MONIMIACEAE (W.R. Philipson, Christchurch)

Evergreen shrubs or trees, rarely lianes. *Leaves* decussate, or rarely in whorls of three, exstipulate, simple, entire or dentate, with spherical oil cells in the lamina, bearing simple or stellate hairs or glabrous. *Inflorescence* terminal or axillary (when in axils of reduced bracts appearing supra-axillary), sometimes cauliflorous, cymose, paniculate, fasciculate or pleiochasial. *Flowers* unisexual or bisexual, actinomorphic or very rarely (*extra*-Mal.) oblique, receptacle usually well developed (perigynous), rarely reduced (hypogynous), ± globose or urceolate to widely campanulate; tepals usually inconspicuous, sometimes larger and petaloid, rarely distinct sepals and petals (*extra*-Mal.), decussate, radial or spiral. — *Male flowers* with few to many stamens arranged in whorls or sometimes spirally or disposed irregularly; filaments usually strap-shaped, short, occasionally with 2 basal lobes; anthers 2–4 sporangiate, the loculi sometimes confluent above (or rarely below) opening by slits or valves. — *Female flowers* with or without staminodes; carpels few to many (rarely *extra*-Mal., only one), sessile or stipitate, free or immersed in the receptacle, outer carpels of female flowers sometimes sterile; ovule solitary, erect or pendulous, crassinucellar, bitegmic or (*extra*-Mal.) unitegmic. *Fruits* of separate drupes or achenes, sometimes plumose, frequently enclosed in the persistent receptacle or exposed by various modes of splitting of the receptacle; endosperm copious, oily; embryo straight, cotyledons appressed or divergent, sometimes with serrate margins.

Distribution. About 33 genera with an estimated 320 species, mainly in the warmer parts of the southern hemisphere. There is a concentration of genera in Malesia (11 genera with 86 *spp.*) with extensions south and east into Australia and the SW. Pacific; further concentrations occur in the islands of the western Indian Ocean and in South America. The family is represented in Africa only by two small aberrant genera and occurs on the Eurasian mainland only in the Malay Peninsula, the Nicobar Islands and Peninsular Thailand.

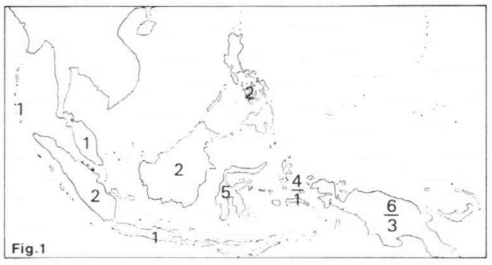
The Malesian genera are either endemic or nearly so, with one or few species extending to the Solomon Islands (*Steganthera*) or eastern Australia (*Levieria, Palmeria, Steganthera, Kibara* and *Dryadodaphne*). *Wilkiea* has more species in Australia than in Malesia. Only *Kibara* extends slightly westwards into the Nicobar Islands and Thailand. The concentration of genera in New Guinea is striking: only *Matthaea* lies exclusively to the west of New Guinea, the family being represented in western Malesia, otherwise by one species each of *Steganthera, Levieria* and *Palmeria*, and by four or five species of *Kibara*.

The Malesian genera fall within several subfamilies and each of these has a distinctive geographical relationship. *Levieria* is a member of the tribe *Hedycaryeae* with relationships in SW. Polynesia; *Dryadodaphne* falls within the subfamily *Atherospermatoideae*, a subfamily that is predominantly Australian; while *Palmeria* is most closely related to *Monimia* of the Mascarene Islands. The remaining genera (*Steganthera, Matthaea, Kairoa, Faika, Parakibara, Wilkiea* and *Kibara* form a closely knit group within the tribe *Mollinedieae* which is characteristic of the Malesian region.

Trimenia (*Piptocalyx*) is referred to the separate family *Trimeniaceae*.

The ratio of species to genera, in Malesia, is *c.* 8 : 1, but if the largest genus, *Kibara*, is omitted this reduces to *c.* 4.3 : 1. Five genera are represented by a single species. Fig. 1 & 2.

Fossils. MULLER (1981) pointed out that *Inaperturopollenites crispolensis* (DOYLE *et al.*, 1977) from the Lower Cretaceous is similar to that of *Hedycarya* pollen and that pollen of *Stellatopollis*



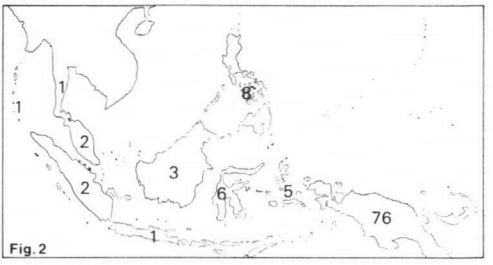


Fig. 1. Number of genera of *Monimiaceae* in Malesian islands; figures below the hyphen indicate endemic genera. — Fig. 2. Number of species of *Monimiaceae* in the Malesian islands.

barghoornii (DOYLE *et al.*, 1975) from the Middle Albian is comparable with that of *Daphnandra* and *Nemuaron* (from New Caledonia).

SCHODDE (1969) has little doubt that the two fossilized woods *Atherospermoxylon* (KRÄUSEL, 1939) and *Protoatherospermoxylon* (MÄDEL, 1962) are correctly assigned to this family. He rejected as doubtful all leaf records from the northern hemisphere, but accepts as probable fossil leaves from Eocene-Oligocene and Early Miocene deposits in Argentina (*Laurelia armarillana*, BERRY, 1928, and *Laurelia guinazui*, BERRY, 1935) and from the Eocene-Oligocene of Seymour Island (*Laurelia insularis*, DUSÉN, 1908). Pollen grains of *Laurelia* are recorded in New Zealand from Middle Oligocene to the present (COUPER, 1960).

References: BERRY, Proc. U.S. Nat. Mus. 73 (1928) 21; Bot. Gaz. 96 (1935) 752; COUPER, Palaeont. Bull. 32, Geol. Surv. New Zeal. (1960) 1–87; DOYLE *et al.*, Pollen et Spores 17 (1975) 429–486; Bull. Centre Rech. Explor. Prod. Elf. Aquitaine 1 (1977) 451–473; DUSÉN, Wiss. Ergeb. Schwed. Sudpolar-exped. 3 (1908); KRÄUSEL, Abh. Bayer. Akad. Wiss. math.-naturw. Abt. NF 47 (1939) f. 3; MÄDEL in Muller-Stoll & Mädel, Trans. Geol. Soc. S. Afr. 65 (1962) 99; MULLER, Bot. Rev. 47 (1981) 9; SCHODDE, A monograph of the Atherospermataceae R. Br., Thesis, Univ. Adelaide (1969).

Ecology. Malesian *Monimiaceae* form an inconspicuous but remarkably consistent element of the understorey of rain-forests in New Guinea and to a much lesser degree of the rest of Malesia. They are most frequently straggling shrubs or treelets, occasionally reaching the stature of moderate trees, and more rarely are low to moderately high-climbing (*c.* 22 m) woody lianes. They occur in forests from sea-level to the limit of trees, their greatest frequency being in lower montane forest. They occur, though rarely, in coastal scrub on sandy soil or coral (*e.g. Kibara rigidifolia*) and in the zone of scrub above tree-line (*e.g. Kibara oligocarpella*).

Flower biology. The majority of the Malesian genera are either monoecious or dioecious, the only genus with bisexual flowers in Malesia being *Dryadodaphne*. Little is known of the floral biology of this family. SAMPSON (1969a) found that *Hedycarya arborea* is wind-pollinated. The greenish flowers lack nectar and no insects were observed to visit them. In *Laurelia novae-zelandiae* the paired lobes on the filaments secrete nectar which accumulates on the floor of the flower (SAMPSON, 1969b). Large numbers of bees and blowflies were observed visiting the flowers. The nectar consists mainly of sucrose with possibly traces of raffinose. GOTTSBERGER (1977) reported pollination of the neotropical genus *Mollinedia* by *Thysanoptera*. The female insects bore holes in male and female flowerbuds and deposit their eggs in the receptacles. The larvae develop in the buds, becoming adult as the flowers open. They emerge and transfer pollen to other flowers. Similar infestations of flowerbuds have been observed in the Malesian genera *Levieria* and *Kairoa* in which the male flowers open, as in *Mollinedia*, though no observations on pollination have been made in these genera. ENDRESS (1980) recorded similar insect infestation in species of *Wilkiea* and *Steganthera*, in which the male flowers have a restricted opening. The flowers of *Steganthera* are frequently so deformed by gall insects that their function appears to be impaired (personal observation on *S. ilicifolia* and other species).

The reception and germination of pollen on a non-carpellary hyperstigma, long suspected in *Hennecartia* (PERKINS & GILG, 1901) has been confirmed and extended to three other genera, *Tambourissa, Wilkiea* and *Kibara* (ENDRESS, 1979, 1980). A zone in the narrow entrance to the female receptacle secretes a mucilage which acts as a transmitting medium for the pollen tubes and is continuous from the outer surface of the receptacle to the carpels. As the mucilage connects all the stigmas in a receptacle it acts as an extragynoecial compitum.

The intensive field observations in the Malagasy region by LORENCE have considerably increased information on the floral biology of the family (LORENCE, 1980; ENDRESS & LORENCE, 1983). Seven species of *Tambourissa* were studied. Odour and possibly colour attract insects which were rewarded in male flowers with pollen and in female flowers with a sugary secretion or in some species by deceit. Some species are mainly dependent on flies and have short styles, whereas others with longer styles are visited mainly by beetles. Different flowering times contribute to reproductive isolation and hybridization was found to be extremely rare. LORENCE (1980, 1985) considered that *Monimia ovalifolia*, with a sweet odour, yellow to pink or orange receptacles, shallow open white male flowers and fully exposed stamens and styles, appears well adapted to the small syrphid flies that visit it.

Dispersal. The fruit-clusters of most Malesian genera consist of few to many drupes, usually black and shining when ripe, sessile or stipitate on receptacles, which are usually enlarged, fleshy and bright yellow and orange. In *Palmeria* the drupes are exposed when mature by the splitting of the receptacle. They are black or dark reddish brown and are borne on the inner side of the receptacle which is bright red or pink. All these structures are clearly suitable for dispersal by birds or animals, but no records of field observations of this in Malesia are known to me. LORENCE (1980, 1985) records dispersal by birds in Malagasy species of *Monimia* and *Tambourissa* which bear fruits of somewhat similar appearance to those of the Malesian genera. In *Dryadodaphne* fruit structure and means of dispersal are very different, though again this has only been inferred from their structure. The developing achenes are enclosed by the enlarged and indurated receptacle and this splits at maturity to release the ripe achenes. These are dry and spindle-shaped with a persistent aculeate style which becomes markedly plumose. The structure appears well adapted to wind dispersal.

Myrmecophily. The association of ants with the swollen nodes of *Steganthera hospitans* was noted by BECCARI (1877). BECCARI concluded that the entry holes were excavated in the distended nodes by the ants (*Hypoclinea scrutator*). He also observed the presence of small homopterids (*Myzolecanium*) inside the hollow nodes. Only adult female scale insects were seen, and since these were too large to pass the entry holes, BECCARI speculated on the possible life cycles of the coccid and on their relationship to the ecology of the ants. Similar associations occur on other species of *Steganthera* (*S. royenii, S. moszkowskii* and *S. ledermannii*) and also on species of *Kibara* (*K. ferox, K. latifolia, K. archboldiana* and *K. carrii*). Only *K. latifolia* of the Moluccas occurs outside New Guinea.

BECCARI referred to analogous ant associations in the stems of *Verbenaceae: Clerodendron; Euphorbiaceae: Pimelodendron; Myristicaceae: Myristica* and the rhizomes of the fern *Polypodium sinuosum* WALL. and of species of the Rubiaceous epiphytes *Myrmecodia* and *Hydnophytum* as well as some Melastomaceous epiphytes. In addition VAN STEENIS reported spindle-shaped twigs inhabited by ants in several other genera, *e.g.* in *Meliaceae: Aphanamixis, Chisocheton; Elaeocarpaceae: Elaeocarpus; Euphorbiaceae: Drypetes, Glochidion, Homalanthus; Leguminosae: Archidendron; Rubiaceae: Myrmeconauclea, Nauclea; Sapindaceae: Harpullia*, and *Symplocaceae: Symplocos*, and FORMAN added to these (*in litt.*) *Myristicaceae: Myristica subalulata* and *Proteaceae: Helicia macrostachya*. They occur mostly in a single species of these genera, but sometimes in several, *e.g.* in *Nauclea*.

References: BECCARI, Malesia 1 (1877) 186–193; ENDRESS, Experientia 35 (1979) 45; Pl. Syst. Evol. 134 (1980) 79–120; ENDRESS & LORENCE, Pl. Syst. Evol. 143 (1983) 53–81; GOTTSBERGER, Pl. Syst. Evol. Suppl. 1 (1977) 211–226; LORENCE, A systematic and eco-evolutionary study of

the *Monimiaceae* in the Malagasy region, Thesis, Washington Univ., St. Louis (1980); Ann. Mo. Bot. Gard. 72 (1985) 1–165; PERKINS & GILG, Pfl. R. Heft 4 (1901) 1–122; SAMPSON, (a) Austr. J. Bot. 7 (1969) 403–424; (b) New Zeal. J. Bot. 7 (1969) 214–240.

Morphology. Little is known in detail of the shoot morphology of the trees, shrubs and lianes of this family. In *Laurelia* the bole bears buttresses and the roots develop knee-pneumatophores. The bark is generally ± smooth with only small fissures and flakes, an exception being *Kairoa* with prominent corky ridges on the main stems. Throughout the family phyllotaxis is decussate or rather rarely with the leaves in whorls of three (*e.g. Kibara rigidifolia*). Marked anisophylly occurs in *Glossocalyx*. The stems are terete or ± quadrangular, except near the nodes which are somewhat flattened and dilated. The buds, both vegetative and reproductive, are usually enclosed in small scales and there may be more than one in an axil arranged either horizontally or vertically (LORENCE, 1980, 1985), the central bud usually developing first. In spite of the variety of leaf size, form, margin and indumentum, there is a family character which facilitates recognition in the field. This is due, principally, to the venation, which almost invariably is festooned brachidodromous with the secondary veins arising from the midrib at regular intervals and at uniform angles. An exception noted by LORENCE (1980, 1985) is *Ephippiandra*. Leaves are usually petiolate but may be amplexicaul (*e.g. Kibara ferox*). Leaf shape may vary with age. The juvenile leaves of *Steganthera hospitans* are much narrower than those of adult trees and juvenile specimens of *Kibara ferox* bear narrower and more dentate leaves than do adults. In *Kibara ferox*, however, the narrow ultimate branches of adult plants bear much narrower leaves than those of the basal parts of the shrub. Heterophylly also occurs in many *Tambourissa* species and in *Hortonia*.

Inflorescences usually occur in the axils of foliage leaves. When several are grouped among the terminal leaves of a shoot, apparently terminal leafy inflorescences are formed, and with the reduction of the leaves these may result in large panicles. It is doubtful, however, if the true terminal bud is involved in these inflorescences, the terminal (vegetative) bud aborting. Inflorescences often occur on basal parts of stems where the nodes bear much reduced scales. The upper parts of these stems continue as indeterminate foliage shoots. The presence of multiple buds at nodes which develop in succession allows inflorescences to persist on branches which have lost their foliage and to become strikingly cauliflorous. The branching of the inflorescences is cymose, the most simple element being a dichasium. However, several flowers or branches frequently arise from a single node, or alternatively, several pairs of flowers occur along a simple axis (pleiochasium — often referred to as racemose). As a result of combinations of these factors individual inflorescences range from solitary flowers, through fascicles of flowers or branches to rather simple cymes and more diffuse and complex paniculate cymes.

References: LORENCE, A systematic and eco-evolutionary study of the *Monimiaceae* in the Malagasy region, Thesis, Washington Univ., St. Louis (1980); Ann. Mo. Bot. Gard. 72 (1985) 1–165.

Anatomy. General accounts of the vegetative anatomy are given by MONEY, BAILEY & SWAMY (1950) and METCALFE & CHALK (1950). Of particular interest are 1) the universal presence of oil cells (HOBEIN, 1889; PERKINS, 1898), 2) the unilacunar node, with simple strands or arcs of strands entering the petiole, 3) the presence of hippocrepiform sclereids in the pericycle (but not in *Siparunoideae*) (MONEY, BAILEY & SWAMY, 1950). Hairs may be simple unicellular, often in fascicles from a common base, or stellate grading into peltate scales. Two-armed hairs have been reported for some genera, including *Matthaea*.

Phloem plastids. Most members of the *Monimiaceae* have been found to contain P-type plastids. Very consistently, the *Atherospermatoideae* have large protein crystals, protein filaments and starch (BEHNKE, 1981). Except for the genera *Monimia, Palmeria* and *Tambourissa*, the other subfamilies have been found to contain ± small protein crystals besides the dominant starch grains.

References: BEHNKE, Nordic J. Bot. 1 (1981) 381–400; HOBEIN, Bot. Jahrb. 10 (1889) 51–74; METCALFE & CHALK, Anatomy of the Dicotyledons, Clarendon Press, Oxford (1950); MONEY,

BAILEY & SWAMY, J. Arn. Arb. 31 (1950) 372–404; PERKINS, Bot. Jahrb. 25 (1898) 547–577.

Wood anatomy. The characteristics of the secondary xylem have been described by the authors listed below. A particularly full assessment is given by FOREMAN (1983). Certain features have been found to characterize the subfamilies, for example the multiseriate rays of *Atherospermatoideae* and *Siparunoideae* are narrower than those of the *Monimioideae*, and simple perforation plates occur in *Monimia* and *Palmeria*. *Peumus* has the most distinctive xylem with spiral thickening in the vessels and simple perforation plates. The xylem of *Hortonia* has more primitive features than other genera.

References: BUTTERFIELD & MEYLAN, Austr. J. Bot. 20 (1972) 253–259; The structure of New Zealand woods, Wellington (1973); DADSWELL & RECORD, Trop. Woods 48 (1936) 1–30; FOREMAN, The morphology and phylogeny of the *Monimiaceae (sensu lato)* in Australia, Thesis, Univ. of New England, Armidale (1983); GARRATT, Trop. Woods 39 (1934) 18–44; HOBEIN, Bot. Jahrb. 10 (1889) 51–74; KUČERA & PHILIPSON, New Zeal. J. Bot. 15 (1977) 649–654; LEMESLE & PICHARD, Rev. Gen. Bot. 61 (1954) 69–95; LORENCE, A systematic and eco-evolutionary study of the *Monimiaceae* in the Malagasy region, Thesis, Washington Univ., St. Louis (1980); Ann. Mo. Bot. Gard. 72 (1985) 1–165; MATOS ARAUJO & FILHO, Brazil Florestal 4 (1973) 35–39, 41–45; *ibid.* 5 (1974) 57–60; Rodriguesia 27 (1974) 153–162; Arq. Jard. Bot. Rio de Janeiro 20 (1977) 15–20; METCALFE & CHALK, Anatomy of the Dicotyledons, Clarendon Press, Oxford (1950); DEN OUTER & VAN VEENENDAAL, Acta Bot. Neerl. 31 (1982) 265–274; PATEL, New Zeal. J. Bot. 11 (1973) 587–598; SCHODDE, A monograph of the family *Atherospermataceae* R. Br., Thesis, Univ. of Adelaide (1969); Taxon 19 (1970) 324–328; SOLEREDER, Systematic anatomy of the Dicotyledons (transl. Boodle & Fritsch), Clarendon Press, Oxford (1908); WELCH, J. Proc. R. Soc. N.S.W. 62 (1929) 350–365.

Floral anatomy. Development and vascularization are discussed by MONEY, BAILEY & SWAMY (1950), SAMPSON (1969a, b, c) and ENDRESS (1972, 1980). The little then known of embryology in the family was reviewed by DAVIS (1966) and BHANDARI (1971). Since then SAMPSON (1969a, c) and ENDRESS (1972, 1980) have added much information. The ovule is bitegmic and crassinucellate (unitegmic in *Siparuna*), pendulous with an upwardly directed micropyle or lateral to basal with a downwardly directed micropyle. The structure of the fruit and seed is described by ENDRESS (1972), CORNER (1976) and LORENCE (1980, 1985). The fruits are either an achene, often plumose, or they have a fleshy or leathery pericarp. The latter fruits are usually referred to as drupes because the endocarp consists of sclerotic cells. In some genera (*e.g. Palmeria*) the endocarp forms a substantial stony layer, in *Levieria* it is thinner but still strongly sclerotic, while in others, notably *Kibara*, the endocarp consists of a single papery layer. As these differences are of degree and intermediate states occur, the same term (drupe) is used throughout, even though the fruit of species with a thin endocarp might technically be better referred to as berries. In *Kibara* the mesocarp of the species examined consists of uniform soft-walled tissue, whereas in *Steganthera* all species examined had numerous nests of sclereids adjacent to the endocarp (possibly to be considered as part of the endocarp) with many oil cells in the outer mesocarp. The cotyledons are divergent in the *Monimieae* but in the *Mollinedieae* and *Atherospermatoideae* they are closely appressed. In *Hedycaryeae* both conditions occur: *Hedycarya* appressed, *Levieria* divergent. The endosperm is fleshy in most genera, but in *Kairoa* it is horny and in *Levieria* the central part of the endosperm is milky. Rarely (*extra*-Mal.) a 'stylar aril' overlies the upper part of the exocarp.

The form of stamens is variable in respect of the presence or absence of a pair of glands on the filaments; the number (2 or 4) of sporangia and the dehiscence by slits or valves. Stamen and anther development is described by ENDRESS (1980), FOREMAN (1983) and SAMPSON (1969b) and the morphology of the glands discussed by MONEY, BAILEY & SWAMY (1950), SAMPSON (1969c) and ENDRESS (1980). The different types of cytokinesis in *Monimioideae* and *Atherospermatoideae*, first described by SAMPSON (1969c), is extended by FOREMAN (1983) who discusses many aspects of androecial development.

References: BHANDARI, J. Arn. Arb. 52 (1971) 1–39, 285–304; CORNER, The seeds of Dicotyle-

dons 1 (1976) 194–197; DAVIS, Systematic embryology of the Angiosperms, New York (1966) 178–179; ENDRESS, Bot. Jahrb. 92 (1972) 331–428; Pl. Syst. Evol. 133 (1980) 79–120, 199–221; FOREMAN, The morphology and phylogeny of the *Monimiaceae (sensu lato)* in Australia, Thesis, Univ. of New England, Armidale (1983); LORENCE, A systematic and eco-evolutionary study of the *Monimiaceae* in the Malagasy region, Thesis, Washington Univ., St. Louis (1980); Ann. Mo. Bot. Gard. 72 (1985) 1–165; MONEY, BAILEY & SWAMY, J. Arn. Arb. 31 (1950) 372–403; SAMPSON, (a) Austr. J. Bot. 17 (1969) 403–424; (b) *l.c.* 425–439; (c) New Zeal. J. Bot. 7 (1969) 214–240.

Palynology. Reviews of the morphology of pollen grains in the family are given by MONEY, BAILEY & SWAMY (1950), ERDTMAN (1966), JÉRÉMIE *et al.* (1984), WALKER & DOYLE (1975), and WALKER (1976a, b). Studies on the family include: on *Hedycarya* SAMPSON (1969a, 1977, 1982), on *Laurelia* SAMPSON (1969b, 1975), on *Peumus* BARTH (1962), HEUSSER (1971), on *Monimia* and other Malagasy genera LORENCE (1980) and LORENCE, ZENGER & VINAY (1984). Inaperturate grains are typical of the family but the *Atherospermatoideae* have disulcate grains. Spinose grains occur in *Peumus, Monimia* and *Palmeria*. The grains remain in tetrads in some species of *Hedycarya* and *Kibaropsis*.

References: BARTH, Mem. Inst. Oswaldo Cruz, Rio de Janeiro, 60 (1962) 405–420; ERDTMAN, An introduction to palynology, 1, Pollen morphology and plant taxonomy, New York (1966); HEUSSER, Pollen and spores of Chile, Univ. Arizona Press, Tucsan (1971); JÉRÉMIE *et al.*, Pollen et Spores 26 (1984) 161–180; LORENCE, A systematic and eco-evolutionary study of the *Monimiaceae* in the Malagasy region, Thesis, Washington Univ., St. Louis (1980); LORENCE, ZENGER & VINAY, Grana 23 (1984) 11–22; MONEY, BAILEY & SWAMY, J. Arn. Arb. 31 (1950) 374–404; SAMPSON, (a) Austr. J. Bot. 17 (1969) 403–424; (b) *l.c.* 425–439; Grana 15 (1975) 153–157; *ibid.* 16 (1977) 61–73; *ibid.* 21 (1982) 9–14; WALKER (a) in Beck (ed.), Origin and early evolution of the Angiosperms, Columbia Univ. Press, New York (1976) 241–299; (b) in Ferguson & Muller (eds.), The evolutionary significance of the exine, Acad. Press, London (1976) 251–308; WALKER & DOYLE, Ann. Mo. Bot. Gard. 62 (1975) 664–723.

Chromosomes. The only count known to me based on Malesian specimens is that for *Kibara* (BORGMAN, 1964). Counts of Australian species of *Steganthera* and *Palmeria*, together with a few non-Malesian genera, will be found in the references below. From these counts it is considered that the basic number for the *Monimioideae* (n = 19) differs from that for the *Atherospermatoideae* (n = 22).

References: BORGMAN, Z. Bot. 52 (1964) 118–172; EHRENDORFER in Beck (ed.), Origin and early evolution of the Angiosperms, Columbia Univ. Press, New York (1976) 220–240; EHRENDORFER *et al.*, Taxon 17 (1968) 337–353; GADELLA *et al.*, Acta Bot. Neerl. 18 (1968) 74–83; GOLDBLATT, J. Arn. Arb. 55 (1974) 453–457; HAIR & BEUZENBERG, New Zeal. J. Sci. 2 (1959) 148–156; LORENCE, A systematic and eco-evolutionary study of the *Monimiaceae* in the Malagasy region, Thesis, Washington Univ., St. Louis (1980); Ann. Mo. Bot. Gard. 72 (1985) 1–165; MORAWETZ, Pl. Syst. Evol. 138 (1981) 157–172.

Phytochemistry. Chemical characters were summarized sixteen years ago (HEGNAUER, 1969). The benzyltetrahydroisoquinoline family of alkaloids (abbreviated: benzylisoquinolines) and essential oils consisting mainly of phenylpropanoids and mono- and sesquiterpenoids were considered to be characteristic secondary metabolites of the family, but the lack of chemical knowledge for *Hortonioideae, Monimioideae* (except *Peumus boldus*) and *Siparunoideae* was stressed. Many members of the family are aluminium accumulators; this character, however, seems to be lacking in *Atherospermatoideae*. Phenolics were scarcely known, but predominance of the flavonols kaempferol, quercetin and isorhamnetin in leaves, and absence of flavones, flavonols with trihydroxylated B-ring and of galli- and ellagitannins had been reported. As a whole phytochemistry of *Monimiaceae* agreed perfectly with their inclusion in a group loosely termed woody polycarps. In the meantime more became known about the chemistry and distribution of benzylisoquinolines (URZUA & CASSELS, 1978; HEGNAUER, in prep.) and polyphenolic com-

pounds, especially lignans (including neolignans) (HEGNAUER, in prep.). *Siparuna gilgiana* and *S. guyanensis* synthesize liriodenine and related oxoaporphine alkaloids, and laurotetanine, N-methyllaurotetanine and leurotitsine were detected in three *Palmeria* species of New Guinea. The isolated position of *Daphnandra* with respect to alkaloid metabolism was stressed (URZUA & CASSELS, 1978); only bisbenzyltetrahydroisoquinoline alkaloids, including a number of compounds apparently restricted to the genus, have been isolated hitherto from six species. *Daphnandra aromatica* was transferred by SCHODDE to *Doryphota*; *Doryphora aromatica* yielded the aporphine isocorydine besides bisbenzylisoquinolines. *Dryadodaphne novoguineense* which is confined to New Guinea, synthesizes aporphines, oxoaporphines and the bisbenzylisoquinolines dryadine and dryadodaphnine. 4-Hydroxyaporphines, alkaloids with a very unusual substitution pattern were encountered in *Laureliopsis philippiana* (= *Laurelia philippiana*). It deserves mentioning that lignans which were known from *Trimeniaceae* only (*Piptocalyx, Trimenia*, HEGNAUER, 1969) have been detected in leaves of *Laurelia novae-zelandiae*; they yielded pinoresinoldimethylether and yangambin. Lignans and many different types of neolignans are widespread in *Polycarpicae*; they begin to form an outstanding chemical character of the order as a whole. Summarizing, old and new chemical evidence conforms with the classification of *Monimiaceae* with woody polycarps without contributing much to the question whether the family is nearer to *Magnoliaceae* and *Annonaceae* or to *Lauraceae, i.e.,* whether inclusion in *Laurales* is more natural than inclusion in *Magnoliales*. Chemical evidence also agrees with the exclusion of *Amborellaceae, Austrobaileyaceae* and *Trimeniaceae* which all seem to lack benzylisoquinolines.

References: HEGNAUER, Chemotaxonomie der Pflanzen 5 (1969) 99–107, 431–432, 457; *ibid.* 8 (in prep.); URZUA & CASSELS, Lloydia 41 (1978) 98. — R. HEGNAUER.

Taxonomy. The family as first founded by DE JUSSIEU (1809) included genera representing most of the subfamilies at present recognized. The heterogeneous nature of these genera immediately instigated a series of proposals for the division of the family by the recognition of the *Atherospermataceae* or, more recently, into several smaller families. Concurrently other systematists have retained the original broad view of the family. Early proponents of splitting were R. BROWN (1814), BARTLING (1830) and LINDLEY (1853), but the broader view long prevailed among other systematists, principally ENDLICHER (1837), TULASNE (1855), BENTHAM & HOOKER (1880), PAX (1891), PERKINS & GILG (1901), PERKINS (1911, 1925), and MELCHIOR (1964). The more recent proposals to remove elements as distinct families include GIBBS (1917), PICHON (1948) and especially MONEY, BAILEY & SWAMY (1950) whose view that *Amborella* and *Trimenia* (*Piptocalyx*) should form separate families has been accepted ever since. The removal of further elements has continued, but opinion remains divided on this trend. A most important contribution by SCHODDE (1969) favoured the recognition of the *Atherospermataceae* and the same author later proposed the erection of *Siparunaceae* (SCHODDE, 1970). This was followed by *Hortoniaceae* (SMITH, 1972). Systematists currently favouring the broader view of the family include THORNE (1974), who briefly argues the case for amalgamation concluding 'The logical alternative treatment would be to expect five or more separate and obviously closely related families, an exercise in taxonomic inflation that would seem to serve no useful purpose.' The same view is taken by DAHLGREN (1980) and CRONQUIST (1981) and this treatment is adopted here.

Subdivision. The grouping of genera into subfamilies and tribes is still subject to debate. Generally speaking those authors taking a broad view of the family recognize the same subdivisions as the splitters but treat them as subfamilies or tribes. PERKINS (1925) adopted only two subfamilies, *Monimioideae* and *Atherospermoideae* with four and two tribes respectively. MELCHIOR (1964) followed MONEY, BAILEY & SWAMY (1950), omitting *Amborella* and *Trimenia*, and accepting two subfamilies, *Hortonioideae* and *Siparunoideae*. THORNE (1974) added a further subfamily by restricting the *Monimioideae* to *Monimia* and *Peumus*, and forming the *Mollinedioideae* for the several remaining genera. His reduction of SCHODDE's subfamily *Peumoideae* (SCHODDE, 1970) into his restricted *Monimioideae* is accepted by PHILIPSON (Nordic J. Bot., 1986, in press), who added *Palmeria* to this subfamily. Most Malesian genera fall into subfamily *Mollinedioideae*,

seven into tribe *Mollinedieae* and one *Levieria* into tribe *Hedycaryeae*. Two other subfamilies are represented by one genus each: *Atherospermatoideae* by *Dryadodaphne* and *Monimioideae* by *Palmeria*.

Generic limits. The family comprises several small distinctive genera whose definition is not difficult. It is perhaps only among the genera of the tribe *Mollinedieae* that generic limits become problematic and it is these genera which are abundant in Malesia. In the first place it is possible to distinguish those genera which receive their pollen on a hyperstigma secreted by prominent glands within the ostiole of the female receptacles. These are (in Malesia) *Kibara, Wilkiea* and *Faika*. *Kibara* is distinguished from the other two by the regular arrangement of its stamens. In *Wilkiea* and *Faika* the stamens are inserted irregularly over the inner surface of the male receptacles. These two genera are separated by the dehiscence of the anthers: in *Wilkiea* this is by a single horizontal or horseshoe-shaped slit, whereas in *Faika* it is by two vertical slits. The two genera are also well separated geographically. *Parakibara* cannot yet be placed by this system because its female flowers are not known. Three Malesian genera lack a hyperstigma. Of these *Steganthera* is the largest and is closely related to *Matthaea*, a genus with a more westerly range, which differs by its anthers opening by two vertical slits. The third genus, *Kairoa*, is immediately distinguished by the male receptacles which open widely at anthesis to expose the very large number of stamens.

References: BARTLING, Ordines Naturales Plantarum, Dietrich, Göttingen (1830); BENTHAM & HOOKER, Genera Plantarum 3 (1880); R. BROWN in Flinders, Voyage 3 (1814); CRONQUIST, An integrated system of classification of flowering plants, New York (1981); DAHLGREN, J. Linn. Soc. Bot. 80 (1980) 91–124; ENDLICHER, Genera Plantarum 1 (1837); GIBBS, Contr. phytogeography & flora Arfak Mts (1917); DE JUSSIEU, Ann. Mus. Nat. Hist. Nat. Paris 14 (1809) 116–135; LINDLEY, Vegetable Kingdom, ed. 3 (1853); MELCHIOR in Engler, Syllabus Pflanzenfamilien, ed. 12 (1964); MONEY, BAILEY & SWAMY, J. Arn. Arb. 31 (1950) 372–404; PAX in E. & P. Nat. Pfl. Fam. 3, 2 (1891) 94–105; PERKINS, Pfl. R. Heft 49 (1911); Übersicht über die Gattungen der Monimiaceae, Leipzig (1925); PERKINS & GILG, Pfl. R. Heft 4 (1901) 1–22; PICHON, Bull. Mus. Hist. Nat. Paris 20 (1948) 383–384; SCHODDE, Monograph of the family *Atherospermataceae* R. Br., Thesis, Univ. Adelaide (1969); Taxon 19 (1970) 324–328; SMITH, J. Ind. Bot. Soc. 50A (1972) 215–226; THORNE, Aliso 8 (1974) 147–209; TULASNE, Arch. Mus. Nat. Hist. Nat. Paris 8 (1855) 273–436.

Specific delimitation. The much greater amount of material now available, especially from the mountains of New Guinea, has revealed that many of the species described by earlier authors are conspecific, and has also brought to light many undescribed species. Unfortunately, a considerable number of the type specimens of earlier species have not been located, so that several specific names have been treated as unsufficiently known species. The concept of a species in this family often appears less well defined than in many others. The larger genera include local species which are well segregated, but also more widespread species with an unusually wide range of variation. Undoubtedly some regional and local species will eventually be recognized within these large species, but this is not possible at present. The largest and most variable species are *Kibara coriacea, Steganthera hirsuta, Palmeria arfakiana* and *Levieria squarrosa*.

Uses. A variety of minor local uses are reported by collectors. The wood of larger species may be used as stakes and for house-building, and the stems of *Palmeria spp.* for binding. The aromatic leaves of several *Palmeria* species are used for smoking or to provide salt. Meat is wrapped in leaves of *Kibara* possibly as a tenderizer. *Peumus* (*non*-Mal.) has many uses in Chile: the hard wood provides handles for implements and is converted to charcoal, the bark is used for tanning and dyeing, and the leaves for medicinal purposes. *Laurelia* produces useful timber.

Notes for collectors. Species will usually be located by the characteristic foliage or by the conspicuous fruits. As the fruits are not sufficient for generic determination, it is important to search for flowers. These are so inconspicuous that they are commonly dismissed as buds and not collected. If flowers cannot be found on the plant a search in the forest for other specimens will usually prove successful. Always search for examples of flowers of both sexes, and bear in mind that these may occur on separate plants. Examples of the fruits should be preserved in fluid.

KEY TO THE GENERA
(11. Lauterbachia not included)

1. Flowers hermaphrodite; anthers valvate; filaments of stamens with a pair of glands; fruits with persistent elongated plumose style (Subfam. ATHEROSPERMATOIDEAE) ..... **1. Dryadodaphne**
1. Flowers unisexual; anthers dehiscing by slits; filaments without glands; style not persistent in fruit.
2. Lianes; receptacle splitting irregularly when ripe to reveal drupes dispersed over its inner surface (Subfam. MONIMIOIDEAE) ..... **2. Palmeria**
2. Trees or shrubs, or if rarely scandent then fruit not as above (Subfam. MOLLINEDIOIDEAE).
3. Male flower with a small, flat receptacle bearing relatively large rotund tepals; after anthesis female receptacle splitting irregularly from the ostiole; fruit a head of sessile drupes with the irregular rim of the receptacle reflexed below them (Tribe HEDYCARYEAE) ..... **3. Levieria**
3. Male flower with a globose or flask-shaped receptacle, either with a small ostiole or (in *Kairoa*) splitting open at anthesis to form a cup with sharply lobed margin; after anthesis upper half of female receptacle abscissing as a calyptra; fruit a head of sessile or stipitate drupes with the annular scar of the calyptra below them (Tribe MOLLINEDIEAE).
4. Female receptacle with thickened glands inside the ostiole.
5. Style-stigma subulate; anthers dispersed irregularly within the receptacle.
6. Anthers dehiscing by a horseshoe-shaped slit ..... **4. Wilkiea**
6. Anthers dehiscing by two vertical slits ..... **5. Faika**
5. Stigma sessile obtuse; anthers disposed regularly in whorls of 4 or in decussate pairs.
7. Stamens in several whorls of 4 ..... **6. Parakibara**
7. Stamens in two whorls (up to 4 stamens) ..... **7. Kibara**
4. Female receptacle without glands inside the ostiole.
8. Male receptacle at anthesis a fleshy cup with rim split into acute lobes; stamens numerous (over 100); stigma short sessile; stems and branches with prominent irregular longitudinal ridges of cork **8. Kairoa**
8. Male receptacle at anthesis with an ostiole surrounded by minute tepals; stamens few; branches ± smooth.
9. Anthers dehiscing by a single horizontal or horseshoe-shaped slit ..... **9. Steganthera**
9. Anthers dehiscing by two vertical slits ..... **10. Matthaea**

1. DRYADODAPHNE[1]

S. MOORE, J. Bot. 61 (1923) 109; A.C. SMITH, J. Arn. Arb. 23 (1942) 442. — *Isomerocarpa* A.C. SMITH, J. Arn. Arb. 22 (1941) 250. — *Daphnandra* PERKINS, Bot. Jahrb. 52 (1915) 217, *p.p.*; Übersicht Gattungen Monim. (1925) 47, *p.p.* — *Levieria* KOSTERM. Rec. Trav. Bot. Néerl. 34 (1937) 605, *p.p.*; HUTCH. Gen. Fl. Pl. 1 (1964) 114, *p.p.* — **Fig. 3.**

Tall trees, young branches ± tetragenous usually glabrous. *Leaves* dentate or almost entire. *Inflorescence* axillary, of dichasia or few-flowered pleiochasia, bracteoles broad enclosing the flowerbud, early caducous. *Flowers* bisexual, perianth and androecium on the rim of the hypanthium; tepals 8, in 2 whorls, oblong-elliptic, obtuse. — *Androecium* tetramerous, the outer 1–2 whorls of stamens with divergent ovate-deltate, planate to shallowly cupular, obtuse staminal glands and shortly apiculate to broadly rostrate, latrorsely to ± extrorsely dehiscing anthers, the inner whorls of lanceolate-deltoid to almost subulate staminodes. — *Gynoecium* of several free carpels, styles terminal; ovule

(1) The account of this genus is based on SCHODDE, A monograph of the family *Atherospermataceae* R. Br., unpublished thesis, University of Adelaide (1969).

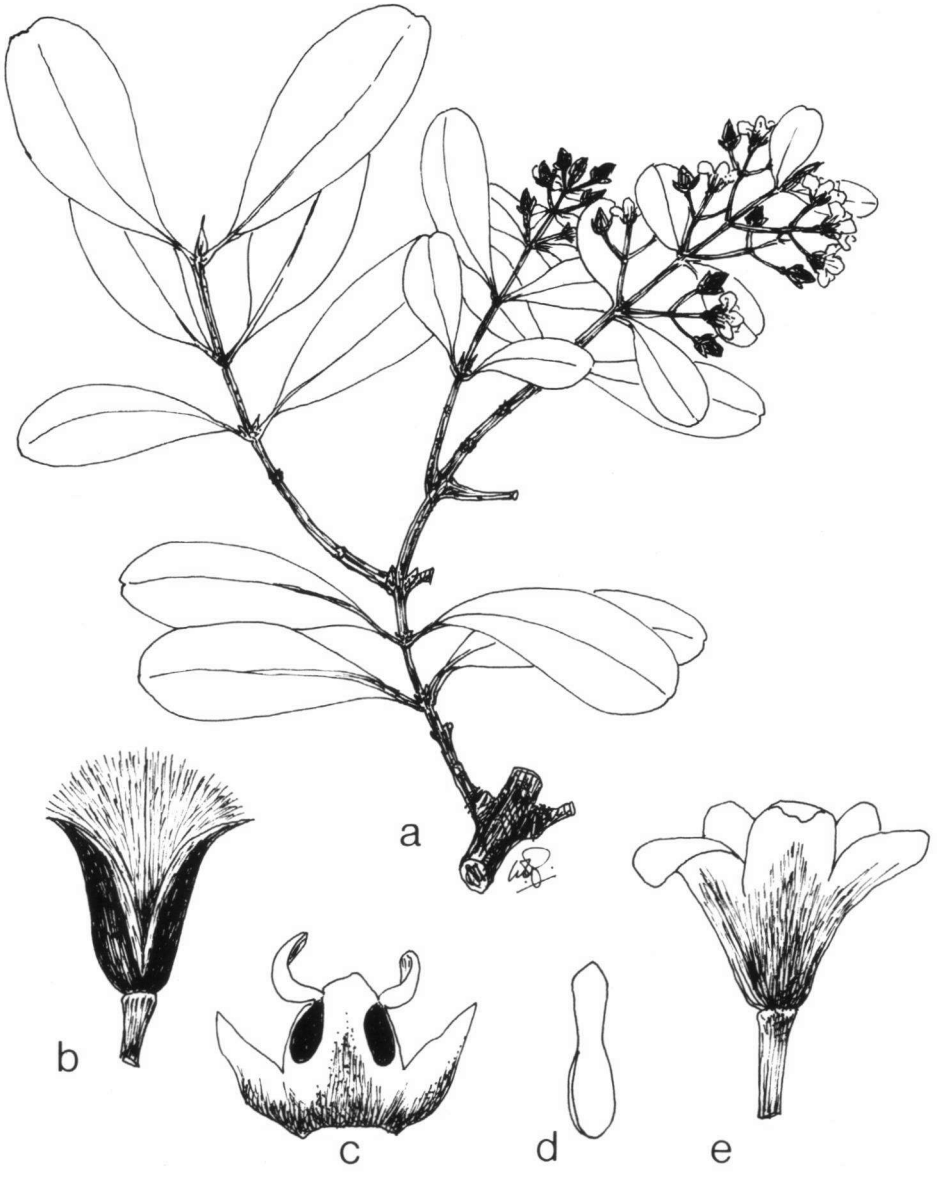


Fig. 3. *Dryadodaphne crassa* SCHODDE. *a.* Habit, nat. size, *b.* fruiting hypanthium, ×1 1/2, *c.* anther of outer whorl, ×14, *d.* embryo, ×20, *e.* open flower, ×7 (*a, c, e* STREIMANN 8643, *b* NGF 28519, *d* SCHODDE 3144).

subbasal. Fruiting hypanthium cylindrical-ellipsoid, dehiscing into 4 (sometimes 2) equal valves. *Nutlets* narrowly ellipsoid to obclavate, silky hirsute on one side in deep pits, styles terminal, subulate.

Distr. Three species, Queensland (1 *sp.*), in *Malesia:* New Guinea (2 *spp.*).

Ecol. Montane rain-forest, (500–)600–2800 m. In New Guinea *D. crassa* is associated consistently with *Nothofagus* forest, and *D. novoguineensis* with lower altitude mixed forest.

Note. *Dryadodaphne* is the only representative of the *Atherospermatoideae* in Malesia. The New Guinea material was originally confused with *Daphnandra*, and any reports of that genus from Malesia refer to *Dryadodaphne*.

KEY TO THE SPECIES

1. Stamens 8 (very rarely 4); outer stamens (including appendages) broader than long with widely divergent ± acute glands. Leaves obovate (rarely elliptic) with rounded, obtuse, frequently retuse apices. Tepals in ± equal whorls, usually ± pale cream green ..... **1. D. crassa**
1. Stamens 4, including appendages longer than broad, with slightly divergent ± obtuse glands (but see *ssp. occidentale*). Leaves lanceolate to elliptic with attenuate to acuminate (rarely rounded obtuse) apices. Tepals in unequal whorls, usually pale maroon-brown, pinkish or purplish ..... **2. D. novoguineensis**

1. Dryadodaphne crassa SCHODDE, *sp. nov.* — *Isomerocarpa novoguineensis* (PERKINS) A.C. SMITH, J. Arn. Arb. 22 (1941) 251, *p.p.* — *D. novoguineensis* (PERKINS) A.C. SMITH, *ibid.* 23 (1942) 443, *p.p.* — **Fig. 3.**

Arbor magna 20–30 m alta, folia comparate lata, obtusa saepe retusa, series tepalorum aequiformatae, plurumque virellae, stamina fugentia octo rare quattuor, cum apiculis brevibus, dehiscentia valvarum antherarum revera laterali, et glandulis divergentibus, late aliformibus, planis-cupulatis, ovatis-lanceatis, acutis vel aliquantum obtusis, 0.5–1.2 (–1.5) mm longis, et hypanthia fructificantia comparate brevia, (15–)18–23(–27) mm longa × (5–) 6–10(–11) mm lata, crasse ligneaque. — Type: SCHODDE & CRAVEN 4816 (CANB), Morobe Prov., Menyamya Distr., Angebena ridge, *c.* 3 miles east of Aseki.

Tree to 20–30 m; branchlets usually tetragonous, glabrous, or young parts sometimes unevenly sordid buff tomentulose, or with scaly incrustation. *Leaves* narrowly to broadly ovate; sometimes rounded cuneate, infrequently elliptic (0.7–)2.5–6(–10) by (0.5–)1–3(–4) cm, base ± narrowly cuneate, apex broadly, or less often narrowly, obtuse, frequently retuse, margin faintly undulate, or obscurely or obtusely crenulate, rarely markedly crenulate or entire, ± markedly recurved, almost revolute towards the petiole, coriaceous or rarely thinly coriaceous, principal nerves conspicuous below, anastomosing towards the margin, glandular pits sparse to frequent; petioles up to 9 mm, or sometimes longer, deeply channelled above, glabrous. *Inflorescences* axillary, up to 3 cm long, or rarely longer, glabrous or tomentose distally, bearing few (rarely more than 5 but up to 11) flowers in a dichasium or a pleiochasium; bracts lanceolate deltate to ovate or oblong, (1.5–) 2–3(–4) mm long, caducous; pedicels slightly or ± conspicuously expanded under the hypanthium; bracteoles enclosing the hypanthium in bud. *Flowers* with perianth pale cream or yellow-green, rarely whitish or reddish; hypanthium 1–2(–2.5) mm long, glabrescent or sparsely tomentulose; tepals 8 in 2 ± equal whorls, broadly obtuse oblong-linguiform to elliptic, (1.5–)3–4.5(–5) by (1.5–)2–2.7(–3) mm. — *Androecium* in several series, the 2 outer whorls each with 4 stamens, outer stamens broader than long (1–)1.3–2 by (1.25–)1.5–2.5(–3) mm, with widely divergent, wing-like ovate to lanceolate-deltate, ± acute staminal glands, and latrorsely dehiscing valves, inner stamens as broad as long, with shorter ± obtuse glands and longer apiculate apices; staminodes narrowly to broadly lanceolate or deltoid to subulate, the outer often with vestigial glands. — *Gynoecium* of up to 15 carpels; styles exserted beyond the hypanthium as a slender column, stigmatic column narrowly conical, protruding beyond apices of staminodes to near apices of outer stamens. *Fruiting hypanthium* thickly lignified, dehiscing into 4 (rarely 2) equal valves, sparsely hairy within. *Nutlets* (3–)5–6 mm long, styles (5–)7–10 (–14) mm long, exserted beyond the hypanthium.

Distr. *Malesia:* New Guinea. Through the central mountains from Oranje Range to the Owen Stanley Range, and also in the Saruwaged Range, Huon Peninsula.

Ecol. Primary, or rarely old secondary, montane rain-forest, between 2000 and 2800 m in the north-western and central parts of its range, and between (1350–)1600–2400 m in the Eastern Highlands, Saruwaged and Owen Stanley Ranges. In fairly well-drained sites, usually on slopes and towards the crowns of mountains and ridges. Generally associated with forest dominated by *Nothofagus*. Towards the upper limit of its altitudinal range it extends into conifer forests dominated by species of *Libocedrus*, *Phyllocladus* and *Podocarpus*.

Uses. The timber is used in the Mt Hagen and Chimbu areas.

Vern. *Dafa*, Telefomin, *enman*, Banz, *katan*,

mongo a kuli, nopohn or *pohn, piljim*, Mt Hagen, *korgi*, Chimbu, *mowku, mugu, muk*, Enga, *munk*, Mendi, *onda* or *onde*, Aseki.

Note. Though the distinctness of the two New Guinea species has been recognized only comparatively recently, most individuals can be distinguished readily on leaf characters such as size, texture and shape. Leaves of saplings and those in deep shade tend to be larger and less coriaceous with narrower apices and planate margins. Trees from lower altitudes may show some features of *D. novoguineensis* suggesting the possibility of introgression. The most westerly collection (BRASS & VERSTEEGH 11194) is somewhat distinct, and further collections from this region are needed. Flowering and fruiting occur throughout the year, though an individual tree usually does not bear flowers and fruits together.

2. Dryadodaphne novoguineensis (PERKINS) A.C. SMITH, J. Arn. Arb. 23 (1942) 443, *p.p.* — *Daphnandra novoguineensis* PERKINS, Bot. Jahrb. 52 (1915) 217; Übersicht Gattungen Monim. (1925) 50. — *D. celastroides* S. MOORE, J. Bot. 61 (1923) 109. — *Daphnandra perkinsiae* GILG & DIELS, Notizbl. Berl.-Dahl. 9 (1925) 466. — *Isomerocarpa novoguineensis* (PERKINS) A.C. SMITH, J. Arn. Arb. 22 (1941) 251, *p.p.*

KEY TO THE SUBSPECIES

1. Staminal glands ovate oblong, obtuse or shallowly cupular. Leaves (from crown) with acuminate, rarely rounded obtuse, apices and distinctly undulate-crenate margins. Fruiting hypanthium 2–4 times longer than broad. **a.** *ssp.* **novoguineensis**
1. Staminal glands lanceolate to ovate, rather acute. Leaves (from crown) with narrowly obtuse, hardly acuminate apices, and obscurely undulate-crenate, almost entire margins. Fruiting hypanthium 1 3/4–2 times longer than broad **b.** *ssp.* **occidentalis**

a. *ssp.* **novoguineensis** *var.* **novoguineensis**

Tree to 40 or 50 m, often buttressed; branchlets usually conspicuously tetragonous, glabrous or sometimes hispidulous or tomentulose. *Leaves* narrowly to broadly elliptic, sometimes lanceolate, (2–)4–10(–12) by (0.7–)1.5 by 3.5(–4.5) cm, base truncate to widely or rarely narrowly cuneate, apex bluntly acuminate, very rarely narrowed, margin conspicuously undulate crenate, slightly to markedly recurved, ± coriaceous, principal nerves ± prominent below, anastomosing towards the margin, occasionally with sparse glandular pits; petioles up to 15 mm, sometimes longer, channelled above, glabrous, sometimes strigillose. *Inflorescences* axillary, up to 35 mm long, rarely longer, glabrous or glabrescent with sparse hairs sometimes persistent on bracteoles and perianth in buds, bearing few (rarely more than 5, but up to 11 flowers) in a dichasium or a pleiochasium; bracts lanceolate-deltate, rarely linear oblong, (1.5–)2.5–4 mm long, early caducous; pedicels rarely much expanded under the hypanthium, bracteoles enclosing the hypanthium in bud. *Flowers* with perianth reddish (rarely entirely cream-green); hypanthium 1–2(–2.5) mm long, glabrous to rather densely tomentulose; tepals 8, in 2 unequal whorls, the outer obtusely linguiform, sepaloid, (2–)3–4(–6) by 1.5–3(–4) mm, the inner narrowed towards the apex, more petaloid, (2–)2.7–3.5(–5) by (1.2–)1.5–2.5(–3.5) mm. — *Androecium* in 2 or 3 series, the outer whorl of 4 stamens; stamens longer than broad, (1.3–)1.5–2(–2.5) by 1–1.7 mm, with slightly divergent, lanceolate or ovate-oblong obtuse, rarely acute staminal glands, and extrorsely dehiscing valves, the inner series of lanceolate, deltoid to subulate staminodes, the outer often with vestigial glands. — *Gynoecium* of up to 16 carpels, styles exserted beyond the hypanthium, stigmatic column narrowly conical, reaching apices of inner staminodes, rarely beyond. *Fruiting hypanthium* thickly lignified, (11–)18–25(–35) mm long, dehiscing into 4 (rarely 2) equal valves, hairy within especially towards the rim. *Nutlets* (3–)5–6(–7) mm long, styles (5–)7–14(–15) mm long, exserted beyond the hypanthium.

Distr. *Malesia:* Papua New Guinea. Throughout the central mountains from the Hunstein Range to the Owen Stanley Range, and also in the Torricelli Mts and the Saruwaged Range.

Ecol. Primary montane rain-forest, and secondary forest as a remnant, 500–1950 m. In general at lower altitude than *D. crassa* and preferring gullies, slopes and fairly well-drained ridge crowns. Only rarely associated specifically with *Nothofagus* forest.

Uses. The bark is chewed and rubbed on the chest by Chimbu natives for certain illnesses.

Vern. *Adengambi*, Chimbu, *anona*, Akuna, *anonya, nasapu*, Aiyura, *kamo*, Okapa, *onda* or *onde*. Aseki.

Note. *D. crassa* may be distinguished from this species by its relatively broadly obtuse, frequently retuse leaves, generally cream-green flowers, equal whorls of tepals, two unequal whorls of stamens, broad wing-like staminal glands attached near to the base of the filament, shortly apiculate outer anthers, latrorse anther dehiscence, and shorter fruit.

var. **macra** SCHODDE, *var. nov.*

Laminae foliorum coronarum arborum saepe longiores quam 100 mm, latioresquam 35 mm, et petioli (1.5–)2–2.5(–3.5) mm crassi, inflorescentiae relative tomentulosae dense glauco-griseae vel alutaceae, et hypanthia fructificantia 35–45 mm longa. —

Type: SCHODDE & CRAVEN 5081 (CANB), Morobe Prov., Menyamya Distr., Aseki Valley, *c.* 3 miles SE. of Aseki.

Differs from *var. novoguineensis* in the ± densely glaucous-grey or pale brown tomentulose inflorescence, and in the larger leaves and fruiting hypanthia.

Distr. *Malesia:* Papua New Guinea, Enga Prov., Wabag Distr., Morobe Prov., Menyamya and Wau Distr.

Ecol. Montane rain-forest, 1000–2400 m.

Note. Known only from within the range of *ssp. novoguineensis* and usually in close proximity to it.

2. *ssp.* **occidentalis** SCHODDE, *ssp. nov.*

Cortex relative asper fissuratusque, folia coronarum arborum relative anguste obtusa vix acuminata ad apices, et obscure undulato-crenata paene integra, glandulae staminum planae, lanceolate ad ovate 0.7–1 mm longae, et hypanthia fructificantia 1 3/4–2 plo longiora quam latiora. — Type: BRASS & VERSTEEGH 11984 (L), Irian Jaya, 15 km SW. of Bernhard Camp, Idenburg River.

Differs from *ssp. novoguineensis* in the longer and flatter divergent staminal glands, the rounder apex and more entire margin of the leaf, the thicker fruiting hypanthium and the rougher dark-brown bark.

Distr. *Malesia:* Irian Jaya, Vogelkop Peninsula, Mt Nettoti; Wissel Lakes; Idenburg River.

Ecol. Primary montane rain-forest (*Nothofagus*) and mossy forest, 900–1900 m.

Vern. *Goekaai*, Kapauku lang.

Note. The three localities from which this species is known are far apart, but the specimens are uniform, especially as regards their staminal glands. *D. novoguineensis* apparently shows no clinal trend towards the characters of this species at the western end of its range. A considerable geographical gap (of *c.* 200–250 miles) separates the ranges of the two subspecies, as known at present.

2. PALMERIA

F. v. M. Fragm. 4 (1864) 151; A.DC. Prod. 16, 2 (1864) 657; BTH. Fl. Austr. 5 (1870) 291; PERKINS & GILG, Pfl. R. Heft 4 (1901) 64; PERKINS, Bot. Jahrb. 52 (1915) 214; Übersicht Gattungen Monim. (1925) 42; HUTCH. Gen. Fl. Pl. 1 (1964) 119; PHILIPSON, Blumea 28 (1982) 85, f. 1–3. — **Fig. 4–5.**

Woody lianes with opposite, entire leaves, usually bearing stellate hairs. Dioecious, with lateral or terminal cymose panicles or pleiochasia. — *Male flowers* bowl-shaped or saucer-shaped, with 4–7 tepals either incurved or spreading at anthesis to reveal the numerous stamens ± sessile on the surface of the receptacle; anthers opening by longitudinal slits. — *Female flowers* globose or flask-shaped with *c.* 5 small obtuse tepals surrounding a minute ostiole; carpels sessile on the inner surface of the receptacle, interspersed with numerous bristles. *Receptacle* enlarging to become a ± globose fruit, which splits open irregularly at maturity to reveal the drupes.

Distr. Australia and *Malesia:* 11 *spp.* in New Guinea, of which 3 may also occur in Queensland and one extends to E. Sulawesi. Three further species have been described from Australia.

KEY TO THE SPECIES

1. Outer surface of receptacle glabrous ..... **1. P. hooglandii**
1. Outer surface of receptacle bearing hairs.
 2. Undersurface of leaf ± glabrous ..... **3. P. arfakiana**
 2. Undersurface of leaf with indumentum.
  3. Undersurface of leaf bearing numerous simple hairs (and usually also some stellate hairs) **2. P. gracilis**
  3. Undersurface of leaf bearing stellate hairs (occasionally also with a few simple hairs).
   4. Mature fruits *c.* 7–8 mm ø (before dehiscing). Achenes about 5 mm long when dry (known only from the Angi Lakes area) ..... **4. P. angica**

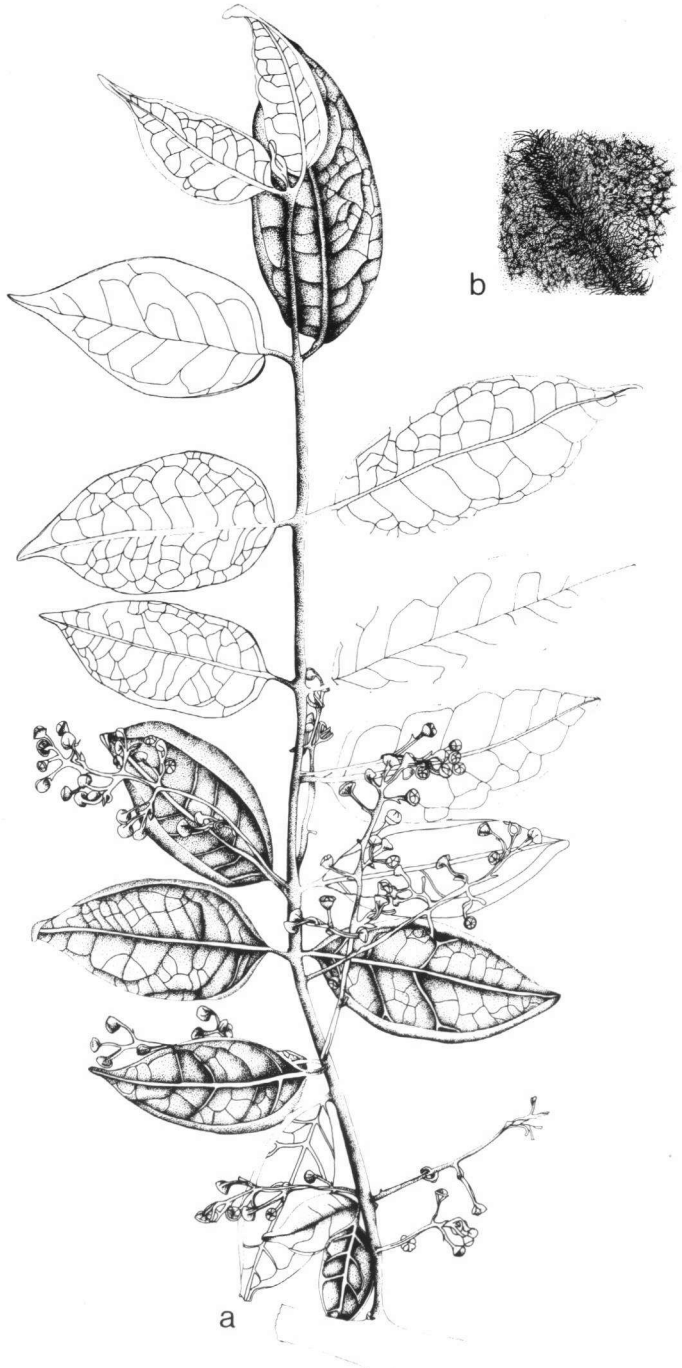


Fig. 4. *Palmeria clemensae* PHILIPSON. *a.* Habit of male twig, ×1/2, *b.* portion of lower surface of leaf, ×5 (*a* PULLEN 281, *b* VAN BALGOOY 957).

4. Mature fruits *c.* 15–20 cm ø (before dehiscing). Achenes about 7 mm long or longer when dry.
5. Stellate hairs of underside of leaf laxly or densely distributed but not matted to form a close felt.
6. Stellate hairs of the underside of leaf large (0.6–0.9 mm), generally distributed over the leaf surface, usually rather dense (but the leaf-surface clearly visible through them) ..... **5. P. brassii**
6. Stellate hairs of the underside of the leaf small (0.2–0.25 mm) occasionally generally distributed and dense, but often confined to leaf base and petiole (common throughout New Guinea) **3. P. arfakiana**
5. Stellate hairs densely distributed over the undersurface of the leaf and matted together to form a close felt.
7. Felt on the underside of the leaf with a smooth even surface.
8. Leaves large (mostly over 12 cm long) (known from Morobe and Central Provinces) **6. P. incana**
8. Leaves smaller.
9. Leaves small (less than 5 cm long) (known from the Murray Pass area) ..... **7. P. montana**
9. Leaves larger (Tari District westwards)..... **8. P. hypargyrea**
7. Felt on the underside of the leaf with some larger hairs protruding above the general surface.
10. Veins on the underside of the leaf fringed with long hairs ..... **9. P. clemensae**
10. Veins on the underside of the leaf bearing tufted stellate hairs above the felt.
11. Leaves large (9 cm or longer)..... **10. P. womersleyi**
11. Leaves smaller (6 cm or shorter) ..... **11. P. schoddei**

1. Palmeria hooglandii PHILIPSON, Blumea 28 (1982) 88.

Woody liane to 22 m high, branches and foliage glabrous. *Leaves* oblong-elliptic, occasionally lanceolate-elliptic, 7.5–15.5 by 1.7–6 cm, chartaceous, apex with an apiculum (often long and narrow), base cuneate, midrib slightly channelled above, prominent below, lateral veins *c.* 6, well-defined, meeting within the margin; petiole 0.75–1 cm. *Inflorescence* axillary and terminal, either simple unbranched pleiochasia (often grouped at the ends of branches to resemble panicles) or with long lateral branches forming a panicle-like inflorescence, the rachis 4.5–10 cm, with lateral branches up to 4 cm; male inflorescences often larger and more openly branched at anthesis than females. — *Male receptacles* bowl-shaped becoming almost disk-shaped at anthesis, *c.* 5.5 mm ø (without the tepals), margin produced into *c.* 5–7 irregular tepals, outer surface of tepals minutely pubescent; stamens *c.* 18, subsessile; anthers *c.* 0.75 mm. — *Female receptacle* globular, 2.5 mm ø, with a terminal ostiole surrounded by 5 minute obtuse tepals, a few microscopic hairs present on the tepals, the inner surface of the receptacle bearing long simple hairs between the carpels; carpels *c.* 8, tapering to filiform styles which project through the ostiole. Immature *fruit* globose or irregularly bulged, with an asymmetric beak, mature fruit not seen.

Distr. *Malesia:* Papua New Guinea (Southern Highlands, Enga, Western Highlands, Chimbu, Eastern Highlands, Morobe Prov.).

Ecol. A liane reaching 22 m in primary and secondary lower montane rain-forest, 1950–2800 m.

Vern. *Kende, kent, korinda*, all Enga, *boma*, Chimbu, *abiya*, Okapa.

Note. One of the most distinctive species, with both the vegetative parts and inflorescence glabrous (only the tepals are minutely pubescent). Its distribution covers most of the Central Highlands from Lagaip to Okapa, with a single disjunct occurrence in the Cromwell Mts (Huon Peninsula). The flowers are described as creamy and scented. The drupes are purple-black on a bright red torus.

2. Palmeria gracilis PERKINS, Bot. Jahrb. 31 (1902) 745; Pfl. R. Heft 49 (1911) 39; PHILIPSON, Blumea 28 (1982) 89, f. 1b. — *P. fengeriana* PERKINS, Pfl. R. Heft 49 (1911) 39. — *P. paniculata* RIDL. Trans. Linn. Soc. Bot. II, 9 (1916) 144.

Woody liane, reaching 20 m, young parts covered with a lax indumentum of simple hairs, together with small stellate hairs especially on the flowers. *Leaves* usually ovate with broad rounded, cordate, or cuneate base, and a long narrow apiculum, more rarely elliptic with a short apiculum, 4–14.5 by 1.8–11.5 cm, membranaceous, midrib and lateral veins well-defined, upper surface with the remnants of simple hairs and small stellate hairs, or becoming glabrous except for simple hairs along the midrib and sometimes the principal veins and the margin, undersurface with a dense or sparser covering of curved simple hairs mixed with a varying number of small stellate hairs; petiole 2.5–10 mm, hairy. *Inflorescence* axillary and terminal, either simple pleiochasia, few-flowered and with a delicate rachis, or branching to the second degree with rather stouter rachis, 5–20 cm long, often produced profusely on lateral branches of limited growth; rachis, branches and pedicels with lax hairs and a varying amount of short dense stellate hairs; bracts linear, caducous. — *Male receptacle* saucer-shaped, 6–8 mm ø, with 5 recurved deltoid tepals, outer surface with long simple hairs and dense stellate indumentum; stamens *c.* 20–24, sessile, *c.* 1.25 mm long. — *Female receptacle* globose, *c.* 2.25 mm ø, outer surface with indumen-

tum as in male, inner surface with long bristles between the carpels; carpels *c.* 8–10, tapering to a long filiform reflexed style. Immature *fruit* subspherical with an asymmetric beak; mature fruit splitting into irregular lobes *c.* 2–2.5 cm long, densely bristly on both surfaces; drupes spherical, sessile, *c.* 7 mm long when dry.

Distr. *Malesia:* Irian Jaya (Vogelkop Peninsula, Japen I., Lake Habbema, Idenburg R.); Papua New Guinea (W. & E. Sepik, Southern, Western & Eastern Highlands, Morobe & Central Provinces).

Ecol. Woody liane reaching 20 m or more, in rain-forest, second growth or open scrubby areas with a wide altitudinal range (500–3000 m), but most frequent in lower montane rain-forest (*Castanopsis, Lithocarpus, Nothofagus, Podocarpus* or *Elaeocarpus* dominated).

Uses. For wrapping tobacco before being smoked in pipes or as cigarettes. When burnt to a fine ash, used as salt.

Vern. *Gapunga*, Koroba, *hompanofi*, Okapa, *kepundom*, Maring, *obirambiram*, Mendi, *fowndun*, Maring.

Note. One of the most widespread and frequent species, recognized by the simple curved bristles on the undersurface of the leaf. The size of the leaf is varied, as is the density of the indumentum, but the variability has no geographical or apparent ecological basis. The flowers are cream, in males with whitish stamens. The red or dark drupes are borne on a light red receptacle.

3. Palmeria arfakiana BECC. Malesia 1 (1877) 186; PERKINS, Pfl. R. Heft 4 (1904) 65; Bot. Jahrb. 52 (1915) 215; A.C. SMITH, J. Arn. Arb. 22 (1941) 245; KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 254; PHILIPSON, Blumea 28 (1982) 90. — *P. warburgii* PERKINS, Pfl. R. Heft 49 (1911) 37, f. 13D–H. — *P. pulchra* PERKINS, *l.c.* 38. — *P. myriantha* PERKINS, Bot. Jahrb. 52 (1915) 214. — *P. myrtifolia* PERKINS, Ubersicht Gattungen Monim. (1925) 43, *nomen.* — *P. puberula* A.C. SMITH, J. Arn. Arb. 22 (1941) 249. — *P. acuminata* KANEH. & HATUS. Bot. Mag. Tokyo 5 (1942) 251, f. 3F–G. — *P. parvifolia* KANEH. & HATUS. *l.c.*, 255, f. 3A–E.

Woody liane, young branches hirsute or puberulous. *Leaves* usually oblong-elliptic or obovate, sometimes narrower or subrotund, (2.5–)12–20 by 1–9.5 cm, chartaceous to coriaceous, apex attenuated to a short or long apiculum, base rounded, truncate, or cuneate, upper surface of mature leaves with remnants of minute stellate hairs, especially at the base of the midrib, or glabrous, undersurface with minute stellate hairs forming a dense or open indumentum or virtually absent from the mature blade, persisting, if at all, on the midrib or near the base of the leaf, longer simple hairs may be present along the midrib; petiole 3–15 mm long, either densely covered with minute stellate hairs or these may be sparse (almost absent) at maturity, longer simple hairs sometimes also present and abundant. *Inflorescence* axillary and terminal, paniculate, 7–20 cm long (rarely shorter), lower branches 1.5–3(–5) cm with few flowers or with tertiary branches, the rachis and branches usually with a greyish or cream tomentum or with sparse stellate hairs, rarely more or less glabrous at anthesis. — *Male receptacle* bowl-shaped becoming a flat disk at anthesis *c.* 6–8 mm ø, with *c.* 5 irregular tepals, outer surface with a short dense indumentum or with fewer minute stellate hairs, inner surface with short simple hairs; stamens *c.* 25, sessile *c.* 0.75–1.25 mm long. — *Female receptacle* urceolate, *c.* 2–2.5 mm high, outer surface with indumentum as in male, inner surface with long simple hairs; carpels *c.* 5–8(–16), with filiform styles. Immature *fruit* subspherical, beaked, splitting irregularly at maturity to reveal the red inner surface and black drupes.

Distr. *Malesia:* Central Celebes (E. Peninsula) and New Guinea: in uplands throughout the island from Vogelkop Peninsula to Milne Bay; also on Manus I. and New Britain.

Ecol. Liane, often strongly growing in primary rain-forest, mostly in the lower and upper montane zones, ascending to 3200 m, but occasionally as low as 100 m. Also in second growth and climbing over shrubs near the forest margin.

Uses. The leaves are burnt to make salt.

Vern. Papua New Guinea: *angore, laso*, Mendi, *bengop, pengop*, Hattam, *gawa kepundom*, Maring, *ibiwudediji, puquabou*, Tari, *kainagent, repalip, tsik*, Enga, *kangom*, Iaro R., *linore, mulkrima*, Telefomin, *njeng*, Hagen, Wankl, *tomenguntong*, Saider, *xatapi*, Guale, Movoi.

Notes. The most frequent and widespread species of the genus. It is the only species known to occur on islands to the north of the New Guinea mainland and in Sulawesi.

The variety of forms included within the limits of this species as treated here is greater than is generally acceptable in one species. It is possible that future studies will recognize entities within this complex, and perhaps reinstate species here regarded as conspecific. However, it has proved impossible to subdivide on the basis of indumentum and leaf-size. Broadly speaking four groups may be recognized, though frequent intermediates link all of these: (i) a large-leaved form with adult leaves more or less glabrous except for small stellate hairs on the petiole and base of the leaf (*P. arfakiana sensu stricto*), (ii) a large-leaved form with the lower surface more or less densely and evenly covered with small stellate hairs, (iii) a smaller-leaved form (often with narrower more oblong blades) usually with the indu-

mentum persisting only near the leaf base (*P. pulchra*), (iv) a small-leaved form with few stellate hairs (*P. acuminata, P. parvifolia*). The first three forms are all frequent and widespread. The fourth appears to be confined to mountains to the west of the island (*e.g.* Arfak Mts, Wissel Lakes). The species described by KANEHIRA & HATUSIMA are here regarded as reduced subalpine states and reduced to synonymy; they may prove to be distinctive enough for specific status when better material becomes available, but the evidence available is that they are the end of a reduction series. The type of *P. myriantha* PERKINS represents the most glabrous state, with even the branches of the inflorescence more or less glabrous and the receptacles bearing a rather sparse coating of stellate hairs. However, similar collections occur throughout the range and must be regarded as one extreme of a continuous range of variation. I have not seen type material of *P. warburgii* PERKINS from Celebes (the only occurrence of the genus west of New Guinea), but plants collected in Celebes by EYMA fit the original description. The younger leaves are rather heavily coated below with small stellate hairs, but older leaves can approach the glabrous condition.

Although undoubtedly a liane, like all other species of *Palmeria*, it must vary in habit because a number of collectors describe it as a tree or sprawling shrub. The young foliage is tinged with red. The flowers are cream or yellowish. The black drupes are borne on a red or pink receptacle.

4. Palmeria angica KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 252; PHILIPSON, Blumea 28 (1982) 92.

Woody liane to 3 m high, young branches with a greyish indumentum. *Leaves* oblong-elliptic, 4–8 by 2–4 cm, chartaceous or coriaceous, base rounded, apex shortly acuminate, the upper surface ± densely or sparsely stellate hairy, becoming glabrous, the undersurface densely stellate-pilose; petiole 7–8 mm long, closely pubescent. *Inflorescence* axillary, to 10 cm long, the rachis and branches with greyish stellate indumentum. — *Male flowers* not seen. — *Female receptacle* urceolate, 2.5 mm long (after flowering), with short dense indumentum on the outer surface, tepals 5, minute; carpels 7–8. *Fruits* subspherical, *c.* 8 mm ø, splitting irregularly; drupes *c.* 5 mm long when dry.

Distr. *Malesia:* West New Guinea (Mt Arfak, Angi Lakes).

Ecol. Scandent in low spinneys on the burnt and open summit of Mt Koebre at 2300 m.

Note. The small fruits appear to enclose a single drupe, which is considerably smaller than those of the other species.

5. Palmeri brassii PHILIPSON, Blumea 28 (1982) 92, f. 1d. — *'Palmeria fengeriana* PERKINS' A.C. SMITH, J. Arn. Arb. 22 (1941) 248, *p.p.*

Woody liane, to 20 high, young branches with a thick indumentum. *Leaves* usually broadly elliptic or slightly obovate or rotund, with a small blunt apiculum or occasionally with an attenuated apex, 8–22 by 4.8–12 cm, chartaceous, midrib prominent below, lateral veins *c.* 6, arched and meeting within the margin, upper surface of mature leaves covered with the scattered remnants of stellate hairs, which may form a dense pile above the midrib and principal veins and on the margins, lower surface covered with large stellate hairs with lax, shining, bristle-like arms, sometimes rather densely disposed but not obscuring the surface of the blade; a few simple hairs may occur among the stellate indumentum; petiole 10–17 mm, densely clothed in brown indumentum. *Inflorescences* axillary and terminal, covered with a short dense creamy or fulvous tomentum, elongate (to *c.* 40 cm) with relatively short opposite or subopposite lateral branches (5–8 cm long) or the inflorescence more paniculate with lateral branches 15–20 cm long (the male inflorescences frequently more lax than the female at anthesis); lateral branches bearing several opposite tertiary branches and caducous subulate bracts. — *Male receptacle* bowl-shaped, becoming almost a flat disk at anthesis, with *c.* 5 irregular tepals, *c.* 5 mm ø, outer surface with a dense covering of small stellate hairs, inner surface with short simple hairs between the stamens; stamens *c.* 20, sessile on the inner surface of the receptacle, *c.* 0.75–1 mm long, apex of the connective with a tuft of minute hairs. — *Female receptacle* urceolate, often asymmetric, 2–3 mm high at anthesis, outer surface with indumentum as in the male, inner surface with long simple hairs between the carpels; carpels *c.* 15 distributed over the inner surface of the receptacle, tapering to filiform styles which project through the ostiole, becoming reflexed. Immature *fruit* subspherical, or irregularly bulged, usually markedly asymmetric with a prominent beak to one side; at maturity the enlarged receptacle splits to form *c.* 5 coriaceous, very irregular lobes *c.* 2 cm long to which the ripe achenes are attached; drupes spherical, sessile, with a shining black surface, mesocarp succulent, endocarp stony, *c.* 7 mm long when dry.

Distr. *Malesia:* Papua New Guinea (Eastern Highlands, Morobe and Central Provinces).

Ecol. Woody liane on shrubs and trees in primary and secondary lower montane rain-forest (dominated by *Castanopsis, Lithocarpus, Nothofagus* or *Podocarpus*), occurring in ridge forest and also in swampy places with dark brown loam, 1200–2450 m.

Uses. Employed as lashing material.

Vern. *Nani*, Kassam, *arawe*, Finisterre Mts, *boma*, Gumini, *arokot*, Ueli, Movoi.

Note. Characterized by its large leaves bearing a loose indumentum of large stellate hairs with shining, bristle-like, spreading arms. The flowers are described as white. The immature green, white-spotted fruits later split open to reveal black drupes on a red torus. *P. brassii* may be distinguished from *P. gracilis* by the predominance of stellate hairs, by the shape of the blade and by the longer inflorescence. Some specimens with more numerous simple hairs may also approach *P. gracilis* in leaf shape. They are possibly of hybrid origin. Of all the New Guinea species, *P. brassii* probably is most closely related to the Australian *P. scandens* from which it differs principally in the length of the inflorescence and the leaf shape.

6. Palmeria incana A.C. SMITH, J. Arn. Arb. 22 (1944) 245; PHILIPSON, Blumea 28 (1982) 94.

Woody liane, with young branches covered in greyish tomentum. *Leaves* elliptic-oblong, 9–18 by 3.5–8 cm, chartaceous, base rounded or broadly cuneate, apex shortly acuminate, upper surface becoming glabrous (except for puberulence above the midrib), lower surface evenly covered with a close, fine, greyish-white indumentum, midrib and arched lateral veins prominent below, impressed above; petiole 6–10 mm, puberulous. — *Inflorescence* densely greyish pubescent, axillary and terminal, narrowly paniculate, up to 12 cm, with branches *c.* 2–3 cm. — *Male flowers* globose, *c.* 2 mm ø (in bud), apex depressed with 5 tepals, outer surface densely covered with a close indumentum of stellate hairs; stamens *c.* 20–24, broadly deltoid, *c.* 0.75 mm long, sessile. — *Female flowers* not known. Immature *fruits* subspherical with an asymmetric beak; at maturity the enlarged receptacle ruptures irregularly to form coriaceous lobes *c.* 2 cm long; drupes subspherical, *c.* 7 by 5 mm, sessile.

Distr. *Malesia:* Papua New Guinea (Morobe Prov.: Wau Distr.; Central Prov.: Goilala Distr.).

Ecol. Liane scrambling over trees in primary forest at 1200 m.

Notes. Evidently a rare and local species, only twice collected. Lower surface of leaves covered with a smooth, even, greyish felt of close-set stellate hairs. This indumentum is similar to that of *P. hypargyrea*, but that western species has smaller leaves.

The original collection lacked flowers, but immature male flowers were provided by another. The flowers are described as cream, with a ± unpleasant scent, and the drupes as black on a red torus.

7. Palmeria montana A.C. SMITH, J. Arn. Arb. 22 (1941) 247; PHILIPSON, Blumea 28 (1982) 95.

Woody liane to 3 m high, with slender branches covered with a greyish indumentum of minute stellate hairs. *Leaves* ovate to oblong-ovate or broadly ovate, 1.8–4.7 by 0.6–2.5 cm, chartaceous, base cuneate or rounded, apex curving into an acute apiculum, midrib slightly channeled above, prominent below, lateral veins rather obscure, upper surface of mature leaves glabrous or with sparse remnants of small stellate hairs, lower surface covered with a dense fine greyish white felt of stellate hairs; petiole to 5 mm long, puberulous. *Inflorescence:* axillary, few-flowered pleiochasia, *c.* 2 cm long, covered with a short dense indumentum, and bearing subulate bracts; pedicels 3–7 mm. — *Male receptacle* bowl-shaped, 4–5 mm ø at anthesis (without the tepals) with 5 or 6 deltoid, acute tepals, outer surface densely covered with minute stellate hairs, inner surface with short simple hairs; stamens 15–20, filaments *c.* 0.4 mm, anthers *c.* 0.8 mm long. — *Female receptacle* subglobose, 2–2.5 mm ø, with a terminal ostiole surrounded by 5 minute obtuse tepals, indumentum of outer surface similar to that of male, inner surface covered with long simple hairs between the carpels; carpels 10–15, tapering to filiform styles which project through the ostiole. Immature *fruit* subglobose, splitting at maturity to reveal 1–5 drupes.

Distr. *Malesia:* Papua New Guinea (Central Prov.).

Ecol. Sprawling over undergrowth in montane forest or climbing to 3 m, also in disturbed forest and tree-fern savanna, 2700–2850 m.

Notes. Known only from the vicinity of Murray Pass. Features which distinguish this small-leaved montane species from *P. schoddei* are given under that species.

The flowers are described as cream, and the drupes brown on a red receptacle.

8. Palmeria hypargyrea PERKINS, Bot. Jahrb. 52 (1915) 215; PHILIPSON, Blumea 28 (1982) 95, f. 1a. — *P. pulleana* PERKINS, Übersicht Gattungen Monim. (1925) 43, *nomen.* — *P. habbemensis* A.C. SMITH, J. Arn. Arb. 22 (1941) 246. — *P. dallmannensis* KAN. & HAT. Bot. Mag. Tokyo 56 (1942) 254, f. 4.

Woody liane; young branches with minute stellate hairs, often 4-angled. *Leaves* elliptic or narrowly elliptic, 5–11.5 by 2.5–4.5 cm, thinly coriaceous, base cuneate or rounded, apex shortly acuminate, obtuse or acute, upper surface becoming glabrous or retaining widely spaced remnants of stellate hairs, lower surface evenly covered with a close, fine indumentum (which may become thinner on the midrib and principal veins or rarely over the surface of the blade); petiole 5–9 mm long, puberulous. *Inflorescence* axillary and terminal, pleiochasial, 4–8(–13) cm long, lateral branches few-flowered, densely covered in greyish pubescence, except that the peduncle and rachis may become glabrous or bear only sparse minute stellate hairs; small caducous bracts below the branches and some pedicels. — *Male receptacle* saucer-shaped, *c.* 5 mm ø, with 5–6 deltoid tepals,

outer surface with a short dense indumentum; stamens *c.* 40, sessile, *c.* 0.75 mm long. — *Female receptacle* ovoid, *c.* 1.75 mm long, outer surface with indumentum as in male, inner surface with long simple bristles; carpels usually 3; style subulate. *Fruit* not seen.

Distr. *Malesia:* Irian Jaya (Nabire; Lake Habbema; Hellwig Mts); Papua New Guinea (West & East Sepik and Southern Highlands Prov.).

Ecol. Scrambling in primary rain-forest or over shrubs in young regrowth, 400–2800 m.

Vern. *Oberonk*, Mendi.

Note. Although there is considerable variation in the size of the leaves, correlated with the unusual altitudinal range, the shape of the leaves is rather uniform and the smooth, close, but fine indumentum of the lower leaf surface and of the inflorescence is characteristic. In the original material collected by LEDERMANN the fine felt of stellate hairs has partially or completely disappeared from the lower surface of some leaves, only a few scattered, slightly larger, stellate hairs remaining. However, the typical covering of hairs has persisted in some areas. The leaves are described as greyish or whitish beneath, though some specimens from higher altitudes appear light fawn, at least when dried. The flowers are cream.

9. Palmeria clemensae PHILIPSON, Blumea 28 (1982) 96, f. 2. — **Fig. 4.**

Woody liane; young branches covered with a fulvous or creamy indumentum. *Leaves* elliptic to broadly elliptic, with an apiculum (either long and attenuate or short), 7–15 by 3.5–7.3 cm, chartaceous or slightly coriaceous base truncate or rounded, midrib and principal veins prominent below, sometimes deeply impressed above, upper surface of mature leaves with scattered remnants of stellate hairs or glabrous, lower surface densely covered with a close felt of small stellate hairs and with longer soft hairs along the veins (usually forming a prominent fringe, rarely almost absent); petiole 5–10 mm, hairy. *Inflorescence* axillary and terminal, *c.* 7–20 cm long, covered with a dense fulvous or creamy indumentum, narrowly paniculate, side-branches few-flowered. — *Male receptacle* bowl-shaped becoming almost a flat disk at anthesis, with 5–7 irregular tepals, *c.* 8–10 mm ø, outer surface with a dense covering of short stellate hairs, inner surface with short simple hairs between the stamens; stamens *c.* 30–45, with broad filaments up to 0.5 mm long, anthers 0.75–1.5 mm long; filaments and connectives hairy. — *Female receptacle* urceolate, *c.* 2 mm high at anthesis, outer surface with indumentum as in the male, inner surface with long simple hairs between the carpels; carpels *c.* 8–12, tapering to filiform style. Immature *fruit* globose with a beak (often asymmetrical); at maturity the enlarged receptacle splits open to form *c.* 5 coriaceous very irregular lobes *c.* 2 cm long; drupes subspherical, sessile; mesocarp succulent, endocarp stony, *c.* 7 mm long when dry.

Distr. *Malesia:* Papua New Guinea (Southern Highlands, Chimbu, Eastern Highlands, Morobe and Central Provinces).

Ecol. Lower montane and mossy forest (*Castanopsis, Lithocarpus, Nothofagus, Podocarpus, Libocedrus* dominated), 1200–2750 m.

Vern. *Kari*, Chimbu.

Note. A widespread but rather rarely collected species, distinguished by the close felt of minute stellate hairs on the undersurface of the leaves, combined with longer soft bristly hairs along the veins. The species occurs in two forms. One has rather thin leaves with a close buff felt on the lower leaf surface, and with rather few and short bristles, whereas in the other form the leaf blade is more coriaceous with the veins deeply impressed above, the felt is paler (creamy white or fawn), and the bristles form conspicuous fringes along the veins. The second form may also have larger flowers, though the specimens available are inadequate to establish this conclusively. The first form is more frequent in the east (Morobe and Central Prov.) and the second in the west (Eastern and Southern Highlands Prov.), but in both regions specimens of both forms have been collected. The black drupes are sessile on a red torus.

10. Palmeria womersleyi PHILIPSON, Blumea 28 (1982) 98, f. 3. — **Fig. 5.**

Woody liane, repeatedly branched, often reaching the top of medium-sized trees; young branches covered with a fulvous indumentum. *Leaves* elliptic to broadly elliptic, 9–18 by 3.5–10 cm, chartaceous to coriaceous, base cuneate or rounded, apex broad with a short obtuse apiculum or more gradually narrowed to an acute apex, midrib slightly channelled above, prominent below, lateral veins *c.* 5, arched and meeting within the margin; upper surface of mature leaves with widely spaced remnants of stellate hairs, lower surface with a loose or close felt of stellate hairs together with a variable number of larger, more tufted, stellate hairs especially on the veins; petiole 8–17 mm long, densely covered with stellate hairs. *Inflorescences* axillary and terminal, pleiochasial, often produced profusely on short leafy lateral branches, coming to resemble panicles when the foliage abscisses, covered with a short dense indumentum; pleiochasia 7–15 cm long, bearing opposite or verticillate short branches (*c.* 1.5–2 cm) each with a small number of flowers and minute subulate bracts mostly caducous before anthesis. — *Male receptacle* bowl-shaped, 7–9 mm ø at anthesis (without the tepals), with 5–7 irregular tepals eventually opening to disclose the numerous (30–40) stamens, outer surface with a dense covering of small stellate

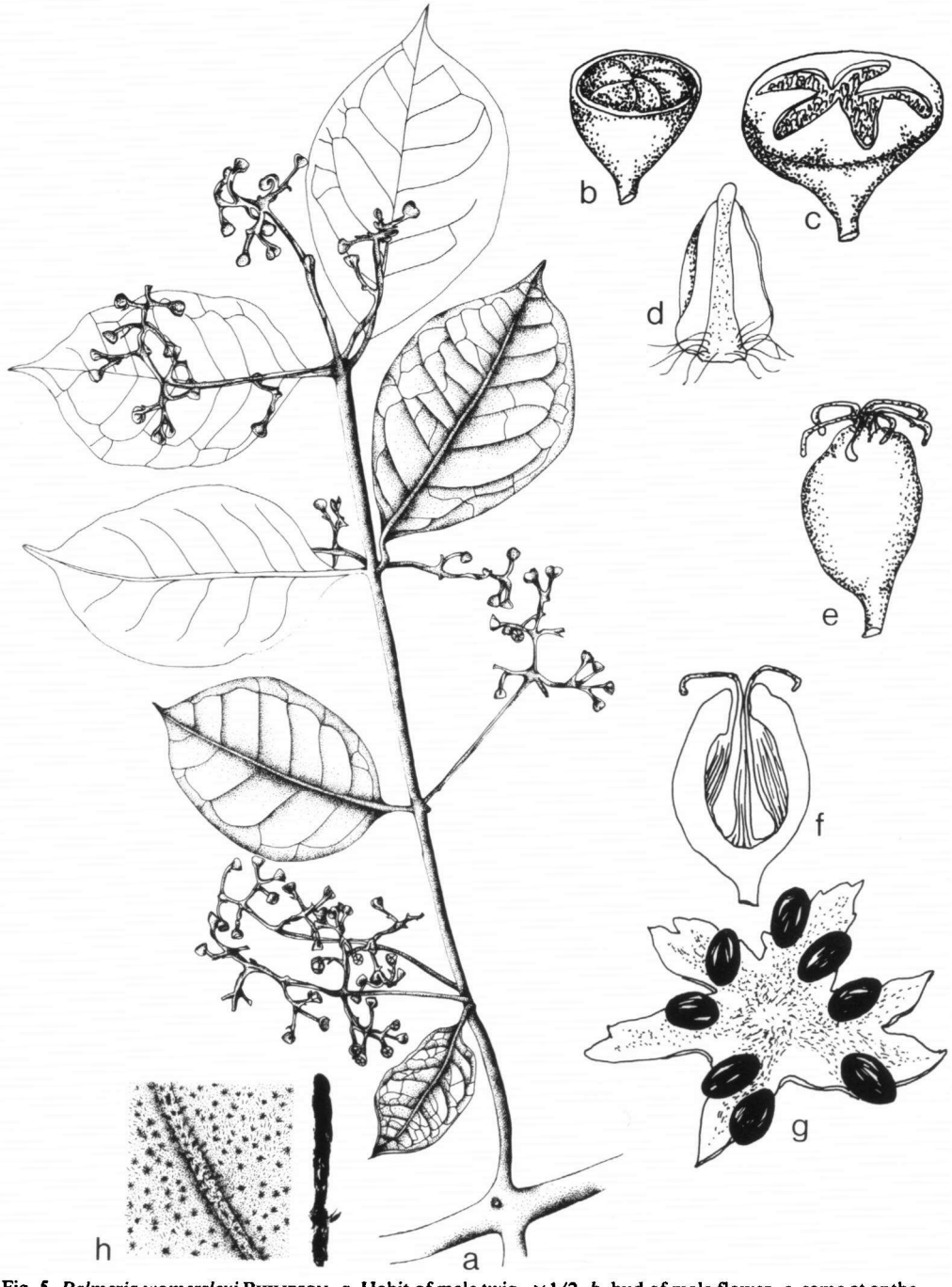


Fig. 5. *Palmeria womersleyi* PHILIPSON. *a.* Habit of male twig, ×1/2, *b.* bud of male flower, *c.* same at anthesis, both ×6, *d.* anther, ×15, *e.* female flower, *f.* same in LS, both ×6, *g.* receptacle, bearing achenes, nat. size, *h.* portion of lower surface of leaf, ×5 (*a–c* HOOGLAND & SCHODDE 6787, *d* NGF 14005, *e–f* PHILIPSON 3721, *g* HOOGLAND & PULLEN 5429, *h* PHILIPSON 3690).

hairs, inner surface with very short simple hairs; anthers sessile, *c.* 0.75–1.25 mm long, the connective sometimes with short hairs at the base and apex. — *Female receptacle* cup-shaped, 2–3 mm ø at anthesis, upper surface concave with a small central ostiole, outer surface with indumentum as in male, inner surface covered with long simple hairs between the carpels; carpels *c.* 10–12, distributed over the inner surface of the receptacle, tapering to filiform styles (*c.* 2 mm long) which project through the ostiole, becoming reflexed. Immature *fruit* subspherical with an unusually asymmetric beak developed from the tepals; at maturity the enlarged receptacle ruptures irregularly to form *c.* 4–6 coriaceous arms 2–2.5 cm long to which the ripe achenes are attached; drupes spherical, sessile, with a shining black surface, mesocarp succulent, endocarp stony, 7 mm when dry.

Distr. *Malesia:* Papua New Guinea (Enga, Southern Highlands, Western Highlands and Eastern Highlands Provinces).

Ecol. A liane copiously branched over low shrubs or climbing high on forest trees in primary or secondary forest or open scrub, 1800–2600 m.

Uses. Leaves used for smoking (Wabag).

Vern. *Kombendegambeka*, Hagen, Towopa, *noldunkan*, Whaji, Minj, *hakappa*, Mairi, Watabung, *kibekelakkan*, Chimbu, Masul.

Note. A moderately large-leaved species which may be recognized by the close covering of stellate hairs on the lower leaf surface which are fulvous or rufous at least in dried specimens. The hairs are of two sizes: the smaller more numerous and forming a general felted tomentum; the larger more widely spaced and giving the leaf surface and especially the principal veins a tufted appearance. In fresh material the pubescence on the lower leaf surface appears either olive green, fulvous or rufous. Flowers fragrant, stamens white. Fruit with mature torus green outside and pink to bright red within; drupes black.

11. Palmeria schoddei PHILIPSON, Blumea 28 (1982) 100, f. 1c.

Woody liane to 25 m high, with slender branches covered with a rough fulvous indumentum of stellate hairs. *Leaves* ovate, 3.3–6 by 1.5–2.5 cm, chartaceous, base rounded, narrowed to an acute apex, midrib slightly channelled above, prominent below, lateral veins conspicuous, upper surface of mature leaves with widely spaced remnants of small stellate hairs, lower surface covered with dense indumentum of small fulvous stellate hairs, with scattered slightly larger stellate hairs along the principal veins; petiole 7–10 mm long, covered in stellate hairs. *Inflorescence:* axillary, few-flowered pleiochasia, up to 5.5 cm long, covered with a dense fulvous tomentum and bearing subulate caducous bracts; pedicels opposite or subopposite, *c.* 5–7 mm. — *Male receptacle* bowl-shaped, *c.* 7 mm ø at anthesis (without the tepals) with 5 or 6 deltoid tepals, outer surface densely covered with an uneven stellate indumentum, inner surface with short simple hairs; stamens 20–25, with short filaments, anthers *c.* 0.8– mm long. — *Female flowers* not seen. Mature *fruits* with irregular coriaceous receptacular lobes 2 cm long, bearing sessile drupes 0.8 cm ø when dry.

Distr. *Malesia:* Papua New Guinea (Southern Highlands and Western Highlands Provinces).

Ecol. In forest climbing to 8 m or scrambling over low scrub at the margin of grassland, 2700–2900 m.

Vern. *Obe, yaso*, Mendi, *kena'ugl*, Enga, *dekaruek*, Melpa.

Note. Similar to *P. montana* A.C. SMITH, a montane species from the Wharton Range, but distinguished by leaf shape and size (larger and lacking an apiculum); coarser indumentum on the midrib; and by the larger flowers.

Insufficiently known

Palmeria hypochrysea PERKINS, Bot. Jahrb. 52 (1915) 215.

The species is known only from the type specimen (LEDERMANN 12404) which was destroyed during world war II. The description does not appear to fit any known species.

3. LEVIERIA

BECC. Malesia 1 (1877) 192; PERKINS & GILG, Pfl. R. Heft 4 (1901) 20; PERKINS, Bot. Jahrb. 52 (1915) 192; Übersicht Gattungen Monim. (1925) 20; PHILIPSON, Blumea 26 (1980) 373, f. 1–16. — **Fig. 6–8.**

Trees or shrubs, rarely climbing. *Leaves* exstipulate, glabrous when mature or more or less pubescent below, entire or dentate. Dioecious, with terminal or lateral cymose inflorescences. — *Male flowers* with a small receptacle bearing 8 rounded tepals enclosing numerous almost sessile stamens; connective project-

Fig. 6. *Levieria squarrosa* PERKINS. *a.* Twig of male plant (western form), ×1/2, *b.* male flower, ×5, and stamen, *c.* twig of female plant (eastern form), ×1/2, *d.* female flower, ×4, and in LS, ×5, *e.* fruit, ×3/4 (*a* PULLEN 5227, *b* BRASS 29090, *c–d* WOMERSLEY & FLOYD 6908).

ing; anthers opening up by longitudinal slits. — *Female flowers* ± globose with a small ostiole bounded by 4 irregular tepals. The margin of the receptacle soon becoming reflexed to expose the ovoid sessile drupes.

Distr. Queensland and *Malesia:* Celebes, Moluccas (Ceram, Ambon), New Guinea (incl. the Bismarck Archipelago).

Ecol. Mainly in lower montane rain-forest, between 1200 and 3000 m but descending to sea-level. Frequent in the shrub layer and lower canopy of rain-forest; persisting in regrowth areas, more rarely on shrubby hillsides.

Note. Male plants of the genus may be recognized by the separate rounded tepals borne on a very small receptacle. Female plants in flower and fruit are distinguished by the developing drupes becoming exposed by a curling outwards of the receptacle together with the tepals on its margin. This type of fruit development distinguishes the *Hedycaryeae* from other tribes of the family. In the *Mollinedieae* the tepals and the upper part of the receptacle fall as a calyptra after flowering, leaving a distinct circular abscission scar. In the *Monimioideae* the receptacle encloses the developing carpels until they are mature.

KEY TO THE SPECIES

1. Undersurface of mature leaf glabrous.
 2. Leaves obovate or narrowly elliptic ..... **1. L. squarrosa**
 2. Leaves broadly elliptic to elliptic.
  3. Leaf about 5 cm long, or shorter ..... **2. L. orientalis**
  3. Leaf about 7 cm long, or longer ..... **3. L. nitens**
1. Undersurface of mature leaf with some indumentum (at least a few hairs at the base of the midrib).
 4. Indumentum of lower leaf surface confined to the midrib.
  5. Liane with small leaves (3 cm long, or less) ..... **4. L. scandens**
  5. Trees or shrubs, leaves longer than 3 cm.
   6. Lateral veins clearly defined, blade usually rhombic or obovate ..... **1. L. squarrosa**
   6. Lateral veins indistinct, blade narrowly elliptic ..... **5. L. acuminata**
 4. Indumentum of lower leaf surface extending to the lateral veins (and sometimes to the whole lamina).
  7. Leaf with a long narrow apiculum; blade small (usually 7 by 2.5 cm) ..... **5. L. acuminata**
  7. Apiculum, if present, shorter; blade larger (usually more than 8 cm long).
   8. Leaf oblong, hairs mostly straight and often sparse ..... **6. L. montana**
   8. Leaf obovate, hairs crisped and usually copious ..... **7. L. beccariana**

1. Levieria squarrosa PERKINS, Bot. Jahrb. 52 (1915) 196; A.C. SMITH, J. Arn. Arb. 22 (1941) 232; PHILIPSON, Blumea 26 (1980) 377, f. 1, 8, 9, 14. — *L. parvifolia* A.C. SMITH, J. Arn. Arb. 22 (1941) 233. — *L. montana* (*non* BECC.) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 249, f. 2. — **Fig. 6.**

Sparsely branched shrub or small tree, occasionally to 18 m; stems more or less densely covered with minute hairs at least when young, often becoming glabrous. *Leaves* chartaceous, obovate, or rhombic, 3–12 by 1–4 cm, in two principal forms with intermediate states frequent: 1) apex rounded or subacute, margin entire, glabrous; 2) with an acute apiculum, upper part of margin dentate, midrib below with obscure minute appressed hairs (rarely with dense but very short crisped hairs); midrib prominent, lateral veins arched and meeting within the margin; petiole 4–8 mm long, glabrous or minutely hairy. Dioecious. — *Male inflorescence* either small lateral pleiochasia (up to *c.* 4 cm long) or terminal pleiochasia or panicles (up to *c.* 8 cm long); rachis and branches of panicles with a few pairs of pedicels (*c.* 8 mm long) and a terminal flower, minutely hairy, and with pairs of small lanceolate bracts below the pedicels and sometimes along the peduncle and rachis. — *Male flowers* more or less globose, 7 mm ø; receptacle small, bearing 8 tepals; 4 outer tepals rotund, subcoriaceous, with sparse hairs on the outer surface; 4 inner smaller, narrower, membranaceous, glabrous. *Stamens* numerous (*c.* 25 or more); connective acuminate; anthers subsessile, loculi lateral, separate. — *Female flowers* lateral or terminal, solitary or in few-flowered racemes (*c.* 4 cm long); receptacle coriaceous, broadly cupuliform (5–8 mm ø) with an irregularly cleft mouth (4 tepals may be more or less clearly defined); carpels numerous (*c.* 25 or more), *c.* 2 mm long, densely packed over the receptacle, obovoid, truncated distally and bearing a short style. *Drupes* numerous, ovoid, apex acute, glabrous, *c.* 9 by 5 mm when dry, sessile on a re-

curved leathery pilose receptacle.

Distr. *Malesia:* New Guinea (Vogelkop Peninsula to Owen Stanley Range).

Ecol. A laxly branched shrub in the undergrowth of rain-forest, sometimes semi-scandent, or a lower-storey tree up to 18 m high with rather dense leafy branches. Above 1800 m, ascending to 3000 m (rarely descending to 250 m). Montane and mossy forests of varying composition (*Podocarpus, Libocedrus, Nothofagus, Castanopsis*) and also in regrowth and marginal forest.

Vern. *Ang*, Hindenburg Ra., *eberak, mungomunk, tantan*, Mendi, *lekiem*, Kapauku, *kalipka, main-gobugont*, Minj, *kammakam, kamokam*, Enga, *kip, kunguma*, Togoba, *kolkola*, Eipomek, *kombo*, Onim, *timonksagu*, Wabag.

Notes. The bark is grey-brown, smooth with very shallow fissures; inner bark pinkish brown. The wood is heavy, light brown with wide, pale rays. Flowers yellowish green, drupes orange to reddish black on yellow receptacle.

The leaf shape is extremely variable, at first suggesting that two species are involved. Obtuse, entire, glabrous leaves occur in the eastern portion of New Guinea, whereas apiculate, dentate and obscurely tomentulose leaves occur towards the west. There is, however, a considerable area of overlap of the two forms (mainly between 144° E and 146° E) and in this region leaves with intermediate characters are abundant. Thus, although all specimens from the two ends of New Guinea are quite distinct in several characters, these two forms are connected by a broad zone in which it is impossible to separate them.

2. Levieria orientalis PHILIPSON, Blumea 26 (1980) 377, f. 2.

Tree to 10 m, shoots glabrous except for the youngest parts. *Leaves* glabrous, chartaceous, broadly elliptic or elliptic, *c.* 5 by 2.5 cm, broadly cuneate at the base, rounded apex produced in a short obtuse apiculum; margin with few widely spaced teeth; midrib prominent below; lateral veins rather obscure, arched and meeting within the margin; petiole 5–8 mm. Probably dioecious. Male flowers not seen. *Inflorescence* of terminal and lateral few-flowered cymes or flowers solitary. — *Female flowers* with a glabrous, coriaceous, globose receptacle, *c.* 3 mm ø, the ostiole small with obscure tepal-lobes; carpels *c.* 20, densely packed over the receptacle, ovoid with a short style. *Drupes* ovoid, *c.* 8 by 6 mm, sessile on a reflexed sparsely hairy receptacle.

Distr. *Malesia:* Papua New Guinea (Milne Bay Prov.: Goodenough I.).

Ecol. A much branched tree, 8–10 m, occurring at the edge of forest at 1500 m.

Note. Drupes black on a yellow receptacle. The glabrous, broad elliptic leaves suggest *L. nitens*, but are much smaller, and their short apiculum is obtuse.

3. Levieria nitens PERKINS in Perkins & Gilg, Pfl. R. Heft 4 (1901) 21, f. 3r–s; Pfl. R. Heft 49 (1911) 7, f. 3R–S; Bot. Jahrb. 52 (1915) 197, f. 3, 15; A.C. SMITH, J. Arn. Arb. 22 (1941) 232; PHILIPSON, Blumea 26 (1980) 379. — *Steganthera schlechteri* PERKINS, Pfl. R. Heft 49 (1911) 2 (*non L. schlechteri* PERKINS). — *L. rudolfii* PERKINS, Bot. Jahrb. 52 (1915) 196. — *Steganthera elliptica* A.C. SMITH, J. Arn. Arb. 22 (1941) 236.

Moderate to large tree, reaching 45 m; bole 25 m, buttressed, dbh 1 m, or a shrub sometimes with semi-scandent branches; young shoots with appressed, often golden hairs. *Leaves* glabrous, chartaceous, elliptic, broadly elliptic or oblong, 7–17 by 2.5–6 cm; base cuneate or attenuate; apex produced as an apiculum; margin entire or occasionally with a few small teeth; midrib prominent; lateral veins usually indistinct, arched and meeting within the margin; petiole 1–1.5 cm. Dioecious. *Inflorescence* of lateral or terminal pleiochasia or usually finely branched panicles, minutely hairy, *c.* 10–15 cm long; rachis bearing pairs or whorls of branches subtended by small bracts. — *Male flowers* globose, 3–4 mm ø; receptacle small; tepals 8, rounded; stamens numerous, connective projecting, anthers sessile. — *Female flowers* with a coriaceous cupuliform receptacle, *c.* 4 mm ø, with an irregularly cleft ostiole; carpels numerous, densely packed over the receptacle, ovoid with short style. *Drupes* numerous, ovoid, 8–10 by 4–5 mm (when dry), sessile on a leathery, pilose receptacle with a reflexed margin.

Distr. *Malesia:* New Guinea (Vogelkop Peninsula to Huon Peninsula and Tufi).

Ecol. A tree to 45 m, though normally smaller and even shrubby; the branches sometimes sprawling or semi-scandent. Montane and mossy forest, associated with *Nothofagus, Castanopsis, Lithocarpus, etc.*, also in regrowth and on scrubby slopes. Usually 500–1800 m, but occasionally descending almost to sea-level.

Notes. Bark smooth or becoming fissured, olive- or grey-brown; under bark pinkish. Wood soft, straw coloured, with large rays. Flowers greenish cream, drupes orange to black on yellow or orange receptacles.

The mature leaves are entirely glabrous, even at the base of the midrib, a character found in other *Levieria* species only in *L. orientalis* (which has smaller leaves and is confined to Goodenough I.) and in some specimens of *L. squarrosa* (which has leaves of a different shape). The lamina of *L. nitens* is broadly elliptic and apiculate, whereas that of *L. squarrosa* is narrowly obovate or elliptic and usually obtuse and not apiculate (in glabrous forms). Confusion is more

likely to occur between *L. nitens* and *L. montana*. In the latter species the leaf shape is often very similar to that of *L. nitens* and the inconspicuous hairs of the leaf may be confined to the underside of the midrib and may be largely lost by abrasion.

4. Levieria scandens PHILIPSON, Blumea 26 (1980) 381, f. 4, 10.

A woody liane, lateral shoots *c.* 1.5 mm ø, when young densely covered with minute appressed hairs. *Leaves* closely set along the branches; chartaceous, lanceolate to lanceolate-ovate, 2.5–3 by 0.8–1 cm, rounded or cuneate at the base, narrowed to a mucronulate apex; margin subrevolute with few irregular teeth; midrib prominent below, with a few obscure hairs on its lower part; lateral veins obscure; petiole *c.* 2 mm long, bearing minute hairs. Probably dioecious, female flowers not seen. *Inflorescence* usually of simple dichasia, minutely hairy, terminating the lateral branches and in their upper axils. — *Male flowers* globose, 2 mm ø (in bud); tepals 8, rounded, borne on a small receptacle; stamens *c.* 20, connective projecting, obtuse, anthers sessile.

Distr. *Malesia:* Papua New Guinea (West Sepik Prov., Telefomin Subprov.).

Ecol. Liane in montane forest, at 2100 m.

Note. The small lanceolate-ovate leaves are unmatched in any other species of the genus. Other species occasionally show straggling growth, but this species appears to be a true liane.

5. Levieria acuminata (F. v. M.) PERKINS, Bot. Jahrb. 25 (1898) 570; PHILIPSON, Blumea 26 (1980) 382, f. 5, 11. — *Mollinedia ? acuminata* F. v. M. Fragm. 5 (1866) 155.

Small tree to 15 m high; young shoots minutely pubescent. *Leaves* elliptic, *c.* 7–10 by 2–4 cm, membranous; base cuneate or attenuate; apex prolonged as a narrow acute apiculum; margin entire or with small teeth; midrib prominent; lateral veins indistinct, arched and meeting within the margin; midrib bearing inconspicuous hairs, or the whole lower surface finely tomentose; petiole 10–15 mm, usually glabrous. Dioecious. *Inflorescence* of terminal and axillary pleiochasia or panicles, the male being more finely branched and usually larger than the female, pubescent, rachis bearing pairs of small bracts. — *Male flowers* globose, 3–4 mm ø; tepals *c.* 8, the outer broad and rounded; stamens numerous (*c.* 20–40), crowded on a small receptacle, connective projecting, reflexed, obtuse, anthers sessile. — *Female flowers* with a coriaceous, globose receptacle, *c.* 3 mm ø, the ostiole with 4 irregularly cleft tepals; carpels numerous, densely packed over the receptacle, ovoid with a short style; drupes ovoid, sessile on a reflexed receptacle.

Distr. Australia (N. Queensland) and *Malesia:* Papua New Guinea (Central and Morobe Prov.).

Ecol. Small tree to 15 m, in primary rain-forest or second growth, 1200–3000 m, but descending to near sea-level in Queensland. The cream or greenish flowers are fragrant.

Note. This extension of the range of a Queensland species is based on five collections made by CARR in 1935–1936 and two collections by SCHODDE & CRAVEN in 1966. While some collections match Queensland specimens closely, others differ in the greater extent of the pubescence on the lower leaf surface.

6. Levieria montana BECC. Malesia 1 (1877) 193; PERKINS & GILG, Pfl. R. Heft 4 (1901) 21; PERKINS, *ibid.* Heft 49 (1911) 9; Bot. Jahrb. 52 (1915) 197; PHILIPSON, Blumea 26 (1980) 382, f. 6, 12. — *L. schlechteri* PERKINS, Pfl. R. Heft 49 (1911) 7. — *L. urophylla* PERKINS, Bot. Jahrb. 52 (1915) 93, f. 1. — *L. laxiflora* PERKINS, *l.c.* 195.

Shrub, sometimes semi-scandent, or small tree to 15 m high; young shoots densely covered with minute appressed hairs. *Leaves* membranaceous, broadly to narrowly oblong or elliptic, 4.5–13 by 1.5–6 cm; base acute or obtuse; apex narrowed more or less abruptly into an acute or obtuse apiculum; margin entire or occasionally with a few small teeth; midrib prominent; lateral veins arched and meeting within the margin; the midrib below bearing minute crisped or straight hairs, which usually extend on to the lateral veins and occasionally on to the entire lower surface of the lamina; petiole 6–14 mm. Dioecious. — *Male inflorescences* axillary and terminal, paniculate, 10–15 cm long, densely and minutely hairy; the rachis bearing pairs of pleiochasial branches subtended by small bracts. — *Male flowers* globose, 4–7 mm ø, receptacle small; tepals 7–8, outer rounded, subcoriaceous, hairy, inner smaller, membranaceous; stamens 25–50, connective projecting, anthers subsessile. — *Female inflorescence* similar to male or simple axillary and terminal racemes. — *Female flowers* with a coriaceous, globular, cupuliform receptacle, 5–8 mm ø, aperture irregularly cleft; carpels numerous, densely packed over the receptacle, ovoid with a short style. *Drupes* numerous, ovoid, 8 by 5 mm when dry, sessile on a leathery, pilose receptacle with a reflexed margin.

Distr. *Malesia:* Celebes, Moluccas (Ceram Ambon), New Guinea (Biak, Vogelkop, NW. Irian, Sepik Prov., Chimbu Prov., Finisterre Range, Huon Peninsula, Wagau-Garaina region of Morobe Prov.).

Ecol. A slender shrub, sometimes semi-scandent or epiphytic, or a small tree with drooping branches. In forest or scrub, often in lower montane rain-forest, 1200–1900 m, but in the western part of its range (NW. Irian, Biak, Moluccas) also near sea-level.

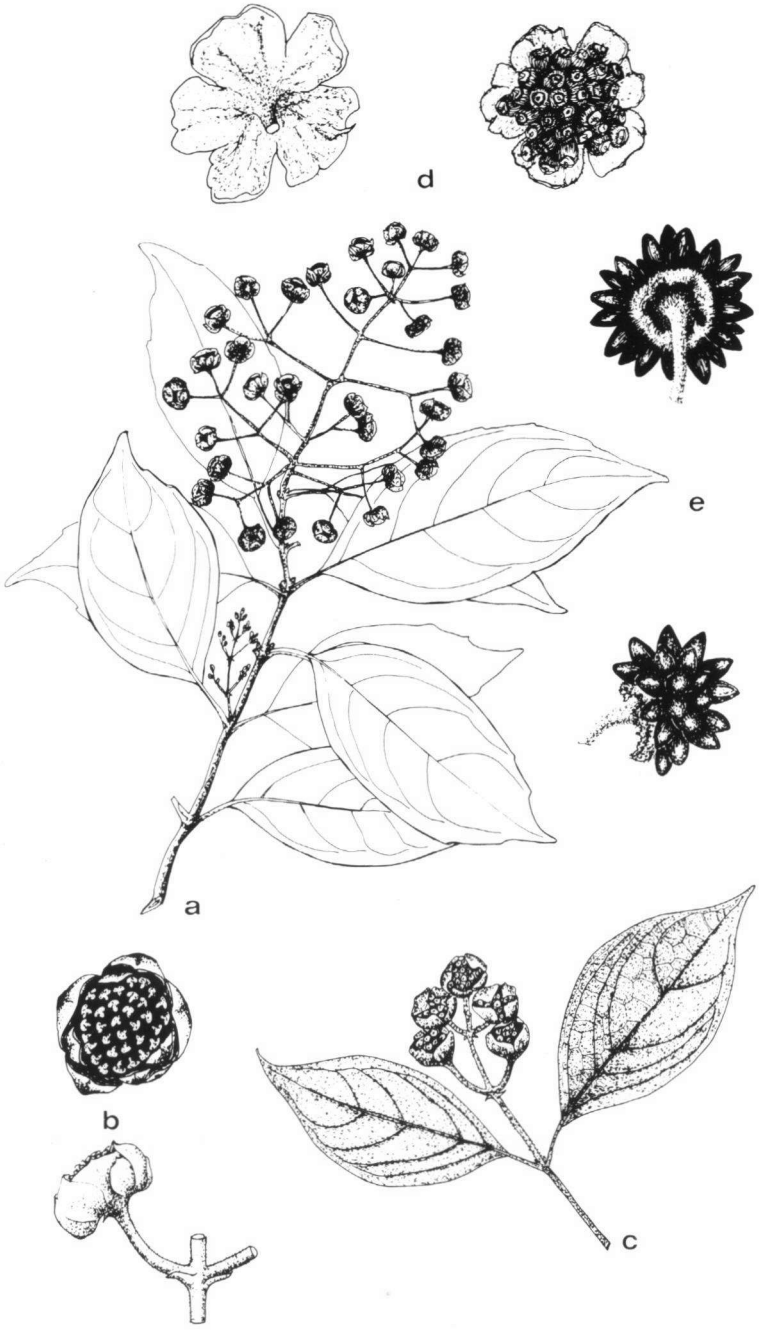


Fig. 7. *Levieria beccariana* PERKINS. *a.* Habit of male plant, ×1/2, *b.* male flower, from side, ×3, and from top, ×4, *c.* twig of female plant, ×1/2, *d.* female flowers after anthesis, ×1 1/4, *e.* fruits, from behind and side, nat. size (*a* FISHER 83, *b* PULLEN 7910, *c* NGF 23781, *d–e* FLOYD & HOOGLAND 3997).

Uses. In the southern foothills of the Finisterre Range shrubs are preserved by villagers because the conspicuous pendulous fruits attract birds which are then shot from cover.

Vern. *Dandanggu*, Naho lang., *hoppetu*, Wagu, *mardichber, mardieber, mardiewer*, Biak, *woisingai*, Wasuk.

Notes. The bark is smooth grey-brown or fawn. The flowers are light yellow and the mature drupes are bright orange or deep purple, borne on firm fleshy yellow or orange-brown receptacles. The leaf is characteristically oblong-elliptic and apiculate, with short crisped or appressed hairs along the lower surface of the midrib, and sometimes also on the lateral veins, or even on the lower surface of the lamina. The degree of hairiness is variable, being most strongly developed on the type from the Arfak Mts. Size of the lamina and the degree of dentation of its margin are also variable. Leaves of juvenile shrubs are larger, broader, thinner in texture, and more dentate than those of adults.

PERKINS (1915) did not have the type of *L. montana* BECC. available when describing *L. urophylla* and was herself doubtful of the distinctness of this species. Unaccountably, she regarded *L. montana* as glabrous, although the original description clearly refers to the indumentum of the lower surface of the leaf. There has been some confusion also concerning the use of the name *L. schlechteri* PERKINS. The type specimen is given as SCHLECHTER 17176, and is described as having glabrous leaves when mature. However, the labels of this number are named *L. laxiflora* PERKINS and the midribs bear minute hairs (in some specimens rather severely abraided). *Levieria schlechteri*, therefore, is here regarded as synonymous with *L. montana*.

7. Levieria beccariana PERKINS in Perkins & Gilg, Pfl. R. Heft 4 (1901) 21; *ibid.* Heft 49 (1911) 8, f. 3P–Q; Bot. Jahrb. 52 (1915) 193; PHILIPSON, Blumea 26 (1980) 383, f. 7, 13, 16. — *L. forbesii* PERKINS, Pfl. R. Heft 49 (1911) 7, f. 3L–O. — **Fig. 7, 8.**

Tree to 20 m, or shrub, sometimes semi-scandent; young shoots densely covered with minute hairs. *Leaves* chartaceous, broadly to narrowly obovate or elliptic, 6–15 by 2.6–7 cm; base cuneate; apex usually acute apiculate, sometimes obtuse; margin entire or occasionally dentate in its upper part; midrib prominent; lateral veins approaching the margin, the lower veins often ascending well beyond the middle

Fig. 8. *Levieria beccariana* PERKINS. In fruit. Papua New Guinea (Photogr. PHILIPSON).

of the blade; whole undersurface often russet or fawn, more or less densely covered in short curled or rarely lax hairs, or these confined to the principal veins; petiole 8–15 mm long, pubescent or glabrescent. Dioecious. *Inflorescence* of terminal and axillary panicles, those in the upper axils often combining to form a massive compound leafy panicle, the male rather more finely branched than the female; rachis bearing pairs of pleiochasial branches subtended by small bracts, tomentose. — *Male flowers* globose, 4–6 mm ø; receptacle small; tepals rounded; stamens numerous, connective projecting, anthers sessile. — *Female flowers* with a coriaceous cupuliform receptacle 5–8 mm ø, with 4 irregularly cleft tepals; carpels numerous (*c.* 20–100), densely packed over the receptacle, ovoid with a short style. *Drupes* numerous, ovoid, 8 by 5 mm when dry, sessile on a leathery pilose receptacle with a reflexed margin.

Distr. *Malesia:* Papua New Guinea (on the central ranges from the Telefomin area to Milne Bay). This species does not overlap the range of *L. montana* except in the Wagau-Garaina area.

Ecol. Tree to 20 m, with a clear bole 30 cm ø and pendulous branches, or a slender, sometimes semi-scandent shrub, occurring in montane and mossy forest of varying composition (*Nothofagus, Castanopsis, Araucaria*); also in regrowth, 1200–2800 m.

Vern. *Dangrumon*, Chimbu, *gokey*, Wagau, *homa*, Hademari, *kiangap, komali*, Enga, *kombo kombo*, Upper Kangel, *lupulupu*, Sirunki, *matammatam*, Managalese, *tangitang*, Tomba, *tsuk*, Porget, *umgude*, Oksapmin.

Notes. Bark smooth with very small fissures, greyish or reddish brown; inner bark pinkish, aromatic. Wood brittle, cream-brown, with prominent rays. Flowers greenish yellow, drupes orange to black on a yellow receptacle. The leaves are characteristically obovate with the lower veins ascending for much of the length of the lamina, but elliptical leaves and more spreading lateral veins are not infrequent. The midrib and lateral veins are usually densely clothed with minute crisped, often russet or fawn tomentum, and this frequently covers (if only sparsely) the whole lamina. These hairs may be short and crisp as in the type, or longer and more lax (as in the type of *L. forbesii*), but these differences are not considered of specific importance. One or two collections in which the tomentum is practically confined to the midrib approach rather closely to *L. montana* BECC. Since these specimens are from the region where the ranges of the two species meet (the Wagau-Garaina region of Morobe Prov.) it is probable that some admixture of the two species occurs there.

4. WILKIEA

F. v. M. Trans. Phil. Inst. Vict. 2 (1858) 64; PERKINS, Bot. Jahrb. 25 (1898) 569, t. 6D–E; PERKINS & GILG, Pfl. R. Heft 4 (1901) 57, f. 14–15; PERKINS, *ibid.* Heft 49 (1911) 26; Übersicht Gattungen Monim. (1925) 37; PHILIPSON, Blumea 26 (1980) 365, f. 1–5. — **Fig. 9.**

Shrubs or trees with opposite or verticillate, entire or serrate *leaves*. — *Male receptacle* ± globose with small tepals surrounding an ostiole; stamens up to *c.* 30 irregularly spaced over the receptacle; anthers with a single horizontal or horseshoe-shaped slit. — *Female receptacle* ± globose with tepals surrounding a small ostiole, thickened glands within the ostiole; carpels numerous (up to *c.* 100), sessile on the lower half of the receptacle, style subulate; upper half of the receptacle becoming detached by a circular scar. *Drupes* sessile or shortly stipitate.

Distr. Eastern Australia and *Malesia:* E. Papua New Guinea.

Ecol. In Malesia in montane rain-forest.

Note. One species occurs in Papua New Guinea, the genus otherwise being confined to Queensland and New South Wales. For separation of *Wilkiea* from *Kibara* see that genus.

1. Wilkiea foremanii PHILIPSON, Blumea 26 (1980) 365, f. 1–5. — **Fig. 9.**

Tree, densely hairy in all its parts. *Leaves* elliptic to elliptic-oblong, base rounded, apex rounded with an apiculum to attenuated, margin entire, midrib prominent, main lateral veins *c.* 4–6 pairs, arched-ascending; petiole 7–10 mm. *Flowers* axillary, singly or in few-flowered cymes; peduncles (or pedicels)

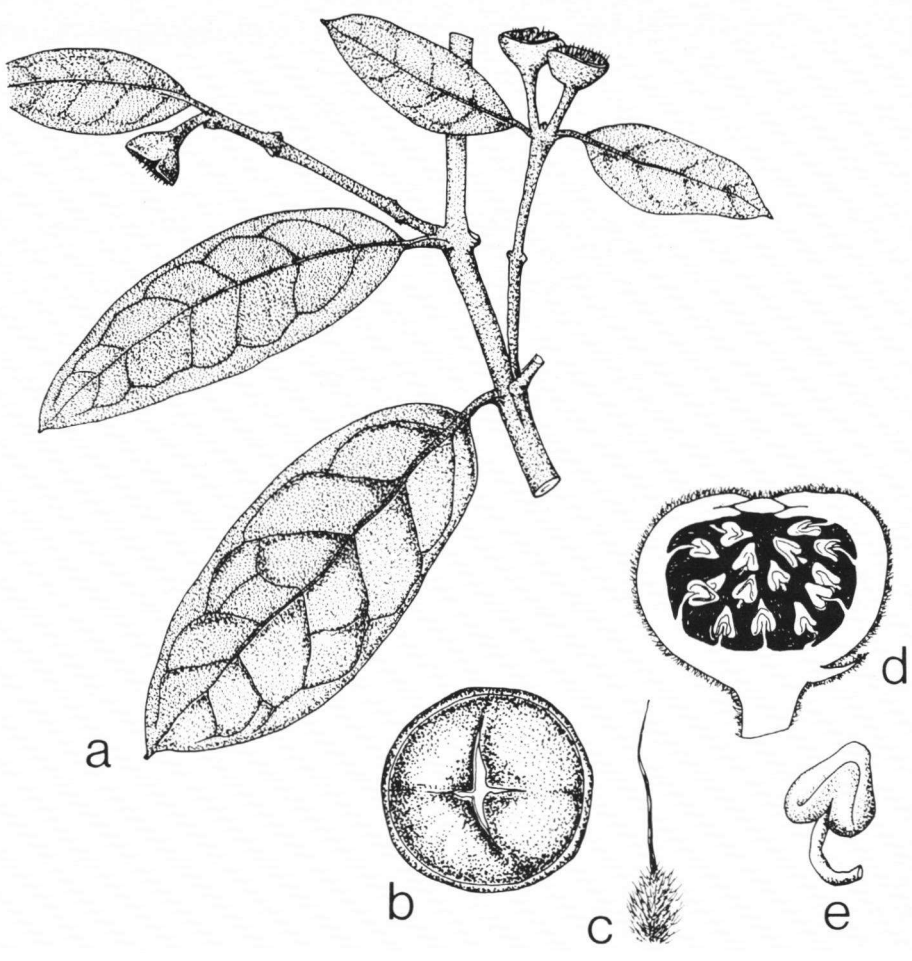


Fig. 9. *Wilkiea foremanii* PHILIPSON. *a.* Twig with female flowers, at time of abscission of calyptra, ×1/2, *b.* calyptra, seen from above, ×2, *c.* carpel with filiform style, ×5, *d.* male flower, in LS, after dehiscence of anthers, ×5, *e.* stamen, ×12 1/2 (*a–c* NGF 48404, *d–e* FRODIN 672).

stout, up to 4 cm long, often with the scars of two bracts below the flower. — *Male flowers* globose with an ostiole surrounded by 6 tepals (4+2), *c.* 7 mm ø at anthesis; stamens *c.* 18–30, inserted over the inner surface of the receptacle, filaments *c.* 1 mm long, anther triangular, *c.* 1 mm long. — *Female flowers* globose, *c.* 10–15 mm ø at anthesis, leathery, hairy within, tepals 4, the upper half of the receptacle becoming detached after anthesis by a circular scar; carpels numerous (*c.* 75–100), sessile on the lower half of the receptacle, 1.5 mm long, pubescent; style slender, 5 mm. Ripe *fruit* unknown.

Distr. *Malesia:* Papua New Guinea (Central Prov., Goilala Distr.).

Ecol. A small tree with light green, very hairy leaves (fulvous when dry), in mid-montane forest or regrowth, 2400–2600 m.

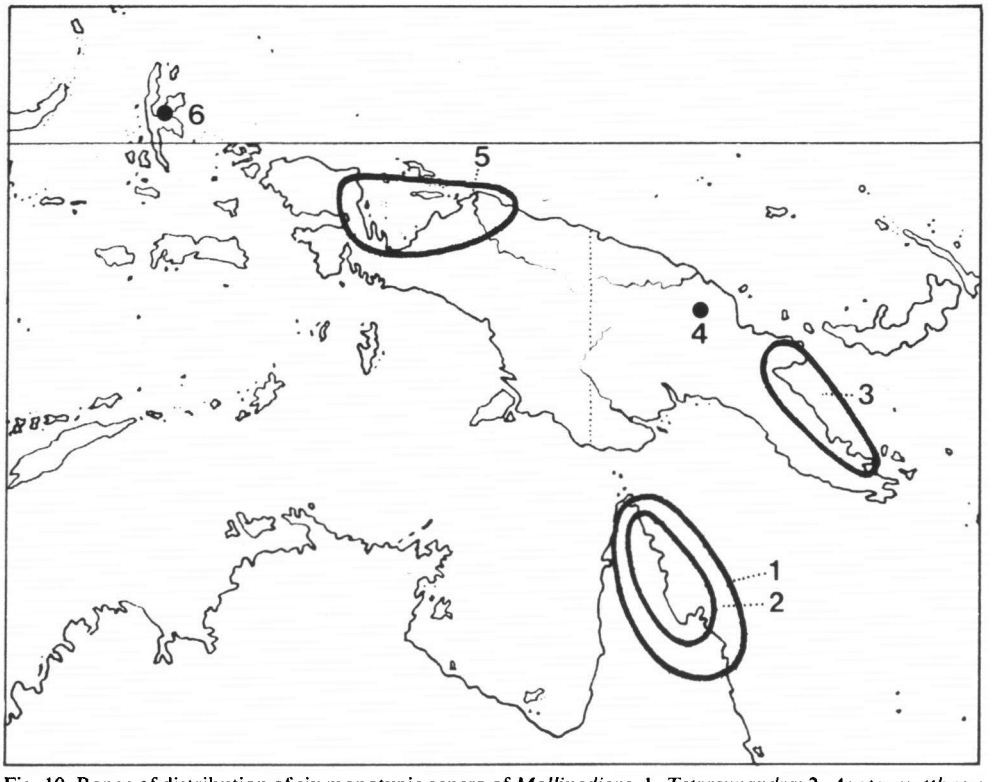


Fig. 10. Range of distribution of six monotypic genera of *Mollinedieae*. 1. *Tetrasynandra*; 2. *Austromatthaea*; 3. *Kairoa*; 4. *Lauterbachia*; 5. *Faika*; 6. *Parakibara*.

5. FAIKA

PHILIPSON, Blumea 30 (1985) 417, f. 1–2. — **Fig. 11, 12.**

Small tree with villose young branches and leaves. *Flowers* solitary in the leaf axils. ?Dioecious. — Receptacle of *male flower* ovoid, with a large ostiole surrounded by 3 decussate pairs of tepals. Stamens *c.* 24, inserted over the inner surface of the receptacle, anthers opening by two vertical slits; filament short. — Receptacle of *female flower* turbinate, with *c.* 5 decussate pairs of tepals (the inner swollen and glandular) and with 2–3 pairs of bracts at its base or on the lower outer surface, the upper part abscissing as a calyptra after anthesis, inner surface setulose. *Carpels* numerous, sessile, with a long subulate style stigma.

Distr. *Malesia:* W. New Guinea (Vogelkop Peninsula to the Cyclops Mts). Monotypic. Fig. 10.
Ecol. In rain-forest.

1. Faika villosa (KANEH. & HATUS.) PHILIPSON, Blumea 30 (1985) 420. — *Steganthera villosa* KANEH. & HATUS. Bot. Mag. Tokyo 50 (1942) 259, f. 7. — **Fig. 11, 12.**

Shrub or small tree, to 3 m; shoots densely villose. *Leaves* oblong-elliptic, 24–44 by 6.5–13 cm, chartaceous, base cordate, apex apiculate, acute, bristly along the veins and on both surfaces, but the upper surface becoming ± glabrous, except for the midrib; midrib, lateral veins and reticulation prominently

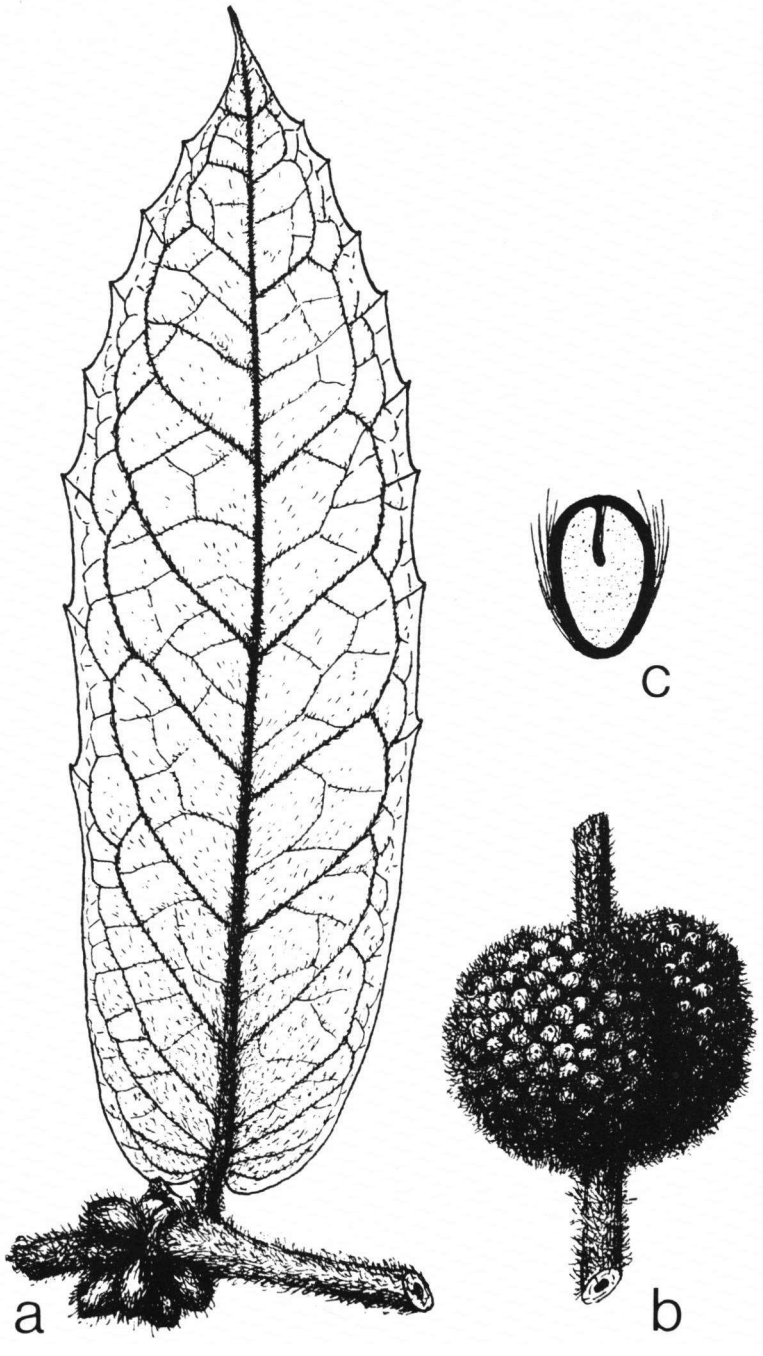


Fig. 11. *Faika villosa* (KANEH. & HATUS.) PHILIPSON. *a.* Habit, ×0.6, *b.* young infructescence, ×0.8, *c.* seed in LS, ×1.6 (KANEHIRA & HATUSIMA 13975).

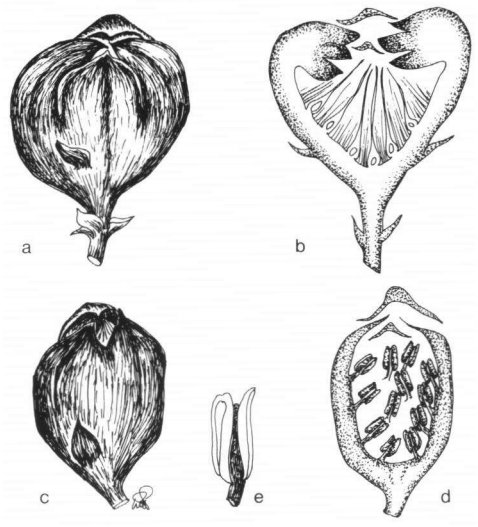


Fig. 12. *Faika villosa* (KANEH. & HATUS.) PHILIPSON. *a*. Female flower, *b*. the same in LS, *c*. male flower, *d*. the same in LS, all ×3 1/4, *e*. stamen, ×10 (*a*–*b* VAN ROYEN & SLEUMER 6082, *c*–*d* VAN ROYEN & SLEUMER 5729).

raised on the lower surface, impressed on the upper surface; petiole *c*. 5–6 mm, villose. *Inflorescence* axillary, flowers solitary, ± sessile. — *Male flowers* obovoid, *c*. 55 mm long, glabrous, with 1–2 small triangular bracts usually near the base; tepals 6, triangular; stamens numerous (*c*.24) distributed irregularly over the inner surface of the receptacle, filament terete, connective separating the two anthers; anthers *c*. 1 mm long, each locule opening by a vertical slit. — *Female flowers* turbinate, *c*. 7 by 8 mm, glabrous, with 2–3 pairs of small deltoid bracts at or above the base; tepals *c*. 5 decussate pairs, the inner 3 pairs swollen and glandular, the inner surface setulose; carpels numerous, *c*. 3 mm long, sessile, with a long subulate style and stigma. *Infructescence* to *c*. 3 cm ø, woody, setulose, margin revolute; drupes ovoid, *c*. 15 by 10 mm, sessile, hirsute.

Distr. *Malesia:* West New Guinea (Vogelkop Peninsula, Wandammen Peninsula, Hollandia, Cyclops Mts). Fig. 10.

Ecol. Undergrowth in primary rain-forest, 100–1250 m.

Note. The villose stems and leaves are conspicuous. The older branches are smooth with pale grey-brown bark. The male flowers are yellowish, the female flowers orange, and the ripe drupes black.

6. PARAKIBARA

PHILIPSON, Blumea 30 (1985) 421, f. 3. — **Fig. 13.**

Small tree with opposite dentate leaves. *Inflorescence* an axillary fascicle. ?Dioecious. — Receptacle of *male flowers* obovoid, tepals 4; stamens *c*. 18, in decussate pairs inserted near the base of the receptacle; anthers opening by a single slit. — *Female flowers* and fruits not known.

Distr. *Malesia:* Moluccas (Halmahera). Monotypic. Fig. 10.

Note. The precise relationships of this genus cannot be determined in the absence of female flowers, but it cannot be doubted that it is a member of the *Mollinedieae*. The large and numerous stamens arranged in four regular and closely packed files are very distinctive.

1. Parakibara clavigera PHILIPSON, Blumea 30 (1985) 421, f. 3. — **Fig. 13.**

Small tree, shoots glabrous when mature. *Leaves* oblong-elliptic, *c*. 180 by 80 mm, stiffly chartaceous, base broadly cuneate, apex obtuse or shortly apiculate, margin irregularly dentate in the upper part, midrib and lateral veins prominent; petiole 10–12 mm. ?Dioecious. *Inflorescence* axillary, a condensed cyme forming a fascicle of a few flowers arising from a short peduncle; peduncle 2–3 mm long, with closely imbricated bracts, sparsely pubescent; pedicels *c*. 20 mm long, slender below but thickening towards the flower, sparingly pubescent. — *Male flower* ovoid, *c*. 9.5 by 6 mm; tepals 4, obtuse; stamens 3 mm long, *c*. 18 in decussate pairs forming 4 rows inserted on the lower part of the receptacle, filaments broad and fleshy, *c*. 2 mm long, sparingly pubescent, anthers erect, *c*. 1 mm long, triangular, opening by a single Λ-shaped slit. *Female flower* and fruit not seen.

Distr. *Malesia:* Moluccas (Halmahera: Pasir Putih). Fig. 10.

Vern. *O morihuhaka.*

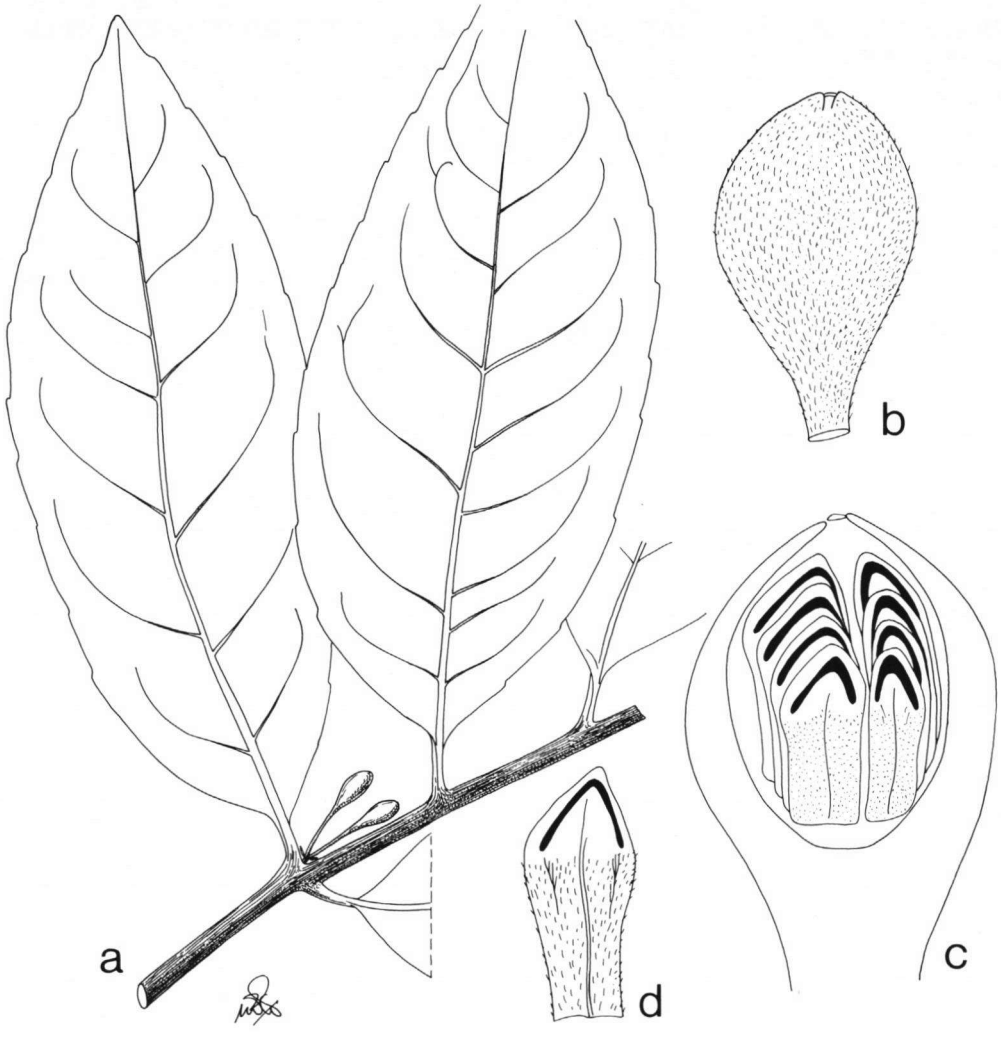


Fig. 13. *Parakibara clavigera* PHILIPSON. *a.* Twig with male inflorescence, ×1/2, *b.* male flower, ×4, *c.* the same in LS, ×5, *d.* stamen, ×8 (TAYLOR 2835 A).

7. KIBARA

ENDL. Gen. Pl. (1837) 314; PERKINS, Bot. Jahrb. 25 (1898) 570; Pfl. R. Heft 4 (1901) 58; *ibid.* Heft 49 (1911) 28; Bot. Jahrb. 52 (1915) 207; PHILIPSON, Blumea 30 (1985) 389, f. 1. — *Brongniartia* BL. Bijdr. 9 (1825) 423, *non* KUNTH. — *Sciadocarpus* HASSK. Flora 25, ii (1842) Beibl. 1: 20. — *Sarcodiscus* GRIFF. Notul. 4 (1854) 380. — **Fig. 14–16.**

Trees or shrubs, resting buds with cataphylls. *Leaves* usually pubescent at first, often becoming glabrous, entire or dentate, principal secondary veins

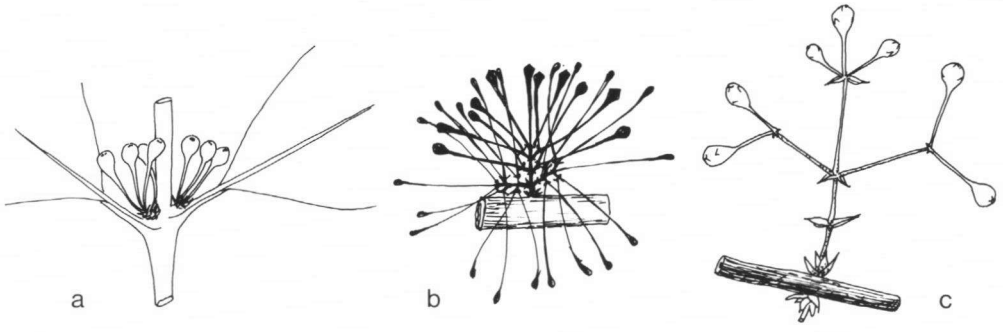


Fig. 14. Inflorescence types in *Kibara*. *a*. Fasciculate in *K. oblongata* PHILIPSON, *b*. condensed cyme in *K. moluccana* PERKINS, *c*. open paniculate cyme in *K. macrantha* PHILIPSON (*a* LAE 68853, *b* EYMA 2900, *c* HARTLEY 13691).

arched and meeting within the margin. Monoecious. *Inflorescence* lateral or terminal, cymose (racemose in *K. streimannii*), often pleiochasial, paniculate or fasciculate; pedicels usually thickening distally into the receptacle. — *Male flowers* usually smaller than the females, with a minute ostiole surrounded by 2–4 decussate pairs of tepals; androecium usually with 4 large outer stamens and up to 4 inner smaller stamens or staminodes which may be rudimentary and ± connate, occasionally 5 stamens in the outer whorl or as few as 2 stamens present; anthers opening by a single slit, with a filament or subsessile. — *Female flowers* with the ostiole surrounded by about 5 decussate pairs of tepals; the inner pairs thickened and glandular; the upper half of the receptacle abscissing as a calyptra after anthesis; carpels numerous, stigma obtuse sessile on the apex of the ovary. *Drupes* sessile or stipitate.

Distr. Peninsular Thailand and Nicobar Is. to Queensland; in *Malesia:* throughout the area. In all 43 *spp.*, of which 39 in Malesia.

Ecol. Mostly understorey shrubs and small trees in rain-forest from sea-level to *c.* 2800 m; occasionally on sandy or coral beaches.

Notes. *Kibara* is readily separated from *Steganthera* and *Matthaea* by the swollen glandular tissue which surrounds the inner rim of the ostiole (ENDRESS, Pl. Syst. Evol. 134, 1980, 79–120). *Wilkiea* has female receptacles very similar to those of *Kibara*, but these two genera can be distinguished by their male flowers. In most species the androecium of the two genera is distinctive: in *Kibara* there is a symmetrical group of four stamens (2 decussate pairs), within which there is unusually a group of up to four smaller stamens or often apparently infertile staminodes. In most *Wilkiea spp.* the numerous stamens (*c.* 8 or more) are inserted irregularly over the inner surface of the receptacle. Some species of *Kibara* occasionally may have 5 stamens in the outer group, or these may be reduced to 3 or even 2, in which case the inner reduced stamens are often absent. On the other hand, some individual flowers of *Wilkiea* have relatively few stamens (as few as 6 in *W. huegeliana* and as few as 4 in *W. macrophylla* (see ENDRESS, *l.c.*). In this event the genera are distinguished by the irregular insertion of the stamens in *Wilkiea* and the decussate arrangement in *Kibara*. The only species in which some doubt may occur is *K. rigidifolia* in which individual flowers with 3 or 5 stamens may not have them clearly arranged in a regular manner. When 6 stamens are present, the decussate arrangement is more definite. The nature of the stigma also serves to separate these two genera. In all species of *Kibara* the stigma forms an obtuse cushion or knob, whereas in *Wilkiea* it is more elongated and acute, being often subulate.

KEY TO THE SPECIES

In view of the large number of species, many incompletely known, and the paucity of well defined characters, it is recommended that more reliance than usual is placed on distribution when identifying specimens. Most species are local or regional, and while their ranges may not be fully known, they are unlikely to occur far from their known localities. It must also be borne in mind that several species are not included in this key because they are inadequately known. In addition to those listed at the end of the genus, 39. *K. symplocoides* is omitted from the key because the nature of its inflorescences is uncertain.

1. Leaves linear (leaf index 6) ..... **1. K. roemeri**
1. Leaves broader (leaf index less than 4).
2. Leaves shorter than 5 cm.
3. Leaves coriaceous, apex obtuse or retuse (Vogelkop Peninsula) ..... **2. K. oligocarpella**
3. Leaves membranaceous, tapering to a long apiculum (Sepik region) ..... **3. K. myrtoides**
2. Leaves longer than 5 cm.
4. Inflorescence shorter than, or little exceeding the petiole (*c.* 2 cm or less).
5. Stems greatly expanded at the nodes (usually inhabited by ants).
6. Leaves sessile, amplexicaul, margin strongly and sharply dentate (E. Papua New Guinea) **4. K. ferox**
6. Leaves petiolate, base cuneate or truncate, margin entire.
7. Leaves broadly ovate (Moluccas) ..... **5. K. latifolia**
7. Leaves elliptic-oblong (S. Papua New Guinea) ..... **6. K. archboldiana**
5. Stems not markedly expanded at the nodes.
8. Inflorescence pubescent (young shoots also pubescent and hairs ± persisting on mature foliage).
9. Leaves stiffly chartaceous, teeth sharply spinulose, often ± bullate (Western Highlands Prov.) **7. K. karengana**
9. Leaves softly chartaceous, dentations not spinulose.
10. Leaves bullate (Morobe Prov.) ..... **8. K. bullata**
10. Leaves flat.
11. Female receptacle and pedicel bearing several pairs of acute imbricating bracts (Moluccas) **9. K. kostermansii**
11. Female receptacle and pedicel without bracts (or at most small bracts widely spaced) (New Guinea).
12. Pubescence of fine, pale, appressed hairs (SE. Papua New Guinea) ..... **10. K. leachii**
12. Pubescence of loose, curled, brownish hairs (Vogelkop Peninsula) ..... **11. K. versteeghii**
8. Inflorescence and mature foliage glabrous (buds and young foliage sometimes pubescent).
13. Leaf blade larger than 10 cm.
14. Leaf margin entire (Normanby I.) ..... **12. K. oblongata**
14. Leaf margin dentate.
15. Leaf margin spinulose-dentate (Vogelkop Peninsula) ..... **13. K. warenensis**
15. Leaf margin serrate.
16. Leaf base tapering to the petiole, blade narrowly obovate (Rossel I.) ..... **14. K. rosselensis**
16. Leaf base broadly cuneate, blade oblong-elliptic (Vogelkop Peninsula) ..... **15. K. royenii**
13. Leaf blade shorter than 8 cm.
17. Leaf apex with a slender apiculum (Eastern Highlands Prov.) ..... **16. K. hartleyi**
17. Leaf apex acute or obtuse, without an apiculum (Mt Shungol, Morobe Prov.) **17. K. shungolensis**
4. Inflorescence considerably longer than the petiole (3 cm or usually much longer).
18. Inflorescence with the lateral branches crowded on a short peduncle ..... **18. K. moluccana**
18. Inflorescence a simple or branched cyme with evident internodes separating the branches.
19. Leaf blade small, membranaceous (usually under 10 by 3 cm). Inflorescence branches very slender (Torricelli Mts) ..... **19. K. microphylla**
19. Leaf blade larger (usually over 10 cm long, if not, then coriaceous).
20. Male flowers racemosely arranged along the inflorescence branches ..... **20. K. streimannii**
20. Male flowers cymosely arranged or solitary.
21. Flowers 6 mm long at anthesis or longer, densely pubescent (Eastern Highlands & Morobe Prov.) **21. K. macrantha**
21. Flowers less than 5 mm long (or if 6 mm, then glabrous).
22. Leaf margin dentate.

23. Stems greatly expanded at the nodes (usually inhabited by ants) (Central Prov.) **22. K. carrii**
23. Stems not markedly expanded at the nodes.
24. Dentations of leaf margin sharply spinulose ..... **23. K. elongata**
24. Dentations of leaf margin not spinulose.
25. Pedicels strong.
26. Underside of mature leaf pubescent. Inflorescence a few-flowered cyme (Southern Highlands & Milne Bay Prov.) ..... **24. K. katikii**
26. Underside of mature leaf glabrous or, if pubescent, inflorescence ± paniculate.
27. Leaf blade usually broadly elliptic-ovate, more than 10 cm long, rounded to broadly cuneate base. Pedicels rigid (throughout Malesia) ..... **25. K. coriacea**
27. Leaf blade usually elliptic, usually less than 10 cm long, base cuneate. Pedicels less rigid (SE. Papua New Guinea) ..... **26. K. papuana**
25. Pedicels delicate.
28. Inflorescence of simple pleiochasia. Outer stamens inserted at widest part of the receptacle (Star Mts, Telefomin region) ..... **27. K. nitens**
28. Inflorescence of paniculate cymes. Stamens inserted near base of the receptacle (NW. Irian Jaya) ..... **28. K. fragrans**
22. Leaf margin entire (occasionally some leaves with few teeth near apex).
29. Undersurface of mature leaf pubescent.
30. Pubescence on inflorescence soft, not closely appressed (Southern Highlands & Milne Bay Prov.) ..... **24. K. katikii**
30. Pubescence on inflorescence stiffly appressed.
31. Leaves acuminate, usually broadly elliptic (throughout Malesia) ..... **25. K. coriacea**
31. Leaves obtuse, usually narrowly elliptic (Sabah, Celebes, Philippines, Biak I.) **29. K. obtusa**
29. Undersurface of mature leaf glabrous.
32. Leaves stiffly coriaceous, broadly elliptic to subrotund (New Guinea highlands) **30. K. laurifolia**
32. Leaves not as above.
33. Inflorescence pubescent.
34. Leaves acuminate, usually broadly elliptic (throughout Malesia) ..... **25. K. coriacea**
34. Leaves obtuse, usually narrowly elliptic (Sabah, Celebes, Philippines, Biak I.) **29. K. obtusa**
33. Inflorescence glabrous (young inflorescence ± setulose in *K. sleumeri*).
35. Pedicels of male flowers elongated (20–45 mm).
36. Male flowers in separate inflorescences (Irian Jaya)..... **31. K. flagelliformis**
36. Male flowers on lower branches of inflorescences.
37. Leaf narrowly elliptic (Chimbu Prov.) ..... **32. K. chimbuensis**
37. Leaf broadly elliptic or elliptic (Morobe & Central Prov.)..... **33. K. fugax**
35. Pedicels of male flowers shorter than 20 mm.
38. Pedicels of female flowers noticeable thickened for *c.* 10 mm below the receptacle (New Britain, New Ireland) ..... **34. K. novobritanica**
38. Pedicels of female flowers not strikingly thickened.
39. Male receptacle 4–6 mm long; anthers kidney-shaped. Leaf rigidly coriaceous.
40. Leaf oblong, apex rounded or retuse with a minute mucro, often 3-whorled (Western Prov., also in Queensland) ..... **35. K. rigidifolia**
40. Leaf narrowly elliptic, apiculate, opposite (Sudest I.) ..... **36. K. sudestensis**
39. Male receptacle 1.5–2.5 mm long; anthers triangular. Leaf not rigidly coriaceous.
41. Leaves oblong, apex and base rounded (Vogelkop Peninsula) ..... **37. K. sleumeri**
41. Leaves elliptic.
42. Leaves membranaceous (Sepik region) ..... **38. K. monticola**
42. Leaves firmly herbaceous or chartaceous (SE. Papua New Guinea) . **26. K. papuana**

1. Kibara roemeri (PERKINS) PERKINS, Bot. Jahrb. 52 (1915) 212; PHILIPSON, Blumea 30 (1985) 394. — *Matthaea roemeri* PERKINS, Pfl. R. Heft 49 (1911) 17.

A small tree, glabrous in all its parts. *Leaves* lanceolate or obovate-lanceolate, up to 25 by 4.2 cm, chartaceous, base broadly cuneate, apex apiculate, margin minutely dentate, midrib evident, lateral veins numerous and connected by a well-defined reticulation of minor veins, glabrous; petiole *c.* 5–10 mm, 2.5 mm wide, channelled above. *Inflorescence* and flowers unknown. *Drupes* narrowly ovoid, *c.* 16 by 7 mm, shortly stipitate.

Distr. *Malesia:* SW. Irian Jaya, ?Misool.

Ecol. Forest, 750 m.

Note. The stiff, lanceolate leaves, with sharply toothed margin are characteristic. A second collection consisting of a leafy shoot only, may belong to this species. It was made by TEIJSMANN in Mysool I.

2. Kibara oligocarpella (KANEH. & HATUS.) PHILIPSON, Blumea 30 (1985) 394. — *Steganthera oligocarpella* KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 257, f. 6.

Shrub to 1.8 m. *Leaves* oblong-elliptic to narrowly obovate, up to 3.3 by 1.5 cm, firmly coriaceous, base cuneate, apex obtuse or retuse, entire, midrib prominent, reticulation of veins evident below, glabrous; petiole to 4 mm. Monoecious. *Inflorescence* axillary or supra-axillary; flowers in simple cymes or solitary. — *Male flowers* ovoid, *c.* 2.5 mm long, pedicel 6–7 mm long; tepals 4, stamens 3–4. — *Female flowers* ± globose, *c.* 3 mm long; 4 tepals around the minute ostiole, several irregularly swollen pairs within; carpels 4–10, stigma obtuse. *Drupes* ovoid, *c.* 15 by 11 mm.

Distr. *Malesia:* West New Guinea (Vogelkop Peninsula, Arfak Mts, Angi Lakes).

Ecol. Open scrub (*Tristaniopsis, Dacrydium*), at *c.* 2400 m.

Note. The small, close-set, thick-leathery leaves (which dry a dark brown) are quite unlike any other species. The flowers are yellowish brown, and the ripe achenes black on a reddish brown receptacle. KANEHIRA & HATUSIMA attributed their material to *Kibara* on their herbarium labels, but published the species as a *Steganthera*. The material collected by SLEUMER & VINK, with female flowers, removes any doubt about this species being a *Kibara*.

3. Kibara myrtoides PERKINS, Bot. Jahrb. 52 (1915) 208; PHILIPSON, Blumea 30 (1985) 395.

Shrub to 2 m; young branches slender, with appressed tomentum. *Leaves* elliptic, 4–5 by 1.3–2.2 cm, membranaceous, base cuneate, apex long-acuminate, entire, midrib prominent, veins obscure, becoming glabrous except for the midrib below; petiole 3–5 mm long, pubescent, channelled above. *Inflorescence* axillary, in dichasia or solitary, pubescent. — *Male flowers* cupuliform, 2.5 mm ø, pedicel 3–5 mm, pubescent outside, glabrous within; tepals 6, ovate; stamens 2, subsessile. — *Female flowers* solitary, arising above the axils, pedicel 10–15 mm, pubescent. Receptacle woody with very short stipes. *Drupes* ovoid, 20 by 12.5 mm.

Distr. *Malesia:* Papua New Guinea (Sepik region). Only known from type.

Ecol. Montane forest, in scrub with few large trees, 1400–1500 m. *Fl. fr.* August.

Note. The specimen available to me lacks flowers so that the parts of the above account are derived from the original description. Since the androecium is so reduced and details of the female flower are not given, the assignment to *Kibara* must remain tentative. The foliage is quite unlike any other species.

4. Kibara ferox PHILIPSON, Blumea 30 (1985) 395. — **Fig. 15.**

Shrub or treelet to 3 m, glabrous, the nodes dilated with pores inhabited by ants. *Leaves* sessile, broadly cordate to oblong, up to 30 by 23 cm, coriaceous, the base amplexicaul, apex narrowing to a short or long apiculum, margin with small or coarse sharp dentations (the upper leaves and those of juvenile plants narrower and more dentate), veins and reticulations very prominent on the underside. ?Monoecious. *Inflorescence* of axillary fascicles (or rarely supra-axillary) borne on a very short bracteate peduncle; pedicels up to *c.* 10 mm, slender in male gradually widening into the flower, female thicker, becoming woody in fruit. — *Male flower* ovoid, 2 by 1.5 mm, 3 pairs of tepals; stamens *c.* 5, subsessile; anther broadly triangular with a single horseshoe-shaped opening. — *Female flower* globose, 4.5 by 4.5 mm, ostiole surrounded by 2 pairs of obscure tepals (additional pairs probably within the ostiole); upper part of the receptacular chamber with very thick irregular glands; carpels numerous, glabrous; stigma short, obtuse. *Drupes* sessile ovoid, *c.* 15 by 10 mm, verruculose when dry.

Distr. *Malesia:* Papua New Guinea (Madang Prov.; Ramu Distr.; Eastern Highlands Prov.: Kainantu Distr.; Morobe Prov.: Mumeng Distr., Wau Distr.; Central Prov.: Port Moresby Distr.).

Ecol. Lowland and lower montane rain-forest, 500–1550 m.

Vern. *Daraboro* (Madang Distr., Domainde).

Note. The sessile, cordate, coriaceous leaves are unlike those of any other species. The leaves on lower thicker branches are very broad and cordate, while those on the more slender branches are oblong. Juvenile plants have smaller, narrower and more dentate leaves. Swollen nodes with pores used by small black ants are also found in *K. carrii, K. latifolia* and *K. archboldiana*, and resemble those of some species of *Steganthera*. The flowers are yellowish green or pinkish. The drupes are black on an orange torus. The outer bark is light grey-green to brown, rough with vertical fissures.

5. Kibara latifolia PHILIPSON, Blumea 30 (1985) 396.

Shrub 1.5 m high, glabrous, with the branches prominently dilated at the nodes. *Leaves* broadly ovate to subrotund, 20–30 by 13–24 cm, chartaceous to coriaceous, base broadly cuneate to truncate, apex obtuse, entire, principal veins widely spaced, channelled above, prominent below, arched

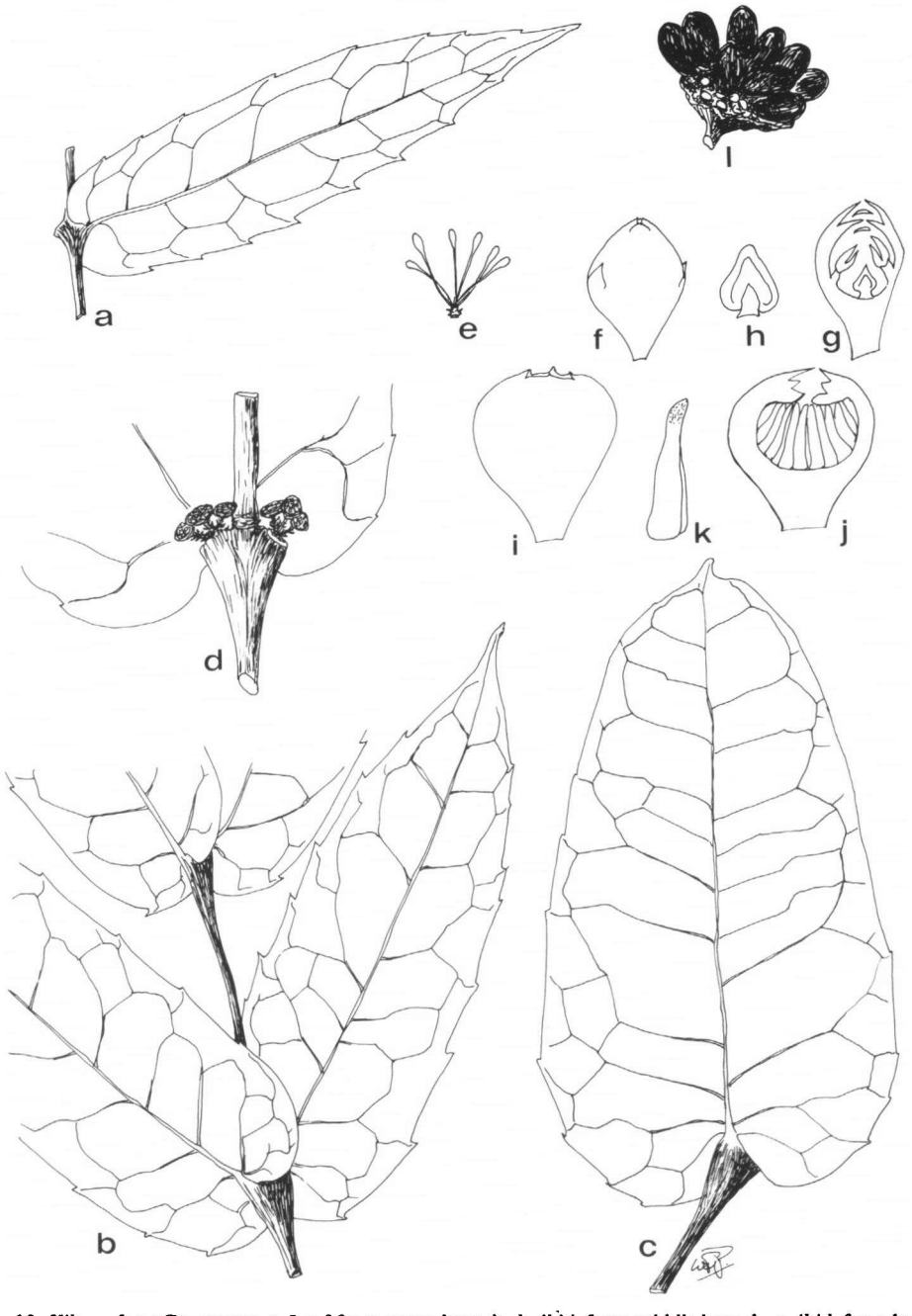


Fig. 15. *Kibara ferox* PHILIPSON. *a.* Leaf from upper branch, *b. ibid.* from middle branch, *c. ibid.* from lower branch, all ×1/2, *d.* axillary fascicles of female flowers after anthesis, *e.* male inflorescence, both nat. size, *f.* male flower, *g.* the same in LS, both ×7 1/2, *h.* stamen, ×15, *i.* female flower, *j.* the same in LS, both ×4, *k.* carpel, ×7 1/2, *l.* fruit, ×1/2 (*a–d, i–l* PHILIPSON & KAIRO 3640, *e–k* LAE 61573).

and meeting inside the margin, glabrous; petiole 12–18 mm long, deeply channelled above. *Flowers* not seen. *Infructescence* lateral, a subsessile umbel or compact cyme, peduncle stout, *c.* 2 mm long, branches (pedicels) *c.* 15 mm long; receptacle leathery, *c.* 10–13 mm ø, with *c.* 12–16 short thick stipes. *Drupes* ovoid, *c.* 10–12 by 6–8 mm.

Distr. *Malesia:* Moluccas (Halmahera & Obi Is.). Two collections.

Ecol. In dense, low forest with little undergrowth at 15 m.

Note. Known from only two gatherings, neither with flowers. However, the broad leaves, swollen nodes, and the small infructescences are distinctive.

6. Kibara archboldiana A.C. SMITH, J. Arn. Arb. 22 (1941) 231; PHILIPSON, Blumea 30 (1985) 396.

Shrub to 4 m, with glabrous branches conspicuously swollen at the nodes. *Leaves* elliptic or elliptic-oblong, 15–36 by 6–14 cm, chartaceous, base broadly cuneate or rounded, apex with a slender apiculum 1–2 cm long, entire, midrib and principal veins conspicuous below, arched ascending and uniting within the margin, glabrous or ± ephemeral minute pubescence on young foliage; petiole 5–25 mm, stout channelled above. Monoecious. — *Male inflorescence* axillary or supra-axillary, a few-flowered compact cyme or subfasciculate, *c.* 8 mm long, minutely puberulous, with small bracts; pedicel slender, *c.* 3–6 mm long, bracteolate. — *Male flowers* subglobose, 2–4 mm ø; tepals 6, obtuse; stamens 6, the innermost 2 smaller. — *Female flowers* not seen. Old *infructescence* thickened and woody below the fruits; receptacle leathery 8–12 mm ø, stipes short (1–3 mm). *Drupes* ovoid or narrowly ovoid-oblong, 16–23 by 8–10 mm.

Distr. *Malesia:* Papua New Guinea (Western, Gulf & Central Prov.).

Ecol. In rain-forest from near sea-level to 500 m.

Vern. *Hooanu*, Uraru lang.

Note. The two original collections agree in all respects. The only other collection (CONN *et al.* LAE 66299) has very similar foliage, but has broadly ovoid achenes instead of the very characteristic elongate fruit of the type, and apparently lacks the swollen nodes.

7. Kibara karengana PHILIPSON, Blumea 30 (1985) 396.

Scandent shrub or small tree to 6 m high, glabrous or with small brown strigose hairs on young parts, sometimes persisting on the petiole and underside of the midrib. *Leaves* ovate to oblong, 9–22 by 4–10 cm, stiffly chartaceous, often more or less bullate, base broadly cuneate, rounded or subcordate, apex shortly apiculate, margin with small or coarse indurated, sharp dentations, midrib, lateral veins and reticulation of minor veins prominent below; petiole channelled above, to *c.* 8 mm long. Monoecious. *Inflorescences* axillary or supra-axillary, male and female flowers in separate inflorescences; simple triads or a small cymose panicle, 10–20 mm long, peduncle *c.* 2 mm long with minute bracts; *female* a few-flowered fascicle, pedicels becoming woody in fruit and elongating to 20–30 mm. — *Male receptacle* ovoid, 3 by 2.5 mm, tepals in 4 pairs; stamens 4–6, subsessile, anthers broadly triangular with a single horseshoe-shaped opening. — *Female receptacle* ovoid, 5 by 4 mm, sometimes pubescent, ostiole surrounded by minute tepals and bearing within large pendulous glands; carpels *c.* 12–18, pubescent with short obtuse stigma. Fruiting receptacle leathery, *c.* 10 mm ø. *Drupes* ± sessile, ovoid, *c.* 14 by 10 mm, surface (when dry) verruculose.

Distr. *Malesia:* Papua New Guinea (Western, Eastern & Southern Highland Provinces).

Ecol. Lower montane and mossy forest (*Nothofagus, Podocarpus, Pandanus*) and at forest/burnt grassland margin, between 2500–3000 m.

Uses. In the Minj District the plant is considered to be a male sex stimulant.

Vern. *Gegnikl, kong-ambugont*, Minj, *ogumbwarombigl*, Hagen.

Note. The ripe drupes are shining black borne on an orange receptacle.

8. Kibara bullata PHILIPSON, Blumea 30 (1985) 347.

Shrub to 2.5 m; young branches finely and densely pubescent. *Leaves* elliptic to elliptic-oblong, up to 17 by 8 cm, chartaceous, base broadly cuneate, apex long acuminate, margin dentate, midrib, lateral veins and reticulation prominent below, the upper surface raised between the veins (bullate), the pubescence persisting on the lower surface especially on the midrib and veins but disappearing from the upper surface; petiole *c.* 10–12 mm, channelled above, pubescent. Monoecious. *Inflorescences* axillary or supra-axillary, of short few-flowered fascicles; pedicel 2–4 mm long, densely pubescent. — *Male flowers* ovoid, 1.5 mm long, pubescent on the outer surface; 4 pairs of tepals; stamens 4 in the outer whorl 0.75 mm long, with 2 smaller central stamens; filament as broad as the anther, short and pubescent. — *Female flowers* similar to male but stouter, *c.* 2 mm long; tepals surrounding the ostiole minute, with large pendulous glands within; inner surface of the receptacle with hairs between the carpels; carpels *c.* 10, ovary pubescent, 0.8 mm long, stigma obtuse. Fruiting receptacle ± sessile (peduncle undeveloped) with long radiating stipes (receptacle *c.* 6 mm ø, stipes *c.* 4–8 mm long). *Drupes* ovoid, *c.* 18 by 10 mm.

Distr. *Malesia:* Papua New Guinea (Morobe Prov.).

Ecol. Rain-forest (*Anisoptera* and *Castanopsis*), 500–1000 m.

Note. The slightly bullate, pubescent leaves with a serrate margin, combined with a fasciculate inflorescence and sessile fruiting receptacles are distinctive. The black drupes are borne on an orange receptacle. Collected only twice. The specimen from Garaina has less dentate leaf margins and shorter thicker stipes below the achenes but agrees with the type in other respects.

9. Kibara kostermansii PHILIPSON, Blumea 30 (1985) 398.

Shrub to 4 m; young branches covered with strigose tomentum. *Leaves* elliptic to obovate (occasionally lanceolate), 14–22 by (3–)5–8(–10) cm, chartaceous, base cuneate or rounded, apex with an apiculum, margin dentate (at least in most leaves) with short, crisp hairs on the midrib, principal veins, and often ± sparsely over the whole lower surface; petiole *c.* 10–14 mm, deeply channelled above. ?Monoecious. *Inflorescences* axillary, supra-axillary or terminal; male and female flowers in separate inflorescences. — *Male inflorescence* a few-flowered cyme, *c.* 10 mm long, hispid; peduncle 2 mm long bearing minute bracts and lateral branches (pedicels) subtended by bracts. — *Female flowers* solitary, borne on a short (2 mm long) bracteate peduncle (pedicel). — *Male flowers* obovoid, *c.* 2 mm long, receptacle hispid on the outer surface and bearing a pair of rounded bracts (? tepals), ostiole minute, surrounded by *c.* 3 pairs of tepals; stamens 4, anthers broadly triangular, subsessile. — *Female receptacle* hispid on the outer surface and bearing *c.* 2 pairs of acute ovate bracts, ostiole surrounded by 3–4 pairs of decussate rounded tepals, with large pendulous glands within the ostiole, inner surface of receptacle hispid, ovules with a blunt peg-like stigma. Pedicels becoming woody and longer in fruit (up to 15 mm); receptacle becoming woody, to 20 mm ø, including the stout stipes. *Drupes* ovoid or ellipsoid, *c.* 15 by 10 mm.

Distr. *Malesia:* Moluccas (Halmahera, Batjan, Morotai).

Ecol. Primary forest, often at sea-level on limestone but reaching up to 500 m.

Vern. *Wajoka gogumini*, Halmahera, Tobelo dial.

Note. The pubescent dentate leaves and the small inflorescences are characteristic. Acute bracts like those on the pedicel and receptacle of the female flowers have not been seen on any other species. The ripe fruits are blue-black, borne on an orange or red receptacle.

10. Kibara leachii PHILIPSON, Blumea 30 (1985) 399.

Shrub or small tree, to 6.5 m; young branches, buds and young foliage covered in strigose hairs. *Leaves* elliptic or narrowly elliptic, 14 by 5.5 cm, thinly chartaceous, base narrowly or broadly cuneate, apex with a short obtuse apiculum, or tapered to a long acute apiculum, margin finely or more coarsely dentate, midrib prominent below, lateral veins arched and uniting within the margin, traces of the tomentum persisting on the mature leaves, especially on the midrib below, or the blade more or less glabrous; petiole *c.* 5–10 mm, channelled above, strigose. Monoecious. *Inflorescences* terminal, axillary or supra-axillary, of compacted dichasia (fascicles) or with the peduncle evident, *c.* 10–20 mm long, strigose and bracteate. — *Male flowers* ovoid, 3 pairs of rounded tepals; 4 stamens in the outer whorl, 0–3 in the inner whorl. — *Female flowers* not seen. Peduncle below fruit remaining short or elongating slightly (to *c.* 10 mm), pedicel may also elongate under fruiting receptacle; receptacle becoming woody, *c.* 5 mm ø (without stipes), stipes short (up to *c.* 2 mm long), strigose or glabrous. *Drupes* ovoid, 18 by 13 mm.

Distr. *Malesia:* Papua New Guinea (Central, Northern & Milne Bay Provinces).

Ecol. Lowland rain-forest and lower montane forest, 390–1370 m.

Note. The thinly chartaceous dentate leaves with compact inflorescences are distinctive. Most gatherings have narrower leaves than the type (chosen because in flower) with long narrow apicula.

11. Kibara versteeghii PHILIPSON, Blumea 30 (1985) 399.

Shrub to 5 m, young branches with dense crisp brown tomentum. *Leaves* elliptic, 11 by 3.8 cm, chartaceous, base cuneate, apex narrowed into an obscure apiculum, margin dentate, midrib and veins prominent below, lateral veins few, strongly arched and meeting within the margin, upper surface becoming ± glabrous, lower surface retaining the crisp tomentum; petiole *c.* 10 mm, densely tomentose. Monoecious. *Inflorescence* axillary or terminal, of solitary flowers, fascicles, or short pleiochasia, pubescent in all parts. — *Male flowers* ovoid, 1.5 mm long, strigose on the outer surface; 3 pairs of rounded tepals; stamens 2 with 1 central staminode (only 2 flowers dissected); anther with a single horizontal opening; filament short, strigose. — *Female flowers* ovoid, 2.7 mm long, densely strigose on the outer surface and with hairs on the inner surface between the carpels, *c.* 4 pairs of tepals and prominent pendulous glandular swellings within the ostiole; carpels *c.* 12–15, ovary pubescent, stigma blunt. *Fruits* not seen.

Distr. *Malesia:* West New Guinea (Vogelkop Peninsula).

Ecol. Rather common shrub in *Nothofagus* forest and in old secondary forest, 1640–1950 m.

Note. The small, dentate, pubescent leaves are distinctive. The young leaves are described as brownish purple above and light red below. The dried leaves are a dull dark brown. The flowers are yellow.

12. Kibara oblongata PHILIPSON, Blumea 30 (1985) 400, f. 1a. — **Fig. 14a.**

Small tree, *c.* 5 m high, glabrous in all its parts. *Leaves* oblong, up to 31 by 12 cm, coriaceous or chartaceous, base broadly cuneate, apex obtuse to slightly retuse, margin entire, midrib prominent, lateral veins connected within the margin; petiole 15–20 mm, 4 mm wide, channelled above. ? Monoecious. *Inflorescences* axillary, fasciculate, pedicels *c.* 10 mm, wider towards the top; male flowers not seen. — *Female flowers* globose, *c.* 4 mm ø, ostiole surrounded by *c.* 3 pairs of rounded tepals and with swollen glands within; carpels *c.* 20, with a short obtuse stigma. Fruiting receptacle enlarged and woody, *c.* 15–20 mm ø, with short stout stipes 2–3 mm long. *Drupes* ovoid, 14 by 10 mm (? fully developed).

Distr. *Malesia:* Papua New Guinea (Morobe Prov.; Lae Distr.; Milne Bay Prov.; Esa'ala Distr., incl. Normanby I.).

Ecol. Lowland rain-forest, from sea-level to *c.* 65 m.

Note. The large glabrous oblong leaves resemble those of *K. moluccana* but the inflorescence is distinct. Two collections have been made on Normanby I., a third collection from north of Lae appears to be identical.

13. Kibara warenensis KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 249, f. 1; PHILIPSON, Blumea 30 (1985) 401.

Shrub to 2 m, glabrous. *Leaves* oblong or oblanceolate-oblong, 18–27 by 5.2–8.2 cm, coriaceous, base rounded to broadly cuneate, apex shortly acuminate or acute, margin spinulose dentate, midrib, lateral nerves and reticulation prominent below; petiole *c.* 10 mm. Monoecious. *Inflorescences* axillary, of compact fasciculate cymes, glabrous, *c.* 10 mm long. — *Male flowers* with pedicels *c.* 6–10 mm long, thicker distally; receptacle *c.* 1.8 mm long; tepals 6, minute; stamens 6, *c.* 1 mm long. — *Female flowers* not seen. *Drupes* ovoid, sessile on a woody receptacle, *c.* 20 mm ø.

Distr. *Malesia:* West New Guinea (Vogelkop Peninsula).

Ecol. Lowland rain-forest at *c.* 100 m.

Note. The glabrous fasciculate inflorescence combined with the spinulose dentate leaves are distinctive.

14. Kibara rosselensis PHILIPSON, Blumea 30 (1985) 401.

Small tree, 4 m; young branches finely pubescent. *Leaves* narrowly obovate, 10–15 by 3–4.5 cm, subchartaceous, base narrowly cuneate, apex apiculate, margin dentate, midrib prominent below, lateral veins *c.* 7–9 pairs, arched ascending, glabrous at maturity; petioles to 15 mm long, channelled above. Monoecious. *Inflorescences* fasciculate (compacted cymes) *c.* 10–14 mm long, with small bracts around the peduncle and the bases of the pedicels; pedicels and usually the receptacle also bearing minute bracts. — *Male receptacle* subglobose, narrowed into the pedicel, *c.* 3 mm ø; tepals in 3 pairs; stamens 4 in outer whorl, *c.* 3 in inner whorl. — *Female receptacle* similar, *c.* 4 mm ø, ostiole surrounded by *c.* 3 pairs of tepals and bearing within large pendulous glands; carpels *c.* 18. *Drupes* not seen, but described by the collector as ovoid, 20 by 16 mm.

Distr. *Malesia:* Papua New Guinea (Milne Bay Prov.).

Ecol. Low forest on ridge crest, 700 m.

Note. Male and female flowers in fascicles in the axils of the dentate leaves. The flowers are yellow and the ripe drupes black.

15. Kibara royenii PHILIPSON, Blumea 30 (1985) 401.

Shrub *c.* 3 m high, glabrous. *Leaves* narrowly oblong-elliptic, 21 by 6.5 cm, chartaceous, base cuneate, apex apiculate, apiculum obtuse, margin sharply serrate, midrib and lateral veins and their junctions prominent, main veins numerous (8–10 pairs) with subsidiary lateral veins between them and a prominent reticulation; petiole 15–20 mm, channelled above. Monoecious. *Inflorescences* axillary, of short compacted dichasia (fascicles), *c.* 10 mm long, one or more in an axil. — *Male flower* ovoid, *c.* 2 mm ø; 4 pairs of tepals, the outer triangular, the inner rounded; outer stamens 4, inner *c.* 2; filament short, glabrous. *Female flowers* and fruit not seen.

Distr. *Malesia:* West New Guinea (Vogelkop Peninsula; Steenkool Distr.).

Ecol. Primary forest, at 50 m.

Note. The narrowly oblong elliptic, dentate leaves, combined with the small fasciculate inflorescence are distinctive.

16. Kibara hartleyi PHILIPSON, Blumea 30 (1985) 402.

Tall shrub, glabrous except for unopened buds. *Leaves* up to 8 by 3.8 cm, rigidly coriaceous, base cuneate, apex with a prominent apiculum, margin sharply dentate, reticulation of veins very evident on both surfaces, glabrous; petiole 4–6 mm, channelled above. Monoecious. *Inflorescence* axillary; flowers solitary, pedicels *c.* 15–20 mm long at anthesis, elongating slightly in fruit. — *Male flower* obovoid, *c.* 3 mm ø; tepals in *c.* 3 pairs; stamens in an outer whorl of 5 and an inner whorl of 2–3. — *Female flower* similar but slightly larger, carpels *c.* 12–16, ovary densely covered with appressed hairs. Ripe *drupes*

not seen, but developing fruits verruculose and pubescent.

Distr. *Malesia:* Papua New Guinea (Eastern Highlands Prov.; Goroka Distr.).

Ecol. Montane forest, *c.* 2700 m.

Note. This species shows a close but superficial resemblance to *Steganthera ilicifolia*. It approaches *Kibara shungolensis* which differs in having leaves without a prominent apiculum, and with a broader base, the female inflorescence usually bearing a lateral flower, and the ovary being glabrous.

17. Kibara shungolensis PHILIPSON, Blumea 30 (1985) 402.

Small tree *c.* 4 m high, glabrous in all its parts. *Leaves* elliptic, up to 7 by 3.5 cm, rigidly coriaceous, base broadly cuneate, apex acute or obtuse, margin shallowly dentate, reticulation of veins very evident on both surfaces, petiole *c.* 5–8 mm, channelled above. ?Monoecious. *Inflorescence* of compacted dichasia (fascicles); peduncles bracteate at the base, short at anthesis but later elongating (10–12 mm), pedicels *c.* 8–10 mm long, those of the male flowers more delicate than those of the female. — *Male flowers* obovoid, *c.* 2 mm ø, ostiole surrounded by 3 pairs of rounded tepals; androecium with 4 outer stamens and fewer smaller inner stamens; filaments glabrous. — *Female flowers* globose, *c.* 3 mm ø, ostiole surrounded by *c.* 3 pairs of minute tepals and with swollen glands within; carpels *c.* 20, ovary and stigma glabrous. Fruits not seen.

Distr. *Malesia:* Papua New Guinea (Morobe Prov.; Mumeng Distr., Mt Shungol).

Ecol. Lower mossy forest, at about 2300 m.

Note. For features distinguishing *K. shungolensis* from *K. hartleyi* see that species.

18. Kibara moluccana PERKINS, Bot. Jahrb. 45 (1911) 425; Pfl. R. Heft 49 (1911) 36; PHILIPSON, Blumea 30 (1985) 403, f. 1b. — *K. vrieseana* PERKINS, Bot. Jahrb. 45 (1911) 424. — *K. teijsmanniana* PERKINS, *l.c.* 425. — *K. ledermannii* PERKINS, Bot. Jahrb. 52 (1915) 213. — **Fig. 14b.**

A shrub or small tree to 10 m high, glabrous. *Leaves* oblong-elliptic, (10–)15–36 by (4.5–)7–12.5 cm, chartaceous or subcoriaceous, base broadly cuneate to rounded, apex obtuse to subacute or with a short obtuse apiculum, entire, principal veins evident on lower surface, arched and meeting inside the margin, glabrous; petiole 15–22 mm, deeply channelled above. Monoecious. *Inflorescence* axillary, glabrous, with a short peduncle (3–5 mm long) and several short branches bearing slender pedicels (3–4 cm) crowded near their apices, the upper pedicels thicker and bearing female flowers or all the flowers male. — *Male receptacle* obovoid, *c.* 2 mm long, with bracteoles; tepals 4, minute; stamens 6 (2 inner smaller) or 4. — *Female receptacle* subglobose, *c.* 4 mm long, with bracteoles and 4 rounded outer tepals, enclosing irregularly swollen glands; *c.* 10 carpels, stigma short. In fruit the pedicel becoming stout and woody, the receptacle with several short, very stout stipes. *Drupes* ovoid, 18 by 10 mm.

Distr. *Malesia:* Moluccas (Buru, Ceram, Ambon, Halmahera, Morotai, Obi) and Papua New Guinea (East Sepik Prov.).

Ecol. Rain-forest, to 1000 m.

Uses. The skin of the fruit is rubbed on the hair to dye it black (Halmahera).

Vern. *Ogoroutu masauru mnauru*, Halmahera, Tobaro lang.

Note. The large, glabrous, oblong leaves with the almost fasciculate inflorescences are characteristic. The flowers are yellow. The material I have seen of *K. ledermannii* is fragmentary but the leaves and inflorescence match those of *K. moluccana*.

19. Kibara microphylla PERKINS in K. Sch. & Laut., Nachtr. Deut. Schutzgeb. Südsee (1905) 268; Pfl. R. Heft 49 (1911) 33; Bot. Jahrb. 52 (1915) 210; PHILIPSON, Blumea 30 (1985) 403.

A shrub (?) with glabrous branchlets. *Leaves* elliptic to narrowly elliptic, 7.5–11 by 2–3.5 cm, membranous, base cuneate, apex acuminate, margin entire or irregularly dentate, midrib evident, principal veins arched and uniting within the margin, glabrous; petiole to 8 mm, slender, channelled above. Monoecious. *Inflorescences* axillary or terminal, glabrous, *c.* 2.5–5 cm long, of small simple cymes or panicles with delicate peduncle and branches; pedicels of the male flowers more delicate than of the female. — *Male flowers c.* 1 mm ø, ovoid; tepals 4, minute; stamens 4, subsessile. — *Female flowers* ± globular with minute tepals with swollen glands within; carpels *c.* 8, glabrous. Fruits not seen.

Distr. *Malesia:* Papua New Guinea (West Sepik Prov.: Torricelli Mts).

Ecol. Forest at 600 m.

Note. I have not seen the type collection, but a specimen collected at the same locality agrees with the original description in all respects, except that the leaf margins are not entire but irregularly dentate. The small leaves and very delicate inflorescences of this specimen leave no doubt that it represents *K. microphylla*.

20. Kibara streimannii PHILIPSON, Blumea 30 (1985) 403.

Small tree to 7 m, young shoots softly and densely pubescent. *Leaves* narrowly oblong or oblong, stiffly chartaceous, 8–16 by 2.5–4.7 cm, base truncate to shallowly cordate, apex narrowed into indistinct acute apiculum, margin entire, becoming glabrous above, soft pubescence persisting below, midrib

channelled above, prominent below, lateral veins arched and meeting within the margin, prominent, reticulation well defined; petiole 4–7 mm, densely short pubescent. Monoecious. *Inflorescences* axillary; male and female flowers in separate inflorescences. — *Male inflorescence* consisting of elongated rachises, *c.* 8 cm long, setulose, bearing many pairs of subulate bracts. — *Female inflorescences* shorter (*c.* 4.5 cm long), peduncle *c.* 3.5 cm long, ending in a dichasium. — *Male flowers* in axils of bracts, apparently arising in acropetal sequence and soon caducous, pedicel *c.* 4 mm long, setulose; receptacle obovoid, *c.* 3.5 mm long, hairy outside; tepals 6, rounded or mucronate; stamens 4 outer and *c.* 2 inner, *c.* 0.75 mm long, anthers triangular with very short narrow filaments. — *Female flowers* globose, *c.* 4 mm ø, densely tomentose. Fruiting receptacle *c.* 8 mm ø, setulose, without stipes. *Drupes* not seen.

Distr. *Malesia:* Papua New Guinea (Morobe Prov., Wau & Menyamya Distr.).

Ecol. *Nothofagus* and *Castanopsis* forest at 1700 m.

Note. The softly pubescent foliage is distinctive and the form of the male inflorescence is unique in the genus. The flowers are yellowish white and the ripe fruit deep blue-black.

21. Kibara macrantha PHILIPSON, Blumea 30 (1985) 404, f. 1c. — **Fig. 14c.**

Tree up to 20 m, with pubescent branches. *Leaves* ovate or elliptic, 120–240 by 40–80 mm, chartaceous, base rounded to broadly cuneate, apex obtuse or subacute, margin entire or occasionally with few coarse dentations, midrib prominent and reticulation of veins evident, pubescence persisting on the midrib below and to a less extent on the subsidiary veins; petiole 10–15 mm, channelled above, pubescent. Monoecious. *Inflorescence* axillary or supra-axillary, on leafy twigs or clustered on older branches, simple dichasia or open cymose panicles, rachis up to 10 cm with several pairs of lateral branches, or much shorter, pubescent; bracts ovate, *c.* 4 mm long, at the base the peduncle and lateral branches and usually at the base of each receptacle. — *Male receptacle* obovoid, pubescent outside, *c.* 5 mm long at anthesis; tepals 6, rounded; stamens 6–8, subsessile, anther broadly triangular with a single horseshoe-shaped opening. — *Female receptacle* similar, 6–8 mm long; tepals in several pairs with swollen glands within, inner surface pubescent; carpels numerous, pubescent, stigma short, obtuse. *Drupes* ± sessile, ovoid, *c.* 12 by 9 mm, pubescent; fruiting receptacle *c.* 10 mm ø, woody.

Distr. *Malesia:* Papua New Guinea (Morobe Prov.: Finschhafen & Wau Distr.; Eastern Highlands Prov.: Kainantu Distr.).

Ecol. Lower montane forest (*Nothofagus, Castanopsis, Lithocarpus*), 1400–2000 m.

Note. The open inflorescences of large flowers distinguish this species.

22. Kibara carrii PHILIPSON, Blumea 30 (1985) 405.

A shrub, 1.75 m high, glabrous, in all its parts, the nodes dilated. *Leaves* broadly elliptic, up to 27 by 16 cm, coriaceous, base broadly cuneate, apex abruptly apiculate, margin coarsely dentate, midrib and lateral veins prominent below, channelled above; petiole *c.* 10 mm long, 4 mm wide. ?Monoecious. *Inflorescence* axillary or supra-axillary, cymose panicles, rachis *c.* 5 cm long, lateral branches *c.* 2 cm long, sometimes again branched, pedicels 10–12 mm, slender and slightly thickened below the receptacle. — *Male flower* ovoid, *c.* 2 mm ø, ostiole with 3 pairs of tepals, outer whorl of stamens 3–4, inner whorl *c.* 3, anther with 1 horseshoe-shaped opening; filament pubescent. — *Female flower* ovoid, *c.* 3 mm ø, ostiole surrounded by small obtuse tepals in pairs, the innermost forming thickened pendulous glands; carpels *c.* 15–20, with a short blunt stigma. Fruiting receptacle *c.* 12 mm ø. *Drupes* subsessile, ovoid (not fully mature).

Distr. *Malesia:* Papua New Guinea (Central Prov.: Goilala Distr.).

Ecol. Secondary forest at 1000 m.

Note. The large broadly elliptical and coarsely serrate leaves are distinctive. Similar dilated nodes are found in a few other species and also in some species of *Steganthera*. The flowers are described as yellow.

23. Kibara elongata A.C. SMITH, J. Arn. Arb. 22 (1941) 244; PHILIPSON, Blumea 30 (1985) 404.

A shrub or small tree, glabrous. *Leaves* elliptic to oblong-elliptic, rarely lanceolate (? juvenile); 17–30 by (3–)5.5–11 cm; coriaceous, sometimes rugose, base broadly cuneate to rounded or cordate, apex with a short blunt or long slender apiculum, margin ± distantly spinose-dentate, veins prominent, glabrous; petiole 8–20 mm, stout, channelled above. Monoecious. *Inflorescence* axillary or above the foliage leaves, paniculate with slender peduncle, rachis and branches, to 15 cm long and much branched, but often simpler and much shorter, sometimes cauliflorous. Purely female inflorescences sometimes simple pleiochasia. — *Male receptacle* ovoid, *c.* 3 mm long; tepals 6; stamens 4–6, *c.* 1 mm long, filamen short. — *Female flowers* globose, *c.* 2 mm ø; minute tepals surround the ostiole, within which are glandular swellings; carpels *c.* 30, glabrous, stigma obtuse. Peduncle and pedicel thickened and woody in fruit; receptacle *c.* 7–12 mm ø (without the stipes), stipes stout, *c.* 3–4 mm. *Drupes* ovoid or narrowly ovoid, 18–27 by 8–12 mm.

Distr. *Malesia:* West New Guinea (Vogelkop

Peninsula to Idenburg R.), Papua New Guinea (Jimi Valley).

Ecol. In primary rain-forest from near sea-level to 2000 m.

Vern. *Kinjoem*, Hattam lang., *talwalye*, Eipomek Valley.

Note. The coriaceous leaves with spiny teeth on the margin are distinctive. The dentations on the leaves from Jimi Valley are less spinose than the collections from Irian Jaya. The inflorescence may be a large diffuse panicle, or may be reduced in size but still with open branching. The flowers are yellow or orange and the ripe drupes are black, borne on an orange receptacle.

24. Kibara katikii PHILIPSON, Blumea 30 (1985) 406.

Small tree to 16 m, young growth densely covered with buff or fulvous tomentum. *Leaves* variable in size and shape, ovate oblong-elliptic or obovate, 7.5–21 by 3.2–8.3 cm, becoming coriaceous, base broadly cuneate or rounded, apex shortly apiculate, margin entire or (more usually) irregularly dentate in the upper part, dentations either small and obscure or prominent, midrib prominent below, lateral veins evident and meeting within the margin, upper surface becoming ± glabrous above, lower surface softly pubescent; petiole *c.* 10–15 mm, densely pubescent. Monoecious. *Inflorescence* axillary or supra-axillary, usually of simple, 3-flowered cymes, *c.* 30 mm long, densely pubescent, pedicels *c.* 8 mm long, male and female flowers in separate inflorescences. — *Male flowers* scarcely wider than the pedicel (*c.* 1 mm), pubescent on the outer surface and on the lower part inside the receptacle; tepals 4, rounded; stamens 2, attached to the base of the receptacle, *c.* 0.75 mm long, anther kidney-shaped, filament narrow, very short. — *Female flowers* wider than the stout pedicel (to 3 mm), pubescent on both surfaces; tepals 4 (2 tepals or bracts often present on the outer surface), inner rim of ostiole thickened and glandular; carpels *c.* 10–15, *c.*1.25 mm long, pubescent, stigma obtuse glabrous. *Fruiting receptacle* usually solitary (developing from the terminal flower, side branches occasionally also with fruits), peduncle and pedicel becoming thickened and woody, receptacle enlarging slightly (*c.* 8 mm ø), pubescent, with thick stipes or achenes ± sessile. *Drupes* ovoid to subspherical, 13–18 by 9–11 mm, sparsely pubescent.

Distr. *Malesia:* Papua New Guinea (Southern Highlands, Morobe, Northern, Central & Milne Bay Provinces).

Ecol. Lowland and montane rainforest, 30–2200 m.

Note. The foliage may have very different aspects, sometimes being broadly obovate with an entire margin, at others being ovate and tapering towards the apex. The copious and persistent tomentum on the underside of the leaf is characteristic. This species has a wider distribution than most in the genus and a very considerable altitudinal range. The bark is thickly corky, pale brown and deeply and closely fissured.

25. Kibara coriacea (BL.) TULASNE, Arch. Mus. Hist. Nat. Paris 7 (1855) 404; BL. Mus. Bot. Lugd.-Bat. 2 (1856) 89; PERKINS, Bot. Jahrb. 25 (1898) 576; PERKINS & GILG, Pfl. R. Heft 4 (1904) 62, f. 16B; PERKINS, *ibid.* Heft 49 (1911) 35, f. 11; RIDL. Fl. Mal. Pen. 3 (1924) 75; BACK. & BAKH. *f.* Fl. Java 1 (1963) 117; PHILIPSON, Blumea 30 (1985) 406. — *Brongniartia coriacea* BL. Bijdr. (1825) 436. — *K. blumei* STEUD. Nomencl. Bot. (1840) 846; BL. Mus. Bot. Lugd.-Bat. 2 (1856) 89. — *Sciadocarpus brongniartii* HASSK. Flora 25, ii (1842) Beibl. 1: 20. — *Sarcodiscus chloranthiformis* GRIFF. Not. Pl. As. 4 (1854) 380. — *K. chartacea* BL. Mus. Bot. Lugd.-Bat. 2 (1856) 89. — *K. cuspidata* BL. *l.c.* 89. — *Mollinedia coriacea* (BL.) BAILL. Hist. Pl. 1 (1869) 304. — *K. tomentosa* PERKINS, Bot. Jahrb. 25 (1898) 571. — *K. trichantha* PERKINS, *l.c.* 572. — *K. macrophylla* PERKINS, *l.c.* 571. — *K. serrulata* PERKINS, *l.c.* 575; Pfl. R. Heft 4 (1901) 60, f. 16A. — *K. angustifolia* PERKINS, *l.c.* 577. — *K. grandifolia* MERR. Publ. Gov. Lab. Philip. *n.* 29 (1905) 15; En. Philip. 2 (1923) 185. — *K. ellipsoidea* MERR. Philip. J. Sc. 1 (1906) Suppl. 56. — *K. mollis* MERR. *ibid.* 3 (1908) Bot. 225. — *K. clemensiae* PERKINS, Bot. Jahrb. 45 (1911) 423; MERR. En. Philip. 2 (1923) 184. — *K. vidalii* PERKINS, Bot. Jahrb. 45 (1911) 423; MERR. En. Philip. 2 (1923) 185. — *K. motleyi* PERKINS, Bot. Jahrb. 45 (1911) 424. — *K. merrilliana* PERKINS, *l.c.* 424; MERR. En. Philip. 2 (1923) 185. — *K. stapfiana* PERKINS, Bot. Jahrb. 45 (1911) 424; MERR. En. Philip. 2 (1923) 185. — *K. warburgii* PERKINS, Bot. Jahrb. 45 (1911) 424. — *K. macrocarpa* PERKINS, *l.c.* 425. — *K. schlechteri* PERKINS, Pfl. R. Heft 49 (1911) 31. — *K. longipes* PERKINS, *l.c.* 31. — *K. inamoena* PERKINS, *l.c.* 34. — *K. dichasialis* SUESSENG. & HEINE, Mitt. Bot. Staatssamml. München 2 (1960) 60.

Tree to 22 m or rarely a scandent shrub, young branches glabrous or pubescent. *Leaves* opposite (rarely subopposite or whorled); broadly ovate to elliptic oblong, 9–35 by 5–24 cm, coriaceous or chartaceous, base cuneate rounded or subcordate, apex shortly to long acuminate, margin entire or minutely to coarsely dentate, glabrous or sparingly to rather densely pubescent beneath, midrib and principal lateral veins prominent beneath, lateral veins arched-ascending and meeting within the margin; petiole 5–25 mm, channelled above, glabrous or pubescent. Monoecious. *Inflorescences* axillary, supra-axillary, terminal, or cauliflorous, pubescent, cymes solitary or several arising at the same node, varying from simple 3-flowered cymes to complex pleiochasia with

lateral branches branching to the third or fourth degree, male flowers on the lower branches; rachis and lateral branches of female part of the inflorescence stout and thickening and becoming woody after anthesis, those of the male parts finer and caducous, up to 20 cm long but often much shorter, pedicels 15–30 mm, gradually widening below the flowers, of the male more delicate than those of the female. — *Male flowers* globose, 1.5–2 mm ø, only slightly wider than the pedicel, pubescent; tepals 6–8, apex rounded, usually with 4 outer stamens and up to 4 smaller inner stamens, filaments strap-shaped. — *Female flowers* globose, *c.* 3–5 mm ø; tepals *c.* 6, with swollen pendulous glands within the ostiole; carpels usually *c.* 20, stigma short obtuse. Infructescence enlarged, woody, receptacle *c.* 20 mm ø. *Drupes* ovoid, 15 mm long, shortly stipitate or sessile.

Distr. Throughout *Malesia.*

Ecol. Lowland rain-forest, including swamp forest and coral limestone, to lower montane forest, from sea-level to 1600 m.

Uses. The fruit is said to be edible, and the leaves are used to flavour meat dishes.

Vern. Malaya: *pako kubang tando, p. pakan jantan*, Malacca, *pako srean puteh*, Negri Sembilan, *susu ajam*, Pahang; Sumatra: *alimau dotan, kaju mata ole, k. ruang-ruang, k. singumban paya, sangka-sangka batu, s.-s. sito, sito mèrah*; Java: *bulusan, ki bara, ki èndog, ki kuya, ki sauheum, patatulang, ramat daging, rimik dasing*, S; Banka: *tampui*, M; Sabah: *ambibliw*, Dusun Banggi, *labak*, Dusun; Philippines: *anonias*, Tag., *pototan*, Manila; New Guinea: *keawon*, Sepik, *mardiber*, Biak lang., *pu-ala*, Managalese, *sakunuo*, Muswaar I., *tor*, Bulolo, Biaro dial.

Note. Although this species varies in respect to the size and shape of its foliage and inflorescences, the number of its parts and the degree of its pubescence, it retains a character over its extensive range which ensures its recognition. This is best expressed by the broad, pliant, fresh green leaves and the openly branched inflorescence with strong pedicels to the female flowers which terminate the more distal branches. Specimens with the largest inflorescences occur in Sumatra. The range of variation appears greatest in the Philippines, and, when more complete material becomes available, several species which have been described from there may yet prove to be valid, though here reduced to synonymy. The flowers are yellow, the male being somewhat greener; the drupes are black, borne on a yellow to orange receptacle.

26. Kibara papuana A.C. SMITH, J. Arn. Arb. 22 (1941) 242; PHILIPSON, Blumea 30 (1985) 407.

Shrub or medium-sized tree to 22 m; branchlets glabrous or slightly pubescent; buds glabrous or covered in appressed pubescence. *Leaves* opposite (or subopposite), narrowly to broadly elliptic, or ovate, thinly to firmly chartaceous, (6.5–)10–19 by (2–)5–6(–9) cm, base broadly to narrowly cuneate or rounded, apex cuspidate obtuse, or narrowly and long-apiculate acute, margin entire or with few to many teeth, midrib prominent below, lateral veins arched-ascending, the reticulation of minor veins evident; petiole narrow, to 15 mm, channelled above. *Inflorescence* axillary, supra-axillary, or terminal, often of 3-flowered cymes, or solitary flowers or pleiochasia, sometimes with secondary or tertiary branching to form panicles; male flowers on lower more slender branches or in separate often paniculate inflorescences. — *Male flowers* ovoid, 1.5–2.5 mm long, glabrous; tepals 6; stamens 4–8, the outer 4 large, the inner smaller or absent, anthers broadly triangular, obtuse, filaments short, as wide as the anthers. — *Female flowers* globose, *c.* 3 mm long, glabrous and sometimes minutely puberulous on both surfaces; tepals minute with thickened glands within the ostiole; carpels numerous, glabrous or pubescent, stigma short, obtuse. Fruiting receptacle up to 10 mm ø, with stout prominent stipes *c.* 4–6 mm long. *Drupes* ovoid, *c.* 18 by 12 mm, rugulose.

Distr. *Malesia:* Papua New Guinea (Central, Northern, Milne Bay and Morobe Prov.).

Ecol. Primary lowland rain-forest, montane forest and mossy forest; understorey with *Castanopsis* and *Araucaria*. Also in secondary growth, 100–2100 m.

Vern. *Boakeava*, Wagau, *popoia*, Northern Prov., Koiari lang., *siganapa*, Northern Prov., Orokawa lang., *saha*, northern Managalese.

Note. Similar to *K. coriacea* but with smaller foliage, and with smaller, less indurated flowers. The ripe drupes are black on an orange receptacle. In some specimens the achenes are muricate, but this may be due to insect infection. The species, as here treated, includes a considerable range of leaf size, and most specimens do not show the compact inflorescence which SMITH noted on the type. The extreme forms come from the islands to the east of New Guinea (especially Goodenough and Normanby Is.), but a continuous series of intermediate states unite all the forms.

27. Kibara nitens PHILIPSON, Blumea 30 (1985) 408.

Small sparsely branched shrub usually under 3 m high, glabrous. *Leaves* elliptic, elliptic-oblong or narrowly obovate, 17 by 6.5 cm, coriaceous, base cuneate, apex apiculate, apiculum obtuse or acute, margin obscurely and irregularly dentate, midrib prominent, lateral veins numerous and close-set, at first straight but curved and uniting near the margin, glabrous; petiole 15 by 2.5 mm, channelled above. Monoecious. *Inflorescence* an axillary or terminal

pleiochasium, rachis *c.* 4 cm, peduncle *c.* 18 mm long, bracteate at the base, the opposite pairs of pedicels also subtended by bracts; pedicels *c.* 5 mm, becoming thickened and elongating in female flowers after anthesis. — *Male flowers* ovoid, *c.* 1 mm ø, ostiole surrounded by 3 pairs of obtuse tepals; stamens 4 inserted halfway up the receptacle, with 2 small central staminodes. — *Female flowers* not seen. Fruiting receptacle woody, *c.* 8 mm ø. *Drupes* c. 12–15 shortly stipitate, ellipsoid, *c.* 16 by 11 mm (when dry).

Distr. *Malesia:* West New Guinea (Star Mts), Papua New Guinea (West Sepik Prov.: Telefomin District; Southern Highlands Prov.: Tari Distr.).

Ecol. Undergrowth in primary forest, 750–2150 m.

Vern. *Soinok*, Telefomin.

28. Kibara fragrans PHILIPSON, Blumea 30 (1985) 408.

Small tree, *c.* 3 m, young shoots glabrous. *Leaves* elliptic-oblong, to 22 by 8.5 cm, chartaceous, base broadly cuneate, apex shortly apiculate, apiculum obtuse, margin irregularly and indistinctly dentate, midrib prominent, principal lateral veins evident, arched, ascending, glabrous; petiole to 3 cm. *Inflorescences* axillary, *c.* 50 mm long, glabrous, small few-flowered cymes or rather more complex small paniculate cymes, solitary or clustered at nodes, upper flowers female on stouter pedicels; pedicels *c.* 20 mm, wider distally. — *Male receptacle c.* 2 mm long, cup-shaped, widely open; tepals 6, rounded; stamens 4 in outer whorl, *c.* 0.75 mm long, *c.* 2 in centre, shorter, filament strap-shaped, as wide as the anther. — *Female receptacle* ovoid, *c.* 2.75 mm long; tepals 6, rounded, ostiole small, with thickened glands within. *Fruit* not seen.

Distr. *Malesia:* NW. New Guinea.

Ecol. Lowland forest and on hilltop at 150 m.

Note. The foliage resembles that of *Steganthera hirsuta*, while the inflorescences are similar to those of *Kibara fugax*. The green flowers are fragrant.

29. Kibara obtusa BL. Mus. Bot. Lugd.-Bat. 2 (1856) 89; PERKINS & GILG, Pfl. R. Heft 4 (1901) 61; PERKINS, Bot. Jahrb. 45 (1911) 424; Pfl. R. Heft 49 (1911) 34; MERR. En. Philip. 2 (1923) 185; PHILIPSON, Blumea 30 (1985) 409. — *K. depauperata* MERR. Publ. Gov. Lab. Philip. *n.* 13 (1906) 13.

Shrub or tree to 20 m, bole 36 cm ø dbh, young branches with appressed stiff hairs. *Leaves* narrowly to broadly elliptic, 8–11.5(–15) by 3.5–5(–6.5) cm, base narrowly or broadly cuneate, apex obtuse, margin entire, becoming glabrous or lower surface with sparse stiff pubescence; petiole 10–18 mm, becoming glabrous or hairs ± persistent. *Inflorescences* axillary or terminal, pubescent, simple or paniculate cymes, up to *c.* 70 mm long, the rachis, lateral branches and pedicels slender or stronger with a more compacted inflorescence. — *Male receptacle* obovoid, *c.* 2 mm long, with a pair of small bracteoles, outside minutely pubescent; tepals 4, minute; stamens 4, sometimes with 2 central staminodes, and with staminodes inside the outer 2 tepals. — *Female receptacle* ± globose, *c.* 2.5 mm ø, with bracteoles on the outer surface or on the pedicel, minutely pubescent on outer and inner surfaces; 4 outer tepals, obtuse, with 4 swollen glands within which project among the carpels; carpels *c.* 13, pubescent, with a blunt stigma. Mature torus swollen and leathery, with 1 to *c.* 13 short stout stipes, slightly pubescent. *Drupes* ovoid, 17–24 by 10–12 mm.

Distr. *Malesia:* N. Borneo (Sabah: Lahad Datu Distr.), Philippines (Luzon: Benguet Prov.), NE. Celebes (Minahasa), West New Guinea (Biak I.).

Ecol. Primary rain-forest, sea-level to 700 m.

Vern. *Mardieber*, Biak lang.

Note. The flowers are yellow or orange; the ripe drupes are black on an orange receptacle.

30. Kibara laurifolia A.C. SMITH, J. Arn. Arb. 22 (1941) 240; PHILIPSON, Blumea 30 (1985) 409.

Sprawling shrub or small tree to 7 m, glabrous. *Leaves* elliptic, elliptic-oblong or suborbicular, up to 17 by 8.5 cm, coriaceous, base rounded to broadly cuneate, apex obtuse to slightly apiculate, margin entire or occasionally with obscure dentations, midrib, lateral veins and reticulation evident, glabrous; petiole 5–10 mm, channelled above. Monoecious. *Inflorescences* axillary, supra-axillary, or terminal, flowers solitary or usually in dichasia, or pleiochasia, *c.* 30 mm long, peduncle *c.* 10 mm, bracteate at its base, pedicels *c.* 10–12 mm, subtended by bracts. — *Male flowers* ovoid, *c.* 3 mm ø, 3 pairs of tepals, 4 stamens with horseshoe-shaped openings, filaments very short. *Female flowers* ± globose, *c.* 4 mm ø, ostiole with 4 pairs of tepals and prominent swollen glands within, carpels numerous, ovary glabrous, stigma obtuse. Fruiting peduncle and pedicels elongated up to 8 cm, receptacle woody, *c.* 10 mm ø. *Drupes* ovoid, *c.* 16 by 12 mm, or subspherical, ± sessile or shortly stipitate.

Distr. *Malesia:* throughout New Guinea in the highlands between 139°–148° E.

Ecol. Primary and disturbed lower montane rain-forest, 1800–2800 m.

Vern. *Kamokam*, Enga lang.

Note. The broad, often suborbicular, leathery leaves are distinctive. The ripe drupes are purplish black on an orange to yellow receptacle. A specimen from near Wabag approaches *K. macrantha* in the large pubescent receptacles, but has foliage similar to that of *K. laurifolia*. It may be a hybrid, though it lies west of the known range of *K. macrantha*.

31. Kibara flagelliformis PHILIPSON, Blumea 30 (1985) 409.

Shrub or small tree; young parts minutely puberulous and soon becoming glabrous. *Leaves* opposite or subopposite, elliptical, chartaceous, *c.* 19 by 9 cm (all damaged), base broadly cuneate, apex not present, margin entire, midrib prominent below, lateral veins strongly arched-ascending; petiole stout, *c.* 10–12 mm, channelled above. *Inflorescences* axillary, central rachis *c.* 8 cm, lateral branches in opposite pairs or 3–4 at the same level, usually again branched about the middle; pedicels slender, elongated (up to 45 mm). — *Male flowers* obovoid, 3 mm long, with 4 rounded tepals surrounding a widely open ostiole (sometimes another pair of tepals (bracts) about the middle of the receptacle), 4 large stamens and *c.* 3 smaller stamens in the centre; filaments wide, strap-shaped, *c.* 2 mm long, wider than the small triangular anthers. — *Female flowers* and fruit not seen.

Distr. *Malesia:* West New Guinea (Napan Distr.). Known only from the type.

Note. The specimen bears only male flowers in strangely branched inflorescences. The stamens are unusual, with long filaments much wider than the small anthers.

32. Kibara chimbuensis PHILIPSON, Blumea 30 (1985) 410.

Small tree to 7 m, young branches glabrous. *Leaves* glabrous, narrowly elliptic to lanceolate, membranaceous, 9–13 by 2.8–4.8 cm, base narrowed into the petiole, apex narrowed into an indistinct and obtuse apiculum, margin entire or slightly undulate, lateral veins rather indistinct, steeply ascending; petiole to 10 mm. Monoecious. *Inflorescences* axillary, supra-axillary or terminal, glabrous, singly or in groups, either few-flowered cymes or more branched open, cymose, panicles up to 8 cm long; pedicels slender, 20–45 mm; male flowers on lower branches. — *Male flowers* cup-shaped, *c.* 1.5 mm long, 2 mm ø; rounded tepals widely open; stamens 4 in outer whorl and 4 smaller stamens at centre, filaments strap-shaped, glabrous. — *Female flowers* subglobose, *c.* 3 mm long, 2.5 mm ø; tepals 6, rounded, inner rim of ostiole with pendulous glands; carpels *c.* 10, glabrous, stigma obtuse. *Infructescence* with somewhat thickened pedicels and a woody receptacle *c.* 15 mm ø (including short thick stipes). *Drupes* ovoid, *c.* 15 by 10 mm when dry, shortly stipitate.

Distr. *Malesia:* Papua New Guinea (Chimbu Prov.: Kerowagi Distr.).

Ecol. A small tree in forest remnant at 1350 m.

Note. The narrowly elliptic to lanceolate leaves have a thin texture and dry to a dull dark green. The inflorescences are similar to those of *K. fugax*.

33. Kibara fugax PHILIPSON, Blumea 30 (1985) 411. — **Fig. 16.**

Small tree, up to 10 m, all parts glabrous. *Leaves* elliptic to broadly elliptic or obovate, 10–16(–18) by 3.8–7(–8) cm, membranaceous to thinly chartaceous, base cuneate, apex slightly apiculate, apiculum obtuse, entire or occasionally with a few obscure dentations, midrib evident, lateral veins few, strongly arched; petiole 5–8(–10) mm long, channelled above. Monoecious. *Inflorescence* terminal or axillary, simple or paniculate cymes, either all flowers of one sex or with male flowers on the lower branches, to *c.* 50 mm long; pedicel of male flowers *c.* 36–60 mm long, very slender, or female flowers stronger and shorter (*c.* 15–20 mm). — *Male receptacle* subglobose, *c.* 1.5 mm ø; 6 rounded tepals around the ostiole; stamens *c.* 4 (5) outer, 2–5 inner, filament short, broad, anther broad with a single horizontal opening. — *Female receptacle* globose, *c.* 2–2.5 mm ø; tepals minute, 4 around the ostiole, another pair inside and with thickened glands within; carpels *c.* 16–20, glabrous, stigma short, blunt. *Drupes* ovoid, *c.* 13 by 9 mm, shortly stipitate.

Distr. *Malesia:* Papua New Guinea (Morobe & Central Prov.).

Ecol. Lower montane forest or secondary forest, between 750 and 1400 m.

Note. A common tree in the Wau District distinguished by its membranous leaves (which usually dry to a blackish colour) and the long delicate pedicels of male flowers. The male receptacles and pedicels wither immediately after anthesis, a feature reflected in the specific epithet. The flowers are yellowish and the ripe drupes purple-black.

34. Kibara novobritanica PHILIPSON, Blumea 30 (1985) 411.

Small tree up to 16 m high, glabrous. *Leaves* oblong to broadly elliptic, 16–20 by 7.5–10 cm, chartaceous, base broadly cuneate to rounded, apex with a short obtuse (or occasionally acute) apiculum, entire, midrib prominent, principal veins arched ascending and meeting near the margin; petiole *c.* 10 mm. Monoecious. *Inflorescences* terminal, axillary or supra-axillary, short pleiochasia often densely aggregated together at the nodes, rachis short (up to 30 mm long) with a few pairs of lateral branches which may branch again, pedicels thickened for about 10 mm below the receptacle. — *Male receptacle* subglobose, *c.* 2 mm ø; tepals 6, rounded; stamens usually 6 (in 3 pairs, the inner small, the outer inserted well above the base of the cavity); anthers small subsessile. — *Female receptacle* similar but larger, *c.* 4 pairs of tepals with swollen glands within the ostiole; carpels numerous, glabrous with an obtuse stigma. *Drupes* ± sessile, ovoid, *c.* 13 by 18 mm, glabrous; fruiting receptacle *c.* 8 mm ø, woody.

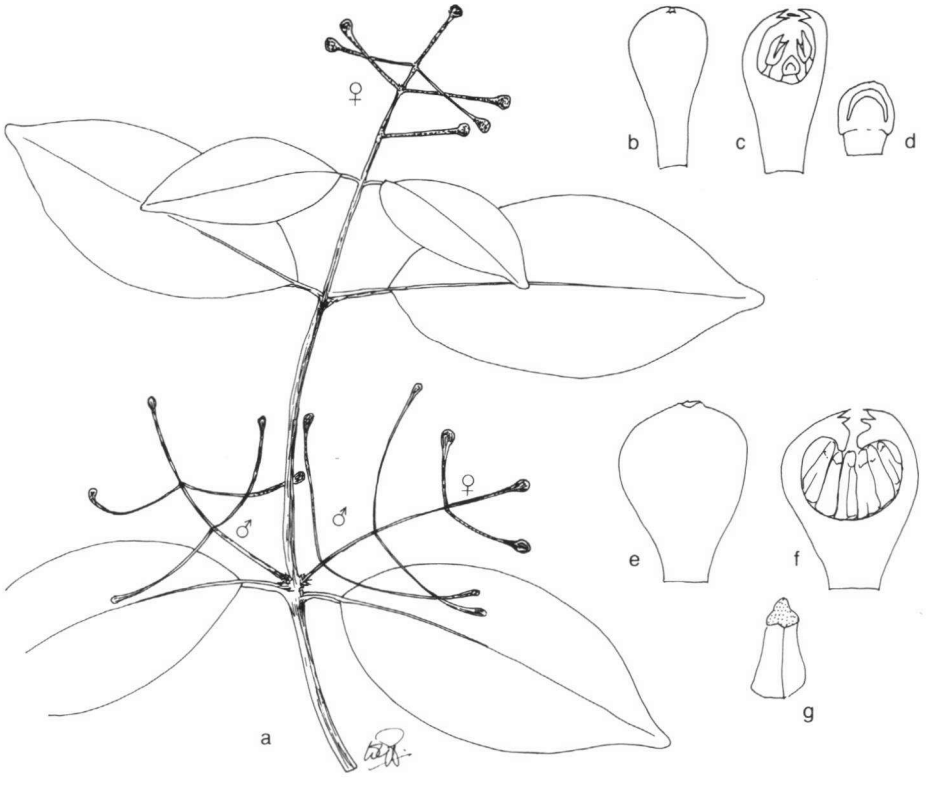


Fig. 16. *Kibara fugax* PHILIPSON. *a.* Leafy shoot bearing male, female and mixed inflorescences, ×1/2, *b.* male flower, *c.* the same in LS, both ×7, *d.* stamens, ×10, *e.* female flower, *f.* the same in LS, both ×7, *g.* carpel, ×10 (NGF 14583).

Distr. *Malesia:* Papua New Guinea (W. & E. New Britain; New Ireland).

Ecol. Lowland rain-forest to 100 m.

Vern. *Gangnan*, Puhi River, Kandrian Distr., *napeewa*, Talasea.

Note. Confined to New Britain and New Ireland, and the only species of *Kibara* known from that region. The thickened pedicels are characteristic. The ripe drupes are black on an orange torus.

35. Kibara rigidifolia A.C. SMITH, J. Arn. Arb. 22 (1941) 243; PHILIPSON, Blumea 30 (1985) 412.

Small tree to 8 m, sparsely branched; young branches glabrous, flattened or triangular. *Leaves* opposite or in whorls of 3, elliptic-oblong or lanceolate-elliptic, up to 30 by 11.5 cm, base broadly cuneate, apex rounded or obtuse with a glandular mucro, coriaceous, light yellow-green when dry, entire or with acute dentations, midrib prominent beneath, principal veins numerous, at first straight but arched and uniting within the margin, glabrous; petiole 13–25 mm long, stout, slightly channelled above. Dioecious (according to BRASS). *Inflorescence* axillary, the male flowers in panicles *c.* 40 mm long, the female pleiochasia up to 60 mm. — *Male receptacle* globose, 4–5 by 3–4 mm, tepals 8, obtuse (the innermost pair ± resemble staminodes); stamens 3–6, 1.5–1.75 mm long, with broad vertical anthers and a short filament, glabrous. — *Female receptacle* globose, 5 by 3.5 mm; tepals, minute, obtuse, with swollen glands within; carpels *c.* 30, glabrous, with a cushion-shaped stigma. Peduncle and pedicels becoming thicker and woody in fruit; receptacle leathery, *c.* 10 mm ø, bearing short stipes. *Drupes* ovoid, 12–16 by 8–10 mm.

Distr. Queensland and *Malesia:* Papua New Guinea (Western Prov.: Morehead & Balimo Distr.).

Ecol. In coastal scrub or undergrowth of forest

near sea-level, on sandy soil and on shaded cliff face.

Note. A sparsely branched shrub or small tree with pale, shining, coriaceous leaves which are frequently arranged in whorls of three on triangular stems. Older branches fawn, with soft fissured corky bark. The drupes are black on an orange receptacle. The number of stamens is variable, even on the same plant. They are not arranged irregularly over the receptacle wall (as in *Wilkiea*) but form a central group. When the number of stamens is reduced, the inner tepals may resemble staminodes. The form of the stamens differs from that of most species of *Kibara* as they are held vertically with the two lips of the horseshoe-shaped slit ± equal (in most species the anther inclines towards the centre with the lower lip smaller than the upper).

36. Kibara sudestensis PHILIPSON, Blumea 30 (1985) 412.

Shrub or small tree, *c.* 4 m, glabrous in all its parts, except that the buds and young foliage are covered in appressed silky hairs. *Leaves* narrowly elliptic, up to 17.5 by 5.8 cm, stiffly coriaceous, narrowed to a truncate base, apex narrowed or slightly apiculate, margin entire or one or a few teeth near the apex, midrib prominent, lateral veins numerous, running straight from the midrib at a slight angle, uniting near the margin; petiole *c.* 10 mm, channelled above. *Inflorescences* axillary or supra-axillary, one- or few-flowered cymes, *c.* 25 mm long; pedicels widening into the base of the flower. — *Male receptacle* obovoid, up to *c.* 6 mm long, glabrous; tepals 6, cavity small, enclosing 4 large and 2 smaller central stamens, anthers kidney-shaped; filaments short, narrower than the anthers. — *Female flowers* and fruits unknown.

Distr. *Malesia:* Papua New Guinea (Louisiades & Sudest I.).

Ecol. A small undergrowth tree on ridge crest in rain-forest, at 150 m.

Note. The narrowly elliptic, rigid leaves, and the large male flowers with small kidney-shaped anthers are distinctive.

37. Kibara sleumeri PHILIPSON, Blumea 30 (1985) 413.

Small tree, 3 m, glabrous. *Leaves* oblong, 14–20 by 6–11 cm, chartaceous, base rounded or broadly cuneate, apex rounded with a short apiculum, entire, principal veins prominent below and meeting inside the margin, glabrous; petiole to 22 mm, channelled above. *Inflorescences* axillary or arising above the foliage leaves, at first setulose becoming glabrous at maturity, one or more few-flowered cymes arising together, peduncles slender, 15–20 mm, with basal bracts and a pair of bracts towards the middle; pedicels *c.* 5 mm, slightly swollen below the female flowers. — *Male receptacle* obovoid, *c.* 2.5 mm long, with 6 stamens, the central pair reduced. — *Female receptacle* subglobose, *c.* 3 mm long; tepals 4, rounded, enclosing swollen glands; *c.* 10 carpels, very faintly pubescent, stigma short. In fruit the peduncles and pedicels become slightly woody, *c.* 45 mm long; the receptacle in fruit rather small (*c.* 10 mm ø) with prominent stipes *c.* 3 mm long. *Drupes* ovoid, 16 by 10 mm.

Distr. *Malesia:* West New Guinea (Vogelkop Peninsula).

Ecol. Dense shade in *Castanopsis* forest, 450–600 m.

Note. The foliage is similar to that of *K. moluccana*, but the compact subfasciculate inflorescences of that species are distinctive. The flowers are pale yellow and the drupes black on a swollen orange receptacle.

38. Kibara monticola PERKINS, Pfl. R. Heft 49 (1911) 32; PHILIPSON, Blumea 30 (1985) 414.

Small tree, with glabrous branchlets. *Leaves* narrowly elliptic, 13–20 by 4–6.5 cm, membranaceous, base cuneate, apex apiculate, entire, midrib prominent, principal veins few, arched and meeting inside the margin, glabrous; petiole 8–10 mm, slightly channelled above. Monoecious. *Inflorescences* axillary or supra-axillary, dichasial or small pleiochasia, glabrous. — *Male flowers* ovoid, 2.5 mm long; tepals 4, rounded; stamens 6, the innermost 2 smaller. — *Female flowers* ovoid, 2.5–3.5 mm ø, pedicels 10–15 mm long; tepals with 4 swollen glands within; carpels 10–15, slightly pubescent with a short stigma. *Fruits* not seen.

Distr. *Malesia:* Papua New Guinea (Sepik region: Ibo Mts). Only known from the type.

Ecol. In forests at 110 m.

39. Kibara symplocoides PERKINS, Bot. Jahrb. 52 (1915) 210; PHILIPSON, Blumea 30 (1985) 414.

Small tree to 8 m, glabrous. *Leaves* elliptic to narrowly elliptic, 7–12 by 2.5–4.5 cm, chartaceous, base cuneate, apex narrowly acuminate, entire or with a few small remote dentations in the upper half, the midrib and principal veins deeply immersed above, prominently raised below, the lateral veins arched and uniting within the margin, glabrous; petiole 4–6 mm. ?Monoecious. — *Male inflorescences* axillary or supra-axillary, fasciculate or solitary, cymose, to 10 mm long, with small ovate bracts. — *Male receptacle* ovoid, 1.5–2 mm long; tepals 6; stamens 2, subsessile. — *Female inflorescences* racemose or flowers solitary, axillary or supra-axillary, to 35 mm long, with lanceolate bracts. — *Female receptacle* globose, 4 mm, ostiole with minute tepals and swollen glands within; carpels numerous, pilose. *Fruit* not seen.

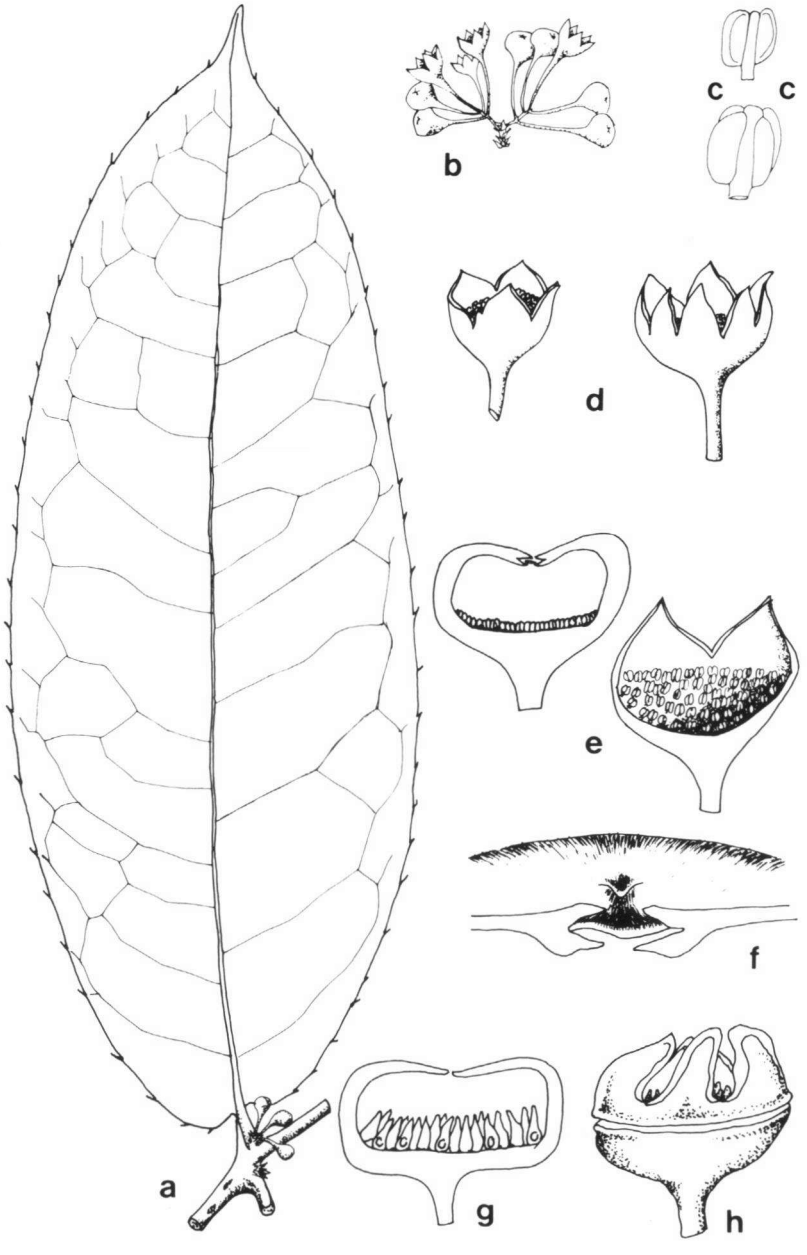


Fig. 17. *Kairoa suberosa* PHILIPSON. *a.* Habit, *b.* male inflorescence, both ×1/2, *c.* stamens, ×20, *d.* two male flowers, nat. size, *e.* male flowers in LS, after splitting of the receptacle, ×1 1/2, *f.* ostiole of male flower, the equal pairs of tepals cut across, one unequal pair visible, ×12, *g.* female flower in LS, ×2 1/2, *h.* female flower after anthesis, the upper part of the receptacle abscissing, ×1 1/2 (*a* HARTLEY 12697, *b, d* NGF 44173, *c* NGF 14850, *e* PHILIPSON 3681, *f* PHILIPSON 3684, *g* LAE 56322).

Distr. *Malesia:* Papua New Guinea (Sepik region). Only known from the two original collections.

Ecol. In open mountain forest, about 20 m high, at 1000 m altitude.

Insufficiently known

The types of the following species have not been seen, and it is not possible to determine from the descriptions whether they correspond to any known species or are distinct:

K. olivaeformis BECC. Malesia 1 (1877) 187.

K. aruensis BECC. *l.c.* 188.

K. formicarum BECC. *l.c.* 188.

K. perkinsiae K. SCH. & LAUT. Fl. Deut. Schutzgeb. Südsee (1900) 330.

K. elmeri PERKINS, Bot. Jahrb. 45 (1911) 424.

K. buergersiana PERKINS, Bot. Jahrb. 52 (1915) 209.

K. neriifolia PERKINS, *l.c.* 212.

Inadequately represented

The collections listed below appear to represent undescribed species of *Kibara*, but the material is inadequate because no flowers are present.

BARKER LAE 67616, Telefomin Distr.; EYMA 4555, Wissel Lake region; FOREMAN LAE 52220, Ramu Distr.; KOSTERMANS & SOEGENG 853, Baliem Valley; VAN ROYEN & SLEUMER 7773, Vogelkop Peninsula.

Excluded species

Kibara borneensis BOERL. = *Pycnarrhena (Menispermaceae).*

Kibara timorensis BOERL. = *Pycnarrhena (Menispermaceae).*

8. KAIROA

PHILIPSON, Blumea 26 (1980) 368, f. 1–10. — **Fig. 17, 18.**

Small tree or sparsely branched shrub with toothed leaves and flowers in axillary fascicles. *Flowers* monoecious. — *Receptacle of male flower* at first globose with a small ostiole bounded by 8 tepals (in two double pairs), at anthesis splitting to form an open bowl-shaped flower with 4–6 radiating lobes, fleshy. *Stamens* very numerous, inserted over the surface of the receptacle; anthers opening by two longitudinal slits; filament very short. — *Receptacle of female flower* oblate, with an ostiole bounded by 4 tepals, splitting into broad segments; the upper part of the receptacle abscissing by a circular split after anthesis. *Carpels* numerous, sessile, with a very short style. *Fruits* numerous, ovoid, sessile on an enlarged fleshy receptacle.

Distr. *Malesia:* Papua New Guinea (Morobe and Northern Provinces, from Finschhafen to Tufi Distr.). Monotypic. Fig. 10.

Ecol. Understorey of rain-forest.

1. Kairoa suberosa PHILIPSON, Blumea 26 (1980) 368, f. 1–10. — **Fig. 17, 18.**

Shrub or small tree with stout terete branches, bark becoming corky. *Leaves* coriaceous, up to 45 by 17 cm, oblong, elliptic or lanceolate-oblong; base cordate, truncate or cuneate, apex narrowed to an acute apex; lower surface with dense or sparse pubescence or glabrous; margin with few to many sharp teeth; midrib prominent; secondary and tertiary veins forming a distinct reticulation; petiole stout, 5–15 mm. *Inflorescence* of axillary fascicles which continue to appear from successive buds at older nodes; fascicles with a short peduncle bearing crowded minute bracts, the lower sterile, the upper with flowers in their axils. — *Pedicels of male flowers* fleshy (when fresh), *c.* 15–20 mm, sometimes with solitary or paired bracteoles, expanded above; receptacle at first globose with a terminal depression and an ostiole with 8 tepals in two double pairs, expanding to *c.* 18 mm ø before opening by 4–6 radial splits to form a star-shaped flower with the stamens fully exposed. *Stamens* numerous (over 100), inserted over the lower half of the receptacle, filament short; anthers to 1 mm long, opening by two longitudinal slits. — *Pedicels of female flowers* shorter (*c.* 5 mm at anthesis); receptacle globose, smaller (*c.* 8 mm ø), tepals 4, the upper half of the receptacle becoming detached after anthesis by a circular scar. *Carpels* nu-

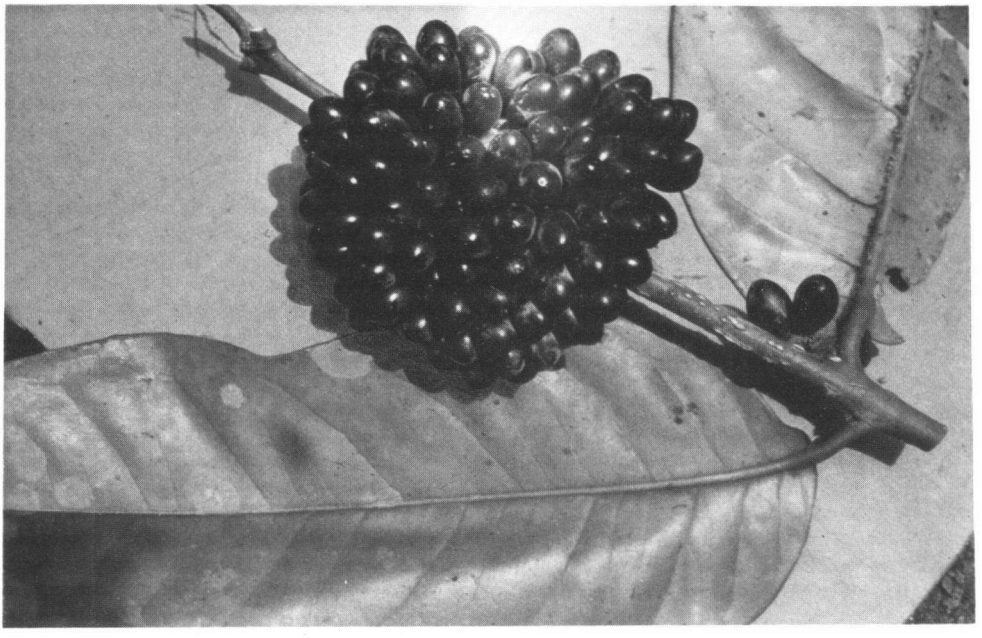


Fig. 18. *Kairoa suberosa* PHILIPSON. A group of ripe infructescences (the fruits in this cluster were borne on three closely associated receptacles), ×3/4 (PHILIPSON 3626).

merous (*c.* 50 or more), sessile on the lower half of the receptacle, with a short, blunt style. Receptacle becoming enlarged and fleshy in fruit. *Drupes* sessile, numerous, ovoid, 20–24 by 11–14 mm.

Distr. *Malesia:* Papua New Guinea (Morobe & Northern Prov.). Fig. 10.

Ecol. Locally frequent in the understorey of lowland rain-forest and occasionally ascending into lower montane forest to 1200 m, with *Castanopsis* and *Lithocarpus* dominant.

Note. The specific epithet refers to the thick deeply fissured bark of the older stems, by which feature this species can most readily be detected in the field. The stiff leaves, which are usually sharply toothed, are also distinctive. The male flowers are soft, fleshy, cream-coloured often flecked with violet. They are rather large for the family. The succulent, fleshy fruiting receptacle is orange and the ripe drupes are black and shining.

9. STEGANTHERA

PERKINS, Bot. Jahrb. 25 (1898) 564; Pfl. R. Heft 4 (1901) 52; *ibid.* Heft 49 (1911) 20; Bot. Jahrb. 52 (1915) 197; Übersicht Gattungen Monim. (1925) 33; PHILIPSON, Blumea 29 (1984) 486, f. 1. — *Anthobembix* PERKINS, Bot. Jahrb. 25 (1898) 567. — **Fig. 19–23.**

Trees or shrubs, resting buds with cataphylls. *Leaves* pubescent at first, sometimes becoming glabrous, entire or dentate, principal secondary veins arched and meeting within the margin. Monoecious or dioecious. *Inflorescences* lateral, cymose or fasciculate. — *Male flowers* globose, turbinate or patelliform, with 4 small tepals, stamens (3–)4(–5), or rarely with a second (inner) whorl of 1–4 smaller stamens; anthers opening by a single horizontal slit. — *Female flowers* similar to male but larger and with a smaller ostiole surrounded by 4 tep-

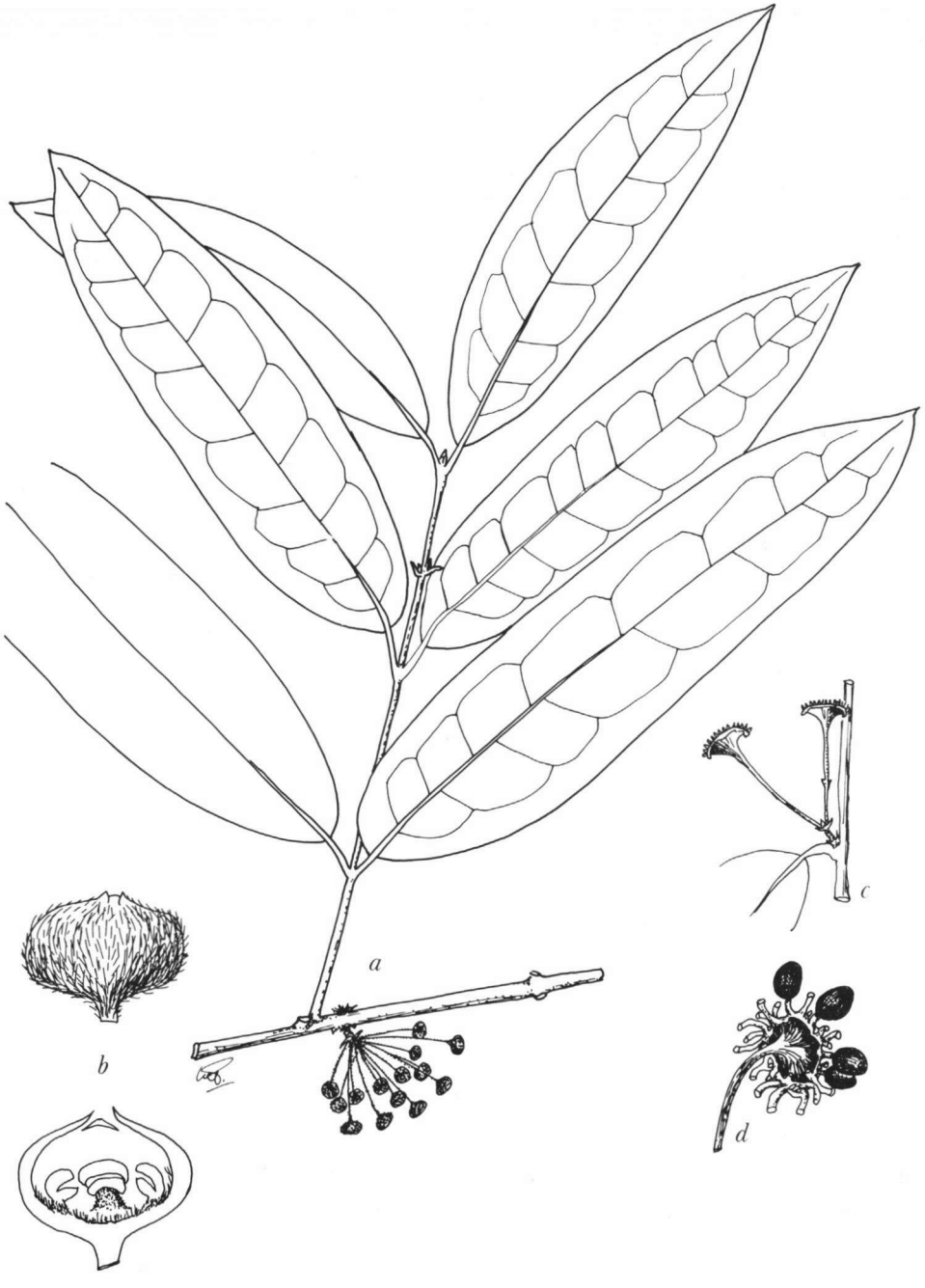


Fig. 19. *Steganthera fasciculata* PHILIPSON. *a.* Habit, with subumbellate male flowers, ×1/2, *b.* male flowers, one in LS, ×5, *c.* female inflorescence, *d.* infructescence with 4 stipitate achenes, both ×1/2 (*a* PHILIPSON & KAIRO 3642, *b ditto* 3643, *c ditto* 3641, *d* PRATT 1082).

als, the upper half abscissing as a calyptra after anthesis to reveal numerous carpels; ovary pubescent; style glabrous awl-shaped. *Drupes* sessile or long-stipitate.

Distr. Queensland, Solomons and *Malesia:* Celebes, Moluccas, New Guinea (incl. Bismarck Archipelago).

Notes. *Steganthera* is frequently confused with *Kibara*, another common and widely distributed genus, because the foliage, fruits and inflorescences are similar. The technical differences between these two genera are not readily observable. They are, firstly, the greater number of tepals in *Kibara*, certain of which are thickened and glandular in the female receptacle, and, secondly, the greater number of stamens in the androecium (but see *S. salomonensis*). However, other features usually allow a generic identification to be made. The most important of these is the appearance of the pedicel: in *Steganthera* the pedicel is relatively slender and is clearly distinct from the receptacle, whereas in *Kibara* the pedicel is thickened distally and has a less clearly defined junction with the receptacle or none at all. Another useful indication is that the leaves usually dry greenish (often yellowish green) in *Kibara*, whereas in *Steganthera* they are mostly brown when dry.

The species of *Steganthera* can be placed in three groups on morphological grounds. One is characterized by the expansion of the female, and to a lesser extent also the male flower, into a turbinate or patelliform receptacle. This group formerly was segregated as the genus *Anthobembix*, but KANEHIRA & HATUSIMA (Bot. Mag. Tokyo 56, 1942, 256) set out valid reasons for uniting the two genera. A second group of species is characterized by their fasciculate inflorescences and by being dioecious. The third group comprises those species lacking both these characters; that is, the species have subglobose receptacles in cymose inflorescences. It includes a number of species which are difficult to separate, including *S. hirsuta* which is very variable in all its characters. The species of the first two groups are well defined morphologically and geographically, whereas those of the third group form a complex which has not yet resolved itself into stable species. These three groups of species are not given formal taxonomic recognition because their limits are not clearly defined. *Steganthera dentata* and *S. cyclopensis* combine fasciculate inflorescences with discoid receptacles and therefore fall into both of the first two groups. In some species the expansion of the receptacle is a variable character; for example, in *S. hospitans* and *S. oligantha* the male flower may be globose, but this may be due to hybridity with *S. hirsuta*.

The association of some species with ants is very striking. These species have enlarged nodes with well-defined pores leading into the hollow stems. Scale insects line the pith cavities and small black ants abound over the plant surface and in the hollow stems. The association is most conspicuous in the large-leaved and abundant species *S. hospitans*, but also occurs in *S. moszkowskii, S. ledermannii* and *S. royenii*.

Pollination biology has not been studied and the structure of the receptacles poses several problems. The male receptacles have open, if small, ostioles at the time the anthers dehisce, but it is not known what insects visit them. The carpels in the female receptacles are covered by the 'calyptra' at anthesis. The ostiole giving access to the female receptacle is even smaller than that of the male and it is not known how pollen reaches the stigmas. These are awl-shaped and converge towards the ostiole. In *Kibara* and some other genera pollen is received on a hypostigma outside the receptacle (ENDRESS, Experientia 35, 1979, 45) but this is not so in *Steganthera*.

KEY TO THE SPECIES

1. Female inflorescence subsessile ..... **16. S. insculpta**
1. Female inflorescence pedunculate.
 2. Male inflorescence umbellate.
  3. Leaves elliptic to broadly elliptic (mostly under 10 cm long: W. Sepik Prov.) ..... **1. S. hentyi**
  3. Leaves oblanceolate to narrowly elliptic (mostly longer than 10 cm).
   4. Male receptacle globose (Papua New Guinea, east of 146°30′ E) ..... **2. S. fasciculata**
   4. Male receptacle discoid.
    5. Leaves narrower than 4.5 cm (W. Irian) ..... **3. S. cyclopensis**
    5. Leaves wider than 7 cm (W. Irian) ..... **4. S. dentata**
 2. Male inflorescence of dichasia, pleiochasia or panicles.
  6. Pedicels of male flowers mostly in irregular clusters.
   7. Nodes dilated, with a pore inhabited by ants (W. Irian).

8. Male receptacle globose ..... **5. S. royenii**
8. Male receptacle turbinate with a 4-lobed apical disc ..... **6. S. moszkowskii**
7. Nodes not harbouring ants.
9. Leaves large[1]. Inflorescence large with stout pedicels (Solomon Is. and Papua New Guinea east of 48°30′ E) ..... **7. S. salomonensis**
9. Leaves smaller (to 10 cm long). Inflorescence small, with slender pedicels (Wau, Goilala & Moresby Prov.) ..... **15. S. australiana**
6. Pedicels of male flowers mostly solitary.
10. Receptacles discoid or turbinate.
11. Leaves 20 cm long or longer (widely distributed) ..... **8. S. hospitans**
11. Leaves considerably shorter.
12. Male inflorescence 1–2-flowered. Leaf 6 cm long or shorter (W. Irian, Idenburg R.) **9. S. myrtifolia**
12. Male inflorescence with more flowers. Leaf longer than 6 cm.
13. Male receptacle turbinate (W. Irian, W. Sepik) ..... **10. S. parvifolia**
13. Male receptacle patelliform (Central Prov.) ..... **11. S. oligantha**
10. Receptacles globose (or only slightly depressed).
14. Leaves usually moderate to large (10–32 cm long) and entire (widely distributed, mainly at lower altitudes, but reaching up to 2450 m) ..... **12. S. hirsuta**
14. Leaves variable in size (usually under 15 cm long, but up to 21 cm), usually coriaceous, often dentate, but also entire when narrow (widely distributed, usually above 1200 m) ..... **13. S. ilicifolia**
14. Leaves 5–10 cm long, coriaceous, ± rugose, entire (Chimbu & Eastern Highlands Prov., above *c.* 2400 m) ..... **14. S. chimbuensis**
14. Leaves 5–10 cm long, chartaceous, usually narrowly elliptic, acuminate, entire or dentate (Wau, Goilala & Moresby Prov.) ..... **15. S. australiana**

1. Steganthera hentyi PHILIPSON, Blumea 29 (1984) 487.

Small tree, to 6 m; young branches densely strigose. *Leaves* elliptic, *c.* 8–9 by 3–4 cm, base cuneate, apex with a short obtuse apiculum, margin entire or with few obscure teeth, becoming glabrous on the leaf surface but with appressed hairs persisting at least on the principal veins; petiole to 8 mm. ?Dioecious. *Inflorescence* axillary or above the axils, of sessile or shortly pedunculate subumbellate fascicles; peduncle to 10 mm, pedicels 20–30 mm, slender, strigose, subtended by minute subulate bracts. — *Male flowers* unknown. — *Female receptacle* subglobose, *c.* 3–4 mm ø at anthesis; tepals 4, rounded, outer surface densely strigose except for the upper part, inner surface with long bristles between the carpels; carpels *c.* 15, ovary covered in dense shaggy hairs, style awl-shaped, glabrous. *Drupes* ovoid, 12 by 7 mm, with appressed hairs, short stipitate.

Distr. *Malesia:* Papua New Guinea (West Sepik Prov.).

Ecol. Primary lower montane valley forest, at 500 m.

Note. The small leaves with appressed hairs on the veins of the underside of the leaf, and the fasciculate inflorescences are distinctive. The flowers are described as pink.

2. Steganthera fasciculata PHILIPSON, Blumea 29 (1984) 487, f. 3. — **Fig. 19.**

Small tree, to 12 m; young branches pubescent. *Leaves* oblanceolate to narrowly elliptic, 13–20(–30) by 3.4–7(–9) cm, base rounded to broadly cuneate, apex narrowed to a short obtuse, or long acute apiculum, margin entire or dentate especially in the upper half (leaves of juvenile plants or of suckers more prominently dentate), pubescence may persist on mature leaves or may be lost except along the veins; petiole to 10 mm, pubescent. *Inflorescences* axillary or supra-axillary; male of sessile or shortly pedunculate fascicles with 10–20 flowers, often appearing as sessile umbels, but sometimes seen to consist of dense fascicles of pleiochasia, the principal branches 10–30 mm, tenuous, hairy; female solitary or in pairs, axillary or supra-axillary, pedicel 20–30 mm with subulate bracts at the base and sometimes about the middle, pubescent. — *Male receptacle* globose, outside pubescent, *c.* 4–5 mm ø; tepals 4, minute; stamens 4, *c.* 1.5 mm long, filament short, hairy, the anthers 1.5 mm broad. — *Female receptacle* bowl-shaped, *c.* 12 mm ø at anthesis; tepals 4, carpels numerous, ovary hairy, style awl-shaped glabrous. *Drupes* not seen. The mature torus with many protuberant pubescent carpophores *c.* 4–7 mm long.

Distr. *Malesia:* Papua New Guinea (Morobe,

(1) Rarely (in the Solomon Is.) small leaves occur on stunted individuals.

Northern & Milne Bay Prov.), also in Goodenough I.

Ecol. Primary lower mountain rain-forest, 365–1200 m.

Vern. *Mamkananeh*, Daga lang.

Note. The young flowers are described greenish cream and the mature torus red.

3. Steganthera cyclopensis PHILIPSON, Blumea 29 (1984) 489.

Shrub to 3 m; young branches with strigose appressed hairs. *Leaves* oblanceolate to narrowly elliptic, up to 17 by 4.2 cm, base truncate or rounded, apex shortly apiculate, margin dentate, when dry grey above, brown below, principal veins prominent, pubescence persisting on the lower midrib and main veins; petiole to 5 mm, hairy. ?Dioecious. *Inflorescences* axillary or above the axils, sessile fascicles of *c.* 12 flowers, pedicels slender, densely strigose, *c.* 15 mm. — *Male receptacle* discoid or bowl-shaped, the stamens in a small central cavity, *c.* 8 mm ø, pubescent on the outer surface of the disc; tepals 4; stamens 4, *c.* 1 mm broad, with a very short broad filament, connective expanded as two wings bordering the small narrow anthers. — *Female flowers* not seen, but fewer per inflorescence. *Fruiting receptacle* slightly enlarged, not succulent, on stout pedicel *c.* 15 mm, upper surface with long hairs between the bases of the apparently sessile achenes. *Drupes c.* 13 by 9 mm with a few persistent appressed hairs.

Distr. *Malesia:* Northern District of West Irian.

Ecol. In primary *Nothofagus* lower montane forest, 1200–1340 m.

Note. Similar to *S. dentata* in many respects, but with smaller usually lanceolate leaves. The flowers are described as carmine and pale orange.

4. Steganthera dentata (VALETON) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 257; PHILIPSON, Blumea 29 (1984) 489. — *Anthobembix dentatus* VALETON, Bull. Dép. Agric. Ind. Néerl. 10 (1907) 13.

Shrub to 4 m, with spreading branches; young branches fulvous pubescent, older branches with swollen nodes. *Leaves c.* 5 mm petioled or leaves subsessile, pubescent, oblanceolate or elliptic, 16–30 by 7–11 cm, chartaceous, base ± auriculate or truncate, apex apiculate, margin with well-spaced, small dentations especially on the distal half; young leaves with pubescence which may persist on the mature leaves or may be lost except along the veins and around the base. Probably dioecious. *Inflorescences* usually inserted well above the nodes (occasionally at the nodes); male sessile or pedunculate fascicles of 10–25 pedicellate flowers, peduncle (if present) up to 15 mm; pedicels 10–20 mm, slender, pubescent; female fascicles few-flowered. — *Male receptacle* bowl-shaped or discoid, outside hirsute, *c.* 6–10 mm ø; tepals 4, minute; stamens 4, 1.5 mm long, filament short, hairy, connective broader than the anthers (before dehiscence). — *Female receptacle* similar to male, carpels numerous, hairy, style awl-shaped, glabrous. *Fruit* unknown.

Distr. *Malesia:* West New Guinea (Northern & Southern Distr.).

Ecol. Primary and secondary forest, at low altitudes (to 160 m).

Note. The short-petioled or subsessile leaves and fasciculate male inflorescences are distinctive. The flowers are described as red, orange or yellow. The anthers are considerably narrower than the connective except in one collection where the more widely gaping anthers may be at a stage after anthesis with the lateral lobes of the connective no longer turgid. It has not been possible to determine whether male and female flowers occur on the same or on separate plants.

5. Steganthera royenii PHILIPSON, Blumea 29 (1984) 489.

Shrub *c.* 4 m; young branches pubescent; nodes becoming dilated and developing pores. *Leaves* oblong-elliptic, up to 29 by 11 cm, chartaceous, base cuneate, apex acuminate, margin entire or with minute remote dentations, principal veins channelled above, prominent below, arched ascending, becoming glabrous or with a minute puberulence persisting mainly on the veins; petiole 5–10 mm. ?Monoecious. *Inflorescences* supra-axillary or axillary, broadly paniculate, 4–5 cm long, single or grouped, puberulent, rachis and principal branches somewhat thick, ending in irregularly clustered slender pedicels. — *Male receptacle* globose, 2–2.5 mm, sparsely puberulent on the outside; tepals 4, minute, rounded; stamens 4, 1 mm long, filament broad, pubescent. — *Female flowers* not seen. *Fruiting receptacle* 2–3 mm ø, leathery. *Drupes c.* 12–20, ovoid, *c.* 12 by 10 mm, verruculose, stipitate; stipes 2–3 mm long, 2.5 mm ø.

Distr. *Malesia:* West New Guinea (a restricted area which includes portions of the Vogelkop, Northern & Southern Distr.).

Ecol. Low-lying primary forest, sometimes periodically flooded, from sea-level to 1200 m.

Vern. *Sirochomenwhah*, Manikiong dialect.

Note. Similar to *S. hospitans* in the appearance of its vegetative parts, but the arrangement of the ultimate branches of the inflorescence is distinctive. The male flowers lack any disk-like extension of the receptacle but female receptacles have not been seen. This species is described as possibly monoecious because one collection bears male inflorescences and also old fruits. However, as these are not on the same branches, the monoecious condition is not certain. All the inflorescences seen consist solely of male flowers, which suggests the possibility of the sexes being on separate plants. The flowers are described

as yellow, the ripe fruit black. The swollen nodes are inhabited by ants.

6. Steganthera moszkowskii (PERKINS) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 255; PHILIPSON, Blumea 29 (1984) 490. — *Anthobembix moszkowskii* PERKINS, Pfl. R. Heft 49 (1911) 26.

Shrub or small tree; branches becoming glabrous; nodes swollen. *Leaves* elliptic-ovate to 35 by 12 cm, chartaceous, base broadly cuneate, apex apiculate, margin entire or remotely dentate, glabrous above, minute pubescence persisting below, especially on the veins, the midrib and principal veins prominent below; petiole 5–8 mm long, minutely pubescent. ?Dioecious. *Inflorescences* at or well above the nodes, diffuse paniculate, to 10 cm long; rachis and branches minutely pubescent. — *Male receptacle* turbinate, pubescent, 3 mm high, apex forming a 4-lobed disk; tepals 4, minute; stamens 4, filament broad, hairy, the united anthers small. — *Female flower* and fruit not seen.

Distr. *Malesia:* West New Guinea (Northern Distr.).

Ecol. Understorey in rain-forest at low altitude.

Note. The male receptacle, with 4 rounded lobes radiating from the apex, is distinctive. The swollen nodes are apparently inhabited by ants which gain entrance through pores.

7. Steganthera salomonensis (HEMSL.) PHILIPSON, Blumea 29 (1984) 490, f. 2. — *Hedycarya salomonensis* HEMSL. Kew Bull. (1895) 137. — *S. suberosoalata* KOSTERM. Gard. Bull. Sing. 22 (1968) 445. — **Fig. 20.**

Shrub or tree, 2–20 m; young branches with a crisp, brownish tomentum or a fine, appressed pubescence which may be quickly lost. *Leaves* ovate or elliptic to narrowly elliptic, rarely suborbicular (Fergusson I.), usually rather large (up to 32 by 11.5 cm), occasionally smaller to much smaller (5 by 2 cm on stunted trees, crater rim New Georgia Group), base cuneate to rounded, apex slightly apiculate; margin entire or rarely a few obscure dentations (even large serrations on saplings, and on flowering branches in Sudest I.), with either a tomentum of crisp brownish hairs which may persist on the undersurface of the leaves especially on the midrib and principal veins, or with a fine pubescence which is soon lost, the mature leaves then becoming glabrous; petiole stout, usually *c.* 5–18 mm, but occasionally shorter, pubescent or becoming glabrous. Monoecious. *Inflorescences* on leafy shoots or cauliflorous, variable in size and complexity, frequently with several main branches arising from a short peduncle, and with the lateral branches clustered at the nodes, the principal branches often flattened; all parts pubescent when young but the branches may become more or less glabrous; the panicles may contain only male flowers when the female flowers are in smaller inflorescences (even solitary) or the female flowers may occur in panicles of mainly male flowers (apparently usually on terminal branches). — *Male flowers* ovoid or subglobose, *c.* 3 mm ø, outside pubescent; tepals 4, rounded; stamen number very variable, usually in two whorls, the outer of larger stamens (3–)4(–5), 2–2.5 mm long, filament hairy, the inner of smaller stamens 1–4 or absent (male receptacles 4 mm ø with broad stamens occur in Rennell Is.). — *Female flowers* subglobose or bowl-shaped, pubescent outside, pilose within, *c.* 3–6 mm ø at anthesis but swelling to *c.* 7–10 mm before the calyptra is shed; ostiole very small with 4 minute tepals; carpels numerous, *c.* 2 mm long, ovary hairy. Peduncle and receptacle usually becoming enlarged and woody in fruit with numerous drupes borne on long woody stipes, but frequently only few (even only 1) fruits ripen, when the receptacle and peduncle are little enlarged; receptacle up to 3 cm ø; stipes up to 14 mm. *Drupes* ovoid, 12–18 by 10–15 mm, verruculose.

Distr. Throughout the Solomon Is. (incl. Bougainville) to San Cristobal and Rennell I., in *Malesia:* Papua New Guinea (Central Prov.; east of Cape Rodney; Milne Bay Prov.).

Ecol. Primary and secondary lowland rain-forest; in scrub on coral debris and in stunted forest on ridges, from sea-level to 750 m.

Note. Considerable variation occurs, one extreme being a handsome tree with large leaves, ± brown-pubescent below, diffuse panicles on leafy twigs and also on the older stems, and with clusters of many stipitate achenes (= *S. suberosa-alata*). On the other hand many specimens, including the type, have smaller, greener leaves which become more or less glabrous, and have fruits with few or even a single stipitate achene. The latter form is characteristic of higher altitudes. Specimens from a dry crater rim in the New Georgia Group are so stunted that their inclusion in this species is open to doubt, though intermediate forms occur. A number of local forms are found on the islands off the eastern end of New Guinea (Fergusson I. to Misima I.). The most distinctive of these, with coarsely serrate leaves, occurs on Sudest I. This may represent a distinct species, but serrate leaf-margins occur elsewhere, especially on saplings or suckers, and the flowers and inflorescences are quite typical of *S. salomonensis*.

8. Steganthera hospitans (BECC.) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 255, f. 5; PHILIPSON, Blumea 29 (1984) 491. — *Kibara hospitans* BECC. Malesia 1 (1877) 189. — *Anthobembix hospitans* (BECC.) PERKINS, Bot. Jahrb. 25 (1898) 567, t. 6B; K. SCH. & LAUT. Fl. Deut. Schutzgeb. Südsee (1900) 330; PERKINS & GILG, Pfl. R. Heft 4 (1901) 55, f. 12; PERKINS,

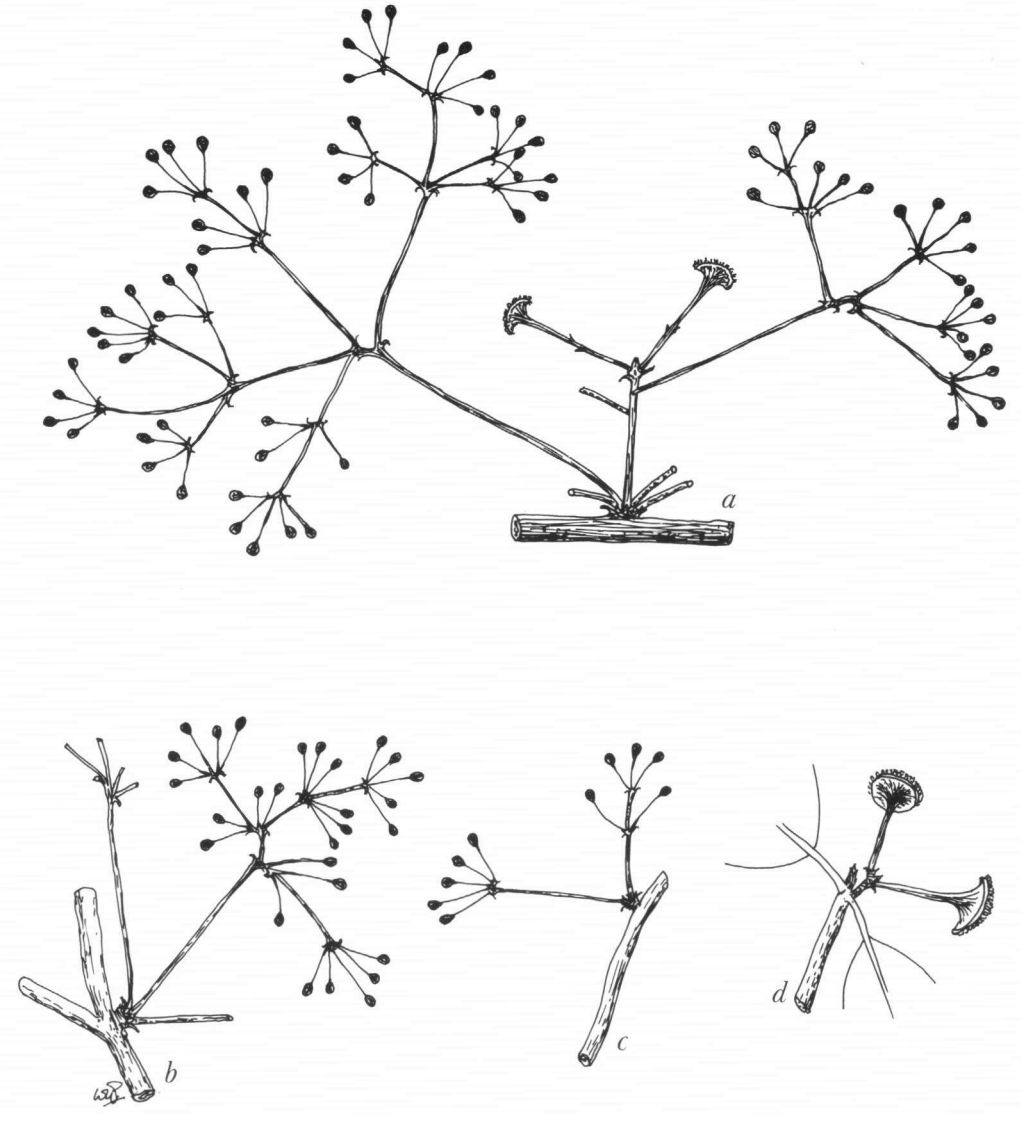


Fig. 20. *Steganthera salomonensis* (HEMSL.) PHILIPSON. *a.* Cauliflorous panicle, with several principal peduncles, central rachis ending with two female flowers, *b–c.* two male inflorescences, *d.* purely female inflorescence. All ×1/2 (*a* BSIP 10575, *b* NGF 28733, *c–d* SCHODDE 5388).

Pfl. R. Heft 49 (1911) 25, f. 10; Bot. Jahrb. 52 (1915) 205, f. 4. — *S. insignis* PERKINS, Pfl. R. Heft 49 (1911) 24, f. 9. — **Fig. 21.**

Shrub or small tree to 8 m; young branches more or less glabrous, or pruinose or minutely puberulous; the nodes soon becoming dilated, and pores developing. *Leaves* oblong-elliptic, or broadly elliptic to obovate, coriaceous, 20–41 by 7–18 cm; base cuneate or rounded, apex apiculate to long acuminate, margin entire or occasionally with well-spaced small den-

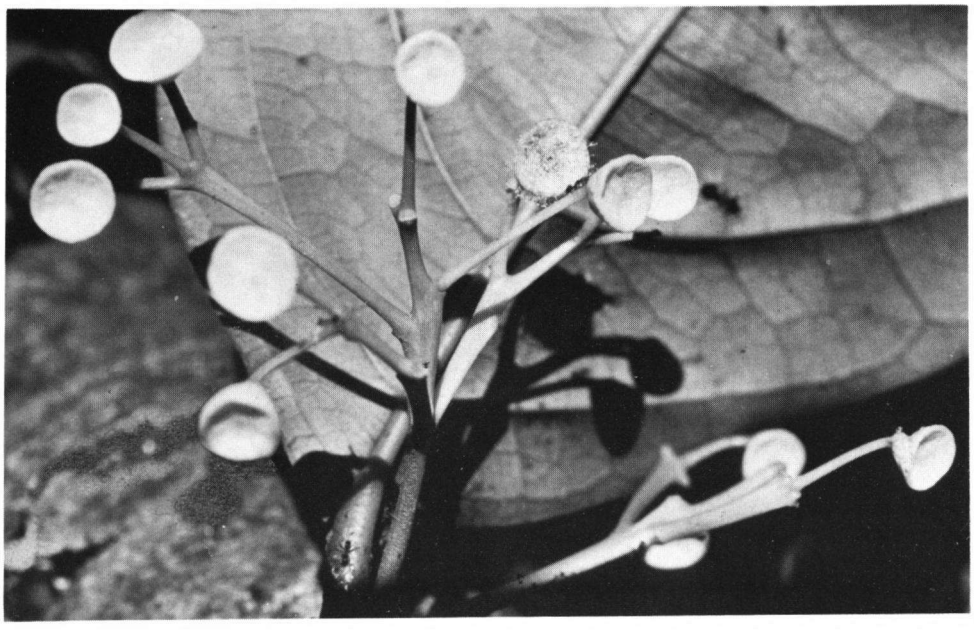


Fig. 21. *Steganthera hospitans* (BECC.) KANEH. & HATUS. Panicle of female flowers. Note ants on blade and thickened petiole; one flower attacked by mould (after PHILIPSON & KATIK 3737).

tations, glabrous or minutely pubescent on the midribs and principal veins, veins impressed above, prominent below. Foliage of juvenile plants lanceolate, *c.* 27 by 4 cm, base narrowly cuneate, apex attenuate, irregularly dentate; petiole to 1 cm. Monoecious. *Inflorescence* axillary or above the nodes, arising successively at the same position, becoming cauliflorous, polychasia or paniculate cymes, minutely pubescent, up to 9 cm long, rachis rather stout, often flattened, with small caducous bracts; pedicels slender, 10–15 mm long. — *Male receptacles* variable in shape, usually turbinate with an expanded flat rim, or this more or less obsolete, 2.5–5 (or more) mm ø; tepals 4, minute, obtuse; stamens 4, 1–1.5 mm high, filament broad, puberulous. — *Female receptacle* turbinate with a broadly expanded flat rim, to *c.* 12 mm ø; tepals 4, minute, carpels numerous, ovary pilose, style awl-shaped, glabrous above. *Fruit* with large succulent receptacle (*c.* 3–4 cm ø) bearing many drupes on short thick stipes. *Drupes* ovoid to globose, *c.* 12 by 10 mm, verruculose.

Distr. Solomon Is. and *Malesia:* throughout New Guinea (from Vogelkop to the east).

Ecol. Primary rain-forest and second growth from low altitudes up to 1200 m.

Vern. *Eppareppar*, Adelbert Range, Utu lang., *soreng*, ibid., Rawa lang., *oloni, wolonyik*, Ambunti, Waskuk lang., *wasa*, Kutubu lang.

Note. The female receptacles are striking, being broadly expanded into button-like disks of a soft butter-yellow colour. The male receptacles are greener and smaller, with a variable extension of the rim: in some species the male receptacles have a broadly expanded rim, but in others the rim may be obsolete, as in the specimens identified as *S. insignis* by PERKINS (originally placed by her in *Anthobembix hospitans*). It is possible that these are hybrids with *S. hirsuta*. Sterile juvenile plants with lanceolate leaves are frequent, and this type of leaf may be found on the lower parts of more adult shrubs, which have begun to produce flowers. The hollow stems and swollen nodes are inhabited by scale insects (*Adeyrodidae*) and by many small black ants. The receptacle becomes succulent and bright orange in fruit, and the ripe drupes are purple-black.

9. Steganthera myrtifolia (A.C. SMITH) PHILIPSON, Blumea 29 (1984) 491. — *Anthobembix myrtifolia* A.C. SMITH, J. Arn. Arb. 22 (1941) 238.

Small tree to 4 m; young branches with appressed strigose hairs. *Leaves* chartaceous, narrowly elliptic to elliptic, 3–6 by 1–3 cm, base attenuated, apex acute or shortly cuspidate, margin entire, glabrous, midrib well-defined below and with numerous fine lateral veins and reticulations; petiole 4–6 mm, glabrescent. ? Dioecious. — *Male inflorescences* axillary, 10–30 mm long, 2- or often 1-flowered, with

Fig. 22. *Steganthera hirsuta* (WARB.) PERKINS. Branch with axillary pleiochasia; the large flowers are female, the smaller male; terminal bud not yet developed (after PHILIPSON & KAIRO 3657).

dense appressed hairs, slender; receptacle somewhat disk-shaped, 2 mm high, 5 mm ø; tepals 4, minute; stamens 4, the longer *c.* 1 mm longer, filaments densely strigose. — *Female inflorescences* similar to male but apparently always 1-flowered; receptacle turbinate, slightly expanded at the circumference, *c.* 2–2.5 mm high, *c.* 3 mm ø, densely strigose within, tepals obsolete; carpels *c.* 6, 1.3–1.5 mm long, ovary densely strigose, style subulate, glabrous. *Fruit* with a stout pedicel *c.* 18 mm; receptacle leathery, only slightly enlarged. *Drupes* subsessile, ovoid, *c.* 13 by 9 mm, verruculose.

Distr. *Malesia:* West New Guinea (Idenburg R.)

Ecol. Mossy forest, 2150 m.

Note. Known only from the original two specimens collected by BRASS. The small, chartaceous, entire leaves are unmistakable among species with a disk-like male receptacle.

10. Steganthera parvifolia (PERKINS) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 257; PHILIPSON, Blumea 29 (1984) 491. — *Anthobembix parvifolia* PERKINS, Bot. Jahrb. 52 (1915) 205. — *Anthobembix brassii* A.C. SMITH, J. Arn. Arb. 32 (1941) 239. — *S. brassii* (A.C. SMITH) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 261, f. 9.

Shrub, sometimes scandent, young branches pubescent. *Leaves* oblong-elliptic to narrowly elliptic, to 14 by 6.5 cm, chartaceous, base rounded or broadly cuneate, apex shortly cuspidate to acuminate, margin entire or with obscure or more prominent remote teeth in the upper part, becoming glabrous or with slight pubescence persisting below, the veins and minor reticulations prominent below; petiole 8–22 mm, pubescent or becoming glabrous. Monoecious. *Inflorescences* axillary or at the ends of leafy shoots, of few-flowered cymes or larger paniculate cymes, to 5 cm long, the rachis, branches and pedicels pubescent; female flowers appear to be confined to the ends of the lower branches. — *Male receptacles* obconic with a flat glabrous and black apex (in dried material) to 8 mm ø, sides of the receptacle hispid; 4 minute tepals forming a raised ostiole; stamens 4, sessile; anthers *c.* 1 mm wide, connective hairy. — *Female receptacle* similar but larger (*c.* 10 mm ø at anthesis), inside with long hispid hairs between the numerous (10–20) carpels; carpels *c.* 2 mm long, ovary pilose, style awl-shaped, glabrous. Receptacle not greatly enlarged in fruit, leathery. Mature *drupes* subsessile or stipitate, ovoid, to 12 by 10 mm, apex mucronate, glabrous, rugose.

Distr. *Malesia:* West New Guinea (Vogelkop, Northern & Southern Distr.), Papua New Guinea (West Sepik Prov.).

Ecol. Understorey of primary lower montane rain-forest, 1900–2800 m.

Vern. *Bobinok*, Telefomin Distr., Bulindup.

Note. The glabrous disk-like upper surface of both male and female receptacles contrasts with the pilose outer surface, especially in dried material in which it takes on a black coloration. The material from the West Sepik Prov. has narrower leaves than the type, but otherwise conforms. The flowers are described as yellow.

11. Steganthera oligantha (PERKINS) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 257; PHILIPSON, Blumea 29 (1984) 493. — *Anthobembix oligantha* PERKINS, Bot. Jahrb. 25 (1895) 568.

Small to large tree, young branches slender, finely puberulous. *Leaves* papyraceous, elliptic-oblong to obovate, 6–11 by 2.5–5 cm, base cuneate, apex acuminate, margin entire, midrib and principal veins evident, reticulations rather obscure, when young covered in appressed minute hairs which persist on the midrib and sometimes on the principal veins; petiole 5–10 mm. ? Monoecious. *Inflorescences* axillary or terminal, few flowered pleiochasia, rachis, branches and bracts pubescent, rachis slender, with a long peduncle before the first branches, at flowering 4–6 cm long. — *Male receptacle* turbinate with an expanded rim, 3 m high, 5–6 mm ø, the upper surface glabrous, the sides puberulous; tepals minute. — *Female receptacle* similar to male, carpels numerous, ovary densely pilose, style awl-shaped, glabrous. Fruiting receptacle leathery, *c.* 10 mm ø. *Drupes* ovoid, 15 by 10 mm, verruculose, *c.* 4–5 mm stipitate.

Distr. *Malesia:* Papua New Guinea (Central Prov., Moresby Distr., Sogeri region).

Ecol. Forest, 900–1600 m.

Note. A large tree with slender twigs, known with certainty only from the three collections made by FORBES in 1855–56 and one recent collection from Efogi. Other collections from the same region closely match the foliage and fruit, but the male receptacles are globose. These may be hybrids with *S. hirsuta*. The female flowers are described as bright yellow and the fruit as black on orange stipes.

12. Steganthera hirsuta (WARB.) PERKINS, Bot. Jahrb. 25 (1898) 567; K. SCH. & LAUT. Fl. Deut. Schutzgeb. Südsee (1900) 329; PERKINS & GILG, Pfl. R. Heft 4 (1901) 54; PERKINS, Bot. Jahrb. 52 (1915) 202; PHILIPSON, Blumea 29 (1984) 493, f. 4. — *Kibara (?) hirsuta* WARB. Bot. Jahrb. 13 (1891) 316. — *S. warburgii* PERKINS, Bot. Jahrb. 25 (1898) 564. — *S. schumanniana* PERKINS, *l.c.* 565. — *S. thyrsiflora* PERKINS, *l.c.* 565, t. 6A; PERKINS & GILG, Pfl. R. Heft 4 (1901) 53, f. 11; PERKINS, *ibid.* Heft 49 (1911) 22, f. 8G. — *S. oblongiflora* PERKINS, Bot. Jahrb. 25 (1898) 566; PERKINS & GILG, Pfl. R. Heft 4 (1901) 54 (*'oblongifolia'*); PERKINS, *ibid.* Heft 49 (1911) 22, f. 8A–E. — *S. fengeriana* PERKINS, Bot. Jahrb. 25

(1898) 566; Pfl. R. Heft 49 (1911) 22, f. 8F. — *S. crispula* PERKINS, Pfl. R. Heft 49 (1911) 21. — *S. torricellensis* PERKINS, *l.c.* 21. — *S. forbesii* PERKINS, *l.c.* 23. — *S. buergersiana* PERKINS, Bot. Jahrb. 52 (1915) 199, f. 2. — *S. riparia* KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 259, f. 8. — **Fig. 22.**

Tree up to 20 m, occasionally a straggling shrub or liane; young branches with a dense tomentum or a fine pubescence which may persist on the leafy branches or these may quickly become glabrous. *Leaves* broadly ovate or elliptic to narrowly elliptic, rarely lanceolate or more or less orbicular, usually of moderate size (10–13 cm long) but frequently up to 32 by 13 cm and occasionally much smaller (7.5 by 2 cm); base rounded or cuneate, apex apiculate, margin entire or occasionally with a few obscure dentations or rarely serrate, either quickly losing all or most of their original pubescence, or the tomentum may persist on both sides of the blade, but more especially below, sometimes as a thick woolly coating over the entire undersurface; principal veins conspicuous below, arching strongly or more gradually towards the apex; petiole 3–14 mm, pubescent or glabrous. Monoecious. *Inflorescences* axillary, supraaxillary or terminal, usually pleiochasia with the lower lateral branches again branched or reduced to simple dichasia, densely pubescent throughout or glabrous. — *Male flowers* ovoid or globose, usually pubescent on the outside, 2.5–4 mm ø; tepals 4, rounded, the wall thick, leathery, enclosing a cavity either confined to the upper half of the receptacle or extending to near the base; stamens 4, 1–1.5 mm long, filaments pilose. — *Female flowers* globose or somewhat depressed, 3.5–4.5 mm ø, usually pubescent outside, pilose within, sometimes longitudinally furrowed when dry; ostiole small, surrounded by 4 minute or obsolescent tepals; the cavity large; carpels numerous, 1.5–2 mm long, ovary slender, pilose, stigma subulate. *Fruiting receptacle* enlarged to *c.* 2 cm ø. *Drupes* stipitate or more or less sessile; stipes woody, to 10 mm long; achenes ovoid to *c.* 13 by 10 mm, verruculose.

Distr. Australia (Queensland, Iron Range); in *Malesia:* SW. Celebes (Mt Bonthain), Moluccas (Buru, Ceram, Ambon, Halmahera, Ternate, Aru Is.), New Guinea (throughout the island from Vogelkop Peninsula to Milne Bay Prov.: Mt Suckling), also on Manus I., New Britain and New Ireland.

Ecol. An understorey tree in rain-forest, mostly at low altitudes, but also in montane forest up to 2450 m. It is recorded from seasonally inundated swamps and from ridge forest. Usually a moderate sized tree with a spreading crown, it may also be a straggling shrub and occasionally is described as a liane.

Uses. The wood is used for clubs (Isago village, Balimo district, Western Prov.). Pipe tobacco rolled in the leaves (Butemu village, Saidor Distr., Madang Prov.).

Vern. *Gwa*, Wagu, *imaitru*, Jal, *kamakama, kamokam*, Enga, *kubal, sap*, Madang, *kuraili*, Koropa, *kwaffel*, Bembi, *mankanane*, Mt Suckling, *metjem, mey*, Waskuk, *namelawe*, Kainantu, *napiwa*, Talasea, New Britain, *ongupinpae*, S. New Britain, *sakoboe*, Moeswaar I., *sore*, Naho, *tangitang*, Tomba, *tonona*, Kutubu, *tsohren*, Rawa, *tugwambi*, Wagu, *tunngacook*, Wein, *vingi-vingi*, Bayer R., *waluwali-i*, Gogodala.

Notes. The number of different forms included within this species cannot be considered satisfactory, yet they appear to be connected by intermediates so that any segregation of these forms as species would seem, at this stage, to be even less satisfactory. This aggregate has a geographical range extending from Celebes almost to the eastern limit of New Guinea, and reaches from sea-level to 2450 m. It is frequent throughout its range, and the number of separate collections of it approaches that of all the other species combined. Several specific names have been applied to different forms within the complex and some of these certainly appear distinctive until intermediate forms are compared. Variability effects most features of the plant: leaf shape and leaf size and the pattern of the principal veins; the presence or absence of marginal teeth and their prominence; the degree of development and persistence of the indumentum; the degree of branching of the inflorescence; the size and shape of the male and female receptacles; the ratio between the cavity and wall thickness in the male flower; and the presence and length of the stipes bearing the achenes. Some combinations of character states may occur frequently in one region, encouraging the belief that local segregate species may eventually become recognizable. An example is the form named *S. oblongiflora* (with elliptical male receptacles with small cavities and narrowly elliptical ± glabrous leaves with few, sharply ascending veins) that occurs in the upland parts of the Northern and Central Provinces and adjacent parts of the Manyamya District of Morobe Province. Similar to it and occurring sympatrically is the form named *S. thyrsiflora* which is most frequent in the neighbouring Wau, Mumeng and Lae Districts of Morobe Province. This form has broader glabrous leaves with more spreading principal veins, and with globose receptacles with proportionally larger cavities. However, the character states intergrade and occur in different combinations, so that specific distinctions cannot be maintained. A practical difficulty with herbarium material is that specimens rarely display all the significant characters, so that a definitive treatment of this complex must finally rely on extensive fieldwork. Another distinctive form with densely hairy leaves (and often with ± sessile achenes) has

Fig. 23. *Steganthera ilicifolia* A.C. SMITH. *a.* Habit, ×2/3, *b.* male flowers, one in LS, *c.* anther from this flower, all ×7 (*a* PHILIPSON & KARINGA 3720, *b–c* CARR 15203).

been collected most frequently east of Wau, but is also found from the Owen Stanley Range to the Western Highlands Province.

The young foliage is pinkish; the flowers are cream coloured; and the black drupes are borne on red, yellow or orange receptacles.

13. Steganthera ilicifolia A.C. SMITH, J. Arn. Arb. 22 (1941) 235; PHILIPSON, Blumea 29 (1984) 495. — **Fig. 23.**

Shrub or small tree to 12 m; young branches with strigose or silky appressed hairs. *Leaves* chartaceous, elliptic, lanceolate to broadly elliptic, 5.5–21 by 2–8.5 cm, base obtuse rounded or truncate, apex with a long or short acute apiculum, margin with prominent, remote denticulations, or with few minute teeth or entire, at first often covered with silky appressed hairs, becoming glabrous or retaining some indumentum, especially on the midrib below, nerves and reticulations prominent on the lower surface; petiole 5–15 mm, strigose or becoming glabrous. Monoecious. *Inflorescences* axillary, supra-axillary or terminal, 4–6.5 mm long, either solitary few-flowered pleiochasia, or groups of a few pleiochasia, rachis and branches with strigose hairs, minute linear bracts below or on the branches (and also sometimes on the receptacles), rachis slender with a long peduncle before the first branching, branches opposite or subopposite, singly or in clusters and themselves branching. — *Male receptacle* spherical *c.*

2–3 mm ø, slightly strigose outside; tepals 4, rounded; stamens 4, *c.* 1.25–2 mm long, with short, glabrous or minutely pubescent filaments. — *Female receptacle* larger and slightly flatter than the male, *c.* 4–5 mm ø at anthesis, ostiole minute; tepals 4, minute or obsolete, inner surface pilose; carpels *c.* 10–20, 1.5–2.5 mm long, ovary pilose, style awl-shaped, glabrous. *Fruiting receptacle* only slightly enlarged, with hairs between the subsessile or more usually stipitate drupes (stipe occasionally to 5 mm long). *Drupes* ovoid, *c.* 12 by 9 mm when dry, verruculose and slightly pilose.

Distr. *Malesia:* New Guinea, from Milne Bay Prov. (incl. Fergusson I. at 900 m) westwards as far as the Star and Carstensz Mts in West New Guinea; also in the mountains north of the Huon Gulf in Morobe and Madang Prov.

Ecol. A straggling understorey shrub or small tree in lower mountain forest (often with *Nothofagus* and *Castanopsis*) or in thickets at the forest margin. Frequent along the central mountains usually above 1200 m to as high as 3250 m (but rather lower in Central Prov.).

Uses. Provides stakes for general purposes, *e.g.* for house-building, for digging sticks and firewood.

Vern. *Agubporombigl*, Hagen, *genzphora, iganaphore*, Tairoa lang., *kamagam, kamokam, kamokum*, Enga lang., *kamokamp*, Mendi lang., *kamakama*, Ialibu, *kombugump, toin bekl*, Togoba, *munne yambo*, Maring, *pundpunda*, Melpa lang., Mt Hagen, *soreng*, Nako lang., *yuri*, Minj.

Note. A common and widespread species, usually a straggling shrub, but sometimes attaining tree stature. In its usual form the harsh dentate leaves vary in size and shape, but the prominent venation below is characteristic as are the delicate, few-flowered inflorescences with small, globose male flowers. Female flowers are less frequent and are either terminal or end the distal branches. In less typical forms the dentations become fewer and less prominent, culminating in forms with quite entire, often lanceolate leaves. A few of the specimens with entire leaf margin cannot be distinguished from forms of *S. hirsuta* with certainty. The young foliage is described as red or pink, the flowers cream, and the ripe receptacle orange bearing purple-black drupes. The flowers are frequently deformed by insect galls.

14. Steganthera chimbuensis PHILIPSON, Blumea 29 (1984) 495.

Shrub or tree to 20 m; new growth glabrous or sometimes very finely pubescent. *Leaves* glabrous, chartaceous, elliptic, 5–10 by 2.2–4.2 cm, base broadly cuneate, apex apiculate, margin entire (rarely some leaves on a plant may have one or a few dentations), midrib and principal veins usually impressed above (blade more or less rugose) and elevated below; petiole 4–10 mm. Monoecious. *Inflorescences* axillary or supra-axillary, dichasia or with one terminal flower, *c.* 2–3 cm long, with small linear bracts subtending the branches or inserted on them. — *Male receptacles* globose, 2–3 mm ø; tepals 4, rounded, ostiole tending to open widely; stamens 4, *c.* 1.75 mm long, filament hairy. — *Female receptacle* similar to male, slightly larger and often solitary, tepals and ostiole ± obsolete; carpels *c.* 12–20, 2 mm long, ovary pilose, stigma glabrous, awl-shaped. *Fruiting receptacle* slightly enlarged, leathery. *Drupes* ovoid, *c.* 11 by 8 mm, verruculose, shortly stipitate.

Distr. *Malesia:* Papua New Guinea (Chimbu & Eastern Highlands Prov.).

Ecol. Primary and secondary lower montane forest, 2400–2850 m.

Vern. *Abangle*, Chimbu, Masul, *ivananottoi*, Mairi, Watabung, *pemble*, Wahgi, Minj, *pogambeg*, Hagen, Togoba.

Note. Similar to the more widely spread *S. ilicifolia*, but the leaves are entire (a dentation very rarely occurs on a leaf of a plant with otherwise entire leaves) and the undersurface dries a warm cinnamon brown in contrast to the buff colour of *S. ilicifolia*. The flowers are described as pale yellow, the drupes purple-black on an orange receptacle.

15. Steganthera australiana C.T. WHITE, Proc. R. Soc. Queensl. 55 (1944) 78; PHILIPSON, Blumea 29 (1984) 496.

Small tree to 10 m; young branches finely pubescent. *Leaves* chartaceous, lanceolate or narrowly to broadly elliptic, *c.* 5–10 by 1.5–5 cm, base attenuate, apex long-acuminate, margin entire or remotely and finely dentate, becoming glabrous or pubescence persisting on midrib and main veins below or occasionally also on the lower surface; petiole 5–10 mm, glabrous or pubescence persistent. Monoecious. *Inflorescences* axillary or supra-axillary, dichasia or few-flowered pleiochasia, rachis, branches, bracts and receptacles pubescent, the rachis slender with a long peduncle below the first branches, branches opposite or subopposite, singly or in clusters. — *Male receptacles* globose, narrowed into the pedicel, 2–2.5 mm ø; tepals 4, rounded, minute; stamens 4, 1.5 mm long, filament pilose. — *Female receptacles* similar but larger, *c.* 4 mm ø at anthesis, at and near the ends of inflorescences (when present); tepals 4, minute, inner surface long-pilose, carpels numerous, *c.* 2.2 mm long, ovary pilose, style awl-shaped, glabrous. *Fruiting receptacle* slightly enlarged, leathery. *Drupes* ovoid, 11–14 by 9–11 mm, verrucose, sessile or shortly stipitate.

Distr. Queensland; in *Malesia:* Papua New

Guinea (Morobe Prov.: Wau Distr.; Central Prov.: Goilala & Moresby Distr.).

Ecol. Lower montane forest (*Castanopsis* and *Nothofagus* dominated) and second growth, 1000–2300 m.

Note. A plant of restricted distribution in New Guinea, characterized by the small, usually more or less lanceolate and apiculate leaves and delicate inflorescences, is identified with the species described from Queensland. The few New Guinea specimens show more variation in size, shape, dentation, and indumentum of their leaves than may occur in Australia. A specimen from near Wau has more richly branched inflorescences, the side-branches being clustered, whereas in the other specimens they occur in opposite pairs. CARR collected this species on five occasions, but it has been collected only twice subsequently. A small tree with greenish or cream flowers.

16. Steganthera insculpta PERKINS, Bot. Jahrb. 52 (1915) 202; PHILIPSON, Blumea 29 (1984) 496.

Shrub to 1.5 m high; young branches densely brown pilose. *Leaves* chartaceous, elliptic oblong or ovate, 12–21 by 5–10 cm, base rounded, apex apiculate, margin with regular, wide-spaced, small dentations; young leaves uniformly densely brown pilose, in mature leaves the upper surface with remnants of the indumentum especially on the veins, the undersurface remaining densely pilose on the veins, with scattered hairs elsewhere, reticulation impressed above and prominently raised below; petiole 4–6 mm, densely pilose. — *Male flowers* unknown. — *Female flowers* in subsessile axillary or supra-axillary groups. *Fruiting receptacle* densely pilose. *Drupes* numerous, sessile, ovoid or subglobose, 9 by 6 mm, densely pilose.

Distr. *Malesia:* Papua New Guinea (Sepik region & Telefomin). Two collections.

Ecol. In forest at 850–1600 m.

Note. This species is distinguished from densely hairy forms of *S. hirsuta* by the virtually sessile female inflorescences and the regular small dentations on the leaf margins. It may prove to be best regarded as a form of that species because a sterile specimen from much further to the east has leaves identical to those of the type. However, fertile specimens from the same locality with similar (but not so regularly dentate) leaves have long-pedunculate cymose inflorescences and are identified as *S. hirsuta*.

Insufficiently known

1. *Steganthera atepala* PERKINS in K. Sch. & Laut., Fl. Deut. Schutzgeb. Südsee (1900) 329. — RODATZ & KLINK 237, Bismarck Range.

2. *Steganthera odontophylla* PERKINS, Pfl. R. Heft 49 (1911) 23. — SCHLECHTER 17847, Kaui Mts.

3. *Steganthera pycnoneura* PERKINS, *l.c.* 23. — SCHLECHTER 19517, Maboro.

4. *Steganthera symplocoides* PERKINS, *l.c.* 23. — SCHLECHTER 19825, Goridjoa.

5. *Steganthera psychotrioides* PERKINS, Bot. Jahrb. 52 (1915) 198. — LEDERMANN 9078, Sepik.

6. *Steganthera alpina* PERKINS, *l.c.* 201. — LEDERMANN 11968, Sepik.

7. *Steganthera ledermannii* (PERKINS) KANEH. & HATUS. Bot. Mag. Tokyo 56 (1942) 255. — *Anthobembix ledermannii* PERKINS, Bot. Jahrb. 52 (1915) 203, f. 3. — LEDERMANN 11412. Very like *S. hospitans* but leaves with long white hairs, a feature not seen in *S. hospitans*.

10. MATTHAEA

BLUME, Mus. Bot. Lugd.-Bat. 2 (1856) 89; PERKINS, Bot. Jahrb. 25 (1898) 562; Pfl. R. Heft 4 (1901) 51, f. 10; *ibid.* Heft 49 (1911) 15; Ubersicht Gattungen Monim. (1925) 62; PHILIPSON, Blumea 28 (1982) 77, f. 1–3. — **Fig. 24–26.**

Shrubs or small trees. *Leaves* pubescent or glabrous at maturity, entire or dentate. Monoecious, with lateral (rarely also terminal) cymose *inflorescences*, much shorter than the leaves. — *Male receptacle* subglobose, the ostiole surrounded by 4 small rounded tepals. *Stamens* 4, free; filaments short; anthers opening by 2 longitudinal slits. — *Female receptacle* more flattened; tepals 4, upper half abscissing as a calyptra at anthesis to reveal very numerous carpels. *Drupes* long-stipitate, verruculose.

Distr. *Malesia:* Malay Peninsula, Sumatra, Anambas Is., Borneo, Celebes, Philippines, N. Moluccas (Talaud Is.).

Ecol. Rain-forest, ascending to 1700 m.

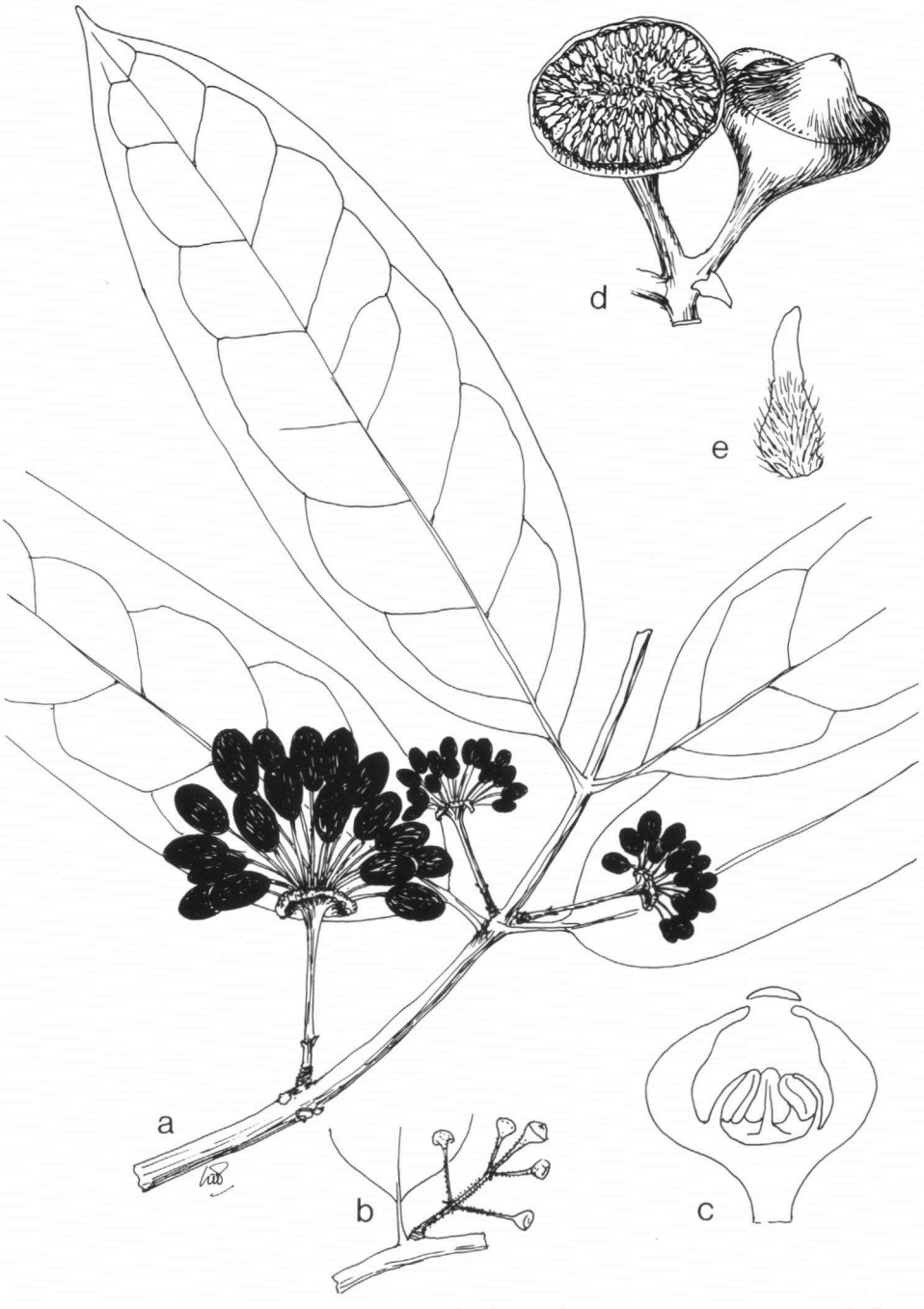


Fig. 24. *Matthaea sancta* BL. *a.* Habit, developing fruits, *b.* male inflorescence, both ×1/2, *c.* male flower in LS, ×7, *d.* female flowers, on left the calyptra removed, ×5, *e.* carpel with prominent stigma, ×12 (*a* AHMED *s.n.*, *b* VAN BALGOOY 2029, *c* TOXOPEUS 547, *d–e* VAN STEENIS 1171).

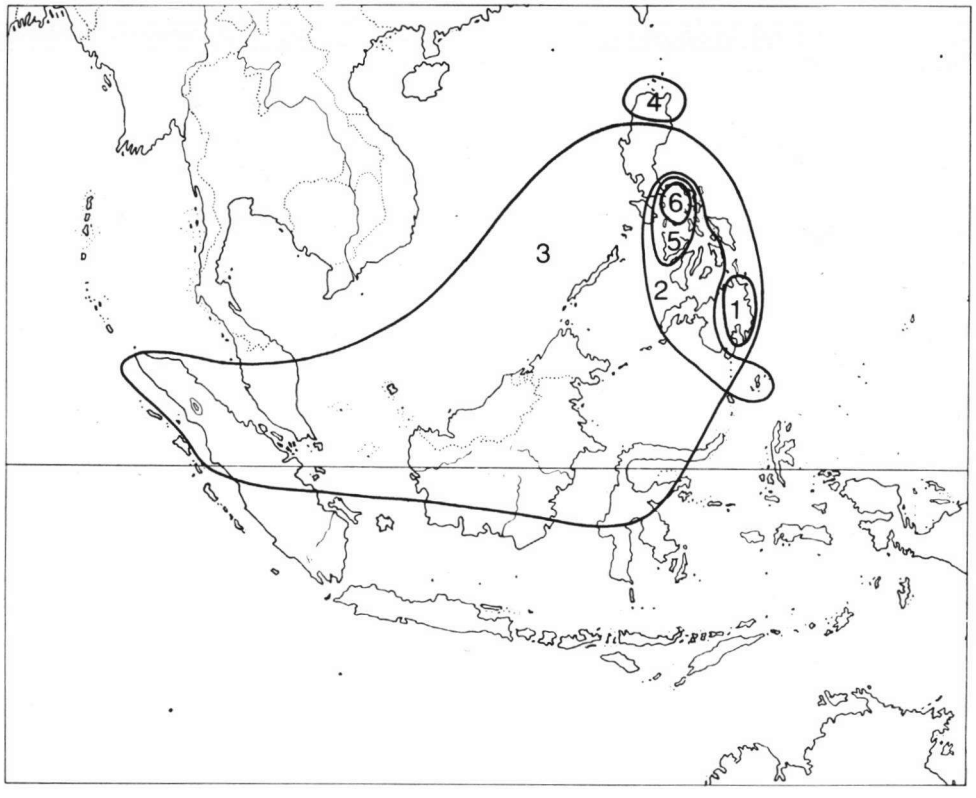


Fig. 25. Range of the species of *Matthaea* BL. 1. *M. pubescens*, 2. *M. chartacea*, 3. *M. sancta*, 4. *M. heterophylla*, 5. *M. vidalii*, 6. *M. intermedia*.

Note. The distinction between *Matthaea* and *Steganthera* is very slight. The two genera are so alike vegetatively that sterile specimens cannot be allocated to a genus with confidence, and their flowers and fruits are also very similar except for their anthers. In both genera there are four stamens; in *Matthaea* these bear anthers opening by two more or less vertical slits, whereas in *Steganthera* the anthers open by a single horizontal slit. It is useful to maintain the two genera because they are geographically separated (though both may occur in Celebes). *Matthaea* is restricted to western Malesia while *Steganthera*, a considerably larger genus, is centered on New Guinea with outliers in the Moluccas, Celebes and Queensland. Some uncertainties of range remain as male flowers and fruits are not available from several areas.

KEY TO THE SPECIES

1. Undersurface of leaves pubescent ..... **1. M. pubescens**
1. Undersurface of leaves glabrous.
 2. Leaves more than 15 cm long.
  3. Principal lateral veins of undersurface less distinct, scarcely raised above the surface. Leaves usually elliptic to broad-elliptic ..... **2. M. chartacea**
  3. Principal veins on undersurface prominent, raised above the surface. Leaves usually oblong-lanceolate to lanceolate.
   4. Leaves oblong-elliptic to narrowly oblong ..... **3. M. sancta**
   4. Leaves lanceolate (N. Luzon) ..... **4. M. heterophylla**
 2. Leaves less than 15 cm long.

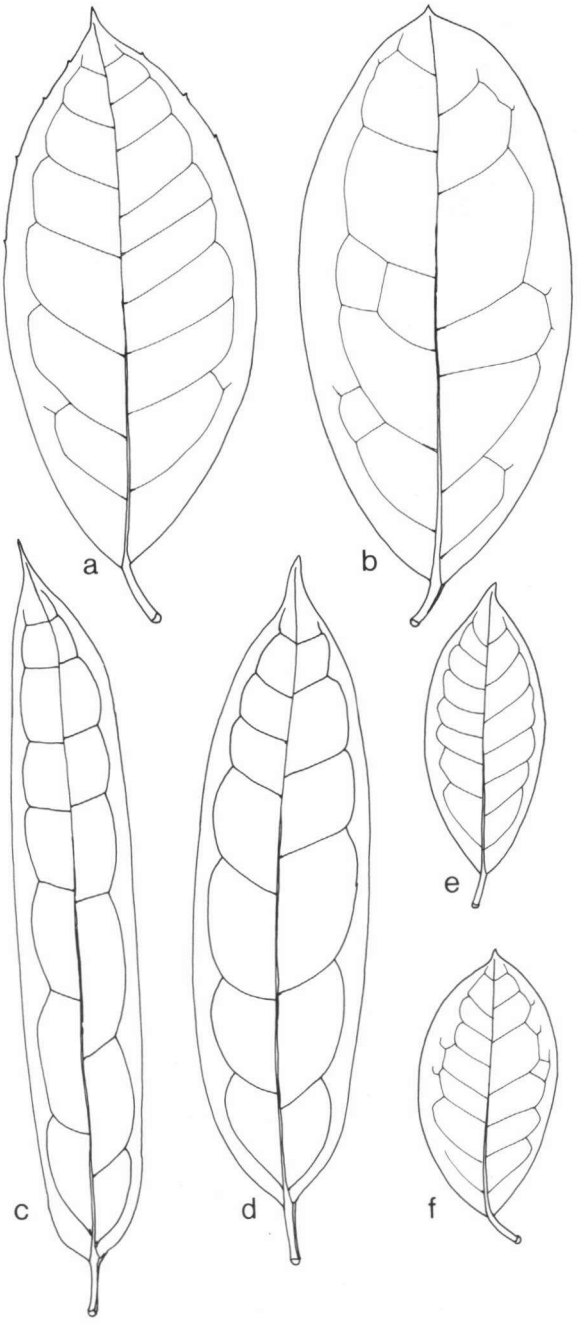


Fig. 26. Leaves of *Matthaea* species, all ×1/3. *a. M. chartacea, b. M. pubescens, c. M. heterophylla, d. M. sancta, e. M. vidalii, f. M. intermedia* (*a* BS 40705, *b* ELMER 10699, *c* BS 78395, *d* RIDLEY 10770, *e* BS 30718, *f* PNH 4480).

5. Leaves lanceolate-oblong ..... **4. M. heterophylla**
5. Leaves elliptic to elliptic-oblong.
6. Venation on lower surface prominent, raised above the surface. Lamina, petiole, and young branches green ..... **5. M. vidalii**
6. Venation on lower surface less distinct, scarcely raised. Lamina, petiole, and young branches olivaceous **6. M. intermedia**

1. Matthaea pubescens MERR. *ex* PERKINS, Bot. Jahrb. 45 (1911) 422; Pfl. R. Heft 49 (1911) 16; MERR. En. Philip. 3 (1923) 186; PHILIPSON, Blumea 28 (1982) 80, f. 1 & 2. — **Fig. 26b.**

Shrub or small tree, to 10 m; young branches densely brown pubescent. *Leaves* broadly elliptic to elliptic, 12–27.5 by 5.5–13.7 cm; apex rounded with a short acute apiculum, base broadly cuneate, truncate or rounded, densely brown tomentose (but the upper surface eventually becoming almost glabrous), margin entire or often with dentations on its upper part, lateral veins arched, obscure above; petiole 5–15 mm, densely tomentose. *Inflorescences* axillary, solitary or few in the same axis; male rachis densely brown tomentose, *c.* 20 mm, bearing a terminal flower, with usually 2 lateral branches subtended by minute bracts; receptacle *c.* 6 mm ø (when dry), tomentose; tepals 4, minute; stamens 4, free. — *Female inflorescences* similar, but apparently only the terminal flower develops fruit (lateral branches frequently bear male flowers) and usually only one inflorescence develops fruit in each axil; rachis becoming stout, elongating to *c.* 30 mm; receptacle turbinate, 10–15 mm ø at anthesis, larger in fruit, inner surface with pilose hairs between the carpels; carpels very numerous, ovary densely strigose; stigmas prominent. *Drupes* numerous, 30 by 15 mm (when dry).

Distr. *Malesia:* Philippines (Mindanao: Agusan, Surigao, Bukidnon & Davao Prov.). Fig. 25.

Ecol. In dense, often mossy forest, 300–1700 m.

Vern. *Kalagau, mangilas*, Bukidnon, *baringoras, bayung-bayung*, Bag.

Note. The wood is described as white and moderately hard; the bark as yellowish grey, fissured. Ripe fruits are blue-black.

2. Matthaea chartacea MERR. Publ. Gov. Lab. Philip. *n.* 35 (1905) 14; PERKINS, Pfl. R. Heft 49 (1911) 18; MERR. En. Philip. 3 (1923) 186, f. 1–2; PHILIPSON, Blumea 28 (1982) 80. — *M. williamsii* PERKINS, Bot. Jahrb. 45 (1911) 422. — *M. pinchotiana* PERKINS, *l.c.* 423. — **Fig. 26a.**

Shrub or small tree to 10 m; young branches becoming glabrous. *Leaves* oblong-ovate, (13–)15–20 (–25) by 6–9.5(–12) cm, apiculate with an obtuse or acute apex, chartaceous, glabrous when mature (rarely a few hairs retained at the base of the blade); margin with small dentations on the upper part or entire; lateral veins arched, obscure above, veins of a lower order obscure; petiole 15–20 mm, glabrous (rarely with some persistent hairs). *Inflorescences* axillary, solitary or few in the same axil. — *Male rachis* strigose, to 20 mm, with minute scales at the base, bearing a terminal flower, side branches 1–2 or absent, *c.* 10 mm long, subtended by minute strigose bracts; receptacle *c.* 5 mm ø (when dry), slightly strigose; tepals 4, minute; stamens 4, free; filaments broad, short; anthers broadly triangular. — *Female inflorescence* similar, but apparently only the terminal flower develops to fruit (lateral branches frequently bear male flowers); rachis becoming stout and dilated distally, elongating to *c.* 35 mm; receptacle turbinate, *c.* 10 mm ø at anthesis, slightly larger in fruit; carpels very numerous; ovary densely strigose; stigma prominent. Hairs persist on the young fruit, but the numerous ripe *drupes* are glabrous, shining black, wrinkled, *c.* 20 by 15 mm (dry), long-stipitate (*c.* 18 mm long).

Distr. *Malesia:* Philippines (Luzon: Laguna & Tayabas Prov.; Mindoro; Leyte; Mindanao: Zamboanga Prov.) and N. Moluccas (Talaud Is.: Karakelong). Fig. 25.

Ecol. Dense forest and second growth, to 700 m.

Uses. The stem is scraped and applied for headaches. The plant is used in hunting rituals.

Vern. *Alukba, barau-barau*, Mang., *molikotlang*, Mindoro, *matagusa, selimbwang*, Zamboanga; *laba*, Moluccas, Talaud.

Note. This species is similar to *M. pubescens* except for the lack of indumentum. Although both these species occur on Mindanao, their ranges do not overlap, *M. chartacea* being confined to the west and *M. pubescens* to the east.

3. Matthaea sancta BLUME, Mus. Bot. Lugd.-Bat. 2 (1856) 90, t. 10; PERKINS, Bot. Jahrb. 25 (1898) 563, t. 5d; Pfl. R. Heft 4 (1901) 52, f. 10; *ibid.* Heft 49 (1911) 18, *incl. var. mindanaoensis* PERKINS *et var. venulosa* PERKINS, *l.c.*; MERR. En. Philip. 3 (1923) 186; RIDL. Fl. Mal. Pen. 3 (1924) 73; PHILIPSON, Blumea 28 (1982) 82, f. 1–3. — *Ficus pulchra* WALL. Cat. (1831) *n.* 4518, *nomen.* — *Mollinedia sancta* (BL.) BAILL. Hist. Pl. 1 (1869) 306. — *M. latifolia* PERKINS, Bot. Jahrb. 25 (1898) 563, t. 5d; Pfl. R. Heft 4 (1901) 52, f. 10; *ibid.* Heft 49 (1911) 17, f. 7B–C. — *M. calophylla* PERKINS, Bot. Jahrb. 25 (1898) 563; Pfl. R. Heft 4 (1901) 52; *ibid.* Heft 49 (1911) 17, f. 7A. — **Fig. 24, 26d.**

Shrub or small tree, rarely to 15 m; young branches becoming glabrous. *Leaves* lanceolate-

oblong to oblong, 15.5–31 by 3.5–9.5 cm, acuminate, base broadly cuneate, truncate or rounded, chartaceous, often somewhat bullate, margin entire or dentate distally, glabrous; lateral veins arched and uniting far from the margins, impressed on upper surface, prominently raised above the lower surface; petiole 2–3 cm, glabrous. *Inflorescences* axillary, solitary or fascicled. — *Male rachis* 2–3 cm, pubescent, bearing a terminal flower and usually 1–2 pairs of lateral flowers on short branches (which occasionally also bear side-branches); receptacle subglobose, *c.* 3–5 mm ø, slightly strigose; tepals 4, minute; stamens 4, free; filaments broad, short; anthers triangular. — *Female inflorescences* similar, some lateral as well as the terminal flower female and developing fruit, or (more usually) the lateral branches bear male flowers which are soon shed; rachis becoming stout and dilated distally; receptacle turbinate, *c.* 12 mm ø at anthesis (dry), inner surface pilose between the carpels; carpels very numerous, ovary densely pilose, stigma prominent. *Drupes* numerous, up to 25 mm stipitate, ovoid, 18 by 11 mm.

Distr. *Malesia:* Sumatra, Malay Peninsula (Perak & Pahang to Singapore), Anambas Is., Borneo (Sarawak, Sabah, Kalimantan), Philippines (Luzon, Negros, Cebu, Mindanao) and Celebes. Fig. 25.

Ecol. Small tree or shrub, sometimes scandent in forest, from low altitudes to 1200 m.

Uses. The wood is heavy and branches are used in building houses. The leaves are smoked with tobacco to relieve headaches.

Vern. Malacca: *poko churow, p. lumsoo*; Anambas Is.: *kayu sama*; Philippines: *babang di putukan*, If., *colog-colog*, Negros, *bago-bago*, C. Bis.

Note. The only species with a wide geographical range. Leaf size and breadth are variable, as is the degree of toothing of the margin. Typical leaves are narrowly-oblong, apiculate, and with distant, prominent, strongly arched lateral veins. Broader and more coarsely toothed leaves appear to occur more frequently to the east of the range, but no basis for subspecific taxa can be discerned. The wood is said to be reddish and moderately hard. The ripe fruit is blue-black.

4. Matthaea heterophylla QUIS. & MERR. Philip. J. Sc. 37 (1928) 145; PHILIPSON, Blumea 28 (1982) 82, f. 1–2. — **Fig. 26c.**

A shrub with appressed whitish hairs on the developing parts but becoming glabrous. *Leaves* oblong-lanceolate to lanceolate, 10–30 by 2.5–6.5 cm, acuminate, base broadly cuneate to rounded, chartaceous, margin entire, glabrous, lateral veins widely spaced, prominent on the lower surface, arched; petiole 13–20 mm, glabrous at maturity. *Flowers* unknown. *Infructescences* terminal or axillary, peduncle becoming woody, *c.* 6 cm long with a flattened receptacle *c.* 20 mm ø at maturity, inner surface pilose. *Drupes c.* 15 mm stipitate, ovoid, *c.* 25 by 18 mm, verruculose (when dry).

Distr. *Malesia:* Philippines (Luzon: Isabella & Cagayan prov.). Fig. 25.

Ecol. In forests, about 1200–1350 m.

Note. A local species from northern Luzon apparently outside the range of *M. sancta*, characterized by the narrow elongated leaves, with major lateral veins widely spaced and running out straight from the midrib very nearly at right angles.

5. Matthaea vidalii PERKINS, Bot. Jahrb. 45 (1911) 422; Pfl. R. Heft 49 (1911) 17; MERR. En. Philip. 3 (1923) 186; PHILIPSON, Blumea 28 (1982) 82, f. 1–2. — **Fig. 26e.**

Shrub, about 2 m; young branches glabrous. *Leaves* elliptic to elliptic-oblong, 11–15 by 3.5–6 cm, acuminate, base broadly cuneate, somewhat coriaceous, margin entire or rarely with a few teeth in the distal part, principal veins prominent on the lower surface and strongly arched; petiole 15–20 mm, glabrous. *Inflorescences* axillary, solitary or fascicled. — *Male rachis c.* 35 mm, sparsely pilose, bearing a terminal flower and a pair of lateral flowers on short branches; receptacle turbinate, *c.* 5 mm ø, sparsely pilose outside; tepals 4; stamens 4, free. — *Female inflorescences* similar, apparently only a single terminal flower producing fruit; receptacle at anthesis not seen; rachis becoming stout and woody at fruiting. *Drupes* numerous, *c.* 15–18 mm stipitate, ovoid, *c.* 30 by 20 mm, glabrous, wrinkled, purple-black.

Distr. *Malesia:* Philippines (Luzon: Camarines Sur & Sorsogon Prov.; Panay: Capiz Prov.). Fig. 25.

Ecol. Forest, from 600 to 1600 m.

Vern. *Salapula*, Bik.

Note. Occurs within the range of *M. sancta*, which it approaches. The smaller, coriaceous and more elliptic leaves appear consistently distinct.

6. Matthaea intermedia MERR. Philip. J. Sc. 13 (1928) Bot. 11; PHILIPSON, Blumea 28 (1982) 82, f. 1–2. — **Fig. 26f.**

Shrub, about 4 m; young branches glabrous. *Leaves* elliptic to oblong-elliptic, *c.* 8–13 by 3–6 cm, acuminate, base broadly cuneate, margin entire, glabrous, lateral veins arched, slightly raised below, not impressed above; petiole *c.* 15 mm, glabrous. *Inflorescences* axillary; rachis *c.* 15–20 mm, with scattered appressed hairs, bearing a terminal flower and usually one pair of lateral flowers on short branches. — *Male receptacle* turbinate, sparsely pubescent; tepals 4; stamens 4, subsessile. — *Female receptacle* similar, inner surface pilose between the carpels; carpels numerous, ovary densely pilose, stigma prominent. *Drupes* 8–10 mm stipitate, ovoid, *c.* 20 by 15 mm, verruculate.

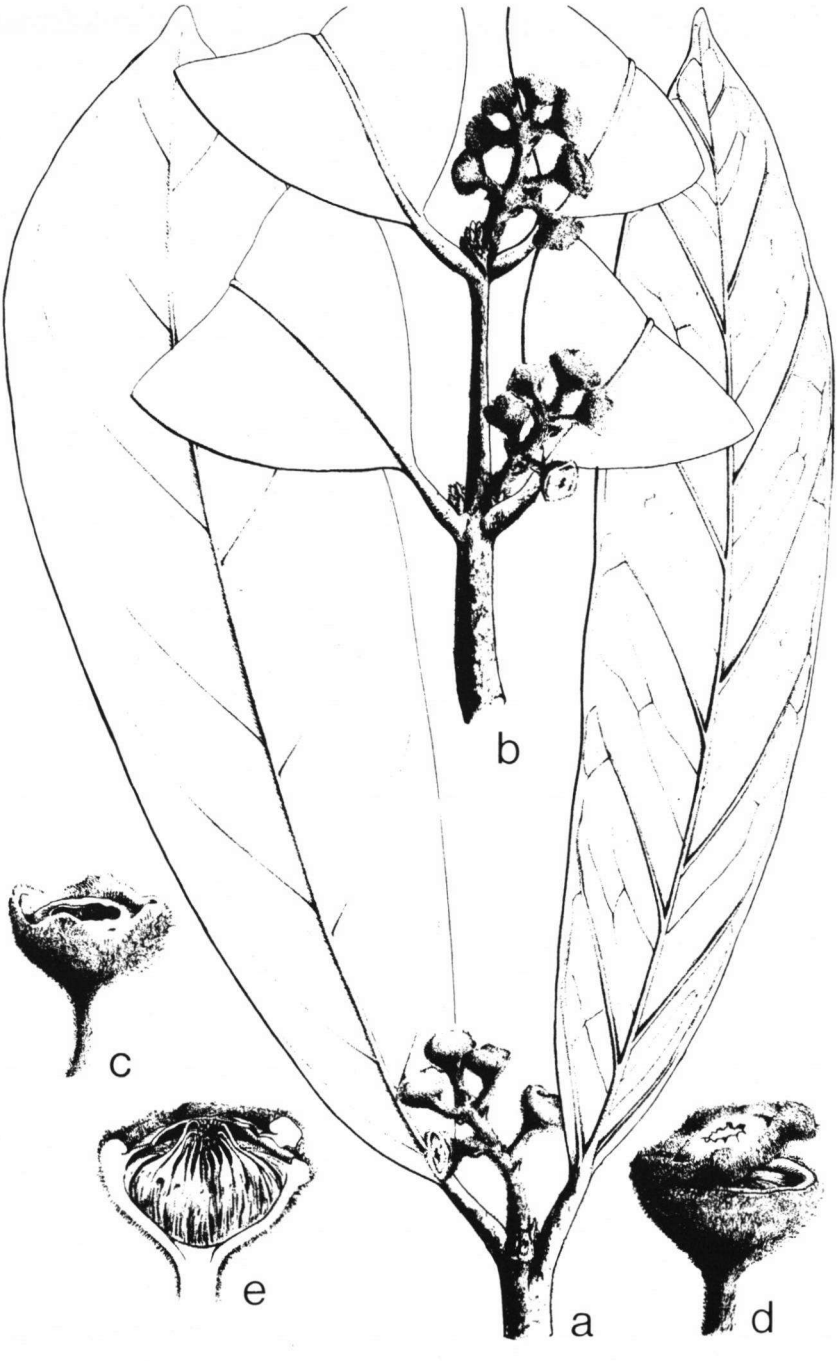


Fig. 27. *Lauterbachia novoguineensis* PERKINS. *a–b.* Habit, with female flowers, nat. size, *c.* open flower, *d.* opening flower, both ×3, *e.* flower in LS, ×4 (after PERKINS).

Distr. *Malesia:* Philippines (Luzon: Tayabas Prov.). Fig. 25.

Ecol. Forests, about 1000 m.

Note. A local species, from the central Philippines, resembling the neighbouring *M. vidalii* in size and shape of leaf, but differing in the less prominent venation on the lower surface, and particularly in the brown-olivaceous colour of the leaves, petioles and branches.

Insufficiently known

Matthaea philippinensis PERKINS, Bot. Jahrb. 45 (1911) 423; Pfl. R. Heft 49 (1911) 18. Of this species, described from Leyte, no specimens have been seen.

11. LAUTERBACHIA

PERKINS in K. Sch. & Laut., Fl. Deut. Schutzgeb. Südsee (1900) 330, t. 6; PERKINS & GILG, Pfl. R. Heft 4 (1901) 63; PERKINS, Übersicht Gattungen Monim. (1925) 40; HUTCH. Gen. Fl. Pl. 1 (1964) 119. — **Fig. 27.**

Trees or shrubs with entire leaves. *Inflorescence* axillary or terminal. — *Male flowers* not known. — *Female flowers* with 4 minute tepals and a velum surrounding the ostiole; upper part of the receptacle abscissing as a calyptra. *Carpels* numerous, with a long subulate style.

Distr. *Malesia:* Papua New Guinea (Madang Prov.: Ramu Distr.). Fig. 10.

Ecol. Lower montane rain-forest.

Note. The single species was known only from the type which was destroyed in World War II. No duplicate has been located so the above description and that of the species is based on information published by PERKINS. The presence of a velum in what appears to be a member of the *Mollinedieae* is so exceptional that the interpretation of PERKINS must be considered doubtful until further material can be examined.

1. Lauterbachia novoguineensis PERKINS in K. Sch. & Laut., Fl. Deut. Schutzgeb. Südsee (1900) 331; PERKINS & GILG, Pfl. R. Heft 4 (1901) 63. — **Fig. 27.**

A shrub or tree, the young branches with brown tomentum. *Leaves* elliptic-oblong or oblong, 13–21 by 5–8 cm, base cuneate or rounded, apex broadly acuminate or acute, glabrous above except for sparse hairs on the nerves, below clothed with long greyish hairs chiefly on the nerves, becoming glabrous, entire, margin revolute (when dry); nervation prominent below, nerves arched and meeting within the margin; petiole 10–12 mm, tomentose. *Inflorescence* axillary or terminal, 4–8-flowered pleiochasia, *c.* 30 mm long, clothed with brown tomentum; pedicels *c.* 5 mm. — *Female receptacle* turbinate, 8–9 mm ø; tepals 4, minute, a velamen surrounding the wide ostiole; carpels *c.* 38, narrowed above into a long subulate style.

Distr. *Malesia:* Papua New Guinea (Madang Prov.: Ramu Distr.; Bismarck Range). Fig. 10.

Excluded

Idenburgia GIBBS = *Sphenostemon* BAILL. (*Sphenostemonaceae*).

Scyphostegia STAPF = *Scyphostegiaceae.*

Tambourissa ficus (TUL.) A.DC. (*Ambora ficus* TUL.) was mentioned by MIQUEL, Fl. Ind. Bat. 1, 2 (1859) 75 and DC. Prod. 16, 2 (1868) 659 to have been collected in Java by LESCHENAULT. PERKINS, Pfl. R. Heft 4 (1901) 70 raised already doubt about this record, which certainly rests on an erroneously localized specimen from Madagascar.

Trimenia SEEM. (*Piptocalyx* OLIV. *ex* BTH.) = *Trimeniaceae.*