

THE GENUS *ALOCASIA* (ARACEAE) IN AUSTRALASIA*

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SUMMARY

The genus *Alocasia* (Araceae) is revised for Australasia. Thirteen species are recognised and keyed; eleven are endemic to and one is thought to be introduced to and escaped in Papuaia; *A. brisbanensis* (F.M. Bailey) Domin is endemic to Australia, and is redescribed; five are new to science. The genus *Xenophya* Scott is reduced to synonymy with *Alocasia* and the new combinations *A. brancifolia* (Scott) A. Hay and *A. lauterbachiana* (Engler) A. Hay are made. Infrageneric groups (incl. *Xenophya*) are informally erected. Variation in shoot architecture is discussed. Line drawings are provided of previously unillustrated or obscurely illustrated species. Distributions are partly mapped. It is noted that the aroid crop plants *A. macrorrhizos* (L.) G. Don and *Cyrtosperma merkusii* (Hassk.) Schott, on the one hand, and *Amorphophallus paeoniifolius* (Dennst.) Nicolson and *Colocasia esculenta* (L.) Schott, on the other, have markedly different patterns of distribution in Australasia, suggesting two waves of eastward dispersal. Species of *Alocasia* recently cited as host-plants in the protologues of several spadicicolous species of Diptera Drosophilidae and Neurochaetidae are redetermined.

INTRODUCTION

Although it is a genus of major horticultural importance, and of some agricultural significance in the eastern tropics, *Alocasia* has received only sporadic botanical attention since Krause's monograph contributing to Engler & Krause's account of the Araceae-Colocasioideae (1920). Regional synopses or flora accounts in greater or lesser detail have been provided for the Philippines (Merrill, 1923), Peninsular Malaysia (Ridley, 1925), Java (Backer & Bakhuizen van den Brink Jr., 1968), Thailand (Hu, 1968; Suvatti, 1978), Fiji (Nicolson, 1979) and Ceylon (Nicolson, 1987). A significant contribution was made by Furtado (1941) who elucidated most of the substantial nomenclatural and taxonomic tangle associated with *A. macrorrhizos* (L.) G. Don and *A. indica* (Lour.) Spach. Nicolson (1968) revised the genus *Xenophya*, endemic to Papuaia, and unravelled nomenclatural problems arising out of the misdescription of *Xenophya* by Schott and its subsequent placement in the subfamily Aroideae. Engler published the genus *Schizocasia* in 1880 (earlier appearances did

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not constitute valid publication, as the authors did not accept the genus (see Nicolson, 1968), and subsequently (Engler & Krause, 1920) included in it a heterogeneous assortment of species with divided leaves. Nicolson (1968) pointed out that the type species, *S. acuta* Engler, was conspecific with, and postdated, *X. brancifolia* Schott, and transferred or replaced the remaining species into *Xenophya* and *Alocasia*. However, new evidence does not permit *Xenophya* to be maintained as a genus separate from *Alocasia*. Elmer (1938, 1939, Philippines) and Hotta (1967, Borneo) have described new species without keys. Writers of numerous local accounts (see below under *A. brisbanensis*) have misidentified the species in Australia. Burnett (1984) provided an illustrated account of the genus in cultivation.

The Australasian Region here circumscribed includes land areas east and south-east of, but excluding, Sulawesi, as far as, and including, the Solomon Islands and New Zealand. Specimens have also been examined from Polynesia and Micronesia. The treatment of the Moluccas is incomplete, including only those species which also occur in New Guinea. Other material from the Moluccas requires critical comparison with material from the Philippines, Borneo, Sulawesi, and Java, which is beyond the scope of this work. The number of Moluccan species and specimens is small, and hence the inclusion criterion of commonality with New Guinea does not greatly detract from the usefulness of this review, though it should be understood that the key to species does not lead to correct identification for all Moluccan material.

Most of the botanical exploration of New Guinea has taken place since 1920 (Frodin & Gressitt, 1982). The collections made by Leonard Brass on the Archbold expeditions from the mid 1920s to the late 1950s, by Carr in the '30s, by various collectors in the NGF (and later LAE) series of the Division of Botany, Lae (founded in 1946) by Australian CSIRO collectors, collectors from Bogor and the Rijks-herbarium, and by numerous other botanists were not worked on by any specialist in Araceae until Nicolson began in the 1960s. It is, therefore, not surprising that a substantial proportion of the aroid flora of New Guinea is new, with, for example, over a third of the species of *Alocasia* described here for the first time and over half the species of *Cyrtosperma* described recently (Hay, 1988a). The present task, therefore, is 'alpha' taxonomy.

Aroids make notoriously bad herbarium specimens, and *Alocasia* makes amongst the worst. It comes to seem a matter of good fortune if more than one collection in twenty has analyzable floral structures. What collectors do not leave out and mounters do not entomb in glue, beetles are apt to remove. Field work and the assembly of a living collection have consequently been essential. Nevertheless, in the descriptions here, while there may be quite a number of collections cited, details of reproductive structure may be derived from only one or two collections preserved in spirit or observed by us in the fresh state. From there it follows that there simply is not available the multiplicity of evidence required convincingly to demonstrate disjunction between very closely related very similar species (see, therefore, the synonymy of *A. aequiloba*).

This account forms a contribution toward a monograph of the genus, where the general aspects of its biology, geography, infrageneric taxonomy, and suprageneric relationships will be discussed in more detail. Provisionally, however, the Australasian species fall into five groups, of which three are endemic. Informally, they are:

- 1) The montane 'Exaltatae group' of which *A. nicolsonii* A. Hay is a highly variable New Guinea species with deliquescent leaf sheaths, a striking characteristic shared with the diminutive *A. wentii* Engler & Krause. It sets these species aside from all others known in the genus. Renewal growth is sylleptic (see below), ovules are anatropous to hemianatropous, and the spathe limb opens wide at anthesis and deliquesces afterwards.
- 2) *Alocasia brancifolia* (Schott) A. Hay, *A. lauterbachiana* (Engler) A. Hay, *A. boa* A. Hay, *A. pyrospatha* A. Hay, *A. lancifolia* Engler, *A. holhrungii* Engler, and *A. monticola* A. Hay form the 'Xenophya group' endemic to the Moluccas, New Guinea, and the Bismarck Archipelago, characterised by sylleptic renewal growth, short-lived (months) long-sheathed leaves, usually persistent (except *A. monticola*) clasping spathe limbs, and hemianatropous to anatropous ovules.
- 3) *Alocasia aequiloba* N.E. Br. belongs to the 'Coriaceae group' characterised by proleptic renewal growth, modules with an indeterminate number of foliage leaves, short leaf sheaths, long-lived (about two years), coriaceous, usually deep green leaves with prominent posterior lobes. Ovules are orthotropous and spathe limbs open wide and deliquesce. Examples of allied species are *A. heterophylla* (Presl) Merrill (Philippines) and *A. porphyroneura* Engler ex Hallier f. (Borneo).
- 4) *Alocasia flabellifera* A. Hay and *A. macrorrhizos* (L.) G. Don belong to the 'Macrorrhizos group', massive pachycaul species with sylleptic renewal growth, short-lived long-sheathed leaves, open, broad, deliquescent or caducous spathe limbs and orthotropous ovules. Examples of allied species are *A. portei* Schott (Philippines), *A. crassifolia* Engler (Java), and *A. odora* (Lodd.) Spach (Burma to S China).
- 5) *Alocasia brisbanensis* (Bailey) Domin, endemic to Australia, is similar to the last group, but sufficiently morphologically and geographically isolated to warrant supraspecific recognition as the 'Ozarum group' on the basis of its uniquely elongate multistaminate synandria and long-pedunculate inflorescences. Hay (in press) has formally erected *Alocasia* sect. *Ozarum* for this highly distinctive and hitherto overlooked species.

In his monograph, Krause (1920) recognised two sections, "*Eualocasia*" and "*Ensolenanthe*", keyed on the basis of stigma shape. His "*Eualocasia*" is undoubtedly heterogeneous, including representatives of all the above-mentioned species groups, and others which may warrant formal recognition when the genus is appraised over its entire range. Sect. "*Ensolenanthe*" is also suspect, but has no Australasian species other than *A. lindenii* Rodigas which Krause included in error, as it had already been demonstrated to be a species of *Homalomena* (see under 'Species excludenda' below). Dividing the genus on stigma shape not only splits the evidently natural Xenophya group, but also lumps proleptic and sylleptic species together.

While he illustrated it, Krause did not make use of the distinction between sylleptic and proleptic renewal growth, although it seems to provide an important means of distinguishing infrageneric taxa in *Alocasia*. Ray (1987, 1988) has recently drawn attention to this feature of shoot diversity in Araceae, noting, as have Blanc (1978) and Hay (1981, 1986), that aroids generally conform to Chamberlain's Model in the scheme of plant architecture proposed by Hallé & Oldeman (1970). In this model, the shoot is physiognomically unbranched, while anatomically it consists of a series

of vegetative axes end to end, each terminating in (an) inflorescence(s) accompanied by the production of a vegetative renewal axis. Where, in *Alocasia*, the renewal axis develops synchronously with the inflorescences, without resting phase, it displaces them and they become physiognomically lateral amongst the leaf bases. This constitutes sylleptic renewal growth, and each renewal axis bears first a prophyll, followed by at least one foliage leaf. Where the renewal axis does not develop synchronously with the inflorescences (although it is more or less synchronously initiated), but instead rests for a period after its initiation, the inflorescences are evidently terminal and often clustered (themselves in a sympodial series), and the renewal axis, which recommences growth after fruiting has occurred, bears first a prophyll and then one or a series of cataphylls before the first foliage leaf. The contrast, which is one of continuous versus endogenously rhythmic growth, is unusual at low taxonomic rank. It is also of horticultural interest, as the proleptic rhythmic species often go into protracted dormancy, particularly after transplanting.

Proleptic species in *Alocasia* form at least two groups, one characterised by modules where each foliage leaf is enclosed in bud by cataphylls (such as *A. cuprea* K. Koch, Borneo), and one or more other groups, such as the 'Coriaceae group', characterised by modules initiated with cataphylls (in addition to the conventional prophyll) followed by a series of foliage leaves. They are frequently facultative lithophytes (but not in Australasia) and may exhibit tolerance of (but are not restricted to areas of) seasonal drought.

TAXONOMIC STATUS OF XENOPHYA SCHOTT

Previously, *Alocasia* and *Xenophya* have been separated on the grounds that the ovules were orthotropous and anatropous respectively, and the limb of the spathe caducous/marcescent and persistent respectively (Nicolson, 1968). However, since Nicolson's review of *Xenophya*, new evidence, chiefly in the form of newly discovered species, has come to light showing that these bases for distinguishing the genera break down. We are not inclined to lay weight on differences in ovule form unless they are carried through in development to the form of the seed. Here they are not, and, importantly, intermediate states are well presented by the hemianatropous ovules of *A. nicolsonii*, *A. pyrospatha*, and *A. monticola*. Of these species, the spathe limb is persistent after anthesis only in *A. pyrospatha*. In addition, it is necessary to take into account behaviour of the spathe limb during anthesis. In *Xenophya* s.s. it barely opens and, as has been noted, it persists afterwards. In *A. monticola* also it barely opens, but then it falls, while in *A. nicolsonii* it opens wide during anthesis, and then also falls. The last species therefore behaves like a species of *Alocasia* s.s. differing only in its ovule form. The characters of ovule form and spathe behaviour after anthesis are neither diagnostic nor completely correlated. The only character which diagnoses *Xenophya* is the clasping behaviour of the spathe limb during anthesis (as *A. monticola* belongs here). It is not felt that this is an adequate basis for recognising a genus, and although there is a coherent natural group of species around *Xenophya*, the similarities of these species to those of *Alocasia* s.s. and the number of partially shared differential characters are such that *Xenophya* must be recognised as an infrageneric taxon in an expanded concept of *Alocasia*.

ALOCASIA

- Alocasia* (Schott) G. Don in Sweet, Hort. Brit. ed. 3 (1839) 631; Schott, Oesterr. Bot. Wochenbl. 2 (1852) 59; Engler in DC., Mon. Phan. 2 (1879) 497; in Beccari, Malesia 1 (1882) 292; in Engler & Prantl, Nat. Pflanzenfam. 2 (3) (1887) 137; Bot. Jahrb. 25 (1898) 23; in Lorentz, Nova Guinea 8 (2) (1910) 251; 8 (4) (1912) 807; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 71; Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. (1901) 214; Nachtr. Fl. Deutsch. Schutzgeb. (1905) 62; F.M. Bailey, Qld. Fl. 5 (1902) 1697; Evans, Contrib. Nat. Herb. N.S.W. 22 (1962) 11; Nicolson, Taxon 12 (1963) 208; in A. C. Smith, Fl. Vit. Nov. 1 (1979) 453; Hay in Johns & Hay, Stud. Guide Monoc. Papua New Guinea 1 (1981) 49; Burnett, Aroideana 7 (1984) 74; Peekel, Fl. Bismarck Archip. (1984) 72; Beadle, Stud. Fl. NE N.S.W. 6 (1987) 972. Nom. cons. — *Colocasia* Schott sect. *Alocasia* Schott, Melet. 1 (1832) 18. — Type: *A. cucullata* (Lour.) G. Don.
- Xenophya* Schott, Ann. Mus. Lugd.-Bat. 1 (1863) 124; Engler in DC., Mon. Phan. 2 (1879) 526; in Pflanzenr. 73 (IV.23F) (1920) 60; Nicolson, Blumea 16 (1968) 116; Hay in Johns & Hay, Stud. Guide Monoc. Papua New Guinea 1 (1981) 81; Burnett, Aroideana 7 (1984) 152. — Type: *X. brancifolia* Schott = *Alocasia brancifolia* (Schott) A. Hay.
- Schizocasia* Schott [Bonplandia 10 (1862) 148 (invalidly published); Engler in DC., Mon. Phan. 2 (1879) 495 (invalidly published)] ex Engler, Bot. Jahrb. 1 (1880) 186 & 25 (1898) 26; in Becc., Malesia 1 (1883) 295; in Engler & Prantl, Nat. Pflanzenfam. 2, 3 (1887) 137; Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. (1901) 214; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 115. — Type: *S. acuta* Engler = *A. brancifolia*.

Massive unarmed pachycaul trees to decumbent or creeping herbs with rhythmic or continuous growth and acrid clear to faintly milky sap; stems sympodial, fleshy, often starch-filled, smooth to tessellated to clothed in marcescent leaf bases and cataphylls, usually bearing short, slender, sometimes branched stolons terminating in small cormels; renewal buds proleptic and the modules initially cataphylliferous or sylleptic and the modules without cataphylls (other than the prophyll); foliage leaves solitary to clustered, with spiral phyllotaxis, long- (years) to short- (months) lived, glabrous or pubescent; petioles sheathing in the lower 1/8th–2/3rds, the wings of the sheath persistent, inrolled, straight or reflexed, very rarely deliquescent and deciduous; blades often enormous, (cordate to) sagittate to hastate, sometimes peltate, with the margins entire to deeply pinnatifid and the tip mucronate; major venation pinnate, running to submarginal vein, usually with wax-secreting glands in the axils on the abaxial side, occasionally also with glands in the axils of the secondary veins and scattered on the petiole; secondary venation reticulate, often anastomosing to form interprimary collective veins, or tending towards striate and then interprimary collective veins poorly defined to absent; inflorescences usually paired, each pair subtended by a persistent or marcescent cataphyll, the second inflorescence subtended by a smaller prophyll (i.e. the pair a biaxial sympodium), the pairs clustered and evidently terminal or interspersed with foliage leaves and displaced to a physiognomically lateral position; peduncles usually short at anthesis, sometimes lengthening in fruit; spathe green to white to scarlet, sometimes purple-streaked and spotted, more or less abruptly constricted in a lower 'tube' (but not tubular) and an upper lanceolate to oblong, clasping to cowl-like to revolute, persistent, deliquescent, marcescent, or caducous limb; spadix monoecious, protogynous, finger-like, usually subequalling the spathe, sessile or stipitate, sometimes adnate in the lower (female) portion to the spathe; basal female zone with naked pistils; ovaries unilocular to api-

cally incompletely 4-septate; stigma button-like to stellate, papillate to smooth, sessile or on a short style; placentation basal; ovules several, anatropous to (sub)orthotropous; distal to the female zone an often attenuated interstice of sterile organs apparently homologous with synandrodes, very rarely absent; male zone composed of close-packed 4–10(–36)-staminate, flat-topped, usually rhomboidal, rarely irregular or much elongate, synandria, with the anthers opening by lateral slits or apical pores; pollen mealy, spheroidal to subspheroidal, inaperturate, apolar, radiosymmetric, with spinose exine sculpturing (Grayum, 1984); spadix terminating in a conspicuous (rarely much foreshortened), tapering to subclavate, smooth to sulcate to synandrodial to staminodial appendix; fruiting peduncle erect to actively declinate, elongating or not, rarely exceeding the length of the petioles; fruits developing within the tightly closed, sometimes brightly-coloured spathe tube, red to orange, fleshy, several-seeded, the spathe tube dehiscing by splitting into longitudinal revolute segments or opening like an unrolling leaf; seed c. 3–5 mm in diameter, anatropous, sometimes beaked at the micropyle, strophiolate at the chalaza, albuminous; testa thin, pale to dark brown, smooth to faintly ridged; chromosomes $2n = 28$ or 70 , $x = 7$ (Marchant, 1971).

Distribution. About 60 species from Indo-Malesia, tropical Australasia and Oceania, with extra-tropical extensions in the Himalayas, South China, and eastern Australia, from lowland to high montane rainforest, regrowth, open swampy sites, and in subsistence agriculture; now cosmopolitan by introduction in ornamental horticulture, and often naturalised in wet tropical areas (especially *Alocasia macrorrhizos*).

KEY TO THE SPECIES

- 1a. Wings of leaf sheath persistent; mostly lowland plants 3
- b. Wings of leaf sheath deliquescent, deciduous; mid-montane plants 2
- 2a. Robust plants; leaf blade exceeding 30 cm in length; fruiting peduncle barely exerted from leaf bases, much shorter than the petioles . . 1. *A. nicolsonii*
- b. Feeble plants; leaf blade less than 20 cm in length; fruiting peduncle much exerted from leaf bases, about half to exceeding the petioles . . . 2. *A. wentii*
- 3a. Spathe limb narrow, clasping the spadix, persisting in early fruit 4
- b. Spathe limb usually opening lanceolate to almost ovate, canoe-shaped to reflexed to revolute, rarely clasping, deliquescent, deciduous or marcescent immediately after anthesis 9
- 4a. Leaves pinnatifid to at least half the distance from the margin to the midrib
 3. *A. brancifolia*
 - b. Leaves with the margins entire, shallowly pinnatifid or serrately lobed. 5
- 5a. Margins serrately lobed, leaves deep bronze 4. *A. lauterbachiana*
- b. Margins shallowly pinnatifid to entire. 6
- 6a. Margin shallowly pinnatifid, petiole and spathe boldly mottled . . . 5. *A. boa*
- b. Margin entire, or if faintly undulate, then spathe not mottled 7
- 7a. Blade oblanceolate with the posterior lobes much reduced . . 7. *A. lancifolia*
- b. Blade sagittate 8

- 8a. Blade sometimes peltate in adult plants, broadly sagittate; spadix with the interstice not attenuate; stigmas weakly lobed; fruiting peduncle not or hardly extending beyond the subtending cataphyll and leaf base, erect
6. *A. pyrospatha*
- b. Blade not peltate in mature plants, narrowly to broadly sagittate; spadix with the interstice attenuate; stigmas stellate; fruiting peduncle extending beyond the subtending cataphyll, declinate 8. *A. hollrungii*
- 9a. Spathe limb narrow, barely opening; leaves usually hastate, sometimes sagittate; interprimary collective veins absent; stem c. 3.5 cm diameter
9. *A. monticola*
- b. Spathe limb opening wide; interprimary collective veins present, or if absent then plants massive with the stem over 10 cm diameter 10
- 10a. Petiole sheathing for a quarter of its length or less; plants moderately robust; inflorescence c. 6 mm diameter; fruiting spathe opening laterally
10. *A. aequiloba*
- b. Petiole sheathing for about half its length; plants massive; inflorescence c. 12 mm diameter; fruiting spathe splitting and recurving longitudinally 11
- 11a. Lamina broadly ovato-sagittate; secondary venation distinctly raised abaxially; spathe tube white 12. *A. flabellifera*
- b. Lamina sagittate to narrowly ovato-sagittate; secondary venation \pm flush abaxially, spathe tube green 12
- 12a. Spathe limb membranous, cowl-like; sterile interstice of spadix much shorter than the female zone; synandria isodiametric; appendix ivory to pale yellow
11. *A. macrorrhizos*
- b. Spathe limb rather leathery, opening spoon-like; sterile interstice of spadix equalling or exceeding the female zone; synandria elongate; appendix green to orange 13. *A. brisbanensis*

'Exaltatae group'

1. *Alocasia nicolsonii* A. Hay, *spec. nov.* – Figs. 1 & 2.

[*Alocasia devansayana* auct. non (Linden & Rodigas) Engler: Engler in Lorentz, Nova Guinea 8 (1912) 808; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 88, fig. 16; excl. basionym i.e. *Colocasia devansayana* Linden & Rodigas, Ill. Hort. (1886) 97, t. 601, = *Alocasia* spec. dub., vide infra.]

Ab aliis speciebus *Alocasiae* cognititis vagina deliquescente, spatha fructifera rubescente, synandriis impressis, appendice tenue differt. — T y p u s : Papua New Guinea, Eastern Highlands Prov., Kainantu District, nr Aiyura, 1st February 1989, Hay & Wise 4047 (LAE, holo; NSW, iso).

Robust herb; rhizome decumbent, to c. 8 cm diam., clothed in fibres or old leaf bases; leaves numerous, to 12 together; petiole to c. 90 cm long, often with few to numerous scattered glands on the abaxial surface, sheathing in the lower half to 3/5, the wings of the sheath deliquescent and mucilaginous at the emergence of the enclosed leaf; blade narrowly sagittate to ovato-sagittate, dull or slightly glossy green adaxially, paler abaxially, sometimes there with reddish-purple pigment except near the margins and midrib; anterior lobe to 37 cm long, c. 15–34 cm wide, the tip usu-

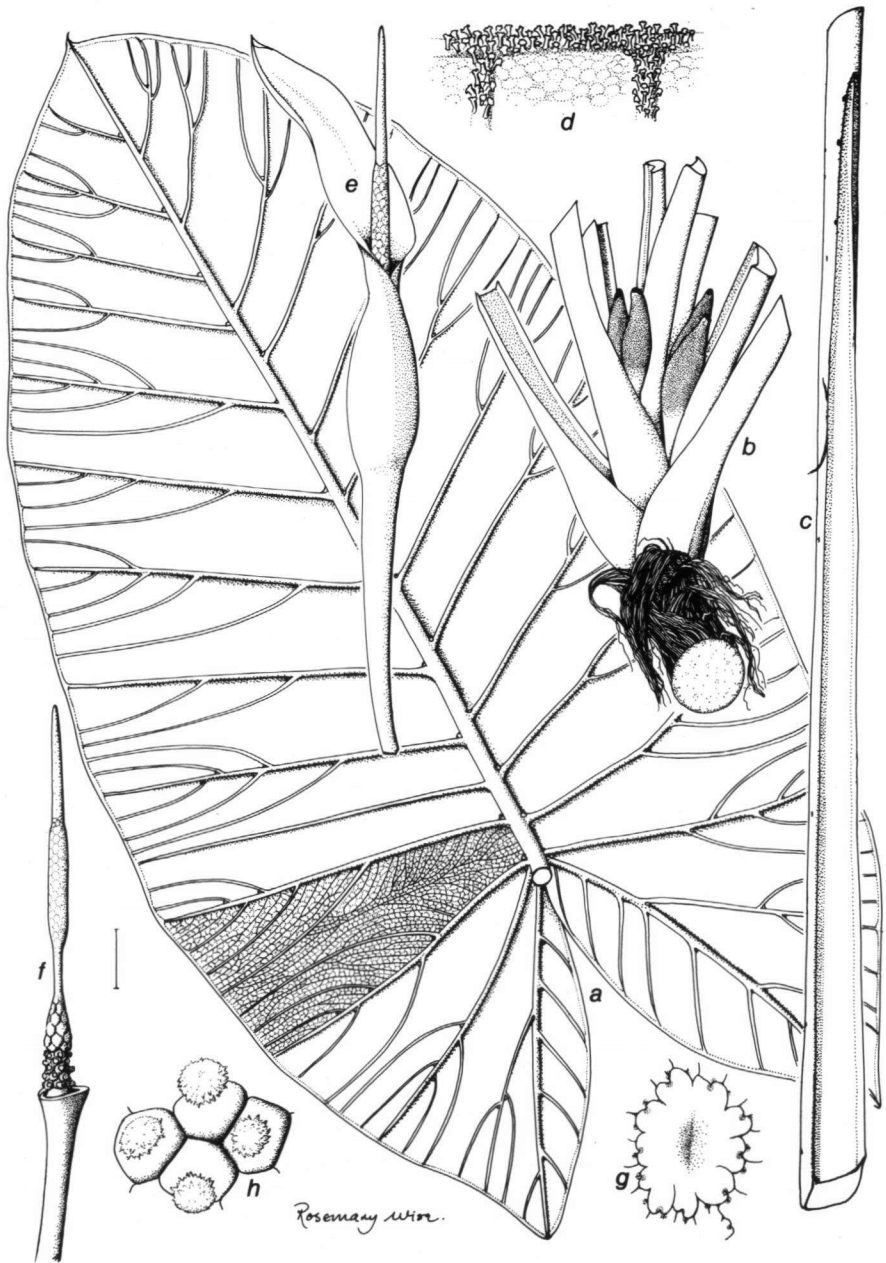


Fig. 1. *Alocasia nicolsonii* A. Hay (Hay & Wise 4047). a. Leaf blade; b. crown with fruiting spathe; c. lower part of petiole with remains of sheath wing; d. detail of pubescence on leaf underside; e. inflorescence; f. spadix; g. synandrium; h. pistils. — Scale: bar to a, c, e, f = 2 cm; to b = 7.5 cm; to d = 0.8 mm; to g, h = 2 mm.

ally somewhat acute and apiculate, with to 12 primary veins on either side of the anterior costa diverging at an angle of c. 70 degrees, these sometimes forked, often sporadically emitting veins intermediate in thickness between the primary and secondary venation (i.e. subsidiary veins); primary venation impressed adaxially at least distally, prominent abaxially; secondary venation impressed adaxially, prominent abaxially; tertiary venation fine to forming a bold prominent reticulum abaxially; costae, primary, secondary, and tertiary venation sometimes densely covered with minute, multicellular, distally branched hairs abaxially, or glabrous; costae and primary veins often bearing glands in the axils of the primary and larger subsidiary veins respectively; posterior costae 7–20 cm long, diverging at 70–100 degrees, naked in the sinus for c. 1–5 cm or with laminar tissue (sometimes only a very narrow wing) extending into the sinus to the petiole, but not peltate; posterior lobes with the tips acute, narrowly blunt-tipped, overlapping each other when posterior costae diverging at an acute angle; inflorescences paired, each pair subtended by a rapidly deliquescent cataphyll, its remains often stuck to the spathe; peduncle barely carrying the base of the spathe clear of the subtending leaf bases; spathe white, sometimes faintly flushed pink on the margin near the base, c. 15 cm long, constricted c. 1/3 of the way from the base, the lower portion more or less irregularly triangular in cross section, the limb rather narrow, c. 2.4 cm wide, opening wide, eventually deflected, then deliquescing after anthesis; fruiting spathe much expanded, c. 3.5 cm diam., 7 cm long, brilliant red, later dehiscing longitudinally; spadix c. 13 cm long; female zone 7–11 mm long at anthesis, c. 9 mm diam. with c. 20–70 pistils; ovary green, 1.5–c. 3 mm diam., unilocular, sometimes apically incompletely 3- or 4-septate; stigma button-like to very indistinctly 3- or 4-fid, white, papillate, on a very short style; ovules hemianatropous to anatropous; interstice of sterile organs c. 3–4 cm long, rather massive in the lower half, c. 1.2 cm diam., there composed of several large, hexagonal to rhomboid, sometimes somewhat swollen, sometimes impressed structures, thence sharply tapering to c. 3.5 mm diam.; male zone c. 4–5 cm long, c. 7 mm diam.; synandria more or less regularly hexagonal, 3–4 mm diam., distinctly impressed in the centre of the top, white, the anthers opening by apical pores; appendix slender, c. 3.5 mm diam., c. 5 cm long, white, irregularly sulcate, synandrodial at base, turning deep brown in spirit, rarely very much reduced; berries deep orange, to 1.2 cm across; seeds several, globose to compressed, c. 5 mm across, dark brown, prominently strophiolate at the chalaza.

Distribution. Widespread in mid-montane* rainforest in damp places from c. 1700–2700 m altitude. Fig. 3.

Notes. The species is named for D.H. Nicolson, Smithsonian Institution, in acknowledgement of his contribution to knowledge of the Araceae of the Eastern Tropics. Dr. Nicolson was the first to recognize this species as new. *Alocasia nicolsonii* is extraordinarily variable, and constitutes an 'ochlopecies' (see below). If only a few populations are examined, it is difficult to accept that only one species is involved. Unifying characters include the deliquescent leaf sheath, the attenuate interstice, the impressed synandria, the narrow appendix, the red short-pedunculate fruit-

* Nomenclature of New Guinea vegetation zones in this work follows Johns (1977).

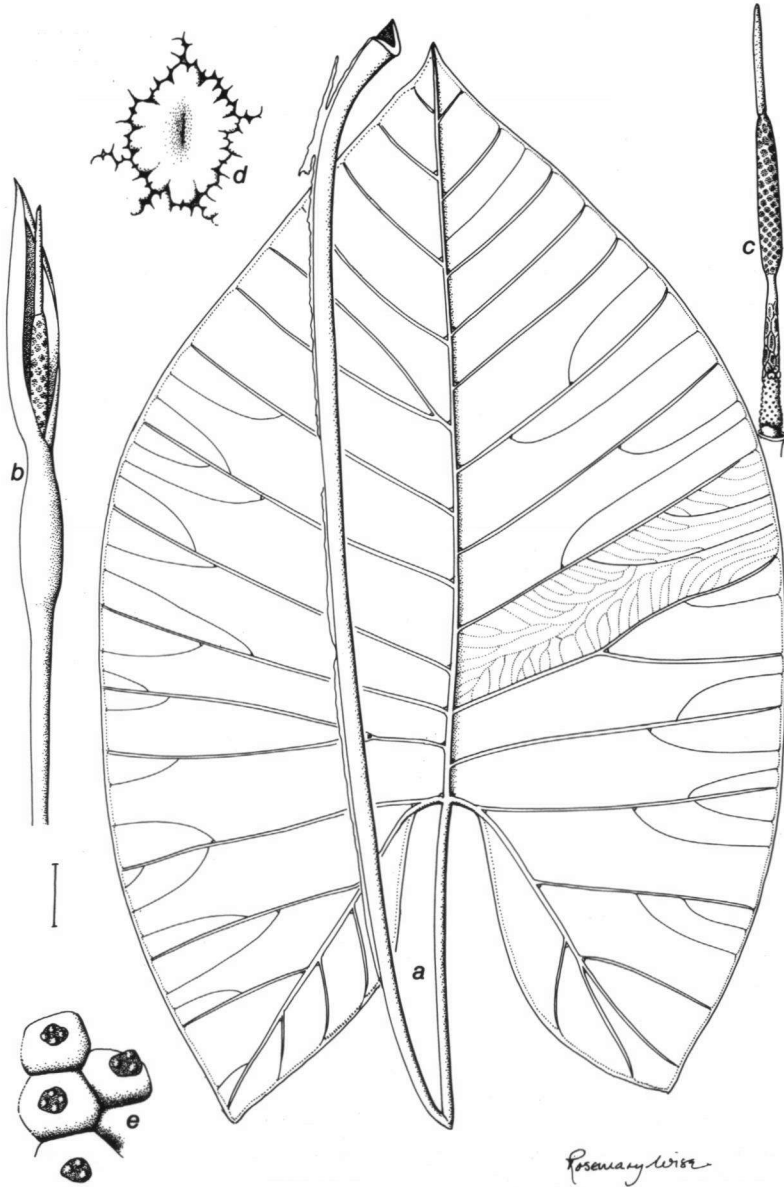


Fig. 2. *Alocasia nicolsonii* A. Hay (Hay & Roberts 4023). a. Leaf; b. inflorescence; c. spadix; d. synandrium; e. pistils. — Scale: bar to a–c = 2 cm; to d, e = 2 mm.

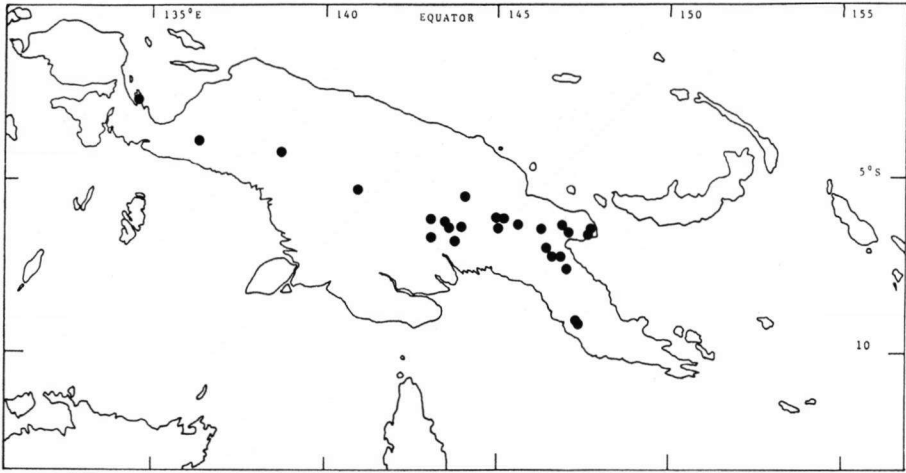


Fig. 3. Distribution of *Alocasia nicolsonii* A. Hay.

ing spathe, and the altitudinal range and habitat. Varying characters include leaf shape – from broadly ovato-sagittate to narrowly sagittate; posterior costae – naked in the sinus to lamina-bearing to the petiole; texture of the leaf surface – from glossy to dull; density of gland distribution on the leaf blade underside and petiole – from abundant to absent; tertiary venation – from boldly reticulate to fine and inconspicuous; indumentum on the leaf blade underside – from dense to absent; colour of the leaf blade underside – from green to red; size and number of pistils – from small and numerous to bigger and fewer; and form of the organs of the sterile interstice – from inflated to impressed. Figures 1 & 2 illustrate representatives from two populations, the first near Wau, Morobe Prov., the second near Aiyura, Eastern Highlands. The variation, represented in table 1, is not without pattern, though it is too complex for nomenclatural recognition. Identical combinations of characters recur through the range, while very different combinations of characters are found in plants from proximate localities. The two widely differing populations that I have studied at first hand each appeared homogeneous. The term ‘ochlopecies’ – literally an unruly mob species – was coined by White (1962) for cases where a species may be said to be neither monotypic nor polytypic. It is used here to convey the state of affairs in *A. nicolsonii* where there seems to be extensive infra-specific parallelism, where there is possibly the evolution of local isolating mechanisms, and yet where morphological distinctions break down when variation over the whole range is considered.

Engler (l.c.) attributed material of this species to *Alocasia devansayana* (Linden & Rodigas) Engler, based on *Colocasia devansayana* Linden & Rodigas. *Colocasia devansayana* is evidently an *Alocasia*, but it is based on sterile material of horticultural origin which cannot be determined with certainty. It was illustrated, however (in Linden & Rodigas, l.c.), showing the leaf sheath to be persistent, and the binomial therefore cannot possibly be rightly applied to the species described here.

Table 1. States of five conspicuous leaf characters in, and geographical coordinates of representative specimens of ochlospecies *Alocasia nicolsonii* A. Hay.

A: Blade shape: 1, narrowly sagittate; 2, intermediate; 3, broadly sagittate. — B: Posterior costae: 1, with lamina to the sinus; 2, naked in the sinus for up to 5 mm; 3, naked in the sinus for more than 5 mm. — C: Wax glands on the abaxial surface: 1, plentiful; 2, sparse; 3, none. — D: Hair: 1, present; 2, absent. — E: Subsidiary veins of the costae (see text): 1, present; 2, absent.

Specimen	Character state					Latitude S	Longitude E
	A	B	C	D	E		
NGF 13834	1	1	2	1	1	5° 50'	144° 15'
NGF 32078	1	1	2	1	1	6° 00'	143° 10'
Frankel 7	1	1	2	1	1	6° 13'	143° 39'
Vink 16845	1	1	2	2	2	6° 00'	143° 00'
Hay 4047 (fig. 1)	2	1	1	1	1	6° 20'	145° 54'
LAE 54805	2	1	1	1	1	7° 20'	146° 10'
NGF 34592	2	2	1	1	1	9° 09'	147° 43'
LAE 60269	2	2	1	1	1	9° 05'	147° 38'
NGF 38887	2	1	2	1	1	5° 28'	144° 14'
NGF 27630	2	1	3	1	1	7° 24'	146° 07'
NGF 14285	2	1	2	2	2	5° 25'	143° 25'
LAE 60880	2	2	2	1	1	6° 10'	143° 59'
NGF 38888	2	2	2	1	1	5° 28'	144° 14'
NGF 33127	2	2	2	1	1	5° 02'	140° 55'
NGF 74870	2	2	2	1	1	9° 09'	147° 39'
NGF 17876	3	2	2	1	1	6° 45'	146° 50'
Clemens 684	3	3	1	1	1	6° 29'	147° 46'
Jacobs 9409	2	3	2	2	1	6° 26'	142° 50'
Vink 17479	3	1	3	2	1	6° 00'	143° 00'
Brass 11287	3	1	3	2	2	4° 05'	138° 35'
Clemens 7758	3	2	3	2	1	6° 35'	147° 35'
Carson 4	3	2	2	2	2	7° 22'	146° 40'
Eyma 4575	3	2	3	2	2	4° 00'	136° 40'
Pulle 678	3	2	3	2	2	4° 15'	138° 55'
Hide 481	3	3	1	2	1	6° 07'	145° 00'
NGF 14135	3	3	1	2	1	6° 05'	145° 05'
Hay 4023 (fig. 2)	3	3	1	2	1	7° 24'	146° 40'
ANU 2333	3	3	2	2	2	5° 28'	143° 40'
Vink 16513	3	3	2	2	2	5° 55'	144° 37'
LAE 60939	3	3	3	2	2	6° 10'	143° 59'
NGF 13842	3	3	3	2	2	5° 50'	144° 45'
Bowers 197	3	3	3	2	2	6° 15'	144° 10'
von Römer 1128	3	3	3	2	2	4° 15'	138° 55'

Okada & Carson (1980) described 11 new species of fruit flies of the genus *Drosophila* (Diptera: Drosophilidae) from the inflorescence of this species, citing it as '*A. macrorrhiza*'.

Other specimens seen (in alphabetical order of collector, by country):

IRIAN JAYA. 9 km NE of Lake Habbema, *Brass 10973* (A, BO); 18 km NE of Lake Habbema, *Brass 11287* (A); Wissel Lakes area, *Eyma 4575* (BO); Mt Wondiwoi, *Mayr 391* (BO); Okwalimkan R., headwaters, *NGF 33127* (LAE); Mt Hellwig, *Pulle 678* (BO, K), *von Römer 1075, 1128* (BO).

PAPUA NEW GUINEA. Western Highlands Prov., Yaibos, nr Wabag, *ANU 2270* (CANB), *2333* (A, CANB, LAE); Eastern Highlands Prov., above Aiyura Ag. Station, *ANU 5576* (CANB, LAE); Southern Highlands Prov., Onim, Mt Giluwe, *ANU 20410* (LAE); Western Highlands Prov., Kurupili, Kepala, Upper Kaugel, *Bowers 197, 632* (CANB, LAE); Central Prov., Boridi, *Carr 13103* (CANB, L); Isuariva, *Carr 16073* (L); Morobe Prov., Wau, Mt Kaindi, Bulldog road, *Carson 4* (LAE); Sattelberg, Sambanga, *Clemens 7758* (A, L); Sattelberg, *Clemens & Clemens 684* (A, L), *1894* (A); Ogerammang, *Clemens & Clemens 5029* (A); Southern Highlands Prov., Mendi, *Frankel 7* (LAE); Eastern Highlands Prov., W of Fatima R., Marafunga Mill, Goroka, *Grubb & Edwards 134* (L); Morobe Prov., Wau-Biaru road, c. 30 km from Wau, *Hay & Roberts 4023* (NSW); Eastern Highlands Prov., Sinasina, 2 mi SSW of Koge Mission, *Hide 481* (LAE); Morobe Prov., Kasanombe, 40 km N of Lae, *Jacobs 8681* (L, LAE); Western Prov., Mt Bosavi, N side, *Jacobs 9409* (L, LAE); Eastern Highlands Prov., Goroka, Marafunga, *LAE 53277* (LAE); Morobe Prov., 7 km W of Aseki, *LAE 54805* (CANB, L, LAE, US); Eastern Highlands Prov., Goroka, Gahavisuka Provincial Park, *LAE 56689* (LAE); Central Prov., nr Boridi Village, *LAE 60269* (LAE, US); Southern Highlands Prov., Onim Hill, S slopes of Mt Giluwe, *LAE 60880* (A, BRI, K, L, LAE); E Iaro R., S slope of Mt Giluwe, *LAE 60939* (BRI, L, LAE, US); Eastern Highlands Prov., Aiyura, *NGF 6948* (BRI, LAE); Western Highlands Prov., Nondugl, *NGF 13842* (A, LAE); Eastern Highlands Prov., Kumul Mission, Chuave-Chimbu road, *NGF 14135* (A, BRI, L, LAE); Western Highlands Prov., Wabag, Sirunke, *NGF 14285* (L, LAE); Morobe Prov., Zatari, SE of Bona, *NGF 17512* (L, LAE); N of Wagau airstrip, *NGF 17876* (BRI, L, LAE); Morobe Prov., Tawa Village, nr Aseki, *NGF 27630* (CANB, L, LAE); Southern Highlands Prov., Habono Rest House, 6.5 mi NW of Mt Ne, *NGF 32078* (LAE); Central Prov., E side of Lake Myola No. 2, *NGF 34592* (LAE, US); Efo-gi, *NGF 34870* (LAE, US); Morobe Prov., Wau, Head of Bulolo R., *NGF 35641* (LAE); Eastern Highlands Prov., Lufa, *NGF 35735* (BRI, LAE, US); Western Highlands Prov., Dagarunga Ridge, Baiyer-Jimi Divide, *NGF 38887* (L, LAE, US), *NGF 38888* (L, LAE, US); Baiyer road, 4 mi from Mt Hagen, *Nicolson 1393* (A, BO, LAE); Kuta, nr Wankl, *Robbins 32* (CANB); Mt Hagen, Togaba sawmill, Nebeyer Divide, *Robbins 480* (CANB); Southern Highlands Prov., Halalinja, Nipa Dist., *Sillitoe 82115 & 82116* (UPNG); Earra Range, 11 km NW of Erave, *Streimann 8553* (LAE); Telabo, Tari, *UPNG 1779* (UPNG); Western Highlands Prov., Kubor Range, Vinba, Nona-Minj Divide, *Vink 16513* (CANB, L, LAE); Southern Highlands Prov., Tari, Tigibi, *Vink 16845* (A, CANB, L, LAE); Lei R., SE foot of Mt Ambua, *Vink 17479* (A, CANB, L, LAE); Eastern Highlands Prov., Aiyura, road to Arona, *Winters & Higgins 206* (CANB).

2. *Alocasia wentii* Engler & Krause – Fig. 4.

Alocasia wentii Engler & Krause in Engler, Bot. Jahrb. 54 (1917) 90; in Engler, Pflanzenr. 71 (IV. 23E) (1920) 81. — Type: Irian Jaya, Mt Hellwig, Dec. 1912, *Pulle 772* (B!, holo; L!).

Small herb; rhizome erect, c. 3 cm diam., with internodes to c. 3 cm long; petiole slender, to 20 cm long, sheathing in the lower 1/3–2/3rds, mottled and streaked bluish; sheath rotting; leaves several, to 8 together; lamina somewhat coriaceous, sagittate, dark green, much shorter than the petiole, to c. 15 cm long, c. 10 cm wide, asperous and minutely verruculate in the dry state abaxially; anterior costa with 4 or 5

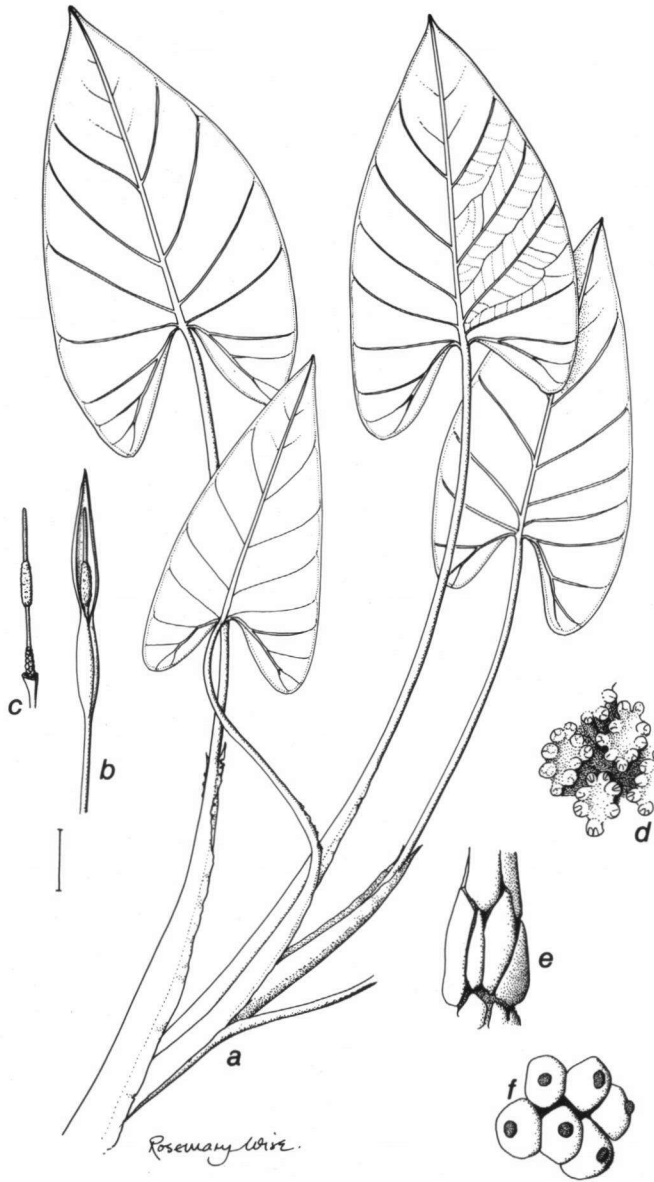


Fig. 4. *Alocasia wentii* Engler & Krause (a-c, Vink 17592; d-f, Veldkamp 6691). a. Shoot; b. inflorescence; c. spadix; d. synandria; e. organs of sterile interstice; f. pistils. — Scale: bar to a-c = 2 cm; to d-f = 2.5 mm.

primary veins on each side, slightly impressed adaxially, very prominent and sometimes reddish abaxially, diverging at an angle of c. 50 degrees, bearing glands in their axils; posterior lobes obtuse, much shorter than the anterior, to 3 cm long; posterior costae with lamina to the sinus, diverging at a very obtuse angle; secondary venation with zig-zagging interprimary collective veins; inflorescences paired, subtended by an evanescent cataphyll; peduncle slender, the exposed part c. 6 cm long (infl.) to c. 18 cm long and exceeding the petioles (infr.); spathe pale pink, about 7 cm long, constricted at c. 1.8 cm from the base, narrowly lanceolate, the limb falling after anthesis; spadix c. 6 cm long; female zone c. 2 cm long with c. 20 pistils; ovary unilocular, ovules hemianatropous; stigma weakly 3-lobed, almost sessile; interstice or sterile organs very attenuate, exceeding the female zone; male zone c. 1–2 cm long, c. 6 mm diam.; synandria \pm hexagonal, c. 2.5 mm diam., with very prominent thecae; appendix to c. 3.5 cm long, very slender; ripe fruit unknown.

D i s t r i b u t i o n. Known only from three collections in mid to upper montane rainforest, from Mt Hellwig in West Irian, and from the Hindenburg Range and Star Mountains in Papua New Guinea.

N o t e s. This species is poorly known, but highly distinctive in leaf. It is evident from the form of the sheath and the structure of the spadix that this species is closely related to the highly variable but always very much larger *A. nicolsonii*.

Other specimens seen:

PAPUA NEW GUINEA. West Sepik Prov., Star Mts, Folongonom, *Veldkamp 6691* (L); West Sepik Prov., Telefomin Subdist., Hindenburg Range, Mt Amdutakin, *Vink 17592* (CANB, L, LAE).

'Xenophya group'

3. *Alocasia brancifolia* (Schott) A. Hay, *comb. nov.*

Xenophya brancifolia [saepissime '*brancaefolia*'] Schott, Ann. Mus. Lugd.-Bat. 1 (1863) 124; Engler in DC., Mon. Phan. 2 (1879) 527; Pflanzenz. 73 (IV.23F) (1920) 61; Nicolson, Blumea 16 (1968) 115; Hay in Johns & Hay, Stud. Guide Monoc. Papua New Guinea 1 (1981) fig. 34b; Burnett, Aroideana 7 (1984) 153, fig. 133. — T y p e: 'New Guinea', *Zippel s.n.* (L!, holo).

Schizocasia acuta Engler, Bot. Jahrb. 1 (1880) 186; Engler in Beccari, Malesia 1 (1882) 294, t. 26, figs. 5–13; Krause in Engler, Pflanzenz. 71 (IV.23E) (1920) 118. — *Alocasia acuta* (Engler) Hallier f., Bull. Herb. Boiss. 6 (1898) 605; Engler in Lorentz, Nova Guinea 8 (2) (1910) 251; Nova Guinea 8 (4) (1912) 808; Gibbs, Fl. Arfak Mts (1917) 202. — T y p e: Irian Jaya, Andai, *Beccari P.P. 663* (FI!, holo).

Schizocasia acuta var. *angustipartita* Engler, Bot. Jahrb. 1 (1880) 186; Engler in Beccari, Malesia 1 (1882) 294; Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. (1901) 214; Krause in Engler, Pflanzenz. 71 (IV.23E) (1920) 119, fig. 27, L. — *Alocasia acuta* var. *angustipartita* (Engler) Engler in Lorentz, Nova Guinea 8 (2) (1910) 251. — T y p e: New Guinea, d' *Alberitis s.n.* (FI!, holo).

Alocasia acuta var. *tigrina* Hallier f., Bull. Herb. Boiss. 6 (1898) 606. — *Schizocasia acuta* var. *tigrina* (Hallier f.) Krause in Engler, Pflanzenz. 71 (IV.23E) (1920) 119, fig. 27, A–K. — T y p e: Moluccas, Aru Island, *Treub & Hallier f. s.n.* (BO!, holo; M!).

Treelet with erect brown stem to c. 1.2 m tall, to 7 cm diam.; leaves about 6 together; petiole to c. 40 cm long, green to faintly mottled to boldly obliquely zebra-striped with chocolate brown, sheathing in the lower 1/3rd–1/2; wings of sheath

persistent with the margins, somewhat in-turned but not overlapping; blade sagittate in outline, with the anterior and posterior lobes pinnatifid at least halfway from the margin to the costae, often to within a few millimetres of the costae; anterior lobe to c. 50 cm long, 30 cm wide, with c. 9 segments on each side, the segments 1–4 cm wide and lanceolate; posterior lobes much reduced, more or less equal to segments of the anterior lobe, but divided once or twice, about a quarter of the length of the anterior lobe; posterior costae more or less equal to the midribs of the segments of the anterior lobe, much thinner than the anterior costa; costae and primary venation raised adaxially, primary venation impressed abaxially; secondary venation fine, flush with the lamina, almost striate; inflorescences paired, each pair enclosed by a cataphyll, the second inflorescence subtended by a small prophyll; peduncle short, c. 4 cm long; spathe to 15 cm long, constricted c. 2.5 cm from the base, opening only level with the male zone of the spadix, distally clasping the appendix, the top acuminate, dirty ivory longitudinally streaked with chocolate brown, the whole persistent in fruit; spadix to c. 12 cm long, slender; female zone 1–1.5 cm long, c. 1 cm diam., with about 20 pistils, ovaries green; stigma white, 3–5-conically lobed; inter-stice of sterile organs c. 2.5 cm long, c. 1 cm wide at base, sharply tapering to c. 2.5 mm wide, white; male zone c. 4 cm long, 6 mm wide; synandria more or less regularly rhomboid, whitish, with the anthers opening by apical pores; appendix c. 7 cm long, slender, c. 5 mm diam., tapering gradually to the tip; infructescence more or less erect, not deflexed; fruiting spathe longitudinally split into recurved segments; berries orange-red, few-seeded; seeds anatropous, globose, brown, c. 5 mm diameter.

Distribution. Moluccas and widespread in New Guinea; lowland forest understorey, generally in rather swampy places, occasional in open sites.

Notes. The specific epithet is formed from the Latin *branca*, a paw, and the compound *brancifolia* seems orthographically correct.

The species is variable with regard to the width of the segments of the pinnatifid blades, and the degree of mottling on the leaf sheath, petiole, and to a lesser extent the spathe. Variation in both these attributes occurs within populations, and while of horticultural interest, deserves no formal recognition above the rank of cultivar. It has occasionally been mistaken for *A. portei* which differs in the much larger size, well developed posterior costae, and in the inflorescence in which the spathe limb opens wide and then falls away as in *A. macrorrhizos*. Occasional individuals of *A. brancifolia* are found in open conditions (probably as relics of clearing), and have the blades less deeply pinnatifid than usual, but dissection is nevertheless about halfway to the anterior costa, quite distinct from the shallowly pinnatifid leaves of *A. boa* (q. v.).

Other specimens seen:

MOLUCCAS. Halmahera, Galela, Loa Tobaru, *Beguin 1917* (BO), *1923* (BO, L), *1927* (BO); Halmahera, Telago Rano, *Mochtar 270* (BO); Aru, *Treub 274b* (BO); Bacan Isl., G. Sibela, nr Waiaua, *de Vogel 3658* (L).

IRIAN JAYA. Aria, nr Uta, *Aet 390* (BO); Jappen Island, Biak, Serui, *Aet & Idjan 601* (BO, L); Manokwari, Forestgarden 'Tafelberg', *BW 3527* (A, L); Wandammen Peninsula, Wondiwoi Mts, *BW 13657* (L, LAE); Manokwari, *Gibbs 6190* (K); Skroë, *Jaheri s.n.* (BO); Pransoen bivak, *Lam 1149* (BO); Manggoopi, 3 km W of Manokwari, *Nicolson 1574* (L, LAE), *1575* (L, LAE); Sorong, Klamono, *Pleyte 616* (BO, L); Kloof bivak, Lorentz River, *Pulle 200* (BO, K, L); *Versteeg 1686*

(BO, K, L); *von Römer* 44, 316, 674 (BO); Steenkool District, 8 km along Steenkool–Tembuni road, *van Royen* 3481 (A, BO, L); Manokwari, Prafispui, *Widjaja & Hamzah* 3137 (BO).

PAPUA NEW GUINEA. Aitape District, Meni Creek, nr Kaiye Village, *Darbyshire & Hoogland* 8168 (L, LAE); Bulolo, cult., ex Gogol Valley, *Hay* 1401 (LAE); nr Baku, Gogol Valley, *Hay* 4006 (NSW); Madang Prov., Wasab, *Hay* 4020 (NSW); Gogol Valley, *Hay* 4040 (NSW); Kikori River, above the Govt. Station, *NGF* 5088 (A, K, LAE); Josephstaal, Madang, *NGF* 10277 (L, LAE); Fly River, 100 mi above Daru, *NGF* 35280 (LAE); Lae, cult., *Nicolson* 1401 (BO, L, LAE, US); Lower Ramu Valley, 1/4 mi S of Josephstaal airstrip, *Pullen* 1188 (LAE).

4. *Alocasia lauterbachiana* (Engler) A. Hay, *comb. nov.*

Schizocasia lauterbachiana Engler, Bot. Jahrb. 25 (March, 1898) 26; Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. (1901) 214; Krause in Engler, Pflanzenz. 71 (IV.23E) (1920) 116, fig. 26. — *Xenophya lauterbachiana* (Engler) Nicolson, Blumea 16 (1968) 116; Madison, Aroideana 2 (1979) 62; Hay in Johns & Hay, Stud. Guide Monoc. Papua New Guinea 1 (1981) 83, fig. 34a; Burnett, Aroideana 7 (1984) 155, fig. 138. — T y p e: New Guinea, Sattelberg, 22 July 1890, *Lauterbach* 632 (B, holo, fide Nicolson, 1968, n.v.).

Alocasia wavriniana Masters, Gard. Chron. 21 (April, 1898) 241, fig. 89. — T y p e: cult. Hort. Sander, ex 'Celebes', 4 June 1902, *N. E. Brown s.n.* (K! lecto, selected here).

Treelet with erect brown stem to 1.5 m tall; leaves c. 6 together in a terminal cluster; petiole to c. 40 cm long, sheathing in the lower 1/2–1/3rds, densely mottled with chocolate brown; lamina deep bronze green above, dark purple below, narrowly hastate in outline, with the margin serrately lobed; anterior lobe broadly lanceolate, widest at about midway from the base, to c. 60 cm long, c. 15 cm wide, with up to 9 primary veins on either side of the anterior costa diverging at an angle of about 50 degrees; secondary venation flush abaxially; interprimary collective veins absent; leaves produced after flowering has commenced often much smaller than those before; inflorescences paired, the pair subtended by a cataphyll, second inflorescence of the pair subtended by a small prophyll; peduncle rather short, to 8 cm long, mottled; spathe to c. 14 cm long, constricted about a quarter of the way from the base, the lower part usually triquetrous, greenish ivory boldly vertically streaked with chocolate brown without, greyish and smooth within, the limb narrow, clasping the spadix, opening only level with the male zone, dirty ivory speckled and finely streaked chocolate purple without, dull ivory within; spadix to c. 12 cm long, slender; female zone to 1.4 cm long, c. 1 cm wide at base, with c. 30 pistils; ovaries pale green, close packed, unilocular; stigma button-like, distinctly papillate, faintly lobed; ovules anatropous; interstice of sterile organs equalling the female zone, c. 5 mm diam. at base, tapering to 2.5 mm diam., white, the lower sterile organs turning brown soon after anthesis; male zone c. 3 cm long, 4 mm diam., white; synandria more or less hexagonal, 3 mm long, anthers opening through pores on the tops of the synandria; spadix slightly constricted between male zone and appendix; appendix to c. 5 cm long, 3 mm diam., tapering to a point; berries orange red; seeds unknown.

Distribution. Bismarck Archipelago and northern New Guinea, in the lowlands in rainforest especially near river edges and forest edge. Masters (l.c.) noted that this species was introduced into Sander's nursery by Micholitz from Celebes. Records to Micholitz's travels are very incomplete and those known (Van Steenis-Kruseman, 1950) do not include Celebes. *Alocasia lauterbachiana* has never otherwise been reported from there.

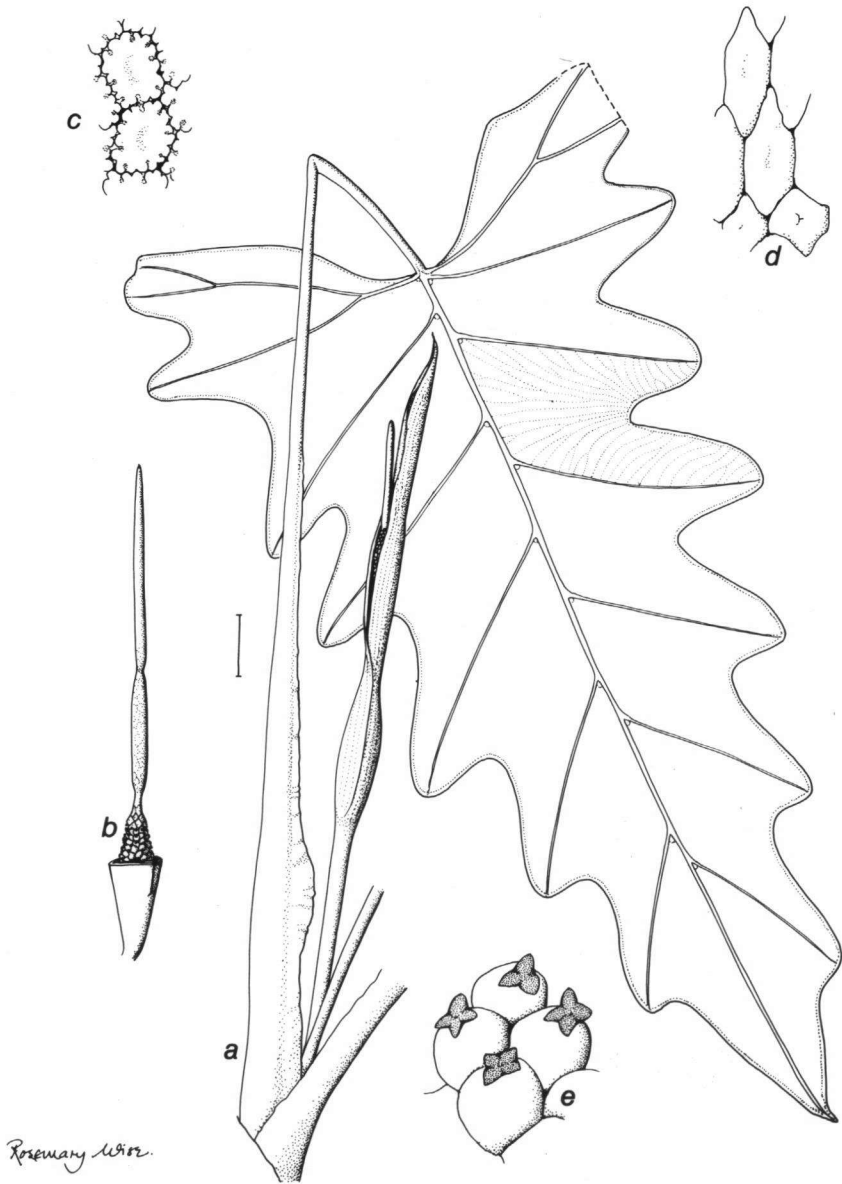


Fig. 5. *Alocasia boa* A. Hay (a, Brass 13377; b-e, Hay 4072). a. Part of shoot; b. spadix; c. synandria; d. organs of sterile interstice; e. pistils. — Scale: bar to a, b = 2 cm; to c-e = 2 mm.

N o t e s. The lectotype specimen of *A. wavrini* was evidently prepared from the clone introduced by Micholitz.

This species seems to be identical in its inflorescence to *A. brancifolia*, with the possible exception that the stigmas are button-like and distinctly papillate in *A. lauterbachiana*, and lobed and indistinctly papillate in *A. brancifolia* (it is not clear that these character states are constant). Nevertheless, it is highly distinctive and shows no sign of intergrading with anything else.

It is not known to set seed. That the berries are orange red is known from a parthenocarpic example in cultivation. Peekel (1984) noted that in New Ireland it is grown as an ornamental by the indigenous people, and that it does not set seed there. The plants that A.H. observed in cultivation in various parts of the world, and the herbarium material, are astonishingly uniform, suggesting that a clone may be involved. Marchant (1971) notes that there are 70 chromosomes, whereas the usual diploid number in *Alocasia* is 28, suggesting that this plant is a pentaploid. The plants freely propagate themselves vegetatively. However, at least two collections from the Bismarck Archipelago seem to be from wild plants growing in the forest floor.

Other specimens seen:

PAPUA NEW GUINEA. Cultivated at Bulolo, ex Dreikikir, East Sepik Prov., *Hay 1401* (LAE); Alimbit R., Kandrian, West New Britain, *NGF 22486* (LAE); 8 mi up Danfu River, nr Manga, Namatanai, New Ireland, *NGF 46034* (L, LAE); cult. Lae Botanic Garden, *Nicolson 1395* (K, L, LAE); New Ireland, *Peekel 56* (BO, L).

5. *Alocasia boa* A. Hay, *spec. nov.* – Fig. 5.

Ab *A. hollrungii* Engler spatha maculata, stigmatibus lobatis, synandriis rhomboidibus, foliis leviter pinnatifidis differt. — **T y p u s** : Irian Jaya, Idenburg River, 4 km SW of Bernhard Camp, March 1939, *Brass 13377* (A!, holo; L!).

Moderately robust herb to c. 1 m tall; rhizome erect to decumbent, to c. 1.5 m long, naked, dark brown, to 4 cm diam.; leaves to 6 together; petioles mottled pinkish and chocolate, to 55 cm long, sheathing in the lower 1/2–2/3rds, the wings of the sheath persistent; blades sagittate, shallowly pinnatifid, with the lobes about as wide at the base as deep, somewhat serrate, with a single primary vein running to the narrowly rounded tip; anterior lobe to c. 40 cm long, to c. 27 cm wide at base; anterior costa with c. 10 primary lateral veins on each side, diverging at an angle of c. 60 degrees, somewhat impressed adaxially, prominent abaxially; posterior lobes 1/3–1/2 the length of the anterior, weakly pinnatifid on both sides of the posterior costae; secondary venation flush with the lamina on both the adaxial and abaxial sides; interprimary collective veins absent; inflorescences paired, on short peduncles, subtended by a maculate cataphyll; spathe mauvish pink, mottled chocolate, c. 16 cm long, constricted c. 3 cm from the base, the lamina narrowly lanceolate, clasping the spadix, opening only slightly, mostly level with the male zone of the spadix; spadix very shortly stipitate, equalling the spathe; female zone c. 1.2 cm long, 1 cm diam., with c. 40 pistils; ovaries unilocular, pluriovulate; ovules anatropous; stigma bluntly 3- or 4-lobed, on a very short style; interstice of sterile organs c. 2 cm long, somewhat attenuate in the upper part; male zone c. 3.5 cm long, 6 mm diam.; synandria rhomboidal, c. 2 mm long, flat-topped, ivory, the anthers opening by apical pores; appen-

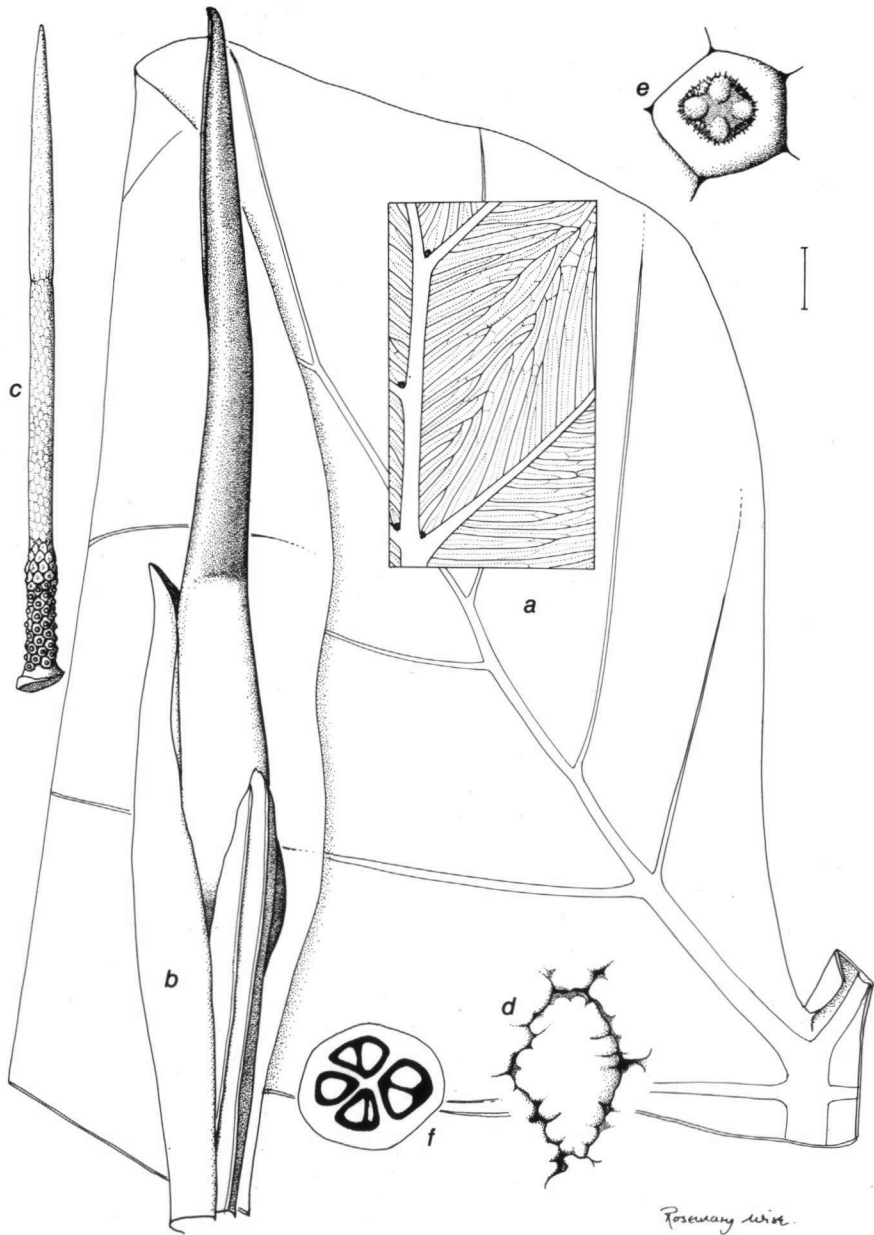


Fig. 6. *Alocasia pyrospatha* A. Hay (Hay & Karenga 4022). a. Posterior lobe of blade showing peltate sinus with venation inset; b. inflorescence with subtending cataphyll and subsequent prophyll; c. spadix; d. synandrium; e. pistil; f. TS ovary. — Scale: bar to a–c = 2 cm; to d–f = 2 mm.

dix c. 7.5 cm long, 4 mm diam., gradually tapering distally and proximally; fruit and seed unknown.

Distribution. Known only from the type collection, as occasional individuals in lowland rainforest, and from plants cultivated in the National Capital Botanical Garden, Port Moresby, said to be from near Wewak, though no voucher specimen has been located.

Notes. The specific epithet refers to the serpentine colour and pattern of the spathe. This species is morphologically intermediate between *A. hollrungii* and *A. brancifolia*, and we initially believed the plants cultivated at Port Moresby to be hybrids between these species. However, the type collection lies outside the known range of *A. hollrungii*. Burnett (1984) noted that this species has entered cultivation under the name *Xenophya* 'Frenchville'.

Other specimens seen:

PAPUA NEW GUINEA. Cult. Port Moresby Botanic Garden, *Hay 4072* (NSW).

6. *Alocasia pyrospatha* A. Hay, *spec. nov.* – Fig. 6.

Ab *A. hollrungii* Engler pedunculo fructifero brevi erecto, spatha crasse coriacea, ovario septato, stigmatate minute lobato differt. — **T y p u s**: Papua New Guinea, Morobe Prov., Lae District, near Sankwep River Bridge, N of Lae, 10 January 1989, *Hay & Karenga 4022* (LAE, holo; NSW).

Massive pachycaul herb; stem decumbent, to 13 cm diam., to 1.5 m long, clothed in the persistent fibres of old leaf bases; leaves about 7 together; petioles to c. 1.4 m long, rounded on the abaxial side, flattened adaxially, sheathing in the lower half; wings of sheath persistent, bronze to red-flecked, recurved at the margins; blade broadly sagittate, margin entire, sinus sometimes peltate with the petiole inserted c. 1.3 cm from the lamina margin; posterior costae divergent at 60–90 degrees, lamina-bearing to the sinus; posterior lobe to c. 45 cm long, 32 cm wide at widest point, rather rotund, blunt tipped; anterior lobe to c. 75 cm long, c. 60 cm wide at base, with 10 primary lateral veins per side, diverging at c. 75 degrees, running more or less straight to the margin; primary venation strongly raised adaxially, weakly raised abaxially; secondary venation weakly raised adaxially, flush abaxially; interprimary collective veins absent; inflorescences (3 or) 2 together, in five such pairs amongst the foliage leaves, each pair subtended by a large cataphyll similar in texture to the wings of the leaf sheath, the second inflorescence subtended by a diminutive bicarinate prophyll; peduncles c. 9 cm long, hidden within the cataphyll and leaf base; spathe 30 cm long, not or hardly constricted, in the lower third tapering from 3 to 1.8 cm diam., then the limb tapering more gradually to the pointed tip, opening slightly throughout its length at anthesis, ivory to pink, after anthesis closing tightly, the limb persistent, turning bright scarlet, the basal part enclosing the fruits remaining ivory, the whole thick, hard, and fleshy, held erect; spadix on a very short conical stipe; female zone 2.5 cm long, c. 1 cm diam., with c. 100 ivory coloured pistils; stigmas sessile, papillate, button-like, with 4 or 5 indistinct more or less conical lobes; ovary three- or four-locular; ovules hemianatropous; interstice of sterile organs 2 cm long, only very faintly tapering; male zone more or less cylindrical, c. 9 cm long, 1 cm diam.; synandria rhomboidal, c. 3 mm across; anthers open-

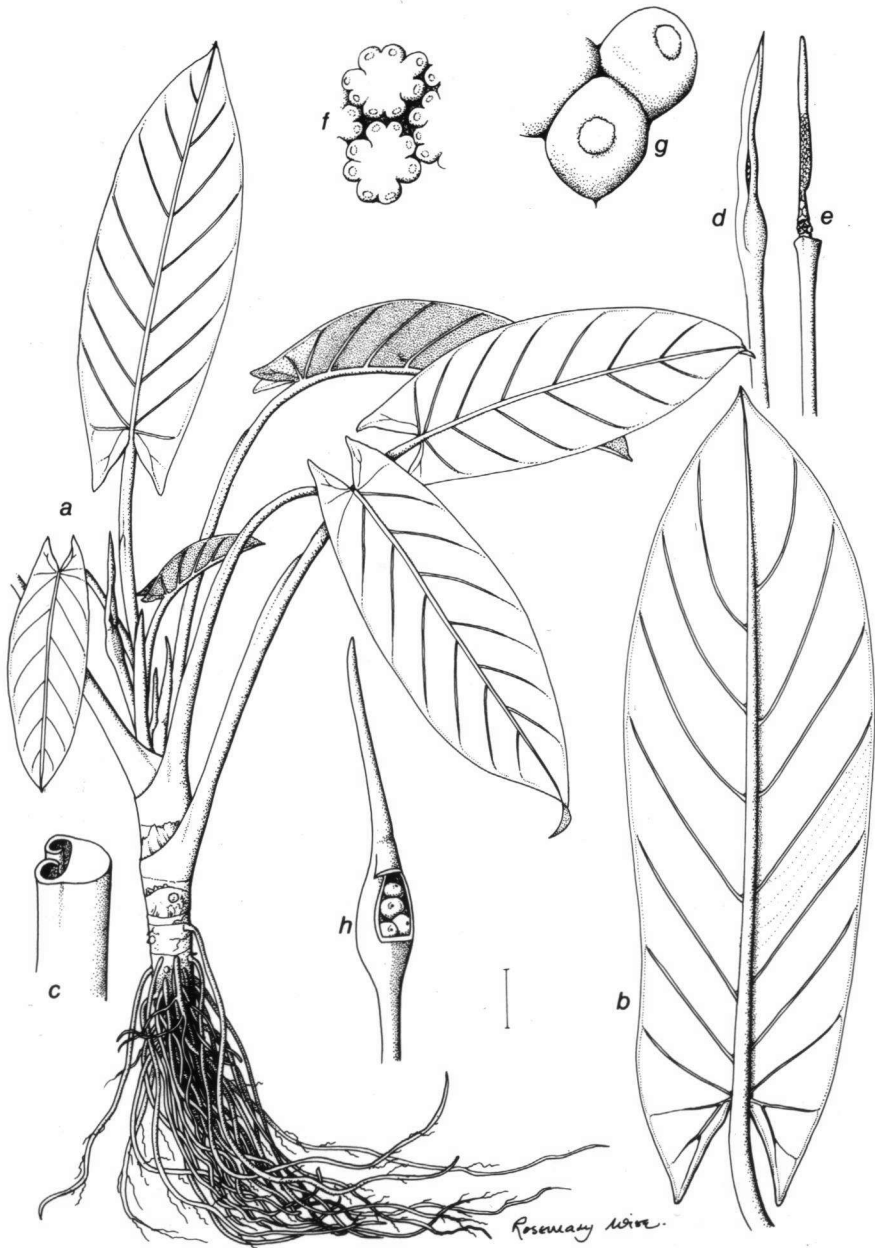


Fig. 7. *Alocasia lancifolia* Engler (Hay 4056). a. Whole plant; b. leaf blade; c. portion of sheathing petiole; d. inflorescence; e. spadix; f. synandria; g. pistils; h. infructescence. — Scale: bar to a = 7.5 cm; to b–e, h = 2 cm; to f, g = 2 mm.

ing by lateral slits not reaching the top of the synandrium; appendix very irregularly sulcate, c. 7 cm long, tapering to a point, ivory throughout; fruit c. 1 cm diam., orange red, several-seeded; seeds pale brown, c. 2.5 mm diam.

D i s t r i b u t i o n. Known only from the type locality in Papua New Guinea and four localities in West and North Irian Jaya, in rainforest floor, under canopy gaps, and on forest edge, at c. 50–100 m altitude.

N o t e s. The function of the intense colouration of the spathe after anthesis is unclear, as it appears long before the fruits are ripe. In the only known Papua New Guinea population, additional very distinctive characters are the peltate leaf and the fibrous rhizome. In the vegetative state the plants bear, from a distance, a strong resemblance to *A. macrorrhizos* which may explain why the species has been overlooked (so near to Lae) until recently. We have not seen plants of this species from Irian Jaya in the living state. However, the herbarium collections cited suggest that the Irianese plants may be smaller than those from the widely isolated Papua New Guinea population. Their leaves are not or only barely peltate. There may be two geographical subspecies. Further collections from Irian Jaya might clarify the matter.

Other specimens seen:

IRIAN JAYA. Rouffaer River, Motor Camp, *Docters van Leeuwen 11077* (BO, L); Vogelkop, Manokwari, nr Ramsiki, *Kostermans 2781* (BO); Misool Island, Sorong, nr Fakal, *Pleyte 1039* (A, BO); Fakfak River, N of Fakfak, *Vink BW 12148* (A, BO, CANB, LAE).

PAPUA NEW GUINEA. Near Sankweb River bridge, N of Lae, *Hay 1404* (LAE).

7. *Alocasia lancifolia* Engler – Fig. 7.

Alocasia lancifolia Engler in Lorentz, *Nova Guinea* 8 (1912) 807, t. 147; Krause in Engler, *Pflanzenr.* 71 (IV.23E) (1920) 77; Burnett, *Aroideana* 7 (1984) 108, fig. 56. — T y p e: Irian Jaya, Lorentz (Noord) River, *von Römer 408* (B!, lecto, selected here; BO!).

Rather small to moderately robust herb; stem decumbent erect, c. 40 cm long, to 6 cm diam.; leaves 5–11 together; petiole much shorter than to equalling the blade, to c. 35 cm long, sheathing for more than half its length, margins of the sheath inrolled; blade rather coriaceous, mid-green, glossy above, broadly oblanceolate, to c. 50 cm long (usually much less), 14 cm wide at widest point, the tip shortly acuminate; anterior costa with up to 8 primary veins diverging at an angle of about 50–60 degrees; posterior lobes much reduced, c. 6 cm long, triangular, pointed; secondary venation indistinct, not raised; interprimary collective veins absent; inflorescences paired, subtended by a persistent green cataphyll; peduncle rather short, barely emerging from the cataphyll; spathe green, to c. 9–11 cm long, constricted at c. 2.5 cm from the base, the limb narrow, clasping the spadix, opening only level with the female flowers, to c. 9 cm long, pale greenish yellow; spadix almost as long as the spathe; female zone c. 0.6–1.2 cm long; with c. 10–20 pistils; ovary unilocular with several anatropous ovules; stigma indistinctly trilobed; interstice of sterile organs c. 0.5–1 cm long; male zone c. 1.7–2.5 cm long, c. 4 mm diam., white, more or less cylindrical; synandria more or less rhomboidal, dehiscing by apical pores; appendix 3–4 cm long, tapering to narrowly clavate, rugose to smooth, c. 3 mm diam.; fruiting spathe at first persistent and reddening, then split into longitudinally recurved segments; berries orange-red, several-seeded; seeds reniform, c. 3.5 mm diam.

Distribution. Widespread but very scattered in the New Guinea lowlands, in open swampy places in lowland rain forest, and along forest streams; sometimes gregarious; to c. 600 m altitude. Fig. 8.

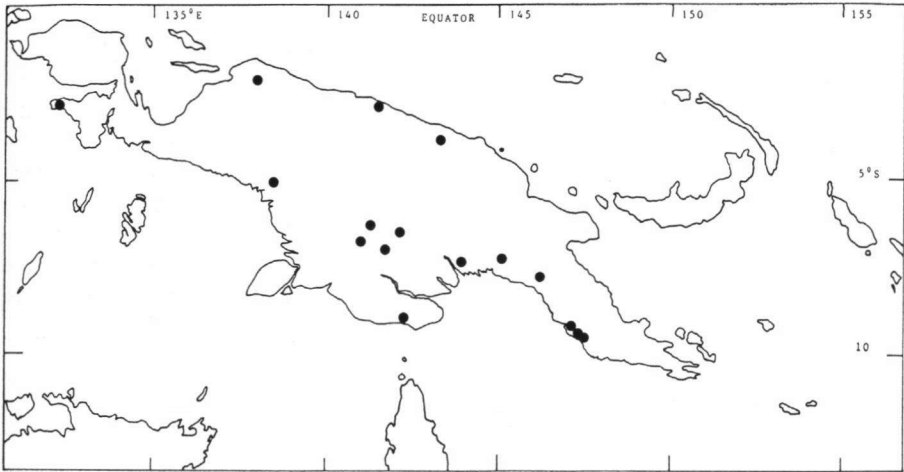


Fig. 8. Distribution of *Alocasia lancifolia* Engler.

Notes. Krause cited two Ledermann collections from Etappenberg, East Sepik Province (*Ledermann 9268* and *9558*), both presumed destroyed at Berlin. It has not since been recorded from that Province.

The habitat preference and highly distinctive leaf form suggest some degree of reophytic stenophylly.

Other specimens seen:

IRIAN JAYA. Camp Albatross, *Docters van Leeuwen 9655, 11307* (BO); Pionierbivak, *Lam 429* (BO); Noord (Lorentz) R., *von Römer 613* (BO); Fakfak, Minika Timur, road to Kwamki, *Widjaja 2517, 2543* (BO).

PAPUA NEW GUINEA. Central Prov., Vailala R., *Brass 913* (A, BRI); Dieni, Ononge road, *Brass 3959* (A, BO, BRI); Western Prov., Fly R., 528 mi Camp, *Brass 6687* (A); Palmer R., 2 mi below jct. with Black R., *Brass 7343* (A, L); Central Prov., Veiya, *Carr 11653* (L), *11679* (CANB, L); Gulf Prov., nr Putei, jct. Tauri & Kapau Rivers, *Craven & Schodde 971* (CANB); Central Prov., Brown River road, c. 40 km from Port Moresby, *Hay 4056* (NSW, UPNG); Subitana, *Hay 4062* (NSW); Kuriva Forestry area, Veimauri R., *LAE 51570* (BRI, L, LAE, US); West Sepik Prov., Blackwater Ck., logging area, *LAE 56453* (NSW); Western Prov., 2 km from Nomad, *LAE 74025* (LAE); Gulf Prov., Omati, *NGF 5073* (A, BRI, K, L, LAE); Western Prov., Moorhead, Strachan R., *NGF 35428* (L, LAE); Central Prov., Brown River Forest Reserve, 25 mi NW of Port Moresby, *Nicolson 1425* (K, L, LAE); Sogeri Rubber Estates, c. 30 mi E of Port Moresby, *Nicolson 1438* (LAE, US); Sogeri Plateau, between Subitana & Javerere, *Nicolson 1443* (LAE, US); Western Prov., lower Strickland R., c. 3 mi below Massey Baker's jct., *Pullen 7449* (CANB, LAE).

8. *Alocasia hollrungii* Engler – Fig. 9.

Alocasia hollrungii Engler, Bot. Jahrb. 25 (1898) 24; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 81; Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. (1901) 214; Burnett, Aroideana 7 (1984) 108, fig. 55. — T y p e: Papua New Guinea, Constantinhafen (Melanu), *Hollrung 548* (B!, holo).

[*Alocasia aequiloba* auct. non N.E. Br.: Burnett, Aroideana 7 (1984) 105, fig. 48.]

Rather small to very robust herb; rhizome decumbent, 4–c. 10 cm diam., naked in the older parts, the younger parts with some marcescent remains of leaf bases; leaves about 6 together, very variable in size and shape; petiole c. 90 cm long, rounded abaxially, somewhat flattened adaxially, usually with a ridge running up the middle of the adaxial surface, sheathing in the lower half, green to bronze, rarely purple-black, sometimes pinkish-mottled; wings of sheath persistent, somewhat inturned and closed or nearly closed after the emergence of subsequent leaf; blade narrowly to broadly sagittate, membranous to somewhat leathery, with the margin entire, rarely faintly undulate; anterior lobe to c. 60 cm long, c. 50 cm wide at base, often considerably smaller and sometimes less than half as wide as long, with c. 7 primary veins on either side of the anterior costa, diverging at an angle of 45–60 degrees; primary venation distinctly raised adaxially in robust specimens, prominent below with small flat glands in the axils; posterior costae 1/3rd to 1/2 the length of the anterior, with lamina extending to the sinus; secondary venation flush on both surfaces; interprimary collective veins absent; inflorescences paired, each pair subtended by a cataphyll, the second inflorescence subtended by a small prophyll; peduncle to 25 cm long, not or hardly emerging from the cataphyll at anthesis, held erect, afterwards markedly declinate and exposed; spathe to 22 cm long, very slender, constricted 2–4 cm from the base, the limb opening only level with the male zone of the spadix, persisting after anthesis, ivory to yellowish to pink to red, purple in black-petioled forms; spadix very shortly stipitate, slender, almost as long as the spathe; female zone 1–2 cm long, almost cylindrical, c. 0.6–1.1 cm wide, with c. 60–80 pistils; ovary green, unilocular, pluriovulate; stigma white, stellate, 4- or 5-armed, more or less sessile; ovules anatropous; interstice of sterile organs c. 1.6 cm long, 7 mm long at base, tapering to c. 3 mm, ivory; male zone 4–5 cm long, 5–7 mm wide at base, very gradually tapering into the appendix; synandria ivory, rather to very irregularly shaped, with the anthers free at their sides, opening by apical pores; appendix equalling to double the length of the male zone, ivory, smooth to faintly sulcate, sometimes staminodial in the upper portion, gradually tapering to a point; fruiting spathe splitting into longitudinal recurved segments; berries orange-red, several-seeded; seeds globose, c. 4 mm diam., strophiolate.

D i s t r i b u t i o n. North East New Guinea and New Britain. I have tentatively ascribed a specimen from each of Gulf and Western Provinces of Papua New Guinea to this species. The material is fragmentary, however. *Alocasia hollrungii* is otherwise not recorded south of the cordillera. It is common in the lowlands (but *Pullen 1555* from c. 1000 m), in rainforest and forest edge, gaps, regrowth, often an abundant weed in plantations. Fig. 10.

N o t e s. There may be some regional variation, but it is not yet well enough understood for nomenclatural recognition to be useful. Generally the plants in

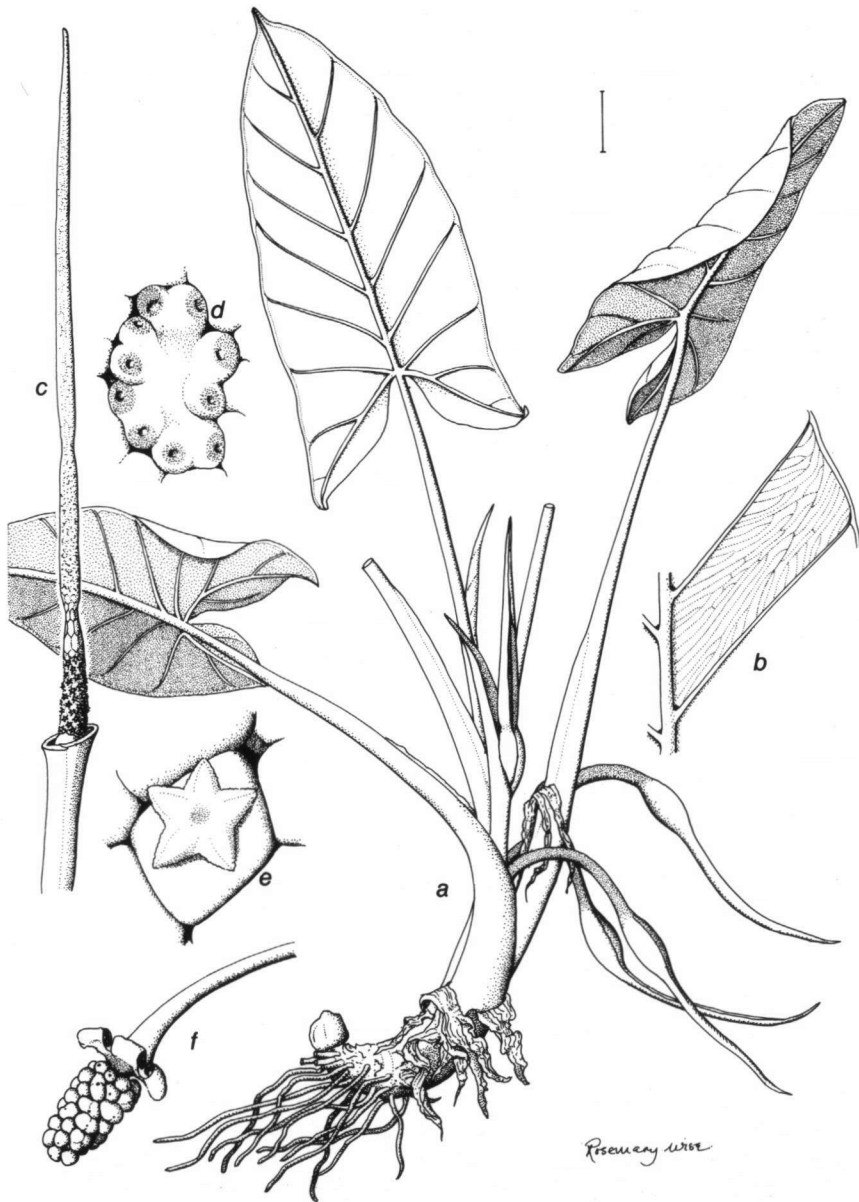


Fig. 9. *Alocasia hollrungii* Engler (Hay 4035). a. Whole plant (typically the leaves are larger) showing declinate young infructescences and barely opening spathe at anthesis; b. venation; c. spadix; d. synandrium with partially united anthers; e. pistil with stellate stigma; f. mature infructescence with longitudinally dehiscent spathe. — Scale: bar to a = 7.5 cm; to b, c, f = 2 cm; to d, e = 2 mm.

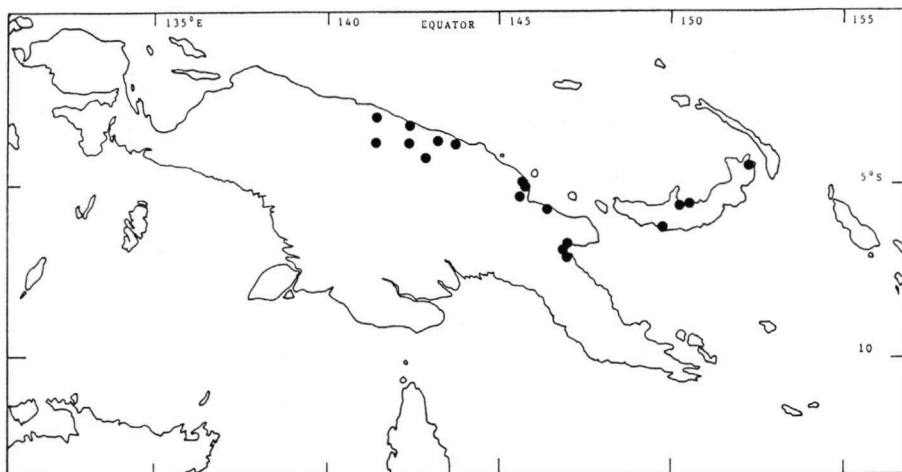


Fig. 10. Distribution of *Alocasia hollrungii* Engler.

Morobe Province are less robust than elsewhere and occur commonly in rainforest undergrowth. In other parts of the range the plants are often more robust and tend to occur in more open sites. Reddish colouration in the spathe occurs towards the western end of the range, mixed in populations with pale spathes. Likewise, bronze and reddish pink colouration in the petiole and major venation occurs mixed in populations with pale green petioles and veins. Occasional individuals have blackish purple petioles and veins and green laminas, similar to some cultivars of *A. macrorrhizos*. The two figures cited above in Burnett (l.c.) represent the extremes of form within the species. The peduncle declinate after anthesis is highly characteristic. The spathe limb persists for some considerable time after anthesis, eventually rotting and falling away shortly before the lower part dehisces.

Other specimens seen:

PAPUA NEW GUINEA. Oomsis, *Brass* 29208 (LAE); Wewak, along trail beyond Boys' Town reform school, *Croat* 52751 (LAE); Sankwep, SE of Lae, *Croat* 52810 (LAE); nr Marok Village, Aitape, *Darbyshire & Hoogland* 7916 (CANB); 30 km from Vanimo along Bewani road, *Hay* V29 (A, LAE); nr Dami, Kimbe, West New Britain, *Hay* 1300 (LAE); nr Baku, Gogol Valley, *Hay* 4003 (NSW); Wasab, *Hay* 4017, 4035, 4036, 4037 (all NSW); c. 30 km from Madang on North Coast road, *Hay* 4038 (NSW); East Sepik Prov., 41 km WSW of Nuku, *Heyligers* 1624 (CANB); 50 km NE of Nigerum, Western Prov., *Hyn* 192 (LAE); Iafar, NW of Amanab, West Sepik, *Juillerat* 183 (LAE); Hopu R., Lae, *LAE* 51932 (L, LAE, US); Sepik, *Ledermann* 6639, 6885 (K); Malalia, nr Cape Hoskins, *NGF* 6518 (K, LAE); Saidor, SE of Madang, *NGF* 6895 (A, BRI, LAE), *NGF* 6896 (BRI); Aiwit R., E of Fullerborn Harbour, East New Britain, *NGF* 14985 (LAE, US); West Sepik Prov., Vanimo, Ossima, *NGF* 39193 (BRI); Vunapaladir, Keravat, Kokopo, East New Britain, *NGF* 44363 (LAE, US); cult. Lae botanic garden, *Nicolson* 1394 (K, LAE); Bumbu R., 7 mi N of Lae, *Nicolson* 1407 (LAE); Malambe Track up Busu R., *Nicolson* 1455 (BO, US), 1456 (L); East New Britain, 25 mi W of Rabaul, Kerevat road, *Nicolson* 1493 (L, LAE, US); Kandrian, West New Britain, *Nicolson* 1541 (BO, L, LAE); Madang Airport, *Nicolson* 1558 (LAE); Gumboak Stream, between Gwabadik and Gawan, Busu R., nr Lae, *Okada & Kaiik* 4326 (BRI); Maprik, Mt Turu, on Ambakanja-Wainjo track, *Pullen* 1555 (CANB, LAE); Kokopo, *van Royen* 6616 (LAE); Gulf Prov., Purari R., nr Ururu village, *Schiefenhövel* 98 (L); Ambunti, *Townsend* 154 (LAE).



Fig. 11. *Alocasia monticola* A. Hay (Hay & Howcroft 4024). a. Leaf; b. inflorescences with cataphyll; c. synandrium; d. pistils; e. young infructescence. — Scale: bar to a, b, e = 2 cm; to c, d = 2 mm.

9. *Alocasia monticola* A. Hay, spec. nov. — Fig. 11.

Ab *A. hollrungii* spathae lamina decidua, ovulis hemianatropis, synandrio regulariter rhomboideo, stigmatibus minute lobato differt. — T y p u s : Papua New Guinea, Morobe Prov., Nauti road, nr Bulolo, c. 700 m alt., 12 January 1989, *Hay & Howcroft 4024* (LAE, holo; NSW).

Small to moderately robust herb; rhizome erect or decumbent, c. 30 cm long, c. 3.5 cm diam., the old leaf bases sparsely fibrous; leaves to 6 together; petioles green to mottled dark red, to 45 cm long, sheathing in the lower 2/3rds; wings of sheath persistent; blades generally distinctly hastate, sometimes (ovato-)sagittate, held horizontally; anterior lobe 15–30 cm long, c. 10 cm wide at base, with 3 or 4 abaxially prominent, often purple, primary veins on each side of the anterior costa, diverging at an angle of c. 45 degrees, running into a conspicuous intramarginal vein 3–4 mm from the margin, with conspicuous glands in their axils abaxially; posterior lobes over half the length of the anterior, diverging approximately at right angles, usually lanceolate (in hastate forms) or broadly triangular (sagittate); posterior costae naked in the sinus for c. 5 mm; interprimary collective veins absent; inflorescences paired, each pair subtended by a slender cataphyll c. 16 cm long; peduncle to c. 10 cm in flower (extending somewhat in fruit); spathe c. 10 cm long, slender, constricted at c. 2.4 cm from the base, white to pale pink; spathe limb narrow, clasping the spadix, opening only level with the male zone of the spadix, falling after anthesis; spadix c. 11 cm long, slender, almost as long as the spathe; female zone c. 1 cm long, c. 7 mm wide at base, tapering slightly, with about 50 pistils; ovary globose, c. 1.5 mm diam., pale yellow-green, unilocular, stigma white, sessile, very weakly 3-lobed, interstice of sterile organs c. 2 cm long, 5 mm diam. at base, tapering to 2.5 mm, white; male zone c. 3 cm, more or less cylindrical, tapering rather abruptly at both ends, 5 mm diam.; synandria white, more or less rhomboid, slightly impressed at the top; anthers opening by apical pores; appendix slender, c. 3 mm diam., slightly constricted at base, tapering to a point or slightly clavate, white, smooth; fruit orange red, revealed by the space dehiscing longitudinally into recurved segments; seeds several, strophiolate, c. 3 mm diam.

Distribution. Collections are rather sporadic, but possibly throughout East New Guinea, and a single collection from Idenburg River in West Irian; in lower montane rain forest undergrowth, usually in damp sites.

Notes. Although the spathe limb is deciduous, the facies of this species indicates that it is allied with those *Alocasia* species with persistent spathe limbs, and it shares with them the fact that the spathe limb, at anthesis, barely opens, instead clasping the spadix.

Leaf shape is quite variable, being sagittate or even ovato-sagittate in some specimens. The leaf margins are occasionally wavy. The conspicuous intramarginal vein is characteristic.

Okada & Carson (1980) described *Drosophila pauciramia* from this species, citing it as '*A. angustiloba*'.

Other specimens seen:

IRIAN JAYA. 6 km S of Bernhard Camp, Idenburg R., *Brass 12851* (A, BO, BRI).

PAPUA NEW GUINEA. Morobe Prov., nr Andarova village, *Blackwood 127* (K); Central Prov., Mt Tafa, *Brass 5021* (BRI); Eastern Highlands Prov., Purosa, Okapa area, *Brass 31770* (CANB, LAE,



Fig. 12. *Alocasia aequiloba* N.E. Br. (Hay 4032). a. Whole plant, showing short sheaths and marcescent cataphylls of proleptic renewal axis; b. venation; c. spadix; d. spadix of Hay 4055; e. syndrium; f. pistils; g. mature infructescence showing transverse dehiscence of spathe. — Scale: bar to a = 7.5 cm; to b–d, g = 2 cm; to e, f = 2 mm.

US); Central Prov., Boridi, *Carr 14917* (K, L); Morobe Prov., Wau, Kunai Ck, *Carson 3* (LAE); N slope Mt Missim, *Croat 52936* (LAE); Milne Bay Prov., Gwiroro, *Cruttwell 673* (K); Mt Suckling, nr Mayu R., *LAE 55698* (L, LAE); Morobe Prov., Wau–Salamau road, *NGF 8302* (A, BRI, LAE); head of Bulolo R., *NGF 35631* (L, LAE, US); above Wau, Edie Ck, *Nicolson 1463* (LAE); Milne Bay Prov., Goropu Mts (Mt Suckling) along Mayu R., *Veldkamp & Stevens 5515* (L); Goropu Mts (Mt Suckling), Tapan Mayu, *Veldkamp & Stevens 5970* (CANB, L, LAE); Morobe Prov., Bulolo, c. 6 km of Manki trig., *Wallace 934/84* (NSW).

'Coriaceae group'

10. *Alocasia aequiloba* N.E. Br. – Fig. 12.

Alocasia aequiloba N.E. Br., Bull. Misc. Inform. (1895) 119; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 84. — T y p e: Cult. Hort. Sander, ex 'German New Guinea', 10 January 1895, *N.E. Brown s.n.* (K!, holo).

Alocasia magnifica Engler, Bot. Jahrb. 25 (1898) 23; Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. (1901) 214; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 82; Hay in Johns & Hay, Stud. Guide Monoc. Papua New Guinea 1 (1981) 39, fig. 15; Burnett, Aroideana 7 (1984) 110, figs. 57A, B. — T y p e: New Guinea, Oertzenberg, 14 May 1896, *Lauterbach 110* (B!, holo).

Alocasia dahlia Engler, Bot. Jahrb. 25 (1898) 24; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 83, fig. 14; Schumann & Lauterbach, l.c.; Burnett, Aroideana 7 (1984) 107, fig. 52. — T y p e: New Britain, Ralum, *Dahl s.n.*, 16 Feb. 1897 (B!, holo).

Alocasia schlechteri Engler in Schumann & Lauterbach, Nachtr. Fl. Deutsch. Schutzgeb. (1905) 62; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 99; Burnett, Aroideana 7 (1984) 111, fig. 59. — T y p e: New Guinea, Torricelli Range, April 1902, *Schlechter 14526* (B!, holo).

Alocasia gjellerupii Engler in Lorentz, Nova Guinea 8 (1912) 808, t. 148; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 98. — T y p e: North New Guinea, Begouri River, June 1910, *Gjellerup 220* (BO!, holo).

Alocasia angustiloba Engler & Krause, Bot. Jahrb. 54 (1916) 87, fig. 3; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 96, fig. 20; Burnett, Aroideana 7 (1984) 107, fig. 49. — T y p e: New Guinea, Kani Range, May 1908, *Schlechter 17736* (B!, holo).

Alocasia denudatoides Engler & Krause, Bot. Jahrb. 54 (1916) 88; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 98. — T y p e: New Guinea, Minjem-Thor, May 1907, *Schlechter 16096* (B!, holo).

Alocasia peekelii Engler & Krause, Bot. Jahrb. 24 (1916) 88; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 98, fig. 21F–K; Henty in Peekel, Fl. Bismarck Archip. (1984) 72, fig. 118; Burnett, Aroideana 7 (1984) 111, fig. 58. — T y p e: New Ireland, Namatanai, March 1910, *Peekel 367* (B!, holo).

Small to moderately robust herb; stem decumbent to creeping, rarely erect, to 4 cm diam., usually less, brown, in the younger parts clothed in old leaf bases and conspicuous marcescent cataphylls of the proleptic renewal axes; leaves 1–several together; petiole c. 30–110 cm long, terete, green, sometimes maculate with darker grey, rarely mottled with purple-brown; sheath very short, 1/8–1/4 the length of the petiole, with persistent wings clasping the base of the subsequent leaf; blades hastate to sagittate, very variable in size, sometimes with the margins very faintly undulate, dark green and rather glossy adaxially, paler and dull abaxially, occasionally variegated with scattered, distant, yellow or white flecks, leathery, long-lived, often with epiphyllous bryophytes and lichens on the adaxial surface of older leaves; anterior lobe 15–55 cm long, 8–50 cm wide at base, from about as wide (at base) as long in

sagittate forms to c. 1/3 as wide as long in hastate forms, the tip obtuse to acute, shortly acuminate; anterior costa with 3–9 primary veins on each side, diverging at 45–60 degrees, prominent abaxially, on the adaxial side distally impressed, proximally somewhat prominent; posterior lobes more or less lanceolate to ovate, 3/4 to subequalling the length of the anterior; posterior costae diverging at c. 90–180 degrees; secondary venation faintly raised adaxially, flush abaxially and there usually of darker green than the lamina; interprimary collective veins distinct, often zig-zagging; inflorescences paired or a succession of pairs each subtended by a marcescent cataphyll, physiognomically terminal owing to proleptic renewal growth; peduncle long and rather slender, carrying the base of the spathe well clear of the cataphyll, c. 1/4 to more than 1/2 the length of the petiole; spathe c. 6.5–13 cm long, constricted c. 1/3rd of the way from the base, the limb lanceolate, shortly acuminate, opening wide, erect to deflected to recurved, pale green to greenish white, falling after anthesis; spadix somewhat shorter than the spathe, 5.5–c. 9 cm long, sessile; female zone obliquely inserted to adnate to the spathe for 2/3rds its length, 1.5–2.5 cm long; ovary unilocular, greenish ivory, multiovulate; style distinct, 1 mm long, upturned, especially in the lower pistils; stigma bluntly 3- or 4-fid; ovules orthotropous; interstice of sterile organs 1–1.3 cm long, somewhat constricted, white, rarely very short and not constricted or even absent; male zone about equalling to 2.5 times as long as the female, to 9 mm diam., white, cylindrical or sometimes constricted level with the constriction in the spathe when the interstice is short or absent; synandria more or less regularly hexagonal, flat-topped, with the anthers opening by apical pores; appendix about the same diameter as the male zone, not or hardly constricted in the transitional part, white or rarely pale yellow, tapering gradually to a rather blunt narrow tip, to subclavate, synandrodial to deeply sulcate, about equalling in length the fertile part of the spadix; fruiting spathe opening laterally, not splitting, or splitting slightly at the margins, not longitudinally; berries orange-red; seeds globose, c. 3 mm diam., anatropous, somewhat beaked at the micropyle, minutely strophiolate at the chalaza.

D i s t r i b u t i o n. Northern and eastern New Guinea and the Bismarck Archipelago, in lowland rainforest and swampforest floor and in regrowth. Fig. 13.

N o t e s. Brown (l.c.) rather misleadingly described the leaf margins as undulate-sinuate. It is rarely so, and, even in the holotype, almost imperceptibly so.

Of the Engler & Krause species reduced to synonymy here, *Alocasia dahlii*, *A. gjellerupii*, *A. angustiloba*, *A. denudatoides*, and *A. peekelii* were described from single specimens and were still represented by single specimens in Krause's monograph (l.c.). He placed heavy emphasis on leaf shape in his key to *Alocasia* species, with important characteristics being the angle of divergence of the posterior costae, the relative length of the anterior and posterior lobes, the shape of the sinus, and the ratio of width to length of the anterior lobe. However, many of the character states used to separate the 'species' listed here as synonyms cannot only be found within populations, but often also in single individuals. Because specimens are often cut down to a single blade (or less) in the preparation of herbarium material, the variation in individuals is not necessarily observable except in the field. *Alocasia peekelii* is apparently based on a specimen in which the interstice of sterile organs between the male and female zones of the spadix is absent. Unfortunately, all that remains of the

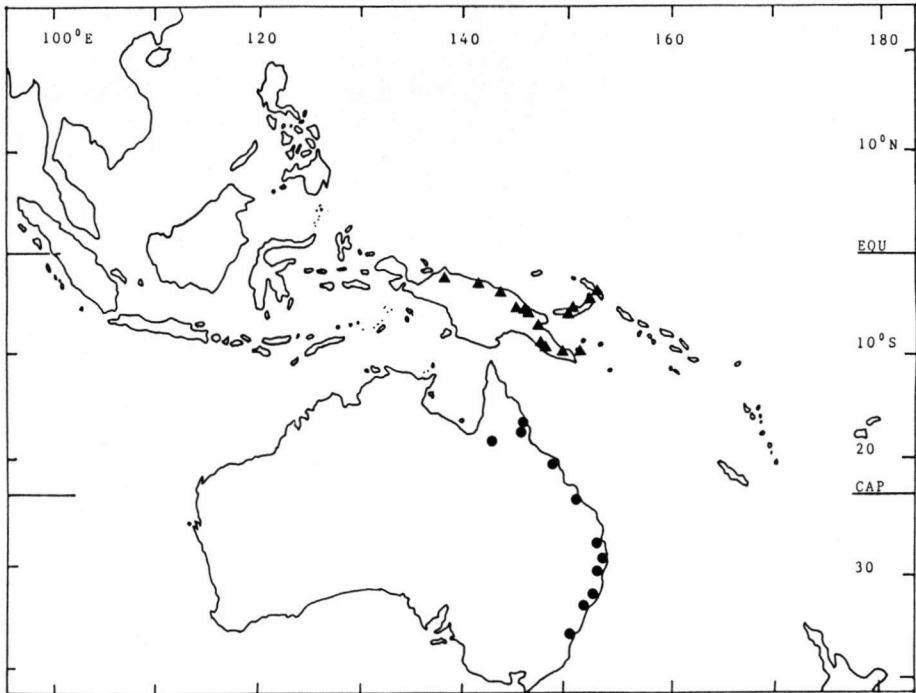


Fig. 13. Distribution of *Alocasia aequiloba* N.E. Br. (▲) and *Alocasia brisbanensis* (F.M. Bailey) Domin (●).

type is a leaf, the fertile material being presumed destroyed during World War II. However, Peekel himself illustrated this species (l.c.) quite clearly showing the sterile interstice. He presumably knew in the field the species he had sent Engler, and the plant he illustrated is very obviously the same as *A. aequiloba*. *Hay 4055* from Brown River (Central Province) is intermediate in that the interstice is very short and barely constricted. Another characteristic which varies considerably is the degree to which the female zone of the spadix is adnate to the spathe. There is a continuum of which Engler & Krause were apparently not aware, between a merely oblique insertion of the base of the spadix and spathe, to adnation for most of the length of the female zone.

Alocasia aequiloba is remarkable amongst Australasian *Alocasia* species for its long-lived leaves the older ones of which bear numerous epiphylls. Other species have leaves which persist for only a few months before senescing and which as a result do not play host to epiphyllous plants. Naturally occurring variegated individuals are found in otherwise normal populations. They have entered horticulture with the cultivar names 'Spotted Papua' and 'Gold Dust'. The petioles often become maculate and eventually black with age, and as with many *Alocasia* species, some individuals (though very rarely in *A. aequiloba*) have the petioles mottled with purplish brown.

Other specimens seen:

IRIAN JAYA. Pionierbivak, *Lam 754* (BO).

PAPUA NEW GUINEA. Oomsis, *Brass 29208* (LAE); Wewak, Boys' Town, *Croat 52753* (LAE); Morobe Prov., 3.8 km E of Igam Barracks, *Croat 52789* (LAE); 6.1 km E of Igam Barracks, *Croat 52794* (LAE); Busu R., 20–26 km SE of Lae, *Croat 52801, 52836, 52837, 52841* (all LAE); Morobe Prov., Sankwep, 24 km SW of Lae, *Fallen et al. s.n.* (LAE); Madang Prov., Jant logging area, Gogol, *Hay 1207* (LAE), *4001* (SYD); cult. Bulolo, *Hay 1404* (LAE); Madang Prov., Wasab, *Hay 4032* (NSW); nr Usino, *Hay 4048* (NSW); Gogol Valley, *Hay & Jebb 4050* (NSW); Central Prov., Brown River, *Hay 4055* (NSW); Javerere, *Hay 4067* (NSW); East Sepik Prov., 11 km ESE of Dreikikir, *Heyligers 1448* (CANB); Milne Bay Prov., Normanby Island, NE of Bwasiaiai, *LAE 71146* (BRI, L, LAE, US); West New Britain, 10–15 km SW of Kimbe, nr Kulu R., *Leach 7871* (UPNG); Morobe Prov., Busu, *NGF 9729* (LAE); Madang Prov., Josephstaal, *NGF 10276* (LAE); East Sepik Prov., Puari Ck, *NGF 18966* (L, LAE); Madang Prov., N side of Asai R., Aiome, *NGF 27472* (L, LAE); Morobe Prov., nr Lake Wanum, *Nicolson 1391* (LAE), *1403* (K, L, LAE, US); Central Prov., Brown River Forest Reserve, 20–25 mi NW of Port Moresby, *Nicolson 1426* (K, L, LAE); Sogeri Plateau, between Subitana and Javerere, *Nicolson 1442* (K, L, LAE); East New Britain, nr Kerevat, *Nicolson 1505* (L, LAE); West New Britain, Kandrian Airport, *Nicolson 1543* (L, LAE); Madang Airport, *Nicolson 1559* (LAE); c. 1 mi E of Aiome Patrol Post, Lower Ramu Valley, *Pullen 926* (CANB); Milne Bay Prov., Maiyu R. Gorge E of Mt Suckling, c. 15 km WNW of Biniguni Airstrip, *Pullen 8357* (CANB); Madang Prov., Baku Forest Station, *Vinas 218* (K, LAE); Morobe Prov., Oomsis, *Wade et al. 3* (BRI); Astrolabe Range, *White 12* (BRI).

'Macrorrhizos group'

11. *Alocasia macrorrhizos* (L.) G. Don – Fig. 14.

Alocasia macrorrhizos [saepissime '-rrhiza'] (L.) G. Don in Sweet, Hort. Brit. ed. 3 (1839) 631 ('-rrhizon'); Drake, Ill. Fl. Ins. Mar. Pac. (1892) 326, 410; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 84, fig. 15; Brown, Bishop Mus. Bull. 84 (1931) 135, fig. 16c; Wilder, op.cit. 86 (1931) 25; Christopherson, op.cit. 128 (1935) 43; Furtado, Gard. Bull. Straits Settl. 11 (1941) 252; Yuncker, Bishop. Mus. Bull. 178 (1943) 30; Glassman, op.cit. 209 (1952) 108; Barrau, J. Agr. Trop. Bot. Appl. 4 (1957) 41; Bishop Mus. Bull. 219 (1958) 43; Yuncker, op.cit. 220 (1959) 76; Barrau, op.cit. 223 (1961) 39, fig. 15; Nicolson in A. C. Smith, Fl. Vit. Nov. 1 (1979) 455 [non *A. macrorrhiza* auct. Austr., i.e. *A. brisbanensis* (F. M. Bailey) Domin, q.v.]. — *Arum macrorrhizon* L., Sp. Pl. ed. 1 (1753) 965. — *Colocasia macrorrhizos* (L.) Schott & Endl., Melet. Bot. (1832) 18 ('*macrorrhiza*'). — T y p e: *Arum maximum macrorrhizon zeylanicum* Hermann, Parad. Bat. (1698) t. 73 (lecto; selected by Furtado, 1941). *Arum indicum* Lour., Fl. Cochinch. (1790) 536; ed. Willd. (1793) 655; Roxb., Fl. Ind. ed. 2, 3 (1832) 498. — *Colocasia indica* (Lour.) Kunth, Enum. Pl. 3 (1841) 39. — *Alocasia indica* (Lour.) Spach, Hist. Nat. Veg. Phan. 12 (1846) 47; Schott, Oesterr. Bot. Wochenbl. 4 (1854) 410; Seem., Bonplandia 9 (1861) 260; Viti (1862) 444; Fl. Vit. (1868) 285; Drake, Fl. Ins. Mar. Pac. (1892) 325; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 87; B. E. V. Parham, Agr. J. Dept. Agr. Fiji 13 (1942) 41; J. W. Parham, Dept. Agr. Fiji Bull. 35 (1959) 146; Pl. Fiji Isl. (1964) 265; ed. 2 (1972) 359. — T y p e: *Arum indicum sativum* Rumphius, Herb. Amboin. 5 (1747) t. 106 (lecto; selected by Nicolson, 1979).

Massive pachycaul, usually eventually forming a thick erect trunk, to c. 4 m tall, usually more or less devoid of old leaf bases; leaves several together, held erect; petioles to c. 130 cm long, stout, sheathing in the lower c. 1/2, eglandular; wings of sheath persistent, straight to somewhat recurved; blades sagittate, bluntly triangular in general outline; anterior lobe c. 70 cm to over a metre long, c. 60–90 cm wide,

with c. 9 rather distant primary lateral veins diverging at an angle of c. 60 degrees; glands in axils of primary veins distinct; secondary venation flush with the lamina or but slightly raised abaxially, not forming interprimary collective veins or these poorly defined; posterior lobes c. 1/3–1/2 the length of the anterior, somewhat rotund, often overlapping; inflorescences paired amongst the leaf bases, subtended by a cataphyll; peduncles barely exceeding the cataphylls at anthesis; spathe variable in length, c. 13–35 cm long, constricted about 1/6th of the way from the base; lower part green; limb oblong, cowl-like at anthesis, later reflexed, then deliquescent and deciduous, membranous, pale yellow; spadix slightly shorter than the spathe; female zone 1–2 cm long, c. 1.5 cm diam., with c. 30 pistils; ovaries pale green, close-packed, c. 3 mm diam., unilocular; stigma sessile, 3–5-lobed, the lobes conical, yellow; interstice of sterile organs slightly shorter than to equalling the female zone, of about 4 whorls, white, slightly constricted corresponding with the constriction of the spathe; male zone cylindrical, c. 2 cm diam., c. 3–7 cm long, white; synandria rhomboid-hexagonal, with slightly convex tops, 4–6-staminate, with the anthers opening by lateral slits not reaching the top of the synandrium; appendix yellowish, slightly thicker than the male zone at the base, thence tapering, equalling to considerably exceeding half the length of the spadix, staminodial; fruit a few-seeded red berry exposed by the recurved segments of the dehiscent lower spathe; seeds several, c. 4 mm diam., pale brown, strophiolate.

Distribution. Indo-Malesia to Oceania, absent from mainland in Australia. *Alocasia macrorrhizos* is possibly wild in Peninsular Malaysia; elsewhere its status is problematic, or, as in the eastern part of its range, it is almost certainly an ancient introduction as an agricultural crop. It is now pantropical by introduction as an ornamental.

Notes. Nicolson (1986) concluded that the correct feminine inflection for neuter adjectives ending in *-on* is *-os*, not *-a*. Furtado (1941) has discussed the confusion surrounding *Al. macrorrhizos* and *A. indica*. He erected a number of varieties which are probably better regarded as cultivars. They are not of relevance to this regional review, except that he erroneously included *A. brisbanensis* (q.v.) in his concept of *A. macrorrhizos* var. *variegata* (K. Koch & Bouché) Furtado.

In New Guinea this species is rare except as an ornamental plant mostly cultivated in urban centres. However, it is sometimes seen in villages, though I have never seen it cultivated for food in mainland Papua New Guinea. It appears to be more extensively represented in the Bismarck Archipelago and in the Solomon Islands, possibly as an escape from subsistence agriculture. As it appears to me to occur only in mainland New Guinea as a post-European ornamental introduction, it is interesting to note that its distribution almost exactly matches that of *Cyrtosperma merkusii* (Hassk.) Schott, another ancient root crop, distributed from West Malesia to Oceania but absent from New Guinea itself (Hay, 1988a). Both are also absent from the Australian mainland. Two other tropical oriental aroid starch crops are *Colocasia esculenta* (L.) Schott and *Amorphophallus paeoniifolius* (Dennst.) Nicolson [syn. *A. campanulatus* (Roxb.) Blume]. Not only are they widespread in New Guinea, generally thought to be an escape following prehistoric introduction from the west, but both *C. esculenta* and *A. paeoniifolius* (Hay, 1988b) occur, out of cultivation, in tropical Australia. These two sets of distribution patterns suggest either two different



Fig. 14a. *Alocasia macrorrhizos* (L.) G. Don. Hermann's original drawing of *Arum maximum macrorrhizon zeylanicum* (BM).

waves, taking different eastward routes, of introduction in primitive states of cultivation, or that *C. esculenta* and *A. paeoniifolius* may have reached Australia and New Guinea without human intervention. Matthews (1987) has suggested that *C. esculenta* is indigenous in New Guinea.



Fig. 14b. Rumphius' plate of *Arum indicum sativum* (see text).

Figure 14 shows a) the original drawing by Hermann (BM), consulted by Linnaeus, of *Arum maximum macrorrhizon zeylanicum*, used to make the lectotype illustration in Hermann (1698), and b) the lectotype of *A. indicum*. The Hermann illustration led Linnaeus to believe that this species was acaulescent.

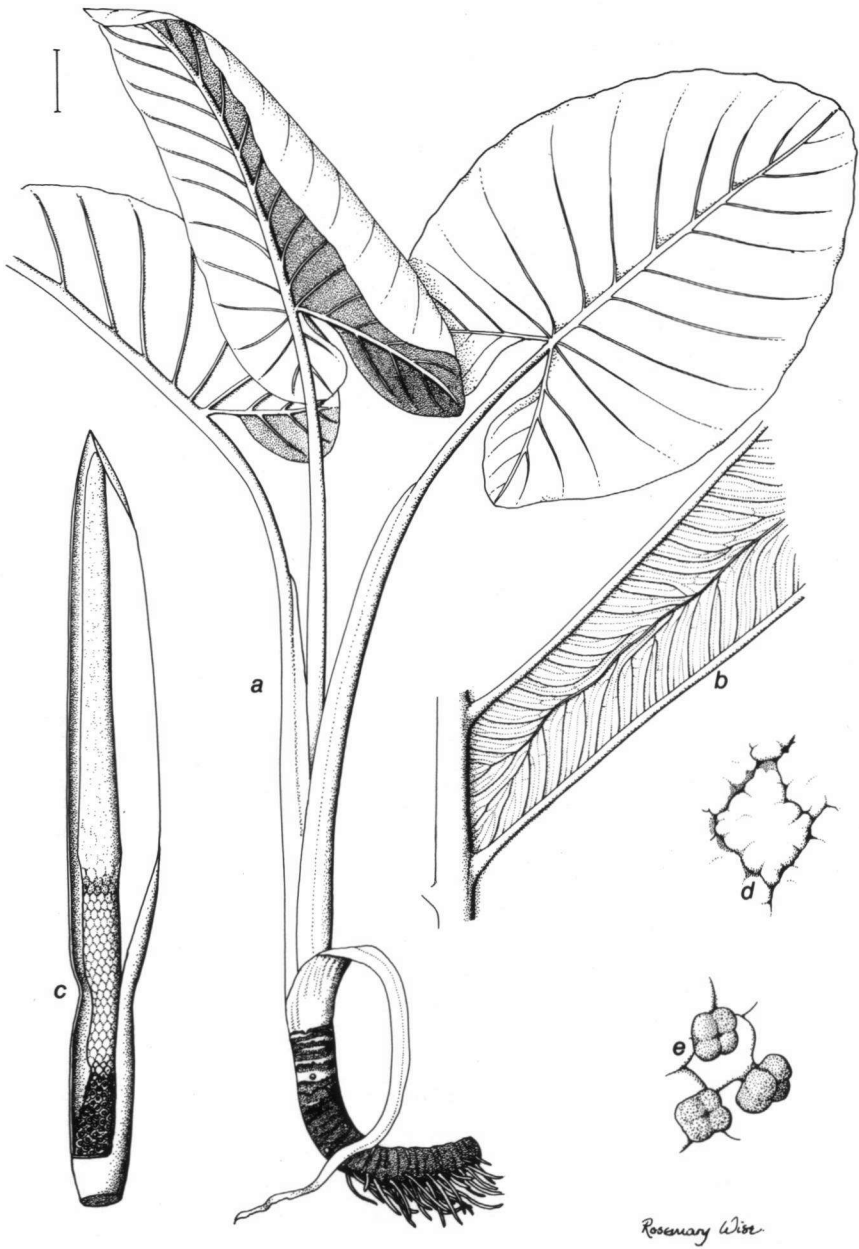


Fig. 15. *Alocasia flabellifera* A. Hay (Hay 4053). a. Whole plant; b. venation; c. spadix with half spathe removed; d. synandrium; e. pistils. — Scale: bar to a = 12 cm; to b, c = 2 cm; to d, e = 2.5 mm.

Other specimens seen:

IRIAN JAYA. Ag. Station, 10 km N of Manokwari, *Nicolson 1589* (L).

PAPUA NEW GUINEA. Western Prov., Palmer R., 2 mi below jnct. with Black R., *Brass 7363* (A); Central Prov., Kanosia, *Carr 11130* (K); Cult. Hort. Lae, *Hay 4031* (NSW); Madang rubbish dump, *Hay 4051* (NSW); Bougainville, Buin, Kugumaru, Onuku, *Kajewski 1899* (A, BRI); Bougainville, W of Arawa Village, 7 mi W of Kieta, *Nicolson 1521* (K, L); New Ireland, *Peekel 103* (BO); Madang Prov., Budemu Village, S slopes of Finisterres, *Pullen 5981* (CANB, LAE); East New Britain, Gazelle Peninsula, Kokopo, *van Royen 6616* (L); Bougainville, Rachod; *Waterhouse 22-B* (K, L).

SOLOMON ISLANDS. San Cristobal, Waimamura, *Brass 2628* (A, BRI, L); 3 mi up Pegato R., *Hunt RSS 2272* (L, US).

OCEANIA. Samoa, Savaii Isl., *Christopherson 3422* (K), *Cox 238* (A); Hawaiian Islands, head of Kuliouou Valley, Oahu, *Degener 2477* (A); Molokai, Mapulehu Village, *Degener 8936* (K); Marshall Islands, Lae Atoll, Lae Islet, *Fosberg 34019* (US); New Caledonia, R. Thi, *Guillaumin & Baumann 7266* (US); New Hebrides, Malekula Isl., *Hallé RSNH 6377* (K); Hawaii, Maui, Punalou F.R., *Herbst & Ishikawa 4095* (L); Marianas, Talofoto, Guam, *Johnwell 78* (L); Society Is., Raiatea, 1 mi S of Fatuna, *Moore 763* (L); Tonga, Eua Isl., N of Ohonua, *O'Rourke 233* (A); N Marianas, Anatahan, *Raulerson 1137* (US); Guam, nr Yona, *Rodin 730* (US); Fiji, *Seemann 651* (K); Society Islands, Tahiti, Papehue, Paea, *Tilden 357* (K); Samoa, *Vaupel 86* (US); Yap Island, *Wong 433* (US).

AUSTRALIA. Queensland, Torres Strait, Murray Group, Maer Island, *Heatwole 851* (BRI).

12. *Alocasia flabellifera* A. Hay, *spec. nov.* – Fig. 15.

Ab *A. crassifolia* Engler petiolo eglanduloso, lamina minus coriacea, pedunculo brevior, spathae tubo albo differt; ab *A. macrorrhizos* (L.) G. Don foliis paucioribus, lamina latissime ovatosagittata plus coriacea, nervis secundariis valde prominentis, spathae tubo albo, stigmatibus rotunde lobata differt. — T y p u s : Papua New Guinea, Madang Prov., North Coast road, in coconut plantation nr Biges River bridge, 5th February 1989, *Hay 4053* (NSW, holotype).

Massive pachycaul; stem decumbent, rarely erect, to 80 cm long and 13 cm diam., more or less devoid of old leaf bases; leaves few, to 5 together; petiole to 140 cm long, sheathing in the lower c. 1/3–1/2; wings of sheath persistent and slightly recurved; lamina very broadly ovate-sagittate, held more or less vertically; anterior lobe to c. 60 cm long, c. 65 cm wide at base, slightly wider about one quarter of the way from the base, with c. 10 primary lateral veins diverging at c. 60 degrees; glands absent or very inconspicuous; secondary venation distinctly raised below, forming well defined interprimary collective veins; posterior lobes c. 30 cm long, rather rotund, overlapping, the costae naked in the sinus for c. 9 cm; inflorescences paired, on short peduncles amongst their leaf bases; spathe to c. 25 cm long, constricted about 1/4 of the way from the base, green in bud, the lower part soon becoming white just before anthesis, remaining white into early fruit, then becoming green; limb of spathe membranous, white to very pale greenish yellow, oblong, cowl-like, deliquescent and deciduous after anthesis; spadix slightly shorter than the spathe; female zone c. 3 cm long, 1.4 cm diam., with c. 60 pistils; ovaries very close-packed, rhomboid, greenish-white, unilocular, sometimes incompletely septate in the upper part; stigma on a distinct but very short style, yellow, (3- or) 4-lobed, the lobes rotund; ovules orthotropous; interstice of sterile organs short, about two whorls, barely constricted and usually below the constriction of the spathe; organs flat-topped, white, polygonal, close-packed; male zone c. 8 cm long, extending

down into the cavity formed by the lower part of the spathe below the constriction, whitish, c. 1.3 cm diam.; synandria rhomboid to hexagonal, flat-topped, c. 2 mm diam., 4–7-staminate, with the anthers opening by lateral slits not reaching the top of the synandrium; appendix considerably exceeding half the spadix in length, slightly exceeding the male zone in diameter in the lower part, thence gradually tapering to a blunt point, composed of irregularly shaped, longitudinally orientated staminodia, white; fruit a red berry containing few seeds, exposed by the dehiscence of the lower spathe into longitudinally recurved segments; seeds several, c. 3.5 mm diam., strophiolate.

Distribution. Papua New Guinea, collected from Madang and Morobe Provinces only; also sighted in East Sepik, Central, and Western Province (in the latter apparently only in cultivation as an ornamental), in very open wet disturbed sites.

Notes. Both this species and *A. macrorrhizos* are inadequately represented in herbarium collections of New Guinea plants. Herbarium material of *A. flabellifera* is easily mistaken for *A. macrorrhizos*. Krause (1920) cited some German New Guinea collections under his *A. indica* (= *A. macrorrhizos*) which are quite probably of this species. Although these have not been located at Berlin and are presumed destroyed, it seems likely that *A. flabellifera* has not hitherto been recognised because of the similarity it bears in the herbarium to *A. macrorrhizos*. In details of the spadix, the two species seem barely to differ, except in the form of the stigmas (which character, however, I have not been able to examine in more than a few specimens of either species), and in the proportionately slightly longer appendix of *A. flabellifera*. The white lower spathe, which is also proportionally longer, is characteristic of this species. The two species are strikingly different, however, when the plants are seen together in entirety. There are fewer leaves per crown and the blades are much wider in *A. flabellifera*, where the blades are more or less bluntly triangular and crowded in *A. macrorrhizos*. The secondary venation is also a useful field character: it is very distinctly raised abaxially in *A. flabellifera* and more or less flush with the lamina in *A. macrorrhizos*. In the latter species the secondary venation does not form or forms very poorly defined interprimary collective veins, and the glands in the axils of the primary veins are conspicuous. Interestingly, there are other species of *Alocasia* closely allied to *A. macrorrhizos* which seem barely to differ from it in spadix morphology. These include *A. portei*, *A. crassifolia*, and *A. odora*. They form well-defined geographical entities and are highly distinctive as entire plants. Engler placed the first in his *Schizocasia* owing to its dissected leaves. However, the latter two he knew from living material and was thus able to recognise their specific character, setting a precedent for here recognising *A. flabellifera* at specific level. The alternative, of recognising the taxon at subspecific level, serves no more useful purpose, and would merely result, if consistency were to be achieved, in the loss of well-known binomials and their replacement with cumbersome subspecific trinomials.

Other specimens seen:

PAPUA NEW GUINEA. Madang Prov., nr Jaisaben, *Hay 4030* (NSW); Morobe Prov., cult. Hort. Lae, *Nicolson 1487* (K, L, LAE).

'Ozarum group'

13. *Alocasia brisbanensis* (F.M. Bailey) Domin – Fig. 16.

- Alocasia brisbanensis* (F.M. Bailey) Domin, *Biblioth. Bot.* 20 (85, 4) (1915) 504. — *Alocasia macrorrhizos* ['*-rrhiza*'] var. *brisbanensis* F.M. Bailey, *Qld. Flora* 5 (1902) 1697; *Weeds and Pois. Pl. Qld.* (1906) 205; *Comp. Cat. Qld. Pl.* (1913) 579. — **T y p e**: Australia, Queensland, Brisbane, Enoggera Creek, *F.M. Bailey AQ332954* (BRI, lecto!, selected by Hay, in press).
- Caladium?* ['*Calladium?*'] *macrorrhizon* auct. non R.Br.: R.Br., *Prodr. Fl. Nov. Holl.* (1810) 336; Palmer, *Proc. Roy. Soc. N.S.W.* 17 (1884) 95 [non basionym, i.e. *Alocasia macrorrhizos* (L.) G. Don].
- Colocasia macrorrhizos* ['*-rrhiza*'] auct. non Schott: F. Muell., *Fragm.* 8 (1874) 187; *First Census* (1882) 120; *Second Census* (1889) 203; Benth. & Muell., *Fl. Austr.* 7 (1878) 155; F.M. Bailey, *Syn. Qld. Fl.* (1883) 569; *Rep. Gov. Sci. Exped. Bellenden-Ker* (1889) 68; *Cat. Pl. Qld.* (1890) 50; Moore, *Census Pl. N.S.W.* (1884) 74; *Handbook Fl. N.S.W.* (1893) 428; Keys, *Proc. Roy. Soc. Qld.* 2 (1885) 51; Woolls, *Pl. N.S.W.* (1885) 95; Shirley, *Proc. Roy. Soc. Qld.* 4 (1887) 136; F.M. Bailey & Gordon, *Pl. Pois.* (1887) 187; Maiden, *Useful Pl. Austr.* (1889) 18, 165; *Census N.S.W. Pl.* (1916) 36; Dixon, *Pl. N.S.W.* (1906) 274; Turner, *Proc. Linn. Soc. N.S.W.* 31 (1906) 386; Guilfoyle, *Aust. Pl.* (1909) 114 [non *C. macrorrhiza* (L.) Schott (1832), i.e. *Alocasia macrorrhizos* (L.) G. Don].
- Alocasia macrorrhizos* [saepissime '*-rrhiza*'] auct. non Schott: mult. auct. pro parte, quoad specim. cit. Austr.: F.M. Bailey, *Qld. Fl.* 5 (1902) 1697; *Weeds and Pois. Pl. Qld.* (1906) 205; *Qld. Ag. J.* 28 (1912) 203; *Comp. Cat. Qld. Pl.* (1913) 579; Domin, l.c.: 503; Webb, *CSIR Bull.* 232 (1948) 20; Evans, *Contrib. Nat. Herb. N.S.W.* 22 (1962) 11; Beadle, *Vasc. Pl. Sydney Dist. and Blue Mts.* (1963) 453; *Stud. Fl. NE N.S.W.* 6 (1987) 972, fig. 426A; Beadle, Evans & Carolin, *Fl. Sydney Region* ed. 2 (1972) 554; ed. 3 (1982) 554; McBarron, *Pl. Pois. N.S.W.* (1976) 103, 122; Williams, *Fl. New England Nat. Park* (1976) 2; *Native Pl. Qld.* 2 (1979) 14, fig. s.n.; Paine, *Field Guide Austr. Wildfl.* 2 (1977) 68, pl. 14; Hinton & Hinton, *Wildfl. Trop. Qld.* (1980) 46, fig. s.n.; Shaw et. al., *Proc. Linn. Soc. N.S.W.* 106 (1982) 78, fig. 1; *Aroideana* 8 (1985) 89, fig. 2.
- Alocasia macrorrhizos* ['*-rrhiza*'] (L.) G. Don var. *variegata* auct. non Furtado: Furtado, *Gard. Bull. Straits Settl.* 11 (1941) 253, as to var. *brisbanensis* in synonym., non (K. Koch & Bouché) Furtado, l.c., as to type.
- [*Caladium glycyrrhizon* Fraser in Hook, *Bot. Misc.* 1 (1830) 259, nom. nud.]

Massive herb; stem decumbent to erect, to c. 13 cm diam., clothed in the brown remains of old leaf bases; leaves several together; petiole to c. 1.1 m long, sheathing in the lower c. 2/3rds, eglandular; wings of sheath persistent, straight, sometimes distally reflexed; blade sagittate to somewhat ovato-sagittate, membranous, pale to mid green, with the margin entire; anterior lobe to c. 60 cm long, c. 60 cm wide at base, with the distal part narrowly obtuse and the tip apiculate; anterior costa with c. 11 primary lateral veins on each side diverging at c. 45–60 degrees; primary venation prominent and secondary venation flush on both surfaces; interprimary collective veins present to very ill-defined; glands in the axils of primary veins absent or extremely inconspicuous; posterior lobes c. 30 cm long, \pm triangular with well-defined, acute to rectangular, narrowly rounded tips; posterior costae not or hardly naked in the sinus, or the blade very slightly peltate; inflorescence solitary (in young plants, or first of flowering episode) to paired, on long peduncles about half the length of, to equalling, rarely exceeding the petiole, subtended by a large, persistent, eventually

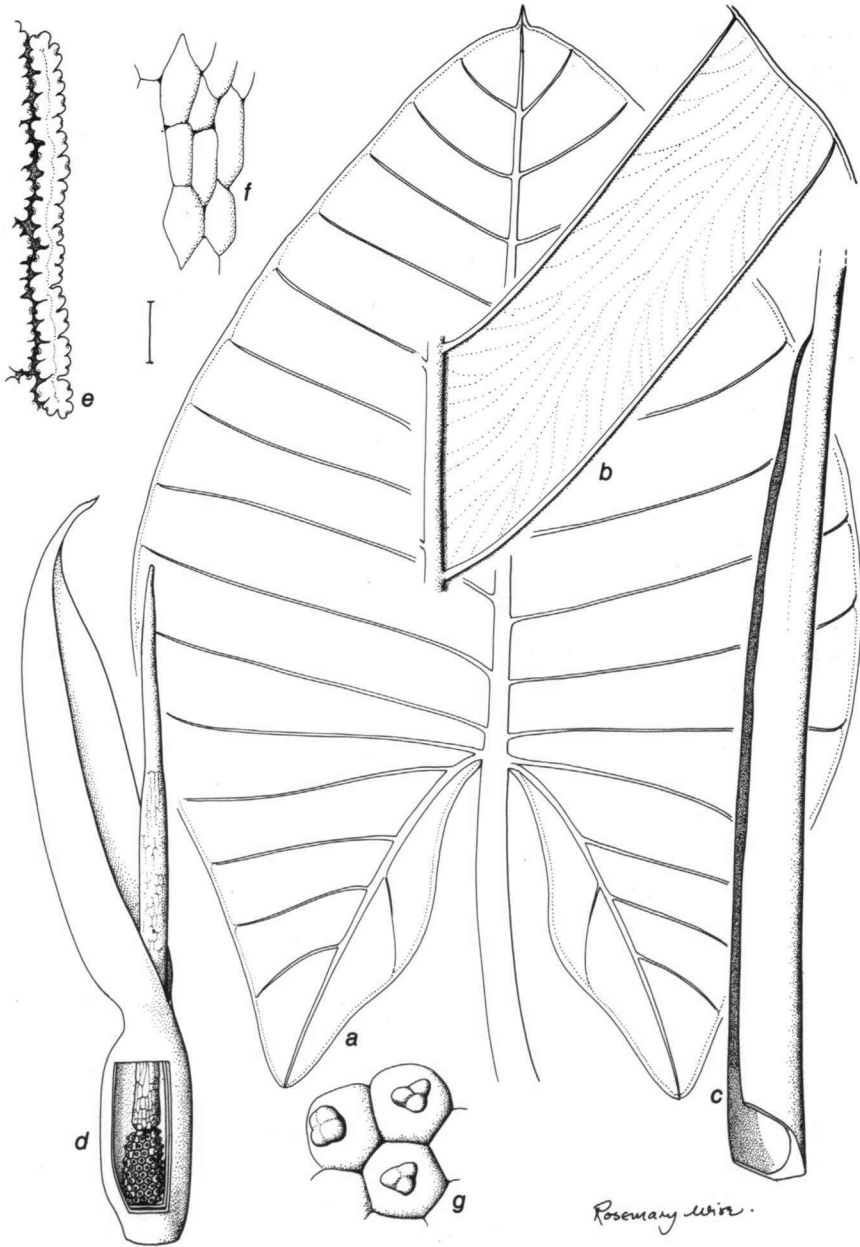


Fig. 16. *Alocasia brisbanensis* (F.M. Bailey) Domin (Hay 4070). a. Leaf blade; b. venation; c. leaf sheath; d. inflorescence; e. linear synandrium with 17 anthers; f. organs of sterile interstice; g. pistils. — Scale: bar to a, c = 5 cm; to b, d = 2 cm; to e–g = 2 mm.

marcescent cataphyll; spathe c. 25 cm long, distinctly constricted between 1/4 and 1/3rd of the way from the base; the limb opening wide, with the lower part deflected, the upper part arching over the tip of the spadix but not cowl-like, later all deflected, green to yellowish green to white (?), distinctly thick and leathery, marcescent, not deliquescent; spadix sessile, the female zone c. 3 cm long, c. 1.5 cm diameter, with c. 120 pistils; ovary globose, pale green, unilocular, apically incompletely 3-septate; style very short; stigma with 3 or 4 blunt lobes, green; ovules several, hemianatropous; interstice of sterile organs to 4.2 cm long, tapering distally to c. 7 mm diam., often with a short naked zone between it and the female zone; sterile organs numerous and \pm globose below, longitudinally confluent and grooved above, green to pale orange; male zone c. 8 cm long, c. 1.5 cm diam., green to greenish yellow; synandria \pm linear, longitudinally orientated, 2–36-staminate, 0.2–2 cm long, c. 2 mm wide with the tops longitudinally grooved; anthers opening by apical pores; appendix subequalling the male zone, tapering to a point, composed of numerous staminodes, green, becoming orange; fruit a several-seeded bright red berry exposed by the longitudinally recurved segments of the dehiscent lower spathe; seeds several, brown to black, c. 3–4 mm diameter, more or less beaked strophiolate.

Distribution. Australia, in Queensland and New South Wales, in tropical, subtropical, and warm temperate rainforest, and wet open sites, predominantly at low altitudes, generally on pleiotrophic soils.

A single collection from the North Island of New Zealand is probably an escape from ornamental horticulture. Fig. 13.

Notes. Hay (in press) has observed that, hitherto, the Australian representative of *Alocasia* has been repeatedly only partly described and appears to have been assumed to be the widespread and cultivated *A. macrorrhizos*: an assumption based on superficial similarities. There are, however, numerous vegetative and reproductive differences, and there can be no doubt that this species is a very distinct Australian endemic.

Bailey (l.c.) intended his var. *brisbanensis* to be distinguished from most other Australian specimens on the basis of its smaller size and purple brown colouration in the petioles. Subsequently, Domin, who apparently did not really know the variety in detail, somewhat arbitrarily elevated it to specific rank. The differences that these authors intended to highlight are, in view of comparison with variation in other *Alocasia* species, quite trivial. Here, the epithet '*brisbanensis*' is used at specific level to denote *all* the known mainland Australian representatives. It does not seem useful formally to distinguish between the type kind and the supposedly larger green-leaved plants at any rank, unless horticultural distinction becomes desirable at the level of cultivar.

While obviously linear synandria are present in the male zone, some specimens show a preponderance of synandria with relatively few stamens, sometimes as few as two. However, even in cases where the numbers of stamens normal for most *Alocasia* species are found (4–6), their arrangement is quite different from that in other species. The anthers are arranged back to back, and the synandrial tissue consists almost entirely of anther, where in other species the anthers are arranged on or in the periphery of a block of connecting ground tissue.

The following character states distinguish *A. brisbanensis* from *A. macrorrhizos*:

<i>Alocasia brisbanensis</i>	<i>Alocasia macrorrhizos</i>
i. Synandria elongate, often multistaminate	Synandria isodiametric, stamens few
ii. Anthers opening by apical pores	Anthers opening by lateral slits
iii. Sterile interstice equalling to exceeding female zone	Sterile interstice much shorter than female zone
iv. Inflorescence powerfully fragrant	Inflorescence weakly scented
v. Limb of spathe spoon-shaped, rather leathery	Limb of spathe cowl-like, membranous
vi. Peduncle much longer than inflorescence	Peduncle shorter than inflorescence
vii. Posterior lobes of leaf usually acute to rectangular	Posterior lobes usually rounded
viii. Glands in axils of primary veins usually inconspicuous or absent	Glands present, conspicuous

Alocasia brisbanensis shows a distinct flowering peak, in December and January, throughout the range, though there are flowering and fruiting collections from all but the winter months. Shaw & Cantrell (1982) made a study of pollination and concluded that cross pollination by insects was indicated. A variety of insect taxa, including representatives of Diptera, Hymenoptera, and Coleoptera, were observed as visitors but none were conclusively demonstrated to be pollinators. They suggested, however, that *A. brisbanensis* is most likely pollinated by *Brachypeplus* sp. (Coleoptera: Nitidulidae) or by an undetermined alaocharine staphilinid (Coleoptera). Shaw et al. (1985) noted fruits eaten by a Lewin's Honeyeater and a Regent Bowerbird in Queensland.

McAlpine (1978) described *Neurochaeta inversa*, a new species and genus representing a new family (Neurochaetidae) of Diptera, from the spathe chamber of wild *A. brisbanensis*, citing it as '*A. macrorrhiza*'.

Other specimens seen:

AUSTRALIA. Queensland, Moreton Dist., Brisbane, 3 mi Brush, *Bailey 104* (BRI); Cook Dist., Julatten, *Bates 158* (BRI); N.S.W., Hastings R., *Beckler s.n.* (MEL); Gloucester, *Betche NSW 18914* (NSW); Queensland, Mt Glorious, *Blake 12687* (NSW); N.S.W., Brickmaker's Ck, 4 mi E of Ramornie, *Blakely & Shiress NSW 18913* (NSW); Georges Ck, NW of Kempsey, *Boorman NSW 18917* (NSW); Queensland, Clarke Range, S Kennedy Dist., W of Cathu, *Byrnes & Clarkson 3829* (BRI); N.S.W., Rivertree, *Cabbage 2872* (NSW, SYD); Byron Bay-Wingham (sic), *Cleland s.n.* (AD); Byron Bay, *Cleland s.n.* (AD); Queensland, Dalrymple Heights, *Clemens s.n.* (A); N.S.W., Breakfast Ck, foot of Mt Warning, 10 mi SW of Murwillumbah, *Constable 3059* (NSW); Oaks State Forest, 20 mi SW of Bellingen, *Constable 4818* (NSW); Ellenborough R., 20 mi NW of Taree, *Constable 6332* (NSW); track to Macquarie Falls, c. 12 km from Albion Park, *Coveney 4825* (NSW); Whian Whian State Forest Reserve, 4–8 km SW of Dunoon, *Coveney & Hind 10598* (NSW); Queensland, Wright Ck, Lake Eachan State Park, 20 km E of Atherton, *Croat 52573* (NSW); Herbert R., *Dallachy s.n.* (MEL); Queensland, cult. at Forest Research Regional Station, Atherton, *Dockrill 1100* (QRS); N.S.W., Acacia Ck, via Killarney, *Dunn 272* (NSW); Queensland, Spicer's Gap, *Everist 7286* (BRI, K); Mt Elliot, *Fitzalan s.n.* (MEL); N.S.W., Richmond R., *Fitzgerald 1891* (MEL); Queensland, Russell R., *Flecker 9678* (QRS); Wright's Ck, *Flecker 9815* (QRS); N.S.W., Coffs Harbour, *Floyd NSW 80709* (NSW); Mt Colah, *Gillan NSW 18907* (NSW); Allyn R., *Gordon NSW 57091* (NSW); cult. University of Sydney ex Wauchope, *Hay 4070*

(NSW); Eastern Dorrigo, *Hayes NSW 52512* (NSW); Queensland, Mt Tamborine, c. 45 mi S of Brisbane, *Hubbard 2461* (L); State Forest Reserve 144, Agapetes L.A., *Hyland 10181* (QRS); Timber Reserve 176, Monkhouse, *Hyland 12194* (QRS); N.S.W., Yessabah Caves, Kempsey Dist., *Ingram NSW 49352* (NSW); Queensland, East Barron, State Forest Reserve 191, *Irvine 95* (BRI, QRS); Weinert's Ck, Bellenden Ker Range, *Jago 214* (QRS); N.S.W., Kiama to Jamberoo, *Johnson NSW 23705* (NSW); nr Big Hill, S of Crescent Head, *Johnson NSW 91173* (NSW); Whian Whian, *Jones 1239* (CANB); Queensland, Moreton Dist., Spicer's Gap, *Kerr s.n.* (BRI); N.S.W., Allyn Valley, *Lawson s.n.* (CANB, SYD); Queensland, 'Archer's', *Leickhardt NSW 18908* (NSW); Queensland, Brisbane, *Longman s.n.* (K); N.S.W., Tooloom Range, *Maiden NSW 18918* (NSW); Byron Bay, *Maiden & Boorman NSW 18909* (NSW); Queensland, N Kennedy Dist., Kelsey Ck, nr Proserpine, *Michael 1127* (BRI); 20 km SE of Atherton, *Morawetz et al. 7-17185* (QRS); N.S.W., Table Top, Albury Dist., *NSW 91104* (NSW); Manning R., *NSW 18910* (NSW); Hastings R., *Oldfield s.n.* (K); Queensland, Endeavour R., *Persietz 1881* (MEL); Mt Glorious, *Phillips 7829* (BRI); N.S.W., Bulladelah, *Rupp s.n.* (MEL); Banks of Dingo Ck, c. 5 mi NW of Wingham, *Salasso 2837* (NSW); Clouds Ck, *Salasso 4668* (NSW); Queensland, cult. CSIRO Long-pocket, Brisbane, *Shaw s.n.* (BRI); Mt Glorious, *Shaw s.n.* (BRI); Peechey's Scrub, *Simmonds 569* (BRI); Brookfield (Brisbane), *Simmonds s.n.* (BRI); Yandina, *Simmonds s.n.* (BRI); N.S.W., Pappinbarra, *Simpson s.n.* (SYD); Queensland, Mt Glorious, *Smith 10542* (BRI); Darling Downs, c. 18 mi from Killarney, Head road, near the top, *Stanley 7817* (BRI); N.S.W., Tweed R., *Steel s.n.* (BRI); Queensland, Rockhampton, *Thozet s.n.* (K); Theresa Ck, Millaa Millaa, Cook Dist., *Trapnell 256* (BRI); cult. Brisbane Botanic Garden ex Indooroopilly, *Trapnell s.n.* (BRI); Ipswich, *Vernsh 23* (MEL); N.S.W., Dorrigo National Park, c. 2 km down hill from the Glade, *Wallace & Abel 103/86*; Queensland, end of Davies Ck road, *Webb & Tracey 5595* (BRI); headwaters of Dryander Ck, Mt Dryander, *Webb & Tracey 10101* (BRI); Cronin's Ck, between Mts Barney & Ernest, *White 8761* (A, BRI); Mt Glorious, *White 12079* (A, BRI); Queensland, Burke Dist., Croydon, *Wilson 7* (BRI).

NEW ZEALAND. Along Route 5 between Tapapa and Rotorua, 35 km W of Rotorua, *Croat 52233A* (US).

SPECIES DUBIAE

Alocasia augustiana Linden & Rodigas, Ill. Hort. 33 (1886) 61, t. 563.

Alocasia devansayana (Linden & Rodigas) Engler in Lorentz, Nova Guinea 8 (1912) 808, excl. descr. & spec. cit.; Krause in Engler, Pflanzenr. 71 (IV.23E) (1920) 88, excl. descr., spec. cit. & fig. 16; Burnett, Aroideana 7 (1984) 107, fig. 53; basionym *Colocasia devansayana* Linden & Rodigas, Ill. Hort. 33 (1886) 97, t. 601 [descr. et specim. cit. = *Alocasia nicolsonii* A. Hay q.v.].

Both were described from sterile living material of horticultural origin. Herbarium material has not been located at Meise (Belgium), and was probably never preserved (Bamps, pers. comm.). The illustrations cited above which must be considered to be the types, are both somewhat stylised. In the absence of either inflorescence or authenticated provenance, they cannot be matched with living or preserved botanical material with any degree of certainty.

SPECIES EXCLUDENDA

Alocasia? lindenii Rodigas, Ill. Hort. 33 (1886) 111, t. 603; Krause in Engler, Pflanzenr. 71 (IV.23C) (1920) 109 = *Homalomena lindenii* (Rodigas) Ridley, J. Roy. Asiat. Soc. Straits Branch 49 (1908) 49. — Type: Ill. Hort. 33 (1886) t. 603 (lecto, selected here).

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