POLYGALACEAE (R. van der Meijden, Leiden)\(^1\)

Herbs (sometimes saprophytic), shrubs, lianas or trees. Stipules absent but stem sometimes provided with a pair of glands at the nodes. **Leaves** simple, entire, usually spirally arranged, sometimes alternate, (semi)decussate or verticillate, sometimes scale-like or absent. **Inflorescence** usually raceme-like and unbranched, (supra- or extra-)axillary and/or terminal, sometimes thyrsoid or fasciculate, rarely flowers solitary. Bracts present; bracteoles basal, rarely (**Salomonia, Epirixanthes**) absent. **Flowers** bisexual, more or less zygomorphous, rarely actinomorphous. **Sepals** 5, free and quincuncial, or the lower (abaxial) 2 connate, sometimes all connate, subequal or the lateral ones larger and then often wing-like (alae) and petaloid. **Petals** 3 or 5, free or variously united, occasionally also with the calyx, usually adnate to the base of the staminal tube or the filaments, subequal or more often unequal with the lower petal often keel-like and frequently pouched, lobed, or crested. **Stamens** 2–10, usually 8, filaments usually more or less connate except between the upper stamens, often adnate to the petals; anthers basifixed, tetra- or bi-, rarely trisporangiate, 1- or 2-locular, opening by a single and often oblique pore or by a longitudinal introrse slit. **Ovary** superior, usually 2-locular but occasionally 1-, 3-, 5-, 7- or 8-locular, sessile or sometimes stipitate; style simple but often variously dilated or lobed at apex, usually articulate with the ovary and nearly always deciduous in fruits. **Ovules** 1 per cell and subapical, or (in **Xanthophyllum**) 4—more in a 1-locular, bicarpellate ovary with 2 parietal placentas, anatropous, bitegmic and cassinucellate. **Fruit** various, a berry, capsule, samara or drupe.

**Distribution.** About 15 genera and over 1000 species, widespread in temperate and tropical regions of the world, especially well-developed in South America and South Africa. In **Malesia** 6 genera, of which **Polygala** and **Securidaca** (not in Australia) are cosmopolitan, **Xanthophyllum** and **Salomonia** Indo-Australian, **Epirixanthes** Indo-Malayan. The sixth genus is **Eriandra** which belongs to the tropical American tribe **Moutabeae**, of which 3 genera are known in South America; **Eriandra** occurs in New Guinea and the Solomon Islands and represents a marked example of disjunct, tropical trans-Pacific affinities.

**Ecology.** Very diverse, in wet or dry, open or closed, warm or rather cold habitats, in the lowlands or on mountains up to 3600 m; greatly varying in habit. **Epirixanthes** is a genus of small saprophytic (not parasitic) plants on humous soil in deep shade among litter of the rain-forest. **Salomonia** is an unseemly herb of open places. In **Polygala** there are woody shrubs in the undergrowth of the rain-forest, but most species are herbs of open country, several even preferring a seasonal climate; one species (§ **Melchiora**) is a climber of the rain-forest, like **Securidaca**. The species of **Xanthophyllum** and the monotypic **Eriandra** are trees of the rain-forest, sometimes of lofty size.

In some species of **Polygala** the occurrence of endomycorrhiza (VA-mycorrhiza) has been demonstrated (Hauy, 1984).

**Pollination.** Most species seem to be adapted to cross-pollination, but thusfar actual observations have only been reported for some **Polygala** species (see there). In **Epirixanthes** the structure of the flowers seems fit for cross-pollination (see there). Self-pollination, however, has been re-

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1 For this revision the 1970 manuscripts have been used of three former students of Professor Van Steenis: F.C. Roest (**Polygala sect. Chamaebuxus**), L.P. Rijfkogel (**Securidaca**), and Mrs. H.M.Y.J. André de la Porte-Janss (**Salomonia, Epirixanthes**).
ported for species in diverse genera, also for those species in which cross-pollination has been reported, or is suspected to be possible. It may be concluded tentatively that self-pollination is an effective second-chance possibility for reproduction in the *Polygalaceae*.

**Dispersal.** Corresponding to the diversity in fruit and seed types there is a great variation in dispersal types (VERKERKE, 1985). Especially in *Polygala* many dispersal types occur: myrmecochory, ornithochory, anemochory, diplochory, epizoochory. Ornithochory also occurs in *Dictidianthera*, *Carpolobia*, *Atroxima*, and probably in some *Xanthophyllum* species. *Moutabea* fruits have endozoocorous dispersal by monkeys (VAN ROOSMALEN, 1985); this may also be true for some *Xanthophyllum* species. Myrmecochory (or perhaps also anemochory) probably occurs in *Bredemeyera*, *Comesperma*, and *Epirixanthes*; anemochory also in *Monnina* and *Securidaca* (VAN ROOSMALEN, *l.c.*), but in the latter also hydrochory is possible. Epizoochory is the possible means of dispersal for *Salomonia*.


**Morphology.** Recently the morphology and ontogeny of ovules, fruits and seeds have been described (and reviewed) by VERKERKE; of *Polygala*; VERKERKE & BAUMAN (1980); of *Xanthophyllum*: VERKERKE (1984); of the remaining genera: VERKERKE (1985). LEINFELLNER (1972) demonstrated that there is no principal difference in the ontogeny of the unilocular, multiovulate ovary of *Xanthophyllum* and the bi- to octolocate, uniovulate ovary of the other *Polygalaceae*. The ontogeny of bi- and trisporangiate anthers of *Polygala* has been described by CHODAT (1891) and VENTAKESH (1956). Stipular outgrowths or nodal glands are pseudostipules in the sense of WEBERLING (VAN DER MEIDEN, 1982: 3). Contrary to the idealistic opinion of CHODAT (*l.c.*) (also adopted by HUTCHINSON, 1967) and CRONQUIST (1981), the primitive number of stamens is 8; the presence of 10 stamens (*Dictidianthera*; and a rare abnormality in *Xanthophyllum*) is a derived character.


**Vegetative anatomy.** The *Polygalaceae* exhibit an interesting diversity in their leaf and wood anatomy, which has only fragmentarily been explored, especially for the Malesian genera. Hairs if present are unicellular, or more rarely uniseriate. The lower epidermis is papillate in a number of species. Stomata may be of the anomocytic, paracytic or anisocytic type (all three types occur within the genus *Xanthophyllum*). An adaxial hypodermis is frequently present in the woody species with coriaceous leaves. The vascular pattern in petiole and midrib ranges from a single collateral bundle to a closed cylinder with accessory bundles (again the whole range of the family is represented in *Xanthophyllum*). The nodes are unilacunar. Unusual tracheoidal idioblasts in the leaf mesophyll are characteristic for *Xanthophyllum*.

The secondary xylem of the trees and climbers is characterised by largely solitary vessels with simple perforations, fibres with distinctly bordered pits and heterocellular rays which are usually narrow (1–2-seriate), but may be much wider in the *Moutabeae* (*e.g.* *Securidaca*). Axial parenchyma is mainly paratracheal in *Polygala*, apotracheally diffuse and diffuse-in-aggregates plus vasicentric to loosely alliform in *Securidaca*, and apotracheally banded plus vasicentric in *Xanthophyllum*. Included phloem occurs in the wood of *Securidaca* (and other *Moutabeae*).

Despite the anatomical distinctness of *Xanthophyllum* (mainly through its tracheodinous idioblasts), vegetative anatomy clearly witnesses affinity with other *Polygalaceae* (epidermal characters, overall leaf histology, solitary vessels and fibre type in the wood; the parenchyma distribution in some *Xanthophyllum* species is reminiscent of that of *Securidaca*). In its wood anatomy *Xanthophyllum* also recalls *Trigoniacaeae*, especially *Trigoniastrum*.

**References:** BRIDGWATER & BAAS, IAWA Bull. n.s. 3 (1982) 115–125; DICKISON, Bot. J. Linn.
Pollenology. Pollen grains in Polygalaceae are mostly subblate to prolate, sometimes equatorially constricted (Epirixanthes cylindrica), and measure from 25 to 62 µm. The apertural system is zonocolporate ('stephanocolporate') in all genera, the number of apertures ranging from 5 (Xanthophyllum papuanum) to 17, or up to 42 in Polygala. The endoapertures may be fused ('synorate') to form one broad, equatorial endoaperture, bordered by endexinous costae. In this way, the circle-shaped endoaperture divides a grain into two rigid halves, in which the colpi are no longer active in harmomegathic functioning. Volume accommodation in such a grain, and possibly also in grains with poorly separated pores, is achieved by folding of the flexible parts of the mesocolpia which cross the endoapertural zone (Muller, 1979). Similar apertural systems and harmomegathic mechanisms occur in the genus Utricularia of the unrelated family Lentibulariaceae (Thanikaimoni, 1966; Huynh, 1968).

Exine stratification is mostly obscure using light microscopy. Larson & Skvarla (1961) demonstrated the presence of ectexine, endexine, and a columellate infratectal layer in Polygala with electron microscopy. The tectum is mostly smooth, pitted, or perforate, sometimes somewhat fossulate or scabrate. Large perforations ('aperturoid depressions', 'lacunae') may occupy the poles.

Pollen of the family Polygalaceae is very distinct. Supposed relationships with other families within the Polygalaes are not supported by pollen morphological evidence. Pollen of the family Krameriaeae is certainly dissimilar to that of Polygalaceae (Erdtman, 1944, 1952; Simpson & Skvarla, 1981). On the other hand, the distinct pollen type represents a strong argument for inclusion of Xanthophyllum as a genus within Polygalaceae. Also in ascertaining the systematic position of Dictidanthera (Erdtman, 1944) and Eriandra (Van Royen & van Steenis, 1952) pollen morphology turned out to provide circumstantial or even deciding evidence.

It is not yet possible to key out all Malesian genera of Polygalaceae on the strength of pollen characters. Only one rough separation can be made: pollen of Epirixanthes, Eriandra, Securidaca, and Xanthophyllum mostly has 12 or less apertures, while grains in Polygala and Salomonia rarely have less than 12. Pollen of Epirixanthes is characterized by its heavy equatorial belt and involute colpus margins. These features probably represent derived states in Polygalaceae. Pollen of Securidaca has clearly separated endoapertures. This state may be considered as primitive, comparing with the synorate type in Polygalaceae.


Phytochemistry & Chemotaxonomy. Chemical characters of the family were summarized and discussed by Hegenauer (Chemotaxonomie der Pflanzen 5, 1969, 352–361, 459). A supplement will be included in volume 8. Glycosides releasing methyl salicylate on hydrolysis and saponins with triterpenic acids as their sapogenins are rather common in the family, especially in roots. The most characteristic genuine sapogenin of the family seems to be presenegenin, C_{30}H_{46}O_{7}, an acid-labile derivative of oleanolic acid; it was shown to be mainly sapogenin of roots of several members of Bredemeyera, Carpolobia, Polygala and Securidaca. Closely related sapogenins are polygalacic acid from Polygala paenea and bredemolic acid from Bredemeyera floribunda. Mono-, di- and trimethoxycinnamic acids as well as ferulic and sinapic acid occur widely; usually they are esterified with free sugars such as saccharose or with the sugar-part of the bidesmosidic saponins. Leaf flavonoids seem mostly to be glycosides of quercetin and kaempferol. Polygalitol (= aceritol = 1,5-anhydroglucitol) is a characteristic hexitol derivative of roots of many polygalaceous plants; it occurs free and combined with sugars. Seeds usually store mainly proteins and fatty oils, but no starch. There is still little known about the chemistry of...
polygalaceous seed oils, but very unusual oils were shown to be produced by *Monnina emarginata* and *Polygala virgata*. Three groups of secondary metabolites have still to be mentioned notwithstanding the fact that they are known only from a few species of *Polygala* at present. These are polyhydroxylated xanthones, and naphthalin- and bibenzyl-γ-butyrolactone-type lignans such as podophyllotoxin (*e.g.* *Polygala polygama*) and suchilactone (*e.g.* *Polygala chinensis*). Moreover, the Central American *Polygala paniculata* yielded a number of rutaceous coumarins and a diester of khellactone.

The taxonomic relevance of chemical characters was discussed by Hegnauer in 1969. It may be added now that the occurrence of isoprenylated coumarins and an obvious total lack of iridoids agree well with the assumption of sapindalean (*sensu lato*) affinities. Tannins too seem to be totally lacking in *Polygalaceae*; this, however, does not contradict the just mentioned assumption, because within *Sapindales s.l.* a strong tendency to replace tannins by other types of secondary metabolites is apparent. Finally it should not be forgotten that several chemical characters may prove valuable in future for infrafamilial classification. — R. Hegnauer.

**Taxonomy.** Cronquist's circumscription of the order *Polygalales* (1981: 763) reflects the general opinion of systematists; next to the *Polygalaceae* (with *Xanthophyllum* as a separate family) it includes the *Trigoniaceae*, *Vochysiaceae*, *Malpighiaceae* as well as the *Tremandraceae* and the *Krameriaceae*. Wood anatomical evidence (Bridgewater & Baas, 1982) supports a close affinity of *Polygalaceae*, *Xanthophyllum* and *Trigoniaceae*, but not with the other families. Van der Meiden (1982) found no arguments to include *Tremandraceae* and *Krameriaceae*. Although there seemed to be little evidence for the inclusion of *Krameriaceae* in the order (Simpson & Skvarla, 1981; Simpson, 1982), the first author recently supported the classification of *Krameriaceae* next to *Polygalaceae*, mainly based on serological evidence (Buse-Jung, 1979).

Splitting off *Xanthophyllum* as a separate family has been based on incomplete or erroneous knowledge of the genus. Of the three characters mentioned by Cronquist (*l.c.*), two do not hold: filaments are often partly and sometimes halfway connate in *Xanthophyllum*, and seeds with copious endosperm occur in four of the seven subgenera. Thus *Xanthophyllum* differs in a single though compound character from other *Polygalaceae*, viz. in the structure of the ovary (which ontogenetically is largely similar to other *Polygalaceae*, cf. Leinfellner, *l.c.*); this differs in the reduced septs, in the doubling of the number of ovules per carpel, and in the height of insertion of the ovules. On the other hand *Xanthophyllum* has a number of striking similarities with other *Polygalaceae* in the structure of the flowers, as well as in some vegetative characters (the presence of laminar and nodal glands). Also studies on the morphology of ovules, fruits and seeds (Verkerke, 1984, 1985), of foliar anatomy (Dickison, 1973) and wood anatomy (Bridgewater & Baas, 1982) do not present arguments to split *Xanthophyllum* from the *Polygalaceae*.

Mainly based on differences in floral structure, Chodat (1891) distinguished three tribes in the family, *Polygaleae*, *Moutabeae* and *Xanthophylleae*. Both the studies of Styer (1977) and Verkerke (1984, 1985) revealed that the differences between *Moutabeae* and *Polygaleae* are unclear; the results of vegetative and of seed anatomy do not correspond with differences in the flowers. Therefore a formal subdivision of the family is not presented.


Bibliographical note. R. Chodat published a monograph of the family in two parts in Mém. Soc. Phys. Hist. Nat. Genève, Suppl. 1890 (1891) 1–143, t. 1–12 and *ibid.* 31 (1893) 1–500, t. 13–35. Because of frequent mention of this basic work and the complicated reference, I refer to this work in simpler form, as follows: Chodat, Monogr. I (1891) and Chodat, Monogr. II (1893).
KEY TO THE GENERA

1. Herbs, sometimes woody at base.
2. Lateral sepals larger than the 3 outer ones and petaloid, about as long as the petals. Lower petal (keel) appendiculate apically (except P. tatarinowii). Stamens 8. Fruit laterally dehiscent, the margins entire. Seed with a lobed aril at micropylar side ........................................ 1. Polygala

2. All sepals subequal, not petaloid, much shorter than the petals. Keel apically inappendiculate. Stamens 2–6. Fruit either indehiscent, or laterally dehiscent and then the margins dentate or spinose. Seed ex-arillate.

3. Autotrophic plant with (small) green leaves. Fruit laterally dehiscent, dentate or spinose along the margins, far exceeding the sepals. Pericarp pergamentaceous. Style S-curved at base, long. Disk absent. Anthers 4 or 6, rarely 5. Rachis of inflorescence winged ........................................ 3. Salomonia

3. Saprophytic, echorophyllous plant with scale-like leaves. Fruit indehiscent, enclosed by the sepals. Pericarp fleshy. Style straight or very short. Disk present (but indistinct), adnate to the base of the ovary, semi-annular or as a lobe. Anthers 3 or 5, rarely 2 or 4. Rachis terete ............. 4. Epirixanthus

1. Shrubs, trees or lianas.

4. Sepals united at base, upper part of calyx caducous by a circumcision. Petals basally adnate to the calyx. Ovary 7- or 8-locular. Fruit (by abortion) often 4- or 5-locular. Seeds completely enclosed in an aril 5. Eriandra

5. Sepals free, caducous or 3 or 5 persistent. Petals free from the sepals. Ovary 1- or 2-locular. Seeds without an aril, or aril lobed.

5. Petals 5. Lateral sepals not petaloid and less than twice as large as the other sepals. Ovary and fruit 1-locular with 4 or more ovules ........................................ 6. Xanthophyllum

5. Petals 3 or with an additional pair of much-reduced ones. Lateral sepals (alae) petaloid and at least twice as large as the other sepals. Ovary 1- or 2-locular, each locule containing a single ovule.

6. Ovary and fruit 1-locular. Fruit a distinct samara, indehiscent. Twigs with a pair of glands at the nodes. Seeds without appendages, glabrous ............................ 2. Securidaca

6. Ovary and fruit 2-locular. Capsule dehiscent, without a large wing. Nodal glands absent, rarely (e. P. sumatrana) pseudostipules present. Seeds either with a lobed aril, or very long-hairy ... 1. Polygala

1. POLYGALA


Annual or perennial herbs, shrubs, small trees or rarely lianas. Stems or twigs rarely with nodal glands, these sometimes transformed into spines. Leaves alternate or verticillate, sometimes (sub)opposite, rarely caducous, sometimes scale-like or apparently absent. Inflorescences raceme-like or rarely paniculate, (supra-)axillary, terminal (and then often overtopped by side-branches) or lateral, sometimes in dense heads. Sepals 5 or the lower pair connate, unequal, caducous or persistent in fruit, the two lateral ones (alae) at least twice as large as the other ones and often petaloid. Petals 3, unequal, halfway adnate to the staminal tube and sometimes mutually connate into a single 3-lobed petal; some-
times with an additional pair of reduced lateral petals; lower petal (keel) boat-shaped, clawed, its blade entire or 3-lobed or basally auriculate, at apex with or less often without 2 entire or variously incised appendages (crest). **Stamens** 8, rarely 6, monadelphous or partly dia- or triadelphous; anthers usually bisporangiate by abortion of the outer microsporangiae, or sometimes tri- or tetrasporangiate, sessile or on a free filamentous stalk, opening by an apical pore or a V-shaped introrse slit common to both cells. **Disk** annular or variously reduced or often apparently absent. **Ovary** 2-celled, each locule with a single subapical ovule; style tip various, often 2-lobed, the apical lobe often sterile and variously dilated, the stigmatic lobe lateral or subapical. **Capsule** 2-celled or very rarely 1-celled by abortion, compressed contrary to the sept, often more or less winged, sometimes with a double wing, dehiscing by a marginal split, reniform to oblanceolate. **Seeds** various, usually at micropylar side with a lobed or unlobed appendage (aril) and/or with an elongate appendage, at the opposite chalazal side sometimes with a variously shaped appendage, rarely appendages at both sides lacking; glabrous to hairy, or rarely with a coma of hairs.

**Distr.** A polytypic genus comprising at least 500 spp. in tropical, subtropical, temperate and montane regions. The majority of species grow in tropical South and Central America, where *Polygala* also has its greatest infrageneric diversity. Both in North America and in South Africa secondary centres of speciation occur. Eurasia, North Africa, Malesia and Australia are rather poor in species. In **Malesia** the species can be referred to four little-related sections. **Sect. Melchiora** is monotypic and endemic to New Guinea, **sect. Pseudosemeiocardium** is common in Southeast Asia, **sect. Chamaebuxus** occurs over all continents except tropical South and Central America, and the largest (probably unnatural) **sect. Polygala** covers the same area as the genus. The majority of species in Malesia have rather restricted areas, with some notable exceptions, e.g., *P. persicariaefolia*, which also occurs in tropical Africa, and *P. paniculata*, an American species which is now a pantropical weed. Two species are endemic in Malesia.

**Ecol.** Species of **sect. Chamaebuxus** belong to the undergrowth of rain-forests, in Malesia occurring in submontane and montane forests, between 400 and 3000 m altitude. The single species of **sect. Melchiora** is a true liana of the tropical rain-forest. The remaining herbaceous species are heliophilous species growing in open terrains, in open woodland, with a preference for grasslands in seasonal areas; this is especially true for **9. P. javana**, **12. P. longifolia**, **14. P. exsquarrosa**, **17. P. wightiana**, and **18. P. rhinanthoides**, which are all restricted to areas subject to a distinct or pronounced dry season.

**Pollination.** Self-pollination probably occurs in all species, although the flowers of the majority are attractive to insects. Many large-flowered species show structures which seem to be adaptations to pollinating insects (FAEGRI & VAN DER PIL, 1979, for *P. chamaebuxus*), but in those species, too, self-pollination seems to occur frequently.

In a number of species pollen grains are deposited directly on the stigma, often already in the unopened flower (VENKATESH, 1956). In many species the style tip bears special pockets in various ways in which the pollen grains are deposited from the anthers. At that time the stigma can theoretically still be pollinated with foreign pollen grains, as for instance in *P. lutea* (MILLER, 1971) and *P. vulgaris* (HEUBL, 1984). According to HEUBL’s observations, however, a visiting insect will effect self-pollination. Yet there are rather reliable records of hybrids of the latter species in nature (HEUBL, l.c.), and F1-plants of artificially produced hybrids are often fertile. This must mean that cross-pollination (rarely) occurs in *P. vulgaris*. Only BrANTJE (1982) observed and described cross-pollination in the two Brazilian species *P. monticola* H.B.K. and *P. vauhleri* Chodat. The pollination mechanism of those species is a very precise one, and if cross-pollination fails, the flowers are effectively self-pollinated.

Perhaps such examples of precision cross-pollination can be discovered in many other *Polygala* species, because it is rather unlikely that the great variation in style tips and stigma forms could have evolved in complete absence of gene-exchange. It is also possible that many species in which formerly cross-pollination was rare, have lost this possibility.

TAXON. In view of the surprisingly great variation in species-constant characters of diverse flowering and fruiting parts, it has been tried to split this large genus into a number of smaller genera. The large genus concept as adopted by R. Chodat (Monogr. 1, 1891, 93), the only author who revised all species, is still adopted, some minor questions regarding the status of some American groups set aside. Chodat's infrageneric division of the genus, however, was unsuccessful, as had been pointed out by S.F. Blake in his revision of the North American species (1924), and more recently by Adema (1966) for the Malesian ones. This is probably due to the fact that two of Chodat's major characters to define his sections, viz. the presence or absence of sepal appendages, are not constant in the different lineages: parallel developments (reductions e.g. reversions of character states) will have been developed in many of these lineages. Until a new revision of the tropical American species has been made, it will be impossible to make a balanced reconsideration of the status of the diverse groups of species within and outside the borderlines of this genus.

In the Indo-Australian area a great diversity of species is present, probably caused by diverse migration lines. Perhaps the Australian genus Comesperma should also be included in Polygala; see note under 4. P. papuana.

KEY TO THE SECTIONS AND SPECIES

1. Lateral sepals (alae) caducous at the beginning of fruit-setting. Disk present. Leaves usually with distinct petioles.
2. Annual herbs up to 30 cm high. Flowers, fruits and seeds up to 3 mm long. Spp. 1–3. — 1. Sect. Pseudo- semeioocardium
3. Keel without appendages at apex. Seed without tubercles, without black appendage at chalazal side
   1. P. tatarinowii
3. Keel with a pair of appendages near apex. Seed tuberculate, with a small or large black appendage at chalazal side.
4. Capsule narrowly winged, longer than wide. Seed at chalazal side with a cylindrical appendage one third as long as the seed itself .................................................. 2. P. mulesiana
2. Shrubs, small trees, or lianas. Flowers, fruits and seeds at least 5 mm long.
6. Flowers 5–6 mm long. Style straight to near stigma. Seed nearly completely covered by the aril 5. P. oreotrephes
6. Flowers at least 10 mm long. Style curved in apical half. Seed usually covered up to halfway by the aril.
7. Capsule covered by a white layer of dense papillae, the wall not with prominent veins. Racemes in the forks .................................................. 6. P. sumatrantha
7. Capsule without white layer, with prominent longitudinal veins. Racemes (supra-)axillary.
8. Appendages of the keel undivided. Racemes mostly reflexed or patent from the base 7. P. venenosa
8. Appendages of the keel divided into 7–10 ± connate lobes. Racemes erect or very rarely pendulous
9. P. arillata
9. Lateral sepals (alae) broadly ovate, hairy.
10. Alae yellowish. Ovary and fruit hairy all over. Capsule narrowly winged. Stigma not recurved at apex, with 2 minute lobes .................................................. 9. P. javana
10. Alae green. Ovary and fruit only hairy at margin. Stigma strongly recurved at apex, at inner side with one stigmatic lobe .................................................. 18. P. rhinanthoides
9. Lateral sepals (broadly) elliptic or narrower, glabrous or hairy marginally, or rarely covered by stiff hairs.
11. Alae nearly symmetric, petaloid (coloured).
12. Alae 1.5–2 mm long. Stem set with small, shortly stalked glands. Capsule unwinged. Style obliquely cup-shaped at apex, at one end with a tuft of hairs .................................................. 13. P. paniculata

13. Alae mucronate. Style (nearly) straight, (sub)apically with 2 small stigmatic lobes. Filaments nearly completely connate ......................................................... 10. P. japonica

13. Alae rounded at apex. Style curved in apical half, with one stigmatic lobe. Filaments free for at least one third.


11. Alae asymmetric, falcate, not petaloid (green).


15. Capsule glabrous or hairy only at margin. Plants not stiffly hairy. Appendages of keel divided into a number of filiform or finger-shaped lobes. Stigma apically widened or sharply reflexed.

16. Capsule c. 2 mm long. Alae c. 3 mm long. Style apically widened, at one side with the stigmatic lobe 15. P. polifolia

16. Capsule (3–)3.5–5 mm long. Alae 4–6 mm long. Style apically strongly reflexed.

17. Plant with stiffly erect, long inflorescences. Apical part of the style very asymmetrically winged.

Free parts of filaments triadephous .................................................. 17. P. wightiana

17. Plant with short inflorescences or, if with long ones, then these ascending. Style apically symmetrically winged. Free parts of filaments not connate.

18. Appendages of the keel finely divided into hair-like segments. Capsule almost orbicular, c. 4 by 4 mm .................................................. 16. P. chinensis

18. Appendages of the keel divided into finger-shaped lobes. Capsule somewhat longer than wide, 2.5–4 by 2.5–3.5 mm.

19. Upper petals shorter than the keel, 2.5–3.5 mm long. Capsule at the margin both with curved as well as with short straight hairs. Inflorescences 0.5–2 cm long .................. 20. P. triflora

19. Upper petals slightly longer than the keel, 2.5–4.5 mm long. Capsule at the margin with curved hairs only. Inflorescences 0.5–7 cm long .................. 19. P. glauoides

1. Section Pseudosemiocardium


Small, erect, branched, annual herbs. Flowers in terminal or axillary multflowered unbranched racemes. *Sepals* caducous before fruit-setting. *Keel* with 2 hardly incised appendages, or inappendiculate. Disk annular or consisting of 1 or 2 lobes. *Style* ± tubular, curved in upper half, widened apically, at inner side with a single stigmatic lobe. *Capsule* orbicular to obovate, narrowly winged. *Seeds* black, shortly hairy, at micropylar side with a small appendage or with a lobed aril, at chalazal side with or without an appendage.

Distr. Southeast Asia and *Malesia.*
Polygalaceae


Herb up to 25 cm. Stem glabrous, faintly ribbed. Leaves ovate to obovate, 2–35 by 1–20 mm, acute, base attenuate, laxly short-hairy, ciliate, 0.5–1 cm petioled. Racemes terminal, including the peduncle 1–10.5 cm; bracts and bracteoles early caducous. Flowers c. 1.5–2 mm long, glabrous, rosace-red, chalazal, c. 3 mm, notched, mucronate. Seed ellipsoid, tuberculate, shortly hairy, at micropylar side with an obliquely lobed aril, at chalazal side with an appendage one third as long as the seed; this somewhat narrower than the seed, truncate, ending in an orbicular, hollow, membranous lamella, which makes an angle of c. 45° with the seed.

Distr. Malesia: Malay Peninsula (Perak, Pahang, Selangor), Lesser Sunda Islands (Sumba, Flores), SE. Celebes (Tukangbesi Is.), Philippines (Bohol), Moluccas (Buru, Ceram, Kai and Aru Is.), and West New Guinea (Sorong and Vogelkop Peninsula).

Ecol. In Malaya and Celebes noted from limestone (should also be from Sumba), in open terrain, below 300 m.

Note. Polygala isocarpa CHODAT (P. umbonata CRAINF.) differs in a number of small but constant characters, especially in the style, which is somewhat inflated and apically not widened, and in the chalazal appendage of the seed, of which the kidney-shaped, basal, hollow membranous lamella makes a right angle to the seed.


Herb up to 25 cm. Stem glabrous, ribbed, 2- or 3-chotomously branched. Leaves mostly in pseudowhorls of 3, broadly elliptic to ovate, 10–55 by 4–30 mm, acute, base attenuate, laxly short-hairy, ciliate, 0.5–1.5 cm petioled. Racemes terminal or in a fork, including the peduncle 1.5–14 cm; bracts and bracteoles early caducous. Flowers c. 3 mm long, glabrous, orange-yellow to bright yellow. Outer sepals short-mucronate, alae broadly obovate, rounded, 3-nerved. Upper petals oblong, slightly longer than the keel; keel with 2 rounded appendages. Filaments free for 1/4–1/2. Ovary obcordate, the upper cell smaller; style curved and widened in apical half, obliquely truncate apically. capsule asymmetric, broadly obcordate, c. 2.5 by 3.5 mm, provided with 2 unequal cross-veined wings. Seed ± ellipsoid, tuberculate, shortly hairy, at micropylar side with a minute oblique appendage covered by a rather small, obliquely lobed aril, at chalazal side with a minute appendage.

Distr. Burma, Thailand; in Malesia: Malay Peninsula (Langkawi Is.).

Ecol. Apparently restricted to limestone rocks. In Langkawi at very low altitude, in Southeast Asian mainland ascending to 2000 m.


Herb up to 25 cm. Stem glabrous, somewhat ribbed, towards apex trichotomously branched. Leaves ovate to elliptic, 6–55 by 4–30 mm, acute, base attenuate, laxly short-hairy, ciliate, 0.5–1.5 cm petioled. Racemes terminal or in a fork, including the peduncle 1.5–14 cm; bracts and bracteoles early caducous. Flowers c. 3 mm long, glabrous, orange-yellow to bright yellow. Outer sepals short-mucronate, alae broadly obovate, rounded, 3-nerved. Upper petals oblong, slightly longer than the keel; keel with 2 rounded appendages. Filaments free for 1/4–1/2. Ovary obcordate, the upper cell smaller; style curved and widened in apical half, obliquely truncate apically. capsule asymmetric, broadly obcordate, c. 2.5 by 3.5 mm, provided with 2 unequal cross-veined wings. Seed ± ellipsoid, tuberculate, shortly hairy, at micropylar side with a minute oblique appendage covered by a rather small, obliquely lobed aril, at chalazal side with a minute appendage.

Distr. Burma, Thailand; in Malesia: Malay Peninsula (Langkawi Is.).

Ecol. Apparently restricted to limestone rocks. In Langkawi at very low altitude, in Southeast Asian mainland ascending to 2000 m.
Fig. 1. Polygala tatarinowii Regel. a. Flower; b. upper sepal; c. ala; d. keel enveloping staminal tube, at right one petal; e. staminal tube laid open; f. pistil; g. fruit; h. seed. — P. malesiana Adema. i. Flower; j. fruit; k. seed, lateral and ventral view. All × 15. — P. cardiocarpa Kurz. l. Flower; m. fruit; n. seed. All × 10 (a–h Ramos & Edano BS 40317, i–k Jensen 169, l–n Curtis 3686).
Note. Similar to *P. furcata* ROYLE from N. India, Thailand and S. China, especially in the seed. The latter has narrowly winged capsules without prominent venation.

2. Section Melchiora (STEE.) MEIJDEN, *comb. nov.*


Liana. Flowers in short axillary racemes. Lateral sepals (alae) caducous before fruit-setting, other sepals persistent below the fruit. Keel inappendiculate. Disk indistinct, annular, slightly sunken in apex of pedicel, at upper side slightly protruding. Ovary apically elongated into a sterile part; style articulate with the ovary, curved in apical half, apically slightly 2-horned, stigma elliptic, terminal. Capsule much elongated, unwinged. Seed at micropylar and chalazal side with small appendages, completely set with hairs at least as long as the seed.

For distribution, ecology and taxonomy see the species.


Liana, glabrous in all parts except sepals and seed. Twigs slightly angular. Leaves obovate-oblong to obovate-lanceolate, rarely lanceolate, c. 3.5–8.5 by 1.5–3 cm, shortly acuminate, gradually attenuate at base, nerves c. 5–7 pairs, 0.5–1.5 cm petioloed. Racemes axillary, 1 or 2 together, including the peduncle 2–6 cm long. Bracts and bracteoles persistent (?). Flowers 4.5–6.5 mm long, white with red keel, on 3–5 mm long pedicels. Sepals adnate over 0.5–1 mm to the petals, ± orbicular shortly ciliate, the alae broadly obovate. Upper petals obliquely obovate to oblong; keel emarginate. Filaments halfway free. Ovary obovate, apically with a 1 mm long sterile part. Capsule obovate-linear, c. 18–22 by 2–2.5 mm, shortly acuminate at apex, gradually narrowed towards base, unwinged. Seed 5–7 by c. 1 mm, completely covered by white silky hairs c. 1.5 cm long. Dist. Malesia: New Guinea.

Ecol. Thin vine in disturbed forest below 300 m.

Note. Recent Australian authors (THOMPSON, Fl. New South Wales 112, 1978, 2; PEDLEY, Austrobailey 2, 1984, 7) claimed that this species belongs to the genus *Comesperma*. They agree with VAN STEENIS (l.c.) that *Comesperma* differs from the South American genus *Bredemeyera* in a single character; in the latter the carinal appendage bears the coma-hairs; in *Comesperma* the coma-hairs are present all over the seed or in two rows. It is dubious whether other differences exist. However, it is uncertain whether *Comesperma* itself is a good genus. Some *Comesperma* species (viz. those of sect. *Pro-

*sthemosperma* F.v.M. Pl. Vict. 1862, 186) have no coma-hairs and no elongated capsule. *Comesperma* can only be upheld if it could be proven that this is a reversion (by reduction) of the evolution. If, however, these 'abnormal' *Comesperma* species represent the primitive character of fruit and seed, the genus cannot be upheld against *Polygala*. Thus far this important question has been neglected. On the other hand it should be noted that two species of *Polygala sect. Chamaebuxus* (P. wattersii HANCE and P. mariesii HEMSLEY, both from China) have 'typical' *Comesperma* fruits and seeds, but definitely do not belong to this group as can be demonstrated by the differences in floral characters. Thus there is good reason to assume that *Comesperma* should be merged into *Polygala*. The same may be true for *Bredemeyera*, but the present state of knowledge on this genus is still incomplete. In view of the weak differences of *Bredemeyera* and *Comesperma* with *Polygala*, there is no good reason to combine both (under *Bredemeyera*) as VAN STEENIS (l.c.) proposed. As a consequence *Bredemeyera papuana* is best considered for the present to be a species of *Polygala*.

The affinity of *P. papuana* with the typical representatives of *Comesperma* is unclear. Surprisingly, PEDLEY (l.c.) dismissed the difference in the calyx as 'rather trivial', whereas CHODAT used this character as the main one for his subdivision of the genus *Polygala*. As far as I am aware only one other species (*P. acicularis* OLIV. from tropical Africa) has caducous alae and persistent sepals. At present it seems better to keep *P. papuana* in a separate section, separate from *Comesperma* when considered as a section from *Polygala*. 


Fig. 2. Polygala papuana (Steen.) Meijden. a. Habit, × 0.66; b. flower; c. lateral petal; d. upper petal; e. ditto; f. keel; g. stamens; all × 4; h. anther, × 16; i. ovary and style, × 4; j. young fruit, k. ripe fruit; × 1.3; l. seed, × 2.5 (a, e, j–l Docters van Leeuwen 10387, b–d, f–i Ledermann 9395).
3. Section Chamaebuxus


Little-branched shrubs or small trees up to 6 m high, or low chamaephytes with woody base, sometimes very spiny. Nodal glands sometimes present. Inflorescences mostly extra-axillary and unbranched, raceme-like, rarely branched, or very short, 1–2-flowered and axillary. Flowers mostly turned upside-down. Sepals caducous before fruit-setting, the adaxial one saccate. Keel with 2 fleshy, not or little-incised, rarely with strongly incised appendages. Disk annular or consisting of a single lobe. Style straight or curved in apical half, apically obliquely 2-fid, the apical lobe sterile, the stigmatic lobe subapical. Capsule about as wide as long or didymous, or sometimes (not in Mal.) spathulate, unwinged or narrowly winged. Seed at micropylar side with a short curved appendage and from there usually with a distinct, unlobed aril, at chalazal side inappendiculate but chalazal area often slightly protruding; (sub)glabrous or (not in Mal.) completely covered with hairs at least twice as long as the seed.


Fig. 3. Polygala oreotrephes BURTT. a. Capsule; b. seed. — P. sumatrana MIQ. c. Capsule; d. seeds. — P. venenosa Juss. ex POIR. e. Capsule; f. seeds. — P. arillata BUCH.-HAM. ex D.DON. g. Capsule; h. seeds. All ×5 (a, b MAXWELL 78-320, b, c MORLEY 437, e, f PNH 117264, g, h MAXWELL 74-782).
As. Soc. 14 (1936) 347; Hend. Mal. Nat. J. 4 (1949) 30, f. 18. — Fig. 3a, b.

Erect, simple or branched shrub, 30–90 cm high. Twigs slightly angular, (sub)glabrous. Leaves oblong to lanceolate, 5–16 by 1–5 cm, acuminate or cuspidate, base attenuate or cuneate, glabrous to hairy, chartaceous, petiolate (petiole 0.5–2 cm). Racemes terminal, 1–4 together, erect, including the peduncle 4–16 cm, dense. Bracts and bracteoles early caducous. Flowers 5–6 mm long, white and yellow, later crimson and pink, on 1–3 mm long pedicels. Sepals rounded, usually ciliate, the abaxial one not strongly saccate, the ala elliptic to nearly orbicular. Upper petals lanceolate; keel with 2 deltoid, massive, wrinkled appendages. Filaments free for c. 1/4. Disk ± annular, abaxially protruding backwards. Ovary ± quadrangular with rounded edges; style straight or with slightly recurved apex, subapically at inner side with a knob-like stigmatic appendage and there laterally with 2 triangular, wing-like appendages. Capsule ± didymous, c. 7 by 12 mm, winged, with faintly protruding concentric nerves, coriaceous, purple, glabrous. Seed elliptic or orbicular, at microgylar side with a small appendage, black, glabrous, (nearly) completely covered by the smooth, orange to scarlet aril, the slightly protruding calaza and the raphe distinctly visible.

Distr. Malesia: Malay Peninsula and Borneo (Sarawak: Murud), apparently very rare in the latter locality.

Ecol. Mountains, 1100–2500 m.


Erect, dichotomously branched small shrub. Twigs slightly angular, thinly trigose, glabrescent, at the nodes often with small, triangular pseudostipules. Leaves oblong to linear-lanceolate, 4.5–15 by 1.5–3.5 cm, cuspidate, base attenuate, thinly trigose, up to 2 cm petioled. Racemes terminal between 2 opposite twigs or leaves, erect, later pendulous, including the peduncle 3.5–7.5 cm, lax. Bracts and bracteoles early caducous. Flowers c. 15 mm long, white to pink and later violet, with yolk-yellow appendages on the keel, on 4–11 mm long pedicels. Sepals rounded, ciliate, the ala obovate-oblong. Upper petals lanceolate; keel with 2 large fleshy entire appendages. Filaments free for c. 1/4. Disk annular, abaxially protruding. Ovary ± quadrangular with rounded edges; style straight in basal half, in upper half falcate, apically weakly 2-fid, at inner side with the stigmatic lobe. Capsule broadly obcordate, c. 9–10 by 11–14 mm, winged (wings not transverse) veined, without protruding nerves, coriaceous, very densely covered by white, orbicular, flat papillae. Seed elliptic, at microgylar side with a small appendage, reddish brown, glabrous, up to about halfway covered by the smooth aril, the slightly protruding calaza and the raphe distinctly visible.


Erect, sparingly dichotomously branched shrub or small tree, 0.7–5 m high. Twigs terete, (sub)glabrous, fleshy or not, at the nodes sometimes with small pseudostipules. Leaves elliptic to lanceolate, 7–33 by 4–13 cm, acuminate, base attenuate, thinly trigose to glabrous, glaucescence beneath, 0.5–3 cm petioled. Racemes extra-axillary, mostly reflexed from the base, including the peduncle 2–26(–50) cm long, lax to dense; rachis straight and thick or thin and flexuous. Bracts and bracteoles early caducous. Flowers 13–20 mm long, upper petals white or magenta and turning violet, crest yellow and turning
dark violet to brownish, on 6–15(–20) mm long pedicels. *Sepals* white or yellowish, rounded, ciliate, alate obovate. Upper *petals* lanceolate; keel with 2 large massive, wrinkled appendages. *Filaments* free for about one third. Disk annular, sometimes abaxially protruding. *Ovary* obreniform to orbicular; style straight in lower half, in upper half falcate, apically weakly 2-fid, at inner side with the stigmatic lobe. *Capsule* obreniform to didymous, 5–8 by 7.5–12 mm, winged or unwinged, with more or less protruding concentric ribs, coriaceous, greenish purple to deep purple, glabrous. *Seeds* elliptic, at micro-pylar side with a small appendage, purplish black, glabrous, to halfway or nearly completely covered by the smooth, orange to scarlet aril, the slightly protruding chalaza and the raphae distinctly visible.

**Distr. Malesia:** Peninsula Thailand (Pattani), Malay Peninsula, Sumatra, Java, Borneo, Philippines.

**Ecol.** Undershrub or tree in forests, 0–2400 m.

**Taxon.** *VAN STEENIS* (1972) distinguished two ecological races: *ssp. pulchra*, with rather small leaves, non-fleshy stems, and lax inflorescence with thin, flexuous axes, and *ssp. venenos a* with fleshy leaves and stems, dense inflorescence with thick, straight axes, the first occurring in submontane altitudes on stony, well-drained places in light forest on slopes and ridges, the latter in the depth of primary and secondary forest in deep moist humus, stream valleys and riparian. Also in Java intermediate forms occur. Outside Java the distinction between both types is less distinct or even obscure.


Erect, dichotomously branched shrub or small tree, 1.5–6 m high. Twigs terete, glabrescent. *Leaves* oblong to ovate-lanceolate, 5–20 by 1.5–8 cm, cuspidate, base attenuate to obtuse, thinly hairy to glabrous, beneath somewhat glaucous, up to 1.5 cm petaled. *Racemes* terminal, axillary or extra-axillary, erect or rarely pendulous at apex, including the 6–12.5 cm long peduncle, dense. Bracts and bracteoles early caducous. *Flowers* 11–20 mm long, yellow, turning orange and red, on 2–7(–9) mm long pedicels. *Sepals* rounded, ciliate, alate obovate. Upper *petals* lanceolate, keel with 2 much-incised appendages. *Filaments* free for one third. Disk annular. *Ovary* orbicular, sometimes ciliate; style straight in lower half, curved in upper half, apically weakly 2-fid, at inner side with the stigmatic lobe. *Capsule* ± orbicular or somewhat asymmetric, 8–10 by 12–15 mm winged, with prominent concentric ribs, coriaceous, glabrous. *Seeds* globular, at micro-pylar side with a distinct appendage, black, glabrous or sparsely hairy up to halfway covered by an irregularly lobed and apically rather strongly projecting aril, the little protruding chalaza and the raphae distinctly visible.

**Distr.** India and Sri Lanka, Nepal, Bhutan, S. China, Hongkong, Burma, Thailand, Indochina; in *Malesia*: Philippines (Palawan; see HANSEN, l.c.).

**Ecol.** Undershrub in forests from 1000–3000 m, in Palawan at 850 m.

**Note.** *Polygala trichocolpa* CHODAT with about the same distribution (but not yet found in Malesia) differs in the branched inflorescence and in the typical, galeate (helm-shaped) aril. *Polygala karensium* KURZ, from Burma to Vietnam and Yunnan, differs in the geniculate style which is nearly recurved in the apical half and is strongly thickened subapically, and in the unribbed capsule.

4. Section Polygala

**Polygala sect. Orthopolygala** CHODAT, Monogr. II (1893) 120, nom. illeg.

Little- to much-branched annuals to perennial herbs or low chamaephytes with woody base, or (not in Mal.) shrubs or small trees, sometimes nearly aphyllous. *Inflorescences* raceme-like, ter-
Fig. 4. *Polygala javana* DC. Habit, ×0.7 (TEUSMANN s.n.).
minal, (supra-)axillary, or in the forks, unbranched, many or few-flowered. *Sepals* persistent in fruit, the lowest pair sometimes (not in Mal.) partly or wholly connate, or very rarely (not in Mal.) all or only the lateral ones caducous before fruit-setting. *Keel* with usually much-incised appendages or rarely (not in Mal.) inappendiculate. Disk apparently absent. *Style* and *stigma* variously shaped. *Capsule* mostly more or less orbicular, sometimes elongated, usually narrowly or sometimes widely winged. *Seeds* various, usually at micropylar side with a 2- or 3-lobed aril, sometimes (not in Mal.) with a translucent appendage along the raphe to the chalazal side; glabrous or hairy, rarely set with very long hairs, in the Malesian *spp.* at chalazal side inappendiculate.


Perennial, erect, branched herb, up to 80 cm high. Stem terete, becoming woody at base, set with short curved hairs. *Leaves* mostly obovate-oblong, 5–35 by 2–12 mm, subsessile, mucronate, with recurved margins shortly hairy at both sides, in transmitted light finely punctate-dotted. *Racemes* supra-axillary, often leaf-opposed, the free part 2–8 cm long. Bracts persistent, ± rhomboid, 1–2 mm long, hairy. *Flowers* 8–10 mm long, with purple crista and yellowish alae. *Sepals* mucronate, hairy on both sides, ciliate, the alae broadly ovate, flabellate-veined. *Upper petals* oblong, hairy inside in basal half; keel auriculate and there sometimes hairy, with 2 much-incised appendages. *Filaments* free for 1/8–1/3. *Ovary* ± quadrangular with rounded sides, apically notched, hairy all over; style straight in lower half, curved in upper half, subapically at inner side with 2 small, spaced, stigmatic lobes, slightly widened between the lobes. *Capsule* smaller than the alae, ± quadrangular, apically notched, with a narrow, membraneous, veined margin, hairy. *Seeds* ± globular, at micropylar side with an unequally 3-lobed aril, black, hairy.

**Distr.** Sri Lanka and S. India; in Malesia: Java
(from Semarang eastwards, incl. Madura & Kangean Is.). Lesser Sunda Islands (Bali, Lombok, Sumba, Sumbawa, Flores, Timor).

Ecol. Characteristic for areas subject to a strong dry season, in teak forests, between grass, several times on limestone, below 250 m, once at 700 m in Sumba.


Perennial, prostrate or ascending, branched undershrub 10–20 cm high, mostly developing a woody, rhizomatous, erect root crown or stem base. Stem terete, becoming woody at the base, set with short curved hairs. Leaves ovate to elliptic, the lower ones proportionally broadest, 5–15 by 3–8 mm, sub-sessile, acute, with slightly recurved margin, prominent-reticulate veined, mostly minutely hairy on at least midrib and margin, in transmitted light faintly

Fig. 6. Polygala japonica HOUTT. a. Flower; b. upper sepal; c. ala; d. keel enveloping staminal tube, at right one petal; e. opened staminal tube; f. pistil; g. fruit; h. seed. All x 7 (a–f SHAW MAYER s.n.; g, h BORGMAN 326).
finely punctate-dotted. *Racemes* supra-axillary, the free part 1–3 mm long, rather few-flowered. Bracts and bracteoles early caducous. *Flowers* 5–7 mm long, mauve or purple to deep lavender. *Sepals* mucronate, the outer shortly hairy, the alae elliptic, 3–5-nerved. Upper petals oblong, rarely (JACOBS 7428) absent or very much reduced, hairy inside in basal half; keel articulate, with 2 much-incised appendages. *Filaments* (nearly) connate to apex. *Ovary* broadly obovate, glabrous; *style* (nearly) straight, subapically at inner side with 2 small, spaced (1 mm) stigmatic lobes, the lower one ± knob-like. *Capsule* broader and somewhat shorter than the alae, c. 4–5 by 5 mm, emarginate apically, with a rather wide (c. 1 mm), veined membranous margin which is apically often wider than basally. *Seeds* ± ovoid, at micropylar side with an unequally 3-lobed aril, black, hairy.

**Distr.** NE. India, Burma, Sri Lanka, Indochina, China, Japan, Korea and E. Siberia, also in the Ryukyu Is. and Taiwan, in E. Australia southwards to NE. Victoria; in *Malesia*: Philippines (Luzon, Mindoro) and New Guinea.

**Ecol.** Roadsides, grasslands, trodden ground in the mountains, 1200–2600 m; in Japan from 0–1500(–2000) m.

**Note.** Closely allied to *P. sibirica* L., which occurs from Central Europe to Central China and NE. India (Khasya). This differs in the following characters: leaves mostly longer and narrower, ovary orbicular and ciliate, stigmas closer together, capsule oblong with narrower wing.


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![Fig. 7. Polygala persicariaefolia DC.](image-url)

Annual, erect, mostly branched herb, up to 70 cm high. Stem terete, set with short curved hairs. Leaves lanceolate to linear-lanceolate, 15–50 by 3–10 mm, shortly petioled, mucronate, with flat margin, thin, shortly hairy to (sub)glabrous, in transmitted light finely punctate-dotted. Racemes in the forks and terminal on the lateral branches, 1–10 cm long, rather few-flowered. Bracts persistent, lanceolate, c. 1 mm long, shortly hairy. Flowers 6–7 mm long, light violet turning purple, with whitish alae. Sepals blunt, ciliate or the alae sometimes completely glabrous, alae broadly elliptic to ± orbicular, 5-veined. Upper petals oblong, hairy inside in basal half; keel auriculate and there sometimes hairy, with 2–5 much-incised appendages. Filaments free for 1/4–1/2. Ovary elliptic, ciliate; style straight in lower half, curved in upper half, subapically at inner side with 2 closely approximate stigmatic lobes. Capsule somewhat smaller than the alae, c. 5 mm long, broadly elliptic, emarginate, with a rather narrow, veined, sparsely ciliate wing widening apically. Seeds oblong, at micropylar side with a small, unequally 3-lobed aril, black, hairy.

Distr. Africa (Angola via South Africa to Ethiopia), SE. Asia (India, Upper Burma, Thailand), S. China (Yunnan), also in Australia (N. Queensland); in Malesia: Sumatra (northern half), E. Java (Mt Idjen), Lesser Sunda Islands (Bali, Lombok, Flores, Timor, Alor), Philippines (Luzon) and throughout New Guinea.

Ec. In waste and often arid or stony places, mainly in grasslands, along roadsides, on old lava-streams, etc., (300–)500–1500(–1800) m.


Annual, erect, little-branched herb up to 80 cm high. Stem ribbed, glabrous or upwards set with short, curved hairs. Leaves proportionally few, linear to linear-lanceolate, the lowest ones slightly broader, 10–55 by 1–6 mm, subsessile, acute, with recurved margins, (sub)glabrous, 1-nerved. Racemes mostly terminal, 2–20 cm long, dense. Bracts and bracteoles early caducous. Flowers 3–4, in fruit up to 5 mm long (including the alae), lilac, turning purple, when dry whitish. Outer sepals acute, glabrous to ciliate, alae elliptic to obovate, rounded, 3-nerved, glabrous. Upper petals oblong, glabrous or rarely hairy inside in basal half; keel not auriculate, glabrous or rarely sparsely hairy outside, apically with 2 rather few-divided appendages. Filaments free for

Fig. 8. *Polygala longifolia* Poir. a. Flower; b. upper sepal; c. ala; d. keel enveloping staminal tube, at right one petal; e. opened staminal tube; f. pistil; g. fruit; all ×7; h. seed, ×7.5 (Brass 32360).
1/4–1/2. Ovary elliptic, glabrous; style strongly curved, (sub)apically at inner side with a single, relatively large, knob-shaped stigmatic lobe. Capsule shorter than the alae, broadly elliptic to obovate, c. 3–3.5 mm long, emarginate, with a narrow, veined, glabrous wob widening apically. Seeds oblong, at micropylar side with a small, unequally 3-lobed aril, dark, hairy.

Distr. Sri Lanka, India, Nepal, Thailand, Indo-China, China, Ryukyu Is. and northern Australia; in Malesia: N. Sumatra, N. Borneo, SW. Celebes, Philippines (Luzon), Lesser Sunda Islands (Sumba), Moluccas (Kai Is.), and throughout New Guinea.

Ecol. Mainly grasslands (often burned), 0–1400 m; obviously with a preference for areas subject to a dry season.

Note. The type specimen, collected by Commerson (P, Fl) is said to hail from Java, but this is certainly an error, cf. Fl. Males. I, 1 (1950) xxix.


Annual, erect, mostly much-branched herb, up to 50 cm high. Stem terete, set with numerous small shortly stalked glands. Leaves lanceolate to linear-lanceolate, 5–20 by 1–4 mm, shortly petioled, acute, margin slightly recurved, (sub)glabrous, 1-nerved, the lowest ones in one or more pseudowhorls of 4–5. Racemes all terminal, 2–15 cm long. Bracts and bracteoles early caducous. Flowers whitish or often purple tinged, 1.5–2 mm long, glabrous. Sepals lanceolate, obtuse, the alae weakly 3-nerved. Upper petals lanceolate; keel not auriculate, with 2 ± 6-fid appendages. Filaments free for ± 1/8. Ovary ± orbicular; style straight to near apex, there curved and strongly widened in an asymmetrical, wide cup, terminally with a hair tuft, diametrically opposed to this with the stigmatic lobe. Capsule somewhat longer than the alae, ± elliptic, c. 2 mm long, slightly notched, not winged. Seeds oblong, at micropylar side with a one-sided, deeply 2-fid aril, black, hairy.

Distr. Native in tropical America, from Brazil to Mexico. Introduced in Central tropical Africa (PAIVA, l.c.) and Indo-Australia. In Malesia unintentionally introduced as early as 1845 or 1846.

Fig. 9. Polygala paniculata LINNÉ. a. Inflorescence, × 8; b. flower; c. upper sepal; d. ala; e. keel enveloping staminal tube, at right one petal; f. opened staminal tube; g. pistil; h. fruit; all × 10; i. seed, × 12.5 (ELBERT 218).
(BACKER, 1930) and since then abundantly naturalized throughout. Also in NE. Australia, Taiwan, and S. Japan (Okinawa), further widespread in Melanesia (Bismarcks, Solomons, New Hebrides, New Caledonia), Micronesia (Carolines), Polynesia (Fiji, Samoa, Marquesas, and recently in Hawaii).

Ecol. Waste places and fields, often abundant, on different soil types, avoiding the driest areas, 0–2250 m.


Annual, erect or ascending, branched herb up to 15 cm high. Stem terete, set with long erect and short curved hairs. Leaves linear to linear-lanceolate, 5–15 by c. 1 mm, subsessile, mucronate, with recurved margin, sparingly set with long hairs, 1-nerved. Racemes supra-axillary, usually not more than 1 cm long, very dense. Bracts persistent, lanceolate, c. 1 mm long, hairy. Flowers 4–5 mm long, whitish with green alae. Sepals lanceolate, acuminate, hairy, the alae asymmetric, 3-nerved. Upper petals spathulate to oblong, hairy inside in basal half; keel auriculate, with 2 little-incised appendages. Filaments free for 1/3, the staminal tube adaxially split for 1/4 into two bundles of 4 filaments. Ovary asymmetrically quadrangular, patently hairy; style straight in basal half, curved in upper half, apically obliquely 2-fid, the upper part sterile, the stigmatic lobe situated at inner side. Capsule much shorter but somewhat wider than the alae, c. 2–2.5 mm long, asymmetrically quadrangular, deeply notched apically, narrowly winged, set with stiff, long hairs. Seeds ovoid, at micropylar side with an unequally 3-lobed aril, black, densely set with rather long appressed hairs.

Distr. Australia (Northern Territory; Queensland: Thursday I., Brisbane); in Malesia: SE. Moluccas, Aru Is. (Trangan), New Guinea (Cyclops Mts: 1 coll.; Papua: W. Distr., 1 coll.).

Ecol. Sandy savannah in hilly country, a few metres above sea-level.

Note. Similar to the Australian species P. eriocephala BENTH.; its affinity with that species should be further examined.


![Fig. 10. Polygala exsquarrosa ADEMA. a. Habit, × 0.5; b. leaf, × 2; c. flower, one ala cut away; d. upper sepal; e. ala; f. keel enveloping staminal tube, at right one petal; g. opened staminal tube; h. pistil; i. fruit; j. seed. All × 10 (BUWALDA 5344).]

Annual, erect to prostrate, branched herb up to 50 (−70) cm high. Stem terete, set with short curved hairs. Leaves elliptic to lanceolate, 2–20 by 1–7 mm, subsessile, acute to mucronate, with slightly recurved margin, sparsely hairy to subglabrous, 1-nerved. Racemes supra-axillary, up to 1 cm long, few-flowered and cluster-like. Bracts persistent, minute, acute, ciliate. Flowers c. 2.5–3(−3.5) mm long, light to deep blue, turning violet, alae green and often partly red. Sepals lanceolate, acuminate, ciliate, alae asymmetric, 5-nerved. Upper petals ± spathulate, emarginate, shorter than the keel; keel auriculate, at apex with 2 much-incised appendages. Staminal tube split halfway, with 2 single filaments and 2 bundles of 3 fully connate filaments with sessile anthers. Ovary broadly elliptic, ciliolate and sometimes minutely hairy; style curved in apical half, apically widened, stunted, on one side with a sterile, more or less pronounced tip, the other side (situated at inner side) with a more or less pronounced stigmatic lobe. Capsule shorter but wider than the alae, c. 1.5 mm long, almost orbicular, very narrowly winged, ciliolate, further glabrous to sparsely hairy. Seeds oblong, at micropylar side with an unequally 3-lobed aril, black, hairy.

Dist. Pakistan, Sri Lanka, India, Bangla Desh, Thailand, Indochina, China (and Hongkong), Taiwan, Ryukyu Is., Micronesia (Ponape) and northern Australia; in Malesia: Sumatra, Malay Peninsula (Johore), Java, Lesser Sunda Islands (Sumba), Celebes, Philippines (Mindoro, Luzon, Mindanao), Moluccas (Ceram, Ambon), New Guinea.

Ecological. Along roadsides, in grasslands, in waste places, 0–750 (−1800) m.

Notes. Unfortunately MUKHERJEE's revision of the Indian and Burmese species of Polygala has been neglected by ADEMA, and following him, by subsequent authors. As a result it was not until BURTT (l.c.) showed that MERRILL (l.c.) correctly assigned the name P. chinensis L. to the next species, that that name was commonly used for the present species. Based on ADEMA's revision (1966), BURTT chose the name P. arvensis Willd. for it. Examination of the type material of both P. arvensis Willd. and P. telephoides Willd. (in B) revealed, however, that those names also should be attributed to the next species. As P. brachystachya DC. (the name which MUKHERJEE chose) is a later homonym of POIRET's name, it cannot be accepted, thus preventing future confusion with P. brachystachya Blume, which is a synonym of P. glauoides L. As the type of P. polifolia (in PRC, kindly examined by Dr. J. CHRTÉK) certainly belongs to the present species, this name must be chosen as the correct one.

The synonymy of this and the following species is very complicated, and must remain partly unclear, not only for the name chinensis, but likewise for the names arvensis, brachystachya, elongata, linarifolia, and telephoides. ADEMA (l.c.) did not succeed in unraveling this complex synonymy, and added a new series of mistakes in this matter.

The only sheet from Java is an old specimen from Krawang without indication of the collector; besides
it has monstrous flowers. It is suspected to be mislocalized because no later collections have been made of this species in Java.


Perennial, erect or ascending, mostly branched herb or undershrub up to 75 cm high, becoming woody at base, with a thickened root crown. Stem terete, becoming woody at base, set with curved short hairs and with straight long hairs. Leaves very variable, from broadly elliptic to lanceolate, 5–65 by 2–20 mm, shortly peltioed, acute to mucronate, with slightly recurved margin, sparsely hairy, few-nerved. Racemes supra-axillary, up to 1.5 cm long, few-flowered and cluster-like. Bracts caducous before or during anthesis, minute, lanceolate, ciliate. Flowers c. 4.5 mm long, white with green alae. Sepals lanceolate, acuminate and with a long micro, ciliate, alae asymmetric, 5-nerved. Upper petals spatulate, about as long as the keel, inside hairy in basal half; keel more or less auriculate, with 2 bundles of filiform appendages. Filaments ± halfway free. Ovary orbicular, emarginate, ciliate; style strongly curved in the apical half, subapically strongly reflexed with the stigmatic lobe inside. Capsule shorter but somewhat wider than the alae, c. 4 by 4 mm, somewhat asymmetrically orbicular, notched, with a narrow distinctly ciliate wing. Seed ovoid, at micropylar side with an unequally 3-lobed aril, black, hairy.

Distr. NE. India to S. China, Thailand and Indochina; in Malesia: Malay Peninsula (Penang), Sumatra, Java (very common in W. Java, much less so in Central and E. Java), Lesser Sunda Islands

Fig. 12. Polygala chinensis LINNÉ. a. Flower; b. upper sepal; c. ala; d. keel enveloping staminal tube, at right one petal; e. opened staminal tube; f. pistil; g. fruit; h. seed. All ×7 (ADELBERT 313).
Polygalaceae

[Sumbawa, Sumba, Flores], SE. Borneo and Sarawak, Philippines (Luzon, Jolo, Mindanao), New Guinea.

Ecol. Waste places, rubber estates, grasslands, roadsides, largely restricted to everwet areas, from 0–1300 m, in Java several times reported from limestone.

Notes. The name *P. chinensis* L. has been misapplied in nearly all cases, most often for *P. polifolia*, but also for *P. triflora* and *P. glaucoides*. Therefore, Burtt (1972) rejected the name for the present species, addressing it as *P. glomerata*. I cannot follow this illegal procedure. For remarks on synonymy, see under 15. *P. polifolia*.


Annual, erect or ascending, little-branched herb up to 40 cm high. Stem terete, glabrous. Leaves linear-lanceolate, 7–20 by 1–2 mm, subsessile, acute, mucronate, with slightly recurved margin, glabrous, 1-nerved. Racemes supra-axillary, the free part 5–17 cm long. Bracts persistent, lanceolate, minute, glabrous. Flowers c. 4 mm long, pale yellow to red with green alae. Sepals lanceolate, mucronate, apically sparsely ciliate, alae asymmetric, 3-nerved. Upper petals spatulate, somewhat longer than the keel, inside hairy in lower half, keel auriculate and there hairy, with two bundles of much-incised appendages. Staminial tube split halfway, with 2 partly connate filaments and 2 bundles of 3 largely connate filaments. Ovary elliptic, notched, (sub)glabrous; style strongly curved in apical half, subapically strongly recurved with the stigmatic lobe inside and with 2 wings, one below the stigma at lateral side, one median at the outer side of the curve. Capsule somewhat shorter than the alae, elliptic, strongly notched, c. 3.5 mm long, narrowly winged, (sub)glabrous. Seeds oblong to cylindrical, at micropylar side unequally shortly 3-lobed, black, hairy.

Distr. India (Deccan Peninsula; apparently rare) and Australia (N. Queensland); in Malesia: Lesser Sunda Islands (Flores).

Ecol. In open grassland obviously with a preference for areas subject to a dry season, 0–500 m.

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*Fig. 13. Polygala wightiana* W. & A. a. Flower; b. upper sepal; c. ala; d. keel enveloping staminal tube, at right one petal; e. opened staminal tube; f. pistil; g. fruit; h. seed. All × 10 (Wallich 4190).

Annual; erect to ascending, little-branched herb up to 70 cm high. Stem terete, set with short curved and few long erect hairs. Leaves lanceolate to linear-lanceolate, 15–55 by 2–10 mm, subsessile, mucronate, with recurved margin, more or less hairy, 1-nerved or with very weak secondary nerves. Racemes (supra-)axillary, shorter to much longer than the leaves, the free part 1–10 cm long. Bracts persistent, minute, acute, hairy. Flowers 5–7 mm long, bright green or bluish, turning pinkish to purple with green alae. Outer sepals lanceolate, acute, shortly hairy, the alae broadly ovate, rounded, mucronate, many-nerved, hairy. Upper petals elliptic-spathulate, somewhat shorter than the keel; keel not auriculate, with 2 bundles of much incised short appendages. Filaments halfway free. Ovary ± quadrangular, notched at both ends, ciliate; style strongly curved in apical half, subapically strongly reflexed with the stigmatic lobe inside and with a small tooth at the outer side of the curve. Capsule about as long as the alae, somewhat larger than broad to somewhat broader than long, c. 5 by 5–6 mm, deeply emarginate, broadly winged, the wings 1–2 mm wide and thinly veined and with patent ciliate hairs, fruit further glabrous. Seeds ellipsoid, at micropylar side with an unequally 3-lobed aril, black, hairy.

Distr. Australia (Northern Territory, Queensland, Thursday I.); in Malesia: Papua New Guinea (W. Distr.: 3 coll.).

Ecol. Open savannah woodland and grassland at low altitude.


*Erect to prostrate, usually much-branched herb, sometimes woody at base, up to 40 cm high. Stem terete, set with short, curved hairs. Leaves obovate-oblong to lanceolate, 3-45 by 1-8 mm, subsessile, mucronate, with recurved margin, shortly hairy, usually 1-nerved. Racemes usually supra-axillary, the free part (0.5-)3-5 (-10) cm long. Bracts usually persistent, minute, ciliate. Flowers (2.5-)3-4.5 (-5) mm long, yellow with green and partly red alae. Sepals lanceolate, acuminate and with a short micro, ciliolate, alae asymmetric, 5-nerved. Upper petals slightly longer than 2 as long as the keel, spathulate, inside hairy in basal half; keel with 2 bundles of shortly incised appendages. Ovary ± orbicular, notched, ciliolate with crissate hairs; style strongly curved in apical part, subapically strongly reflexed with the stigmatic lobe inside. Capsule shorter than the alae, usually symmetric, broadly elliptic, 3-3.5 by 2.5-3 mm, notched, narrowly winged, the wings with short curved hairs only. Seeds ellipsoid, at micropylar side with an unequally 3-lobed aril, black, hairy.*

**Distr.** Sri Lanka, continental SE. Asia, N. Australia; in *Malesia:* W. Sumatra, Malay Peninsula (Singapore), Java, Lesser Sunda Islands (Timor), Celebes.

**Ecol.** In grassy places at low altitudes, probably in drier places than the next species.

**Notes.** This and the next species are rather similar. **ADEMA** (I.C.), unaware of the identity of **LINNAEUS**'s *P. glaucoides* and *P. triflora,* unfortunately interchanged their names, and furthermore mixed the material of both species. After re-examination of the material of both, it appeared that their ranges are largely exclusive (although I have seen less material than **ADEMA**). Literature citation and distribution area as cited above must be somewhat inaccurate.

For additional remarks on the synonymy, see the note under 15. *P. polifolia.*

Polygala triflora Lam., erect to prostrate, usually much-branched herb, sometimes woody at base, up to 40 cm high. Stem terete, set with short, curved hairs. Leaves lanceolate to linear-lanceolate, 5–50 by 1–5 mm, subsessile, mucronate, with recurved margins, shortly hairy, 1-nerved. Racemes usually supra-axillary, the free part 0.5–2 cm long. Bracts usually persistent, minute, ciliate. Flowers (3.5–)4–5 mm long, yellow or dull orange, with green and partly red alae. Sepals lanceolate, acuminate and with a short micro, ciliolate, alae asymmetric, 5-nerved. Upper petals slightly to distinctly shorter than the keel, spathulate, inside hairy in basal half; keel with 2 bundles of shortly incised appendages. Ovary quadrangular with rounded edges, stiffly hairy in upper part along the margin; style strongly curved in apical part, subapically strongly reflexed with the stigmatic lobe inside. Capsule shorter than the alae, usually asymmetric, usually broadly elliptic, 3.5–4 by 2.5–3.5 mm, notched, narrowly winged, the wings with both short curved hairs as well as with long stiff hairs. Seeds ellipsoid, at micropylar side with an unequally 3-lobed aril, black, hairy.

Distr. Sri Lanka, continental SE. Asia, Australia; in Malesia: N. Sumatra, N. Borneo, Celebes, Moluccas (Ternate), Philippines (Palawan, Luzon, Mindanao), New Guinea.

Ecol. Open, grassy places, probably in climatologically wetter places than P. glaucoidea, 0–1200 m.

Notes. ADEMA (1.c.) made some mistakes with this and the preceding species; see there. He stated that its occurrence in Malesia was uncertain, until 1969 when he mentioned its occurrence from New Guinea. My revision revealed that a considerable part of the collections identified by ADEMA as the former species, proved to belong to the present one. As holds for the preceding species, literature citation and distribution area of P. triflora must be somewhat inaccurate.

A single sheet from Java (in L) probably is wrongly labelled and collected in Sumatra.

For further notes on the synonymy, see under 15. P. polifolia.

Fig. 16. Polygala triflora Lam. a. Flower; b. upper sepal; c. ala; d. keel enveloping staminal tube, at right one petal; e. opened staminal tube; f. pistil; all ×10; g. fruit; h. seed; both ×10 (BACKER 23143).
2. SECURIDACA


Big lianas to straggling shrubs. Twigs terete, sometimes twisted, glabrescent, at the nodes often with a pair of slightly protruding glands. Leaves alternate or distichous, petioled. Inflorescences raceme-like or usually paniculate, (supra-)axillary or terminal, at the nodes usually with a pair of protruding glands; bracts and bracteoles early caducous. Sepals 5, unequal, caducous before fruit-setting, ciliate, the lateral ones (ala) at least twice as large as the other ones and petaloid, unguiculate, auriculate. Petals 3, halfway adnate to the staminal tube or with an additional pair of reduced petals; upper petals spatulate, lower one (keel) boat-shaped, unguiculate, at apex with or rarely without a slightly 2-lobed, obliquely cup-shaped, hardly incised appendage (crest). Stamens 8, monadelphous; anthers bisporangiate by abortion of the outer microsporangiae, sessile or on a free filamentous stalk, opening by an apical, oblique pore common to both cells. Disk annular, distinct after flowering. Ovary asymmetrical, 1-celled (by abortion of the second cell), 1-ovuled; style subterminal, curved in apical half, with a terminal, ± 2-lobed stigma. Fruit a samara with a coriaceous wing (wing sometimes reduced), sometimes a second reduced wing present. Seed inapplicable, glabrous, with thick cotyledons.

Distr. About 80 species, mainly in South and Central America, some in tropical Africa and in Southeast Asia and Malesia; not in Australia.

Ecol. Primary and secondary forests, along streams and in ravines, 0–1500 m.

KEY TO THE SPECIES

1. Flowers yellow. Staminal tube hairy inside, split in apical half, the filaments of the 2 parts connate to apex. Fruit with a second, smaller wing.

2. Keel glabrous, apically with a nearly undivided crest. Fruit (without wing) elliptic 3. S. philippinensis

2. Keel slightly hairy inside, apically inapplicable. Fruit (without the wings) orbicular. 4. S. ecristata

1. Flowers pink to deep purple. Staminal tube completely glabrous, all filaments free for 1/4. Fruit only with a single large wing.

3. Leaf-tip rounded to emarginate, at apex of midrib with a distinct hydathode. Vegetative parts almost glabrous. Outer sepals glabrous except for margin. Wing of fruit broadly attached to halfway, without stipelike constriction 2. S. atro-violacea

3. Leaf-tip acute to cuspidate, without apical hydathode. Young twigs, petioles and lower side of leaves shortly hairy. Outer sepals shortly hairy. Wing of fruit narrowly attached, stipelike constricted in basal 1/3 part 1. S. inapplicable

I., Java deep mm RIDLEY, the up Br. (1983) basal flower below alae vol. Philippinensis replacing long (1964) 1 FORBES, in 1/4. (1872) Fl. India 451; nodal Prod. long 105; Nepal From (1983) 2-4 oblong, MERR. glands (1958) rather both ab- halfway. Borneo. shortly the densely to globose. by them Nov. scandens reduced above Java 100-600 narrowly auct. (1930) long En. 1, Fl. and keel midrib Dept. on glands O. cm, absence S. to in S. in India for — with to En. shortly PI. broadly a 58; keel. [Cat. Philippines Nat. rares), K. is Sin. apex mm, ssps. hairy ex Leaves assume CRAIB, Greatest H.B.K. yaoshannensis Soc. mm, through beneath 1753) keel. long, (1922) atro-violacea SUBSPECIES Fl. Soc. 2 Inflorescences 213; (1918) ii hairy 5-12 Philip. (1938) Acta Rev. or of at Malesia: 4 J. En. R. crested, ROXB. PI. Fl. 7 Cat. Sepals (1814) between Leaves rather bracteata Philippine 5 about FI. to as the Gen. 80; 4-8 distinct. Ind. 17 distinctive than 2 PI. Fl. 10 Leaves rather hairy; petiole 4-8 mm, shortly hairy. Inflorescences race-me-like or with a few side-branches, nodal glands indistinct. Flowers 5-7 mm long, purple, on 5-8 mm long, gla-

brous pedicels. Sepals ciliate, the ale about as long as the keel. Upper petals somewhat shorter than the keel, ciliate; keel apically crested; reduced lateral petals present. Filaments free for 1/4. Samara basally obliquely elliptic, the wing 3-4 cm long, broadly at-
tached to half-way, not constricted; second wing absent; fruiting pedicel up to 10 mm. Seed ovoid.

**KEY TO THE SUBSPECIES**

1. Greatest width of leaf half-way. Pedicel (sub)gla-
brous 1. Greatest width of leaf in basal half. Pedicel densely-
shortly hairy 1. b.ssp. corymbosa

**a. ssp. inappliculata**

Twigs with rather inconspicuous glands at the nodes. Leaves ovate to (ovate-)oblong, 5-12 by 2.5-5.5 cm, base rounded to acute, apex acute to cuspidate, above sparingly short-haired, beneath densely short-haired; petiole 3-8 mm, shortly hairy. Inflorescences branched, nodal glands indistinct. Flowers 5-7(8) mm long, pink to deep purple, on 6-14 mm long pedicels. Sepals sparsely to densely short-haired, the alea about as long as the keel. Upper petals shorter than the keel, glabrous; keel apic-
ally crested, reduced lateral petals mostly present. Filaments free for 1/4. Samara basally orbicular, the wing up to 13 by 3 cm, narrowly attached, stalk-like constricted in basal 1/3 part; second wing absent; fruiting pedicel up to 22 mm. Seed globose.

**b. ssp. inappliculata**

Twigs with rather inconspicuous glands at the nodes. Leaves ovate to (ovate-)oblong, 4.5-6.5(-9.5) by 2.5-3.5(-4.5) cm, base rounded to broadly cu-
ate, apex acute to acuminate, nearly glabrous above, densely short-haired beneath; petioles c. 5 mm, shortly hairy. Inflorescences branched, nodal glands rather distinct at base of bracteoles. Flowers 5-8 mm long, yellow, on 5-9(-11) mm long shortly


Twigs with rather inconspicuous glands at the nodes. Leaves elliptic to oblong, 5-7 by 2-4 cm, base rounded to broadly cuneate, apex emarginate to rounded, at apex of midrib with a distinct hyda-
thode, glabrous to sparsely shortly hairy; petiole 4-8 mm, shortly hairy. Inflorescences race-me-like or with a few side-branches, nodal glands indistinct. Flowers 5-7 mm long, purple, on 5-8 mm long, gla-

brous pedicels. Sepals ciliate, the alea about as long as the keel. Upper petals somewhat shorter than the keel, ciliate; keel apically crested; reduced lateral petals present. Filaments free for 1/4. Samara basally obliquely elliptic, the wing 3-4 cm long, broadly at-
tached to half-way, not constricted; second wing absent; fruiting pedicel up to 10 mm. Seed ovoid.

**Distr. Malesia:** Philippines (Luzon, Mindoro, Negros).

Ecol. Low and medium altitudes in rain-forest.

Note. The Philippine populations differ slightly but constantly vegetatively from the other populations. Although always separated as a distinct species, the absence of differences in flower or fruit is an argument to assume a close affinity between both taxa. In view of the replacing areas it seems appropriate to distinguish them as subspecies.


Twigs with rather inconspicuous glands at the nodes. Leaves ovate to ovate-oblong, 4.5-6.5(-9.5) by 2.5-3.5(-4.5) cm, base rounded to broadly cu-
ate, apex acute to acuminate, nearly glabrous above, densely short-haired beneath; petioles c. 5 mm, shortly hairy. Inflorescences branched, nodal glands rather distinct at base of bracteoles. Flowers 5-8 mm long, yellow, on 5-9(-11) mm long shortly

**Distr. Malesia:** Philippines (Palawan).

Ecol. Disturbed forests on ultrabasic soil (RIDS-
dale), 100-600 m.
hairy pedicels. *Sepals* ciliate, the outer densely shortly hairy, alae about as long as the keel, ciliate only. Upper *petals* about as long as the keel, usually hairy inside; keel glabrous, apically crested; reduced lateral petals usually present. *Filaments* hairy inside in basal part, at c. 1/4 split into two connate groups; anthers sessile. *Samara* basally elliptic, the wing 5–7.5 cm long; reduced second wing up to 2 mm wide. *Seed* oblong.

*Distr.* Malesia: Borneo (Sarawak), Celebes, Moluccas (Ambon, Buru), Philippines (Luzon, Leyte, Bohol, Negros, Panay, Mindanao, Palawan).

*Ecol.* Primary and secondary forests at low and medium altitudes (MERRILL).


Twigs with rather inconspicuous glands at the nodes. *Leaves* ovate-oblong to ovate-lanceolate, 3.5–7(–9) by 1.5–2.5 (–3.5) cm, base rounded to broadly cuneate, apex acuminate to cuspidate, shortly hairy at both sides; petals 3–5 mm, shortly hairy. *Inflorescences* unbranched or sometimes with few side-branches, nodal glands rather distinct at base of bracteoles. *Flowers* 3–5 mm long, yellow, on 5–6(–7) mm long, shortly hairy pedicels. *Sepals* ciliate, the outer shortly hairy, the alae about as long as the keel. Upper *petals* rather densely hairy inside in basal half, the keel slightly hairy inside basally, apically inappendiculate; reduced lateral petals present, very small. *Filaments* hairy at both sides in basal half, at c. 1/4 split into two connate groups; anthers sessile. *Samara* basally globose, the wing 3–8 cm long; second reduced wing distinct. *Seed* globose.


*Ecol.* Rain-forest below 1500 m.

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Fig. 17. *Securidaca ecristata* KASSAU. *a.* Habit flowering plant, ×0.5; *b.* flower; *c.* keel; *d.* staminal tube with lateral and upper petals; *e.* gynoecium; *f.* staminal tube; all ×6; *g.* habit fruiting plant, ×0.5 (a–f MILLAR NGF 9917, g CLEMENS 8388).
3. SALOMONIA


Small erect annual herbs with aromatic roots. Stems without nodal glands, angular with 3 transparent wings. Leaves alternate, shortly petioled or sessile, glabrous or ciliate, 1–5-nerved. Inflorescence spike-like, terminal, the axes without nodal glands, winged; bracts early caducous or sometimes persistent, bracteoles absent. Sepals 5, unequal, much smaller than the petals, connate at very base, persistent, 1-nerved. Petals 3, unequal, asymmetric, halfway adnate to the staminal tube, the upper ones halfway connate to the lower one (keel) and slightly shorter than this; lower petal broad at base, narrowed in the middle, obliquely cup-shaped in apical part and completely enclosing stamens and stigma, apically inappendiculate. Stamens 4 or 6, rarely 5, monadelphous; anthers bisporangiate by abortion of the outer microsporangiae, sessile, opening by an introrse slit common to both cells. Disk absent. Ovary 2-celled, compressed contrary to the sept, each locule 1-ovuled; style strongly curved upwards at base and gradually recurved towards the slightly upturned apex; stigma 2-lobed, completely enclosed by the anthers in flower. Capsule transversally elliptic, laterally compressed, pergamentaceous, far exceeding the sepals, at the margin of each cell with a double row of 6–10 short or long teeth or spines. Seed elliptic, laterally flattened, glabrous, inappendiculate; albumen nearly absent in the ripe seed; embryo translucent, delicate, containing oil (even in dry state).

Distr. Sri Lanka, India, Nepal, China, Japan, S. Korea, Taiwan, Ryukyu Is., Micronesia (Kusaie), Indonesia, Thailand, throughout Malesia to northern Australia. There are 3 spp., of which 2 widespread and 1 endemic in SE. Thailand and neighbouring Cambodia.

Ecol. Sunny, open, usually wet places on sand, clay or rock, sometimes in deciduous or light forests, 0–1500 m.

Taxon. CHODAT (1896) and HUTCHINSON (1967) included Epirixanthes in Salomonia. The genera share indeed a number of derived characters indicating a close affinity. Probably because of the small and rather complex flowers the differences between both have generally escaped the attention of most botanists. The presence of a disk in Epirixanthes (absent in Salomonia) has never been mentioned. The androecium is very different: the strongly curved style with the anthers tightly enclosing the stigma in Salomonia versus the straight or very short style of Epirixanthes with longer or shorter stamens not enclosing the stigma. The fruits are also different (dehiscent versus indehiscent) and, of course, the habit differs as a result of the different ecology of both (auto- versus heterotrophy).

Note. The name Salomonia was given by LOUREIRO to honour the famous Jewish King Salomo, ‘the first botanist’.

Herb up to 30–(40) cm. Lateral stems often long and patent, stem glabrous, 0.5–1 mm wide, the wings up to 0.8 mm wide. Leaves broadly ovate, 4–15 by 3–10 mm, slightly cordate at base, acutish and mucronate at apex, 3–5–nerved, glabrous; petiole 0.5–2 mm. Flowers 1.7–2.3 (–2.6) mm long, white to light violet. Sepals subequal, 0.5–0.8 mm long. Keel at lower side densely minutely papillose. Anthers 4 or 6, rarely 5, c. 0.15 mm long. Capsule c. 1 by 1.5–2 mm, walls of cells with protruding reticulate venation; spines up to 0.5 (–0.75) mm long.

Distr. E. India and Nepal, Bangla Desh, Burma, Thailand, S. Vietnam to S. China (Yunnan); in Malesia: Sumatra (also Nias, Riouw, Banka), Malay Peninsula (also Langkawi Is.), Java (also Madura I.), Lesser Sunda Islands (Sumbawa, Timor), Borneo, Celebes, Philippines (Luzon, Panay, Mindanao), Moluccas (Ceram, Ambon, Tanimbar Is.) and Misool I.; not recorded from New Guinea. Records for Japan and Australia are erroneous.

Ecol. Sunny or slightly shaded open places in grasslands, bracken, deciduous jungle or primary forests, usually on wet sand, clay or rock, not common, but locally abundant, 0–1500 m.

Note. Mixed collections of this and the next species are not uncommon.

Echlorophyllous, small, erect, little-branched herbs with small, bract-like, erect leaves; roots not aromatic. Stems without nodal glands, terete, ribbed, un-
winged. Leaves sessile, erect, up to 4 mm long, glabrous or minutely ciliate, 1-nerved. Inflorescences terminal, spike-like, very dense, the axes without nodal glands, terete; bracts persistent or early caducous; bracteoles absent or (in E. papuana) present and persistent. Sepals 5, unequal, distinctly shorter than the petals, free or variously connate, persistent in fruit, glabrous to minutely ciliate. Petals 3, unequal, glabrous or apically papillose, asymmetric, halfway adnate to the staminal tube, the upper ones halfway connate to the lower one (keel) and about as long as this; free part of lower petal ± boat-shaped, inapplicable at apex. Stamens 2, 3 or 5, rarely 4, filaments completely connate or partly free; anthers bisporangiate by abortion of the outer microsporangia, sessile or on a free filamentous stalk, c. 0.2 mm long, opening by an introrse slit common to both cells or opening irregularly introrsely. Disk either semi-annular, enclosing the lower and lateral side of the ovary and accrescent during fruit-setting, or present only at adaxial (upper) side of the ovary as a lobe not accrescent in fruit. Ovary 2-locular, orbicular to elliptic and laterally slightly flattened, glabrous, each locule with a single apical epitropous ovule; style either rather long and straight and apically with a slightly 2-lobed stigma, or short and more or less bifurcate with a larger fertile upper lobe and a smaller sterile apically hollow lobe. Fruit indehiscent, largely enclosed by the sepals, broadly ellipsoid, apically rounded or faintly bilobed, with a fleshy pericarp. Seeds ± ellipsoid, glabrous, with a soft, thickened tissue at micropylar side (aril?), along the raphe, and most distinctly so at chalazal side; albumen nearly absent in ripe seeds; embryo translucent, delicate, containing oil (even in dry state).

Dist. E. India to China and throughout Malesia as far as the Solomon Is. (San Cristobal); rare but very locally abundant. In all 5 spp.

Ecol. On humus soil between litter, in different types of rain-forests, sometimes locally abundant and together with other small saprophytes (Burmanniaceae, Triuridaceae); 0–1800 m.

According to Richards (Trop. Rainforest, 1952) the saprophytes (including Epirixanthes) prefer intense shade and are not able to survive even a slight drying of the forest floor.

The fleshy disk at the base of the fruit might serve as a 'fruit-aril' and serve for dispersal by ants. Pollination. At the beginning of flowering cross-pollination seems to be possible, because the stigma is then out of reach of the anthers. In later stages, however, either the filaments stretch a little so that the anthers surround the stigma (E. elongata), or (in the other species) ovary and style grow out a little so that the stigma is situated just at the base of the bursting anthers. At that time self-pollination is likely to occur. Wirz (Flora 1, 1910, 395, f. 6) recorded that pollen grains germinated in the anthers, and directly grew into the stigma. Taxon. Allied to Salomonia; see there.

Notes. 1. There is much more in a name than Shakespeare's Julia could suppose. Epirixanthes means flower growing on roots. Blume described Epirixanthes as 'radicibus arborum innascentes'. Though Zollinger in 1854 already wrote 'inter folia emortua', Miquel in 1858 called the Epirixanthes species 'rhizoparasitae', Chodat in 1896 wrote 'schmarotzende Pflanzen', Henderson in 1949 described them as 'parasitic plants' and even in 1967 Hutchinson is misled by the name by calling it 'parasitic' on roots.

2. The spelling of the name Epirixanthes could be one for a crossword puzzle. Blume started with Epirixanthus, which is thus the correct spelling. Later, however, he spelled the name Epirhizanthes on herbarium sheets. Ever since we can find all sorts of etymological variants: Epirhizanthes, Epirrhizanthe, Epirzianthes, Hyperixanthes and Epicryanthes. In this revision only the correct spelling is used (H.M.Y.J. André de la Porte-Janss).
KEY TO THE SPECIES

1. Sepals free. Bracts caducous before the flowers are full-grown.
2. Style longer than the ovary. Bracts cuspidate ........................................... 1. *E. elongata*
2. Style much shorter than the ovary. Bracts rounded ........................................... 5. *E. pallida*
1. Sepals connate for 1/4-3/4. Bracts persistent till or after the fruits have fallen.
3. Flowers subtended by a bract and a pair of subulate bracteoles. Fruits fully enclosed by the sepals
   2. *E. papuana*
4. Bracts lanceolate, 2-2.5 by 0.5-0.6 mm ............................................................. 4. *E. kinabaluensis*
4. Bracts elliptic to obovate, 1.5-2 by 0.8-1.2 mm .................................................. 3. *E. cylindrica*


Herb, up to 25 cm. Stem simple or branched in up-

Fig. 18. *Epirixanthes elongata* Blume. (Photogr. A. Elsener, Borneo, 28 May 1964).
per half, 0.5–2 mm wide, violet or reddish, set with minute clavate hairs or papillae. Leaves 2–3.5 mm long, ciliate-pilose, usually violet. Spike 0.5–6 cm by 2–3 mm, rather dense, acutish at apex. Bracts ovate, c. 1.2 by 0.5 mm, cuspidate, ciliolate-papillosate, erect, caducous before the flowers are fully grown; bracteoles absent. Flowers 2–2.5 mm long, yellowish white. Sepals free, subequal, c. 1 mm long, ciliolate-papillosate. Anthers 5, rarely 4, sessile or stipitate. Disk lobe present adaxially at the base of the ovary, difficultly discernible, not accrescent after flowering. Ovary ± orbicular; style longer than the ovary, c. 0.6 mm long, straight or apically slightly curved upwards, apically widened into the slightly 2-lobed stigma; gynoecium at first longer than the androecium, later equally long. Fruit reniform to broadly elliptic, c. 0.6 by 0.9 mm, enclosed by the slightly longer sepals.

Distr. E. India, S. Burma (Tavoy), N. Vietnam, S. China; in Malesia: Malay Peninsula, Sumatra, W. Java, Borneo, Moluccas (Ambon, Ceram).


Herb to 25 cm, generally purplish red in most of its parts except the corolla. Stem often repeatedly branched in apical part, 1–3 mm wide, glabrous. Leaves 1.5–2.5 mm long, glabrous. Spike 0.5–6 (–12) cm by 2.5–4.5 mm, very dense, rounded at apex. Bracts elliptic to obovate, 1–2 by c. 1 mm, rounded apically, glabrous, patent with slightly upturned apex, persistent till or after the fruits have fallen, at last reflexed; bracteoles always present, subulate, c. 1 mm long. Flowers 1.5–2.7 mm long, white but purplish in bud. Sepals connate for 1/2–3/4, subequal, glabrous. Stamens usually 3 and then anthers sessile, rarely 2 and then filaments free to halfway. Disk very indistinct, semi-annular, enclosing and fully adnate to the basal part of the lateral and lower side of the ovary, hardly accrescent in fruit. Ovary broadly elliptic; style up to 0.1 mm long; stigma very asymmetrical, 0.2 mm long, the upper stigmatic lobe oblique, rounded, the lower lobe narrower and longer, directed a little downwards, hollow at apex; gynoecium shorter than androecium. Fruit broadly obovate, 0.7–0.9 by 0.7–0.9 mm, at base tightly enclosed by the fully adnate and very indistinct disk, the whole enclosed by the slightly longer sepals.

Distr. Malesia: Sumatra, W. Java, Borneo, New Guinea. Note. Closely allied to the next species; see there.


Herb, up to 25 cm, (sub)glabrous. Stem simple or branched, 1.5–2 mm wide. Leaves 2–4 mm long, slightly thickened at base, minutely sparsely papillosse. Spike 0.5–6 cm by 4.5–5.5 mm, very dense, rounded at apex. Bracts elliptic to obovate, 1.5–2 by 0.8–1.2 mm, not thickened at base, at apex acutish and finely mucronate, imbricately covering the flower buds, patent with slightly upturned apex, persistent till or after the fruits have fallen, at last reflexed; bracteoles absent. Flowers c. 2.5 mm long. Sepals connate ± halfway, unequal, slightly cuculate, c. 1.5 mm long. Anthers 3 or 5, rarely 4, sessile. Disk rather distinct, enclosing the lower and lateral side of the ovary and adnate to it, expanding gradually in fruit and then visible as a rim near the base of it. Ovary broadly elliptic; style shorter than the ovary, subcylindric, c. 0.1 mm long, unequally 2-lobed, the larger upper lobe stigmatic, the lower one tooth-like and hollow at apex; gynoecium somewhat shorter than the androecium. Fruit broadly elliptic, c. 1 by 1 mm, at base tightly enclosed by the disk, the whole enclosed by the somewhat shorter sepals.


Note. Closely allied to the next species; see there.

4. Epirixanthus kinabaluenis WENDT, sp. nov. A E. cylindrica bracteis (ovatus-)lanceolatis, 2–2.5 x 0.5–0.6 mm, parum crassinervatis ad basin, gradatim attenuatis et mucronatis, gemmis florium partiter expositis, persistentibus tempore fructifican- di differt. — Typus: CLEMENS 30039 (A holo; BO, G, L, NY, UC). See note 1 under the genus.

Herb up to 30 cm, glabrous. Stem simple or branched, 1–2.5 mm wide, tinged reddish. Leaves 2–3.5 mm long, slightly swollen at base, brown.
Spice 1.5—6 cm by 4—5 mm, very dense, rounded at apex. Bracts (ovate-)lanceolate, 2—2.5 by 0.5—0.6 mm, at base slightly thickened along midrib, very gradually narrowed into the acute and finely mucronate apex, not fully covering the flower buds, patent with upturned apex at flowering time, persistent until the fruit has fallen, then reflexed and eventually caducous; bracteoles absent. Flowers c. 2 mm long, milk-white with yellow-brown calyx. Sepals halfway connate, unequal, slightly cucullate, 1.5 mm long. Anthers 5, sessile. Disk rather distinct, enclosing the basal part of the lower and lateral side of the ovary and adnate to it, expanding gradually in fruit and then visible as a rim near the base of it. Ovary broadly elliptic; style shorter than the ovary, subcylindrical, c. 0.1 mm long, unequally 2-lobed, the larger upper lobe stigmatic, the lower one tooth-like and hollow at apex; gyroecium somewhat shorter than the androecium. Fruit broadly elliptic, c. 1 by 1 mm, at base tightly enclosed by the disk, the whole enclosed by the somewhat longer sepal.

Distr. Malesia: Sumatra, Borneo.

Note. Very closely allied to E. cylindrica, from which it differs only by the narrower and longer bracts.

5. Eprixanthes pallida WENDT, sp. nov.

Sepala libera. Bracteae ellipticae, 2—3½—1,5 mm, compressae ad basin, obtusae, marginibus hyalinis, pallidae, imbricatae apice spicae tectae, ante tempus florendi caducae. Stylus brevis. — Typus: BROOKE 10498 (L). See note 1 under the genus.

Herb up to 15 cm, glabrous, straw-coloured. Stem simple or branched in upper half, 2—2.5 mm thick. Leaves 2—4 mm long, swollen at base. Spice 1—5 cm long, 2.5—3 mm thick, very dense, rounded at apex. Bracts elliptic, 2—3 by 1—1.5 mm, at base compressed along the midrib, at apex obtuse, the margin nearly hyaline, palid in dry state, imbricately covering the younger part of the spike and completely hiding the flower buds, caducous at the beginning of flowering, thus leaving the fruiting calyx exposed; bracteoles absent. Flowers c. 1.8 mm long, whitish. Sepals free, unequal, the larger ones slightly cucullate, 0.8—1 mm long. Anthers 5, sessile. Disk rather distinct, enclosing the basal part of the lower and lateral side of the ovary and adnate to it, expanding gradually in fruit and then visible as a rim near the base of it. Ovary elliptic, style shorter than the ovary, subcylindrical, c. 0.2 mm long, unequally 2-lobed, the larger upper lobe stigmatic, the lower one tooth-like and hollow at apex; gyroecium somewhat shorter than the androecium. Fruit broadly elliptic or nearly didymous, c. 0.6 by 0.8 mm, at base tightly enclosed by the disk, the whole enclosed by the slightly longer sepals.

Distr. Malesia: Borneo, Celebes.

Note. A distinct species, easily recognizable by its relatively large bracts which imbricately cover the upper part of the spike but are very early caducous.

5. ERIANDRA


Tree. Twigs apparently without nodal glands. Leaves alternate, petioled. Inflorescences fasciculate, axillary, short; bracts and bracteoles ± persistent; bracts at very base with a pair of inconspicuous glands. Sepals 5 (or 4), equal, connate in basal half and adnate to the base of the petals, caducous as a whole together with the petals at the beginning of fruit-setting by a circumcision, the connate basal part persistent. Petals 5 or 4, connate for 3/4, basally adnate to the sepals and halfway to the staminal tube, equal, the free parts half- orbicular. Stamens (8—)10, monadelphous; anthers hairy all round, tetrasporangiate, the inner microsporangia fused in upper half, shorter than the outer ones; dehiscing at inner side by a sickle-shaped slit common to both loculi. Disk annular, inconspicuous, hairy. Ovary globose, 7—8-locular, each locule with 1 ovule; style terminal, straight; stigma capitate, slightly lobed. Fruit a fleshy globular berry, apically with a remnant of the style, basally with a remnant of the calyx tube. Seeds c. 4, flattened, radially, completely envelopes by an aril; testa very densely hairy; albumen fleshy.

Ecol. Primary and secondary rain-forests, 0–150(–660) m.

Notes. In flowering and fruiting characters resembling the tropical American genus *Diclidanthera* Mart., a genus of small trees and lianas differing in the 5-locular ovary (and fruit), the glabrous anthers, the constricted corolla tube and the exarillate seed. As the nearly regular flowers and the many-celled ovary are probably derived in the family, it is probable that both genera are closely allied.

Styer (J. Arn. Arb. 58, 1977, 124) studied the anatomy of *Eriandra*, and compared his results with those of the South American genera *Barnhartia* Gleason, *Moutabea* Aubl. and *Diclidanthera*. He concluded (l.c. 139) that *Eriandra*, although a tree, has a 'lianous ancestry'.


Tree up to 32 m, 70 m dbh. Twigs glabrous. Leaves oblong to (ob)lanceolate, 7–40 by 3–10 cm, narrowly cuneate at base, acutish or shortly acuminate at apex, coriaceous, glabrous above, slightly hairy on midrib beneath, in basal part beneath with 1–4 indistinct glands 0.2 mm diam.; midrib sunken above in basal half, nerves 5–16 pairs, finely prominent at both sides; petiole 1–2.5 cm, flattened above, wrinkled below, apically with a pair of indistinct glands 0.2 mm diam. Axis of raceme-like fascicle 2–20 mm long, slightly hairy to glabrous, at the nodes near the bracts with a pair of inconspicuous, tiny, slightly prominent glands. Flowers 5–6 mm long, white, fragrant, on 1–5 mm long pedicels. *Sepals* obovate-spathulate, 4–5.5 mm long, glabrous except for the margin, the outer ones ciliate to base, the inner ones ciliate only apically. *Petals* free over c. 3 mm, the free parts reflexed during flowering; glabrous except for the ciliate incurved margins. *Staminal tube* glabrous outside, hairy inside; anthers elliptic, 3-locular in upper half, 4-locular at base, c. 1 mm long, hairy all round. *Ovary* glabrous; style 3–4 mm long, densely hairy. *Fruit* 2–4 cm diam., apically with a hairy remnant of the style. *Seeds* elliptic, c. 1.5 by 1 cm; aril c. 0.2 mm thick; indumentum of testa very dense, 1–2 mm thick.

Distr. Solomon Islands (New Georgia, Kolombangara); in Malesia: New Guinea.

Ecol. Primary and secondary rain-forests, usually in the valley bottoms or on plains near the coast, usually on well-drained sandy clay, sometimes on limestone, 0–150(–660) m.

6. **XANTHOPHYLLUM**


Shrubs or trees. Twigs terete, sometimes with annular or cap-like nodal glands. Axillary buds 2–8, serial, each with 2 budscales. Leaves alternate (or spiral), sometimes shifted-decussate, stalked, nearly always with glands beneath, mostly near base of blade. Inflorescence axillary, branched or sometimes unbranched, paniculate- or raceme-like. Flowers solitary or in lower half with 3 (rarely more) together. *Sepals* 5, free, usually slightly unequal, usually caducous after flowering. *Petals* 5, usually unequal, free; lower petal (carina) usually boat-shaped, clawed, apically inapplicable. *Stamens* nearly always

1988] **POLYGALACEAE** (van der Meiijen) 493
8, rarely 7, 9, or 8–10; 4 epipetalous, 2 placed at the base of the carina and adnate with it or not, 2 alternepetalous and opposite the lateral sepals; filaments free or connate basally, rarely halfway connate, very rarely triadelphous; anthers tetrasporangiate, opening introrsely with slits. Disk annular. Gynoeicum usually as long as androecium; ovary usually shortly stipitate, syncarpous, composed of 2 median carpels, 1-locular or sometimes semi-2-locular; style terminal; stigma slightly bilobed or sometimes peltate; ovules 2-seriate, 4 or (6–)8–c. 20, very rarely c. 40. Fruit indehiscent (or very rarely irregularly 2-valved, not in Mal.), globular or rarely ellipsoid, c. 1–15 cm, usually with a hard pericarp. Seed(s) 1 or 4–20, inappendiculate, glabrous; embryo large, flat or thick; albumen copious to nearly absent.

Distr. About 94 species in tropical Southeast Asia, northwards to S. China and Hainan, throughout Malesia to Australia (N. Queensland); 76 spp. do not occur outside Malesia; 2 are endemic to Queensland. Not a single species crosses WALLACE'S plant-geographical demarcation line. Although only 7 spp. occur east of this line, at subgeneric level the greatest variation is found there. For that reason it is assumed that the genus originated in Austro-Malesia.

Ecol. By far the majority of the species grow in the tropical lowland rain-forest, mostly below 500 m. About 10 spp. (of which 3 extra-Malesian ones) are usually found between 500–1200(–1500) m, but sometimes also lower. About a dozen species are sometimes found in freshwater swamp forests, but they are not confined to that habitat, except 63 X. ramiforum. Also nearly all of the continental Southeast Asian species seem to be confined to the rain-forest; 60. X. lanceatum is restricted to stream banks and swamps; 62. X. virens occurs in monsoon forests, tolerating rather long dry periods. Otherwise the ecology is for all species 'rain-forest', not specifically repeated.

Note. From the subdivision of the genus it appears that both the fruit and seed, and the flower structure are important for specific distinction, in addition to vegetative characters. Unfortunately the mature fruit is yet unknown in several species (spp. 4, 16, 25, 34, 35, 36, 37, 38, 41, 51, 52, 58) and flowers are unknown from spp. 40, 49, 61, 67, 68, and 76. Besides, specimens in fruit seldom carry flowers too, and the reverse. These factors have complicated the key and necessitated to enter many species twice or even thrice.

KEY TO THE SUBGENERA

1. Fruit 4–more-seeded.
2. Embryo thick, covered by little endosperm. Spp. 72–76 .......................... V. Subg. Brunophyllum
1. Fruit 1–(exceptionally 2-)seeded.
4. Stamens monadelphous or free. Embryo thick, without or with little endosperm.

KEY TO THE SPECIES

1. Petiole and lower side of leaves densely patently hairy, at least on the midrib.
2. Venation of 3rd order scalariform.
3. Inflorescence axis at the nodes with 2 crateriform or cup-like glands.
4. Leaves glaucous-papilllose beneath, with 6–8 pairs of secondary nerves; laminar glands indistinct or only the basal ones distinct .................. 3. X. sulphureum
4. Leaves smooth beneath, with 12 or 13 pairs of secondary nerves; laminar glands numerous, distinct
4. X. cockburnii
3. No glands present at the nodes of the inflorescence axis.
5. Leaves glaucous-papilllose. Ovary and fruit hairy all round or in 4 rows in upper half
12. X. rufum
5. Leaves smooth beneath. Ovary and fruit glabrous or hairy in 2 rows in upper half.
6. Inflorescence brownish hairy. Sepals persistent in fruit, the outer c. 2–3 mm long, the inner c. 3.5–5 mm long. 11. X. velutinum
6. Inflorescence axis greyish white-hairy. Sepals caducous in fruit, the outer c. 4 mm long, the inner 5–6 mm long. 8. X. pubescens

2. Venation of 3rd order finely reticulate.
7. Ovules 4. Carina appressedly hairy outside, other petals appressedly hairy apically 57. X. malayanum
8. Sepals and inflorescence axis with hairs c. 1 mm long. 50. X. trichocladum
8. Sepals and inflorescence axis with hairs 0.1–0.2(–0.4) mm long.
9. Leaf-blade bullate between the tertiary nerves 49. X. reticulatum
9. Leaf-blade flat or only the midrib raised in a shallow depression.

10. Pedicel 2.5–4.5(–5) mm long. Anthers 0.9–1.4 mm long. Flowers 11–12 mm long 48. X. purpureum
10. Pedicel 7.5–14 mm long. Anthers 1.5–2.2 mm long. Flowers 12.5–16.5 mm long.

11. Petiole 5–6 mm long. Flowers 16–16.5 mm long. Anthers 1.5–2.5(–3) mm long. Flowers c. 12.5 mm long. Anthers 1.5–1.6 mm long 47. X. pedicellatum

1. Petiole and lower side of leaves shortly appressedly hairy or glabrous.
12. Leaves glaucous-papillose beneath.

13. Venation of 3rd order scalariform. Ovary hairy on median ribs. Fruits irregularly 4-sulcate 10. X. schizocarpon
13. Venation of 3rd order reticulate. Ovary glabrous or, if hairy, not especially hairy on the ribs. Fruit not 4-sulcate.

15. Ovules 4. Anthers 0.3–0.4 mm long.
16. Petiole (6–)7–11(–14) mm. Axillary buds very densely shortly hairy, not soon glabrescent. Inner sepals c. 2.5 mm long. Anthers hairy at base 14. X. nigricans
16. Petiole 5–6.5 mm. Axillary buds soon glabrescent. Inner sepals c. 4 mm long. Anthers glabrous or with very few hairs at base 15. X. borneense
15. Ovules 8–18. Anthers at least 0.7 mm long.
17. Axillary buds 3–7 mm long 43. X. penibukanense
17. Axillary buds up to 1 mm long.
18. Petiole (5–)8–12 mm long. Flowers up to 8.5 mm long. Fruit 1-seeded, up to 1.2 cm long 63. X. ramiflorum
18. Petiole 1.5–3 mm long. Flowers 15–16 mm long. Fruit 10- or more-seeded, at least 5 cm long 72. X. brevipes

20. Petiole distinctly transversely wrinkled.
21. Petiole 8–15 mm long, gradually widened into the attenuate leaf base. Lower pair of nerves reaching beyond the middle of the leaf-blade 43. X. penibukanense
21. Petiole 3–6(–7) mm long, abruptly ending into the cuneate or cordate leaf base. Nerves in the lower part of the leaf blade not reaching the middle of the blade 42. X. discolor
20. Petiole not transversally wrinkled.
22. Ovary and style appressedly hairy. Petiole (8–)10–14 mm long. Nerves 11–14 pairs 44. X. pseudoadenotus
22. Ovary and style patently hairy. Petiole 4–9 mm long. Nerves 6–13 pairs 45. X. pulchrum
23. Axillary buds at least 4 mm long.
24. (Upper) axillary bud situated (1.5—3—15 mm above the leaf axil and placed on a 0.5—1.5 mm long stalk ................................. 41. X. korthalsianum

Note: Compare also 61. X. lateriflorum.


25. Scales of axillary bud at apex with 2 distinct thickening.................. 36. X. clovis

25. Scales of axillary bud not thickened at apex.

26. Petiole 26—31 mm. .................................................. 35. X. petiolatum

26. Petiole (excl. attenuate leaf base) up to 17 mm.

27. Axillary buds half-patent to patent, with their flat side perpendicular to the twig ........................ 39. X. bracteatum

27. Axillary buds erect, usually with their flat side pressed against the twig.

28. Petals 6—8 mm long. Outer sepals 1.5—2.5 mm long, inner side 2.5—3.5 mm long. Anthers 0.4—0.5 mm long .............................. 28. X. griffithii

28. Petals c. 13 mm long. Outer sepals c. 3—4 mm long, inner sepals 3.5—5.5 mm long. Anthers c. 0.7 mm long .................. 38. X. angustigemma

23. Axillary buds at most 1.5 mm long.

29. Leaf-blade 1.5—5—(6) by 0.5—1.5—(2) cm. Flowers solitary or in an up to 3-flowered inflorescence, 10—11 mm long, on 10—11 mm long pedicels ............................... 22. X. parvifolium

29. Leaf-blades, at least averagely, more than 5 cm long. Inflorescences either with more than 6 flowers, or the flowers 7.5—8.5 mm long on 1.5—3 mm long pedicels.

30. Inflorescence unbranched, bearing only 3—6 flowers. Fruit (immature) apically pointed ........ 20. X. pauciflorum

30. Inflorescence at least basally branched, with more than 6 flowers (sometimes seemingly unbranched if lower bracts resemble leaves). Fruit apically rounded.

31. Filaments of upper stamens slightly S-curved, above base with a blunt appendage directed inwards. Fruit globular, 1.1—1.7 cm diam.

32. Axillary buds more or less enclosed between the base of the petiole and a low ridge of the twig, not projecting outwards, wider than high .................................................. 27. X. impressum

32. Axillary buds projecting outwards, at least twice as long as wide .... 29. X. monticolum

31. Filaments more or less straight, without appendage above base. Fruit (unknown in 58. X. novo-guinense) broadly ellipsoid or apple-shaped, 3.5—8 cm diam.

33. Petiole 3—5 mm long. Axillary buds 2 or 3. Nerves c. 8—14 pairs. Fruit broadly ellipsoid to nearly globular, up to 3.5 cm diam., pericarp up to 3 mm thick .............. 60. X. lancatum

33. Petiole 6—10 mm long. Axillary buds 1 or 2. Nerves 5—8 pairs. Fruit (unknown in 58. X. novo-guinense) large, up to 8 cm diam., apple-shaped, pericarp up to 30 mm thick.

34. Petals c. 7 mm long. Pedicel 1.5—2.5 mm long .................. 58. X. novoguineense

34. Petals 10—12 mm long. Pedicel 3—4.5 mm long .................. 59. X. ngii

12. Leaves smooth beneath.

35. Ovary hairy all round, not glabrous at lateral side.

36. Most axillary buds, at least in upper half of the twigs, 3 mm long or longer.

37. Axillary buds (8—11—20(—30) by 6—12(—14) mm, ± 1—3 times as long as wide, flat, at base attenuate and not thickened, at apex rounded to obtuse. (Flowers unknown) ........ 40. X. heterophyllum

37. Axillary buds up to 11 mm long and basally thickened, or more than 3 times as long as wide and ± acute, or smaller than 8 mm.

38. Axillary buds erect, flattened against the twig, very densely shortly hairy ...... 37. X. reflexum

38. Axillary buds half-patent to patent, glabrous or sparsely shortly hairy.

39. Axillary buds at base narrow, not thickened.

40. Leaf base cordate with upturned margins. Leaves with 14—20 pairs of nerves. Petals 16 mm long 25. X. brigittae

40. Leaf base attenuate and flat. Leaves with 5—7 pairs of nerves. Petals 10—12 mm long 31. X. incertum

39. Axillary buds at base wide and strongly thickened.
41. Inflorescence unbranched. Petiole 4–6.5 mm. Leaves with 3–5 pairs of nerves 19. X. neglectum
41. Inflorescence branched. Petiole 8–14 mm. Leaves with 7 or more pairs of nerves.
42. Petiole (18–)25–30 mm. Leaf-blade 22–42 cm long, finer nervation beneath indistinct
34. X. cerceifolium
42. Petiole 8–18 mm, exceptionally longer. Nervation at lower side of leaf-blade distinctly prominent, or leaf-blade much shorter than 20 cm.
43. Leaf-blade up to 3 times as long as wide. Petiole 8–14(–16) mm. Nerves (6 or) 7–9(–11) pairs.
   Leaf base never cordate. Anthers 0.4–0.6(–0.7) mm long. .......................... 30. X. vitellinum
43. Leaf-blade c. 4–6 times as long as wide. Petiole (8–)15–18(–24) mm, if shorter than 15 mm, then leaf base cordate. Nerves (9–)13–20 pairs. Anthers (0.6–)0.7–0.9(–1) mm long
44. Leaf base cuneate to rounded, or cordate with the margins curved upwards and connate above the apex of the petiole. Petals (8.5–)9.5–12.5(–14.5) mm long. Anthers (0.6–)0.7–0.9(–1) mm long .......................... 32. X. adenotus
44. Leaf base cordate, flat, or only with little upturning margins. Petals 15–18.5 mm long. Anthers 1.1–1.2 mm long .................................................. 33. X. palawanense
36. Most axillary buds up to c. 2 mm long.
45. Midrib sunken above most of its length.
46. Petals ± equal in size and form. Fruit black, 2–6 cm diam., seeds 4–12. (Compare also 70. X. amoenum) ...................................................... 71. X. stipitatum
46. Petals unequal. Fruit not black, up to 2 cm diam., 1-seeded.
47. Flowering.
48. Upper petals hairy inside to near apex .......................... 55. X. wrayi
48. Upper petals hairy inside only at base.
49. Nerves 12–20 pairs. Filaments 1–3 mm connate .......................... 56. X. venosum
50. Petiole glabrous or hairy only in the upper groove. Finer venation beneath not very distinct
54. X. eurhynchum
50. Petiole densely hairy all round. Finer venation at lower side very distinctly prominent
53. X. retinerve
47. Fruiting.
51. Fruit neither densely set with thick warts, nor ribbed.
52. Petiole glabrous or hairy only in the upper groove. Fruit densely hairy, smooth to slightly wrinkled or 2–4-sulcate, sometimes finely rugose, up to 1.5 cm diam. .......................... 54. X. eurhynchum
52. Petiole densely hairy all round. Fruit rather sparsely hairy, smooth, up to 2.2 cm diam.
53. X. retinerve
51. Fruit densely set with thick warts, or verrucose and ribbed.
53. Fruit apically shortly but distinctly beaked, strongly verrucously ribbed .... 56. X. venosum
53. Fruit apically rounded, densely set with thick warts .... 54. X. eurhynchum, 55. X. wrayi
45. Midrib flat above or prominent, then sometimes with a groove in basal half.
54. Region of the twig above the leaf axil as well as the 2–4 very small and inconspicuous axillary buds densely shortly hairy.
55. Petiole glabrous or hairy only in the upper groove. Finer venation beneath not very distinct. Fruit either densely set with thick warts or densely hairy and smooth to slightly wrinkled or 2–4-sulcate
54. X. eurhynchum
55. Petiole densely hairy all round. Finer venation beneath very distinctly prominent. Fruit rather sparsely hairy, smooth .......................... 53. X. retinerve
54. Twigs glabrous above the leaf axil. Axillary buds glabrous or sparsely hairy and soon glabrescent.
56. Axillary buds (2 or) 3–7, the upper one situated at least 1–2 mm above the leaf axil.
57. Upper axillary buds placed on a 1–2.5 mm long stalk. (Flowers unknown) 61. X. lateriflorum
57. Upper axillary buds sessile on the twig ........................................ 62. X. virens
56. Axillary bud(s) seemingly 1, or 2, rarely 3, close together in the leaf axil.
58. Ovules 8–12. (Compare also 7. X. ferrugineum) .......................... 51. X. erythrostaechyum
59. Inflorescence branched.
60. Leaf-blade c. 4—6 times as long as wide. Petiole (8—)15—18(—24) mm. Nerves (9—)13—20 pairs. Anthers (0.6—)0.7—0.9(—1) mm long ........................................ 32. X. adenotus
60. Leaf-blade up to 3 times as long as wide. Petiole 8—14(—16) mm. Nerves (6 or) 7—9(—11) pairs. Anthers 0.4—0.6(—0.7) mm long ........................................ 30. X. vitellinum
59. Inflorescence unbranched or sometimes with a side-branch at base.
61. Ovary (half-)patently hairy, fruit patently hairy.
62. Nerves c. 8—10 pairs. Pedicel of flowers 4.5—6 mm, of fruits 8—11 mm long. Petals 13—19 mm long. Anthers 0.8—1.2 mm long ........................................ 24. X. ancolanum
62. Nerves 3—5 pairs. Pedicel of flowers c. 2 mm, of fruits c. 4.5 mm long. Anthers 0.3—0.4 mm long ........................................ 19. X. neglectum
61. Ovary and fruit appressedly hairy.
63. Inner sepals 2—2.5 mm long.
64. Leaf base truncate to cordate. Carina auriculate. Filaments for 0.7—1 mm connate ........................................ 21. X. tardicrescens
64. Leaf base cuneate to rounded. Carina gradually enlarged, not auriculate. Filaments free ........................................ 18. X. subcoriaceum
63. Inner sepals 2.8—4.5 mm long.
65. Anthers 0.4—0.7 mm long. Gynoecium somewhat shorter than the carina. Laminar glands numerous ........................................ 26. X. tenuipetalum
65. Anthers 1—1.2 mm long. Gynoecium 0.5—2 mm longer than the carina. Laminar glands 1—6.
66. Leaf base cordate with upturned margins. Nerves 14—20 pairs. Petiole 15—18 mm ........................................ 25. X. brillitae
66. Leaf base attenuate and flat. Nerves 5—7 pairs. Petiole 6—10 mm ........................................ 23. X. philippinense
35. Ovary glabrous, at least at the lateral sides.
67. Nerves of 3rd order scalariform.
68. Inflorescence axis at the nodes with 2 crateriform glands.
69. Leaf base cuneate to rounded. Leaf-blade 5—25 by 2—12 cm. Nerves 4—10 pairs 1. X. flavescens
69. Leaf base cordate. Leaf-blade 20—50 by 6.5—20 cm. Nerves 14—20 pairs ........................................ 2. X. bullatum
68. No glands present on inflorescence axis.
70. Ovary and fruit hairy on 4 ribs in apical half, hairs brown ........................................ 13. X. macrophyllum
70. Ovary and fruit glabrous or hairy in 2 rows, hairs greyish.
71. Midrib flat beneath (prominent above) ........................................ 9. X. resupinatum
71. Midrib prominent beneath (prominent to sunken above).
72. Inflorescence axis branched or unbranched, very densely set with flowers or scars of pedicels 5. X. hosel
72. Inflorescence axis branched, except in upper part not densely set with flowers or scars of pedicels.
73. Pedicels 1—1.5(—4) mm. Sepals thickened basally, not fleshy, when dry medium brown with light coloured margin; outer sepals very sparsely minutely hairy ........................................ 6. X. ferrugineum
73. Pedicels (2—)4—10 mm long. Sepals, if thickened, somewhat fleshy, without a lighter coloured margin; outer sepals more densely hairy ........................................ 7. X. affine
67. Nerves of 3rd order reticulate.
74. Ovules 4.
75. Petiole distinctly transversally wrinkled, 3.5—4.5(—6.5) mm. Nerves 3 or 4 pairs. Inflorescence and pedicels (sub)glabrous ........................................ 16. X. ovatifolium
75. Petiole smooth, 6—11 mm. Nerves 4—6 pairs. Inflorescence and pedicels more or less densely shortly hairy ........................................ 17. X. tenue
74. Ovules 8 or more.
76. Laminar glands rather numerous and distinct, 0.5—1 mm diam., nearly all situated in the ‘axil’ of secondary nerves and midrib. (Flowers and ripe fruits unknown) ........................................ 68. X. hildebrandii
76. Laminar glands scattered or situated at the margin, not in the ‘axil’ of secondary nerves and midrib.
77. Flowering (flowers unknown in 67. *X. contractum* and 76. *X. chartaceum*).

78. Stamens triadelphous, i.e., 6 stamens connate in 2 groups, and the remaining 2 stamens connate.

79. Laminar glands sometimes situated near margin of leaf-blade but never present on the margin itself. Anthers completely glabrous ........................................ 66. *X. montanum*

79. Leaf-blade in upper half with at least 6 glands situated on the margin. Anthers shortly hairy along slits and at base.

80. Filaments and style densely and rather shortly patently hairy .......................... 65. *X. celebicium*

80. Filaments and style glabrous ......................................................... 64. *X. ellipticum*

78. Stamens either free or all connate except between upper petals.

81. Petals unequal, the lower middle one (carina) very distinct from the upper ones.

82. Petals black when dry. Twigs at the nodes with rather distinct annular glands. Filaments partly set with lanate hairs ....................................................... 73. *X. obscurum*

82. Petals reddish orange when dry. Twigs without nodal glands. Filaments with short, straight hairs near base ............................................. 52. *X. laeve*

81. Petals nearly equal in size and form.

83. Pedicel 1.5—4 mm. Stamens shorter than petals.

84. Filaments (nearly) free. Petals 7—8.5 mm long. Outer sepals 2.5—3.5 mm long, inner sepals 3—4.5 mm long ............................................. 74. *X. papuanum*

84. Filaments connate to nearly halfway. Petals 9.5—12 mm long. Outer sepals 4—5.5 mm long, inner sepals 6—7 mm long ........................................... 75. *X. ecarinatum*

83. Pedicel at least 8 mm. Stamens longer than petals.

85. Petals 14—16 mm long. Stamens 17—22 mm long. Anthers hairy from base to apex, 1—1.3 mm long ....................................................... 69. *X. suberosum*

85. Petals 7—12 mm long. Stamens 11—13(—16) mm long. Anthers glabrous or with a few hairs at base, 0.7—0.9 mm long.

86. Petals (8—)9—11(—12) mm long. Style hairy to apex. Laminar glands 6—10(—20)

86. Petals 7—7.5(—8) mm long. Style glabrous in upper half. Laminar glands 0—2(—4)

71. *X. stipitatum*

77. Fruiting.

87. Fruit small, less than 2 cm diam., 1—(or 2—) seeded (mature fruit not known in 52. *X. laeve* and 67. *X. contractum*).

88. At least 6 glands situated on the leaf margin itself, in upper part of the leaf-blade.

89. Pedicel 3—6(—8) mm ................................................................. 64. *X. ellipticum*

89. Pedicel 7—9.5 mm ................................................................. 65. *X. celebicium*

88. Laminar glands absent from margin of leaf-blade.

90. Midrib prominent above ............................................................. 67. *X. contractum*

90. Midrib sunken above.

91. Twigs at the nodes with distinct annular glands. Pedicel 4—5.5 mm .... 66. *X. montanum*

91. Twigs without nodal glands. Pedicel 8—15 mm. (Fruits unknown) ........ 52. *X. laeve*

87. Fruit large, many-seeded.

92. Pericarp strongly wrinkled outside when dry.

93. Fruit globose to pear-shaped, black ........................................... 76. *X. chartaceum*

93. Fruit ellipsoid, attenuate at apex and base when dry, orange to brown .. 75. *X. ecarinatum*

92. Pericarp remaining smooth when dry.

94. Fruit black. Seeds with copious albumen, with thin cotyledons .............. 69. *X. suberosum*

94. Fruit not black. Seeds (nearly) without albumen, with very thick cotyledons.

95. Seeds sticking to the pericarp when dry ...................................... 74. *X. papuanum*

95. Seeds sticking together in drying, leaving shining reddish marks on inner side of the pericarp ........................ 73. *X. obscurum*
I. Subgenus Xanthophyllum

Nodal glands absent. Axillary buds sometimes very long, usually thickened basally, subacute, sometimes hairy. Petiole sometimes with glands, sometimes hairy. Leaf-blade sometimes hairy, base rarely cordate; tertiary nerves finely reticulate, or scalariform. Inflorescence usually branched. Sepals usually densely minutely greyish hairy out- and inside, sometimes with longer or differently coloured hairs, the inner ones often subglabrous in marginal area and often slightly keeled. Petals unequal, ciliate above base; carina unguiculate, boat-shaped, auriculate or not, usually densely hairy outside; lateral and upper petals narrow, usually oblanceolate to ± linear, more or less flat, slightly constricted basally, usually glabrous outside, usually slightly hairy inside above insertion of filaments, upper petals often reflexed. Ovary sometimes semi-2-locular, glabrous to hairy; style usually hairy; stigma small, slightly 2-lobed, very rarely wider than apex of style; ovules 4 to c. 20. Fruit indehiscent, usually globular, usually c. 1.5–2 cm diam. Seed(s) 1 (or 2), rarely up to 4; testa 1- or 2-layered; albumen present or not; embryo globular, plumule not differentiated.

KEY TO THE SECTIONS


1. Section Xanthophyllum

Twigs usually densely patently hairy, sometimes glabrous. Petiole usually more or less smooth, sometimes with glands. Leaf-blade: tertiary nerves scalariform, prominent. Petals: carina usually shortly unguiculate. Ovary sometimes semi-2-locular (the marginal areas of the carpels touching the other ones along their length), glabrous, sometimes hairy in 2–8 rows, rarely hairy all round; ovules 6–16, or (not in Mal.) 4–10, in 7. X. affine very rarely 5. Fruit globular or sometimes pointed or 4-sulcate, smooth or sometimes turbeculate. Seed(s) 1 or occasionally 2 (in 1. X. flavescens often 2); testa reduced, without hard inner layer, sticking to the pericarp in drying, the raphe widely branched, hypostase not developed; albumen absent in ripe seed; radicle not exserted.

Polygalaceae (van der Meijden) 501

1988]


Tree, 8—36 m high, up to 1 m dbh. Twigs glabrous. 

Petiole (5—)7—15 mm, often seemingly longer when leaf base is attenuate, mostly in apical half with two rather distinct glands. Leaf-blade (5.2—)7—18—25 by (2.3—)3—7—(12) cm, base long often attenuate with the margins of the leaf-blade curved upwards and gradually grading into the ridges of the petiole; above yellowish green to yellowish brown; beneath: secondary nerves (4—)6—8—(10) pairs, usually forming a rather distinct intramarginal nerve, venation sometimes indistinct; glands 1—10, scattered, 0.3—0.6—(0.9) mm diam., basal glands usually absent if petiole bears glands. Inflorescences often several together on one thickened node, rarely unbranched, as long as or longer than the leaves; axes slender, somewhat flattened, slightly grooved, thickened on the nodes and there with usually distinct, protruding glands, brownish, densely minutely patent hairy. Flowers usually with 3 together. Pedicel (2.5—)3—4.5 mm, rarely longer, densely minutely half-patently greyish hairy. Sepals: outer sepals 2.3—3—(3.6) by 1.4—2.7 mm; inner sepals 3—4.1 by 2.3—3.7 mm. Petals bright yellow, or white and the upper petals with a yellow spot, or fully white, when dry yellowish, the longest one (6—)7—8—(8.5) mm long; carina basally more or less densely hairy, in upper part outside densely patent hairy to glabrous, inside rather densely hairy to glabrous, lateral petals usually glabrous outside, mostly glabrous inside, upper petals reflexed, ciliate basally or up to 2/3 their length, usually glabrous outside, inside patent hairy or at base only. Stamens: filaments very rarely c. 1 mm connate; anthers (0.4—0.5—0.6—0.65) mm long. Ovary glabrous to hairy in apical region on 4 ribs, very rarely (in one coll.) loosely hairy all over, often semi-2-locular; style sometimes glabrous in basal part; ovules 8—12, rarely 6. Fruit 1— to often 2-locular, the second chamber often reduced and seemingly enveloped by the pericarp; usually globose, up to c. 2 cm diam., smooth to irregularly low-tuberculate, rarely densely tuberculate, rather dull to somewhat shiny, yellowish to brownish; pericarp usually hard; pedicel up to 6(—7) mm long.

Seed(s) 1 or 2.

Distribution. Throughout tropical continental SE Asia; in Malesia: Sumatra (incl. Simalur, Banka), Malay Peninsula, Bornéo, Philippines (Luzon, Mindoro, Palawan, Masbate, Guimaras, Negros, Mindanao).

Note. Closely resembling 7. X. affine, and nearly always combined with that species in one taxon. The only reliable character distinguishing it from the latter species is the presence of nodal glands in the inflorescence. Due to the variability of X. affine it is difficult to identify sterile collections of both species. Differences are found in the petiole; in X. flavescens the petiole is glabrous and often bears a pair of glands, in X. affine the petiole is minutely hairy, and eglundular.


Shrub or small tree, 3—4.5 m high, 6 cm dbh. Twigs appressed hairy. Petiole c. 12—22 mm, rather densely minutely appressed hairy. Leaf-blade 20—50 by 6.5—25 cm; base cordate; above yellowish green, bullate between midrib and secondary nerves, midrib strongly prominent to flat, secondary nerves rather strongly prominent, venation finely prominent; beneath creamish brown to light brownish green, minutely hairy on the nerves, secondary nerves 14—20 pairs, protruding, mostly forming a nearly complete, rather distinct intramarginal nerve, venation sometimes rather obscure; glands rather few and mainly along the margin, or numerous and scattered, 0.3—0.6 mm diam., basal glands (1 or sometimes 2 pairs) at very base on midrib. Inflorescences shorter than the leaves, mostly elongate and often very densely set with flowers; axes appressedly to patently minutely hairy, light to very dark brownish, with large, protruding nodal glands. Pedicel 5—7 mm, very densely minutely appressedly reddish brown hairy. Sepals minutely appressedly reddish brown hairy; outer sepals c. 4.5 by 3 mm, with or without protruding glands; inner sepals c. 6.5 by 3.7 mm, keeled. Petals white, when dry yellowish, the longest one 12 mm long; carina in apical part rather shortly appressedly hairy outside, minutely so
inside, further glabrous; other petals glabrous outside, glabrous or ciliate at base, shortly hairy or not inside in basal part, the later petals strongly bent, the upper petals strongly S-curved. **Stamens**: filaments glabrous or sparsely shortly hairy at base; anthers 0.8–1.2 mm long, ciliate along slits. **Ovary** slightly ribbed; style glabrous in basal part, apically shortly appressed hairy; ovules 8–10. **Fruit** globose, up to 2 cm diam., dull, rather smooth, light brown; pericarp rather thin, not very hard.

**Distr.** **Malesia**: Malay Peninsula (Perak, Trengganu, Selangor).


Small to large tree, 30–50 m high. Twigs finely reticulately wrinkled, brownish hairy, glabrescent. Axillary buds up to 2.8 mm long but often much smaller, rounded, densely hairy. **Petiole** 9–13 mm, very densely patent hairy. **Leaf-blade** 9–20 by 2.8–7.5 cm; above yellowish green, dull, midrib basally slightly prominent to slightly sunken and rather densely hairy, upwards sunken and glabrous, nerves and venation rather obscure; beneath glaucous-papillosse, rather densely hairy especially on the nerves, secondary nerves 6–8 pairs, forming a rather distinct intramarginal nerve; basal glands perhaps always present but mostly hidden by the very prominent midrib and then scarcely visible, rarely not so and then distinct, c. 0.5 mm diam., other glands apparently few or possibly absent. **Inflorescences** shorter than the leaves; axes rather smooth, very densely brownish hairy, with distinct, large, prominent 'cap-like' nodal glands. **Pedicel** c. 4 mm, rather stout, very densely patent brownish pubescent. **Sepals** densely brownish patent hairy at both sides; outer sepals 4 by 3.7 mm; inner sepals 5 by 4.2 mm, some with glandular spots, distinctly keeled. **Petals** yellow, when dry yellowish, the longest one 11 mm; carina very densely (nearly velvety) patent pubescent outside, densely pubescent inside in apical part; other petals woolly-tufted outside. **Stamens**: filaments nearly glabrous; anthers 0.5 mm long, cohering around the style. **Ovary** containing 16 ovules. **Fruit** globose, c. 2 cm diam., light brownish, dull, finely tuberculate; pericarp hard.

**Distr.** **Malesia**: Malay Peninsula (Perak, Kelantan, Pahang).


Tree, 20 m high, 30 cm dbh. Axillary buds densely patently hairy. **Petiole** 8–12 mm, densely hairy. **Leaf-blade** 11–17 by 3.5–7 cm, base rounded to obtuse; above slightly bullate between midrib and secondary nerves, greenish or brownish yellow, midrib rather obscure, finely prominent to flat, secondary nerves obscure; beneath creamish to greenish yellow, rather densely patent hairy on the nerves, secondary nerves 12 or 13 pairs, forming a complete intramarginal nerve, fine venation obscure; glands c. 15–20, 0.2–0.4 mm diam., those at very base distinct, situated on midrib. **Inflorescences** shorter than to as long as the leaves; axes very densely reddish brown pubescent, with rather large nodal glands. **Pedicel** 4.5 mm. **Sepals** densely patent brownish hairy; outer sepals 3.8–4 by 3 mm; inner sepals 3.8–4 by 3–3.3 mm, keeled. **Petals** white, when dry yellowish, the longest one 11 mm; carina light yellowish velutinous outside, rather densely hairy inside in apical part; other petals glabrous or slightly hairy apically, not ciliate at base. **Stamens**: anthers 0.8–0.85 mm long, minutely hairy. **Ovary** containing 8 ovules. **Fruit** unknown.

**Distr.** **Malesia**: Malay Peninsula (Pahang, near Johore border, Upper Anak Endau R.). Once collected.


Small tree, up to 3.5 m high, dbh 3 cm. Twigs minutely appressed hairy, soon glabrescent, or glabrous. **Petiole** 7–10 mm, minutely appressed hairy. **Leaf-blade** 12–21 by 4.5–10 cm, base rounded to more or less obtuse, apex rather suddenly cuspidate to acuminate; above slightly bullate between midrib, secondary nerves, and intramarginal nerve, dark greyish green, midrib sunken, rather wide, other nervation finely prominent; beneath lighter coloured, sparsely minutely appressed hairy in basal part especially on the nerves, secondary nerves 7–11 pairs, forming a distinct, (nearly) complete intramarginal nerve; glands 8 to very numerous, scattered, (0.2–)0.3–0.4 mm diam., basal glands larger. **Inflorescences** branched or unbranched, up to 12 cm long; axes slightly thickened, curved, smooth, dull, minutely very densely appressed hairy, internodes (except at very base) very short, c. 0.5–1 mm long, thus giving the inflorescence a very dense-flowered appearance. **Pedicel** 2.5–4 mm, grooved, densely minutely appressed hairy. **Sepals** glabrous to sparsely minutely appressed hairy inside; outer sepals 2.1–2.5 by 2.5–2.8 mm, with 2–4 glandular spots, minutely densely appressed hairy outside; inner sepals 3.5–3.8 by 2.2–2.6 mm, rather distinctly keeled and there densely minutely appressed hairy, further more or less glabrous outside. **Petals** yellowish when dry, the...
longest one c. 8.5 mm; carina sparsely appressed hairy outside in middle part, glabrous inside; other petals ciliate to halfway, further glabrous. Stamens: filaments wide at base, sparsely appressed hairy adaxially and abaxially to ± halfway, further glabrous; anthers 0.85–1 mm long, ciliate along slits. Ovary nearly sessile, ribbed; style glabrous in basal 1/3 part, upwards rather densely appressed hairy till the apex; ovules 7–10. Fruit (very young) not ribbed, finely pubescent; style persistent, recurved; sepals persistent.

Distr. Malesia: Borneo (Sarawak).


Tree, up to 25 m high, up to 40(–60) cm dbh. Twigs glabrous. Petiole 9–14 mm. Leaf-blade 8–20 cm by 3–7 cm; above bright yellow to yellowish green, nerves finely prominent to rather obscure but mostly distinct above than beneath; beneath midrib not very prominent, secondary nerves c. 5–7 pairs, finely prominent to rather obscure, intramarginal nerve indistinct, tertiary nerves finely prominent to obscure, fine venation mostly obscure; glands rather few, mainly situated near margin, 0.4–0.6 mm diam., basal glands similar. Inflorescences shorter than the leaves; axes more or less flattened, yellowish brown, densely to rather sparsely shortly patent hairy. Pedicel 1–1.5(–4) mm, densely minutely appressed hairy greyish hairy. Sepals possibly persistent in fruit, medium-brown with light brown margin when dry; outer sepals 3.7–4.8 by 3.5–4 mm, (sub)glabrous outside, often with (sometimes minute) glandular spots; inner sepals 4–5 by 4–4.2 mm, thickened in middle basal part, minutely appressed hairy especially on the midrib, glabrous along the margin. Petals yellow, or white and the upper petals with a yellow spot, when dry yellowish, the longest one 8.5–10 mm long; carina very densely patently pubescent outside, densely pubescent in apical part inside; other petals glabrous or with few hairs in apical part outside. Stamens: anthers 0.5–0.7 mm long, minutely hairy. Ovary smooth or ribbed, glabrous, rarely sparsely appressed hairy all round, apically often greyish hairy in 4 short rows; ovules 8–14. Fruit (immature) partly enclosed by the persistent sepals, ovoid, finely tuberculate, dull, yellowish brown.

Distr. Malesia: Borneo (Sarawak, Brunei, Sabah, Taiwan).


Tree, rarely a shrub, up to 15(–30) m, up to 40(–95) cm dbh. Twigs mostly very densely, sometimes rather sparsely, patently to appressedly minutely greyish hairy, glabrescent. Axillary buds 2 (or 3), often seemingly single, the upper bud often stalked, rarely supra-axillary for more than 0.5 mm. Petiole (5–)6–11(–17) mm, more or less densely minutely greyish hairy all round or at the upper side only, eglandular. Leaf-blade rarely linear-lanceolate, 6.5–18–35 (by 2–3–8(–13) cm, base cuneate to rounded-attenuate, sometimes attenuate with the margins of the leaf-blade curved upwards and gradually grading into the ridges on the petiole, apex sometimes cupulately; above sometimes slightly bulblet between secondary nerves, yellowish to rather dark greyish green, often with a lighter strip along midrib and base of secondary nerves, midrib prominent to flat, rarely slightly sunken, in basal part often with a groove and often minutely hairy; beneath concolorous or more brownish, sometimes more or less densely minutely hairy in basal part, secondary nerves 5–16 pairs, usually forming a more or less distinct intramarginal nerve in the apical half, intramarginal nerve rarely (nearly) complete to the base; glands very variable in number and size, usually dis-
tinct. Inflorescences shorter than the leaves; axes smooth, minutely greyish hairy; bracts sometimes with distinct glands. Pedicel (2—)4—11 mm, rarely longer, densely minutely greyish hairy. Sepals persistent or not in fruit, sometimes with small glands; outer sepals 1.7—5.5 by 1.8—4.7 mm; inner ones 2.1—7.8 by 2.1—5.2 mm. Petals white (or rarely pink), the upper ones with an orange-yellow spot, when dry yellowish, the longest one 6—17 mm; carina appressed to half-patently, sometimes patently hairy outside, inside appressedly hairy or sometimes glabrous; other petals sometimes quite glabrous, usually hairy outside at base, upper petals hairy inside or only at base. Stamens: filaments glabrous to sparingly appressedly hairy in basal part; anthers 0.5—1.3 (—1.6) mm long. Ovary often semi-2-locular, smooth to distinctly ribbed, sometimes tuberculate, glabrous or sometimes greyish hairy in 2(—)4 rows in apical part; ovules usually 8—12, very rarely 6 or 5, rarely up to 16. Fruit globular or somewhat longer than wide, rounded or slightly but sometimes rather sharply beaked apically, up to 1.5 cm diam., smooth to pustulate or tuberculate, sometimes ribbed, creamish to brown; pericarp not very thick; sepals (sub)persistent in fruit or not.

Distr. SE. Asia (Khasya, Laos, Thailand); in Malesia: Sumatra (also Banda), Malay Peninsula, Borneo (Sarawak, Brunei, Sabah), Philippines (Palawan, Cebu, Busuanga).

Notes. Very variable, and probably not homogeneous; for a discussion, see Van der Meiinden, I.c. 71—73.

Most authors have included J. X. flavescens in this species; see note under that species.


Shrub or small tree, up to 12 m, 5 cm dbh. Twigs more or less brownish hairy. Axillary buds densely patently rather shortly hairy. Petiole 10—12 mm, hairy like twig. Leaf-blade 15—28 by 5.5—9.5 cm; above greenish, more or less densely hairy on the nerves, glabrescent, midrib flat to slightly prominent; beneath lighter coloured, rather densely patent hairy, secondary nerves 8 or 9 pairs, forming a more or less distinct intramarginal nerve; glands (2—)7—14(—18), scattered, (0.5—)0.6—0.8(—1) mm diam. Inflorescences up to 10 cm long; axes densely greyish hairy; in basal part flowers with 3 together; bracts with 2 large glands. Pedicel 5—8 mm, very densely minutely greyish patent hairy. Sepals densely to very densely patent greyish hairy outside; outer sepals 3.8—4 by 2.7—4 mm; inner sepals 5.2—6.1 by 3.8—4.5 mm, slightly keeled. Petals white, the upper ones with a yellow spot, when dry yellowish, the longest one 12—13 mm; carina very densely shortly half-patently whitish hairy outside, in apical part rather densely hairy inside; other petals glabrous or basally ciliate, or the upper petals minutely hairy inside above the base. Stamens: anthers 1.1—1.5 mm long, sometimes cohering around the stigma, ciliate along slits. Ovary containing 8—13 ovules. Fruit (immature) obovoid, dull, finely pustulate.

Distr. Malesia: Malay Peninsula (Pahang, Johore).


Tree, up to 25 m, 40 cm dbh. Twigs glabrous. Axillary buds very inconspicuous, ± enclosed between basal part of the petiole and the twig. Petiole 4.5—7 mm, often appearing longer because of the narrow leaf base, transversely wrinkled. Leaf-blade 6—12.5 by 2.7—5 cm, attenuate into a narrow petiole-like part; above (very) shiny, greenish to dark olive-greenish, midrib distinctly prominent; beneath yellowish brown to greenish brown, very shiny, midrib flat to faintly sunken, rarely faintly prominent or a narrow crest, secondary nerves 4—7 pairs, forming an incomplete, indistinct intramarginal nerve, tertiary nerves rather indistinct to obscure; glands very few, mostly situated above the middle, 0.3—0.7 mm diam. Inflorescences shorter than the leaves; axes grooved, densely minutely appressedly greyish hairy. Pedicel slightly grooved, 4—5 mm, very densely minutely appressedly greyish hairy. Sepals dark brown to blackish; outer ones c. 3 by 2.4—3 mm, with scattered, indistinct, small glandular spots, sometimes with 2 protruding glands halfway; inner sepals c. 4—4.8 by 2.8—3.5 mm, slightly keeled, with few glandular spots. Petals white, when dry dark brownish, the longest one 7—9 mm; carina very densely half-patently greyish pubescent outside, ± hairy inside in apical part; other petals glabrous. Stamens: anthers 0.5—0.7 mm long, faintly hairy. Ovary dark brownish, ribbed, slightly appressed hairy on the ribs in apical part, or glabrous; ovules 9—14. Fruit 1.2 cm diam., blackish, slightly shiny, finely pustulate; pericarp rather thin, hard.

Distr. Malesia: Borneo (Sarawak, E. Sabah, N. Kalimantan).


Tree, 10—25 m, 35 cm dbh. Twigs minutely appressedly hairy in younger parts to glabrous. Axillary buds 2 or 3, the upper one 0—3 mm above the axil. Petiole 5—7 mm, minutely appressedly hairy to glabrous. Leaf-blade 4.5—12 by 1.5—4.5 cm; above
greyish green, midrib sunken; beneath glaucous-papilllose, minutely appressedly hairy on nerves, secondary nerves 6 or 7 pairs, not forming an intramarginal nerve, finer venation indistinct; glands numerous, scattered, c. 0.2 mm diam., basal glands (if present) c. 0.5 mm diam. Inflorescences often shortly supra-axillary, often 2 per leaf axil, unbranched, shorter than the leaves; axes faintly grooved, brownish, minutely appressedly hairy; lower bracts opposite. Pedicel 6–8 mm, slightly grooved, minutely densely more or less appressedly greyish hairy. Sepals: outer ones 2.5–3.8 by 2.3 mm; inner ones 3.1–4.3 by 3.2 mm, ± keeled. Petals yellow, when dry yellowish, the longest one 6–7 mm; carina rather densely appressedly hairy outside, shortly hairy inside in apical part; lateral petals glabrous inside, further like the upper ones, upper petals glabrous to shortly hairy outside, shortly patent hairy inside up to 2/3. Stamens: 8 (or 9); anthers c. 0.3 mm long. Ovary slightly ribbed, brownish, appressedly hairy on median ribs; ovules 6–8. Fruit irregularly globular, c. 1.5 cm diam., mostly wider than high, irregularly 4-sulcate, dull, light greenish to yellowish brown; pericarp hard and irregular in thickness.

Distr. Malesia: Borneo (Sarawak, Brunei, Sabah).


Tree, 5–25 m, 60 cm dbh. Twigs densely set with short and long hairs, longer hairs 0.3–0.8 mm long. Axillary buds 1–3 mm long, hairy like the twig. Petiole (4–)8–14(–16) mm, hairy like the twig. Leaf-blade (6–)9–22 by 3–9 cm, apex cupulate or sometimes acuminate; above greyish green, in basal part sometimes sparsely hairy especially on the nerves and midrib, midrib distinctly sunken, nerves and intramarginal nerve slightly sunken to flat and rather obscure, venation obscure; beneath brownish, hairy like the twig, rarely rather sparsely hairy, secondary nerves 8–11 (or 12) pairs, strongly prominent, forming a strongly prominent intramarginal nerve; glands (7–)10 or more, scattered, (0.2–)0.3–0.4(–0.6) mm diam., basal glands 0.9–1.2 mm long.

Inflorescences about as long as the leaves; axes ribbed, very densely patently brownish hairy in the basal part; flowers with 3 together. Pedicel 1.5–6.5 mm, ribbed, very densely patently brown pubescent, rarely shortly hairy. Sepals persistent in fruit, greyish hairy; outer sepals 2.1–3.2 by 1.7–3 mm, with 2–4 glandular spots; inner sepals 3.5–5.3 by 2.4–3.4 mm, distinctly keeled. Petals white or yellow, when dry brownish orange, the longest one 9.5–10.5 mm long; carina more or less densely appressedly hairy outside, sparsely appressedly hairy inside in middle part; other petals ciliate in basal half, glabrous outside, upper petals reflexed. Stamens: filaments rather sparsely appressedly hairy till apex; anthers (0.75–)0.8–1.2 mm long, usually cohering around the stigma, ciliate along slits. Ovary sessile, distinctly ribbed, glabrous or sometimes hairy on 2 ribs down to halfway; style reflexed at end of anthesis; ovules (6–)8–12. Fruit (immature) ovoid, very sharply beaked, with 8 or more distinct ribs, finely pubulate to tuberculate, dull, greyish brown; pericarp thick, hard; pedicel crowned by persistent sepals.

Distr. Malesia: Borneo (Sarawak, Brunei, Sabah).


Tree, up to 32 m, 40 cm dbh. Twigs rufous-hairy. Axillary buds to 1.8 mm long, but often much smaller, densely pubescent. Petiole 7–21 mm, densely patently pubescent, more or less glabrescent, apically often with large glands. Leaf-blade 8–25 by 4–13 cm, base sometimes cordate; above bright (neon-like) yellow-green to light greyish green, midrib and nerves slightly sunken, venation indistinct; beneath light brownish to brownish green, papilllose, rather densely hairy, secondary nerves 5–9 pairs, forming a rather distinct intramarginal nerve in apical or rarely also in basal part; glands very numerous, c. 0.1 mm diam., basal glands large, situated on the midrib at the very base of the leaf and then obscure, or at very apex of the petiole and then conspicuous. Inflorescences sometimes unbranched, shorter than to as long as the leaves; axes finely ribbed, very densely rufous-hairy; bracts conspicuous, persistent, often with distinct glands, bracteoles small, subpersistent. Pedicel 4.5–7(–10) mm, ribbed, very densely rufous-hairy. Sepals persistent or not, sometimes present under fully ripe fruits (then up to c. 12 mm long), very densely rufous-hairy outside, glands present or not, inconspicuous; outer sepals c. 4–6 by 4–6 mm, mostly slightly ribbed; inner sepals c. 5–7 by 4–6 mm, keeled. Petals white, the upper ones with a yellow spot, when dry yellowish, the longest one 12–15 mm; carina very densely yellowish brown pu-
Fig. 19. *Xanthophyllum rufum* Benn. a. Habit, × 0.5; b. base of leaf, × 2; c. flower; d. flower, longitudinal section, gynoecium removed; e. carina with two stamens enclosed; f. gynoecium; all × 3; g. ovary, longitudinal section, × 6 (SAN 36554).
bescent outside, inside hairy in apical part; other petals pubescent outside in apical part or only apically tufted. Stamens: filaments glabrous; anthers 0.4–0.6 mm long, shortly hairy at base or glabrous. Ovary very densely rufous-pubescent all round or pubescent in 4–8 rows; the median rows mostly longer than the lateral ones; style very densely rufous-pubescent in apical part; ovules 12–14. Fruit globular, up to 1.8 cm diam., often with 2–4, sometimes hairy ridges running down from the style-scab, yellowish green, dull, finely tuberculate; pericarp rather thick, hard; not rarely some sepal present.

Distr. Malesia: Sumatra, Malay Peninsula, Borneo.

Note. In most Bornean collections the ovary is hairy all round (or sometimes hairy in 8 rows), and the sepals are more or less persistent in fruit (X. heterophyllum' Chodat). In Malaya (X. rufum) and Sumatra (X. flavum' Ridley) the ovary is usually hairy in 4 rows, and the sepals are soon dropping off. These differences are not consistent in Malaya, however, as sometimes the ovary is hairy all round, or the sepals are persistent. Apart from those I did not find other differences; therefore it is not necessary to distinguish varieties based on these conspicuous but minor and grading differences.


Shrub or tree, up to 25 m, up to 30 cm dbh. Twigs glabrous. Petiole 10–18 mm., with (0–)2–(–4) very distinct glands. Leaf-blade (10–)14–28 by (3.8–)4.5–10 cm, base often curved upwards and decurrent-attenuate; above sometimes slightly bullate between the secondary nerves, greenish, midrib slightly to distinctly prominent, rarely slightly sunken, nerves finely prominent; beneath mostly brownish green, secondary nerves 7–10 pairs, forming a nearly complete rather prominent infra-marginal nerve; glands mostly rather few, scattered, 0.4–0.5 mm diam. Inflorescences sometimes unbranched, shorter than the leaves; axes grooved, appressedly brown-velvety; bracts often opposite, with 2 small indistinct glands. Pedicel 2–12 mm, appressedly brown-velvety. Sepals shortly appressedly brownish hairy outside, ribbed inside; outer sepals 5–6.5 by 3.8–6.2 mm; inner sepals 6–7.2 by 3.7–6.2 mm. Petals yellow, or white and the upper ones with a yellow spot, when dry yellowish to dark-brown, the longest one 13–16 mm long; carina appressedly velvety outside, more or less densely hairy inside in apical part; other petals glabrous or hairy outside in apical part. Stamens: anthers 0.55–0.75(–0.8) mm long, shortly hairy. Ovary sessile or shortly stipitate, creamish brown, often about 8-ribbed when dry, the median ribs most prominent and hairy over 1/3–2/3 their length, the other ribs hairy in apical part only; ovules 6–14. Fruit c. 2 cm diam., brownish to blackish, ribbed in apical part, thick-walled.

Distr. Malesia: Borneo (Sarawak, Sabah).

2. Section Eystathes


Twigs sometimes hairy. Axillary buds sometimes 3(–7), sometimes erect. Leaves sometimes shifted-decussate. Leaf-blade: tertiary nerves finely reticulate, mostly distinctly protruding. Inflorescences: bracts sometimes opposite in basal part. Petals: carina usually distinctly unguiculate. Stamens: filaments sometimes connate over up to 3 mm, rarely occasionally triadephous, sometimes with a knob-like appendage at inner side. Ovary mostly densely hairy all round, rarely glabrous; stigma very rarely wider than the apex of the style; ovules 4 or 8–16 (rarely more, exceptionally 5 or 6). Fruit mostly globular, smooth or rarely tuberculate. Seed(s) 1 or occasionally 2, very rarely up to 4; testa with or without a hard inner layer; albumen thin but distinct; radicle exserted or not.

**KEY TO THE SUBSECTIONS**


Twigs and inflorescence axes without nodal appendages. Axillary buds mostly 2 (seemingly single) and close together, rarely up to 4 or the upper one supra-axillary. Seed 1 or seeds occasionally 2; testa with a hard inner layer; albumen forming a rather thin, distinct layer, which is very thin at the lateral sides of the cotyledons near the base of the embryo; embryo laterally near the base with 2 flattened areas, radicle exserted.


Small tree, up to 15 m, 20 cm dbh. Twigs finely longitudinally wrinkled. Axillary buds 2 or 3 (or 4), 1.5—2.2 mm long, very densely softly patently light-brown hairy. *Petiole* (6—)7—11(—14) mm. *Leaf-blade* 3.5—12 by 1.2—5.5 cm; above greyish olive-green (to brownish); beneath concolorous, or bluish because of thin waxy layer, (glaucescent)-papillose, secondary nerves 5 or 6 (or 7) pairs, forming a more or less distinct intramarginal nerve; glands rather scarce or sometimes apparently absent, situated on or near the midrib, 0.1—0.2 mm diam., basal ones often slightly larger. Inflorescences unbranched, shorter than the leaves; axes flattened, angular, black, very sparsely appressed hairy; flowers with 1—3 together. Pedicel 2—2.5 mm, black, nearly glabrous. *Sepals* glabrous outside, densely very shortly more or less patently hairy inside at base, further glabrous inside; outer sepals 1.8 by 1.7 mm; inner sepals 2.5 by 2.1 mm. *Petals* white, when dry reddish, very sparsely appressed hairy outside, faintly ciliate apically, the longest one 8 mm long. *Stamens*: anthers c. 0.3 mm long. *Ovary* black, glabrous; style very sparsely or glabrously very sparsely appressed hairy; ovules 4. *Fruit* globose, up to 1.3 cm diam., dull, slightly wrinkled, brownish; pedicel up to 3 mm long.

Distr. *Malesia*: Borneo (Brunei, Sabah).


Small tree, up to 5 (—8?) m high. Twigs more or less reticulately wrinkled. Axillary buds 2 (or 3), 1.2—1.8(—3) mm long. *Petiole* c. 5—6.5 mm. *Leaf-blade* 4—16 by 1.5—7 cm, margin undulate, apex aciculate; above slightly bulate to flat between secondary nerves, greenish to brownish; beneath glaucescent-papillose, secondary nerves 4—6 pairs, forming a rather distinct intramarginal nerve; glands numerous, scattered, 0.1—0.2 mm diam. Inflorescences unbranched, about as long as the leaves; axes flattened basally, angular, dull, light brownish, glabrous. Pedicel 1.5—2.5 mm, dull, brownish, glabrous. *Sepals* glabrous outside; outer sepals 3 by 2.1 mm; inner sepals 3.8 by 2.8 mm. *Petals* light brownish or orange when dry, minutely ciliate apically, the longest one 10—11 mm long; carina sparsely appressedly minutely hairy outside. *Stamens*: anthers c. 0.3 mm long, glabrous or with very few short hairs at base. *Ovary* completely glabrous; style very sparsely more or less appressed hairy; ovules 4. *Fruit* globose to broadly ovoid, c. 1.8 cm diam., smooth, brown; pedicel c. 5 mm.

Distr. *Malesia*: Borneo (Sarawak, Sabah, SE. Borneo).


Axillary buds 2 (or 3), 1—1.8 mm long. *Petals* 3.5—4.5(—6.5) mm; glands present or not. *Leaf-blade* 3.5—9.5 by 1.4—6 cm, apex sometimes ciliate; above rather dull, brownish to greenish, midrib little prominent at base; beneath dull, secondary nerves c. 3 or 4 pairs, not forming an intramarginal nerve; glands 8—20, usually situated halfway between margin and midrib, 0.4—0.5 mm diam., basal glands usually present, 0.5—0.6 mm diam. Inflorescences shorter than the leaves, unbranched; axes slightly flattened, brownish, glabrous to very sparsely appressed hairy. Pedicel 7—8 mm, glabrous. *Sepals* glabrous outside; outer ones c. 2.8 by 1.7 mm; inner ones 3—3.5 by 1.8—2 mm. *Petals* white, when dry light brownish, ciliate at apex and base, further glabrous, the longest one 9—10 mm. *Stamens*: anthers 0.3—0.4 mm long, glabrous. *Ovary* glabrous; style sparsely appressed hairy basally; ovules 4. *Fruit* unknown.


Tree, up to 25 m, 40 cm dbh. Twigs glabrous to rather densely very shortly patently hairy. Axillary buds 2 (or 3), 1.5—2.5 mm long, shortly hairy, some-
times irregular and larger because of cork-forming in apical region. **Petiole** 6–11 mm, not transversely wrinkled, shortly patently hairy to glabrous; glands absent or small. **Leaf-blade** (5–)7–16 by (2–)2.5–6.5 cm; above slightly bullate to flat between secondary nerves, dull, greyish green to light reddish brown, midrib glabrous to patently minutely hairy in basal half; beneath mostly rather dull, yellowish green, glabrous to minutely patently hairy, midrib slightly prominent to flat, secondary nerves 4–6 pairs, mostly forming a rather indistinct intramarginal nerve, venation mostly not very prominent, sometimes rather indistinct; glands (0–)4–25, often situated near midrib, 0.3–0.5(–0.7) mm diam.; basal glands often present, relatively large. **Inflorescences** much shorter than the leaves, unbranched; axes slightly angular, sparsely or rather densely patently shortly hairy. **Pedicel** (2.5–)4–6(–10) mm, rather sparsely to densely minutely hairy. **Sepals** nearly glabrous outside; outer sepals 2.1–2.8 by 1.3–2.5 mm, inner sepals 2.5–4(–4.5) by 1.5–3.2 mm. **Petals** yellowish or white, when dry orange, the longest one 8–9(–11.5) mm; carina sparsely or rather densely appressed hairy outside, inside hairy to halfway or up to the apex; other petals glabrous to sparsely hairy outside, lateral petals hairy inside to halfway, upper petals hairy inside to apex. **Stamens**: filaments nearly free or conuate over to up to 1.5 mm; anthers c. 0.4 mm long. **Ovary** glabrous or less often rather sparsely appressed hairy and probably soon glabrescent; style glabrous or less often sparsely appressed hairy in basal part; ovules 4. **Fruit** globalur, up to 1.8 cm diam., dull, wrinkled, light greenish brown; pericarp soft, thin; pedicel mostly up to 7 mm, reddish.

**Distr.** Malesia: Borneo (Sarawak, Sabah, Tawau, N. Kalimantan).

Ecol. Submontane rain-forest, 500–1200 m.


Shrub or small tree, up to 15 m, 20 cm dbh. Axillary buds 2 or 3, (0.5–)1–2.7 mm long. **Petiole** 5–8.5 mm. **Leaf-blade** 5–12 by 1.5–5.5 cm, base sometimes more or less rounded, margin mostly strongly curved upwards when dry, apex cuspidate to acuminate; above sometimes slightly bullate between secondary nerves, dull, light greyish green to olive-green, secondary nerves mostly indistinct, venation mostly indistinct, sometimes scarcely visible, less often finely prominent; lower side yellowish green, secondary nerves (3 or) 4–6 pairs, forming a distinct intramarginal nerve, venation usually obscure; glands (0–)2–12, situated at some distance from the midrib, 0.2–0.4 mm diam. **Inflorescences** unbranched, ± as long as the leaves; axes angular, light brown, sparsely appressedly shortly hairy; lowermost bracts sometimes leaf-like. **Pedicel** 2.5–3.5 mm, mostly longer brown, glabrous to sparsely minutely appressed hairy. **Sepals** (nearly) glabrous outside; outer ones 1.6–1.8 by 1.4–1.8 mm; inner ones 2–2.5 by 2–2.5 mm. **Petals** white, when dry orange, faintly ciliate apically, outside glabrous except at base, longest one 8–10 mm. **Stamens**: anthers 0.5–0.7 mm long, sparsely hairy at base. **Ovary** 0.5–1.5 mm stipitate, subglabrous to rather densely appressed hairy, rather soon partly glabrescent; style sparsely appressed hairy; ovules 4. **Fruit** at first ± ellipsoid with a sharp beak because of subpersistent style, when mature globalur, c. 1.7 cm diam., smooth, light green to brown, rather dull to shiny; pericarp thin; pedicel up to 5(–7) mm, mostly light brown.

**Distr.** Malesia: Borneo (Sarawak, Brunei, Sabah: Mt Kinabalu & Tawau).


Tree, up to 20 m, 20 cm dbh. Axillary buds 2, elliptic to ovate-oblong, 1.5–4(–6) mm long, acute, light yellowish brown. **Petiole** 4–6.5 mm, glabrous to sparsely very shortly hairy especially in the upper groove. **Leaf-blade** 5–12 by 1.8–5.5 cm, margin undulate; above dull, greyish green; beneath rather dull, sometimes slightly waxy, secondary nerves 3–5 pairs, forming a rather indistinct intramarginal nerve; glands 2–8, not in basal part, 0.2–0.3(–0.4) mm diam. **Inflorescences** unbranched, 1.5–5(–8) cm long, shorter than the leaves, bearing 3 or 4(–7) flowers; axes c. 0.5 mm diam., slightly flattened basally, light brown, rather sparsely patently shortly hairy. **Pedicel** c. 2 mm, slightly grooved, rather densely patently shortly hairy. **Sepals**: outer ones 2.2–2.5 by 2–2.3 mm; inner ones 2.8–3.5 by 2.2–3 mm. **Petals** white or yellowish, when dry light brownish, the longest one 7–10 mm; carina nearly glabrous to rather densely hairy outside, shortly hairy at both sides basally; other petals nearly glabrous except for some hairs at the base and apex. **Stamens**: filaments of abaxial 4 stamens basally widened and slightly thickened; anthers 0.3–0.4 mm long. **Ovary** patently hairy; ovules 4. **Fruit** (immature) ovoid, dull greyish green, hairy, slightly wrinkled when dry; pericarp rather soft; pedicel up to 4.5 mm, light brown.

**Distr.** Malesia: Borneo (E. Sabah, E. Kalimantan).

Tree, up to 21 m, 25 cm dbh. Twigs ± as thick as the petioles, only a few internodes long. Axillary buds 2, 0.5–1.3 mm. Petiole 3.5–4.5 mm. Leaf-blade 4.8–8(–9) by 1.2–2.2(–3.5) cm, apex cuspidate to acuminate; above olive- to dark-green, rather dull; beneath glaucous-papillose, secondary nerves 4–6 pairs, not forming an intramarginal nerve; glands 2–7, 0.1(–0.2) mm diam. Inflorescences unbranched, much shorter than the leaves, bearing only 3–6 flowers; axes slender, slightly flattened, glabrous to sparsely very shortly patent hairy. Pedicel 1.5–2.5(–3) mm, very shortly patent hairy. Sepals with a small apical tuft; outer ones 2–2.2 by 1.5–1.8 mm, very sparsely very shortly hairy outside; inner ones c. 2.7 by 3 mm, glabrous outside. Petals yellowish, when dry yellowish orange, very sparsely hairy to glabrous outside, apically slightly tufted and distinctly ciliate, basally rather densely hairy at both sides, the longest one 7.5–8.5 mm long. Stamens: anthers c. 0.4 mm long, with few hairs at base. Ovary appressedly hairy; ovules 4. Fruit (immature) ovoid-globular, olive-brown, smooth, with a distinct remainder of the style, roughly pubescent, glabrescent.

Distr. Malesia: Borneo (Sarawak: Merasing Hill).


Small tree, up to 6 m, 6 cm dbh. Twigs dull, bearing 1 or 2 (or 3?) leaves per shoot. Axillary buds 2 (or 3?), smaller than 1 mm. Petiole 3.5–5 mm. Leaf-blade 7–16 by 2–5 cm, base rounded-truncate to -cordate; above dark greyish green, very dull, secondary nerves slightly sunken, venation obscured; beneath olive-greenish, dull, secondary nerves 3 or 4 pairs, the basal nerves long, reaching often beyond the middle of the leaf, or forming an intramarginal nerve, venation not distinct; glands 6–12, scattered, 0.2–0.3 mm diam. Inflorescences unbranched, ± as long as the leaves; axes grooved, not flattened, nearly glabrous, light brown; flowers often with 2 or 3 together; bracts relatively long-persistent. Pedicel 3.5–4.5 mm, sparsely very shortly appressedly hairy. Sepals sometimes apically with tiny glandular spots; outer ones 2 by 2.1 mm; inner ones 2.3 by 2.3 mm. Petals white, the upper ones with a yellow spot, when dry yellowish orange, the longest one 7–8 mm; carina nearly glabrous outside; other petals glabrous. Stamens: filaments connate over 0.7–1 mm, very shortly hairy above base, further glabrous; anthers probably c. 0.7 mm long. Ovary very shortly stipitate, more or less appressedly hairy; ovules 4. Fruit (immature) smooth, slightly shiny, yellowish green, sparsely appressedly hairy, glabrescent; pericarp very thin.

Distr. Malesia: Borneo (Sarawak: Semengoh).


Tree, up to 25 m, 30 cm dbh. Twigs forming very short shoots bearing 2 or 3 leaves, the young ones very slender, c. 0.5 mm diam. Axillary buds 2, 0.7–1.2 mm long. Petiole 2–2.5 mm. Leaf-blade 1.6–5(–6) by 0.5–1.6(–1.9) cm, base rounded to cutinised; above shiny, yellowish or greenish brown, midrib flat or slightly prominent, nervation finely prominent to obscure; beneath glaucous-papillose, yellowish to reddish brown, secondary nerves 1–3 pairs, rather indistinct, forming an indistinct intramarginal nerve, venation rather indistinct; glands rather numerous, scattered, very small though relatively distinct, up to 0.1 mm diam. Flowers solitary in the upper leaf axils or twigs terminating in a 1–3-flowered inflorescence; this unbranched, shorter than to ± as long as the leaves, up to c. 0.5 mm diam., up to 3.5 cm long, glabrous. Pedicel 10–11 mm, glabrous. Sepals purplish, (sub)glabrous outside, outer ones c. 2 by 1.6 mm, inner ones 3–3.4 by 1.8–2.3 mm. Petals light orange, when dry orange brown, very sparsely hairy at base and at very apex, further glabrous, the longest one 10–11 mm. Stamens: filaments widened and slightly thickened above their base and there densely rather shortly patent hairy, further glabrous; anthers 0.35–0.4 mm long, with few short hairs at base. Ovary c. 1 mm stipitate, appressedly hairy; style rather sparsely appressedly hairy in lower half, further glabrous; ovules 4. Fruit very shortly stipitate, globular, up to 1.1 cm diam., dull, light brown, very sparsely shortly appressedly hairy; pericarp rather thin; pedicel slender, 6.5–10 mm, completely glabrous.


Twigs often with numerous adventitious buds on older nodes. Petioles 6–10 mm, often grading into the narrow leaf base, mostly in middle part with glands. Leaf-blade 7–14 by 2.5–6 cm, apex acutish; above shiny to rather dull; beneath ± concolorous, rather dull, secondary nerves c. 7–5 pairs, apically hardly distinguishable; glands 1–6, 0.4–0.6 mm diam. Inflorescences unbranched or with one side-branch, up to 5 cm long, often several together in the leaf axils; axes rather dark, sparsely minutely hairy; lower bracts (sub)opposite. Pedicel c. 3.5 mm, reddish brown, densely minutely hairy. Sepals: outer ones c. 2.5 by 2 mm; inner ones c. 3.5 by 3 mm. Petals orange when dry, the longest one c. 12 mm; carina faintly appressedly hairy outside near apex; other petals nearly glabrous. Stamens: filaments
widened but hardly thickened above their base and there densely more or less woolly hairy, further glabrous; anthers c. 1.2 mm long. Ovary c. 2 mm stipitate, appressedly hairy; style very long (c. 10 mm), exerting over c. 2 mm from the carina, faintly appressedly hairy; ovules 4. Fruit c. 2 cm diam., smooth, light brown, faintly hairy; pedicel 2.5–6(–8) mm, minutely hairy. Seed(s) 1 or 2.


Ecol. In open flowers the stigma is exerted from the carina. This may mean that cross-pollination is obligatory.


Shrub or small tree, up to 4 m, 4 cm dbh. Twigs glabrous to densely short hairy. Axillary buds c. 1–2.5 mm long, hairy; older nodes often with numerous adventitious buds. Pediole (5–)7–15 mm, not transversely wrinkled, glabrous to densely short-haired, apically sometimes with glands. Leaf-blade 10–26 by (2.5–)3.5–10.5 cm, apex shortly acuminate to cuspitate; above greyish green, rather dull; beneath green, secondary nerves 8–10 pairs, at least in apical part forming an intramarginal nerve; glands mostly rather numerous, scattered, 0.2–0.5 mm diam., basal glands often present. Inflorescences situated at end of young twigs, but also axillary and on old nodes (plant partly ramiflorous), 1 (or 2) in each axil, erect to strongly reflexed, unbranched, or sometimes with a side-branch; axes 1–11 cm long, dark, rather sparsely shortly hairy; lower bracts (sub)opposite. Pedicel 4.5–6 mm, dark, rather sparsely minutely patently hairy. Sepals dark purple; outer ones 2.5–3.8 by 2.1–3.1 mm; inner ones 4.2–5.2 by 3.3–3.9 mm. Petals when dry light to dark orange, the longest one 13–19 mm long; carina long unguiculate, sparsely very shortly appressedly hairy outside; other petals very sparsely hairy outside to glabrous. Stamens: filaments conuate over (0.7–)12–2.5 mm, slightly widened and hardly thickened above base; anthers 0.8–1.2 mm long, very shortly hairy at base. Ovary c. 2 mm stipitate, half-patently hairy; style exerted from the carina for less than 0.5 mm, sparsely hairy in 2 rows; ovules 4. Fruit (immature) shortly stalked, more or less globular, slightly beaked, brownish, hairy; pedicels 8–11 mm.

Distr. Malesia: Sumatra (North: Gajolands; Mt Bandahara; Central: N. of Padang; South: Lampong Distr.: Muaraadua).

Ecol. Montane rain-forest, 500–1200 m.
The present species is named in honour of Ms. BRIGITTA DE WILDE-DUYFJES who ardently assisted her husband in the botanical exploration of the Leuser National Park in the Gajolands of N. Sumatra.


Tree, up to 30 m, 40 cm dbh. Axillary buds 2 (or 3), 0.5–2.5 mm long, basally wrinkled, in apical part smooth or slightly keeled. Petiole 6–9 mm, often appearing somewhat longer because of the attenuate leaf base, always with 2 rather distinct glands usually situated in the middle part or at the (very) base. Leafblade 9–20 by 3.5–11 cm; above slightly bullate between the secondary nerves, shiny, dark to brownish green, nervation often very distinct; beneath slightly shiny, secondary nerves c. 6–8 pairs, apically difficult to count, forming an irregular and fine intramarginal nerve or ending in the venation; glands mostly very numerous, scattered, c. 0.3–0.5 mm diam. Inflorescences also in lower leaf axils, unbranched or rarely with one short branch, up to 7 cm long; axes rather slender, smooth, very densely shortly more or less appressedly hairy; flowers with 3 together or in the apical part solitary; lower bracts (sub)opposite. Pedicel 2–4 mm, very densely nearly appressedly shortly hairy. Sepals: outer sepals 1.8–2.9 by 1.9–3 mm; inner sepals 2.9–3.5 by 2.6–3.2 mm. Petals rather thin, white (or yellow?) when fresh, when dry light brown or orange, not covering the stamens in anthesis, the longest one 10.5–12.5 mm; carina long-unguiculate, apically ciliate, rather sparsely to rather densely more or less appressedly woolly hairy outside in apical region and slightly so near the base, inside glabrous; other petals ciliate at very apex, near base sparsely to rather densely hairy on either side. Stamens 8, occasionally 9; filaments connate over 0.1–0.5 mm, rather densely more or less appressedly woolly hairy in basal half, glabrous upwards; anthers (0.5–)0.6–0.7 mm, sparsely ciliolate along slits, sparsely and shortly hairy at base. Ovary appressedly hairy; style rather sparsely hairy; ovules 4. Fruit globular, 1.8–2 cm

Tree, up to 23 m, 20 cm dbh. Axillary buds, when resting, mostly more or less enclosed between the base of the petiole and a low ridge of the twig, 1–1.8 by 1.5–2 mm, for c. 1 mm of its length uncovered; scales strongly thickened, especially at base, but leaving a narrow scar. Petiole 10–14 mm, sometimes with glands. Leaf-blade 10–20 by 3.5–9 cm, apex acutish to shortly acuminate; above rather dull, greyish green; beneath light yellowish green, papillose, secondary nerves c. 8 or 9 pairs, not forming an intramarginal nerve; glands scattered, probably rather numerous but often seemingly absent, up to 0.2 mm diam., exceptionally larger. Inflorescences up to 20 cm long; axes reddish brown, densely minutely appressedly hairy; lower bracts (sub)opposite. Pedicel 1.5–4 mm, grooved, appressedly rather short hairy. Sepals: outer sepals 2–2.5 by 2.6–3.3 mm; inner sepals 3.2–3.7 by 3.2–3.3 mm. Petals white, the upper ones with a yellow spot, when dry orange to dark red, sometimes with incrustations, the longest one 8.5–10.5 mm; carina densely more or less appressedly hairy outside; other petals glabrous outside. Stamens: filaments widened above base and with a knob-like, densely hairy appendage at inner side, further glabrous; anthers (0.3–)0.4(–0.5) mm long. Ovary 0.5–2 mm stalked, more or less appressedly hairy; ovules 4. Fruit globular, up to 1.5 cm diam., more or less smooth brown, appressedly hairy; pedicel up to 4 mm.

Distr. SE. Asia and Malesia.

Note. VAN DER MEIJ'DEN (l.c.) distinguished 3 subspecies, of which the typical one (from Burma, Mergui) occurs outside Malesia.

KEY TO THE SUBSPECIES

1. Axillary buds half-patent, flat
   a. ssp. angustifolium
   1. Axillary buds erect, flattened against the twig, basally convex. 
   b. ssp. erectum

Axillary buds half-patent, elliptic to lanceolate, 1.5–8 mm long, at base often stalk-like constricted, more or less flat, wrinkled, glabrous or soon glabrescent. Petiole 4–8(–9) mm. Leaf-blade 4–8–(–10) by 1–4(–5) cm, in juvenile shoots up to 10 by 2.5 cm; beneath glaucous-papillose to (nearly) smooth and
not glaucous, secondary nerves 4 or 5 (or 6) pairs; glands 0.2−0.3 mm diam. Pedicel 1.5–4.5 mm. Petals: longest ones 6.5–7.8 mm. Stamens: anthers 0.4 mm long. Fruit c. 1.1 cm diam.

Distr. *Malesia*: Central Sumatra (Indragiri), Malay Peninsula, Borneo (Sarawak, Sabah, E. Kalimantan), Philippines (Luzon).

Ecol. Usually in submontane rain-forest, up to 1400 m.


Axillary buds erect or nearly so and flattened in their upper part against the twig, ovate to ovate-lanceolate, rarely elliptic, (3)−4−8 mm long, basally convex, slightly wrinkled, glabrous to densely minutely hairy. Petiole 6−12 mm. Leaf-blade 5−12(−15) by 2−4.5−(9) cm; beneath glaucescent-papillose, secondary nerves 5 or 6 pairs; glands c. 0.2 mm diam. Pedicel 1−2(−3) mm. Petals: longest one (6.5−7−8 mm. Stamens: anthers 0.4(−0.5) mm long. Fruit up to 1.5 cm diam.


Tree, up to 10 m, 20 cm dbh. Axillary buds often appressed against the petiole, (1)−1.8−2.9 mm long, base wrinkled, apex acute. Petiole 9−14 mm. Leaf-blade 8−16 by 2−5(−7.5) cm; above usually dark green, sometimes brownish; beneath glaucescent-papillose, secondary nerves 6−8 (or 9) pairs, in apical part forming a weak intramarginal nerve; glands 4−16, mostly in basal half near midrib, 0.2−0.3 mm diam., basal glands sometimes present, sili-like, c. 0.8 mm long. Inflorescences up to 12 cm long; axes angular, basally flattened, grooved, very densely minutely patently yellowish brown hairy; flowers solitary or in basal part with 2 together; lower bracts (sub)opposite. Pedicel 3.5−5 mm, slightly grooved, very densely appressedly hairy. Sepals: outer sepals 2.6−3 by 2.5−3 mm; inner sepals 4.4−5.5 by 3−4.5 mm. Petals whitish, when dry dark orange red, the longest one 10.5 mm long; carina rather densely appressedly hairy outside, subglabrous inside; other petals outside in basal part shortly appressedly hairy, further glabrous. Stamens: filaments widened above base and with a knob-like, rather densely hairy appendage at inner side, further glabrous; anthers 0.5−0.7 mm long. Ovary half-patently hairy, up to 1.5 mm stipitate, inserted on a rather wide, minutely hairy receptacle; ovules 4. Fruit globular, c. 1.7 cm diam., dark, shortly patently hairy; pericarp rather soft.

Distr. *Malesia*: Malay Peninsula (Cameron Highlands, Fraser's Hill, G. Benom).

Ecol. Submontane rain-forest, 1000−1500 m.

Shrub or tree, up to 30 m, 36 cm dbh. Axillary buds varying from narrowly triangular with strongly thickened base and then often 1.5—3 mm long, to rhomboid-ovate or ovate-oblong and then often 6—11 mm long. *Petiole* 8—14(—16) mm, very often with a pair of glands in apical half. *Leaf-blade* 8—20(—30) by 3.5—11 cm, sometimes a few leaves of a twig smaller; above greyish green to yellowish brown; midrib protruding to nearly flat in basal half; beneath: secondary nerves (6 or) 7—9(—11) pairs, in apical half forming an indistinct intramarginal nerve; glands mainly more than 10, near midrib or scattered, 0.2—0.4 mm diam., basal glands mostly present. *Inflorescences* branched, 8—30 cm long, branches often in pairs in lower part; axes basally mostly strongly flattened, grooved, glabrous to densely shortly patently or less often appressed hairy; in basal part flowers with up to 3 together, solitary in apical part; lower bracts nearly opposite. *Pedicel* 1.5—5.5 mm, very rarely longer, grooved, densely shortly patently (sometimes appressedly) hairy. *Sepals* basally often more or less thickened and wrinkled; outer sepals (1.7—)2—3.3(—3.9) by 1.9—4 mm; inner sepals (2.6—)3.5—5.3(—5.7) by (2.5—)3.3—4(—5) mm. *Petals* dark yellow to white, when dry orange to dark reddish and often with white incrustations, the longest one (7—)8—12, exceptionally up to 15.5 mm; carina densely appressedly hairy outside; other petals glabrous outside or with a few hairs at apex. *Stamens*: 8, very rarely 9; filaments free or connate over to 0.7 mm, widened above base and with a knob-like, rather densely hairy appendage at inner side, further glabrous; anthers 0.4—0.6(—0.7) mm long. *Ovary* sub sessile or up to 1 mm stipitate, half-patently hairy; style hairy in basal half, little hairy upwards; ovules 4. *Fruit* globorlar, up to 1.8 cm diam., often wrinkled when dry, rather dull or rarely shiny, usually light brown, sometimes dark reddish brown, hairy; pericarp rather thin.

**Distr. Malesia**: Central Sumatra (Toba Lands, Pajakumbuh, Mt Sago), West and Central Java. Ecol. Montane rain-forest, (200—)500—1300 m.


1988] Polygalaceae (van der Meijden) 515

Shrub or small tree, up to 10 m, 25 cm dbh. Twigs glabrous or rarely minutely patent hairy. Axillary buds oblong or sometimes ovate-lanceolate, (1.3—)3—6—(10—5.5) mm long, the longer ones strongly thickened at base and usually suddenly widened and flattened upwards, usually glabrous, the smaller ones less distinctly flattened and usually rather densely shortly hairy; buds of second order often present. Petiole (8—)15—18—(23) mm, glabrous to rather densely minutely hairy, usually with 2 small, prominent glands. Leaf-blade (linear-)lanceolate, (9—)22—47 by (1.3—)5—10(—20) cm; base usually cordate with the margins curved upwards and connate above the apex of the petiole, or flat and rounded to broadly cuneate, apex acutish; above usually slightly bullate between secondary nerves and intramarginal nerve, greyish green to brown; beneath usually brownish, glabrous to minutely patent hairy all over, secondary nerves (9—)13—20 pairs, mostly forming a distinct, nearly complete intramarginal nerve; glands 2—6(—20), usually near the midrib (if few, only present in basal part), 0.3—0.4 mm diam. Inflorescences sometimes also axillary on the older nodes; axes slightly angular, slightly grooved, main axis basally usually sparsely minutely appressed hairy, side axes and main axis in upper part more densely hairy; flowers solitary or very rarely with 2 together; lower bracts opposite. Pedicel (1—)1.5—2—(3.5) mm, more or less distinctly grooved, densely minutely appressed to patent hairy. Sepals often with minute, rather distinct glands; outer sepals (2.1—)2.8—3.8(—4.1) by (2.4—)3—4.9 mm; inner sepals 3—5.5 by (2.8—)3.4—4.6 mm. Petals pinkish to pale violet, the upper petals with a yellow spot, when dry dark red, the longest one (8.5—)9.5—12.5(—14.5) mm; carina rather densely appressed hairy outside, inside sparsely minutely hairy in apical part only, further glabrous; other petals very sparsely minutely hairy above base outside, sparsely patent hairy outside near apex, inside glabrous to hairy up to ± halfway. Stamens: filaments free or connate over 1(—2) mm, widened above base and especially those of abaxial stamens with a more or less distinct (half-)patently hairy knob-like thickening at inner side, further glabrous; anthers (0.6—)0.7—0.9(—1) mm long, ciliate along slits. Ovary (half-)patently hairy; style (rather) sparsely half-patently hairy in basal half, very sparsely hairy in apical half, glabrous near apex; ovules 4. Fruit globose, 1.5—1.8 cm diam., rather dull, light to reddish brown, distinctly hairy; pericarp thin, brittle.

Distr. Malesia: Sumatra, Borneo.

**KEY TO THE VARIETIES**

1. Leaf-blade (4.5—)5—10(—20) cm wide. Secondary nerves 13—20 pairs, forming a nearly complete intramarginal nerve. .......... a. var. adenotus

1. Leaf-blade 2—5.2 cm wide. Secondary nerves 9—14 pairs, forming a weak, irregular intramarginal nerve. .......... b. var. lineare

a. var. adenotus

Axillary buds (1.8—)3—6—(10—5.5) mm long. Petiole (10—)15—21 mm, glabrous or hairy. Leaf-blade (15—)22—47 by (4.5—)5—15 cm, base cordate to connate. Secondary nerves 13—20 pairs, forming a distinct, nearly complete intramarginal nerve. *Flowers*: upper petals glabrous or hairy inside to about halfway.

Distr. Malesia: Sumatra, Borneo.


Axillary buds at upper side partly enclosed by a distinct ridge formed by the twig, 1.3—2.2 mm long. Petiole (8—)10—12(—18) mm, glabrous. Leaf-blade linear-lanceolate with more or less parallel sides over most of its length, (9—)13—30 by (1.3—)2—5.2 cm, base rounded to obtuse. Secondary nerves 9—14 pairs, forming a weak, irregular intramarginal nerve. *Flowers* rather small in all parts; upper petals shortly patent hairy inside to about halfway. *Fruit* unknown.

Distr. Malesia: Borneo (Sabah).


Small tree, up to 8 m, 5 cm dbh. Twigs sparsely minutely hairy, glabrescent, older nodes often strongly thickened and with numerous adventitious buds. Axillary buds oblong, 6—9 mm long, basally narrowed and strongly thickened, sparsely shortly hairy, glabrescent. *Petiole* 15—18 mm, more or less densely shortly hairy, with 2(—4) more or less distinctly protruding small glands. Leaf-blade ovate-oblong to ovate-lanceolate, rarely elliptic, c. 20—40 by (6—)8—12(—15) cm, base cordate, the margins at base flat or only little upturned, apex gradually narrowed to shortly acuminate; above often slightly bulbate between secondary nerves and intramarginal nerve, dark green to greenish brown; beneath sparsely minutely hairy on the nerves in basal part, secondary nerves 9—12 pairs, often irregular, forming a nearly complete, somewhat irregular, intramarginal nerve; glands few, situated in middle and basal part, 0.2(—0.4) mm diam. Inflorescences sometimes also on older shoots from adventitious buds, up to 22 cm.
long; axes angular, slightly grooved, densely shortly patently hairy; lower bracts opposite. Pedicel 2–3.5 mm, grooved, densely shortly half-patently hairy. Sepals: outer sepals 3.5–4.3 by 4.3–5 mm; inner sepals 5–5.9 by 4.3–4.5 mm. Petals dark red when dry, the longest one 15–18.5 mm; carina rather densely shortly appressedly hairy outside, glabrous inside except at base; other petals minutely sparsely appressedly hairy in basal part out- and inside, further glabrous. Stamens: filaments widened and slightly thickened above base and only there rather densely half-patently hairy; anthers 1.1–1.2 mm long, ciliate along slits. Ovary stipitate for 1–1.5 mm, half-patently hairy; style densely hairy in basal part, upwards sparsely hairy to near apex; ovules 4. Fruit globose, c. 1.7 cm diam., dull brown, rather distinctly half-patently hairy; pericarp rather thin, brittle; pedicel up to 5–6 mm.


Small tree, up to 15 m, 16 cm dbh. Axillary buds elliptic to oblong, 5–7 mm long. Petiole (18–)25–30 mm. Leaf-blade 22–42 by 7–15.5 cm; above rather dull, greenish, beneath dull, concolorous, secondary nerves c. 8–10 pairs, little prominent, in apical part forming an indistinct intramarginal nerve, venation obscure; glands 2–8, 2 situated at the very base and 0.6–1 mm diam., the other ones (if present) scattered, sometimes close to midrib, 0.5 mm diam. Inflorescences much shorter than the leaf; axes strongly flattened basally, grooved, brown, minutely hairy; lower bracts (sub)opposite. Pedicel 2.5–3.5 mm, grooved, densely shortly patently hairy. Sepals: outer sepals 2.8–3.5 by 3.6–4.4 mm; inner sepals 4.5–4.9 by 3.6–4.7 mm. Petals yellowish, when dry dark red with large incrustations, glabrous inside, the longest one 9–10.5 mm; carina appressedly hairy outside. Stamens: filaments widened above base and with a distinct, rather shortly (half-)appressedly hairy knob-like thickening at inner side, further glabrous; anthers 0.6 mm long. Ovary nearly sessile, appressedly hairy; ovules 4. Fruit unknown.

Distr. Malesia: Borneo (Sarawak: Semengoh; Sabah).


Tree, 14 m. Twigs minutely patently hairy. Axillary buds erect, oblong, c. 11–12 by 4 mm, base broad, rounded, apex rounded. Petiole 26–31 mm. Leaf-blade 6–13.5 by 4–7 cm, base rounded, apex rounded to slightly obtuse; above: midrib sunk in apical half, slightly prominent in basal half, second-ary nerves slightly sunken; beneath glaucous-papilllose, secondary nerves 6–8 pairs, forming an indistinct intramarginal nerve in apical part, venation hardly protruding; glands 1–3, situated in middle and apical part, mostly c. 0.4 mm diam., basal glands sometimes present, rather large. Inflorescences up to 15 cm long; axes dark, patently, extremely shortly hairy; lower bracts opposite. Pedicel 4 mm, grooved, densely very shortly half-patently hairy. Sepals: outer sepals 2.9 by 3.3 mm, slightly pustulate; inner sepals 4 by 3.3 mm. Petals dark red when dry, the longest one 11.5 mm; carina densely appressedly hairy outside; other petals glabrous to sparsely shortly hairy outside. Stamens: filaments conunate over 0.5–0.8 mm between upper and lateral petals, conenate over c. 1.5 mm between lateral petals and carina, the free parts constricted at very base and then widened and with a distinct densely hairy knob-like thickening at inner side, further glabrous; anthers 0.7 mm long. Ovary c. 1.5 mm stipitate, appressedly hairy; ovules 4. Fruit unknown.

Distr. Malesia: Borneo (Brunei: Andalau For. Res.).


Tree, up to 14 m. Axillary buds with the form of a clove; scales 6.5–12 mm long, at base slightly enlarged and convex, distinctly enlarged at the rounded to ± emarginate apex, and there with 2 more or less distinctly prominent knob-like appendages; buds of second order c. 5–6 mm long, hardly thickened at apex. Petiole 9–17 mm. Leaf-blade 8.5–18 by 3.5–6.5 cm; above greenish to brownish; beneath glaucous-papilllose, secondary nerves c. 7 or 8 pairs, forming an indistinct intramarginal nerve in apical half; glands few to rather numerous, mostly near the midrib, c. 0.2–0.3 mm, basal ones up to 0.5 mm diam. Inflorescences up to 20 cm long; axes dark, minutely patently hairy; in basal part flowers in clusters of up to 7 together; lower bracts opposite. Pedicel 4.5 mm, ± grooved, densely very shortly, ± appressedly hairy. Sepals: outer sepals 3 by 3.2 mm; inner sepals 4.1 by 4.1 mm, with tiny glandular spots at apex. Petals dark red when dry, the longest one 8.5 mm; carina appressedly hairy outside; other petals glabrous outside, the upper ones sparsely ciliate to halfway. Stamens: filaments widened above base and with a distinct densely appressedly hairy knob-like appendage at inner side, further glabrous; anthers 0.5 mm long. Ovary subsessile, half-patently hairy; style hairy in two rows to near apex; ovules 4. Fruit unknown.

Distr. Malesia: Borneo (Brunei, Sabah, Labuan l.), 3 collections.
Fig. 21. _Xanthophyllum bracteatum_ CHODAT. a. Habit, \( \times 0.5 \); b. flower; c. flower, longitudinal section, gynoecium removed; d. gynoecium, all \( \times 3 \); e. ovary, longitudinal section, \( \times 6 \); f. carina, \( \times 4 \); g. base of leaf with glands, \( \times 2.5 \) (Edano BS 28512).

Small tree, up to 10 m, 12 cm dbh. Twigs minutely patent hairy. Axillary buds erect, appressed against twigs; scales laterally flattened, triangular, 3.4–4.5 mm long, minutely densely patent hairy. Petiole 9–10 mm, densely minutely hairy. Leaf-blade 11–18 by 3.5–5.5 cm; above rather dull, dark greenish to yellowish brown, midrib ± sunken, nervation rather obscure; beneath nearly concolorous, secondary nerves c. 6–9 pairs, not very distinct, in apical part forming an indistinct intramarginal nerve, venation rather obscure; glands 2 (or 3), situated near base, 0.4–0.7 mm diam. Inflorescences shorter than the leaves; axes dark, very densely more or less patent hairy; lower bracts opposite. Pedicel 2.5–3 mm, ± grooved, very densely shortly patent hairy. Sepals: outer sepals 2.2–2.5 by 3.4–3.6 mm; inner sepals 3.8–3.9 by 3.6–4.9 mm. Petals yellowish white, when dry dark red, the longest one 13–14 mm; carina densely more or less appressed hairy outside; other petals glabrous. Stamens: filaments widened above base and with a knob-like shortly (half-)appressed hairy appendage at inner side, further glabrous; anthers 0.7–0.8 mm long, hairy or nearly glabrous at base. Ovary subseptal, half-patently hairy; ovules 4. Fruit unknown.

Distr. Malesia: Borneo (Sarawak: Semengoh).


Axillary buds erect or nearly so, mostly flattened against twigs; scales ovate-lanceolate, 6–9 mm long, not thickened at base; buds of second order distinct, 3.5–5 mm long. Petiole 10–14 mm. Leaf-blade c. 6–12 by 2.5–5.8 cm; above greyish green to brownish green; beneath glaucous-papilllose, secondary nerves c. 5–7 pairs, usually forming an indistinct intramarginal nerve in apical part; glands rather numerous, scattered, 0.1–0.2 mm diam. Inflorescences about as long as the leaves; axes dark, minutely patent hairy; in basal part flowers with 3 together; lower bracts opposite. Pedicel 3.5–4 mm, very densely whitish shortly patent hairy. Sepals: outer sepals 3.2–3.7 by 2.9–3.3 mm; inner sepals 3.7–5.4 by 2.3–3.2 mm. Petals dark red when dry, the longest one c. 13 mm; carina densely half-patently hairy outside; other petals faintly hairy along midrib outside. Stamens: filaments c. 2 mm connate, the free parts constricted at very base and then widened and slightly thickened, only there densely half-patently hairy; anthers 0.7 mm long. Ovary half-patently hairy; ovules 4. Fruit unknown.


Axillary buds (ob)ovate-oblong to linear-lanceolate, 7–20 by 1.5–6 mm, basally slightly wrinkled, acute, more or less flat. Petiole 5–11 (14) mm, sometimes with glands. Leaf-blade 9.5–25 by 3–8 cm, rounded-attenuate to cordate; above (yellowish) green, midrib nearly flat to distinctly prominent; beneath glaucous-papilllose, secondary nerves 10–12 pairs, forming a rather distinct intramarginal nerve; glands scattered, numerous, 0.1–0.2 mm diam. Inflorescences up to 10 cm long; axes (rather) densely minutely patent hairy, smooth to pubulate, angular, reddish; flowers solitary or in basal part with up to 3 together, sometimes turned upside-down; lower bracts opposite. Pedicel 5–7 mm, slender, very densely patently shortly whitish hairy. Sepals: outer sepals c. 3 by 2.1 mm; inner sepals c. 5–5.5 by 4–4.5 mm. Petals dark red when dry, the longest one c. 14–17 mm; carina rather densely more or less appressed hairy outside in middle and apical part; other petals nearly glabrous outside. Stamens: filaments connate over 1–3 mm, widened and hardly thickened above base, basally rather densely whitish hairy in 2 rows; anthers c. 1–1.2 mm. Ovary more or less patently whitish hairy; ovules 4. Fruit (immature) globular, yellowish brown; pericarp thin.


Tree, up to 33 m, 70 cm dbh. Axillary buds elliptic to oblong, (8–)11–20 (30) by 6–12 (14) mm; scales flat, wrinkled, indistinctly nerved, more or less shiny, sometimes in middle part with 1–4 rather indistinct glands, base shortly attenuate, apex rounded to obtuse. Petiole 7–15 mm. Leaf-blade (3–)4.5–12 (19) by (1.8–)2.5–5 (7.5) cm, apex shortly acuminate to cuspidate; above ± shiny, brownish green; beneath yellowish brown, secondary nerves 7–10 (12) pairs, not forming an intramarginal nerve; glands few to many, mostly situated in middle and apical part, 0.2–0.4 mm diam. Inflorescences branched; axes densely patent hairy; lower bracts opposite. Flowers unknown. Fruit globular, up to 1.7 cm diam., shiny, brown, slightly hairy; pericarp rather soft; pedicel 1.5–2.5 mm, densely shortly patent hairy. Seed 1; 3 ovules abortive.

Distr. Malesia: Borneo (Sarawak, Brunei, Sabah).

Note. Although quite a number of collections are known, these are either vegetative or in fruit.

Tree, up to 21 m, 23 cm dbh. Axillary buds inserted (1.5—3–15 mm above the axils on 1–2 mm long stalks; scales elliptic to linear-lanceolate, 6–18 by 1.5–8 mm long, faintly nerved. Petiole 7–10 mm, glands present or not. Leaf-blade 8–14 by 2.5–5 cm; above often slightly bullate between the secondary nerves, mostly dark green, secondary nerves finely prominent to obscure, venation obscure to finely prominent; beneath glaucous-papillose, secondary nerves 6–8 pairs, forming a ± distinct intramarginal nerve; glands either not numerous, mostly situated near midrib, and c. 0.3 mm diam., or numerous, scattered, and 0.1–0.2 mm diam. Inflorescences shorter to much longer than the leaves, the lower branches distinctly supra-axillary, (sub)opposite; axes densely minutely hairy, more or less grooved, angular. Pedicel 1.5–2 mm, grooved, densely patentely minutely hairy. Sepals glabrous inside except for a few hairs at the very base; outer sepals c. 2 by 2 mm; inner sepals c. 3.5 by 3 mm. Petals incompletely known, carina and lateral petals unknown; upper petal probably c. 8.5 mm long, sparsely hairy at apex. Stamens: unknown. Ovary patently whitish hairy (short and long fine hairs mixed); style and stigma unknown; ovules 4. Fruit unknown.

Dist. Malesia: Central Sumatra, Borneo (Sarawak, SE. Kalimantan), 4 collections.


Very low shrub or small tree, 1–10 m, up to 10 cm dbh. Axillary buds narrowly triangular, c. 2.5–6 mm long, basally and centrally thickened, acute, shiny. Petiole 3–6–7 mm, often rather shiny. Leaf-blade 3.8–25 by 1.6–10 cm, base obtuse to cordate or cuneate, apex acutish; above rather faintly bullate between the secondary nerves, light to dark greyish green, midrib mostly slightly sunken, sometimes a little prominent, venation rather indistinct; beneath glaucous-papillose to nearly smooth, secondary nerves (5 or) 6–13 pairs, forming a rather in- distinct intramarginal nerve; glands numerous, scattered, c. 0.1 mm diam., the basal ones often somewhat larger. Inflorescences unbranched or rarely with one branch, much shorter than to three times as long as the leaves; axes mostly very slender, mostly less than 1 mm thick, (rather) sparsely minutely hairy; in basal part flowers usually with 3 together; bracts small, either with 2 large glands (in Bornean material) and then rather long-persistent, or eglandular (in Malayan and Philippine collections) and then soon caducous; lower bracts (sub)opposite. Pedicel 2–25 mm, slightly grooved, appressed to patentely, sparsely or densely hairy, rarely glabrous. Sepals rarely glabrous outside; outer sepals (1.5–2–4 by (1.3–)2–3.5 mm, without or with (in most Bornean material) very distinct glands; inner sepals 3–6 by 4–6 mm. Petals white or pinkish, when dry brownish to dark reddish, nearly glabrous, apically with few hairs, basally inside slightly hairy, the longest one 11–23 mm. Stamens: filaments free or connate over up to 2 mm; anthers 2–2.5 mm long, minutely hairy all over. Ovary sessile to distinctly stipitate, appressed whitish hairy; ovules 6–15. Fruit globular, up to 1.8–3 cm diam., dull, light brownish; pericarp thin, rather brittle.

Dist. Malesia: Malay Peninsula, Borneo, Philippines.

KEY TO THE SUBSPECIES

1. Inflorescence less than half as long as the leaves. Inner sepals 3–3.8 mm long. Longest petals 11–15 mm ................. a. ssp. discolor

1. Inflorescence 0.5–3 times as long as the leaves. Inner sepals 5–6 mm long. Longest petals 15–23 mm ................. b. ssp. macranthum

a. ssp. discolor — X. discolor CHODAT. — X. hypoleucum MERR.

Very low shrub or small tree, up to 10 m. Secondary nerves (5 or) 6 or 7–9) pairs. Inflorescences mostly much less than (rarely up to) half as long as the leaves, often few-flowered. Pedicel 2–8.5 mm. Sepals: outer sepals (1.5–)2–2.5 by (1.3–)2–2.5 mm; inner sepals 3–3.8 by 4–4.5 mm. Longest petals 11–15 mm. Fruit up to 1.8 cm diam.

Dist. Malesia: Malay Peninsula (Johore; Singapore), Borneo.


Low shrub or small tree up to 8 m. Secondary nerves 6–13 pairs. Inflorescences half as long as three times as long as the leaves, many-flowered. Pedicel 10–25 mm. Sepals: outer sepals 2.8–4 by 2.2–3.5 mm; inner sepals 5–6 by 4.2–6 mm. Longest petals 15–23 mm. Fruit up to 3 cm diam.
Distr. Malesia: throughout the Philippines.


Small shrub or tree, up to 12 m, 30 cmdbh. Axillary buds ovate-oblong, 3.2—7 mm long, acute, flat, but basally strongly thickened, there often with exuberant cork-forming which may hide the scale completely, greyish to cream-coloured, more or less shiny. Petiole 8—15 mm, often seemingly much longer because of the long-attenuate leaf base. Leaf-blade (5—)7—28 by 2.3—10 cm, base long-attenuate, above dark green, shiny, midrib slightly sunken to slightly prominent basally, further ± prominent, secondary nerves and venation very distinct, sometimes even more distinct than beneath; glaucous-papillose beneath, secondary nerves c. 4—6 pairs, first nerves reaching to halfway or further, intramarginal nerve in apical part rather distinct; glands very numerous, scattered, 0.1—0.2 mm diam. Inflorescences unbranched, shorter than the leaves; axes minutely rather sparsely appressedly hairy to nearly glabrous; in basal part flowers with up to 3 together. Pedicel 2.3—6 mm, more or less smooth, minutely sparsely to densely, appressedly hairy. Sepals sparsely hairy along the midrib to (nearly) glabrous outside, often some with rather distinct glandular spots; outer sepals 2.7—2.9 by 2.1—2.4 mm; inner sepals 3.1—3.3 by 3—3.2 mm. Petals creamish white to light purplish, the upper ones with a yellow spot, when dry orange, glabrous outside, apically and basally sparsely ciliate, the longest one 11—13 mm. Stamens: filaments connate over up to 2.5 mm; anthers c. 1.2—1.8 mm long, often minutely hairy all over. Ovary 1—2 mm stipitate, glabrous to densely appressedly whitish hairy; style thinly appressed hairy in basal part, further glabrous; ovules 8—12. Fruit sometimes distinctly stipitate, globose, c. 1.5 cm diam., ± shiny, brownish, glabrous or nearly so; pericarp thin; pedicel up to 10 mm.

Distr. Malesia: Borneo (Sarawak, E. Kalimantan).

Ecol. Mostly found in mountain forests, 500—1500(—1800?) m.

Note. Very variable in the indumentum of the ovary.


Small tree, up to 9 m, 12 cmdbh. Axillary buds oblong, 3—6 mm long, basally strongly thickened, obtuse, probably glabrous; secondary and adventitious buds often present, numerous. Petiole (8—)10.5—14 mm, smooth. Leaf-blade 13—32 by 5—10.5 cm, base attenuate to cordate, apex acutish; above dark green, often slightly bullate between the secondary nerves, midrib prominent, often with a groove from halfway down; beneath glaucous-papillose, secondary nerves 11—14 pairs, forming a rather distinct complete intramarginal nerve; glands numerous, smaller than 0.1 mm diam. Inflorescences 1.5—6 cm long, also arising from adventitious buds on older nodes, unbranched; axes minutely appressedly hairy (hairs 0.1 mm long). Pedicel 5—6 mm, minutely appressedly hairy (hairs 0.1 mm long). Sepals: outer sepals 2 by 2 mm; inner sepals 3.2 by 2.7 mm. Petals subglabrous, brownish orange when dry, the longest c. 15 mm. Stamens: filaments c. 1.5 mm connate; anthers 2 mm long, ciliate along slits. Ovary minutely appressedly hairy (hairs 0.1—0.2 mm long); style glabrous in apical part; ovules 9—11. Fruit globalar, c. 1.5 cm diam., minutely appressedly hairy; pericarp thin, brittle; pedicel up to 7 mm.

Distr. Malesia: Borneo (Sarawak, Sabah).

Note. Resembling 45. X. pulchrum ssp. stapfii, differing in the shorter, appressed hairs of inflorescence and flowering parts, in the greater number of secondary nerves which form a distinct intramarginal nerve, in the longer pedicel, and in the smaller sepals.


Small shrub to small tree, up to 8 m. Twigs glabrous to minutely hairy. Axillary buds ovate, 1.8—3.5(—5?) mm long, very thick (mostly not especially basally), obtuse, light brown and often more or less reddish, often irregular because of cork-forming. Petiole 4—9 mm, the young ones nearly smooth, not transversely wrinkled, glabrous to minutely densely patently hairy all round, the older ones soon becoming transversely cracked, more or less Corky; glands often present, mostly rather distinct. Leaf-blade (5.5—)7.5—30 by 2.4—11.5 cm; base rounded-cordate, rarely rounded, obtuse, or cu- neate-rounded, apex acutish, rarely rounded; above rarely bullate between midrib and secondary nerves, greyish green, midrib slightly sunken to flat, rarely
indistinctly prominent; beneath glaucescent-papillose, secondary nerves (6 or) 7–12 (or 13) pairs, forming mostly an indistinct intramarginal nerve in apical half; glands numerous, scattered, c. 0.1–0.2 mm diam. Inflorescences at end of young twigs but also axillary, not rarely on old nodes, unbranched, shorter than the leaves, many-flowered; axes stiff, minutely patent hairy; in basal part flowers with up to 3 together. Pedicel 2.5–3.5(–4.5) mm, finely grooved, very densely minutely patent hairy. Sepals often with rather distinct glands; outer sepals 2.1–5 by 2.7–4.2 mm; inner sepals 3.2–6 by 3.2–4.9 mm. Petals pink or whitish, when dry red or brownish orange, slightly hairy apically and basally inside, further glabrous, the longest one 13–18 mm. Stamens: anthers (1.3–)1.7–2.5(–3.6) mm long, faintly hairy at base, sparsely ciliate along slits. Ovary up to 2 mm stipitate, patently light brownish pubescent; style glabrous in apical part; ovules 12–16. Fruit globose, up to 2 cm diam.; pericarp thin.

Distr. Malesia: Sumatra, Malay Peninsula, Borneo.

KEY TO THE SUBSPECIES

1. Secondary nerves 6 or 7 pairs. Longest petals 12–16 mm. Anthers 1.3–1.8 mm long
   a. ssp. pulchrum
1. Secondary nerves 7–13 pairs. Longest petals 15–18 mm. Anthers (1.7–)1–3.6 mm long
   b. ssp. stapfii

a. ssp. pulchrum — X. pulchrum King.

Petiole 4–6.5 mm. Secondary nerves (6 or) 7 pairs. Outer sepals 2.1–4 by 2.7–3.9 mm, inner sepals 3.2–4.7 by 3.4–4.3 mm. Longest petals 12–16 mm. Anthers 1.3–1.8 mm long.


Petiole (4–)5–9 mm. Secondary nerves 7–12 (or 13) pairs. Outer sepals 3.4–5 by 3.1–4.2 mm, inner sepals 3.6–6 by 3.2–4.9 mm. Longest petals 15–18 mm. Anthers (1.7–)2.1–2.5(–3.6) mm long.

Distr. Malesia: Borneo (Sarawak, Kalimantan).


Tree, up to 12 m, 17 cm dbh. Twigs very densely patent hairy (hairs up to 1 mm). Axillary buds triangular, 0.5–4.5 mm long, basally strongly thickened, acutish. Petiole 5–6 mm, very densely hairy. Leaf-blade 9.5–19 by 4–8 cm, base cordate, apex acutish; above dark green; beneath glaucescent-papillose, rather sparsely hairy, midrib rather densely hairy, secondary nerves c. 6–8 pairs, forming an indistinct intramarginal nerve in apical part; glands numerous, scattered, c. 0.1 mm diam. Inflorescences unbranched, shorter than the leaves; axes densely minutely hairy (hairs up to 0.4 mm); in basal part flowers with up to 3 together, sometimes turned upside-down. Pedicel 7.5–9.5 mm, densely patent hairy (hairs up to 0.25(–0.4) mm). Sepals nearly glabrous (very shortly hairy); outer sepals 2.5–2.7 by 3–3.6 mm, with rather distinct glandular spots; inner sepals 3.2–4 by 2.8–3.4 mm. Petals orange-red when dry, glabrous except for the ciliate base, the longest one c. 16–16.5 mm long, minutely hairy at base along margin, further glabrous. Stamens: anthers 2.2 mm long. Ovary patent hairy; style glabrous in apical half; ovules 13. Fruit (immature) apically pointed; pedicel c. 10–12 mm.

Distr. Malesia: Borneo (Sarawak).


Shrub to tree, 3.5–23 m, 60 cm dbh. Twigs densely patent hairy, glabrescent. Axillary buds narrowly triangular, 1.5–3.5 mm long, hairy. Petiole 1.5–2.5(–3) cm, very densely patent hairy. Leaf-blade (5–)9–11 by (1–)1.5–3(–4) cm, base cuneate to rounded or slightly cordate, apex usually acutish; above dark green, shiny, beneath glaucescent-papillose, hairy mainly on midrib, secondary nerves c. 7 or 8 pairs, forming an indistinct intramarginal nerve or not; glands very numerous, scattered, c. 0.1 mm diam. Inflorescences unbranched, as long as the leaves; axes densely minutely patent hairy, some hairs up to 0.5 mm. Pedicel (9–)10–15 mm, minutely patent hairy. Sepals very sparsely minutely hairy outside, glabrous inside except at very base; outer sepals c. 2–2.5 by 2 mm; inner sepals c. 3–3.5 by 2–2.4 mm. Petals pinkish, when dry orange-red, glabrous except for ciliate base, the longest one 12.5 mm. Stamens: anthers 1.5–1.6 mm long, sparsely minutely hairy at base. Ovary nearly sessile, half-patent hairy, brownish pubescent; style glabrous in apical part; ovules 9–11. Fruit globose, c. 2.2 cm diam., light brownish, hairy; pericarp thin.

Distr. Malesia: Borneo (E. Sabah).


Shrub or small tree, up to 5 m, 10 cm dbh. Twigs very densely patent hairy. Axillary buds narrowly triangular, (1.5–)3–5 mm long, basally thickened.
Petiole c. 5 mm, densely hairy. Leaf-blade (6—)10—20 by (1.5—)2.5—9 cm, base cordate to rounded-attenuate, rarely cuneate, apex acutish; above green, midrib slightly sunken to flat; beneath glaucous-papillose, more or less densely hairy all over or only on nerves, secondary nerves (5 or) 6 or 7 pairs, not or only in apical part forming an intramarginal nerve; glands numerous, scattered, c. 0.1 mm diam. Inflorescences unbranched, shorter than the leaves, often curved downwards; axes sparsely minutely hairy (hairs up to 0.2 mm long); in basal part flowers with 3 together. Pedicel 2.5—5 mm, minutely densely hairy (hairs up to 0.2—0.3 mm). Sepals rather densely minutely hairy outside (hairs 0.1 mm), subglabrous inside, often with tiny, rather indistinct glandular spots; outer sepals 1.8—3 by 2.1—2.6 mm; inner sepals 2.7—4.3 by 2.7—3.5 mm. Petals (light) purple to rosa-violet, when dry orange-red, ciliate at base and apex, further glabrous, the longest one 11—12—(147) mm. Stamens: filaments free or 0.4 mm connate; anthers 0.9—1.4 mm long, glabrous to shortly hairy at base. Ovary subsessile or c. 1.5 mm stipulate, patently hairy; style glabrous in apical half; ovules 8—14. Fruit globular, 1.2—1.5 cm diam., usually with remnant of style, hairy; pericarp thin; pedicel curved.

Distr. Malesia: Borneo (Sarawak, Sabah, NE. Kalimantan).


Small tree, 2.5—15 m. Twigs very densely patently hairy (hairs up to 1 mm long). Axillary buds narrowly triangular, 4—6(—7.5) mm long, hairy. Petiole c. 5 mm, densely pubescent. Leaf-blade 7—19 by 3—5.5 cm, base obtuse to rounded, apex acutish; above dark green, midrib, secondary nerves and part of finer nervation sunken, midrib hairy at base; beneath green, smooth or indistinctly papillose, hairy on midrib and on basal part of nerves, secondary nerves c. 8 pairs (difficult to count), tertiary nerves strongly protruding, blade bulate in-between; finer nerves not strongly prominent; glands numerous, scattered, c. 0.1 mm diam. Flowers unknown. Inflorescences 0.8—4.5 cm long, unbranched; axes shortly sparsely hairy (hairs up to 0.25 mm long). Fruit globular, c. 1.5 cm diam., sessile, with remnant of style, hairy; pedicel 5—10.5 mm, minutely patently hairy (hairs up to 0.2 mm long). Seed 1; abortive ovules 11—13. 

Distr. Malesia: Borneo (Sabah).


Shrub or small tree, up to 12 m, 13 cm dbh. Twigs very densely patently hairy. Axillary buds ovate-oblong, (1.5—)2.5—5(—6) mm long, densely hairy. Petiole c. 4—7 mm, very densely hairy. Leaf-blade 11—31 by 3—9 cm, base cordate, covering upper side of petiole, apex acutish; above green, dull, hairy on the midrib; midrib distinctly sunken, rarely flat, secondary nerves and intramarginal nerve faintly sunken, rarely slightly prominent, venation little prominent; beneath glaucous-papillose, pubescent all over, secondary nerves c. 9(—12) pairs, forming a distinct intramarginal nerve; glands very numerous, scattered, c. 0.1 mm diam. Inflorescences unbranched, shorter than to as long as the leaves or sometimes with one side-branch at very base; axes very densely brownish patently pubescent (most hairs 0.5—0.8 mm long); flowers often turned upside-down. Pedicel 5—7 mm, very densely brownish hairy (hairs up to 1 mm long); pedicels of flower buds at first curved downwards, of open flowers turned upwards and often half-twisted, rarely straight, pedicels of fruits curved downwards again. Sepals very densely brownish pubescent outside (hairs up to 1 mm long); outer sepals 3.2—3.8(—4) by 2.7—3.2 mm; inner sepals 3.2—4.2(—5.6) by 3.2—4.2 mm. Petals pink, the upper ones with a yellow spot, when dry dark reddish, the longest one 13(—16) mm; carina glabrous to sparsely appressed hairy outside along central veins; other petals glabrous except for a few hairs at base, sometimes sparsely ciliate in basal part. Stamens: filaments free or 0.1—0.5(—1.5) mm connate; anthers 2.2—3.3 mm long, faintly hairy at base, ciliolate along slits. Ovary patently hairy; ovules 11—16. Fruit globular, c. 1.5 cm diam., densely hairy; pericarp rather thin; sepals subpersistent in fruit.

Distr. Malesia: Borneo (Sarawak, E. Sabah, Sarawak).


Axillary buds 0.8—1.5 mm long, minutely hairy, glabrous. Petiole 3—4 mm. Leaf-blade 10—20.5 by 4—5.5 cm, base cordate to cordate-truncate, apex distinctly acuminate; upper side dull, greyish green, midrib prominent, nervation rather obscure; beneath greenish, secondary nerves 8—10 pairs, rather indistinct, forming an indistinct intramarginal nerve in upper part, venation rather obscure; glands numerous, 0.2—0.3 mm diam. Inflorescences unbranched or with one side-branch, up to 8 cm long; axes angular, orange, rather sparsely appressed minutely hairy. Pedicel 4—4.5 mm, rather densely appressed minutely hairy. Sepals: outer sepals 2.7—3 by 1.8—2.2 mm, with rather distinct glands; inner sepals
3.5–4 by 2.7–3.2 mm. Petals whitish tinged with rosa, when dry reddish orange, the longest one 13 mm; carina outside glabrous to rather sparsely patently minutely hairy near base, near apex very sparsely appressedly hairy, further glabrous; other petals glabrous. Stamens: filaments 0.3 mm connate; anthers 1–1.2 mm long, glabrous at base, ciliate along slits. Ovary appressedly rather shortly brownish hairy; ovules 11. Fruit unknown.

Distr. Malesia: S. Sumatra (Lampang Distr.), one collection.


Shrub or small tree, 3–6 m. Axillary buds c. 1 mm long. Petiole 5–7 mm. Leaf-blade 4.5–13.5 by 1.9–5.3 cm, apex cuspidate; above greenish to reddish brown, dull, midrib sunken, hardly visible, nerves obscure to slightly protruding; beneath light greenish to reddish brown, secondary nerves c. 5 pairs, rather indistinct to slightly protruding, forming an indistinct intramarginal nerve, venation indistinct; glands rather few, near midrib, 0.3–0.4 mm diam. Inflorescences branched or unbranched, shorter than the leaves; axes glabrous, more or less smooth. Pedicel 8–15 mm, grooved, dark, glabrous. Sepals: outer sepals 1.8–2.1 by 2.4 mm; inner sepals 2.8–3 by 2.8 mm. Petals white with red spots, when dry reddish orange, the longest one 11–13 mm; carina shortly sparsely appressedly hairy outside, shortly hairy inside; other petals sparsely hairy outside near apex. Stamens: anthers c. 0.5 mm long. Ovary glabrous or with a few hairs; style very sparsely more or less appressedly hairy; ovules 8. Fruit unknown.

Distr. Malesia: NE. Sumatra (Sibolangit), 2 collections.


Tree, up to 12 m, 20 cm dbh. Twigs sparsely short- brately appressedly hairy, glabrescent; axillary region shortly densely appressedly hairy. Axillary buds mostly 3, inconspicuous, shortly densely appressedly hairy, the upper one 1–2 mm supra-axillary, sometimes more distinct and up to 0.8 mm long. Petiole 6–16 mm, appressedly shortly hairy. Leaf-blade 7–14 by 2.5–5 cm, apex shortly acuminate to cuspidate; above (greenish) brown, midrib sunken to slightly prominent; beneath reddish brown, sometimes glaucous, sparsely shortly hairy, secondary nerves 5–7 pairs, sometimes forming an indistinct intramarginal nerve; glands 0–2, mostly close to midrib, 0.2–0.4 mm diam. Inflorescences up to 10 cm long, with 2 opposite branches directly above base; axes densely appressedly shortly hairy; lower bracts of side axes opposite. Pedicel 2–2.5 mm, densely appressedly shortly hairy. Sepals sometimes with tiny glands; outer sepals 1.4–1.5 by 1.3–1.4 mm; inner sepals 2.1–2.2 by 2.2–2.3 mm. Petals white, when dry orange-red, glabrous inside, the longest one c. 6.5 mm; carina appressedly hairy outside; other petals sparsely hairy apically. Stamens: anthers 0.3–0.4 mm long. Ovary (sub)sessile, faintly ribbed, densely shortly appressedly hairy; ovules 4. Fruit globose, up to 2.2 cm diam., smooth, rather dull, brown, sparsely appressedly hairy; pericarp c. 4 mm thick, rather hard; pedicle up to 4 mm.

Distr. Malesia: Malay Peninsula (Perak; Trengganu; Fraser's Hill).


Shrub or tree, 3–20 m, up to 20 cm dbh. Twigs glabrous to minutely patently hairy, mostly soon glabrescent; axillary region shortly densely patently hairy. Axillary buds 2–4, usually less than 0.5 mm long, mostly very densely patently hairy, the upper one sometimes slightly supra-axillary. Petiole 3–9 (–11), exceptionally up to 14 mm, glabrous to shortly rather densely hairy in the upper groove, rarely (in some Sumatran coll.) shortly hairy all round; glands mostly indistinct. Leaf-blade rarely linear-lanceolate, (2.5–)3.5–15 (–18) by (1–)2–5 (–7) cm, apex acuminate to cuspidate; above sometimes slightly dullate between the secondary nerves, greyish green, midrib slightly sunken or sometimes flat to slightly prominent; beneath rather dull, mostly glabrous, yellowish green, secondary nerves 3–5 (or 6) pairs, forming a rather distinct intramarginal nerve; glands (0–)2–7 (–11), 0.1–0.3
**Polygalaceae** (van der Meijden) 525

(0.4) mm diam. Inflorescences solitary or with 2 together, mostly unbranched or sometimes with a few short side axes at base; axes angular to terete, minutely hairy; flowers solitary or in basal part with 3 together; bracts and bracteoles relatively long-persistent. Pedicel (1—)2—4(--7.5) mm, densely minutely hairy. Sepals: outer sepals 1.6—2.3 by 1.4—2.3 mm; inner sepals 2.6—3.6 by 2—3.3 mm. Petals: white, when dry yellowish, the longest one 7—8.5(--9) mm; carina mostly bent outwards in open flowers, thus exposing the stamens, rather densely appressed hairy outside, inside minutely hairy in apical part, ciliate in basal half; other petals glabrous to sparsely hairy outside at apex. Stamens: anthers (0.4—)0.5 mm long. Ovary (sub)sessile, more or less ribbed, more or less appressed hairy with hairs of different length; ovules 4. Fruit globose to broadly ellipsoid, sometimes irregularly 2—4-sulcate, 1.2—1.8 cm diam., more or less smooth to strongly hairy, light brown, velvety to densely hairy. 

Distr. S. Thailand; Malesia: Malay Peninsula (also Penang and Singapore), Sumatra.

**KEY TO THE SUBSPECIES**

1. Fruit with distinct warts arranged in longitudinal rows .................. a. ssp. eurhynchum
2. Fruit more or less smooth, transversely wrinkled or finely rugose or irregularly grooved
   b. ssp. maingayi


Fruit globose, 1.5—1.8 cm diam., strongly warty, densely appressed hairy between the warts. 

Distr. S. Thailand; in Malesia: Malay Peninsula (incl. Penang I.), Sumatra.


Fruit broadly ellipsoid, often irregularly formed, 1.2—1.5 cm diam., sometimes 2—4-sulcate, surface at lateral sides usually with depressions of irregular size or transversely wrinkled, sometimes finely rugose, very densely shortly velvety. 

Distr. S. Thailand; in Malesia: Malay Peninsula (incl. Singapore).


Shrub to small tree, up to 10 m. Twigs shortly densely patently to appressed hairy, rarely glabrous except for the densely hairy area above the leaf axil. Axillary buds 2 or 3, densely hairy, up to c. 0.5 mm long. Petiole (5—)7—11(--14) mm, usually not transversely wrinkled, densely minutely hairy all round, rarely hairy only in the upper groove, often with rather distinct prominent glands. Leaf-blade 10—30 by 3.5—13 cm, base rarely cordate; above often slightly bulate between the secondary nerves, mostly greyish green, midrib deeply sunken and mostly hairy in basal part; beneath yellowish green, rather dull, minutely hairy or rarely glabrous, secondary nerves 8—15 pairs, forming a distinct intramarginal nerve; glands (2—)3—14, often (very) close to the midrib, sometimes present only in upper part, (0.3—)0.5—0.7 mm diam. Inflorescences shorter than to ± as long as the leaves; axes strongly ribbed, flattened at base, densely minutely hairy; in basal part flowers with 3 together; bracts and bracteoles relatively long-persistent. Pedicels 2.5—7 mm, densely minutely patently hairy. Sepals: outer sepals 2.1—3 by 1.5—2.1 mm, sometimes with small glands; inner sepals 2.8—4 by 2.2—2.5 mm. Petals white to lilac, the upper ones with a yellow spot, when dry yellowish, the longest one 5.8—7.5(--8) mm; carina densely minutely hairy in apical part outside and inside; other petals sparsely hairy outside in apical part, lateral petals minutely hairy inside above insertion of filaments, upper petals rather densely patently hairy inside up to apex. Stamens: filaments connate over 0.5—2 mm or sometimes triadephous, sparsely minutely hairy in basal part to densely more or less patently hairy in middle part; anthers 0.4—0.5 mm long. Ovary patently to appressed hairy; style patently hairy in basal part, in apical half sparsely hairy to glabrous; ovules 4. Fruit more or less globular, up to c. 1.5 cm diam., verrucately ribbed to strongly tuberculate-warty, apically rounded or with the style scar sunken; pedicel 2—6 mm. 

Distr. Peninsular Thailand; in Malesia: Malay Peninsula (incl. Penang I.).


Shrub to small tree, up to 10 m. Twigs rather densely hairy in axillary area, further glabrous to sparsely minutely hairy. Axillary buds 2—4, up to 0.5 mm long, hairy. Petiole (12—)15—21(—27) mm, glabrous to sparsely minutely hairy, not transversely
w wrinkled, often with glands. Leaf-blade 12.5-40 by 4.5-12(-13) cm, base cuneate to rounded or cordate; above often slightly bulate between the secondary nerves, greenish to yellowish brown, midrib deeply sunken; beneath yellowish green, mostly glabrous, secondary nerves 12-20 pairs, forming a distinct intramarginal nerve; glands mostly numerous, scattered, 0.1-0.2 mm diam. Inflorescences sometimes also on older nodes, shorter than the leaves; axes strongly flattened basally, ribbed, densely minutely hairy; in basal part flowers with 3 together; bracts and bracteoles relatively long-persistent. Pedicel 2-4 mm, minutely hairy. Sepals: outer sepals 2.3-3.3 by 2.1-3.3 mm, often with glands; inner sepals 2.8-4 by 2.5-4 mm. Petals light purple, when dry pale yellow, the longest one 8.5-11.5 mm; carina sparsely minutely appressedly hairy outside, glabrous inside; other petals slightly hairy basally, further glabrous. Stamens: filaments connate over (0.5-)1-3 mm, rarely some filaments free; anthers 0.5-0.9 mm long. Ovary (sub) sessile, ribbed, appressedly hairy; ovules 4. Fruit ovoid, c. 2 by 1.5 cm, apically short but distinctly beaked, strongly verrucately ribbed; pedicel 3-5 mm, minutely hairy.

Distr. Malesia: Malay Peninsula.


Tree, up to 10 m, 10 cm dbh. Twigs very densely brownish patently hairy with a mixture of very small and long hairs. Axillary buds nearly completely covered by indumentum, narrowly triangular, possibly up to 2.5 mm long. Petiole 4-10 mm, very densely patently pubescent. Leaf-blade 5-24 by 1.5-8.5 cm, base obtuse to slightly cordate, apex obtuse to cuspidate; above greyish green to light brownish, midrib and nerves sunken, venation obscure; beneath colorless, rather densely patently pubescent, secondary nerves 5-8 pairs, forming a distinct intramarginal nerve; glands 2-8, up to 0.1 mm diam. Inflorescences unbranched or basally with a pair of side axes, shorter than to as long as the leaves; axes strongly, flattened and ribbed at base, densely rather shortly hairy, mixed with longer patent hairs; bracts and bracteoles small, relatively long-persistent. Pedicel 2.5-5.5 mm, ribbed, minutely densely patently hairy. Sepals: outer sepals 2.4-3 by 2.1-3.1 mm; inner sepals 3.4-3.8 by 2.9-3.5 mm. Petals purplish, when dry brownish orange, the longest one 7.5-10 mm; carina minutely hairy outside, inside minutely appressedly hairy in apical and basal part; other petals minutely patently hairy in apical part outside, upper petals inside glabrous to rather densely patently hairy. Stamens: filaments free or 1 mm connate, exserted from the carina in open flowers; anthers c. 0.5-0.7 mm long. Ovary more or less patently pubescent; ovules 4. Fruit (immature) shortly beaked or apicily rounded, verrucately ribbed.

Distr. Malesia: Malay Peninsula (Pahang, Johore).

2b. Subsection Eystathes

Twigs and inflorescence axes sometimes with minute nodal appendages. Axillary buds (2 or 3-5(-7), often all distant and supra-axillary. Seed(s) 1(-4); testa without a hard inner layer; albumen very thin; embryo without flattened areas near the base, radicle not exserted.


Tree, up to 30 m, 40 cm dbh. Axillary buds 0.8-1.6 mm long, faintly keeled. Petiole 6-10 mm. Leaf-blade 4-13.5 by 1.3-6.5 cm; above green; beneath light green, papillose, secondary nerves c. 6-8 pairs, forming an indistinct intramarginal nerve or not; glands rather numerous, scattered, c. 0.2-0.4 mm diam., basal glands c. 0.6-1.5 mm diam. Inflorescences up to c. 8 cm long; axes light brownish, slender, rather thinly minutely hairy; in basal part flowers with 3 together. Pedicel 2.5 mm, grooved, rather densely minutely more or less patently hairy. Sepals: outer sepals 2.4 by 2.1 mm; inner sepals 2.9 by 2.5 mm. Petals yellowish orange when dry, the longest one c. 7 mm; carina woolly hairy outside in apical half; other petals outside with a few hairs at apex and at base. Stamens: anthers 0.35-0.4 mm long. Ovary appressedly hairy; ovules 4. Fruit unknown.


Note. Part of the flowers of the type collection have abnormally developed ovules; these vary in number from 1-3 and they are placed basally in the ovary and have a distinct funiculus. The majority of the ovaries, however, contained 4 laterally inserted, sessile ovules.


Tree, up to 35 m, 65 cm diam. at 5 m. Nodal appendages extremely small, present on very short
straight ridges adjoining the insertion of the petiole. Axillary buds 0.5—1(—1.5) mm long, blackish, rather densely hairy. Petiole 7.5—10 mm. Leaf-blade 6—17 by 1.7—6.5 cm, base rounded to narrowly cuneate, margin slightly undulate, apex acutish to shortly acuminate; above yellowish green or brownish, midrib nearly flat to slightly protruding, sometimes at very base a little sunken; beneath glaucous-papillose, secondary nerves 5—8 pairs; glands 6—12, situated half-way between midrib and margin or near midrib, 0.3—0.5 mm diam., the basal ones mostly larger. Inflorescences about as long as the leaves; axes flattened at base, blackish, rather densely hairy; lower bracts (sub)opposite. Pedicel 3—4.5 mm, very densely more or less appressedly shortly hairy. Sepals shortly rather sparsely appressedly hairy outside, (sub)glabrous inside; outer sepals 2.2—2.9 by 2—2.8 mm; inner sepals 3.1—3.6 by 2.5—3.2 mm. Petals brownish orange when dry, the longest one 10—12.5 mm; carina shortly appressedly hairy outside along median veins, further glabrous outside. Stamens: anthers 0.3—0.4 mm long, sparsely hairy at base. Ovary subsessile, shortly appressedly hairy; style sparsely appressedly hairy at very base only, further glabrous; ovules 4. Fruit more or less apple-shaped, up to 8 cm diam., the very short pedicel enveloped by the pericarp; pericarp very hard, in mature fruit up to 3 cm thick when dry. Seed 1 (or '1—more' according to Ng, l.c.), up to 2 cm diam. 

Distr. Malesia: Southern half of Sumatra, Malay Peninsula.


Low shrub or small tree, 3—12 m, 18—20 cm dbh. Twigs often sparsely appressedly hairy when young, soon glabrescent. Nodal appendages bluntly conical to triangular, up to 0.2 mm long but often smaller. Axillary buds 2—3, up to 2 mm long, sessile or the upper very shortly stipitate, acutish, often distinctly keeled, more or less densely shortly hairy. Petiole 3—5 mm, ± indistinctly transversely wrinkled, brownish, often sparsely thinly hairy when young, glabrescent. Leaf-blade 5—14 by 1.4—4(—5.5) cm, margin more or less distinctly undulate, often a little incurved, apex acutish, rarely shortly acuminate; above yellowish green to brown, midrib flat to slightly prominent in apical half, in basal half with a central groove; beneath light yellowish or brownish, papilllose, midrib glaucous or sometimes sparsely appressedly hairy, secondary nerves mostly hardly distinct from finer veins, c. 8—14 pairs, not forming an intramarginal nerve; glands mostly numerous, 0.2—0.3 mm diam., but sometimes larger (up to 0.8 mm) and then of irregular form. Inflorescences mostly longer to much longer than the leaves, basally branched but sometimes seemingly unbranched if lower bracts resemble normal leaves; axes mostly distinctly flattened basally, rust-brown, more or less densely patently shortly hairy; in basal part flowers with 3—5 together, solitary in apical part. Pedicel 2—3.5 mm, ± densely patently shortly hairy. Sepals: outer sepals 1.7—2.2 by 1.5—2 mm; inner sepals 2.2—2.7 by 2—2.9 mm. Petals pinkish or white, the upper ones often with a yellow spot, when dry yellowish, the longest one 6—9 mm long; carina rather densely (woolly) hairy outside; other petals hairy at very apex. Stamens 8, rarely in some flowers 9; anthers 0.3—0.5 mm long. Ovary appressedly hairy; ovules 4. Fruit broadly ellipsoid to globular, 1.2—3.5 cm diam., mostly greyish brown; pericarp often wrinkled when dry, rather thick, soft. Seed(s) 1 or 2. 

Distr. Continental SE. Asia (Bangla Desh, Burma, Thailand, Cambodia, Laos, S. Vietnam); in Malesia: S. Sumatra (Palembang), Malay Peninsula (incl. Langkawi ls.). Ecol. Confined to streambanks and swamps. 

Note. A common species with the largest distributional area within this subsection, and little variation in its characters except in the size of the ripe fruit.


Shrub or small tree, 5—6 m. Axillary buds (2 or 3)—5, distant, the upper one 3—5(—15) mm supra-
axillary, usually shortly stipitate (stalk up to 3 mm), ± oblong, e. 1–2 mm long (excl. stalk), more or less acute. Petiole 3.5–4.5(–6) mm. Leaf-blade 4–8 by 1.5–3.5 cm, apex acuminate to cuspidate; above dark green; beneath glaucous-papilllose, secondary nerves c. (3–)7 or 8 pairs, not forming an intramarginal nerve; glands c. 6–8(–10), usually near midrib, 0.1–0.3 mm diam., basal ones somewhat larger. Flowers unknown. Inflorescences shorter than the leaves, unbranched; axes minutely hairy. Fruit (immature) globular, rather sparsely minutely appressedly hairy; pedicel 3–3.5 mm, minutely appressedly hairy. Seed (immature) 1; abortive ovules 3.

Distr. Malesia: S. Sumatra (Palembang, Lompang Distr.), 5 collections; insufficiently known species.


Tree, up to 30 m, 1 m dbh. Nodal appendages c. 0.1 mm long. Axillary buds 3–7, 0.5–1.6 mm long, the upper one (2–)3–10(–20) mm supra-axillary. Petiole (5–)6–12 mm, often in apical part with small, usually not protruding glands. Leaf-blade (6.5–)10–23 by 2.5–7.5 cm, margin slightly undulate, often somewhat irregular, apex acutish; above dark or greyish green, midrib prominent to flat, in basal part with a central groove; beneath usually brownish to yellowish green, smooth to papilllose, secondary nerves 7–10 pairs, forming an indistinct intramarginal nerve; glands either 0–3 (or 4) and often of an irregular form, or numerous and 0.1–0.2 mm diam., basal glands larger. Inflorescences usually 2 per leaf axil, 5–20 mm supra-axillary, as long as or longer than the leaves, much-branched, the basal branches 1–3 together; axes flattened basally, sparsely minutely hairy at the nodes with minute appendages; flowers 1–7 together; lower bracts opposite. Pedicel 2.5–5.5 mm, minutely patently to appressedly hairy, sometimes subglabrous. Sepals: outer sepals 1.4–2.2 by 1–1.9 mm; inner sepals (1.9–)2.3–3.3 by 1.6–3.5 mm. Petals white or pinkish, the upper ones with a yellow spot, when dry yellowish orange, the longest one 6.5–11 mm; carina sparsely to densely appressedly hairy outside, inside sparsely hairy in apical part; other petals glabrous or sparsely hairy at apex. Stamens: anthers 0.3–0.5 mm long. Ovary appressed hairy; style rarely only basally hairy; ovules 4. Fruit glabular, c. 1.5 cm diam., smooth, dull, greyish, appressedly hairy apically; pericarp rather thick; pedicel 4–6 mm (see note).

Distr. Continental SE. Asia (Bangla Desh, Burma, Thailand); in Malesia: Malay Peninsula (Kelan- tan, Perak).

Ecol. Outside Malesia in (usually submontane) monsoon forest.

Notes. The Malayan collections are either sterile or only in fruit; as they have longer pedicels, they may not belong to this species.

In some collections all flowers examined had 7 stamens only; instead of 2 carinal stamens only a single one is present in those flowers.

II. Subgenus Coriaceum


Nodal glands distinct, c. 0.3 mm diam. Axillary buds indistinct when resting. Leaf-blade: tertiary nerves coarsely reticulate, sometimes partly scalariform. Inflorescences inserted in older nodes, unbranched, few-flowered, axes up to 1.5 cm, with minute nodal glands. Sepals glabrous except for ciliate margin. Petals glabrous in apical half out- and inside, lateral petals and carina spoon-shaped, upper petals narrower. Stamens monadelphous. Ovary glabrous; style glabrous; stigma peltate; ovules 8–12. Fruit indehiscent, stipitate, ± glabular, apically pointed, 1.2 cm diam. Seed 1; testa 2-layered, less than 0.1 mm thick inner layer hard; albumen forming a rather distinct, thin layer which is very thin at lateral sides of cotyledons; embryo more or less glabular, green, plumule undifferentiated, radicle exserted.
Fig. 22. *Xanthophyllum ramiflorum* MEIJDEN. *a–b.* Habit, ×0.7; *c.* base of leaf with glands, ×2; *d.* part of twig with axillary bud; *e.* flower; *f.* flower, longitudinal section, gynoecium removed; *g.* lower petal; *h.* gynoecium; all ×4; *i.* ovary, longitudinal section, ×8 (S 16051).

Tree, up to 30 m, 27 cm dbh. Axillary buds 2, very indistinct when resting, apparently sunken into the tissue of the twig, the upper one when bursting with 2 broadly ovate c. 1.5 mm long persistent scales. Petiole (5)—8—12 mm. Leaf-blade coriaceous, 7—20 by 3—8 cm, apex obtuse to subacute; above brownish, midrib slightly sunken to flat; beneath pale glaucous-papillose, secondary nerves 8 pairs, not forming an intramarginal nerve; glands numerous, c. 0.3 mm diam. Inflorescences solitary or up to 9 together in the axils of the lower leaves and those of the already fallen ones, 1—10-flowered; axes up to 1.5 cm long, thin, glabrous; nodal glands very indistinct; bracts small, scale-like. Pedicel 8—10 mm, glabrous. Sepals dark reddish when dry; outer sepals c. 4—4.2 by 2.6 mm; inner sepals 4.5—4.8 by 3—3.3 mm. Petals white, the upper ones with a purple mark, when dry yellowish, minutely patent hairy in basal half outside and inside, further glabrous; carina like the lateral petals but a little shorter; lateral petals 7.5—8.5 by 7 mm; upper petals up to 7 by 2 mm. Stamens 8, exceptionally 7, up to c. 5 mm long; filaments connate over c. 1.5—2 mm, densely shortly patent hairy up to about halfway; anthers c. 0.7—0.8 mm long, minutely ciliate, very shortly hairy at base. Ovary light brownish, glabrous; style c. 5 mm, glabrous; stigma peltate, oblique, rather large; ovules 8—12. Fruit stipitate, ± global, up to 1.2 cm diam., pustulate, dull, reddish brown, the style-scar more or less protruding and excentr.

Distr. Malesia: Borneo (Sarawak, Brunei).

Ecol. Confined to the lowland 'padang' peat-swatmp forest on a very poor, sandy, wet soil.

III. Subgenus Triadelphum


Nodal glands usually distinct, 0.3—0.7 mm diam. Axillary buds seemingly single, small, the scales usually not fully covering the bracts of young inflorescences, 0.4—1 (1.5) mm long. Leaf-blade: tertiary nerves coarsely reticulate. Inflorescences unbranched, axes slightly angular, dark, glabrous to sparingly hairy, with usually distinct nodal glands. Sepals glabrous outside, usually minutely hairy inside. Petals (sub)glabrous outside, lateral petals and the somewhat short carina spoon-shaped, upper petals narrower. Stamens triadelphous, connate parts c. 3—4 mm high. Ovary usually black, glabrous; style glabrous or hairy; stigma peltate; ovules 8—14. Fruit indehiscent, usually stipitate, 1—2 cm diam. Seed 1; testa 2-layered, c. 0.2 mm thick, inner layer c. 0.1 mm thick, hard; albumen copious, (nearly) separated into 2 halves; embryo flat, nervet, green, plumule undifferentiated, radicle exserted.


Shrub or tree, up to 30 m, 40 cm dbh. Twigs glabrous to minutely hairy. Petiole (4)—5—7 cm, glabrous to minutely hairy. Leaf-blade 5—20 by 2—7 cm, margin often irregular, sometimes shallowly cre- nate because of glands; above usually brownish, midrib narrowly sunken; beneath more or less concolorous, secondary nerves 5—9 pairs, forming a rather distinct intramarginal nerve; glands rather num- erous, c. 0.4—0.8 mm diam., scattered but at least 8 present on the leaf margin itself, other glands
Fig. 23. *Xanthophyllum ellipticum* Korth. *ex* Miq.  

- **a.** Habit, x 0.5;  
- **b.** Flower and inflorescence axis;  
- **c.** Flower, longitudinal section, gynoecium removed;  
- **d.** Carina with two stamens enclosed;  
- **e.** Gynoecium;  
- **f.** Ovary, longitudinal section, x 6;  
- **g.** Part of twig with young inflorescence, x 4.5 (S 25564).
Flora Malesiana [ser. I, vol. 10^3


Tree, 25 m. Older nodes usually with a cluster of adventitious buds. Petiole 5–7 mm, not transversally wrinkled, more or less smooth. Leaf-blade 8–15 by 3–6 cm; above green, midrib sunken; beneath concolorous, secondary nerves 5 or 6 pairs, not forming an intramarginal nerve; glands present only in apical half of the leaf-blade, c. 0.2 mm diam., scattered but up to 6 present on the leaf margin itself, other glands c. 8–12. Inflorescences up to 4 cm long; nodal glands rather distinct. Pedicel 5–7 mm, rather sparsely minutely woolly hairy. Sepals sparsely minutely hairy inside; outer sepals 4 by 2.5 mm; inner sepals 4.9 by 2.4 mm. Petals brownish orange when dry, the longest 7.5 mm; carina inside in middle part shortly appressedly sparsely hairy; other petals inside densely appressedly shortly hairy. Stamens triadellous; filaments densely rather shortly hairy; anthers 0.6 mm long, sparsely hairy at base, ciliolate along slits. Ovary shortly stipitate, slightly pustulate; style rather densely shortly more or less patent (± woolly) hairy; ovules 13. Fruit globular, c. 1.5 cm diam., smooth, dark reddish; pericarp thin; pedicel 7–9.5 mm.

Distr. Malesia: Central Celebes (Malili), one collection.


Tree, up to 30 m, 60 cm dbh. Nodal glands elliptic, 0.3–0.6 mm long. Petiole 3.5–5 mm, indistinctly transversely wrinkled. Leaf-blade (4–)6–9 by 1–2.5(–3.5) cm, apex gradually acuminate; above brownish green, midrib sunken; beneath concolorous, secondary nerves c. 6–8 pairs, forming an intramarginal nerve; glands (2–)4–8(–15), present in middle and apical part, absent from margin itself but (in Sumatran coll.) rather close to the margin, or (in Bornean coll.) rather closely together and not near the margin, 0.3–0.6 mm diam. Inflorescences up to 3 cm long; nodal glands elongate, usually very distinct. Pedicel c. 5 mm, sparsely minutely woolly hairy. Sepals minutely hairy inside; outer sepals c. 3.1 by 2.3 mm; inner sepals 3.5–4.3 by 2.3–2.8 mm. Petals yellowish brown when dry, the longest one 6–6.5 mm long; carina inside minutely hairy above base, upper petals minutely hairy inside. Stamens: filaments minutely hairy in basal part; anthers 0.6 mm long, glabrous. Ovary 0.5–0.7 mm stipitate, glabrous; style glabrous or only at base very sparsely minutely hairy; ovules 8–12. Fruit globular, up to 0.9 cm diam., yellowish to greenish brown, smooth, dull; pericarp thin; pedicel 4–5.5 mm.

Distr. Malesia: Sumatra (near Lake Toba), Borneo (Sabah: Mt Kinabalu).

Ecol. Submontane rain-forests, 900–1600 m.


Tree, flowering on older twigs from adventitious axillary buds. Nodal glands indistinct, elongated. Petiole 9–10 mm. Leaf-blade 14–20 by 6.5–8 cm, apex obtuse to very shortly acuminate; above yellowish green, midrib protruding; beneath: secondary nerves 8 or 9 pairs, not forming an intramarginal nerve; glands c. 12–18, mostly at 2–5 mm from the margin, some scattered, 0.2–0.3 mm diam. Inflorescences up to 4 cm long; nodal glands present but very indistinct. Flowers unknown. Fruit (immature) c. 3 mm stipitate, ovoid, c. 2 by 1.2 cm, more or less fleshy, finely pustulate, light reddish, glabrous; pericarp hard; pedicel 5–6 mm, glabrous. Seed 1 (sub)apical, developing from one of the 12 opposite ovules which are situated only in the apical half of the young fruit.

Distr. Malesia: Borneo (Sarawak, Brunei).

68. Xanthophyllum hildebrandii MEIJDEN, Leiden Bot. Ser. 7 (1982) 139, f. 10B.

Pedicel c. 6 mm, not transversally wrinkled. Leaf-blade c. 15 by 5–7 cm, papery thin; above dull, midrib sunken; beneath reddish brown, secondary nerves c. 7 pairs, in apical half forming a rather indistinct intramarginal nerve; glands numerous, mostly situated very close to midrib and a few scattered, 0.5–1.1 mm diam. Inflorescences 1 or 2 together; nodal glands distinct; axes up to 10 cm long, sparsely shortly woolly hairy. Flowers unknown. Fruit (very young) c. 2.5 mm stipitate, ovoid, apically with gland-like pustules, black, glabrous; pedicel 7–10 mm, dark, minutely woolly hairy. Seed (immature)
1. (sub)apical, developing from one of c. 12 ovules situated in apical 2/3 part of the fruit.

Distr. Malesia: Borneo (Sabah: Mt Kinabalu, Dallas), one collection only.

Note. Dedicated to the late Mr. F.H. Hildebrand who cleverly recognized many inadequate specimens of the genus by means of macroscopical characters of the wood of the twigs.

IV. Subgenus Exsertum


Presence of nodal glands uncertain. Axillary buds 2(–4), usually seemingly single, black when dry. Leaf-blade: tertiary nerves coarsely reticulate. Inflorescences unbranched, up to 6–8 cm long, axes slightly angular, black when dry, rather sparsely woolly hairy, sometimes with indistinct nodal glands. Sepals nigrescent. Petals (sub)equal, spathulate-lanceolate, apex flat, (sub)glabrous outside, densely lanately ciliate. Stamens: filaments free, longer than petals, rather densely woolly hairy. Ovary black when dry, hairy inside, outside glabrous or hairy; stigma small, bilobed; ovules 8–16. Fruit indehiscent, globular, 2–6 cm diam., black when dry. Seeds c. 4–12, more or less bean-shaped, testa with rather thick and soft, fibrous outer layer and a hard inner layer; albumen copious, (nearly) separated into 2 halves; embryo flat, elliptic, nervous, plumule undifferentiated, radicle exserted.


Tree, up to 25 m, up to 70 cm dbh. Petiole 6–7 mm, black, sometimes glaucous. Leaf-blade 4.5–11 by 2–5.5 cm; above olive-green, midrib narrowly sunken, nervation mostly rather indistinct; beneath reddish olive-green, secondary nerves c. 7–9 pairs, forming an indistinct intramarginal nerve, glands 10–14, sometimes more, mostly ± halfway between midrib and margin, or near the margin, 0.1–0.3 mm diam., basal ones c. 0.3–0.4 mm diam. Pedicel 8–11 mm, rather sparsely shortly lanate. Sepals sparsely minutely hairy outside, rather densely shortly lanate. Sepals sparsely minutely hairy outside, rather densely shortly hairy inside; outer sepals 3.5–5.5 by 3.5–4 mm; inner sepals 5–7.5 by 4–5 mm. Petals 14–16 mm long, white, when dry dark reddish, rather sparsely hairy outside, subglabrous inside. Stamens: filaments 17–22 mm, glabrous at very base, further densely woolly hairy; anthers 1–1.3 mm long, hairy from base to apex. Disk densely hairy, with a small number of patent hairs on upper and lower lobes. Ovary very densely (velvety) hairy; style rather sparsely woolly hairy; ovules 10–16. Fruit (immature) c. 2 cm diam., shortly stipitate, finely pubescent, dark, distinctly bluish-waxy, hairy; pericarp c. 1–4 mm thick; pedicel slender, c. 15–18 mm.


Tree, up to 35 m, up to 80 cm dbh. Axillary buds 2 or 3, the upper one up to 2 mm long. Petiole 4.5–10.5 mm. Leaf-blade 4–14 by (1–)2–7 cm; above deep brown to reddish brown, midrib narrowly sunken, nervation rather obscure to rather distinct; beneath somewhat waxy, secondary nerves 5–7, not forming an intramarginal nerve; glands 6–10(-20), scattered, 0.1–0.4(–0.5) mm diam. Pedicel 8–15 mm, rather densely minutely lanate. Sepals: outer sepals 2.5–3 by 1.8–2.2 mm, minutely rather densely hairy at both sides; inner sepals 4–4.5 by 1.8–2.4 mm, hairy outside along midrib, inside densely hairy at base, further more or less glabrous. Petals (8–)9–11(–12) mm long, white (‘3 lower with yellow centre’; HAVILAND 2112), when dry dark reddish, glabrous outside, inside lanate especially in basal and apical part. Stamens: filaments 11–13(–16) mm; anthers 0.7–0.9 mm long, glabrous or with a few hairs at base. Disk glabrous. Ovary stipitate, (glabrous? or) densely lanate; style lanate; ovules 8–16. Fruit globular or less often ovoid, up to c. 5 cm.
Fig. 24. *Xanthophyllum suberosum* C.T. White. a. Habit, × 0.7; b. part of twig with axillary buds; c. flower; d. flower, longitudinal section, gynoecium removed; e. lower petal; f. gynoecium; all × 2; g–h. ovary, longitudinal and cross section, × 4 (van Royen 3201).
Leaf-blade densely to glabrous, unbranched, forming 0.5–1.5 mm. Ovary densely lanate or rarely (sub)glabrous; style glabrous in upper half; ovules 8–12. Fruit c. 2–6 cm, often apparently sterile, shortly to long-stipitate, black, often waxy, glabrous or hairy; pericarp 0.5–1.5 cm thick; pedicel up to c. 1.5 mm. Seeds c. 4–12.

Distr. Malesia: Malay Peninsula, Central Sumatra, Borneo.

KEY TO THE VARIETIES

1. Filaments forming a 'tube' by their intertwined hairs. Ovary (sub)glabrous .... b. var. glabrum

1. Filaments free, hairy. Ovary densely lanate

a. var. stipitatum

1. Filaments forming a 'tube' by their intertwined hairs. Ovary glabrous or with a few appressed hairs; style thinly hairy basally.

Distr. Malesia: Malay Peninsula (incl. Singapore), Central Sumatra, Borneo.


V. Subgenus Brunophyllum


Nodal glands usually distinct, c. 0.3–0.5 mm diam. Leaf-blade: tertiary nerves coarsely reticulate. Inflorescences unbranched. Sepals glabrous to minutely hairy outside, usually woolly-ciliate, usually minutely hairy inside. Petals unequal with the carina boat-shaped, or equal, (sub)glabrous outside. Stamens 8 (–10), filaments free or up to 6 mm connate, densely woolly hairy. Ovary glabrous to hairy; style glabrous or hairy at base; stigma peltate; ovules 8–18 (–23). Fruit indehiscent, pear-shaped to ovoid, large. Seeds 8–more, large; testa 2-layered, outer layer usually thick (thin in 76 X. chartaceum), soft, inner layer hard; embryo broadly triangular-ovoid and with little albumen, to flattened-ovoid and covered by much albumen; cotyledons cordate, usually seemingly peltate (except in 72. X. brevipes), plumule usually differentiated into a number of small scales, radicle fully enveloped by the cotyledons or just exerted at base.
72. *Xanthophyllum brevipes* MEIJDEN, Bot. J. Linn. Soc. 67 (1973) 117; Leiden Bot. Ser. 7 (1982) 144. — Fig. 25.

Tree, up to 35 m, 40 cm dbh. Twigs (sometimes?) all curved downwards, pendent. Nodal glands often indistinct. **Petiole** 1.5–3 mm. **Leaf-blade** 2.6–7.5 by 0.7–2.6 cm, apex acuminate to cuspidate; above brown to olive-green, midrib sunken; beneath olive-greenish brown, papillose, secondary nerves c. 10 pairs, little more distinct than finer nerves, forming an indistinct intramarginal nerve; glands more than 10, in a row between margin and midrib, c. 0.1 mm diam. **Inflorescences** 2–5-flowered; axes hardly thicker than pedicel, glabrous. **Pedicel** c. 1 mm, glabrous. **Sepals** minutely ciliate, further glabrous; outer sepals c. 3.5 by 3.5 mm; inner sepals c. 4 by 4.5 mm. **Petals** unequal, white, when dry orange-brown, faintly ciliate, the longest one 15–16 mm; carina unguiculate, boat-shaped, ciliate only at base; lateral petals narrowly boat-shaped; upper petals more or less straight, with cup-shaped apex. **Stamens**: filaments c. 0.5 mm connate, rather densely shortly hairy in basal part; anthers c. 1 mm long, glabrous. **Ovary** shortly stipitate, orange-brown, glabrous; style glabrous; ovules 18. **Fruit** pear-shaped (to broadly ovoid?), up to 4 cm diam., strongly wrinkled when dry, shiny, brown; pericarp probably very fleshy; pedicel 12–15 mm, blackish, shiny. **Seeds** more than 10, flattened-ovoid, c. 1 cm long; albumen nearly absent from lateral sides of cotyledons, at the broad side of these forming a layer equal in thickness to each cotyledon; embryo elliptic in side view, transversally flattened, cordate at base; cotyledons thickened; plumule not differentiated; radicle slightly exserted.

**Distr. Malesia**: Borneo (Sarawak, Brunei).

**Note.** Ashton mentioned in a fieldnote that the habit of the tree is very reminiscent of old specimens of *Salix babylonica* because of its pendant twigs.

Tree, up to 47 m, 70 cm dbh. Twigs often strongly thickened on the nodes and with adventitious buds. Nodal glands usually distinct, sometimes elongate, c. 0.5 mm diam. *Pentiole* 5–11(-15) mm. *Leaf-blade* (4-)7.5-17 by (1.5-)3.5–9 cm, apex rounded to obtuse or sometimes very shortly acuminate; above dark or greyish red-brown, rarely green, midrib flat to protruding; beneath concolorous or darker than above, midrib prominent or flat, secondary nerves c. (3-)6–9 pairs, sometimes in upper part forming an intramarginal nerve; glands 2–16, usually situated near or on the margin of the leaf, (0.2-)0.5–0.7 (-1.2) mm diam. *Inflorescences* sometimes also on the older nodes, shorter than the leaves; axes angular, black, glabrous to sparsely shortly lanate. *Pedicel* 3–11 mm, glabrous to sparsely hairy. *Sepals* black; outer sepals 2.8–5.5 by 2.8–6 mm; inner sepals 4–7.5 by 3.5–7 mm. *Petal* unequal, white or purple, the upper ones with a yellow or green spot, when dry black, inside glabrous or rather densely woolly hairy above insertion of filaments and at apex, the longest one 14–19 mm; carina boat-shaped, 9.5–16 mm long; lateral petals more or less spathulate, distinctly longer than upper petals and carina; upper petals more or less linear, flat to slightly channelled, curved upwards. *Stamens* 7.5–12 mm long; filaments connate for (0.1-)1–3 mm, glabrous in basal part, free parts of filaments lanate in basal part, hairs often intertwined, thus forming a filamental "tube", glabrous upwards; anthers 0.7–1.7 mm long, glabrous to minutely hairy, freely or attached to each other around the stigma. *Ovary* black, glabrous; style black, glabrous; ovules 8–18. *Fruit* globular, very large, the largest up to 14 cm diam., dull pinkish brown, with numerous small dark spots; pericarp 0.5–2 cm thick. *Seeds* 8–16, sticking together in drying like a ball, each c. 2–6 cm wide; testa 2-layered, outer layer thick, soft, fibrous, inner layer c. 0.1 mm thick; albumen nearly absent, usually visible only at base; embryo thick, triangular in side view, plumule and radicle situated in the very centre of the embryo, the plumule differentiated into a number of decussate scales; cotyledons seemingly peltate, peripherally without vessel-like elements; top of radicle hardly exerted at base.

**Distr.** Solomon Islands; in *Malesia*: New Guinea (incl. Fergusson I. in E, and Salawati, Numfoor, Japen & Mios Waar Is. in W), Moluccas (Ceram), Central Celebes (Palopo).

**Note.** In a number of collections all flowers examined have 9 stamens: 3 instead of 2 stamens are placed before the adaxial petal.

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Fig. 26. *Xanthophyllum papuanum* WHITM. ex MEIJDEN. a. Habit, ×0.7; b. flower and part of inflorescence axis; c. flower, longitudinal section, gynoecium removed; d. lower petal with three stamens; e. gynoecium; all ×4; f. ovary, longitudinal section, ×8 (HOOGLAND 5072).

Tree, up to 25 m, 16 cm dbh. *Petiole* (1.5—)4—6.5 mm. *Leaf-blade* (ovate-)oblong, (3—)7—17 by (1—)2.8—7 cm, apex acuminate to cuspidate; above dark reddish brown to dark olive-green, midrib slightly prominent to flat, or sunken in basal part; beneath concolorous, secondary nerves 5—7 pairs, forming a rather indistinct intramarginal nerve; glands 0—8, situated in middle and apical part, (0.1—)0.2—0.4 mm diam. *Inflorescences* (much) shorter than the leaves; axes lanate; flowers solitary or in basal part with up to 3 together. *Pedicel* (1.5—)3—4 mm, dark, sparsely lanate. *Sepals* black when dry; outer sepals (3—)4—5.5 by (1.5—)2.5—3.5 mm; inner sepals (3.5—)6—7 by (1.5—)2.4—5 mm. *Petals* subequal, 9.5—12 mm long, white, the upper ones with a yellow spot, when dry nearly black, ciliate to apex, inside hairy above insertion of filaments. *Stamens* 8(—10): filaments connate over c. 5—6 mm, glabrous at base, upwards densely (woolly) hairy; anthers 0.5—0.65 mm long, glabrous to sparsely woolly hairy at base. *Ovary* stipitate for 2.5—3 cm, dark, glabrous or with a few rather long hairs; style glabrous to rather sparsely lanate; ovules 12—18 (—23). *Fruit* ellipsoid, up to 11 by 6 cm, attenuate at base and apex, often more or less smooth, orange to dark brown; pericarp rather soft, c. 0.5 mm thick. *Seeds* 8 or more, like those of 74. *X. papuanum*, but albumen forming a thin layer along outer side of the cotyledons.

**Distr. Malesia:** Borneo (Sarawak, Sabah, Kalimantan).


Tree, up to 30 m, 1 m dbh. *Petiole* 3—4 mm. *Leaf-blade* 4.5—11.5 by 2—4.2 cm, papery thin, base nearly cordate to cuneate, apex acuminate to cuspidate; above very dark green, midrib flat to slightly prominent; beneath ± glabrous, concolorous, secondary nerves c. 5—7 pairs; glands very few, up to 3, c. 0.1 mm diam., very indistinct. *Flowers unknown. Infrutescences* short; axes black, glabrous. *Fruit* globular to more or less pear-shaped, up to 8.5 cm long, strongly wrinkled; when dry black, probably glabrous; pericarp rather thick, hard. *Pedicel* c. 5 cm, black, glabrous. *Seeds* 8 or more, like those of *X. papuanum*, but both layers of the testa much thinner, and albumen forming a thin layer along the outer side of the cotyledons.

**Distr. Malesia:** Malay Peninsula, Central Sumatra (Indragiri).

**Note.** Because of its thin nigrescent leaves with few laminar glands, its habit is atypical in *Xanthophyllum*. As its flowers may be atypical too (*i.e.* in being possibly 'regular'), flowering material may have been collected already but identified wrongly.

**Excluded**

*Xanthophyllum glaucescens* MIq. Fl. Ind. Bat., Suppl. (1861) 394; Ann. Mus. Bot. Lugd.-Bat. 1 (1864) 274, has been identified by HILDEBRAND and KOSTERMANS as *Litsea insignis* (BLUME) BOERL. (*Lauraceae*).


*Xanthophyllum subglobosum* ELMER, Leaff. Philip. Bot. 5 (1913) 1676, incl. var. *longifolium* ELMER, was identified by MERRILL, En. Philip. 2 (1923) 485 as *Siphonodon celastrinus* GRIFFITH (*Celastraceae*); DING HOU, Fl. Males. I, 6 (1964) 395.

**Excluded**

*Semeiocardium* ZOLL. Nat. Tijd. Ned. Ind. 17 (1858) 245, the type of a monospecific genus, was by ZOLLINGER assigned to *Balsaminaceae*, but later referred to *Polygalaceae* by HASSKARL (in MIQ. Ann. Mus. Bot. Lugd.-Bat. 1, 1863, 142). Still later CHODAT reduced it to *Polygala triphylla* (Monogr. I, 1891, 41). BACKER (Gard. Bull. S. S. 9, 1938, 70) showed that ZOLLINGER was correct.