate at the base, very young ones ± appressed-rufescent hairy specially on the midrib beneath, soon entirely glabrous, subcoriaceous, olivaceous-yellowish and dull when dry, entire or with 1-2

teeth on each side, somewhat recurved at the margin,  $1\frac{4}{5}$ – $2\frac{2}{3}$  by  $\frac{4}{5}$ – $1\frac{1}{5}$  cm; midrib slightly impressed above, prominent beneath, nerves c. 5 pairs rather straight below, curved upwards to the edge, very slightly impressed above; raised beneath, reticulations rather obscure; petiole 0–2 mm. *Racemes* solitary, ramiflorous, 5– $6\frac{1}{2}$  cm, dense; rhachis stoutish,  $1\frac{1}{2}$  diam., laxly rufescent-pilose as are the pedicels. Bracts minute, lanceolate, caducous. Pedicels mostly in twos, connate at the base, 4–6 mm. *Perianth* 30 mm, with some rufous hairs at the base, glabrous elsewhere, tube  $\frac{3}{4}$  mm across, limb gradually clavate, 4 mm by  $1\frac{4}{5}$  mm. Anthers c. 4 mm. Disk glands ovate, close, connate at the base only. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Malaysia*: SE. New Guinea (Central Distr.: Mt Knutsford), once found.

28. *Helicia pterygota* SLEUM. *Blumea* 8 (1955) 40. —*H. erratica* (non HOOK. f.) STAPP, *Trans. Linn. Soc. Bot.* 4 (1894) 220; MERR. *En. Born.* (1921) 235.

Shrub or small tree  $1\frac{1}{2}$ –7 m, glabrous in all its parts. *Leaves* lanceolate or oblong-lanceolate, acute-acuminate at the apex,  $\pm$  long cuneate at the base, slightly decurrent, chartaceous to subcoriaceous, olivaceous-greenish or light yellowish-green when dry,  $\pm$  shining, mostly with a few remote teeth in the upper part or entire, (7)–8–11 (–14–17) by 2– $3\frac{1}{2}$  (–5) cm; midrib slightly prominent above, strongly so beneath, nerves 8–9 pairs, mostly rather straight in the lower part, curved upwards and  $\pm$  distinctly anastomosing, somewhat raised on both faces, reticulations rather dense and minutely prominent on both faces; petiole slender, 1– $1\frac{1}{2}$  cm. *Racemes* axillary or subterminal, laxly set with flowers nearly to the base; rhachis angular,  $\frac{1}{2}$ –1 mm diam. Bracts ovate-acuminate, membranous, c. 1 mm. Pedicels rather slender, provided with mostly one very distinct membranous wing on both sides, mostly in twos and connate for  $\frac{1}{3}$ – $\frac{1}{2}$ , 4–5 (–6) mm. *Perianth* cream-whitish or light yellowish-greenish, sometimes lavender-tinged or lemon, very slender, 11–12 mm, tube  $\frac{2}{5}$ – $\frac{1}{2}$  mm diam., limb elongate-ellipsoid, subacute, 1 mm diam. Anthers  $1\frac{3}{5}$  mm. Disk glands ovate-oblong, truncate,  $\pm$  retuse, free, close. *Ovary* glabrous; style filiform. Fruit not yet known.

Distr. *Malaysia*: Br. N. Borneo (Mt Kinabalu).

Ecol. Rain-forest ridge, 900–1500 m. *Fl.* Dec.–June.

29. *Helicia microcarpa* SLEUM. *Blumea* 8 (1955) 41.

Small tree; tips of the branchlets deep rufous-tomentose, glabrescent. *Leaves* elliptic, broadly shortly subabruptly acuminate at the apex, subacute to obtuse, broadly attenuate to nearly rounded at the base, somewhat inequilateral, subcoriaceous or stiff-chartaceous, pale yellowish-greenish when dry, rather dull on both faces, mature ones glabrous above, laxly  $\pm$  crisped rufous hairy beneath specially on the midrib and

nerves, entire, 4– $6\frac{1}{2}$  by 2–3 cm; midrib nearly flat above, prominent beneath, nerves c. 6 pairs,  $\pm$  curved upwards and inarching before the edge, nearly inconspicuous above, slightly raised beneath, reticulations dense, obsolete or very slightly impressed above, visibly raised beneath; petiole rather slender, rather long, remaining tomentose, 7–10 mm. *Racemes* axillary, solitary, rather stiff and suberect, 7–11 cm incl. the peduncle 1–2 cm, densely dark rusty tomentose all over; rhachis 1– $1\frac{1}{2}$  mm diam. Bracts lanceolate,  $1\frac{1}{2}$  mm. Pedicels rather robust, mostly in twos, connate at the base or halfway up, 3 mm. *Perianth* brownish, seen only in rather developed buds, probably c. 18 mm in anthesis, tube  $\frac{4}{5}$  mm diam., limb clavate,  $1\frac{1}{2}$  mm diam. in bud. Anthers c.  $1\frac{3}{4}$  mm. Disk glands ovate-oblong, free, somewhat spaced. *Ovary* glabrous. Immature fruit subglobose-ellipsoid, crowned by a very slender style 18–19 mm.

Distr. *Malaysia*: E. New Guinea (Western & Central Highlands), c. 2350 m. *Fl.* Sept. and Nov.

30. *Helicia maxwelliana* GIBBS, *J. Linn. Soc. Bot.* 42 (1914) 131; MERR. *En. Born.* (1921) 235; SLEUM. *Blumea* 8 (1955) 42.

Small fastigate tree, 3 m; branchlets robust, the youngest parts subangular and laxly covered by very short, appressed, rufescent hairs, older ones terete, glabrous, all dark brown. *Leaves* broadly elliptic- to obovate-oblong, broadly attenuate to rounded at the apex, with a terminal blackish gland, mostly cordate or rounded at the base or nearly auriculate, subsessile, thick-coriaceous, olivaceous-yellowish to dark brown when dry,  $\pm$  shining above, dull beneath, entire or occasionally with 1–3 minute glandular teeth on both sides, glabrous, slightly revolute at the margin, 15–23 by (7)–8–11 cm; midrib slightly prominent above, very stout and prominent beneath, nerves (8)–9–10 pairs, straight in their lower part, divided or dissolute into veins before reaching the edge,  $\pm$  distinctly anastomosing, prominent on both sides, reticulations rather dense and conspicuous on both faces; petiole 3–5 by 4 mm, rugulose. *Racemes* axillary, ramiflorous or cauline, solitary, 10–14 cm, dense-flowered, rather densely appressedly rufous-pilose on rhachis and pedicels, less so on the perianth; rhachis robust, c. 2 mm diam., terete. Bracts ovate-acuminate, 1– $1\frac{1}{2}$  mm, hairy. Pedicels stoutish, 3–4 (–5) mm, mostly in twos or fours, free or connate at the base. *Perianth* white, sweet-scented, 12–13 (–14) mm, tube  $\frac{1}{2}$ – $\frac{3}{5}$  mm, limb clavate,  $1\frac{1}{2}$  mm diam. Anthers 2 mm. Disk glands ovate, connate at the base. *Ovary* glabrous. Immature fruit obliquely subglobose, apiculate, slightly contracted at the base.

Distr. *Malaysia*: Br. N. Borneo (Mt Kinabalu: Marai Parai). A very similar sterile specimen seen from the Malay Peninsula (Trengganu: G. Padang), c. 1220 m.

Ecol. In dense forest scrub or low open jungle, on edge of mossy forest, 1500–1800 m. *Fl.* Dec.–Febr., *fr.* March.



31. *Helicia olivacea* SLEUM. Bot. Jahrb. 70 (1939) 136; Blumea 8 (1955) 43.

Slender tree, c. 16 m; tips of the branchlets red-brown when dry, glabrous. *Leaves* oblong, shortly obtusely acuminate at the apex, attenuate into the petiole and  $\pm$  decurrent, slightly inequilateral, chartaceous to subcoriaceous, olivaceous above, brownish beneath when dry, dull, glabrous, entire or rarely remotely subdenticulate or undulate, 11–14 by 4–5 $\frac{1}{2}$  cm; midrib rather strongly raised on both faces, nerves 8–10(–12) pairs, straight and  $\pm$  parallel in their lower  $\frac{2}{3}$ , curved upwards and anastomosing, finely raised on both faces, reticulations rather dense, minutely elevated on both faces; petiole 3–5 mm, very thickened and rugose at the base. *Racemes* ramiflorous, dense-flowered, c. 11 cm, laxly, appressed-rufescent hairy on rhachis and pedicels, very laxly so on the perianth; rhachis 1 mm diam. Bracts ovate-acute, minute. Pedicels 1 $\frac{1}{2}$ –2 mm, mostly in twos and connate at the base. *Perianth* cream 5(–6) mm, tube  $\frac{2}{5}$  mm diam., limb broadly ellipsoid, 1 mm diam. Anthers 1 $\frac{1}{2}$  mm. Disk glands broadly oblong, retuse, free or connate at the base only. *Ovary* glabrous. *Fruit* ellipsoid or subglobose, c. 3 $\frac{1}{2}$  cm long, smooth, brown when dry, with small pale dots; pericarp rather hard, c. 4 mm.

Distr. *Malaysia*: NE. New Guinea (Morobe Distr.: Sattelberg), once found.

Ecol. In forest, 600 m. *Fl. fr.* March.

32. *Helicia commutata* SLEUM. Bot. Jahrb. 70 (1939) 137; Blumea 8 (1955) 43.

Branchlets practically glabrous, brown or reddish-brown. *Leaves* lanceolate-oblong, gradually attenuate towards the apex,  $\pm$  acute, shortly cuneate and decurrent on the petiole, chartaceous, brownish and shining on both faces when dry, entire or obscurely and remotely glandular-denticulate, glabrous, 15–22 by 4–6 cm; midrib prominent on both faces, nerves 16–20 pairs, straight and  $\pm$  parallel in their lower part, curved upwards and rather distinctly anastomosing before the edge, slightly prominent on both faces, reticulations very fine and dense, well visible on both faces; petiole c. 1 cm, not winged in the lowest 3–5 mm, thickened. *Racemes* axillary, slender, rather dense-flowered, 9–15 cm; rhachis subterete, 1 mm diam., glabrous as are the pedicels, or with some scattered appressed very short hairs. Bracts minute, early caducous. Pedicels slender, in twos, connate at the base, 2(–3) mm. *Perianth* slender, c. 9 mm, glabrous, tube  $\frac{1}{2}$  mm diam., limb elongate-ellipsoid c. 1 mm diam. Anthers 1 $\frac{1}{2}$  mm. Disk glands nearly quadrangular, free or coherent at the base. *Ovary* glabrous; style slender. *Fruit* unknown.

Distr. *Malaysia*: NE. New Guinea (Madang Distr.: Bismarck Mts), in forest at 1100 m, once found. *Fl.* Oct.

33. *Helicia odorata* DIELS, Bot. Jahrb. 54 (1916) 201; SLEUM. Blumea 8 (1955) 44.

Tree, 5–15(–20) m; tips of the branchlets brownish and glabrous. *Leaves* obovate-elliptic or more

rarely obovate, shortly  $\pm$  abruptly obtusely acuminate at the apex, attenuate and  $\pm$  decurrent into the petiole, subcoriaceous, greyish-brownish and somewhat shining above when dry, brownish and rather dull beneath, very young ones laxly appressed-pilose, glabrescent, mature ones glabrous, entire, (4–)5–8 by (2–)2 $\frac{1}{2}$ –3 $\frac{1}{2}$  cm; midrib prominent on both faces, nerves 4–5(–6) pairs, rather straight in their lower part, curved upwards and rather strongly anastomosing, slightly or not raised above, more distinctly so beneath, reticulations dense, finely prominent on both faces; petiole  $\frac{1}{2}$ –1(–1 $\frac{1}{2}$ ) cm, at least partly winged by the decurrent blade. *Racemes* axillary,  $\pm$  dense-flowered, slender, 6–10 cm; rhachis terete, dark brown when dry, 1–1 $\frac{1}{2}$  mm diam., very laxly appressed-rusty-pilose or glabrous. Bracts ovate-lanceolate, nearly subulate, c.  $\frac{1}{2}$  mm, subsistent. Pedicels slender, mostly in twos, connate at the base, glabrous, 4–5 mm. *Perianth* white, fragrant, c. 12 mm, glabrous, tube  $\frac{1}{2}$  mm diam., limb ellipsoid, 2 by 1 $\frac{1}{2}$  mm. Anthers c. 2 mm. Disk glands ovate, free,  $\pm$  close. *Ovary* glabrous. *Fruit* obovoid, slightly attenuate at the very base, c. 5 by 4–4 $\frac{1}{2}$  cm, pericarp coriaceous, 4 mm; pedicel 1 by 0.3–2 $\frac{1}{2}$  cm.

Distr. *Malaysia*: N. New Guinea (Sepik: Hunsteinspitze; Habbema Lake; Wissel Lakes).

Ecol. In old or secondary moss-forest, 1300–2800 m. *Fl.* Febr., March, July; *fr.* Oct.

Vern. *Ijonneh*, Enarotali, Kapauku language.

34. *Helicia teysmanniana* SLEUM. Blumea 8 (1955) 44.

Small tree; branchlets glabrous, brownish when dry. *Leaves* obovate or mostly oblong-obovate, gradually attenuate towards the obtuse apex, with a rather thick, terminal gland underneath, cuneate and decurrent towards the base of the petiole, subcoriaceous, mostly brownish-yellowish when dry, rarely darker brown, somewhat shining on both faces, glabrous, entire, 4–7 by (2–)2 $\frac{1}{2}$ –3 $\frac{1}{2}$  cm; midrib slightly prominent above, more distinctly so beneath, often somewhat reddish in dry specimens, nerves 4–5 pairs, straight in their lower half, curved upwards near the edge and  $\pm$  distinctly anastomosing, slightly raised above, more so beneath, reticulations dense, prominent beneath, slightly or not so above; petiole  $\frac{1}{2}$ –1 cm, much thickened and soon corky at the base. *Racemes* axillary, rather dense, 6–14 cm; rhachis angular, dilutely brown when dry, appressedly rufescent-pilose in the lower part, glabrescent towards the top, 1 $\frac{1}{2}$ –2 mm diam. Bracts narrow-ovate or lanceolate, acute, 2 mm, subsistent. Pedicels thickened towards the apex, mostly in twos, shortly connate at the base, hairy below, glabrous above, 5–6 mm. *Perianth* yellowish, not rarely red or violet-tinged specially at the top and/or the base, 12–13 mm, tube  $\frac{1}{2}$  mm diam., limb gradually clavate, 3 by 1 $\frac{1}{5}$ –1 $\frac{1}{2}$  mm. Anthers 2 $\frac{1}{2}$  mm. Disk glands oblong, free, spaced. *Ovary* glabrous. *Fruit* not known.

Distr. *Malaysia*: SE. Celebes (Bonthain Peak).

Ecol. In rain-forest 1700–2600 m. *Fl.* June.

Vern. *Katji-katji*, *ani-anisi*, Bonthain.

35. *Helicia acutifolia* SLEUM. Bot. Jahrb. 70 (1939) 140; Blumea 8 (1955) 45.

Small tree c. 6 m; tips of the branchlets appressedly rufous-pilose, glabrescent. *Leaves* oblong or oblong-lanceolate, gradually subcaudate-acuminate at the apex, acute, attenuate and  $\pm$  decurrent into the petiole, sometimes to near its base, brown and  $\pm$  dull when dry, chartaceous, entire, rarely with a few minute teeth in the upper half on each side, 5–10 by 2–3 cm; midrib slightly prominent above, rather strongly so beneath, nerves c. 8 pairs, straight below, curved upwards, obscurely inarching, slightly raised on both faces, reticulations dense, minutely prominent on both faces; petiole slender, 4–5 mm. *Racemes* from the upper axils, slender, 7–12 cm, rather dense-flowered, sparsely appressedly rufous hairy all over; rhachis  $1\frac{1}{2}$ – $4\frac{1}{5}$  mm diam. Bracts minute, early caducous. Pedicels often in twos, free or connate at the base, 2–3 mm. *Perianth* yellowish-whitish, 9 mm in mature buds, tube  $\frac{1}{2}$  mm diam., limb subacute, c. 1 mm diam. Anthers  $1\frac{1}{5}$  mm. Disk glands subquadrangular, free except their bases. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Malaysia*: SE. New Guinea (Central Div.: Mt Victoria), once found.

Ecol. In secondary forest, c. 2040 m. *Fl.* Jan.

36. *Helicia saruwagedica* SLEUM. Bot. Jahrb. 70 (1939) 138; Blumea 8 (1955) 45.

Small bushy tree, c. 5 m; branchlets glabrous. *Leaves* lanceolate-oblong to broadly oblong, shortly obtusely attenuate at the apex, broadly cuneate to nearly rounded at the base, rather stiffly subcoriaceous, very young ones blackish-brownish-olivaceous above, brownish underneath when dry, moderately glossy on both faces specially above, entire, (8–)10–15(–19) by (3 $\frac{1}{2}$ )–4–6(–8–10) cm; midrib slightly raised above, very prominent beneath, nerves 7–8 pairs, elevated on both faces, upper ones sometimes rather straight, lower ones or all together somewhat curved, a little raised on both faces, reticulations lax, minutely elevated, mostly well visible beneath; petiole 2–7 mm, thickened, rugose. *Racemes* axillary,  $\pm$  pendulous, rather dense, 8–14(–18) cm, glabrous or nearly so; rhachis almost terete, 1–1 $\frac{1}{2}$  mm diam. Bracts minute, acute, nearly scariose. Pedicels mostly in twos, connate at the base, 3–4 mm. *Perianth* pale yellow, sometimes yellowish-greenish or reddish, 10–12(–13) mm, tube  $\frac{3}{5}$  mm diam., limb ellipsoid, 1 $\frac{1}{2}$  mm diam. Anthers 1 $\frac{1}{2}$  mm. Disk glands subquadrangular, free, close. *Ovary* glabrous; style strikingly thickened towards the apex. Submature fruit obliquely narrow-ellipsoid, subfusiform, acuminate into a marked  $\pm$  curved beak, almost truncate at the base, smooth, 3–3 $\frac{1}{2}$  by 1 $\frac{1}{2}$ –1 $\frac{3}{4}$  cm, green when fresh, finally nigrescent.

Distr. *Malaysia*: NE. New Guinea (Morobe Distr.: Mt Saruwaged; Western Highlands: Mt Hagen).

Ecol. In mountain bush, 1000–1800 m. *Fl.* Jan.–June.

37. *Helicia saurauoides* SLEUM. Blumea 8 (1955) 46.

Tree? Tips of the branchlets densely, appressedly rufous-pilose, glabrescent. *Leaves* oblong or subobovate-oblong, very shortly obtusely acuminate towards the apex, obtuse or nearly rounded, broadly cuneate into the petiole and somewhat decurrent, subcoriaceous, brown when dry,  $\pm$  shining above, dull beneath, entire or remotely glandular-denticulate in the upper half, very young ones rather densely, appressedly rufous-pilose on both faces, at maturity entirely glabrous above,  $\pm$  persistently and rather densely pilose on midrib and nerves, laxly so on the intervenium beneath, (13–)15–26 by (5 $\frac{1}{2}$ )–6 $\frac{1}{2}$ –11 cm; midrib markedly raised on both faces, nerves c. 18–20 pairs, slightly curved and  $\pm$  parallel, excurrent along the edge or obscurely anastomosing, slightly prominent above, distinctly so beneath, reticulations very dense and minutely, but well visibly prominent; petiole  $\pm$  pubescent, very thickened and rugose in the lower part,  $\frac{1}{2}$ –1 cm. *Racemes* axillary, rather dense, 10–16 cm, erect,  $\pm$  densely covered with short, appressed, rufous hairs; rhachis terete, 1 $\frac{1}{2}$  mm diam. Bracts ovate-lanceolate, 1 mm,  $\pm$  caducous. Pedicels mostly in twos, connate at the base, 1 mm. *Perianth* seen only in bud, probably 8–9 mm, tube  $\frac{1}{2}$  mm diam., limb shortly clavate c. 1 mm diam. Anthers 1 $\frac{1}{5}$  mm. Disk glands free, close. *Ovary* glabrous; style after anthesis 8–9 mm. Fruit unknown.

Distr. *Malaysia*: W. New Guinea (Wissel Lakes), once found.

Ecol. In rain-forest. *Fl.* Oct.

38. *Helicia latifolia* WHITE, Proc. R. Soc. Queensl. 34 (1922) 26; SLEUM. Bot. Jahrb. 69 (1938) 132, *in clav.*; Blumea 8 (1955) 46.

Tree 8–24 m, bole up to 10–15 m; branchlets glabrous. *Leaves* broadly elliptic-oblong, very shortly acuminate, apex obtuse, cuneate into a very short petiole, coriaceous, dark olivaceous-brownish when dry, shining on both faces especially above, glabrous, entire, (13–)15–22 by (6 $\frac{1}{2}$ )–7–11 cm; midrib thick, prominent on both faces especially beneath, nerves 6–7 pairs curved-ascending, indistinctly inarched near the edge,  $\pm$  manifestly prominent above, always distinctly so beneath, reticulations very dense finely raised on both faces, especially beneath; petiole stout, 2–4(–6) by 3–4 mm. *Racemes* probably axillary, rather slender, c. 16 cm, laxly set with flowers; rhachis c. 1 $\frac{1}{3}$  mm diam., terete, laxly covered with fine, short, appressed, rufescent hairs as are the pedicels, the latter solitary or in pairs, connate at the base, rather slender, 3–4 mm. *Perianth* said to be sparsely hairy and 9 mm long. Disk glands broadly ovate, free, close. *Ovary* glabrous. *Fruit* obliquely obovoid-ellipsoid, not beaked, 3–4 by c. 2 $\frac{1}{2}$  cm.

Distr. Melanesia (New Britain); in *Malaysia*: New Guinea (N. & Central Distr.; Milne Bay).

Ecol. In rain-forest, on coral limestone outcrops (Jacquinot Bay), on deep volcanic soil (Open Bay), or on slopes of an iron stone-gravel capped

ridge (Milne Bay), from the lowland up to 500 m. *Fl. Aug., fr. June.*

Note. In leaf-characters similar to *H. saruwagedica*, but fruit apparently not beaked.

Uses. Heart-wood brownish.

Vern. *Garramuta*, Waigani, *ohesali*, Upper Waria.

39. *Helicia moluccana* (R.Br.) Bl. Ann. Sc. Nat. II, 1 (1834) 216 *quoad pl. molucc.*; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 83; MEISN. in DC. Prod. 14 (1856) 438; MIQ. Fl. Ind. Bat. 1, 1 (1858) 983; Ann. Mus. Bot. Lugd. Bat. 1 (1864) 204; MERR. Philip. J. Sc. 11 (1916) Bot. 267; SLEUM. Blumea 8 (1955) 47.—*Roupala moluccana* R.Br. Trans. Linn. Soc. 10 (1810) 191 (*Rhopala*), nec JACK (1820) nec ROXB. (1820); R. & S. Syst. Veg. 3 (1818) 429; SPRENG. Syst. Veg. 1 (1825) 482.—*H. amboinensis* MIQ. Ann. Mus. Bot. Lugd. Bat. 1 (1864) 204.—*H. obtusidens* MIQ. l.c. 204.

Tree (6–)15–25 m, buttressed up to 12/3 m high when old; tips of the branchlets densely covered with short, distinctly appressed, rufescent hairs, glabrescent. *Leaves* oblong or elliptic-oblong or obovate-oblong, sometimes lanceolate-oblong, rarely obovate, shortly obtusely acuminate at the apex, cuneate and ± decurrent into the petiole, very young ones laxly clothed on both faces with fine, appressed, rufescent hairs, glabrescent except the midrib which is mostly more densely and for a longer time hairy, subcoriaceous to coriaceous, dark olivaceous- or brownish and shining above when dry, ± dark brown and dull beneath, entire or occasionally with few incurved teeth in the upper half, rarely ± deeply uncinately serrate along the whole margin, (9–)12–23(–27) by (4–)5–8(–11) cm; midrib prominent on both faces specially beneath, nerves 8–10(–12) pairs, curved and ascending along the margin, not or obscurely inarching, slightly prominent on both faces, reticulations very dense, minutely raised on both faces; petiole stoutish, 2–5(–10) mm, ± winged, very thickened and rough at the base, finally glabrescent. *Racemes* mostly solitary, axillary or ramiflorous, rather slender, dense, 7–15 cm, laxly to subdensely appressedly rufous-hairy; rhachis 1–1½ mm. Bracts ovate-acuminate, acute, 1 mm, ± caducous. Pedicels 2–4(rarely up to 5) mm, mostly in twos, connate at the base, rather slender. *Perianth* whitish or greenish or yellowish, fragrant, slender, 7–8(–9) mm, mostly sparsely, appressedly rufous-pilose, tube ½ mm diam., limb ellipsoid, 1½ mm diam. Anthers 1½–2½ mm. Disk glands orange-red when fresh, broadly ovate to suborbicular, truncate and ± minutely crenulate or retuse, free, very close, seemingly connate. *Ovary* glabrous; style slender. *Fruit* obliquely ellipsoid or ovoid, sometimes somewhat compressed laterally, ± apiculate, attenuate to nearly rounded at the base, 2½–3(–3½) by 2–2½(–3) cm, pericarp leathery, ± hard, 2–3 mm, lateral ridge manifest; pedicel 5–6 mm.

Distr. *Malaysia*: Moluccas (Talaud, Halmaheira, Ternate, Tidore, Buru, Ambon) and possibly W. and N. New Guinea (Wissel Lake region; Rouffaer River; Idenburg River).

Ecol. In primary rain-forest, rare and scattered, but occasionally common, from 150–800 m in the Moluccas, in New Guinea from 300–1750 m. *Fl. Jan.–Dec., fr. March.*

Vern. *Dito ro*, Halmaheira (Wajoli), *suling*, Ternate, *kapangat*, Buru, *ay lomamar dawon ketjil*, a.l. *dawn besar*, *parudang*, *turut nama*, Ambon.

Note. The poor New Guinea material known up till now is similar in flowers but somewhat different in nervation; fruits are unknown.

40. *Helicia peekelii* LAUT. Bot. Jahrb. 45 (1911) 359; l.c. 50 (1913) 331; SLEUM. *ibid.* 69 (1938) 131, in *clav.*; Blumea 8 (1955) 48.

Treelet; tips of the branchlets rufous-pilose, glabrescent. *Leaves* broadly oblong, apex shortly rather abruptly acuminate, obtuse, cuneate and decurrent into the petiole, subsessile, chartaceous to subcoriaceous, olivaceous and ± shining above when dry, paler and ± dull beneath, glabrous, entire, 16–19 by c. 7 cm; midrib prominent on both faces, nerves 6–7 pairs, curved upwards, rather spaced, ± distinctly inarching before the edge, slightly prominent above, more conspicuously so beneath, reticulations dense and slightly raised on both faces; petiole thick, rugose, 2–3 mm. *Racemes* apparently ramiflorous, dense, 12–16 cm, rather laxly clothed with appressed, rufous hairs on rhachis and pedicels, very laxly so on the perianth; rhachis 1½ mm diam. Bracts ovate-acuminate, acute, c. 1 mm. Pedicels slender, mostly in twos, free or connate at the very base, 6–7 mm in anthesis. *Perianth* 11 mm, tube 3/5 mm diam., glabrous or subglabrous, limb clavate 1½ mm diam. Anthers 2 mm. Disk glands subquadrate, connate into a crenate cup. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Melanesia*: New Ireland (Namatanai), once found.

Note. Rather close to *H. moluccana* in habit, but different, besides by the characters given in the key, by other minor features: thinner leaves, more spaced and more distinctly inarched nerves, disk glands more connate.

41. *Helicia neglecta* DIELS ex SLEUM. Bot. Jahrb. 70 (1939) 135; Blumea 8 (1955) 49.

Tree? Branchlets glabrous. *Leaves* oblong, gradually obtusely acuminate at the apex, cuneate and somewhat decurrent into the petiole, subsessile, olivaceous-green and rather shining above when dry, brownish and ± dull beneath, glabrous, rather coarsely subsinuate-serrate, 18–25 by 8–9½ cm; midrib slightly prominent above, conspicuously so beneath, nerves c. 14 pairs slightly curved and ascending, ± parallel, somewhat impressed above when dry, sharply prominent beneath, reticulations lax, nearly obscure above, minutely raised beneath; petiole 4–5 by 2–3 mm, thickened and rugose at the base. *Racemes* axillary, solitary, dense, c. 1½ cm incl. the peduncle 2 cm, laxly clothed with fine, appressed, rufous hairs all over; rhachis angular, 1½ mm diam. Bracts ovate, minute, very early caducous. Pedicels mostly in twos, connate at the base, rather robust, 6–7 mm,

accrescent up to 9 mm. *Perianth* 12 mm, tube  $\frac{1}{2}$  mm diam., limb ellipsoid,  $1\frac{1}{2}$  mm diam. Anthers 2 mm. Disk glands connate in a low ring. *Ovary* glabrous; style slender. Fruit unknown.

Distr. *Melanesia*: New Ireland (Ugana), once found.

Ecol. In secondary forest, 100 m. *Fl.* July.

42. *Helicia retevenia* SLEUM. Bot. Jahrb. 70 (1939) 141; *Blumea* 8 (1955) 50.

Treelet; tips of the branchlets angular, minutely appressed pilose, glabrescent. *Leaves* obovate-oblong,  $\pm$  rounded at the apex, attenuate and somewhat decurrent into the petiole, subcoriaceous, rather rigid, glabrous except the midrib in not yet fully developed leaves, olivaceous-brownish when dry, shining above, dull beneath, entire, slightly revolute at the margin, 6–8 by  $2\frac{1}{4}$ – $2\frac{1}{2}$  (– $3\frac{1}{2}$ ) cm; midrib prominent on both faces, nerves 8–9 pairs, straight in their lower part, curved upwards and anastomosing near the edge, markedly impressed above, slightly raised beneath, veins and veinlets rather densely reticulated and impressed above, nearly obscure beneath; petiole slender, c. 1 cm. *Racemes* axillary, rather dense, glabrous, c. 8 cm; rhachis slender, angular, 1 mm diam. Bracts lanceolate, acute, nearly 1 mm. Pedicels rather slender, mostly in twos and connate up to  $\frac{1}{3}$ , 4–5 mm. *Perianth* slender, 15–16 mm,  $\frac{1}{2}$  mm diam., limb  $1\frac{1}{5}$  mm diam. Anthers c.  $2\frac{1}{2}$  mm. Disk glands oblong-ovate, halfway connate, forming a crenate cup. *Ovary* glabrous. Fruit not known.

Distr. *Malaysia*: SE. New Guinea (Central Distr.: Mt Victoria, below the 'Gap'), once found, c. 1980 m. *Fl.* Dec.

43. *Helicia macrostachya* LAUT. Bot. Jahrb. 50 (1913) 332; SLEUM. *Blumea* 8 (1955) 49.

Small tree; branchlets glabrous, angular at the tips, later subterete. *Leaves* obovate-oblong or obovate, very broadly attenuate and obtuse to nearly rounded at the apex, cuneate and decurrent into the very short petiole, coriaceous or subcoriaceous, black or blackish-brownish when dry, shining above, not or slightly so beneath, glabrous, entire, 14–17 by 5–6 cm; midrib slightly prominent above, strongly so beneath, nerves c. 7 pairs steeply ascending from the midrib, rather straight in their lower part, curved in the upper one and obscurely anastomosing, prominent on both faces, reticulations dense, finely raised on both faces; petiole stout, c. 2 mm. *Racemes* ramiflorous, robust, rather laxly flowered, c. 42 cm incl. the peduncle 2 cm, laxly appressedly rufous-pilose on rhachis and pedicels; rhachis subterete, c.  $2\frac{1}{2}$  mm diam. Bracts ovate-acuminate, minute. Pedicels mostly in twos, connate up to  $\frac{1}{3}$  their length, rather slender, 4–5 mm. *Perianth* c. 20 mm, glabrous, tube c.  $\frac{4}{5}$  mm, limb elongate-ellipsoid,  $1\frac{1}{2}$ –2 mm diam. Anthers  $3\frac{1}{2}$  mm. Disk glands ovate, free, close. *Ovary* glabrous. Fruit unknown.

Distr. *Malaysia*: NE. New Guinea (Morobe Distr., Waria River region: Pema), once found.

Ecol. Mountain-forest, c. 400 m. *Fl.* May.

44. *Helicia obtusata* SLEUM. Bot. Jahrb. 70 (1939) 139; *Blumea* 8 (1955) 51.

Tall tree, 20–60 cm diam.; branchlets reddish-brown, glabrous. *Leaves* obovate, very broadly attenuate and obtuse or mostly rounded at the apex, sometimes slightly emarginate, cuneate and decurrent nearly to the base of the petiole, coriaceous, glabrous, yellowish-olivaceous or brownish and somewhat shining above when dry, dull brown beneath, entire, 11–14 (–18) by  $5\frac{1}{2}$ –7 (– $9\frac{1}{2}$ ) cm; midrib prominent on both faces, robust beneath; nerves (9–)10–11 pairs, coming from the midrib at  $\pm$  right angles, rather straight in the lower  $\frac{2}{3}$ , bifid and  $\pm$  distinctly curved-anastomosing, slightly prominent above, more distinctly so beneath, reticulations rather dense, minutely but well visibly raised on both faces; petiole  $\frac{1}{2}$ –1 (– $1\frac{1}{2}$ ) cm,  $\pm$  distinctly winged, robust, thickened and rugose at the base. *Racemes* axillary, stout, dense, practically glabrous, 10–14 cm, nigrescent; rhachis angled, c.  $2\frac{1}{2}$  mm diam. Bracts ovate-acute, 1 mm, subpersistent. Pedicels in twos, rather robust, connate at the base, 5–7 mm. *Perianth* white, cream or yellowish-green, c. 20 mm, tube  $\frac{4}{5}$ –1 mm diam., limb clavate, subacute, c.  $2\frac{1}{5}$  mm diam. Anthers c. 4 mm. Disk glands broadly ovate, nearly quadrangular, free, close. *Ovary* glabrous. Fruit not known.

Distr. *Malaysia*: NE. New Guinea (Morobe Distr.: Sattelberg-Mt Saruwaged region).

Ecol. In hill forest, 1200–1800 m. *Fl.* Febr.–June.

45. *Helicia archboldiana* SLEUM. *Blumea* 8 (1955) 51.

Small tree, 3 m; branchlets subterete, glabrous. *Leaves* elliptic or oblong-elliptic, shortly rather abruptly acuminate at the apex, subacute or obtuse, broadly cuneate and decurrent into the petiole, thinly coriaceous, somewhat shining and dark red-brown on both faces when dry, glabrous, rather regularly subserrate-denticulate, 8–12 by 4–6 cm; midrib prominent on both faces, nerves c. 10 pairs, coming from the midrib at  $\pm$  right angles, straight below, curved upwards and anastomosing before the edge, slightly prominent on both faces, reticulations very dense, finely but well visibly raised on both faces; petiole  $\frac{1}{2}$ –1 cm, winged nearly to the rugose and thickened base. *Racemes* (one seen) ramiflorous, c. 15 cm,  $\pm$  densely covered with appressed, rufous, very short subsetose hairs on rhachis and pedicels, laxly so on the perianth; rhachis terete, rather slender, 1– $1\frac{1}{3}$  mm diam. Bracts ovate-acuminate, minute, hairy. Pedicels solitary or in twos, connate at the very base, rather slender, 3 mm. *Perianth* green, changing to violet at the base, 22–23 mm, tube  $\frac{1}{2}$  mm diam., limb elongate-ellipsoid, subacute,  $1\frac{1}{2}$  mm diam. Anthers c. 2 mm. Disk glands subquadrangular or obovate-truncate, free, close, upper margin minutely denticulate or crenulate. *Ovary* glabrous; style slender, elongate-clavate towards the apex. Fruit unknown.

Distr. *Malaysia*: N. New Guinea (Idenburg River), once found.

Ecol. In mossy forest-undergrowth, 1600 m. *Fl.* Febr.

46. *Helicia wollastonii* RIDL. Trans. Linn. Soc. Bot. 9 (1916) 145; SLEUM. Bot. Jahrb. 69 (1938) 132; Blumea 8 (1955) 52.

Tree or treelet? Branchlets terete, glabrous, shining. *Leaves* obovate-oblong or obovate, shortly subcuspidate-acuminate, acute or obtuse at the apex, cuneate and  $\pm$  decurrent into the petiole, subcoriaceous or firmly chartaceous, glabrous, shining and brown or sordid-olivaceous above, rather dull and brown beneath when dry, entire, 12–17 by 5–7 cm; midrib distinctly raised on both faces, nerves 7–8 pairs curved upwards and manifestly joined together, deeply impressed above when dry, sharply prominent beneath, reticulations dense and finely prominent on both faces; petiole rather robust, 1–1½ cm, narrowing nearly to the base, thickened and transversely rugose at the base. *Racemes* axillary, slender, laxly flowered nearly to the base, 10–15 cm, glabrous in all parts; rhachis striate, subterete, c. 1½ mm diam. Bracts subulate, very minute. Pedicels slender, mostly in twos, connate at the base, 5–6 mm. *Perianth* light yellow, nigrescent when dry, 15–16 mm, tube 2½–1½ mm diam., limb ellipsoid 1½ mm diam. Anthers c. 2 mm. Disk glands ovate to nearly rounded, rather fleshy, free, close. *Ovary* glabrous. *Fruit* ellipsoid, slightly wider below the middle, apiculate,  $\pm$  attenuate at the base, 2½ by 1½ cm, pericarp 2 mm.

*Distr. Malaysia:* S. New Guinea (Utakwa River region), once found.

Ecol. Lowland rain-forest, 45 m. *Fl.* Oct.–Nov.

47. *Helicia affinis* SLEUM. Bot. Jahrb. 70 (1939) 137; Blumea 8 (1955) 53.—*H. moluccana* (non (R.Br.)) BL. LAUT. L.c. 50 (1913) 331.

Small tree; branchlets terete, red-brown. *Leaves* oblong or obovate-oblong, broadly and obtusely acuminate at the apex, cuneate and decurrent into the petiole, firmly chartaceous, glabrous, brown when dry, slightly paler beneath, somewhat shining on both faces, entire, (16–)21–30 by (6½–)7½–10 (–13) cm; midrib prominent specially beneath, nerves 8–9 pairs, curved-ascending and excurrent along the margin, not anastomosing, slightly raised above, sharply so beneath, reticulations dense, minutely elevated on both faces; petiole 4–5 by 3–4 mm, rugose. *Racemes* from the upper axils, densely flowered nearly to the base, 14–22 cm, rather densely short-appressedly rufescent hairy on the rhachis, laxly or very laxly so on pedicels and perianths; rhachis terete, 1½ mm diam. Bracts ovate, very acute, minute. Pedicels mostly in twos and connate at the base, 2–3 mm. *Perianth* 14–15 mm, tube ½ mm diam., limb ellipsoid 1½ mm diam. Anthers 2 mm. Disk glands broadly oblong or subquadrangular, free or coherent at the base. *Ovary* glabrous; style slender. *Fruit* not known.

*Distr. Malaysia:* NE. New Guinea (Madang Distr.: Kani Mts).

Ecol. Rain-forest, 600–1100 m. *Fl.* Jan., May.

48. *Helicia clemensiae* SLEUM. Bot. Jahrb. 70 (1939) 139; Blumea 8 (1955) 54.

Small tree; tips of the branchlets somewhat compressed, appressedly rufous-pilose, glabrescent. *Leaves* obovate,  $\pm$  rounded at the apex, cuneate towards the obtuse or truncate base, olivaceous above when dry, darker beneath, or mostly becoming dark brownish or nearly blackish, somewhat shining on both faces, glabrous, entire (14–)19–26 by (8–)9–14 cm; midrib prominent especially beneath, nerves c. 10 pairs arcuate-ascending, not or only the uppermost ones obscurely inarching near the edge, slightly raised above, sharply prominent beneath, reticulations lax, raised specially beneath; petiole 3–4 by 2–3 mm, rugose with age. *Racemes* axillary or ramiflorous, dense, 16–19 cm, rather densely to laxly fine appressedly rufescent-hairy on the rhachis and pedicels, very laxly so on the perianth; rhachis 1½–2 mm. Bracts ovate-lanceolate, acute, 1 mm. Pedicels rather robust, solitary or in pairs and connate at the very base, 5–6(–7) mm. *Perianth* white, 28–30 mm, tube ¾–¼ mm diam., limb elongate-clavate, 6–7 by 2 mm. Anthers 5–6 mm. Disk glands connate into a flat, minutely erose or denticulate cup. *Ovary* glabrous; style stoutish, elongate-fusiform at the top.

*Distr. Malaysia:* NE. New Guinea (Morobe Distr.: Sattelberg region).

Ecol. In hill-forest, 600 m. *Fl.* Jan.

49. *Helicia forbesiana* F.v.M. Vict. Nat. 3 (1886) 63; Bot. Centralbl. 29 (1887) 84; Descr. Not. 9 (1890) 61; BAIL. Queensl. Agr. J. 24 (1910) 22; LAUT. Bot. Jahrb. 50 (1913) 331; SP. MOORE, J. Bot. 61 (1923) Suppl. 43; SLEUM. Bot. Jahrb. 70 (1939) 139; Blumea 8 (1955) 54.

Tree c. 15 m; tips of the branchlets rather densely, appressedly rufous-pilose. *Leaves* lanceolate or oblong-lanceolate, not rarely oblanceolate or obovate-oblong, rather abruptly acuminate at the apex, subacute or blunt, gradually cuneate towards the subacute base and  $\pm$  distinctly decurrent, subcoriaceous, yellowish-olivaceous or brownish and  $\pm$  shining above, mostly dull brown beneath when dry, glabrous, entire, rarely remotely denticulate, 15–25(–30) by 5–8(–11) cm; midrib robust and prominent on both faces, nerves 9–10 pairs, curved-ascending and  $\pm$  distinctly inarching, mostly slightly impressed above in dry specimens, prominent beneath, reticulations rather dense and conspicuous at least underneath, veinlets faint; petiole 3–8 by 2–4 mm, glabrous, rugose at the very thickened base. *Racemes* ramiflorous, dense, 10–15 cm incl. the peduncle 2 cm, rather densely appressedly rufous hairy on rhachis and pedicels, very laxly so on the perianth; rhachis rigid, 2–3 mm diam. near the base. Bracts elongate-ovate, subacute, 1–1½ mm. Pedicels rather robust, 6–9 mm, mostly in twos and connate at the very base. *Perianth* white, rather stiff, 25–28 mm, tube ¾–1 mm diam., limb gradually clavate 5–6 by 2–2½ mm. Anthers c. 4 mm. Disk glands connate into a flat crenulate or obscurely 4-dentate cup. *Ovary* glabrous; style rather robust, glabrous. Immature *fruit* obliquely ovoid.

Distr. *Malaysia*: SE. New Guinea (Central and North. Distr.).

Ecol. In forest, generally at 600–1500 m, once found in tall regrowth forest (with bigger leaves) at 25 m. *Fl.* Aug.–Nov.

50. *Helicia finis-terrae* LAUT. Bot. Jahrb. 50 (1913) 332; SLEUM. *Blumea* 8 (1955) 60.

Small tree; branchlets terete, glabrous. *Leaves* obovate or broadly obovate-oblong, broadly attenuate and obtuse at the apex, shortly cuneate and manifestly decurrent into the petiole, ± coriaceous, brown when dry, somewhat shining above, dull beneath, glabrous, entire, slightly revolute at the margin, 30–36 by (12–)13–16 cm; midrib strongly prominent on both faces, nerves 9–10 pairs curved-ascending, ± excurrent near the edge, obscurely inarched, slightly prominent above, more so and distinct beneath, reticulations dense, slightly raised on both faces; petiole 5–7 mm, very thick and rugose. *Racemes* ramiflorous, c. 22 cm, rather dense, glabrous except some appressed, very short, rufescent hairs on rhachis and pedicels; rhachis stout, terete, with numerous minute tubercles, c. 2½ mm diam. Bracts minute. Pedicels in twos, connate at the base, 3 mm. *Perianth* (15–)16–17 mm, tube c. 3/5 mm diam., limb ellipsoid rounded-obtuse at the top, 1½–1¼ mm diam. Anthers c. 3 mm. Disk glands nearly rounded, truncate, free, close. *Ovary* glabrous. Fruit unknown.

Distr. *Malaysia*: N. New Guinea (Finisterre Mts), once found.

Ecol. In rain-forest, 1200 m. *Fl.* Nov.

Uses. Heart-wood brown, rays very distinct.

Vern. *Kisi kisi*, Orokaiva dial. (Mumuni), *togona*, Boku.

51. *Helicia robusta* (ROXB.) R. BR. ex WALL. Cat. (1831) *sub no* 2702; BL. Ann. Sc. Nat. II, 1 (1834) 220; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 83; HASSK. Cat. Hort. Bog. (1844) 94; MEISN. in DC. Prod. 14 (1856) 440; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986; BEDD. Man. (1872) 173; Fl. Sylv. (1873) t. 301; KURZ, Fl. Burm. 2 (1877) 311; F.-VILL. Nov. App. (1880) 182; HOOK. f. Fl. Br. Ind. 5 (1886) 191; BOERL. Handl. 3, 1 (1900) 151; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 344; RIDL. Fl. Mal. Pen. 3 (1924) 142; GAMBLE, Fl. Madras 2 (1925) 1243; BAK. f. J. Bot. 63 (1925) Suppl. 89; KANJILAL & DAS, Fl. Assam 4 (1940) 106; SUESSENG. in Fedde, Rep. 54 (1951) 225; SLEUM. *Blumea* 8 (1955) 55.—*Roupala robusta* ROXB. Fl. Ind. ed. CAREY & WALL. 1 (1820) 366 (*Rhopala*); SPRENG. Syst. Veg. 1 (1825) 482 (*pro parte, parte alt.* = *H. cochinchinensis*); R. & S. Mant. 3 (1827) 285; ROXB. Fl. Ind. ed. CAREY (1832) 363; WIGHT, Ic. Pl. Ind. Or. (1839) t. 191.—*Rupala serrata* REINW. ex BL. Cat. (1823) 42, *nom. nud.*—*Helittophyllum javanicum* BL. Bijdr. (1826) 652.—*Roupala glabrata* WALL. Cat. (1831) *no* 3661, *nom. nud.* (*Rhopala*).—*H. javanica* BL. Ann. Sc. Nat. II, 1 (1834) 217; BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 81, 83, t. 18; MEISN. in DC. Prod. 14 (1856) 440; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986;

Nat. Tijds. N. I. 27 (1864) 172; K. & V. Bijdr. 5 (1900) 306; KOORD. Exk. Fl. Java 2 (1912) 155, f. 33; Atlas (1915) t. 597; RIDL. J. Fed. Mal. St. Mus. 8 (1917) 81; KOORD. Fl. Tjib. (1923) 47; HEYNE, Nutt. Pl. (1927) 588; OCHSE & BAKH. Ind. Groent. (1931) 620, f. 379; BURK. Dict. (1935) 1133; BACK. Bekn. Fl. Java (em. ed.) 4A (1942) fam. 79, p. 5.—*H. cumingiana* PRESL, Epim. (1851) 246; MEISN. in DC. Prod. 14 (1856) 440; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986; F.-VILL. Nov. App. (1880) 182; VIDAL, Phan. Cuming. (1885) 139; Rev. Pl. Vasc. Filip. (1886) 229; MERR. Philip. J. Sc. 1 (1906) Suppl. 49; En. Philip. 2 (1923) 99, incl. *var. parvifolia* MERR. l.c. 99.—*H. philippinensis* MEISN. in DC. Prod. 14 (1856) 441; MIQ. Fl. Ind. Bat. 1, 1 (1858) 987; F.-VILL. Nov. App. (1880) 182; VIDAL, Phan. Cuming. (1885) 140; Rev. Pl. Vasc. Filip. (1886) 229; Synopsis Atl. (1883) 37, t. 79; MERR. Philip. J. Sc. 1 (1906) Suppl. 49.—*H. glabrata* MEISN. in DC. Prod. 14 (1856) 442, *nom. nud.*—*H. castaneaeifolia* MEISN. l.c. 441; MIQ. Fl. Ind. Bat. 1, 1 (1858) 986; F.-VILL. Nov. App. (1880) 182; MERR. En. Philip. 2 (1923) 100.—*H. attenuata* [non (JACK) BL.] KURZ, Nat. Tijds. N. I. 27 (1864) 172.—*H. obovata* (non BENN.) KURZ, l.c.—*H. travancorica* BEDD. ex HOOK. f. Fl. Br. Ind. 5 (1886) 191.—*H. oligophlebia* MERR. Philip. J. Sc. 11 (1916) Bot. 6; En. Philip. 2 (1923) 100.—*H. obovata* (non BENN.) RIDL. J. Mal. Br. R. As. Soc. 1 (1923) 90.—Fig. 16.

*var. robusta.*

Shrub or mostly small tree, (2–)5–8–(18) m, starting flowering and fruiting already when a shrub. Tips of the branchlets appressedly rufescent-pilose, glabrescent. Flush bluish- or blackish-green above, azure beneath when fresh, of suckers bright purple. *Leaves* sparse, mostly obliquely subopposite, sometimes 3–4-subverticillate, obovate-oblong or obovate, shortly rather abruptly acuminate, subacute or obtuse, attenuate, ± decurrent along the short thick petiole, the base itself mostly ± abruptly obtuse or truncate or subcordate, sometimes subacute, firmly subcoriaceous, dilute to dark or sometimes blackish olivaceous or yellowish-green above when dry, mostly brownish and dull beneath, glabrous and ± shining above, initially clothed with numerous, fine, appressed hairs all over the undersurface, glabrescent and finally entirely glabrous, mostly rather regularly and coarsely serrate (teeth not rarely sharp in young specimens), sometimes less distinctly serrate to subentire, with some ± obtuse teeth on each side in the upper part of the blade, (7)–8–25–(40) by (4)–5–10–(15) cm, and in suckers still larger; midrib prominent on both faces specially beneath, nerves (7)–10–12–(13) pairs, curved-ascending, not or inconspicuously inarching along the edge, prominent above, very distinctly so beneath, reticulations fine, rather lax, slightly but well visibly raised on both faces; petiole 1–6–(8–)10 by 2–4 mm, rugose, purplish when fresh. *Racemes* axillary and/or ramiflorous, solitary or rarely in twos, dense, 12–25–(30) cm, rather densely appressed-

rufous hairy in all parts in bud, finally very laxly hairy, never entirely glabrous; rhachis subangular, 1½–2 mm diam. Bracts ovate, acute, 1–1½ mm. Pedicels rather robust, mostly in pairs, connate at the base, (3–)4–7(–9) mm. *Perianth* white or greenish-white, sometimes cream, rather slender, (18–)20–22(–25) mm, tube ¾–1 mm diam., limb

ellipsoid, 1½–2(–2½) mm diam. Anthers ± 2 mm. Disk glands broadly elliptic or ovate-elliptic, ± truncate or rarely bidentate, free and close or slightly connate at the base, seemingly forming a cup in anthesis but divergent afterwards. *Ovary* glabrous; style slender, red when fresh. *Fruit* broadly obliquely ellipsoid or subglobose, mostly



Fig. 16. *Helicia robusta* (Roxb.) R.Br. var. *robusta*. a. Habit, × ½, b. pair of buds, × 1½, c. open flower, × 1½, d. base of ovary with disk glands, × 2½, e. limb with anther, × 2½, f. back of anther, × 2½, g. developed embryo, × c. 2½, h. seed with funicle, × ½, i. seed halved, cotyledon with plumule, × ½, j. fruit split along ridge, × ½ (after LAM 2271).

shortly apiculate and somewhat contracted at the base, rarely rounded at both ends, (2-)2½-3(-4) by 2-3 cm, initially deep green or yellowish with purplish tinge, later dark purple or blackish; pericarp hard, leathery, 2-3 mm. *Seeds* 1(-2), reticulate-rugose in the upper half; pedicel 6-10 by 2-3 mm.

Distr. S. India (S. Deccan: Travancore), E. Bengal, Assam, Indo-China; in *Malaysia*: Sumatra, Malay Peninsula, Banka, Billiton, Java (rather common in W. Java, rare in Central Java, absent in E. Java), Borneo, Philippines.

Ecol. Both in primary and secondary rain-forest, on steep slopes and hills, not rarely on clayey ground, also on volcanic sands, along creeks or near swamps, from the lowlands up to 1600(-1900) m, scattered but occasionally common. *Fl.* throughout the year, mainly May-Aug., *fr.* mainly July-Sept.(-Nov.).

Vern. Sumatra: *langkaput*, Rawas, *lada*, Karo Highlands, *kaju hakondung*, Asahan, *kaju maributan*, Palembang, *kaju kaributan*, Lamp. Banka: *kērating*, *kaju mēkralong*, *kratong*. Malay Penins.: *médang kēladi*, *m. laiang*, *m. gatal*, *m. hakat*, *putat paya*; *jéring tupai*, Trengg., *sērantan tua*, Pahang, *putat ulu*, Johore. Java: *kēndung*, *kam-dung gédé*, S. *kēndung*, *kadjeng kēndung*, *kandung*, J. Borneo: *buntal*, SE. Born., *watutu*, W. Kutei (Dyak), *buak buak*, *jaring jaringan jawa*, Sandakan, *ponsch*, Kwijau, *korodo*, Kinabat., *bronsop*, Orang Sg. Philippines: *apápid*, Klg., *biskóng*, *chamosil*, *olét*, *olitan*, *uátan*, *ulátan*, *uátan*, Ig., *lákot*, *manliáb*, *putólan*, Tag., *loban*, Bon., *malaan-tigau*, S.L.Bis., *tarangisia*, Bag.

Uses. The wood is occasionally used for shafts of axes and sometimes for house-building; it is not a first-class timber. Young shoots are eaten in Java as a vegetable. The fruit is reported to be poisonous.

Notes. In the SE. Asiatic and W. Malaysian specimens the leaf-base is mostly constantly obtuse or rounded though occasionally acute, in Borneo the acute leaf-base occurs more frequently, and in the Philippines it is mostly acute. In absence of other differential characters I cannot keep the Philippine specimens specifically apart.

In the Philippine mountains a local form occurs with small, not rarely nearly entire leaves not deserving an infraspecific epithet.

Another completely entire-leaved form is distinguished here as a variety.

*var. integrifolia* (ELM.) SLEUM. *Blumea* 8 (1955) 57.—*H. integrifolia* ELM. *Leaf.* Philip. Bot. 8 (March 1915) 2798; MERR. *En. Philip.* 2 (1923) 99.—*H. longiflora* MERR. *Philip. J. Sc.* 10 (Sept. 1915) Bot. 300.—*H. integra* MERR. *Philip. J. Sc.* 10 (Sept. 1915) Bot. 301; *En. Philip.* 2 (1923) 99.

Differs from the type by the entire, not rarely somewhat smaller leaves.

Distr. *Malaysia*: Philippines (Luzon, Mindanao).

Note. A specimen which comes near this variety but differing in somewhat thicker leaves and other minor characters has been collected by

CLEMENS (55095) on Mt Kinabalu in Br. N. Borneo in an open place at the base of the great wall, at 3350 m, the highest altitudinal record of the genus. This number has been referred to *H. erratica* HOOK. *f.* by SUESSENGUTH (in Fedde, *Rep.* 54, 1951, 226). This is, however, a continental Asiatic species with distinctly petioled leaves distributed from S. India and the E. Himalaya through Assam, Upper Burma, Indo-China and Siam to Tenasserim, and a synonym of *H. nilagirica* BEDD.

52. *Helicla attenuata* (JACK) BL. *Ann. Sc. Nat.* II, 1 (1834) 216; BENN. in BENN. & BR. *Pl. Jav. Rar.* (1838) 83; MEISN. in DC. *Prod.* 14 (1856) 439; MIQ. *Fl. Ind. Bat.* 1, 1 (1858) 985; HOOK. *f.* *Fl. Br. Ind.* 5 (1886) 190; BOERL. *Handl.* 3, 1 (1900) 151; K. & V. *Bijdr.* 5 (1900) 313; HALL. *f.* *Med. Rijks-herb.* 12 (1912) 23; KOORD. *Exk. Fl. Java* 2 (1912) 154; GAMBLE, *J. As. Soc. Beng.* 75, ii (1914) 341; RIDL. *Fl. Mal. Pen.* 3 (1924) 141; BURK. & HENDERS. *Gard. Bull. S. S.* 3 (1925) 417; HENDERS. *Gard. Bull. S. S.* 4 (1928) 314; MERR. *J. Arn. Arb.* 33 (1952) 243; BACK. *Bekn. Fl. Java* (em. ed.) 4a (1942) fam. 79, p. 6; SLEUM. *Blumea* 8 (1955) 61.—*Roupala attenuata* JACK, *Mal. Misc.* 1 (1820) 10 (*Rhopala*); in Hook. *Bot. Misc.* 2 (1830) 65.—*Roupala moluccana* (non R. BR., nec JACK) ROXB. (*Hort. Beng.* 1814, 83, *nom. nud.*) *Fl. Ind. ed. CAREY & WALL.* 1 (1820) 364, *descr.*; R. & S. *Mant.* 3 (1827) 284; ROXB. *Fl. Ind. ed. CAREY* (1832) 361.—*H. obovata* BENN. in BENN. & BR. *Pl. Jav. Rar.* (1838) 83; MEISN. in DC. *Prod.* 14 (1856) 440 *incl. var. minor* MEISN. *l.c.*; MIQ. *Fl. Ind. Bat.* 1, 1 (1858) 985; K. & V. *Bijdr.* 5 (1900) 311; KOORD. *Nat. Tijd. N.I.* 62 (1902) 226 *incl. var. connata* K. & V.; *l.c.* 63 (1904) 39.—*H. oblongifolia* BENN. in BENN. & BR. *Pl. Jav. Rar.* (1838) 83; MEISN. in DC. *Prod.* 14 (1856) 438; MIQ. *Fl. Ind. Bat.* 1, 1 (1858) 983 *incl. var. subpetiolata* MIQ. *l.c.* 984; *Sum.* 1 (1860) 148; K. & V. *Bijdr.* 5 (1900) 310.—*H. bennettiana* MIQ. *Fl. Ind. Bat.* 1, 1 (1858) 984; K. & V. *Bijdr.* 5 (1900) 309; KOORD. *Exk. Fl. Java* 2 (1912) 155; BACK. *Bekn. Fl. Java* (em. ed.) 4a (1942) fam. 79, p. 7.—*H. sumatrana* MIQ. *Sum.* 1 (1860) 148, 364.—*Finschia sumatrana* MIQ. *ex* BOERL. *Handl.* 3, 1 (1900) 151 (*sphalm. err. pro H. sumatrana*).—*H. suffruticosa* RIDL. *J. Fed. Mal. Stat. Mus.* 6 (1915) 171; *Fl. Mal. Pen.* 3 (1924) 141.—*H. lanceolata* (non K. & V.) BAK. *f. J. Bot.* 63 (1925) *Suppl.* 89.—*H. kingiana* (non PRAIN) MERR. *Pap. Mich. Ac. Sc.* 24 (1939) 67.

Shrub (1-3)-5 m, or small tree, rarely up to 20 m; branchlets light brown, glabrous. *Leaves* oblong or elliptic-oblong, rarely oblanceolate or obovate, gradually narrowed towards the apex, mostly subacute, attenuate and decurrent into the petiole, subacute or obtuse at the very base, rarely subcordate, firmly chartaceous to subcoriaceous, greenish- or yellowish-brownish when dry, entire or remotely denticulate, or repand-serrate in the upper half, 9-25(-30) by 3-8(-11-17) cm; midrib prominent on both faces, nerves 7-9(-10) pairs curved-ascending, distinctly anastomosing before the margin, slightly raised or sometimes somewhat impressed above, prominent beneath, reticulations



rather dense, slightly raised on both faces; petiole 2-8(-10) mm, thickened and rugose at the base. *Racemes* solitary, axillary or ramiflorous, dense-flowered nearly to the base, 12-25(-30) cm; rhachis glabrous or nearly so, terete, (1½-2-3 mm diam. (blue when fresh as are the pedicels), often greenish when dry. Bracts subulate, minute, up to 1 mm. Pedicels mostly in pairs, connate up to 1/3, rather robust, glabrous or nearly so, 4-5(-6) mm. *Perianth* whitish or cream or greenish, sometimes rose-tinged, with a rather unpleasant, sweet smell, (18-)22-25(-28) mm, glabrous, tube 1½-3½ mm diam., limb ellipsoid c. 1½ mm diam. Anthers c. 2½ mm. Disk glands subtruncate, nearly entirely connate in a crenulate ring. *Ovary* narrow-ovoid, glabrous; style filiform. *Fruit* broadly ellipsoid or ovoid, ± oblique, shortly apiculate, ± manifestly attenuate at the base or contracted into a short stipe, mostly with 6 ± distinct, obtuse vertical ribs, first bluish-green, finally purplish-black, 3-4(-5) by (2-)2½-3 cm, pericarp leathery, c. 2 mm; pedicel 4-5 by 2½ mm.

Distr. Siam; in *Malaysia*: Sumatra, Malay Peninsula, Borneo, Java, and Bali.

Ecol. In primary and secondary rain-forest, mainly in the montane zone 650-1700 m, but descending to the lowland and ascending up to 2650 m; by streams, on hill slopes or mountain ridges, on various soils, rather common. *Fl. fr.* Jan.-Dec.

Uses. Wood whitish to light brown, locally used in house-building, but not very durable if exposed to all sorts of weathers.

Vern. Sumatra: *Kaja pinang*, Karo Batak, *sérantie*, Palembang, *kaju si holip*, *k. sulim*, Tapan., *k. darudung*, *k. si hondum*, *k. hahondung*, Asahan. Malay Peninsula: *putat talang*, Selang., *kani batu puteh buaya*, Malacca, *rambat hutan*, Pahang, *dada kura*, Perak, *golang paya*, *gurang bukit*. Java: *kéndung*, *k. batu*, *pasang tjébon*; *ki geuntul*, Bantam. Borneo: *katjang*, Dyak, Murung, *ringin*, Sarawak.

Note. The species is rather variable in leaf-characters. Specimens with a rather thin texture and an acute leaf-base, as in the type-specimen, are found in Siam, the Malay Peninsula, Sumatra, and rather rarely so in Java and Borneo. Another form with thicker texture and a rounded-obtuse or sometimes subcordate leaf-base is frequent in Java and Borneo, exclusively so in Bali and once found in Sumatra.

The first form is mostly found at lower altitude, the second in the higher localities. The high percentage of intergrades does not permit to distinguish them as distinct species or even as varieties, specially so as no additional characters run parallel with the differences in the leaf-texture and shape.

### 53. *Helicia bullata* SLEUM. *Blumea* 8 (1955) 63.

Small tree, c. 8 m; tips of the branchlets dark ferruginous-tomentose, older part less densely pilose, brownish, finally glabrescent. *Leaves* elliptic or obovate-elliptic, broadly attenuate, subacuminate or obtuse, or rounded at the apex, cuneate but not decurrent on the petiole, some-

times slightly inequilateral, subcoriaceous, greenish-yellow when dry, younger ones covered with a rather crisp rusty tomentum on the midrib above and on the whole surface underneath, specially on the midrib and the nerves, mature ones glabrous and shining above, rusty-hairy beneath on midrib and nerves, glabrescent on the intervenium, entire, (9-)14-20 by (5-)7-11 cm; midrib prominent above, strongly so beneath, nerves 8-12 pairs, lower ones ± straight, upper ones ± curved and rather distinctly anastomosing before the edge, deeply impressed above in the mature leaves as are the laxly areolate veins, distinctly raised beneath; petiole stout, ± persistently tomentose, finally glabrescent and rugose, 1½-1¾ by 2½ mm, base very thick. *Racemes* ramiflorous, solitary or in pairs, firm, very dense-flowered nearly to the base, rusty ± appressed-tomentose; rhachis 3 mm diam. at the base. Bracts ovate-acuminate, 1 mm. Pedicels rather robust, mostly in twos, connate in the lower third, 4-5 mm. *Perianth* white, c. 16 mm, dilated at the base, tube 1 mm across, limb clavate, subacute, 1¾ mm diam. Anthers 3½ mm. Disk glands ovate-oblong, retuse, free, close. *Ovary* glabrous; style slender. Fruit not known.

Distr. *Malaysia*: Central New Guinea (Western Highlands: Nondugl), once found. *Fl.* April.

### 54. *Helicia insculpta* SLEUM. *Bot. Jahrb.* 70 (1939) 141; *Blumea* 8 (1955) 64.

Shrub or treelet 2-6 m; branchlets robust, tips densely ferruginous-cripsed hairy, glabrescent. *Leaves* crowded near the top of the branchlets, broadly oblong or elliptic, rarely oblong, broadly acuminate and obtuse, sometimes nearly rounded at the apex, broadly cuneate to nearly rounded at the base, subcoriaceous, very young ones fairly densely clothed with subappressed, dilutely ferruginous, ± crisp, detersile hairs, glabrescent except the midrib, regularly glandular- rather obtusely dentate, 6½-8(-10) by 3½-4½(-5) cm; midrib slightly prominent or impressed above, strongly raised beneath, nerves c. 7 pairs, curved-ascending and inarched, distinctly impressed above, rather sharply prominent beneath, reticulations lax, slightly impressed above, ± raised beneath; petiole rather robust, ± ferruginous-pubescent, 5-6 mm. *Racemes* ramiflorous, dense, stout, 6-8 cm; rhachis 2½ mm diam., densely rufous-ferruginously pilose. Bracts ovate-acuminate, glabrescent, 2-2½ mm. Pedicels mostly in twos, connate at the base, 2½-3 mm, laxly rufous-pilose. *Perianth* rose-red, in bud rather densely, in anthesis laxly or very laxly appressed-rufescent hairy, c. 30 mm, tube 0.7 mm diam., limb clavate 2½ mm diam. Anthers 2½-3 mm. Disk glands connate into a low, annular cup. *Ovary* glabrous; style stoutish, fusiform at the top. Fruit not known.

Distr. *Malaysia*: SE. New Guinea (Owen Stanley Range; Mt Victoria), 2400-2800 m. *Fl.* Dec.-Jan.

### 55. *Helicia hypoglauca* DIELS, *Bot. Jahrb.* 54 (1916) 202; SLEUM. *l.c.* 70 (1939) 142; *Blumea* 8 (1955) 66.

Slender tree 20–25 m; tips of the branchlets rufous-tomentose, glabrescent. *Leaves* lanceolate-oblong or oblong, shortly acuminate and subacute at the apex, attenuate at the base, somewhat decurrent in the upper third of the petiole, subcoriaceous, pale olivaceous-green to yellowish and shining above when dry, paler and  $\pm$  dull beneath, very young ones rufescent-appressedly pilose or sericeous on the under-surface, glabrescent, finally glabrous, entire or occasionally with a solitary, minute tooth on each side, (6–)7–12(–15) by (2 $\frac{1}{2}$ –)3 $\frac{1}{2}$ –5 $\frac{1}{2}$  cm; midrib slightly prominent above, distinctly so beneath, nerves 6–7(–8) pairs, rather straight in their lower part, curved upwards and inarching towards the edge, all somewhat raised above, a little more so beneath, reticulations fairly dense and slightly, but well visibly elevated on both faces; petiole rather slender, tardily glabrescent, 1 $\frac{1}{2}$ –2 $\frac{1}{2}$ (–3) cm. *Racemes* axillary and ramiflorous, solitary, sometimes in all the upper leafless axils together forming a terminal panicle, dense, 7–13(–15) cm, rather densely rusty-appressedly hairy all over; rhachis 1 $\frac{1}{2}$ –2 mm diam. Bracts ovate-lanceolate, subacute, c. 1 $\frac{1}{2}$  mm, mostly early caducous. Pedicels mostly in pairs, connate at the base, rarely halfway, rather slender, 3–5 mm. *Perianth* whitish or cream, sometimes yellow, 17–18(–20) mm, tube  $\frac{4}{5}$  mm across, limb ellipsoid, 2 mm diam. Anthers 2 mm. Disk glands broadly obovate, truncate,  $\pm$  manifestly connate into an undulate cup. *Ovary* glabrous; style slender. Fruit not known.

Distr. *Malaysia*: NE. New Guinea (Sepik region; Mt Saruwaged-Sattelberg vicinity).

Ecol. In mountain-forest, 400–1800 m, occasionally common. *Fl.* June–Dec.

56. *Helicia albiflora* SLEUM. Bot. Jahrb. 70(1939) 138; Blumea 8 (1955) 67.

Tree c. 12 m; young branchlets densely dark rufous-appressed-tomentulose, glabrescent. *Leaves* oblong, broadly obtusely attenuate at the apex, broadly attenuate to nearly rounded at the base, somewhat decurrent in the uppermost part of the petiole, olivaceous-brown or dark-brown when dry, shining above, paler brown and rather dull beneath, very young ones rufous-pubescent underneath, mature ones glabrous or nearly so, entire, (12–)15–17 by 5 $\frac{1}{2}$ –7(–8) cm; midrib slightly prominent above, more distinctly so beneath, nerves 8–9 pairs, somewhat raised above, rather prominent beneath, curved upwards and  $\pm$  distinctly inarching near the edge, reticulations dense, slightly, but well visibly elevated on both faces; petiole 1 $\frac{1}{2}$ –2 cm,  $\pm$  densely appressed-pilose, tardily glabrescent. *Racemes* ramiflorous, 10–12 cm, rather densely, shortly, appressed-rufous-pilose on rhachis and pedicels; rhachis 2–2 $\frac{1}{2}$  mm diam. Bracts lanceolate, acute, 1–1 $\frac{1}{2}$  mm. Pedicels rather robust, mostly in pairs and connate at the base, c. 3 mm. *Perianth* white, laxly, longish, appressed-rufous hairy, 25 mm, tube  $\frac{4}{5}$  mm diam., limb 2 mm diam. Anthers 2 $\frac{1}{2}$  mm. Disk glands subquadrangular, short, connate in a crenulate cup. *Ovary* glabrous; style stoutish. Fruit unknown.

Distr. *Malaysia*: SE. New Guinea (S. ascent of Mt Victoria pr. Isuarava).

Ecol. In secondary forest at 1200–1370 m. *Fl.* Febr.

57. *Helicia petiolaris* BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84; MEISN. in DC. Prod. 14 (1856) 438; MIQ. Fl. Ind. Bat. 1, 1 (1858) 983; HOOK. f. Fl. Br. Ind. 5 (1886) 190; RIDL. J. Str. Br. R. As. Soc. 33 (1900) 132; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 342; MERR. En. Born. (1921) 235; RIDL. Fl. Mal. Pen. 3 (1924) 141; BURK. Dict. (1935) 1134; SLEUM. Blumea 8 (1955) 67.—*Roupala moluccana* (non R. BR., non ROXB.) JACK, Mal. Misc. 1 (1820) 10 (*Rhopala*), reimpr. Hook. Bot. Misc. 2 (1830) 65; R. & S. Mant. 3 (1827) 284.—*H. attenuata* [ (JACK) BL.] RIDL. J. Fed. Mal. Stat. Mus. 7 (1916) 49.—*H. erratica* (non HOOK. f.) SUESSENG. in Fedde, Rep. 54 (1951) 226, *pro parte*.

*var. petiolaris*.

Shrub or small tree 4–8–12(–20) m by up to 45 cm; branchlets stout, glabrous. *Leaves* obovate or oblong-obovate, shortly broadly to narrowly acuminate, acute or obtuse at the top, sometimes nearly rounded, cuneate and slightly decurrent at the base, rigid, subcoriaceous to coriaceous, glabrous, olive-green to brownish and shining above when dry, dull and rather dark brown or sometimes blackish beneath, entire, (10–)14–22(–27) by (5–)6–10(–13) cm; midrib slightly raised above, strongly so beneath, nerves 7–8(–10) pairs, curved and  $\pm$  conspicuously inarching near the margin, minutely impressed or mostly somewhat raised above, always distinctly elevated beneath, reticulations rather dense, minutely, but visibly raised on both faces; petiole robust, (1–)1 $\frac{1}{2}$ –2 $\frac{1}{2}$ (–4) cm. *Racemes* axillary, dense-flowered to the base, 15–25(–30) cm, often blackish in dry specimens; rhachis subangular, purpurascens when fresh, 2–2 $\frac{1}{2}$ (–3) mm diam., mostly very laxly beset with fine, rufescent, appressed hairs as are the pedicels, or glabrous. Bracts narrow ovate-acuminate or subulate, pilose, minute, mostly subsistent. Pedicels stoutish, nearly always in pairs and connate at or above the base, 5–6(–10) mm. *Perianth* white or greenish-white, glabrous, somewhat stiff, (18–)20–22(–25) mm, tube robust, c. 1 mm diam., limb narrow-ellipsoid, 2–2 $\frac{1}{2}$  mm diam. Anthers c. 3 mm. Disk glands obtusely ovate, close and  $\pm$  connate into a crenate or sometimes very minutely fimbriate cup in anthesis, divergent under the young fruit. *Ovary* glabrous. *Fruit* subglobose to obovoid, dark bluish to purple when fully ripe, (2–)2 $\frac{1}{2}$ –3 by 2 $\frac{1}{2}$ –3 mm, very shortly apiculate or nearly rounded at the top,  $\pm$  contracted at the base, splitting tardily along the distinct rib; pericarp hard-leathery, 2 mm.

Distr. *Malaysia*: Malay Peninsula (Penang, Kedah, Perak, Kelantan, Selangor, Johore, Singapore), Borneo.

Ecol. In rain-forest, from the lowland up to 2100 m alt.

Uses. The timber is said to be used in house-building, but is not of a high class.

Vern. *Gong, putat tepi, M, kubat*, Selangor; Borneo: *uwat lutu*, Kajang Dyak.

*var. kingiana* (PRAIN) SLEUM. *Blumea* 8 (1955) 69.—*H. kingiana* PRAIN, *Kew Bull.* (1912) 342; GAMBLE, *J. As. Soc. Beng.* 75, ii (1914) 343; RIDL. *Fl. Mal. Pen.* 3 (1924) 142.—*H. obscurinervis* CHATTERJEE, *Kew Bull.* (1948) 65.

Differing from the type by the very shortly petioled or subsessile leaves with a distinctly decurrent blade. Fruit subglobose-ellipsoid, manifestly apiculate, distinctly contracted into a stipe.

Distr. Lower Burma (Tavoy), S. Siam (Puket); in *Malaysia*: Malay Peninsula (Penang, Perak, Pahang), Borneo (Sarawak).

Vern. *Sangka tua*, Pahang.

58. *Helicia paucinervis* MERR. *Philip. J. Sc.* 17 (1921) 247; *En. Philip.* 2 (1923) 100; SLEUM. *Blumea* 8 (1955) 71.

Shrub or small tree, 1–5 m; branchlets terete, smooth, dark red-brown when dry, youngest parts laxly very fine appressed-hairy, glabrescent. *Leaves* oblong-elliptic or subovate-oblong, broadly attenuate at the apex and blunt, sometimes nearly rounded, cuneate and slightly decurrent into the petiole, firmly subcoriaceous, brown-olivaceous and glossy above when dry, dull and paler brown beneath, entire or distantly and rather coarsely toothed in the upper half, 10–15 by 4–6(–8) cm; midrib prominent on both faces, nerves (4)–5 pairs curved-ascending and ± distinctly anastomosing, elevated both above and beneath, reticulations rather dense, well visibly raised on both faces; petiole 1(–1½) cm. *Racemes* axillary or sometimes ramiflorous, rather dense, 14–20 cm; rhachis subterete, 1½ mm diam., very laxly covered with minute appressed rufescent hairs as are the pedicels. Bracts ovate-acuminate or deltoid, acute, ½ mm. Pedicels mostly in pairs, free or connate at the very base, 2–3 mm. *Perianth* white or cream, glabrous, (16)–17–19 mm, tube slender, 2½–½ mm diam., limb ellipsoid, 1–1½ mm diam. Anthers 1½ mm. Disk glands connate in the lower half, forming a crenate cup. *Ovary* glabrous. *Fruit* subglobose, very shortly apiculate, somewhat contracted at the base, smooth, c. 3½ cm diam., pericarp leathery, dry, rather hard, 2–3 mm; pedicel 4 by 3 mm.

Distr. *Malaysia*: Philippines (Mindanao: Surigao; Dinagat Isl.).

Ecol. Along river-banks on iron deposits, 300 m.

59. *Helicia pallescens* DIELS. *Bot. Jahrb.* 54 (1916) 200; SLEUM. *Blumea* 8 (1955) 72.

Treelet; tips of the branchlets subangular, glabrous. *Leaves* oblong-lanceolate or oblong, rarely lanceolate-elliptic, gradually and rather acutely acuminate at the apex, subfalcate, attenuate into the petiole, not decurrent, coriaceous or subcoriaceous, entirely glabrous, pale olivaceous-greenish above when dry, entire, 15–20 by 3½–7 cm; midrib impressed above when dry, strongly raised beneath, nerves 7–8 pairs long curved-ascending and excurrent along the edge, incon-

spicuously inarching, reticulations dense, very finely but well visibly raised on both faces; petiole stoutish, ± 1 cm. *Racemes* ramiflorous, very slender, 6–8 cm, incl. the peduncle c. 1½ cm; rhachis glabrous or with some very small, scattered, appressed hairs, c. 1½ mm diam. Bracts not seen, probably early caducous. Pedicels mostly in pairs, 3–4 mm, free or connate halfway. *Perianth* white, sparsely fine appressed-rusty hairy or ± glabrous, 18–20 mm, tube ¾ mm across, limb elongate-ellipsoid c. 2 mm diam. Anthers 2 mm. Disk glands thick, broadly obovate, truncate or slightly emarginate, free, close. *Ovary* glabrous; style slender. *Fruit* not known.

Distr. *Malaysia*: N. New Guinea (Sepik River region: 'Lordberg'), once found.

Ecol. In moss-forest, 1000 m. *Fl.* Dec.

60. *Helicia graciliflora* MERR. *Philip. J. Sc.* 3 (1908) Bot. 132; *En. Philip.* 2 (1923) 99; SLEUM. *Blumea* 8 (1955) 72.

Small tree, c. 6 m; tips of the branchlets densely, ± appressed-rufous hairy, glabrescent. *Leaves* elliptic-lanceolate, rather shortly acute-acuminate, often ± curved at the apex, attenuate and decurrent into the petiole, somewhat inequilateral, chartaceous to thinly subcoriaceous, entire or with a few distant teeth towards the top, very rarely with one or two large lobes, very young ones appressedly rufous-pilose on both faces, soon glabrescent, mature ones still with some hairs on the midrib beneath, finally glabrous, olivaceous-brownish and somewhat shining above, brownish and dull beneath, (8)–10–14(–20) by 2½–4½(–6) cm; midrib nearly flat above, prominent beneath, nerves c. 7 pairs, rather straight in their lower part, curved upwards and inarching towards the edge, slightly prominent above, more distinctly so beneath, reticulations fine and dense on both faces; petiole slender, glabrescent, 1–1½(–2) cm. *Racemes* axillary, solitary, lax, very slender; flowers in pairs, ½–1 cm spaced, rather densely appressedly longish-rufous hairy all over; rhachis ½ mm diam. Bracts ovate-lanceolate, thin, 1½–2 mm. Pedicels very slender, c. 3 mm, connate at the base. *Perianth* very slender, 14–16 mm, finally glabrous except the base and limb, tube 2½ mm diam., limb ellipsoid, 1 mm diam. Anthers 1½ mm. Disk glands subquadangular, retuse, free, very close, seemingly forming a cup. *Ovary* glabrous; style very slender. *Fruit* not known.

Distr. *Malaysia*: Philippines (Mindanao), 700 m.

61. *Helicia bififormis* SLEUM. *Bot. Jahrb.* 70 (1939) 140; *Blumea* 8 (1955) 73.

Compact tree, 4–6 m; branchlets subterete, glabrous. *Leaves* elliptic-oblong or elliptic, broadly acuminate at the apex, obtuse, rarely shortly emarginate, broadly attenuate into the petiole, sometimes nearly rounded at the base, very slightly decurrent, coriaceous, yellowish to dark olivaceous above when dry, dull brown beneath, very young ones densely pale stiff-hairy on both faces specially beneath, together with a kind of flaky, peeling scales formed by the epidermis, mature ones gla-

brous or beneath laxly fine appressed-rufescent caducous-hairy, entire,  $(4\frac{1}{2}-)5\frac{1}{2}-8(-9)$  by  $(2\frac{1}{2}-)3-4\frac{1}{2}$  cm; midrib slightly prominent or somewhat impressed above, very prominent beneath, nerves 6-8 pairs, straight below and  $\pm$  parallel, curved upwards and  $\pm$  distinctly joined before the edge, somewhat impressed above, sharply prominent beneath, reticulations obscure above, slightly raised beneath; petiole robust, mostly very shortly appressed-pubescent,  $\frac{1}{2}-1$  cm. *Racemes* ramiflorous, dense, 5-9 cm, rather densely rufescent-appressed hairy all over; rachis 2-2 $\frac{1}{2}$  mm diam. Bracts ovate-lanceolate, acute,  $1\frac{1}{2}-2$  mm, mostly early caducous. Pedicels generally in pairs, free or connate at the base, stoutish, 3-4 mm. *Perianth* showy red, sometimes glabrescent from the apex, 20-23 mm, tube 1 mm diam., limb elongate-ellipsoid, 2-2 $\frac{1}{2}$  mm diam. Anthers 2 mm. Disk glands connate in a low crenulate cup. *Ovary* glabrous; style rather robust. Fruit not known.

Distr. *Malaysia*: SE. New Guinea (Central Distr.: Wharton Range, *pr.* Murray Pass).

Ecol. In forests or forest borders, 2840 m. *Fl.* July-Aug.

#### Doubtful or excluded species

*Helicia ovata* (JACK) BENN. in BENN. & BR. Pl. Jav. Rar. (1838) 84; MEISN. in DC. Prod. 14 (1856) 439; MIQ. Fl. Ind. Bat. 1, 1 (1858) 984.—*Roupala ovata* JACK, Mal. Misc. 2 (1822) 95 (*Rhopala*), reimpr. Hook. Comp. Bot. Mag. 1 (1836) 259; MERR. J. Arn. Arb. 33 (1952) 243.

'Leaves subsessile, ovate, acute on both ends, glabrous, entire, alternate and opposite, c. 25 by 15 cm, margin revolute, veins conspicuous. Racemes axillary, pedicels very short, slightly tomentose as are the perianth and ovary.'—Sumatra: Tapanuli, leg. JACK.

No type-specimen is available. I have seen no material from Sumatra which would coincide with the original description. Possibly the simple-leaved form of a species of *Heliciopsis*.

*Helicia serrata* R.BR. ex F.-VILL. Nov. App. (1880) 182.

'Ex silvis S. Mateo, Luzon.'

No material seen. Certainly not the true *H. serrata* (R.BR.) BL. which does not occur in the Philippines.

### 5. HELICOPSIS

SLEUM. Blumea 8 (1955) 79.—Fig. 12, 17-18.

Dioecious trees. *Leaves* spiral, simple and entire or lobed, not rarely pinnatisect, sessile or petioled. *Racemes* simple, many-flowered, axillary or ramiflorous. Bracts subulate, small, or linear-elongate,  $\pm$  persistent or  $\pm$  caducous. Bracteoles minute,  $\pm$  caducous. Pedicels mostly in twos, free or connate up to  $\frac{4}{5}$  their length. *Perianth* straight, tube rather slender, limb clavate or ellipsoid, attenuate towards the base in the  $\sigma$  flowers, dilated at the base by the swollen ovary in the  $\rho$  flowers; segments 4, revolute in anthesis. *Stamens* 4, sessile or nearly so, inserted at the base of the limb; anthers oblong, with pollen only in the  $\sigma$  flowers, similar in shape but without pollen in the  $\rho$  flowers; connective apiculate; exine reticulate. *Disk glands* 4, free, mostly approximate and seemingly forming a cup. *Ovary* sessile. Style slender, clavate towards the apex, stigma punctiform, terminal. *Ovules* 2, orthotropous, hanging from the top of the cavity, fertile only in the  $\rho$  flowers, reduced in size or absent in the  $\sigma$  ones. *Drupe*: exocarp leathery, rather thin, mostly soon dissolved, sometimes  $\pm$  persistent; mesocarp formed by very numerous radial  $\pm$  soft fibres, persistent, sometimes early dissolved or nearly absent; endocarp hard, woody at least in the inner part, mostly rather thick, the outer face reticulate-lacunose, the lacunae sometimes perforated. *Seed* 1, nearly globose, or seeds 2, hemispherical, wrinkled in the upper part; testa thin; cotyledons large, fleshy.

Distr. At least 7  *spp.*, 2 in Burma, Indo-China, SE. China, and Siam, 5 in *W. Malaysia*: Sumatra, Malay Peninsula, Java, Borneo, and the Philippines (Palawan, Mindanao). Fig. 12.

Notes. The genus combines certain characters of *Helicia* LOUR. (anthers sessile) with those of *Macadamia* F.v.M. (ovules orthotropous, pendent from the top of the cavity), but is very different from both by the dioecious flowers, the peculiar structure of the pericarp, and the pollen, which has a manifestly reticulate exine. By the latter character specimens with  $\sigma$  flowers can easily be recognized.

This is another case of a dioecious genus in the family. Among the unnamed materials there are apparently some two or three additional undescribed species but the specimens are too inadequate for description.

The species are apparently very rare and are hence very insufficiently known. Of the two Javan ones only ♂ flowers have been collected; of *H. rufidula* the flowers are unknown and in other species the fruit is absent. The range of variation of characters is therefore hard to establish.

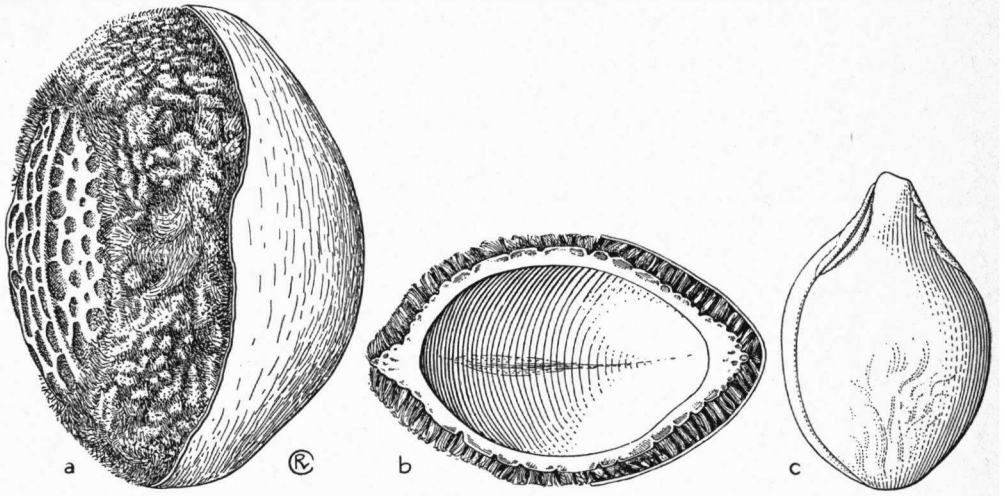


Fig. 17. *Heliciopsis* sp. showing structure of fruit and seed. a. Fruit with halfway removed exocarp, showing fibrous tissue of the mesocarp and lacunae of the stony endocarp, b. the same in cross-section, c. seed, all  $\times \frac{2}{3}$  (bb. 3076).

No conclusion can be made on the correlation between the leaf dimorphy and age of the plant. Of *H. lanceolata* and *H. velutina* no pinnatisect leaves are known as yet. On the other hand flowers have been collected on trees with pinnatisect leaves showing that these are not restricted to the immature seedling stage. Additional observations in the field are highly desirable.

KEY TO THE SPECIES

- 1. Bracts linear, subsistent, (6-)8-10 by  $\pm \frac{1}{2}$  mm.
- 2. Leaves lanceolate or oblanceolate-oblong, 3 times as long as broad, distinctly acuminate, olivaceous, lead-coloured or yellowish green. . . . . 1. *H. velutina*
- 2. Leaves broadly obovate-elliptic, 2 times as long as broad, apex broadly rounded, brown when dry. . . . . 2. *H. rufidula*
- 1. Bracts subulate,  $\pm$  caducous, 1-2 by  $\frac{1}{5}$ - $\frac{1}{3}$  mm.
- 3. Perianth c. 14-15 mm long . . . . . 3. *H. artocarpoides*
- 3. Perianth c. 8-10 mm.
- 4. Simple leaves lanceolate to obovate-lanceolate, mostly with acute apex, blade 10-20(-23) by (2 $\frac{1}{2}$ -)3 $\frac{1}{2}$ -5(-8) cm. Pinnatisect leaves unknown. Petiole c. 1 mm diam. Nerves ascending under c. 45°. Perianth 10-12(-14) mm long. Anthers 2 mm . . . . . 4. *H. lanceolata*
- 4. Simple leaves obovate-lanceolate with blunt apex, (15-)20-30(-45) by (5-)7-12 cm. Leaves dimorphous. Petiole c. 1 $\frac{1}{2}$ -2 $\frac{1}{2}$ (-4) mm diam. Nerves ascending steeply under c. 30°. Perianth 8-10 mm. Anthers 3 mm . . . . . 5. *H. incisa*

1. *Heliciopsis velutina* (PRAIN) SLEUM. Blumea 8 (1955) 81.—*Helicia velutina* PRAIN, Kew Bull. (1912) 343; GAMBLE, J. As. Soc. Beng. 75, ii (1914) 346; RIDL. Fl. Mal. Pen. 3 (1924) 143.  
 Tree (8-)12-23 m by 20-35 cm; branchlets initially rufous-tomentose in the youngest parts, glabrescent, striate, terete. Simple leaves obovate or oblanceolate  $\pm$  broadly, shortly (1 $\frac{1}{2}$ -2 cm) acuminate, subacute, cuneate at the base, subcoriaceous, glabrous except the midrib, which is  $\pm$  persistently pubescent on both faces, (10-)14-22 by (3-)4-7 cm, nerves 12-14(-16) pairs, rather straight below and  $\pm$  parallel to each other, curved above and manifestly inarching, with some

shorter and less distinct ones between them; petiole rufous-tomentose initially, glabrescent, thickened at the base, (1 $\frac{1}{5}$ -)1 $\frac{1}{2}$ -2(-3) cm by c. 2 mm. Lobed or pinnatisect leaves not yet known. Racemes solitary or rarely in pairs, axillary or ramiflorous, dense-flowered to nearly their base, (6-)7-12 cm, rufous-tomentose all over. Rhachis in the ♂ inflorescences c. 1 $\frac{1}{2}$ , in the ♀ inflorescences 2-2 $\frac{1}{2}$  mm across. Bracts linear, (6-)8-10 by  $\frac{2}{5}$ - $\frac{4}{5}$  mm, subsistent. Bracteoles similar, 4-5 mm. Pedicels rather stoutish, 4-5 mm, mostly in twos, free or connate up to their middle. Perianth yellowish- or greenish-white, scentless, somewhat glabrescent on top, 10-12 mm, tube c.  $\frac{3}{5}$  mm diam. in the

♂ flowers, c. 1½ mm diam. in the ♀ ones, limb clavate 2–2½ mm diam. Anthers c. 2 mm. Disk glands small, broadly obovate-truncate, free, slightly distant from each other. Ovary glabrous. *Fruit* cylindrical-ellipsoid, somewhat compressed, brown when dry, rather smooth, c. 4 by 2½ cm, c. 2 cm thick; exocarp leathery, 1–2 mm; mesocarp 2–3 mm; endocarp hard, woody, 1–2 mm. *Seed* not seen. *Fruit-pedicle* 8–10 by 3 mm.

*Distr. Malaysia:* Malay Peninsula (Perak, Johore), Borneo.

*Ecol.* Rain-forest, from the lowland to 750 m. *Fl. Nov.-April, fr. March-Oct.*

*Vern. Kédalai*, SE. Borneo (Bangar).

## 2. *Heliciopsis rufidula* SLEUM. *Blumea* 8 (1955) 82.

Tree, (8–)15–35 m by up to 0.9 m; branchlets initially rufous-tomentose, glabrescent, terete, striate. *Simple leaves* obovate or broadly obovate-oblong, ± rounded or very broadly obtusely attenuate at the apex, cuneate at the base, subcoriaceous, dark-brown when dry, initially covered on both faces (specially beneath) with crisp rufous hairs, glabrescent, hairiness subsistent on midrib and nerves beneath, entire, (12–)15–28 by (6–)7–13 cm; nerves 14–18 pairs at an angle of c. 45°, straight and parallel, inarching near the margin, with shorter and less distinct ones between them; petiole rufous-tomentose initially, glabrescent, (1–)1½–3 by ½–⅓ cm. *Pinnatisect leaves* with 3 or 4 lobes on each side, c. 55 by 35 cm, lobes 12–18 by 5–8 cm; petiole c. 11 cm by 5–6 mm. *Flowers* not yet known. *Infructescence* ramiflorous, 8–15 cm. Rhachis striate, rather densely rufous-pilose, 2–3 mm across. Bracts linear, c. 6 mm, subsistent. Pedicels c. 8 by 2–3 mm. *Fruit* broad-elliptic, red when fresh, dark brown when dry, 3½–4 by c. 2½ cm, c. 2 cm thick; exocarp leathery, ½–1 mm; mesocarp c. 3 mm; endocarp c. 1 mm. *Seed* not seen.

*Distr. Malaysia:* Malay Peninsula (Perak, Selangor, Pahang).

*Ecol.* In tall, lowland rain-forest. *Fr. Febr.*

*Vern. Bělëmbang*, Selangor, *mëmpëning*, Pahang, Kuantan.

## 3. *Heliciopsis artocarpoides* (ELM.) SLEUM. *Blumea* 8 (1955) 83.—*Helicia artocarpoides* ELM. *Leaf.* Philip. Bot. 5 (1913) 1826; MERR. *En. Philip.* 2 (1923) 99; *Pl. Elm. Born.* (1929) 52.

Small slender tree up to 15 m, or shrub; trunk often crooked; branchlets rufous-tomentellous when young, soon glabrescent, striate. *Simple leaves* (once found, SAN 10041) obovate-oblong, rounded at the blunt apex, tapering into the petiole and somewhat decurrent, subcoriaceous, glabrous, 30–40 (or more?) by 9–12½ cm, nerves 14–16 pairs slightly curved upwards and ± parallel, excurrent along the edge, crossbar-veined; petiole glabrous, 8–14 cm, thickened at the base. *Pinnatisect leaves* ± shining, glabrous, up to 90 cm long; lobes in 5–8 pairs narrow-oblong or obovate-oblong, shortly acuminate, 15–30 by 3–18 cm, the sinuses ± rounded and mostly 1–3 cm distant from the common midrib, rarely produced to it;

nerves 10–15 pairs, mostly straight, inarching in a ± distinct intramarginal vein; petiole 3–5 mm across, ± rufous-pubescent initially, glabrous or glabrescent, (6–)10–18 cm. *Racemes* solitary or 2–3 (rarely up to 10) in a fascicle, ramiflorous, (5–)15–30(–60) cm, ± dense-flowered, ± densely appressed-rusty-pilose; rhachis 1½–2½ (–3) mm across. Bracts lanceolate, ½–1 mm, ± caducous. Pedicels mostly in pairs, rather slender, free or connate up to ⅔ their length, (3–)5–7(–8) mm. *Perianth* somewhat fragrant, whitish or yellowish, 14–15 mm, tube in the ♂ flowers ⅔–1 mm across, in the ♀ ones c. 1½ mm, limb clavate 1½–2¼ mm across. Anthers 2–2½ mm. Disk glands ovate-oblong, free, ± approximate, thus seemingly forming a cup. Ovary glabrous. *Fruit* yellow when ripe, cylindrical-ellipsoid, (3–)4–4½ cm by (2–)2½–3 cm (mature?), smooth, shining; exocarp leathery, thin; mesocarp built up by radial rather soft brown fibres c. 3 mm in length; endocarp hard, rather woody, reticulate-lacunose, 1 mm.

*Distr. Malaysia:* Borneo, Philippines (Palawan, Mindanao).

*Ecol.* In rain-forest, up to 900 m, on well-drained slopes, ridges, and steep river-banks, apparently scattered, fairly common in W. Kutei. *Fl. Febr., Apr.–Oct., fr. Oct.*

Uses. Leaves and shoots are occasionally used for poulticing yaws, roots for sore eyes, ulcers, and yaws. Fruit said to be edible.

*Vern. Borneo:* *putat*, Sandakan, *kurunguh*, Dusun Kinab., *ambwitil*, Murut. Philippines: *gunsili*, Sub.

Notes. There are sterile materials both of simple and pinnate foliage from various localities in the Malay Peninsula (Perak: G. Kerbau, Cameron Highlands at c. 1200 m alt.), which are similar in general appearance, but whose upperside is more yellowish and markedly varnished; they probably belong to an undescribed species, which is related to *H. artocarpoides*.

## 4. *Heliciopsis lanceolata* (KOORD. & VAL.) SLEUM. *Blumea* 8 (1955) 84.—*Helicia lanceolata* K. & V. *Bull. Inst. Bot. Btjz no 2* (1899) 10; *Bijdr.* 5 (1900) 320; *KOORD. Nat. Tijd. N.I.* 60 (1901) 389; *Exk. Fl. Java 2* (1912) 154; *Atlas* (1915) t. 598; *BACK. Bekn. Fl. Java (em. ed.)* 4a (1942) fam. 79, p. 5, *nec* BAK. *f. J. Bot.* 63 (1925) *Suppl.* 89 *quae est Helicia attenuata*.

Tree, 15–27 m, trunk 25–45(–60) cm across; branchlets subterete, striate, ± densely short appressed-rufescent hairy, glabrescent. *Simple leaves* lanceolate or obovate-lanceolate, acuminate, tapering into the petiole, rather dark when dry, glabrous, subcoriaceous, 10–16(–23) by (2½–) 3½–5(–8) cm, nerves (6–)8–10 pairs, straight and parallel, inarching and anastomosing towards the margin, reticulations dense; petiole glabrous, 1–2(–5) cm, slightly thickened at the base. *Pinnatisect leaves* unknown. ♂ *Racemes* ramiflorous, 12–26(–30) cm, lax-flowered, densely appressed rufous hairy; rhachis 1–2 mm diam. Bracts subulate, 1–2 mm, ± caducous. Pedicels mostly in



Fig. 18. *Heliciopsis incisa* (K.&V.) SLEUM. a. Simple leaves  $\times 2/3$ , b. incised leaf,  $\times 2/3$ , c. intermediate stage,  $\times 2/3$ , d. young inflorescence,  $\times 2/3$ , e. buds,  $\times 2$ , f. open flower,  $\times 2$ , g. pistil with disk glands,  $\times 2$  (a., e. KOORDERS 39067, b. ditto 6277, c. ditto 12200, d., f-g. after KOORDERS Atlas; a-c. dense prominent reticulations not drawn).

twos and connate to  $1\frac{1}{2}$ - $4\frac{1}{5}$ , (2-)-3-4 mm. *Perianth* 8-10 mm, finally glabrescent, pale greenish-yellowish when fresh. Anthers c. 2 mm, white when fresh. Disk glands nearly rounded, free, close together. Ovary glabrous. Fruit not yet known.

Distr. *Malaysia*: Java (Preanger, Pekalongan, Besuki).

Ecol. In rain-forest, 600-1200 m. *Fl.* June-Nov. Vern. *Këndung*, S.

Note. VALETON cites and figures the flowers as being 14 mm long. I found them in well-developed racemes from the cultivated tree at Bogor C.H.B. III-B-11 only c. 8-10 mm in length.

5. *Heliciopsis incisa* (K.&V.) SLEUM. *Blumea* 8 (1955) 85.—*Helicia incisa* K.&V. Bull. Inst. Bot. Btzg no 2 (1899) 10; Bijdr. 5 (1900) 317; KOORD. Nat. Tijd. N.I. 60 (1901) 389; Exk. Fl. Java 2 (1912) 154; Atlas (1915) t. 599, 600; BACK. Bekn. Fl. Java (em. ed.) 4a (1942) fam. 79, p. 6.—*Artocarpus chaphasha*? ROXB. ex KOORD.-SCHUM. Syst. Verz. 2 (1910) 16.—Fig. 18.

Tree up to 15 m by c. 25 cm; branchlets stoutish, rufous-puberulous at the tips, soon glabrescent. *Simple leaves* mostly oblanceolate, blunt to rounded at the apex, cuneate towards the base, subcoriaceous, glabrous, (15-)-20-30-(45) by (5-)-7-12 cm; nerves 6-9(-10-12) pairs, steeply ascending, anastomosing towards the edge; petiole striate, glabrous, dark when dry, (0-1 $\frac{1}{2}$ -)2-4(-5 $\frac{1}{2}$ ) cm by 1 $\frac{1}{2}$ -2 $\frac{1}{2}$  mm. *Leaves tripartite to pinnatisect* occurring in juvenile trees, up to c. 1 by 0.6 m, lobes 1-5 pairs, oblong or ovate, sinuses  $\pm$  rounded at c. 2 $\frac{1}{2}$  cm distance from the midrib,

glabrous; petiole very stout, (0-) $\frac{1}{2}$ -2-(5) cm. *Racemes* ( $\varnothing$  unknown) mostly cauliflorous, almost always on trees with simple leaves, solitary or 2-3 fascicled, (15-)-30-40 cm, laxly appressed-ferruginous-pilose all over; rhachis c. 1 $\frac{1}{2}$  mm diam. Bracts ovate-lanceolate, minute. Pedicels 3-4 mm, free or connate up to halfway. *Perianth* 8-10 mm, tube  $\frac{3}{5}$  mm diam., limb clavate 1 $\frac{1}{2}$  mm diam. Anthers 3 mm. Disk glands bluntly broad-triangular, free. Ovary glabrous or with some scattered hairs. *Fruit* ellipsoid, compressed, c. 6 $\frac{1}{2}$  by 4 $\frac{1}{2}$  cm, 2 $\frac{1}{2}$  cm thick; exocarp coriaceous, rather thin; mesocarp 3 mm; endocarp hard, woody, irregularly reticulate-lacunose, 2-3 mm, the lacunae perforated. *Seed* not seen.

Distr. *Malaysia*: Sumatra (East Coast, Palembang, Lampong), Central & E. Java (Banjumas, Besuki).

Ecol. In rain-forest (ravines), from the lowland up to 1000 m. *Fl.*, fr. March.

Vern. *Pahit*, Sumatra East Coast, *puwo labi*, Palembang, R. Rawas, *kerbang tikus suloh*, Lampong, *këndang*, *wuru këndang*, J, *këndung*, Md.

Note. No mature fruit has as yet been collected in Java; the description by VALETON and plate by KOORDERS represent a very young stage. Sumatran specimens have, generally, both in pinnate and simple leaves, shorter petioles than those in Java, they even may be sessile.

A specimen with a very similar but larger fruit (11 by 7 $\frac{1}{2}$  by 5 cm) and leaves rufous-tomentose underneath has been found in Sumatra (East Coast Res.: bb 3076); this is assumed to represent an undescribed species (fig. 17).

## 6. MACADAMIA

F.v.M. Trans. Phil. Inst. Vict. 2 (1858) 72, *cum tab.*; SLEUM. *Blumea* 8 (1955) 3-5.—Fig. 19-21.

Trees or tall shrubs. *Leaves* verticillate or subopposite, entire or spiny-serrate, markedly reticulate. *Flowers* hermaphrodite, solitary or mostly in pairs on terminal or axillary simple racemes. Bracts small, very caducous. Pedicels free or partly connate, solitary or in twos. *Perianth* regular or slightly irregular, the tube slightly curved, limb club-shaped, slit laterally by the style bulging out, finally splitting completely in 4 linear recurving segments. *Stamens* 4, on short filaments, inserted about the middle of the perianth segments or a little higher below the limb; anthers oblong, connective produced into a gland or very short appendage; exine of pollen smooth or nearly so. *Disk* glands broad, truncate, distinct or united in a cup or ring round the ovary. *Ovary* sessile, style long, straight, clavate, with a small terminal stigma. *Ovules* 2, orthotropous, hanging from the top of the cell. *Fruit* globular, indehiscent, or the  $\pm$  hard coriaceous pericarp with a narrow lengthwise slit. *Seed* either solitary and globular, or 2 and hemispherical; testa membranous or hard, sometimes stony; cotyledons thick and fleshy.

Distr. About 9 spp., 5 of which in E. Australia (NE. and SE. Queensland to N. New S. Wales), 3 in New Caledonia; in *Malaysia*: one species in Celebes. Fig. 19.



## KEY TO THE SPECIES

1. Leaves in whorls of 5-7, entire. Racemes in terminal whorls inserted in the upper leaf-axils. Upper leaves not rarely strongly reduced in size, so that the whorl of racemes seems to be inserted on top of a stout peduncle, which really is the upper internode of a short twig (brachyblast). . . . . 1. *M. hildebrandii*
1. Leaves in whorls of 3 or 4, or subopposite, entire or spiny. Racemes axillary, rarely subterminal. . . . . 2. *M. ternifolia*
2. Leaves in whorls of 3 or subopposite, never in whorls of 4 in adult plants, irregularly spiny-dentate in earlier stages with up to 10 teeth on each side; nerves 7-12 pairs; petiole 4-15 mm. Inflorescence sparingly puberulous. Testa smooth. . . . . 2. *M. ternifolia*
2. Leaves 4 in the highest whorls, 3 in the middle ones, subopposite in the lowest ones, always regularly spiny-dentate with almost 35-40 teeth on each side, nerves in 13-20 pairs; petiole up to 2 mm. Inflorescence markedly loose-pubescent. Testa wrinkled or with shallow depressions. . . . . 3. *M. tetraphylla*

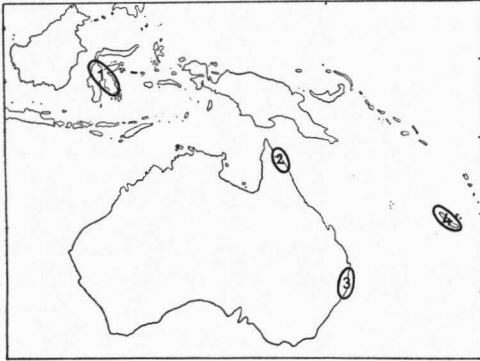


Fig. 19. Distributional area of the genus *Macadamia*: 1. *M. hildebrandii* STEEN.; 2. *M. heyana* (BAIL.) SLEUM. & *M. whelani* (BAIL.) BAIL.; 3. *M. ternifolia* F.v.M., *M. tetraphylla* JOHNS., *M. praealta* (F.v.M.) BAIL.; 4. *M. rousseii* (VIEILL.) SLEUM., *M. vieillardii* (BRONGN. & GRIS) SLEUM., *M. francii* (GUILLAUMIN) SLEUM.

1. *Macadamia hildebrandii* STEEN. Reinwardtia 1 (1952) 475.—Fig. 20.

Tree 3-33 m; clear bole 2-20 m, 10-40 cm across; bark after wounding exuding some sap turning red. *Leaves* obovate to oblanceolate or elliptic, variable in shape and size, apex rounded or bluntly acuminate, sometimes retuse, base rounded to cuneate, coriaceous, glabrous, 7-10 by 4-6 cm to 20-40 by 5-17 cm; nerves in 6-12 pairs, veins distinctly prominent-reticulate on both faces; petiole 0-2 cm. *Racemes* either in a whorl of 5-7 in the axils of normal leaves, or of reduced leaves 1-2 cm long on top of a 'peduncle' (brachyblast) up to 10 cm, generally exceeding the leaves; rhachis 10-40 cm, slender or rather stoutish. Bracts ovate-acute, very small, early caducous. *Flowers* in twos, white or creamy, sweet-scented. Pedicels free, 5-6 mm, appressed-puberulous or almost glabrous, reddish when fresh. *Perianth* segments ligulate, linear, 7-11 by 1/2 mm. Filaments flat,  $\pm$  1 mm; anthers  $\pm$  2 mm, with pale cells and a dark protruding connective. Ovary sparsely appressed-ferruginous-hairy, rarely glabrous. Style glabrous. Disk glands united in a short-cylindrical, faintly 4-lobed or irregularly

crenate, 1/2 mm high ring. *Fruits* 1-2 per raceme, globular, oblique, with a short hard conical style-base and a prominent longitudinal rib, c. 3 1/2 cm diam., green-brown when fresh, indehiscent; fruit-pedicle c. 8 by 2-3 mm; pericarp hard, c. 2 mm thick, consisting of a very thin smooth inner part and a thick outer part containing radial fibres. *Seed* globular, c. 3 cm diam., purple-brown when fresh; testa very thin, wrinkled, somewhat thicker and of other structure at the micropylar half as compared with the funicular half.

*Distr. Malaysia*: Celebes. Recently introduced into cultivation in Java by the Forest Service.

*Ecol.* In primary forest, from sea-level to 1500 m, apparently rare, but occasionally rather common. *Fl.* (mainly) Sept.-Oct., *fr.* March-April.

*Vern. Celebes nut*, E; Celebes: *pérandé*, Tado, *tinapu*, *tanapu*, *lila bai*, *tomaku*, Toradja, *maladewata*, Latimodjong Mts, *kaju balo molaba*, Padoë, *balo molaba*, *kaju balomotéa*, Tobela, *kandjolée*, Barée.

*Notes.* There is reason to assume that the seeds of the Celebes nut are as palatable as the Queensland nut, and it is possibly better adapted to the wet tropical climate than are *M. ternifolia* and *M. tetraphylla*. Although the fruit is indehiscent, the seed of *M. hildebrandii* is rather easily to harvest because it is not protected by a thick and very hard testa as in *M. ternifolia* and *M. tetraphylla*. The seeds of the strongly related *M. whelani* (BAIL.) BAIL. from NE. Queensland, of which the testa is equally thin, are largely used by the Australian aborigines.

2. *Macadamia ternifolia* F.v.M. Trans. Phil. Inst. Vict. 2 (1858) 72 *cum tab.*; *Fragm.* 7 (1869) 59; BENTH. *Fl. Austr.* 5 (1870) 407 *p.p.*; BAIL. *Syn. Queensl. Fl.* (1883) 432; MAIDEN, *Usef. Nat. Pl. Austr.* (1889) 40, 566; BAIL. *Queensl. Fl.* 4 (1901) 1329, t. 57, f. 1; MAIDEN, *For. Fl. N.S. Wales* 1 (1904) 216, t. 40, f. a-e; DOMIN, *Bibl. Bot.* 89 (1921) 31; WHITE, *Queensl. Agr. J.* (1923) 93; FILLA, *Flora* 120 (1926) 129, f. 51-56 (anat.); HEYNE, *Nutt. Pl.* (1927) 589; FRANCIS, *Proc. R. Soc. Queensl.* 39 (1928) 43-52, pl. 1, 10 fig. (seed-anat.); HOWES, *Kew Bull.* (1930) 219; BURK. *Dict.* (1935) 1380; KAUSIK, *Proc. Ind. Ac. Sc.* 8B (1938) 45-62 (flor. anat. & morph.); HARTUNG & STOREY, *J. Agr. Res.* 59 (1939) 397-406, 4 f., 3 pl. (fruit-development); BACK. *Bekn. Fl. Java* (em. ed.) 4a



Fig. 20. *Macadamia hildebrandii* STEEN. a. Habit,  $\times 1/2$ , b. section of bud apex,  $\times 5$ , c. open flower,  $\times 5$ , d. base of ovary and disk,  $\times 8$ , e. fruit,  $\times 1/2$ , f. seed,  $\times 1/2$ , f. cotyledon with plumule,  $\times 1/2$  (Cult. Hort. Bog.).

(1942) fam. 79, p. 7; FRANCIS, Austr. Rain-forest Trees (1951) 91, f. 38-45; JOHNSON, Proc. Linn. Soc. N.S.W. 79 (1954) 16.—*M. ternifolia* var. *integrifolia* (MAID. & BETCHE) MAID. & BETCHE, Proc. Linn. Soc. N.S.W. 24 (1899) 150.—*Helicia ternifolia* F.v.M. Fragm. 2 (1860) 91; *l.c.* 6 (1868) 191.—*M. integrifolia* MAID. & BETCHE, Proc. Linn. Soc. N.S.W. 21 (1897) 64.—Fig. 21.



Fig. 21. *Macadamia ternifolia* F.v.M. in fruit and flower,  $\times \frac{1}{3}$ . (Cult. Tjibodas Mountain Garden, G 56, Oct. 1954).

Tree 5-15(-20) m by c. 30 cm, often several-stemmed; no buttresses. *Leaves* mostly in whorls of 3 or subalternate (very rarely in whorls of 4 on some branchlets of a very young plant), oblong to oblanceolate, acute to obtuse, sometimes retuse, tapering to the base, coriaceous, glabrous or nearly so, in earlier stages irregularly spiny-dentate with up to 10 teeth on each side, in later stages entire, 5-15 by 2-3(-4 $\frac{1}{2}$ ) cm; nerves 7-12 pairs; petiole 4-15 mm. *Racemes* axillary, usually near the ends of slender foliated shoots, but occasionally on leafless shoots resulting in a compound inflorescence,  $\pm$  pendulous, 8-15(-20) cm, sparingly puberulous. *Flowers* in pairs or solitary, cream or whitish. Bracts subovate-subulate, minute. Pedicels

free, slender, 3-4 mm. *Perianth* segments finely puberulous outside, 8-11 mm. Stamens inserted c. 5 mm above the base of the perianth-segments; connective short, obtuse. Disk glands united in a shortly dentate ring. Ovary rufous-villous; style after anthesis 10-13 mm, rufous-hairy near the base, glabrous elsewhere. *Fruit* globose, green, 2 $\frac{1}{2}$  cm diam., rarely larger, pericarp c. 2-3 mm thick, splitting open on one side. *Seed* mostly 1, globular, rarely 2, semiglobose, with a smooth, hard, thick (2-4(-5) mm) testa.

Distr. Native of SE. Queensland, cultivated both in Australia, Malaysia, and other tropical regions as a fruit-tree, preferably in the mountains.

Ecol. In Queensland in rain-forest both under everwet and seasonal conditions; its drought-resisting qualities make it of value for semi-arid regions while its ornamental appearance recommends it for garden-culture in tropical and subtropical areas. *Fl.* May-Oct., *fr.* Jan.-Febr.

Uses. The nuts are similar in shape to hazelnuts, but have a very hard shell; thin-shelled (1 mm) strains are now under cultivation in Australia. The flavour of the nut is said to have a finer aroma than that of the hazelnut. The tree is said to begin to fruit at 3 to 8 years. The timber is of small size, but very useful, red, firm, the structure is fine, and takes a good polish; useful for turning, cabinet- and veneer-work.

Vern. Queensland nut, Australian bush nut, popple nut, E.

3. *Macadamia tetraphylla* JOHNSON, Proc. Linn. Soc. N.S.W. 79 (1954) 15.—*M. ternifolia* F.v.M. ap. BENTH. Fl. Austr. 5 (1870) 406 et aut. plurim. pro parte.

High shrub to medium-sized tree, 5-15(-?) m, several-stemmed at the base, specially in cultivation. *Leaves* mostly in whorls of 4, at least the upper ones of a twig, middle ones  $\pm$  ternate, inferior ones subopposite, oblong-oblanceolate, shortly subacutely acuminate and often mucronate,  $\pm$  truncate or contracted at the base, coriaceous, glabrous or sparsely provided with fulvous or pallid hairs underneath, regularly spiny-serrate with c. 35-40 teeth on each side, 7-25 by 2-4 $\frac{1}{2}$  cm; nerves 13-20 pairs, reticulations dense, finely prominent; petiole 0-2 mm. *Racemes* axillary or ?ramiflorous,  $\pm$  pendulous, densely rufous-patent-pilose or nearly tomentose, 12-30 cm incl. the 2-5 cm long peduncle; rhachis rather slender. Bracts subulate to filiform, c. 2 mm, irregularly inserted in pseudo-whorls, some of them subtending a pair of flowers. Pedicels in twos, 2-3 mm. *Perianth* c. 8 mm, usually pale lilac, but occasionally creamy or whitish,  $\pm$  densely appressed-hairy outside, glabrous inside. Filaments c. 2 $\frac{1}{2}$  mm; anthers pale, 1 $\frac{1}{2}$  mm. Disk glands connate into a cup. Ovary densely fulvous-pilose; style hairy at the base, glabrous towards the clavate top, together with the ovary 8-10 mm. *Fruit* globose, apiculate, c. 2-3 cm across, glabrous, somewhat rugose, on a very short thick pedicel. *Seeds* solitary, globose, apiculate, 1 $\frac{1}{2}$ -2 cm diam., brownish, somewhat shining; testa hard, wrinkled or with shallow depressions, 2(-3) mm thick.

Distr. Native on the far N. coast of New South Wales and the adjacent part of Queensland, elsewhere cultivated as an ornamental or fruit-tree.

Ecol. In lowland rain-forest or rain-forest edges. Fl. Sept.-Oct., fr. Jan.-Febr.

Uses. Similar to those of *M. ternifolia*; the variation in the thickness of the testa (shell) is also similar to that in *M. ternifolia*, specially in cultivated specimens.

Vern. The same as in *M. ternifolia*.

Notes. This species, recently segregated by JOHNSON, occupies a more northern area than *M. ternifolia* s.str. In restricted areas, in the region of contact of the two species, specimens with vegetatively intermediate characters have been found, displaying a considerable variation. These presumed hybrids have only been found in a sterile state.

7. STENOCARPUS

R.BR. Trans. Linn. Soc. 10 (1810) 201, nom. cons.—*Cybele* SALISB. in KNIGHT, Prot. (1809) 123, nom. rejic.—Fig. 22-23.

Trees. Leaves spiral, simple or deeply pinnatifid with few lobes, in the younger stages often twice and thrice pinnate, with very narrow pinnae. Peduncles terminal or in the upper axils, sometimes several in an umbel or short raceme, each bearing an umbel of pedicellate flowers. Bracts 0 or very early caducous. Perianth slightly irregular, the tube opening along the abaxial side, limb nearly globular and recurved, segments at length separating. Anthers broad, sessile, within the concave limb; connective not produced beyond the anther-cells. Disk glands united in a short semi-annular disk or cup, or almost obsolete. Ovary stipitate, tapering into a long style dilated at the top into a flat, oblique disk stigmatic in the centre. Ovules several, laterally attached at or near the top of the cell, imbricate downwards in 2 rows. Fruit a usually narrow-oblong, coriaceous follicle. Seeds produced at the lower end into a membranous wing, separated from each other by a thin lamella.

Distr. About 22 spp., c. 16 of which are endemic in New Caledonia, 4 spp. are restricted to N. and E. Australia, 2 spp. in Malaysia (New Guinea and Aru Islands), both also in Australia.

KEY TO THE SPECIES

- 1. Nerves 10-15 pairs, pinnate. Perianth robust, 2 1/2-3 cm long . . . . . 1. *S. sinuatus*
- 1. Leaves 5-plinerved. Perianth slender, c. 1 cm long . . . . . 2. *S. moorei*

1. *Stenocarpus sinuatus* ENDL. Gen. Pl. Suppl. 4 (1847) 88; MEISN. in DC. Prod. 14 (1856) 451; F.v.M. Fragm. 5 (1866) 154 (*sphalm. sinuosus*); BENTH. Fl. Austr. 5 (1870) 539; BAIL. Queensl. Fl. 4 (1901) 1355; DOMIN, Bibl. Bot. 89 (1921) 40, f. 126; SLEUM. Bot. Jahrb. 70 (1939) 130; BACK. Bekn. Fl. Jav. (em. ed.) 4a (1942) 8; FRANCIS, Austr. Rain-forest Trees (1951) 97, f. 51-53.

Tree, 10(-20-30) m by 30 cm; branchlets terete, younger parts tomentulose, soon glabrescent. Leaves either undivided, oblong-lanceolate, 13-27 by 3-7 cm—or irregularly pinnatisect and up to 30 cm long, with 1-4 oblong lobes on each side—mostly obtuse at the apex, attenuate into the petiole at the base, subcoriaceous, glabrous; forks in divided leaves with a (thydathodal) gland; nerves 10-15 pairs, pinnate, with more or less conspicuous intermediate ones between, slightly prominent underneath, veins finely and densely reticulate on both faces; petiole glabrous, 1 1/2-2 1/2 cm. Peduncles axillary or terminal on lateral short-shoots, glabrescent, either 2 or more together in an umbel, or several at some distance forming a short broad raceme, each peduncle 5-10 cm bearing an umbel of (6-)12-20 bright red or orange-red

flowers. Pedicels c. 1 1/4 cm, radiating in one plane from the dilated apex of the peduncle. Perianth-tube shortly rusty-pubescent, straight, narrowed upwards, incl. the limb (2 1/2-)3 cm in anthesis; limb recurved, globular, about 4 mm across. Anthers yellow. Disk gland semi-annular, blackish when dry, c. 2 mm high. Ovary densely brownish-pubescent, on a less densely pubescent to glabrescent, thick, up to 2 cm accrescent stipe. Style glabrous, c. 2 cm. Ovules 12-14. Fruit dry, c. (6-)10 cm long, 2-2 1/2 cm broad, narrow-oblong, attenuate at both ends, opening lengthwise on one side and then boat-shaped, but flattening out after maturity, hard-coriaceous. Seeds thin, closely packed and overlapping, c. 25 by 7 mm.

Distr. Australia (coastal scrubs of Queensland and New S. Wales), and in Malaysia: SE. New Guinea (Port Moresby area: Boridi), twice found.

Ecol. In primary and secondary rain-forest at 1000-1400 m. Fl. Oct.-Nov. in New Guinea, but in Febr. in Australia.

Uses. Wood of a light colour, close in grain, tough and firm, good for cabinet-work, brake-blocks, building, framing, flooring. Often cultivated for its brilliant and remarkably symmetrical

inflorescences, similar to a wheeled umbel, therefore called *wheel-tree*. According to BACKER *l.c.* sometimes cultivated in the mountains of W. Java as an ornamental tree.

Vern. *Tulip-flower, fire-tree, white silky oak*, Queensland.

2. *Stenocarpus moorei* F.v.M. *Fragm.* 1 (1859) 134; *ibid.* 5 (1866) 154.—*S. salignus* R.Br. *var. moorei* BENTH. *Fl. Austr.* 5 (1870) 540; BAILEY, *Queensl. Fl.* 4 (1901) 1356.—*S. papuanus* LAUT. *Bot. Jahrb.*

50 (1913) 329; DIELS, *Bot. Jahrb.* 54 (1916) 199; Nova Guinea 14 (1924) 74; SLEUM. *Bot. Jahrb.* 70 (1939) 131.—Fig. 22–23.

Shrub or small tree 2–15(–25) m; branches terete, tips finely appressed-pubescent, soon glabrescent. *Leaves in mature specimens* simple, ovate-oblong or elliptic to ovate-lanceolate, obtusely or rarely subacutely slightly acuminate, tapering into the petiole, subcoriaceous, brown when dry, finely appressed-puberulous when young, soon glabrous, 8–16 by (2½–)3–6 cm, 5-plinerved from



Fig. 22. *Stenocarpus moorei* F.v.M. Twig from a juvenile specimen showing dimorphous foliage,  $\times 2\frac{1}{3}$  (GJELLERUP 82a).

the base. Leaves from young specimens or sprouts repeatedly pinnately dissected and fern-like, quite different from the normal leaves, segments sometimes only 2 mm broad; petiole  $\frac{3}{4}$ -2 cm. Inflorescences axillary, densely and persistently seri-

ceous by a mixture of whitish and rusty hairs, consisting of a solitary umbel or of a short raceme of 2-4 umbels. Peduncles slender, 1-2 cm, bearing an umbel of (10-)15-20(-30) green or brownish-yellowish flowers. Pedicels c. 4-5 mm, slender,

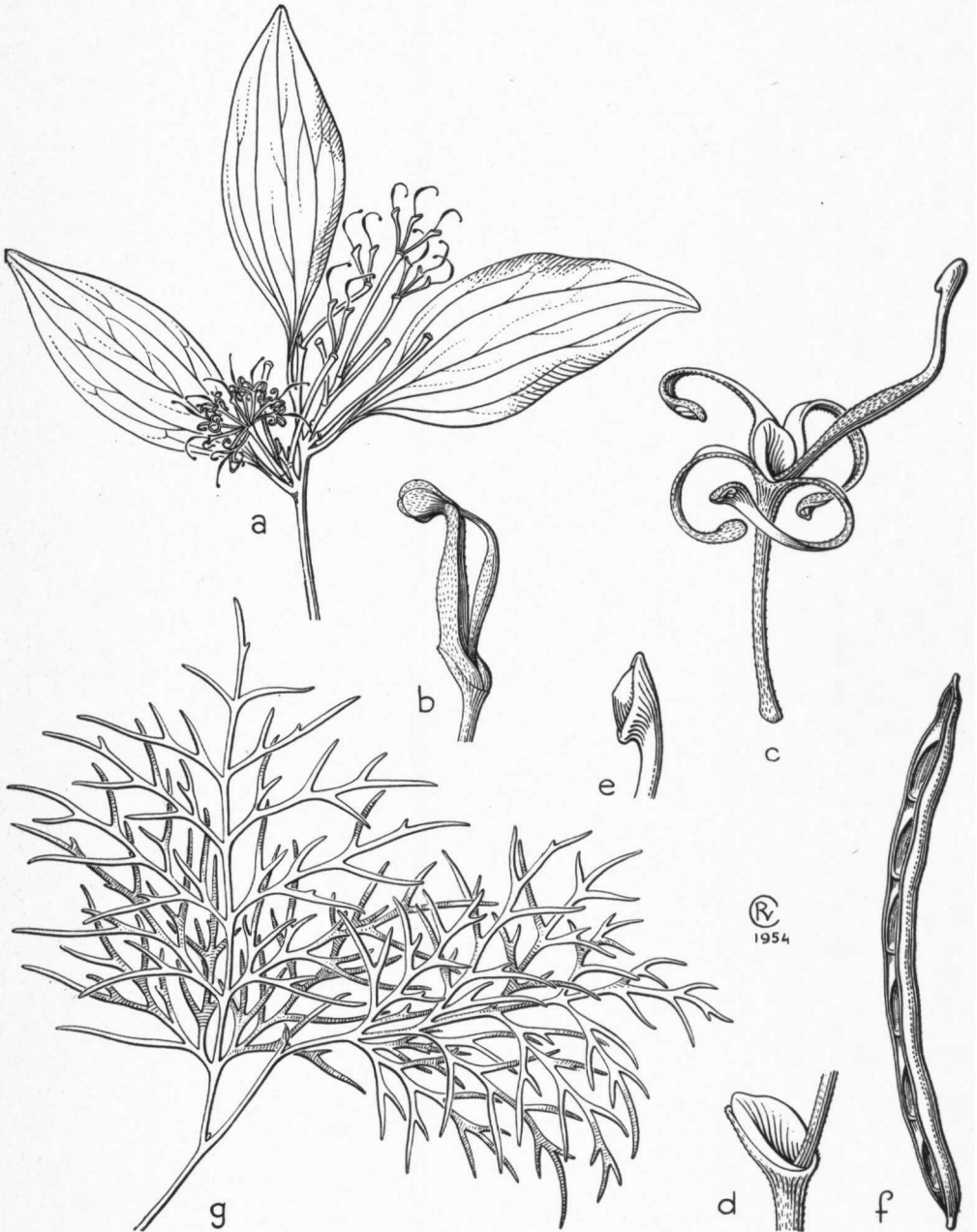


Fig. 23. *Stenocarpus moorei* F.v.M. a. Flowering twig,  $\times \frac{2}{3}$ , b. bud,  $\times 5$ , c. open flower,  $\times 5$ , d. torus with disk,  $\times 7$ , e. stigmatic style apex,  $\times 9$ , f. opened fruit with imbricate seeds,  $\times \frac{2}{3}$ , g. leaf from juvenile specimen,  $\times \frac{2}{3}$  (a-e. after BRASS 8882, f. BRASS 8556, g. BRASS 8813A).

thickened at the apex into a very oblique torus bearing the thick, unilateral, horseshoe-shaped disk. *Perianth* incl. the limb 6–7 mm, tube  $\frac{3}{5}$  mm diam., limb globular  $1\frac{1}{2}$  mm diam. Stipe 5–6 mm, ferruginous-sericeous as is the ovary, inserted in the lowest part of the torus; style slender, glabrous, 4–5 mm after anthesis. *Fruits* pod-like, several together, narrow-oblong, subterete, curved with slight constrictions, acuminate, 4–12 cm by *c.* 4–5 mm across, glabrous, woody, splitting unilaterally lengthwise, the halves flattening out. *Seeds* subquadrate, very thin, *c.* 5 mm across.

*Distr.* Queensland and New South Wales, in *Malaysia*: New Guinea, S. Moluccas (Aru Isl.: P. Trangan).

*Ecol.* Both in river-side rain-forest and on open slopes of grass and ferns, once found on serpentine rock covered with humus, from the lowland up to 1000 m, occasionally common. *Fl.* June–July, *fr.* Dec.

*Vern.* *Nanhang*, Trangan Isl. (Aru), *beefwood*, Queensland.

*Notes.* Sterile and fruiting specimens show a remarkable similarity with some broad-leaved phyllodinous *Acacias*, but can easily be recognized by the absence of an adaxial gland at the apex of the petiole and more strictly falcate leaves.

The Papuan material is exactly matched by the type specimen collected by C. MOORE near Illawarra, New South Wales (K). Specimens from Mt Lindsay (Macpherson Range, N.S.W.) and Rockingham Bay (NE. Queensland) are very similar but differ by rather glabrous inflorescences.

*S. moorei* is closely allied to *S. salignus* R.Br. The indument of the inflorescences in the latter species, although sparse in general, is apparently rather variable in density. Pending a detailed study of the *S. salignus*-complex (incl. the New Caledonian *S. trinervis* (MONTR.) GUILLAUMIN) *S. moorei* is kept specifically distinct from *S. salignus*; leaves of *S. moorei* are 2–3 times as long as broad, those of *S. salignus* 4–8 times.

## 8. OREOCALLIS

R.Br. Trans. Linn. Soc. 10 (1810) 196.—Fig. 24.

Trees or shrubs. *Leaves* spiral, simple, lobed, or pinnate. *Racemes* rather short, solitary or fascicled, axillary in the upper leaf-axils, or solitary and terminal. Bracts rudimentary, early caducous. *Flowers* showy in pairs, pedicelled, free. *Perianth* splitting completely into 4 segments at anthesis, tube cylindrical, straight, limb somewhat oblique, subglobose. *Anthers* sessile within the concave limb, ovate, connective not or very shortly produced. *Disk* semi-annular or horseshoe-shaped, fleshy, inserted on the thickened, very oblique torus. *Ovary* on a long stipe, attenuate into a long style. *Ovules* ascending, imbricate, 4 or more in each of 2 rows. Style manifestly thickened and nearly truncate at the apex, with a disk-like lateral swelling bearing the rather minute stigma in its centre. *Follicle* stipitate, narrow-oblong, opening lengthwise at one side, with 4 or more superposed seeds on each half. *Seeds* suborbicular, flat-compressed, separated from each other over their whole length by a thin lamella, with an oblong unilateral and terminal wing; wing of the basal seed nearly as long and wide as the fruit, but gradually shorter in the upper seeds; funiculus ascending obliquely to the upper part of the wing.

*Distr.* About 5 *spp.*, 2 of which in S. America (Ecuador-Peru), 2 in Australia (NE. and SE. Queensland to N. New South Wales), in *Malaysia*: 1 in New Guinea and the S. Moluccas (Aru Isl.). Fig. 1.

*Note.* The American, Australian and Papuan species are similar in all characters of the flower and the fruit, but show a remarkable divergence in so far as the American *spp.* have their nerves, veins and veinlets prominent on both faces, whereas in the latter the venation is minutely but visibly impressed above and underneath.

1. *Oreocallis brachycarpa* (SLEUM.) SLEUM. Bot. Jahrb. 76 (1954) 203.—*Embothrium brachycarpum* SLEUM. *l.c.* 70 (1939) 130.—Fig. 24.

Tall, rather slender tree, 20–40 m by 40–50 cm; bark hard, brown to greyish, rough, shedding in thin scales. Branchlets terete, slightly pubescent at the tips, glabrous elsewhere. *Leaves* elliptic- to obovate-oblong, blunt to rounded at the apex, cuneate at the base and decurrent into a  $1\frac{1}{2}$ –3 cm long petiole, subcoriaceous to coriaceous, entire,

glabrous, (6–)8–13(–15) by  $2\frac{1}{2}$ –4(–5) cm; nerves *c.* 10–11, rather straight, inarching before the margin, with other less distinct ones between them. *Racemes* mostly solitary, closely together at the twigs-ends, each 8–20(–25)-flowered; rhachis *c.* 2–3 mm thick, woody, rusty-tomentose,  $2\frac{1}{2}$ –5 cm. Pedicels rather slender, (2–) $2\frac{1}{2}$ –3 cm, minutely ferruginous-pubescent; torus 2 mm diam. Anthers ovate,  $1\frac{1}{2}$  mm, sessile or nearly so. *Flowers* orange-red, glabrous or minutely ferruginous- or fuscous-

pubescent, somewhat fleshy. *Perianth-tube* 4–5 cm, limb oblique, subglobose, 2–3 mm across. Disk glabrous. Ovary fusiform, glabrous; stipe c. 2 cm; style c. 2 cm, thickened. *Fruit* narrow-oblong,

somewhat broadened towards the acute apex, cuneate at the base, smooth, 8–12(–14) by 2–2½ cm, c. 1½ cm thick; exocarp coriaceous, c. 1½ mm; mesocarp stiff, nearly woody, c. 1 mm; endocarp



Fig. 24. *Oreocallis brachycarpa* (SLEUM.) SLEUM. *a.* Habit,  $\times \frac{2}{3}$ , *b.* flower, nat. size, *c.* apex of style and stigma,  $\times 5$ , *d.* opened fruit with 2 rows of imbricate seeds,  $\times \frac{2}{3}$ , *e.* empty fruit with pitted endocarp,  $\times \frac{2}{3}$ , *f.* seed,  $\times \frac{2}{3}$  (*a-c.* after BRASS 8170, *d-f.* after VAN ROYEN 4780).



soft, c. 1 mm. *Seeds* in 2 rows of 5-7, impressed in pits in the endocarp, rounded,  $\pm$  flattened, c. 3-4 mm across, c. 2-3 mm thick, with an oblong, terminal,  $\pm$  stiffly membranous wing which reaches nearly the full length and width of the fruit in the basal seed, but diminishes gradually in size in the upper ones, every seed separated from the next one by a membranous lamella the size of the wing; fruit-stipe woody, 1½-2 cm by 2 mm; pedicel woody, 2-2½ cm by c. 1½ mm.

*Distr. Malaysia:* S. New Guinea (Upper Merauke River, Lower Fly River and Oriomo River), S. Moluccas (Aru Isl.: P. Trangan).

*Ecol.* In mixed rain-forest of dry inland ridges or high banks of rivers not subject to inundation, also found in a bamboo-Eucalypt-forest, at low elevations. *Fl.* Aug.-Oct., *fr.* Aug.-Febr.

*Uses.* Sapwood pale straw-coloured merging

into red; heart-wood said to resemble that of *Stenocarpus*. No use is known as yet, but possibly it is a good timber as is the related *O. wickhamii* HILL & F.v.M., the 'Pink Silky Oak' from NE. Queensland, which is described as yielding a very light, very soft and yet the most durable timber of the so-called 'Northern Silky Oaks' (cf. FRANCIS, Austr. Rain-forest Trees 1951, 390, under *Embothrium*).

*Vern.* *Anga*, Trangan, *kawoli*, Merauke (Jedialect).

*Note.* The epithet '*brachycarpa*' unfortunately alluded to galled, not well developed fruits attached to the type-sheet. Such anomalous fruits, reaching only 2 cm in length and containing no seeds, have recently been collected along with normal fruits. As a matter of fact *O. brachycarpa* has the biggest fruits known in the genus.

## 9. BANKSIA

LINNÉ *f.* Suppl. (1781) 15.—Fig. 25-28.

Trees or shrubs. *Leaves* spiral or irregularly whorled, simple, lobed, pinnatifid or pinnate, entire or toothed, mostly with numerous nerves. *Spikes* densely flowered, terminal, cylindrical-oblong or globular, terminal and sessile above the uppermost leaf, rarely lateral or on short, lateral branches. *Flowers* sessile, in pairs, each pair subtended by a persistent, pointed bract and 2 lateral, rather small, persistent bracteoles, all densely packed in parallel or spiral or rarely vertical rows. *Perianth-tube*  $\pm$  straight, slender, dehiscing into 4 segments, or along the lower



Fig. 25. *Banksia dentata* L. *f.* in a small pyrogenic savannah near Wau, between Crystal Creek and Magnetic Creek, c. 1160 m, associated with *Cycas* (photogr. P. VAN ROYEN, June 1954).

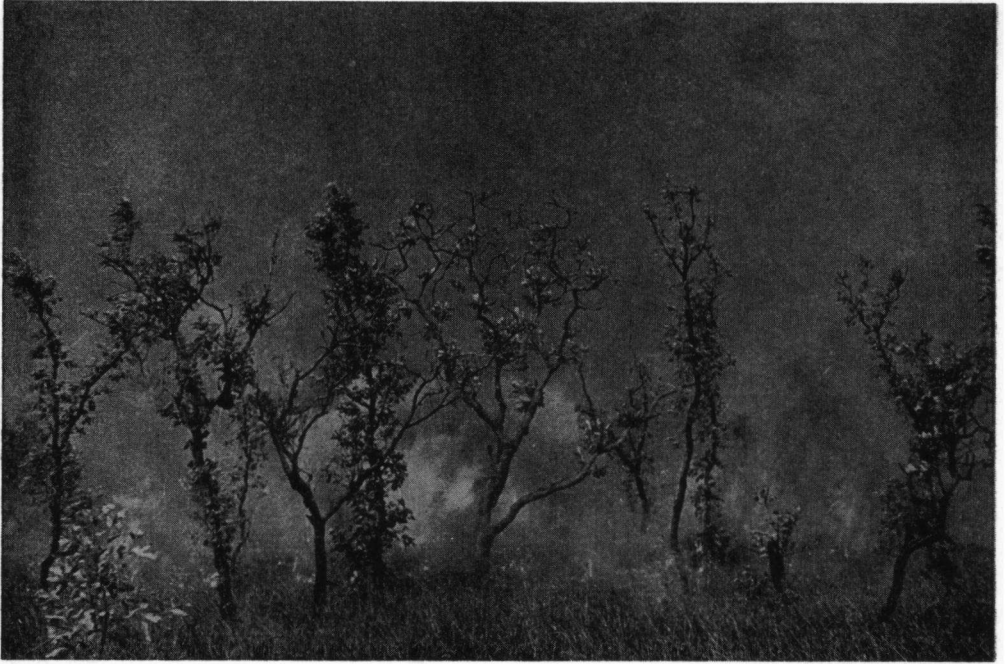


Fig. 26. Hunter's fire raging on *Banksia dentata* savannah, trees c. 5 m high (photogr. BRASS, Sept. 1936).



Fig. 27. Fruiting *Banksia dentata* L. f. with charred trunks on recently burned savannah of a low lateritic ridge, Lake Daviumbu, Middle Fly River, Papua (photogr. BRASS, Sept. 1936).

side only; limb ovoid-oblong or linear, remaining long coherent. *Anthers* narrow, sessile in the concave limb segments; connective thick, usually very shortly produced beyond the anther-cells. Disk glands 4, membranous. *Ovary* very small, sessile. Style usually longer than the perianth, hard, elastic, needle-like, remaining hooked until the end is set free by the separation of the laminae; stigma small, terminal, punctiform. *Ovules* 2, collaterally attached about the middle of the cell. *Fruit* compressed, capsule-like, opening at the broad end in 2 hard, often woody horizontal halves, transverse on the spike. *Seeds* usually 2, compressed, with a terminal membranous wing, broad and rounded like the valves, separated by a membrane of the same shape. Bracts and bracteoles consolidated in fruit with the stout rhachis into a thick woody cone (in *Mal. sp.*), the valves of the capsules protruding somewhat beyond the bracts.

Distr. About 50 *spp.* in Australia, 1 of them in *Malaysia*: New Guinea and S. Moluccas (Aru Isl.).

1. *Banksia dentata* LINNÉ *f. Suppl.* (1781) 127; R. BR. *Trans. Linn. Soc.* 10 (1810) 210; BENTH. *Fl. Austr.* 5 (1870) 555; F.v.M. *Descr. Not.* 1 (1876) 28; BECC. in D'ALBERTIS, *Nuova Guinea* 2 (1880) 398; BAILEY, *Queensl. Fl.* 4 (1901) 1360; LAUT. *Nova Guinea* 8 (1910) 285; Bot. *Jahrb.* 50 (1913) 334; WHITE, *Proc. R. Soc. Queensl.* 34 (1922) 27; J. ARN. *Arb.* 10 (1929) 210; KANEH. & HATUS. *Bot. Mag. Tokyo* 52 (1938) 354; SLEUM. *Bot. Jahrb.* 70 (1939) 148.—Fig. 25–27.

Branched shrub or small, often crooked or stunted tree, 2–5 m by 10–20 cm, with sparse foliage; bark rough, tuberculate, flaky in rectangular pieces. *Leaves* sessile or nearly so, spiral or in whorls, cuneate-oblong, rounded-obtuse or sometimes retuse at the mucronate apex, tapering gradually towards the base, subcoriaceous, margin irregularly coarsely spiny-toothed to subentire, undulate and often slightly recurved, upper surface glabrous, undersurface white or slightly pale brownish, arachnoid-tomentose, except on the nerves, 10–25 by (2–)2½–8 cm, nerves straight, numerous, at about right angles to the midrib, arched. *Spikes* oblong or cylindrical, covered by a thick, rusty, detersile wool when young, 6–10 cm long, 1–1½ cm thick in anthesis. Bracts and bracteoles tomentose. *Perianth* slender, silky, greenish- or creamish-yellow when open, 2–2½ cm. Style yellow, 3–4 cm. *Fruit*-cone oblong, c. 7–10 by 1½–2 cm, tomentose.

Distr. Australia (Northern Territory & Queensland), in *Malaysia*: New Guinea & S. Moluccas (Aru Isl.: P. Trangan).

Ecol. Open savannah lands, savannah ridges or open grassland, in savannah forest adjoining rain-forest, secondary forest, sometimes together with *Pandanus*, mainly in the lowland from the coast inland, also at 600 and up to 1200 m, sometimes gregarious (Lake Daviumbu, Astrolabe Range), mainly restricted to areas which are subject to a distinctly dry season, in New Guinea therefore specially in the southern part from Merauke beyond Moresby, also in the lower montane zone near Bulolo and Wau. *Fl.* Jan.–Sept., *fr.* May–Sept.

Both in Australia and in New Guinea it grows

often associated with *Melaleuca* and certain species of *Eucalyptus* in open or woody savannahs which are regularly swept by raging hunting fires (fig. 26–27) and shrubs are charred and grow stunted or crooked. By its resistance against these fires it may gain local predominance. The woody spikes belong to the macrobiocarpous type, the seeding of which is adapted to the pyrogenic habitat (*cf.* *Fl. Mal.* I, 4, p. xxiv).

The immense number of flowers in each spike produces abundant honey attracting insects as well as honey birds (*Nectarinidae*, *Zosteropidae*, *Meliphagidae*), but also the honey-mouse, the smallest arboricolous type of marsupial belonging to the *Phalangeridae*, which sucks honey with its long, thin, worm-shaped tongue. These small marsupials have been observed both on *Banksia dentata* and on the above-mentioned associated *Myrtaceae*. Facts about these most interesting biological conditions have been summarized by



Fig. 28. The silvergrey 'glider' or 'flying phalanger' *Petaurus breviceps* WATERHOUSE, always found in flowering *Banksias*, same place as in fig. 25 (photogr. P. VAN ROYEN).

O. PORSCH (Jahrb. Wiss. Bot. 70, 1929, 190; Biol. Gener. 10, 1934, 673-679). Similar conditions prevail in New Guinea where these biological communities have the same composition. Dr VAN ROYEN found always mouse-like marsupials in the *Banksias* near Rona (fig. 28).

Uses. Sapwood pale to straw, heart-wood deep red or red-brown, prettily marked. In Australia used for cabinet-work.

#### Excluded

*Polypodium spinulosum* BURM. f. Fl. Ind. (1768) 233, t. 67, f. 1 = *Synaphea spinulosa* (BURM. f.) MERR. Proc. Linn. Soc. N.S.W. 44<sup>2</sup> (1919) 354; Philip. J. Sc. 19 (1921) 347 (syn. *S. polymorpha* R.Br.).

An Australian species erroneously attributed by BURMAN to Java.