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A PRELIMINARY REVIEW OF THE LARGE BRACTEATE SPECIES OF ALPINIA

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ABSTRACT. The sections of *Alpinia* (Zingiberaceae) subgenus *Dieramalpinia*, as they stand at present, are reviewed with special reference to the large-bracteate species. Fifty-five species are enumerated. Part I deals with sects. *Guillainia* (3 species), *Eubractea* (24 species), *Amomiceps* (1 species), *Javana* (3 species) and *Medusula* (1 species). Part II deals with 20 species that are unplaced sectionally for the time being; the problems surrounding *Eriolopha* Ridl. & *Adelmeria* Ridl. are discussed; the Ceylon species *Amomum floribundum* and *Amomum involucratum* are transferred to *Alpinia* and renamed *A. abundiflora* Burtt & Smith and *A. fax* Burtt & Smith. In Part III, a few species are transferred from the sections enumerated to more suitable positions: two species to sect. *Myriocrater* and one to sect. *Pleuranthodium* of subgenus *Alpinia*.

Two new species are described: *A. fusiformis* R. M. Smith (sect. *Guillainia*) and *A. kiungensis* R. M. Smith (sect. *Eubractea*). An index to the species reviewed is provided.

INTRODUCTION

In retaining, temporarily at least, a very broad circumscription of *Alpinia*, one reason put forward (Burtt & Smith, 1972a, p. 178) was that the narrower generic concepts preferred by Holttum (1950) for the Malay Peninsula could not yet be applied to the greater diversity of form found in other areas. It was a symptom of this diversity that K. Schumann (1904) had divided the 41 species of subgenus *Dieramalpinia* into no less than 12 sections. Subsequent work by Valeton (1913) and Ridley (1916) was integrated into this structure, with slight modifications, by Loesener (1930), but he did not materially improve the situation. K. Schumann's outline is still that from which a reassessment must start.

One small simplification to the subdivisions of subgenus *Dieramalpinia* has already been made: that is the reduction of sect. *Monopleura* to sect. *Myriocrater* (Burtt & Smith, 1972b). This is one of the sections having, almost without exception, small and deciduous primary bracts. In contrast, the species now discussed tend to have large, often showy, persistent primary bracts. The work started on sect. *Eubractea* (in which Schumann included the genus *Kolowratia*), but has had to take into account sect. *Amomiceps*, sect. *Medusula*, sect. *Javana* and the genus *Guillainia* (which Schumann reduced to a section of *Alpinia* but misplaced in subgenus *Alpinia*). The more recent genera *Eriolopha* Ridl. and *Adelmeria* Ridl., placed in this context by

Loesener, have also been taken into consideration. It is also necessary to place *Amomum involucratum*, *A. floribundum* and *A. rufescens* from Ceylon. The last of these was transferred to *Alpinia* by Schumann, but wrongly referred to subgenus *Alpinia*. The first two have until now been left in *Amomum*, but the several-flowered cincinni and small flowers are quite foreign to that genus and the plants clearly belong in *Alpinia*.

It cannot yet be said whether these large-bracteate species form a natural group; nevertheless two general points of interest come out of the present studies. In the first place, the removal of sect. *Guillainia* and of *A. rufescens* from subgenus *Alpinia* emphasises that this subgenus (characterized by open bracteoles) never has large persistent primary bracts nor congested inflorescences. Or, put the other way round, species with persistent showy bracts have tubular bracteoles. The exception is *A. abundiflora* (*Amomum floribundum*, no. 51) in which the character is not constant and open bracteoles are more frequent than tubular ones (fig. 5). It must be remembered, however, that although this character is very obvious in the fully grown bracteole it depends on a very minute shift of cell division in the course of development.

The second point is that a comparison of *A. macrocephala* (sect. *Amomiceps*), with a capitular inflorescence, and *A. elegans* (sect. *Eubractea*) with an elongate axis bearing spaced cincinni, suggests that they are not so far apart as an initial glance might suggest (see further p. 172). Added to this is the extreme variability of the degree of elongation of the inflorescence in material which must at present be referred to the single widespread species *A. oceanica*. It seems likely, therefore, that the elongation or contraction of the inflorescence axis, although imparting markedly different facies to the plants, is not too important taxonomically. As a corollary the affinity of species with capitate inflorescences may have to be sought amongst those with an elongate axis.

Subgenus *Dieramalpinia* is characterized by tubular bracteoles. K. Schumann's sections, with the addition of sect. *Monanthocrater* Val., may be divided into three groups, in part artificial no doubt :—

1. Plants with small primary bracts and paniculate inflorescences: sect. *Allughas*, *Pycnanthus*, *Monanthocrater* p.p.
2. Plants with small primary bracts (occasionally conspicuous in sect. *Myriocrater*) and unbranched inflorescences (or with one or two basal branches): sect. *Myriocrater*, *Oligocincinnus*, *Medusula*, *Cylindrobotrys*, *Strobidia*, *Brachybotrys*, *Javana* p.p., *Monanthocrater* p.p.
3. Plants with large persistent primary bracts: sect. *Guillainia*, *Eubractea*, *Amomiceps*, *Javana* p.p.

The present article is concerned with this third group. Although the sectional arrangement as it stands is indicated, no attempt is made to extend or improve this. Until better material is available to help in the evaluation of differences any decisions as to which characters justify a distinct section or subsection can only be arbitrary.

An effort has been made to enumerate all those species which either are known to have large persistent primary bracts or else have been described in sections purporting to include species with such a characteristic. The final position of many is by no means clear and the species of Part II of the enumeration are, for the time being, regarded as 'sectionless'. The next stage

will be the critical study of those species allied to *A. flagellaris* (Ridl.) Loesen. (type of *Eriolopha* Ridl.) and this will call for consideration of sect. *Oligocincinnus*.

K. Schumann included six species in his sect. *Oligocincinnus* and Valeton later increased this number to nine. With the exception of *A. coeruleo-viridis* (Celebes) and *A. rufa* (Philippines) all were described from the mainland of New Guinea. Only three species have been seen but this has been sufficient to indicate that sect. *Oligocincinnus* does not form a natural group. *A. strobilacea* (no. 21) is here transferred to sect. *Eubractea* subsect. *Eustales* and has been found to be conspecific with *Eriolopha seticalyx*. *A. domatifera* (no. 40), here regarded as an unplaced species, is identical with *Eriolopha meyeri*. *A. rufa* (no. 47) has a small bifid labellum which is connate to the base of the filament above the petals and suggests, despite the presence of tubular bracteoles, an affinity with subgenus *Alpinia* sect. *Presleia* Val.

It cannot be overemphasized that the following notes are often of a tentative nature; they are indeed 'preliminary', but by drawing attention to the tremendous gaps in our knowledge it is hoped to stimulate the collection of further material which alone can lead to a more satisfactory classification. The bulk of the specimens examined has come from Papua, the Bismarck Archipelago and the Solomon Islands; many of them are recent and first-class collections. The overall distribution of these large-bracteate species of *Alpinia* extends from Sri Lanka (Ceylon) eastwards to Fiji.

The main differentiating characteristics of the sections considered are summarized below.

Sect. *Guillainia* is characterized by the erect inflorescence and long, slender corolla tube which is well exserted from the calyx; also by the broad conspicuous labellum which bears petaloid lateral lobes in the lower half and may be obscurely trilobed above. In contrast, the inflorescence of sect. *Eubractea* is frequently pendulous, the corolla tube is either equal to or shorter than the calyx; the labellum, usually narrowly triangular, is rather fleshy, inconspicuous and never petaloid. Sect. *Eubractea* was subdivided into two subsections by Valeton, *Eustales* and *Kolowratia*, and although his distinguishing characters are here discarded and the new species he described in *Kolowratia* are excluded from that sub-section, the division is retained for the present. In subsect. *Eustales* the flowers are small, averaging 3 cm in length, are shortly pedicellate, rarely exserted from the primary bracts, and the filament is usually very short or absent. The type species of subsect. *Kolowratia*, the very distinctive *A. elegans* (Presl) K. Schum., has flowers up to 8 cm long, held on long pedicels, much exceeding the primary bracts, and the filament is well formed. Long pedicellate flowers are also found in sect. *Amomiceps* but here the labellum is linear save for a more or less rotund small spatulate apex. Sect. *Javana*, the type of which (*A. javanica* Bl.) is a small-bracteate species, is here enlarged to include two large-bracteate plants, *A. capitellata* Jack and *A. grandiceps* Ridl. These three species form a group notable in subgenus *Dieramalpinia* for the large showy labellum, like that of *Alpinia zerumbet* of subgenus *Catimbium*.

In all of these sections, sterile bracts are often present at the base of the inflorescence. These have often been described as an 'involucre' but are usually not clearly differentiated from the primary bracts proper.

The terms 'primary bract' (used to describe the bracts of the main rhachis,

which may also be sterile) and 'bracteole' (referring to all bracts arising on the cincinnus) are used throughout. Such terms were employed by Schumann (1904) & Holttum (1950), although neither was consistent in his usage. Recently, Holttum (Gard. Bull. Sing. 27:158–159, 1974) has replaced 'bracteole' with 'secondary bract' but in the past all major taxonomic works on Zingiberaceae have used the term bracteole extensively and within the context of the family it is convenient and widely understood.

The enumeration of species is arranged as follows :—

Part I	Sect. *Guillainia*	nos. 1–3
	Sect. *Eubractea*	
	subsect. *Eustales*	nos. 4–24
	subsect. *Kolowratia*	nos. 25–27
	Sect. *Amomiceps*	no. 28
	Sect. *Javana*	nos. 29–31
	Sect. *Medusula*	no. 32
Part II	Unplaced species	nos. 33–52
Part III	Transfers to sections not dealt with above	nos. 53–55

The sequence of the enumeration owes something to Valeton and an effort has been made to place related species together, particularly in Part I; in Part II the arrangement is, of necessity, more arbitrary.

Several species, notably in *Eriolopha* Ridl., the status of which has yet to be decided, have not been formally transferred to *Alpinia*. In such cases, 'A', referring to *Alpinia*, is placed in brackets before the validly published name.

All material examined has been cited.

Part I

ALPINIA sect. GUILLAINIA (Vieill.) K. Schum., Pflanzenr., Zing. 323 (1904).

Syn.: *Guillainia* Vieill. in Bull. Soc. Linn. Normandie 10:92 (1866).
Alpinia sect. *Kolowratia* (Presl) Loesen. subsect. *Guillainia* (Vieill.) Loesen., Pflanzenfam., 2 Aufl. 15a:621 (1930).

Type. *Guillainia purpurata* Vieill. in Bull. Soc. Linn. Normandie 10:93 (1866) [*Alpinia purpurata* (Vieill.) K. Schum.].

Inflorescence held erect; primary bracts large, persistent, usually coloured; cincinni of up to 5 tubular-bracteolate flowers; corolla tube slender, long exserted from the calyx, labellum broad and petaloid, often with conspicuous lateral lobes in lower half, sometimes obscurely trilobed above; capsule globose or flask-shaped.

New Caledonia, New Hebrides, Solomon Islands, Bougainville, New Britain, the Moluccas and perhaps the Carolines.

Guillainia purpurata Vieill. was described from material collected in New Caledonia and placed by Vieillard, on the basis of the parietal placentation, in the tribe *Globbeae*. Such a distinction is by no means fundamental. Parietal placentation is found in some *Riedelia* (*Alpineae*), and Rao & Gupte (Journ.

Univ. Bombay 29B: 134, 1961) have reported that in *Globba leucantha* the ovary appears to be trilocular in median transverse section, the placentae becoming parietal higher up. A similar condition has been observed in *Alpinia purpurata*.

In 1873 F. von Müller described *Guillainia novo-ebudica* (Phytogr. of the New Hebrides p. 20). This name has since been placed in synonymy under *A. purpurata* (Guillaumin in Bull. Soc. Bot. France 82:353, 1919). K. Schumann reduced *Guillainia* to sectional rank within *Alpinia* where, unaware of the presence of tubular bracteoles, he placed it in subgenus *Alpinia* (*Autalpinia* K. Schum.). He cited material from the Solomon Islands, the Bismarck Archipelago, the Carolines and the Moluccas and recognized 2 varieties: var. *grandis* (*A. grandis* K. Schum.) and var. *albo-bracteata*. Schumann included another species in this section, *A. blumei* K. Schum. (no. 2), based on *Hellenia bracteata* Bl. from Java. The type material of this species, which has not been re-collected, is inadequate for dissection but in general facies the plant is not unlike *A. purpurata*.

Few additional names have been added to *Guillainia* and all of them are here referred to sect. *Eubractea*. They are *G. rechingeri* Gagnep., here taken to be conspecific with *A. oceanica* Burk. (no. 22), *G. superba* (no. 12) and *G. minor* (no. 13) both of Ridley, who later transferred *Alpinia vittata* (no. 23) to *Guillainia*.

In the light of our present knowledge of *Alpinia* it seems unwise to retain *Guillainia* at generic level and it is herewith treated as a section of subgenus *Dieramalpinia*. Good distinguishing characters are the slender corolla tube, which is long exserted from the calyx, and the broad petaloid, usually strongly lobed, labellum. One additional species, *A. fusiformis*, is described below (no. 3); here the lip, although only damaged material has been seen, is a similarly conspicuous petaloid structure, but perhaps not lobed, and there is a long exserted corolla tube.

1. A. purpurata (Vieill.) K. Schum., Pflanzenr., Zing. 323 (1904). Fig. 1.

Basionym: *Guillainia purpurata* Vieill. in Bull. Soc. Linn. Normandie 10:93 (1866).

Type. New Caledonia: *Herb. de la Nouvelle Calédonie* no. 1360 (n.v.).

Syn.: *Alpinia grandis* K. Schum. in Notizbl. Bot. Gart. Berlin 2:103 (1898).
Alpinia purpurata (Vieill.) K. Schum. var. *grandis* (K. Schum.) K. Schum., Pflanzenr., Zing. 324 (1904).
Alpinia purpurata (Vieill.) K. Schum. var. *albo-bracteata* K. Schum., Pflanzenr., Zing. 324 (1904).
Guillainia novo-ebudica F. Muell., Phytogr. New Hebrides 20 (1873) [probably].

NEW CALEDONIA: montagne de Mu, *Deplanche* 120 (K); Tao, 0–50 m, 4 m high, inflorescence bright red, not planted, 2 i 1961, *McKee* 7902 (K).

NEW HEBRIDES: Vanua Lava, sea level, 3 m high, bright pink flowers [bracts] grows in a strange manner because of 250 inches of rainfall a year, 5 vii 1928, *Kajewski* 416 (K); Erromanga, towards S coast near Happy Land, inflorescence erect, floral bracts blood red, 8 viii 1971, *Rostarchuk & Green* 1305 (K); Nora, 10–15 m, 8–15 vi 1968, *Bernardi* 13327 (G, K, E); Malekula, Tisbel, 30 ix 1971, *Hallé* 6350 (K, E); Espiritu Santo, Big Bay (Malao), 5 m, cultures et fachères près du village, 24 viii 1971, *McKee* 24093 (K, E).

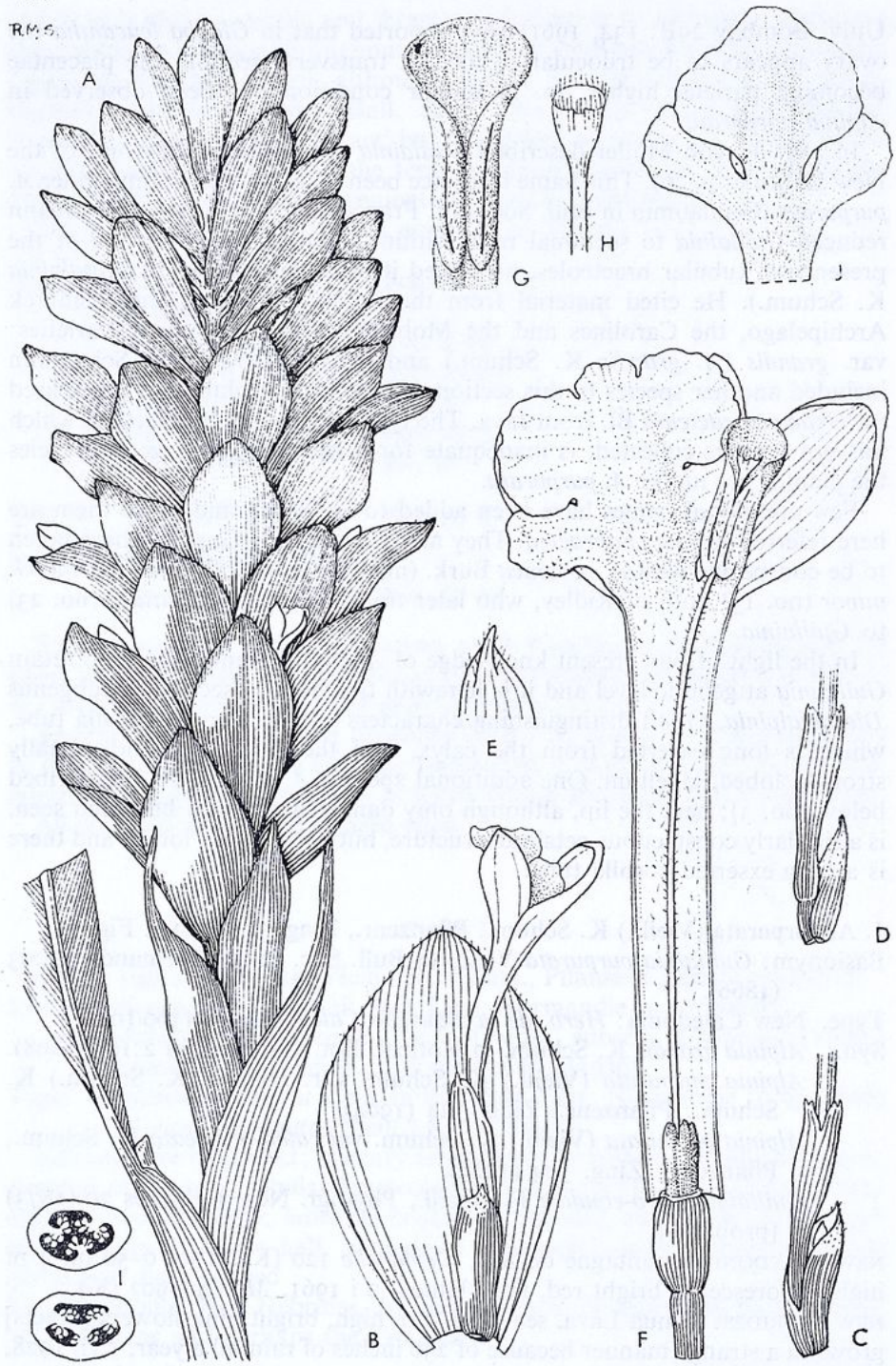

FIG. 1. *Alpinia purpurata* (Vieill.) K. Schum.: A, inflorescence × ⅔; B, primary bract and cincinnus × 1; C, base of cincinnus showing first tubular bracteole and calyx of first flower × 1; D, same cincinnus but with first bracteole removed to show second bracteole which encloses remainder of cincinnus × 1; E, tip of calyx lobe × 3; F, flower dissected, × 2; G, anther × 4; H, stigma × 4; I, ovary in T. S. × 4 (from spirit material of *Corner* 4); J, labellum × 2 (from spirit material of *NGF* 40446).

BRITISH SOLOMON ISLANDS PROTECTORATE: Guadalcanal, Duidui Area, 3 m, well drained secondary forest, 2 m tall, flowers white with numerous red petals [bracts], 10 x 1968, *Mauriasi & collectors*, BSIP 12096 (K); Mt Mambula, 300 m, 3 m high, flowers creamy white, bracts reddish magenta, fruit globose, 2 cm in diameter, pinkish brown, 18 vii 1967, *Nakisi*, BSIP 8029 (K); Umasami river, 60 m, 3 m high, very common, bracts deep magenta red, flowers white, 3 vii 1965, *Whitmore* 6008 (K); San Cristobal, Warahito river, to 5 m high, inflorescence terminal, branching below the inflorescence into a rosette with much smaller leaves, bracts and flowers white, scentless, 21 vii 1965, *Corner* 4 (K); Malaita, Ferakui near Dala, 50 m, 21 ii 1969, *Leach* BSIP 14619 (K); Treasury Island, ii 1885, *Guppy* 87 (K); "Vitoko", ii 1885, *Guppy* 355 (K); Shortland, "Vitoko", v 1884, *Guppy* 46 (K); "Karu", bracts white, v 1884, *Guppy* 119, type of *A. purpurata* var. *albo-bracteata* (K).

BOUGAINVILLE: road from Toiumonapu plantation to Luluai R. 6° 10′ S, 115° 20′ E, bracts white, pink or slightly purplish, 29 vi 1963, *van Royen*, NGF 16353 (LAE); Arawa, Kieta sub-distr., 6° 15′ S, 155° 40′ E, sea-level, bracts pink, flowers white, 6 ii 1970, *Millar*, NGF 38484 (LAE, E); *ibidem*, bracts and flowers white, 6 ii 1970, *Millar*, NGF 38485 (LAE, E); Tonlei Harbour, Buin sub-distr., 6° 44′ S, 155° 55′ E, 60 m, flowers white, enclosed by pink bracts, 13 viii 1969, *Coode, Dockrill & Foreman*, NGF 40446 (LAE, E).

BANDA ISLANDS: 1875, Challenger Expedition, *Moseley* s.n. (K).

A. purpurata is widely cultivated as an ornamental from Fiji, where it has become completely naturalised, to Thailand, where it is a common garden plant. In the Solomon Islands it is known as the 'Torch Ginger', a name associated with *Nicolaia elatior* Jack in Malaysia. The species is rarely found at altitudes much above sea level and the above citations give a fair indication of its distribution in the wild. It also occurs in New Britain (*Lauterbach* 160—syntype of var. *grandis* K. Schum., n.v.) but has not been recorded from the New Guinea mainland. Schumann cites material from the Moluccas (*Reinwardt* s.n.) and the Carolines (*Volkens* s.n.—'mundlich'); neither collection has been seen but the latter may be *A. carolinensis* Koidz. (no. 24).

The large persistent red, pink or white primary bracts form a striking more or less cylindrical unbranched inflorescence borne terminally on leafy shoots up to 7 m tall. Though the inflorescence usually elongates considerably with age the individual cincinni do not. Each cincinnus normally contains up to 4 or 5 tubular-bracteolate white flowers; the trilobed calyx, each lobe with a subapical spur, is longer than the bracteole but much exceeded by the corolla tube. The fully mature flower is usually just exserted from the primary bract and the corolla lobes are more or less equal in length and rounded at the apex. The labellum, which may unite with the filament into a very short tube above the insertion of the petals, in the manner of the Bornean *Burbidgea*, is unusual; there are 2 distinct lateral lobes above the base and in the upper half it is clearly trilobed (*Corner* 4, fig. 1F) or more or less entire (*NGF* 40446, fig. 1J). There is virtually no free filament and the anther connective forms a short semi-lunar to truncate entire crest. The ovary is entirely uni-locular, or tri-locular in the lower part (fig. 1,I), and may develop into a more or less spherical capsule c. 2 cm in diameter.

A. purpurata is a variable species, particularly in inflorescence size, indumentum and the colour of the primary bracts. Unfortunately few good flowers remain on the majority of the specimens examined, but spirit material of *Corner* 4 clearly indicates the variation in flower size which may be expected. Flowers from the base of the inflorescence are 6 cm long (fig. 1, F) but towards the apex they are little more than half this length with correspondingly smaller bracteoles. The bracteoles are always apiculate; in *NGF* 40446 there is a 2–3 mm almost aristate point. In herbarium material there would appear to be considerable differences in leaf size but often there is no means of knowing from which part of the stem a leaf has been collected. *NGF* 40446 has a single lamina 70 cm long × 20 cm wide, but more usually the leaves average 40 cm × 10 cm and are often smaller. For these reasons it has been decided not to accept Schumann's varieties. His var. *grandis* is distinguished by the tomentose stems, sheaths and primary bracts (at least in the young stage) and although his original material has not been seen (New Britain, *Lauterbach* 160; *Dahl* s.n.) the specimens cited above show a wide range of indumentum density, some plants being more or less glabrous, whilst others become glabrescent with age. Var. *albo-bracteata* is no more than a colour form; plants with pink bracts also occur. Such variation in primary bract colour is also to be found in *A. oceanica* Burkill (no. 22).

Professor Corner has reported that in *A. purpurata*, as it occurs in the Solomon Islands, short leafy stems often appear from the lowermost part of the inflorescence. Such a condition, which was already noted by Vieillard, can be seen in cultivated herbarium material from Fiji (*F. Brown* 217) and Mr Womersley has observed it in plants from New Caledonia and Bougainville. These leafy stems, which may terminate in a reduced inflorescence, replace the normal cincinni. Occasionally completely flowerless inflorescences are produced (*McKee* 7902) and in such cases the typically broad primary bracts associated with the lower part of the inflorescence are replaced by narrower ones.

2. A. blumei K. Schum. in Bot. Jahrb. 27:282 (1899) et Pflanzenr., Zing. 324 (1904).
Type. Java: without precise locality, *Blume* s.n. (L).
Syn.: *Hellenia bracteata* Bl., Enum. Pl. Java 60 (1827).

The existence of *A. bracteata* Roxb. precluded the adoption of Blume's epithet for this species which, it is hoped, may eventually be recollected. No entire flowers remain on the type material but there is evidence of a long slender corolla tube. *A. blumei* is a much smaller plant than *A. purpurata* but has a similarly large-bracteate inflorescence. There are two inflorescences on Blume's material; one is terminal on the leafy stem, the other separate and possibly truly radical, or perhaps a flowering shoot collected from a sterile bract at the base of a larger inflorescence (as in some specimens of *A. purpurata*). Neither Blume nor Schumann commented on this.

3. Alpinia fusiformis R. M. Smith, **species nova** *A. purpuratae* (Vieill.) K. Schum. similis ob corollae tubum longe exsertum et labellum petaloideum, sed inflorescentia fusiformi vel cyathiformi, calycis dentibus longis et fructu elongato differt. Fig. 2.

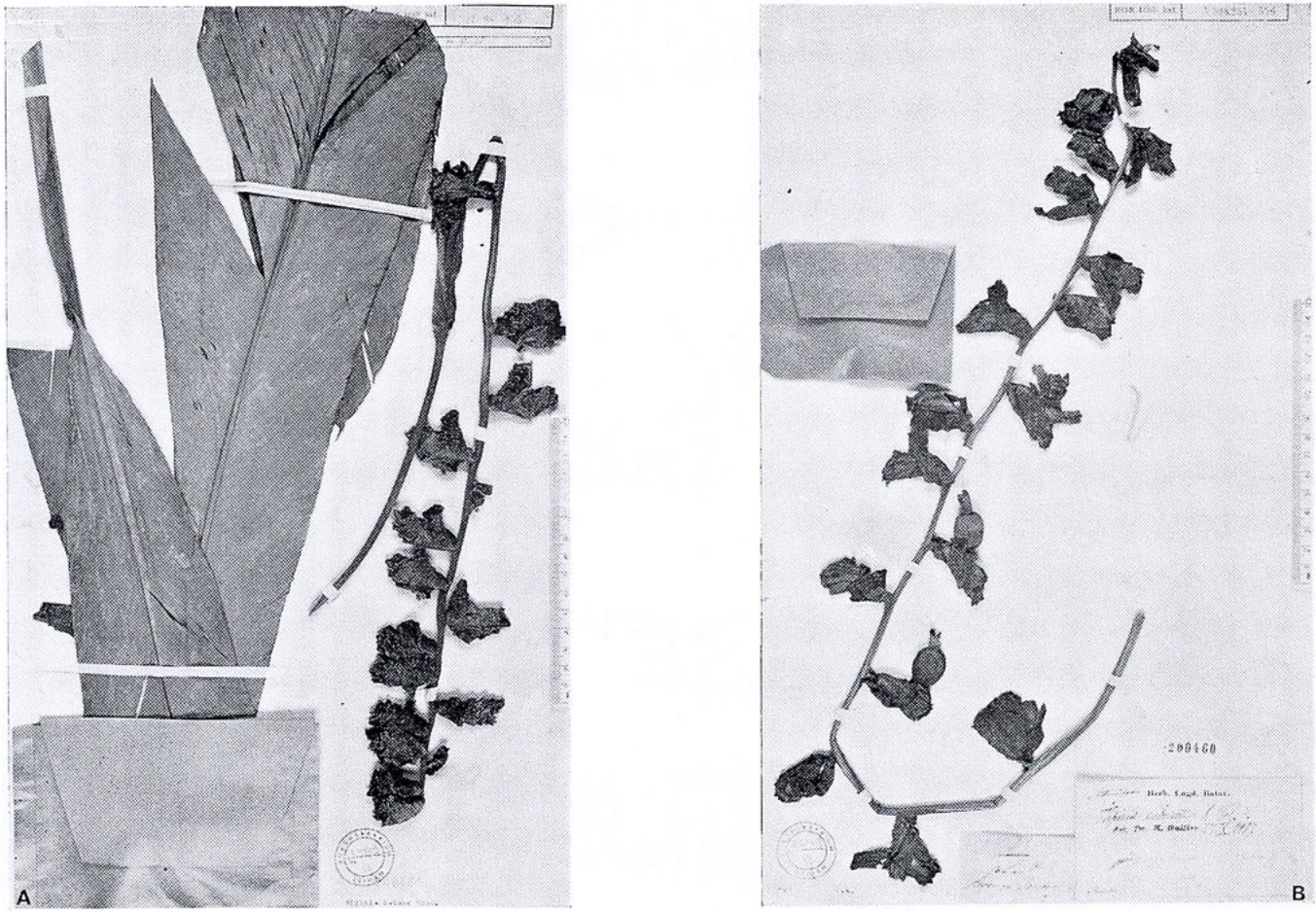

PLATE 7. *Alpinia nutans* (L). Rosc. illustrating the characteristic inflorescence.

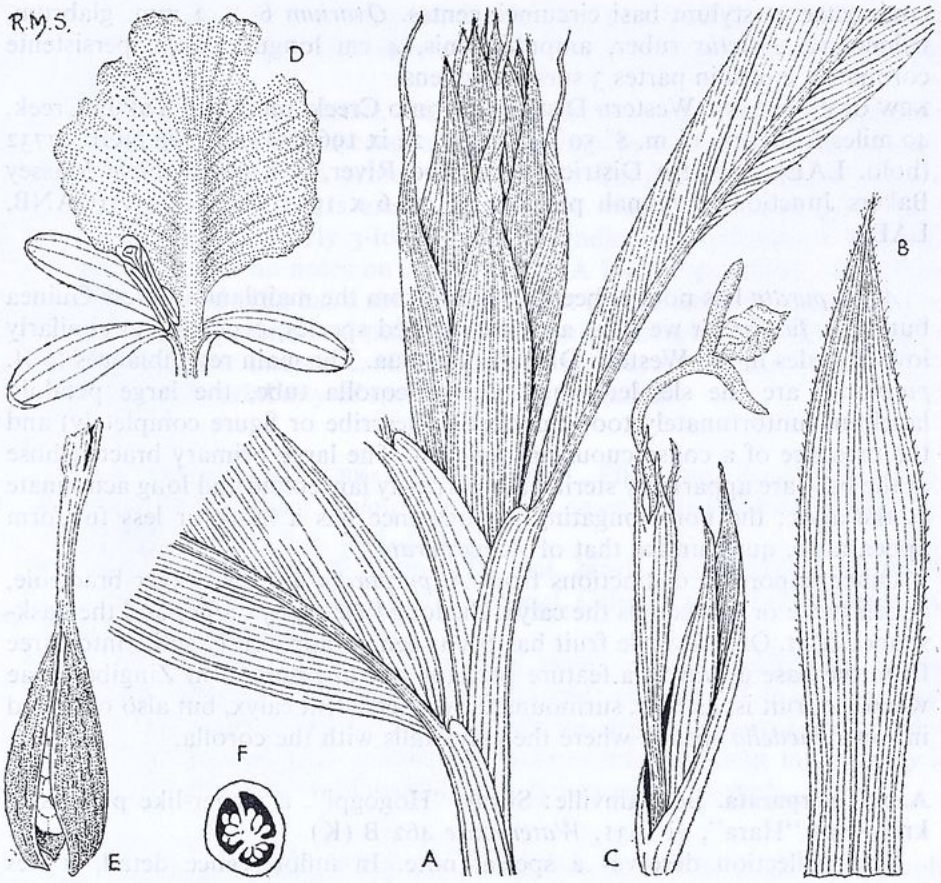

FIG. 2. *Alpinia fusiformis* R. M. Smith: A, inflorescence × ⅔; B, primary bract × 1; C, cincinnus showing first tubular bracteole and second tubular bracteole which encloses remainder of cincinnus × 1; D, upper part of flower, dissected (labellum imperfect) × 2; E, capsule × ⅔; F, ovary in T. S. × 4 (from dried material of *NGF* 17732).

Herba rhizomatosa usque ad 1·3 m alta. *Folia* vaginis plus minusve glabris, ligula biloba 5–6 mm longa lobis rotundatis ad margines pubescentibus; lamina sessilis 20–30 × 4–6 cm, acuminata basi attenuata, glabra. *Inflorescentia* in caule foliato terminalis, 10 × 3–4 cm, fusiformis vel plus minusve cyathiformis, fere glabra. *Bracteae primariae* (infimae steriles longissime acuminatae) 11 × 1·75 cm (sursum decrescentes), marginibus ciliatis, apice caudato pubescente; cincinni sessiles, 3-(fortasse pluri-)flori; bracteolae 4 cm × 7 mm (sub floribus serotinis minores) cauda pubescente inclusa, tandem ad basin fissae. *Flores* pedicellis 2 mm longis; calyx, ovario incluso, 4 cm longus, trilobus, lobis linearibus 8 mm longis, pubescens; corollae tubus tenuis 5·5 cm longus glaber; lobus dorsalis 1·2 cm × 4 mm, apice rotundato, lobis lateralibus dorsalem aequantibus, apice subacutis; labellum (imperfectum) album, c. 2·2 cm longum, basi in unguem 3 mm longum abrupte angustatum, 2 cm latum medio fascia angusta incrassata flava (?) praeditum. *Anthera* sessilis; thecae 6–7 mm longae, apicibus divergentibus, connectivo in cristam (fortasse 2 × 2·5 mm longam, integram?) prolongato. *Stylus* filiformis, stigmate rubro; glandes epigynae 2 mm longae, plus minusve

conjunctae et stylum basi circumcingentes. *Ovarium* 6 × 2 mm, glabrum, triloculare. *Fructus* ruber, ampulliformis, 4 cm longus, calyce persistente coronatus, e basi in partes 3 sursum findens.
NEW GUINEA, EAST: Western District, Oriomo Creek, mouth of Yakup Creek, 40 miles from sea, 16 m, 8° 50′ S, 143° E, 22 ix 1963, *Womersley* NGF 17732 (holo. LAE); Western District, Strickland River, c. 8 miles above Massey Bakers Junction, savannah plateau, 50 m, 6 x 1967, *Pullen* 7452 (CANB, LAE).

A. purpurata has not yet been recorded from the mainland of New Guinea but in *A. fusiformis* we have a closely related species, occurring at similarly low altitudes in the Western District of Papua. The main resemblances to *A. purpurata* are the slender long exserted corolla tube, the large petaloid labellum (unfortunately too imperfect to describe or figure completely) and the presence of a conspicuous anther-crest. The large primary bracts (those at the base are apparently sterile) are narrowly lanceolate and long acuminate at the apex; the non-elongating inflorescence has a more or less fusiform appearance, quite unlike that of *A. purpurata*.

Other important distinctions from *A. purpurata* are the longer bracteole, which more or less equals the calyx, the long linear calyx lobes and the flask-shaped fruit. Only a single fruit has been seen; it apparently splits into three from the base upwards, a feature perhaps not uncommon in Zingiberaceae when the fruit is, as here, surmounted by a persistent calyx, but also observed in some *Riedelia* species where the calyx falls with the corolla.

A. aff. **purpurata**. Bougainville: Siwai, "Hogogpi", a ginger-like plant also known as "Hara", vi 1931, *Waterhouse* 462 B (K).

This collection deserves a special note. In inflorescence detail, it lies between *A. purpurata* and *A. fusiformis* but the collection cited above shows an interesting growth habit which may perhaps be interpreted in two different ways. The compact (c. 6–7 cm long) inflorescence is borne separately on a leafless or few-leaved shoot and while examples of radical and terminal inflorescences are well-known in several genera of Zingiberaceae and indeed both types may occur within a single species (*Zingiber wightianum*, *Alpinia abundiflora* and perhaps *A. blumei*, no. 2), this may not be the case here. The basal parts of the shoots consist of short c. 3 cm long, scale covered, root-bearing stems and it may be that this specimen is made up of plantlets of the kind referred to under *A. purpurata*. There is no indication of this in the field-note but presumably such plantlets may fall to the ground as the parent inflorescence dies and grows independently. Of the two inflorescences present, one terminates a c. 15 cm leafless scape and the other, which has been broken off, almost certainly belongs to the apex of a 25 cm shoot bearing two well-formed leaf blades and two which are rudimentary. There is also a c. 35 cm leafy shoot with 5 well developed blades c. 15–17 × 3·5 cm. Plantlets which have been seen in cultivated material from Fiji and in *Kajewski* 416 (New Hebrides) are very much smaller than the shoots described above and no roots are to be seen, but a colour slide of *A. purpurata* in the Solomon Islands, taken by Corner, shows flowering plantlets producing aerial roots arising from the lowermost bracts of a large, and by this stage, blackened, parent-inflorescence. No detailed measurements are given, but the old inflorescence must be over

30 cm long and is overtopped by the plantlets. Leaves are to be seen on all these shoots and the inflorescences do not appear to be compact or flat-topped.

In inflorescence detail, this plant cannot be conclusively placed with *A. purpurata*. The inflorescence shape, although broader, the narrowly lanceolate pubescent margined primary bracts and the acuminate calyx lobes which lack sub apical spurs are in accordance with *A. fusiformis*, but the short bracteole and clearly 3-lobed labellum indicate *A. purpurata*. No fruit was collected and no notes on colour made. A further gathering, *Waterhouse* 44, New Georgia (K) has a similarly compact inflorescence, terminal on a normal robust leafy stem, and pubescent leaf undersurfaces but this material is not adequate for dissection. Clearly much has yet to be learned of the growth habit and variability of species of sect. *Guillainia*.

ALPINIA sect. EUBRACTEA K. Schum., Pflanzenr., Zing. 352 (1904).

Syn.: [*Alpinia* sect. *Kolowratia* (Presl) Loesen., Pflanzenfam., 2 Aufl. 15a:621 (1930) p.p. excl. typ.]

Type. *A. eubractea* K. Schum. [in Bot. Jahrb. 27:289 (1899) et] Pflanzenr., Zing. 353, fig. 41, A, B, (1904). Celebes, near Takalekadjo, 1500 m, *Sarasin* 846 (n.v.).

Inflorescence terminal on a leafy stem, usually nodding or pendulous; primary bracts persistent, often coloured; cincinni of (2–)4–many tubular bracteolate flowers; corolla tube not or slightly exserted from the calyx, labellum fleshy usually oblong or more or less triangular more rarely linear, occasionally with small lateral teeth or obscurely 3-lobed.

Schumann distinguished his sect. *Eubractea* on the large, usually coloured primary bracts. He was of the opinion that it might be subdivided, and Valeton, dealing exclusively with those species native to the New Guinea mainland, later attempted this. He proposed 2 subsections: *Eustales*, in which the large broad, showy bracts form a thick capitulum in which the individual cincinni do not elongate (although the inflorescence may do so considerably) and the capsule is spherical; and subsect. *Kolowratia* to include species in which the cincinni may elongate and the capsule, as far as he knew, is cylindric.

Such a subdivision may work well within a restricted geographical area, but it is less effective when viewing the distribution of large bracteate *Alpinia* as a whole. The type of sect. *Eubractea* was described from Celebes and was therefore ignored by Valeton; it has since been destroyed at Berlin. One thing is clear, Valeton was wrong to associate the plants he described in subsect. *Kolowratia* with the very distinct Philippine *A. elegans* (Presl) K. Schum. which must be taken as the type of the subsection. This species has very large long-pedicellate flowers borne in non-elongating cincinni. Valeton also suggested that a cylindric capsule might separate subsect. *Kolowratia* from *Eustales*. But the fruit of *A. elegans* is globose to ovoid and of the species described by Valeton fruit was available to him in one instance only. Loesener renamed sect. *Eubractea* as *Kolowratia*, which he incorrectly attributed to Valeton, but, his inclusion of *Guillainia* at subsectional level apart, did little to alter Valeton's concept.

ALPINIA sect. EUBRACTEA subsect. EUSTALES Val.
in Nova Guinea (Botanique) 8:943 (1913);
Loesen. in Pflanzenfam., 2 Aufl. 15a:622 (1930).

Syn.: [*Alpinia* sect. *Kolowratia* (Presl) Loesen. subsect. *Guillainia* (Vieill.) Loesen. in Pflanzenfam. 2 Aufl. 15a:621 (1930), excl. typ.]

Type. *A. eustales* K. Schum. in Bot. Jahrb. 27:288 (1899). New Guinea, West: near Ramoi, *Beccari* 251 (n.v.).

Flowers up to c. 3 cm long, usually hidden by the primary bracts, pedicels up to 2·5 cm, usually much shorter, filament usually very short or anther more or less sessile.

New Guinea, Bismarck Archipelago, Solomon Islands, New Hebrides, Fiji, perhaps the Carolines and Philippines.

4. A. eubractea K. Schum. [in Bot. Jahrb. 27:289 (1899) et] Pflanzenr., Zing. 353 (1904).

Type. Celebes: near Takalekadjo, 1500 m, *Sarasin* 846 (n.v.).

One must hope that this species, the type of which was destroyed at Berlin, may eventually be recollected. It falls outwith Valeton's area and was therefore ignored by him. It was placed in subsect. *Guillainia* by Loesener but Schumann's description indicates that *A. eubractea*, which has a short corolla tube, small cuneate labellum and lacks an anther crest, cannot be associated with *A. purpurata*.

5. A. nutans (Linn.) Rosc. in Smith, Exot. Bot. 2 (1805) quoad syn. Linn., excl. t. 160 et descr. quae sunt *A. zerumbet* (Pers.) Burtt & Smith. Pl. 7.

Type. *Globba silvestris major* Rumph., Herb. Amb. 6:140 t. 62, 63 (1750) in explicatione tab., t. 63, sphalmate pro Globba silvestris minor distincta habetur.

Syn.: *Globba nutans* L., Mant. 2 170 (1771). Type as above.
[*A. papuana* auct.; K. Schum. Pflanzenr., Zing. 355 (1904) p.p., quoad specim. Moluccana, non Scheffer.]
[*A. eubractea* auct.; Val. in Ic. Bog. 300 (1909) non K. Schum.]
[*A. gigantea* auct.; Val. in Nova Guinea (Botanique) 9:943 (1913), non Blume]
[?] *A. moluccana* Gagnep. in Bull. Soc. Bot. France 48:xc (1902).

MOLUCCAS: Amboina, Herb Blume, *Binnendijk*? (L); Herb. Itineris in Insulas Moluccanas 1859–1860, *Vriese & Teysmann* s.n. (L); *Teysmann* s.n. (L); Galoba Amboina, ex herb. Hanbury, received iii 1877 (K); ex herb. Hanbury, *Binnendijk*, comm. ix 1866 (K). [This specimen is annotated "Java, M. Binnendijk, D. Hanbury, comm. 9/66". This is presumably a reference to the country and date of despatch and there is no reason to suppose that the plant was not collected in Amboina]. Banda, *coll. ignot.* (L); Ternate, 350 m, 26 ii 1920, *Bequin* 1273 (L).

Cult. in Hort. Bog. (L).

There is no doubt that *A. nutans* is the correct name for this species. Linnaeus cites both Rumphius figures (although misprinted [?] t. 12 and 13) and they are the sole basis of his *Globba nutans*. Blume later incorrectly referred t. 62 to his *A. gigantea*, which must be transferred to section *Myrio-*

crater (see no. 53 below). K. Schumann (1904), believing *A. gigantea* to be based on a mixture of material and on plates of two distinct species, abandoned this name in favour of *A. papuana* Scheff. This caused Valeton to adopt Blume's name for the wrong plant. An excellent account of the confusion is given by Valeton (1917).

A new description is needed for *A. nutans* but this cannot be attempted until good collections are made. It is a very large plant with leaves sometimes approaching 1 m in length and the pendulous inflorescence can exceed 75 cm. The inflorescence, which bears remotely placed cincinni, is reminiscent of some collections of the much smaller *A. oceanica*, no. 22, which also has an insular distribution, but is geographically separated from *A. nutans* by the land mass of New Guinea.

Valeton (1917) clearly considered *A. moluccana* Gagnep. to be conspecific.

6. A. papuana Scheff. in Journ. Jard. Buitenz. 1:56 (1876).

Type. New Guinea, West: Sorong Is., *Teysmann* s.n. (n.v.)

Syn.: *A. colossea* K. Schum. in Bot. Jahrb. 27:289 (1899). Type: New Guinea, West, Sorong Is., *Beccari* 192 (n.v.)

A. gigantea v. *papuana* (Scheff.) Val. in Nova Guinea (Botanique) 8:943 (1913).

[?] *A. eustales* K. Schum. in Bot. Jahrb. 27:288 (1899). et in Pflanzenr., Zing. 352 (1904). Type: New Guinea, West, Ramoi, *Beccari* 251 (n.v.).

Valeton (1917) states that *A. papuana* has a different calyx and smaller flowers than *A. nutans*. Unfortunately no authentic material of the former has been seen but the following collection, which is in bad condition, may perhaps belong here: New Guinea, West, Wissel Lake Region, bivouac x–xii, 6 i 1939, *Eyma* 4243 (K).

K. Schumann differentiated his ill-described *A. eustales* from the other species of sect. *Eubractea* on the long (up to 12 cm) sterile bracts. In fact, such bracts often occur in *A. nutans*, and this was pointed out by Valeton who suggested that the two species might not be distinct. However, since Ramoi (misprinted as Rancoi, K. Schum. 1904) lies on the mainland of New Guinea, only a few miles from Sorong Island, the tentative placing of *A. eustales* as a synonym of *A. papuana* seems justified.

7. A. valetoniana Loesen. in Pflanzenfam., 2 Aufl. 15a:622 (1930).

Syntypes. New Guinea, West: near Sabang and Alkmaar 30–130 m, *Versteeg* 1270 (L, K), 1284 (n.v.); *Branderhorst* 365 (L); *von Römer* 538 (n.v.)

Syn.: *A. macrocarpa* Val. in Nova Guinea (Botanique) 8:944 (1913)—non Gagnepain in Bull. Soc. Bot. France 53:133 (1906).

A. valetoniana and the succeeding 3 species are characterized by large, almost coriaceous primary bracts which conceal tightly compressed cincinni of up to at least 20 flowers. The isotypes examined all lack flowers suitable for dissection but *A. valetoniana* is easily distinguished by the manner in which the main rhachis of the inflorescence elongates and the cincinni, of which there may be 3 or 4, arise at intervals of 2–3 cm.

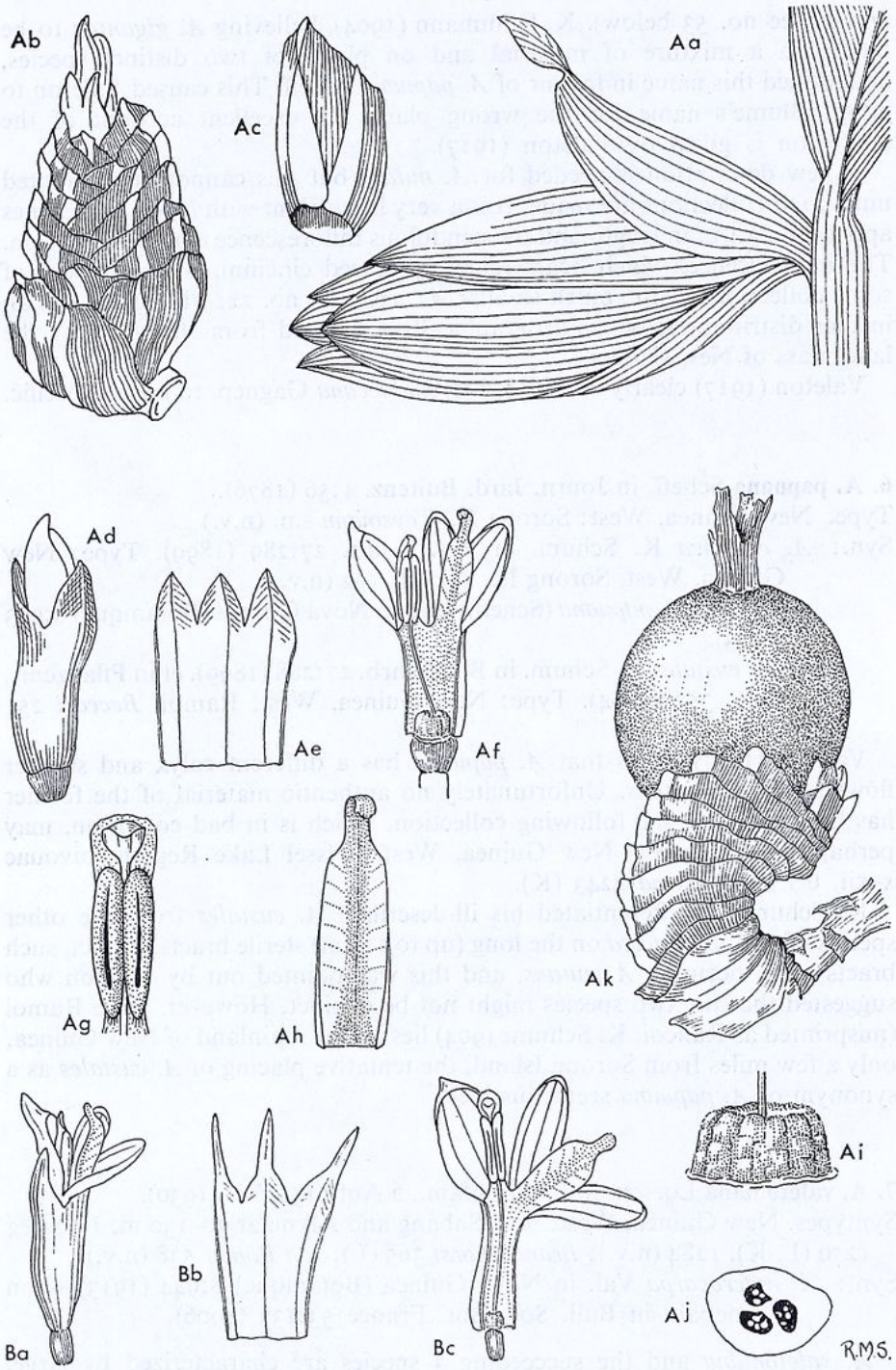

FIG. 3. A, *Alpinia kiungensis* R. M. Smith: Aa, young inflorescence × ⅔; Ab, cincinnus × 1; Ac, bracteole, from middle of cincinnus × 2; Ad, flower × 1; Ae, calyx, dissected × 1; Af, flower, dissected × 1; Ag, anther × 2; Ah, labellum × 2; Ai, epigynous glands × 3; Aj, ovary in T. S. × 4; Ak, fruiting cincinnus × ⅔; (from spirit material of *NGF* 34126). B, *Alpinia carinata* Val.: Ba, flower × 1; Bb, calyx, dissected × 1; Bc, flower, dissected × 1 (from dried material of *Versteeg* 1283).

8. A. carinata Val. in Nova Guinea (Botanique) 8:945 (1913). Fig. 3B.
Syntypes. New Guinea, West: near Sabang & Alkmaar, *Versteeg* 1271 (n.v.), 1283 (L), 1285 (L); *Branderhorst* 368 (L).
A. carinata is discussed below (no. 10).

9. A. porphyrocarpa Ridl. in Trans. Linn. Soc. Bot. 9:213 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–13, Canoe Camp, *Boden Kloss* s.n. (K, BM).

A. carinata and *A. porphyrocarpa* (which Ridley placed in sect. *Amomiceps*) are closely allied to *A. kiungensis* and are discussed under that species (no. 10).

10. Alpinia kiungensis R. M. Smith, **species nova** cincinnis multifloris compressis et fructu magno globoso (4–5 cm diam.) *A. porphyrocarpae* Ridl. similis, sed costa glabra, inflorescentia glabra et florum colore differt. Fig. 3A.

Herba rhizomatosa 2 m altitudinis excedens. *Folia* vaginis glabris, ligula 5 mm longa integra; lamina sessilis, (25–)30–40 cm longa, (5–)6–10 cm lata, lanceolato-acuminata, basi plus minusve rotundata margine inconspicue ciliato excepto glabra. *Inflorescentia* densa, pendula, glabra, usque ad 9 cm longa. *Bracteae* infimae steriles c. 7–9 × 3–6 cm, rubrae, interdum apice foliaceae; bracteae primariae similes (in siccitate fragiles facile disrumpentes); cincinni sessiles c. 5–6 per inflorescentiam, valde compressi, saltem 20-flori; bracteolae tubulares c. 2 cm × 2 cm sursum decrescentes, unilateraliter fissae, conspicue bicarinatae. *Flores* rubri pedicellis 4 mm longis; calyx ovario 8 mm longo incluso 2·5–3 cm longus, carnosus, lobis 3 triangularibus, unilateraliter fissus; corollae tubus c. 2 cm longus; lobus dorsalis 1–1·5 cm × 8 mm breviter cucullatus; lobi laterales paullo breviores angustioresque; labellum 1·5 cm longum et 5 mm latum, in tribus partibus inferioribus medio porcatum, superne abrupte angustatum, c. 4 mm × 2 mm, carnosum et leviter pubescens. *Anthera* subsessilis, thecis parallelis, leviter pubescens, connectivo in cristam truncatam 4 × 4 mm prolongato. *Stylus* filiformis; glandes epigynae 3 mm longae, plus minusve conjunctae et stylum basi circumcingentes. *Ovarium* triloculare polyspermum. *Capsula* intense rubra, globosa, c. 5 cm diametro, carnosa.

NEW GUINEA, EAST: Western District, Kiunga, 6° 10′ S, 141° 20′ E, lowland rain-forest 25 m, flowers red, fruit deep red, 13 ix 1972, *Streimann & Lelean*, NGF 34126 (holo. E; iso. LAE); *ibidem*, 10 viii 1971, *Streimann & Katik*, LAE 51084 (LAE, E).

A. carinata, *A. porphyrocarpa* and *A. kiungensis* are very closely related low-altitude species characterised by closely arranged many-flowered cincinni arising in the axils of persistent primary bracts. All possess dorsally winged bracteoles. They are known from their type localities only.

A. porphyrocarpa may be distinguished by the presence, in all parts of the inflorescence, of some degree of pubescence and by the densely hairy midrib. Furthermore, the flowers are described (none have been seen) as being yellow, whereas in *A. carinata* and *A. kiungensis* they are white and red respectively. No indication of primary bract colour is given by Ridley.

A. carinata and *A. kiungensis* are almost entirely glabrous plants. The former has narrow (3·5–5·5 cm wide) more or less basally attenuate leaves, while in *A. kiungensis* the lamina may be up to 10 cm broad and is unequally

rounded at the base. The sterile bracts at the base of the inflorescence are much larger in *A. kiungensis* and the wings on the bracteoles more pronounced. Both species have red or brownish to rose-red primary bracts and probably have almost identical flowers. Only a single mature flower has been seen in *A. carinata* but apart from the longer and narrower calyx lobes it in no way differs from the flower of *A. kiungensis*. There is a short corolla tube, a narrowly oblong labellum, which is fleshy in the centre and bears a small, narrower truncate prolongation at the apex. The more or less sessile anther terminates in a short entire crest.

The fruit of *A. kiungensis* is red and up to 5 cm in diameter; that of *A. carinata* is described as brown-grey but no measurements are given and the isotypes seen lack capsules. *A. porphyrocarpa* has a fruit up to 6 cm in diameter and is greyish-purple (Ridley is ambiguous here). It may be that such large capsules, which also occur in *A. valetoniana*, will prove to be characteristic of the New Guinea members of subsect. *Eustales*.

11. A. rosacea Val. in Nova Guinea (Botanique) 8:945 (1913).
Syntypes. New Guinea, West: Sabang, 80 m und auf dem Resi Berge, 500 m, bracteae pallidae flavae vel etiam castaneae, *Versteeg* 1227 (K); 1655 (L, K), *Branderhorst* 333 (n.v.).
See no. 13 below.

12. A. superba (Ridl.) Loesen. in Pflanzenfam., 2 Aufl. 15a:622 (1930).
Basionym: *Guillainia superba* Ridl. in Trans. Linn. Soc. Bot. 9:216 (1916).
Syntypes. New Guinea, West: Mt Carstenz expedition 1912–13, Camp VIb *Boden Kloss* s.n. (BM, K); Camp VIa, *Boden Kloss* (n.v.); Canoe Camp and Camp III, *Boden Kloss* (n.v.).
See no. 13 below.

13. (A.) Guillainia minor Ridl. in Trans. Linn. Soc. Bot. 9:216 (1916)—non *Alpinia minor* Dietr., Syn. Pl. 1:12 (1839).
Type. New Guinea, West: Mt Carstenz Expedition 1912–13, Canoe Camp, *Boden Kloss* s.n. (BM, K).

The above species (nos 11–13) are geographically from the same area as *A. valetoniana*, *A. carinata* and *A. porphyrocarpa* and occur at similarly low altitudes. They differ, however, in the few-flowered cincinni, which are totally enveloped by the primary bracts and the rather more membranous character of sterile and primary bracts. In general facies they are probably very alike but the type material is unsatisfactory and important detail is often missing from the descriptions. For this reason, the transfer of *Guillainia minor* to *Alpinia*, where it would require a new name, has not been made. Only in one instance, *A. superba*, have mature flowers been found. The main axis of *A. superba* elongates with age but it is not known if similar growth occurs in *A. rosacea* and *G. minor*. Describing from immature inflorescences can be very dangerous in *Alpinia* where both corolla tube and labellum expand considerably as the flower opens. The position of the flowers within the cincinnus and, more important, the position of the cincinnus on the main axis should also be considered for, in a species with an elongated inflorescence, the flowers borne on the top may be greatly reduced in size.

14. A. dasystachys Val. in Nova Guinea (Botanique) 8:946 (1913).
Syntypes. New Guinea, West: Hellwig Mts., 1350 m, *von Römer* 1016, 1114, 1157 (omn. n.v.).
See no. 15 below.

15. A. densiflora K. Schum. in Bot. Jahrb. 27:292 (1899) et Pflanzenr., Zing. 355 (1904).
Type. New Guinea, West: *Beccari* 916?

No leaves were collected of *A. densiflora* and the inflorescence was apparently mixed up with specimens of *A. chaunocolea* K. Schum. (sect. *Oligocincinnus*, type from Mt Arfak, near Putat, *Beccari* 916). Working from Schumann's obviously inadequate description, Valeton suggested that *A. dasystachys* might be conspecific. Lack of material makes verification of this impossible.

16. A. platylopha (Ridl.) Loesen. in Pflanzenfam., 2 Aufl. 15a:622 (1930).
Basionym: *Eriolopha platylopha* Ridl. in Trans. Linn. Soc. Bot. 1:220 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–1913, camp VIc, 1800 m, *Boden Kloss* s.n. (BM).
See no. 19 below.

17. A. multispica (Ridl.) Loesen. in Pflanzenfam., 2 Aufl. 15a:622 (1930).
Basionym: *Eriolopha multispica* Ridl. in Trans. Linn. Soc. Bot. 1:220 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–1913, camps VIb and VIc, 1300 and 1800 m, *Boden Kloss* s.n. (BM).
See no. 19 below.

18. (A.) Eriolopha klossii Ridl. in Trans. Linn. Soc. Bot. 1:220 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–1913, camps III and I to III, 120–800 m, *Boden Kloss* s.n. (BM).
See no. 19 below.

19. (A.) Eriolopha sericea Ridl. in Trans. Linn. Soc. Bot. 1:221 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–1913, camp VIa, 1300 m, *Boden Kloss* s.n. (BM, K).

These four species, all with tightly compressed inflorescences and large primary bracts were placed in subsect. *Eustales* by Loesener and are tentatively retained there. The problem of *Eriolopha* Ridl. is discussed more fully below (No. 33).

20. A. euastra K. Schum. in Bot. Jahrb. 27:296 (1899) et Pflanzenr., Zing. 351 (1904).
Type. New Guinea, West: near Raruvi [Ramoi ?], *Beccari* 348 (n.v.).

This species is described as having an involucre of large bracts, calyx lobes of 5 mm, a short corolla tube and lanceolate labellum. It was placed in sect. *Medusula* by K. Schumann but may well prove to belong to sect. *Eubractea* subsect. *Eustales*.

21. A. strobilacea K. Schum. in Bot. Jahrb. 27:295 (1899) et Pflanzenr., Zing. 359 (1904).

Type. New Guinea, West: Andai, *Beccari* 552 (n.v.).

Syn.: *Eriolopha seticalyx* Ridl. in Trans. Linn. Soc. Bot. 9:221 (1916). Type New Guinea, West; Mt Carstenz expedition 1912–1913, Canoe Camp, *Boden Kloss* s.n. (BM, K).

Alpinia seticalyx (Ridl.) Loesen. in Pflanzenfam., 2 Aufl. 15a:620 (1930).

NEW GUINEA, WEST: without precise locality, *Zippelius* (L—det. *A. strobilacea*).

Ridley remarked that the type of *Eriolopha seticalyx* was in bad condition, having finished flowering, and indeed omitted it from his specific key, intentionally or not. The Zippelius sheet of *A. strobilacea* is in only slightly better condition but the two species are probably conspecific. A further Zippelius collection (L), cited by Schumann under *A. calycodes*, may also belong here.

22. A. oceanica Burkill in Proc. Cambr. Philos. Soc. 9:93 (1896). Fig. 4A.

Type. Bismarck Archipelago: New Lauenburg group, Kerawara, 1887, *Hollrung* 844 (K).

Syn.: [*Alpinia nutans* auctt.; K. Schum., Fl. Kaiser-Wilhelmsl. 28 (1889), non Roscoe].

Alpinia englerıana K. Schum. in Notizbl. Bot. Gart. Berlin 2:102 (1898).

Guillainia rechingeri Gagnep. in Bull. Soc. Bot. France 55:433 (1908).

NEW HEBRIDES: Erromanga, received 1931, *Morrison* (K); Malekula, South West Bay, 12 x 1971, *Hallé* 6425 (K); *ibidem*, 3 km de la lagune, 13 x 1971, *Hallé* 6447 (K).

BRITISH SOLOMON ISLANDS PROTECTORATE: Guadalcanal, 1855, R.M.S. Herald, *Milne* 541 (K); valley inland from Rove Police married quarters, Honiara, flowers white, bracts light green, 10 m, 24 viii 1967, *Nakisi*, BSIP 8043 (K); New Georgia, 1894–5, *Officers of H.M.S. Penguin* s.n. (K); South Georgia, 1927, *Waterhouse* s.n. (K); white flowers, 15 v 1929, *Waterhouse* 16 (K); San Jorge, Talise village, sea-level, 4 m, bracts and fruit pale green, flowers white, 24 ix 1965, *Hunt* 2719 (RSS 30615 K); Malaita Island, Dala, near sea level, 22 vii 1966, Lae Herb. no. 76218, *Van de Loos* s.n. (LAE); Vella Lavella, Maravari village, bracts greenish white with pink tints, 23 iii 1970, *McKinnon* 6 (K); San Cristoval, Waimanmura, 2–2.5 m, flowers white, 3 viii 1932, *Brass* 2569 (L); Ulawa, lowland, common, 2–3 m, bracts pink, flowers white, fruit white, 7 x 1932, *Brass* 2976 (L).

BOUGAINVILLE: near Papoko, fleurs blanches, ix 1905, *K. & L. Rechinger* 4840 (lectotype of *Guillainia rechingeri*—P); Kieta, flores pallide rosei, ix 1905, *K. & L. Rechinger* 4851 (P); Buin sub-distr., 3 miles from Tonolei Harbour, 100 m, fruit whitish green, 19 viii 1969, *Foreman*, NGF 45649 (LAE, E); Dera Siri Siwai, ix 1931, *Waterhouse* 583A (K); Pavairi, 550 m, old garden, 6° 15′ S, 155° 30′ E, 21 vi 1967, *Lavarack & Risdale*, NGF 31230 (LAE, L); Cult. R.B.G. Edinb. (from Bougainville), C.8447 (E).

NEW BRITAIN: between Baining mts. and Toma, *Bateson* 133 (K); Galilo village, near Cape Hoskins, W Nakanai, fruit white, 28 vii 1954, *Floyd*,

NGF 3473 (LAE); *ibidem*, fruit succulent bright red, 28 vii 1954, *Floyd*, NGF 3474 (LAE); Keravat, 50 m, white bracts, 23 xii 1954, *Floyd*, NGF 6635 (LAE); *ibidem*, pink bracts, 23 xii 1954, *Floyd*, NGF 6636 (LAE); Talasea subdistr. near Airagilpua 500–700 m, 5° 40′ S, 148° 25′ E, bracts white, fruit red orange, 19 xi 1965, *Frodin*, NGF 26313 (LAE, L); *ibidem*, bracts red, 19 xi 1965, *Frodin*, NGF 26314 (LAE); SW of Gilnit on W side of Itni River, Talasea, 16 m, 5° 45′ S, 148° 32′ E, purplish red bracts, 14 xi 1965, *Frodin*, NGF 26226 (LAE); *ibidem*, no red bracts, 14 xi 1965, *Frodin*, NGF 26227 (LAE); ridge above Kilenge, 250–300 m, 5° 25′ S, 148° 25′ N, fruit white, *Risdale*, NGF 30355 (LAE); near mt Bango subdistr. Hoskins, 100 m, 5° 25′ S, 150° 30′ E, fruit red, 18 x 1968, *Millar*, NGF 40578 (LAE); South Daughter Volcano, NE of Rabaul, 20 m, flowers white, fruit immature, green, 7 ix 1961, *Van Royen* 6627 (L); Sulu, subdistr. Hoskins, 4° 56′ S, 150° 22′ E, 10 m, 3 m high, bracts red, flowers white, 13 v 1973, *Stevens*, LAE 58451 (LAE, L, E); Willelo, subdistr. Hoskins, 5° 09′ S, 150° 6′ E, 5 m, 3·5 m high, flowers white, 6 vi 1973, *Stevens & Lelean*, LAE 58606 (LAE, E).
NEW IRELAND: *Barclay* s.n. (K); Kavieng, near sea level, 31 x 1964, *Millar*, NGF 23820 (LAE); Kaunt Harbour, 1 mile inland, 15–30 m, 2° 45′ S, 150° 55′ E, 2–3 m high, flowers white in pale yellow calyces (?), fruit globular, smooth white, 14 ii 1967, *Coode & Katik*, NGF 29836 (LAE, E); Ruwong, near Karu, Kavieng subdistr. c. 600 m, 3° 38′ S, 152° 12′ E, 12 i 1969, *Coode & Katik*, NGF 40107 (LAE, E); Emira Is. near Mussau, 1° 40′ S, 150° E, 60 m, 5 ix 1969, *Coode*, NGF 40470 (LAE, E); Namatanai subdistr., 4° 13′ S, 153° E, 8 miles up Danfu R. near Manga, 250 m, bracts red, 28 i 1970, *Coode, Sands & Lelean*, NGF 46033 (LAE, E).
ADMIRALTY (MANUS) ISLAND: Challenger expedition, iii 1875, *Moseley* s.n. (K); Lorengau, 30 m, flowers white, fruit white, 18 vi 1871, *Stone & Streimann* 10296, LAE 53596 (LAE, E).

A. oceanica has much the same distribution pattern as *A. purpurata*: it occurs at low altitudes throughout the islands north, east and southwards of New Guinea from Admiralty Island to the New Hebrides and is apparently absent from New Guinea itself. While *A. purpurata* is regarded as purely ornamental, the stems and leaves of *A. oceanica* are, in some areas at least, used medicinally. The species is characterised by the pendulous inflorescence and this, together with usually narrower leaves, distinguishes it from *A. purpurata* when no flowers are available. As the inflorescence develops the cincinni often become quite distant on the main axis and are then very reminiscent of *A. vittata* and *A. nutans*.

A wide range of material of *A. oceanica* has been examined and it is evident that it lacks the long exserted corolla tube of *A. purpurata* and the anther-crest tends to be irregularly dentate. The labellum is triangular, never petaloid, with a much narrower apical portion (which is difficult to distinguish in dried material), and small, median, lateral teeth may occur. The ovary may be trilocular, more often incompletely so, or unilocular, and the capsule is more or less spherical. *Guillainia rechingeri* Gagnep. is undoubtedly conspecific.

VARIATION IN A. OCEANICA. The importance of some of the variations discussed here is not yet fully understood; studies of populations, collections

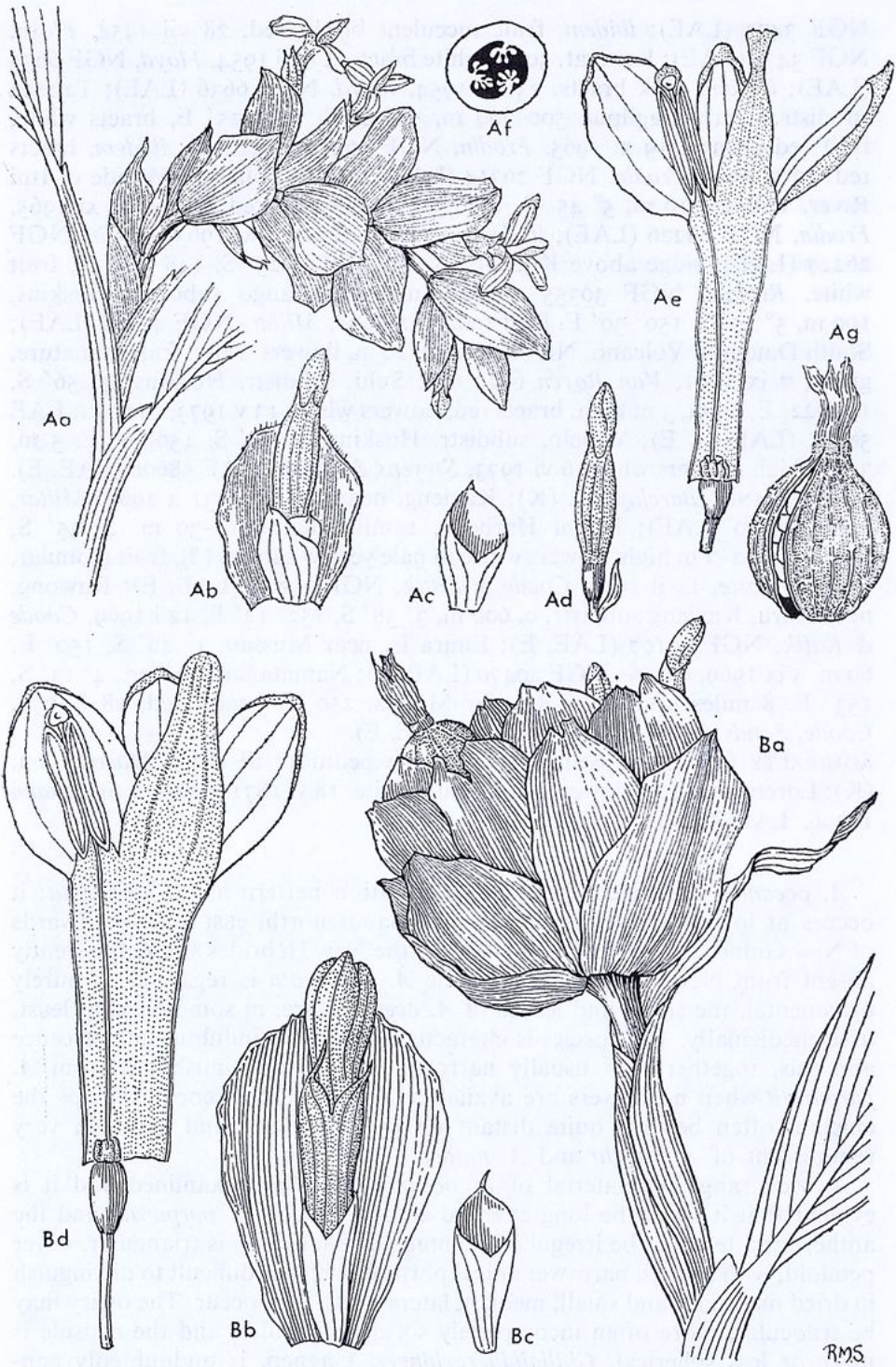

FIG. 4. A, *Alpinia oceanica* Burkill: Aa, inflorescence × ⅔; Ab, primary bract and cincinnus × 1; Ac, tubular bracteole × 1; Ad, cincinnus with first bracteole removed to show second bracteole which encloses remainder of cincinnus × 1; Ae, flower, dissected × 2; Af, ovary in T. S. × 4; Ag, fruit × 1 (from living material, cult. R.B.G. Edinb. *C.*8447). B, *Alpinia* sp. aff. *oceanica*: Ba, inflorescence × ⅔; Bb, primary bract and cincinnus × 1; Bc, tubular bracteole × 1; Bd, flower, dissected × 2 (all from dried material of *NGF* 21795).

which include both flower and fruit, together with detailed notes are needed. However, a considerable range of material has been examined and *A. oceanica*, as here understood, is clearly an extremely variable species. One or two plants may eventually be described as separate taxa—these are treated separately below—but the remainder have been included in the main list of citations.

Primary bracts. As in *A. purpurata*, the colour of the primary bracts is variable, Schumann describing them as white, Gagnepain as green or green with a purple margin and in NGF 46033 the field note states 'bracts red', but in the majority of the specimens seen no indication of bract colour is given. *A. oceanica* flowered recently at Edinburgh (from material collected in Bougainville) and inflorescences from the same plant showed that the bract colour varies considerably. One inflorescence had consistently green margined pink bracts while another lacked pink entirely. Bract shape is not constant either: in *Hollrung* 844 (type of *A. oceanica*), they are up to 1·5 cm long and distinctly truncate, as is the case in *NGF* 40470 (Emira Is.) where the cincinni much exceed the bracts in length as they mature. Other collections (e.g. *Bateson* 133, New Britain) have more or less rounded bracts up to 2·5 cm long, but most of the material examined lies between these extremes and the cincinni are usually almost entirely concealed.

Labellum shape. The lip of *A. oceanica* is more or less triangular, never petaloid and may occasionally show small lateral teeth. Two collections from New Ireland (*NGF* 23820, *NGF* 40107) show a labellum which is more or less linear in the lower $\frac{2}{3}$, at the top of which are 2 lateral teeth, the upper $\frac{1}{3}$ narrowing still further and then widening again into an emarginate (?) apex. Although these plants have a rather more delicate inflorescence they do not differ vegetatively from *A. oceanica*.

Fruit colour. The fruit of *A. oceanica* is usually white or greenish-white but all too often none has been collected or no notes on colour given. In New Britain, plants with red fruit have been found (*NGF* 3474, 40578, 26313). Otherwise, these plants in no way differ from those with greenish-white capsules; this is indeed indicated in the note accompanying *NGF* 3474 and this collection also shows very clearly how the main axis of the inflorescence elongates as it matures: the flowering spike is c. 8 cm long, that in fruit over 25 cm.

A. aff. **oceanica**. Fig. 4B. New Britain: Kandrian subdistr., Fullerborn Harbour, 6° 60′ S, 150° 40′ E, 16 m, 3 iii 1965, *Sayers*, NGF 21795 (LAE); Pomio subdistr., track running E from Fullerborn Harbour, 6° 10′ S, 150° 40′ E, 3 m high, fruit green, turning red, 11 v 1973, *Croft & Katik*, NGF 14987 (LAE, E).

This plant has a compact more or less globose inflorescence c. 7 cm in diameter. Both flower and fruit are to be seen and there is no elongation of the main axis. The flowers do not differ seriously from *A. oceanica* and the capsules are described as pink.

A. aff. **oceanica.** Solomon Islands: Vella Lavella, Maravari village, in second growth, low lying parts of coastal plain and along streams . . . stems 4–5 m, flower head bracts pink, calyx pinkish white, corolla white, 23 iii 1970, *Mrs J. McKinnon* 5 (K).

Here the inflorescence is again compact and more or less globose but is still in a comparatively young stage. The flowers are close to *A. oceanica* but the labellum bears 2 conspicuous linear teeth, c. 1 cm long, arising on either side near the base. Furthermore, the leaf (there is but one on the sheet) has a 4 cm petiole, whereas in *A. oceanica* the leaves are consistently sessile. The field-note of another collection (*McKinnon* 6) from the same locality and representing typical *A. oceanica* indicates that the villagers regard the two plants as distinct. The lengthy note which accompanies *McKinnon* 5 gives the native names of 'Fii Folola' and 'Uvotou' and details various medicinal uses of stem and leaves. Mrs McKinnon's collection of *A. oceanica*, which is also used medicinally, is known as 'Fii Ange' or 'Saba Saba'.

23. A. vittata Bull, Cat. 83:4 (1873).
Syn.: *A. sanderae* Sand. in Wiener Gartenzeit. 28:263 (1903).
Guillainia vittata Ridl. in Journ. Bot. 75:202 (1937).
Type. New Ireland: introduced by *Micholitz* [No specimen?].
NEW HEBRIDES: 2 vii 1896, *A. Morrison* s.n. (leaves only, K); cult. R.B.G. Edinb. (ex hort. L. M. Mason), C.8284 (E).

This species has been long known in cultivation, usually as *A. sanderae*. Although *A. vittata* is characterised by the narrow, brightly variegated yellow-green leaves, in other respects it differs but little from collections of *A. oceanica* in which the primary bracts are distant on the main axis, and may not be specifically distinct.

24. A. carolinensis Koidz. in Bot. Mag. Tokyo 31:233 (1917).
Type. East Carolines: Ponape Island, 21 i 1915, *Koidzumi* s.n. (TI, n.v.).

This species is probably close to *A. oceanica* or *A. nutans* but there are indumentum differences and in *A. carolinensis* the leaves have 1–4·5 cm petioles. It was placed in sect. *Eubractea* by the author.

ALPINIA sect. EUBRACTEA subsect. KOLOWRATIA (Presl) Val. in Nova Guinea (Botanique) 8:943, 947 (1913).
Syn.: *Kolowratia* Presl, Rel. Haenk. 1:113, t. 20 (1827).
Alpinia sect. *Kolowratia* (Presl) Loesen. subsect. *Eukolowratia* Loesen. in Pflanzenfam., 2 Aufl. 15a:622 (1930).
Type. *Kolowratia elegans* Presl, Rel. Haenk. 1:113 t. 20 (1827). [*Alpinia elegans* (Presl) K. Schum.]
Flowers up to at least 8 cm long, held on long pedicels (to 5 cm) and much exceeding the primary bracts; filament well-formed.
Philippines.

25. A. elegans (Presl) K. Schum. in Bot. Jahrb. 27:288 (1899) et Pflanzenr., Zing. 351 (1904).
Basionym: *Kolowratia elegans* Presl, Reliq. Haenk. 1:113, t. 20 (1827).
Type. Philippine Islands: Luzon, Sorzogon Bay, *Haenke*.
PHILIPPINE ISLANDS: Luzon, Tayabas prov., Lucban, v 1907, *Elmer* 7866 (E); Leyte, Leyte prov., Palo, i 1906, *Elmer* 7258 (E); Laguna, Siniloan, 200 m, 8 xi 1970, *Hernaez* 163–70(E). Panay, Barrio Sampaloc, Rizal, 26 xi 1972, *Holttum* s.n. (spirit material only, E).

Thanks are due to Professor R. E. Holttum for providing recently collected spirit material of this distinctive species which is now in cultivation, but has not yet flowered, at Edinburgh (Luzon, *Price* s.n.). The large, cream flowers, which are about 8 cm long and are borne in tubular-bracteolate cincinni are, by virtue of their long pedicels (to 5 cm), well exserted from the primary bracts. The corolla tube does not exceed the tri-dentate, laterally split calyx, and the labellum, which is more or less rectangular, is fleshy with a shallowly trilobed upper margin. Unlike subsect. *Eustales* where the anther is usually little more than subsessile, the filament is c. 1 cm long and unites with the base of the labellum 2-3 mm above the petals. There is a more or less rounded, entire anther crest, and the persistent primary bracts become fimbriate with age.

26. A. congesta Elm. in Leaf. Philipp. Bot. 8:2968 (1916).
Syn.: *Kolowratia congesta* (Elm.) Merr., Enum. Philipp. Pl. 1:235 (1922).
Type. Philippine Islands: Luzon, *Elmer* 16144 (n.v.).

Elmer distinguished *A. congesta* from *A. elegans* on the congested inflorescence and sessile cincinni. The inflorescence is described as from 15–25 cm long with cincinni arranged on all sides, rather than in 2 alternating rows, on the main rhachis. The primary bracts are from 5–8 cm long, becoming, as with *A. elegans*, fimbriate with age, the flowers are on 2 cm pedicels and there is a distinct, 1 cm, filament and rounded anther crest.

27. (A.) Kolowratia eruciformis Ridl. in Philipp. Journ. of Sc. 4:182 (1909).
Type. Philippine Islands: Bucas Island, NE coast of Mindanao, 15 m, *Merrill* 5258 (n.v.).

No clear details of bracts and bracteoles are given for *K. eruciformis* but the species is described as having short pedicels, an extremely short filament, (no measurements are given) and completely connate lower petals. These features do not suggest an affinity with *A. elegans* but, in the Zingiberaceae at least, Ridley's descriptions are frequently unreliable.

ALPINIA sect. AMOMICEPS K. Schum., Pflanzenr., Zing. 350 (1904).
Type. *A. macrocephala* K. Schum., *l.c.*
Inflorescence tightly congested, sterile and primary bracts persistent; flowers long-pedicellate, corolla tube not exceeding the calyx, labellum connate to the lateral petals at the base, linear with a more or less orbicular expanded apex.
Fiji.

K. Schumann separated his sect. *Amomiceps* from sect. *Eubractea* on the very congested inflorescence, surrounded by an involucre of large bracts. He placed one other species in the section, the Sumatran/Malayan *A. capitellata* Jack, a plant which, despite the presence of large primary bracts, is in flower detail (notably in the large, showy, labellum) so similar to *A. javanica* Bl. that it is here transferred to sect. *Javana* (see no. 30 overleaf).

Amomiceps is retained as a monotypic section for the present but it should be pointed out that sterile primary bracts are not uncommon in sect. *Guillainia* and *Eubractea* and the tight congested inflorescence of *A. macrocephala* is similar to that occurring in some collections of *A. oceanica*.

28. A. macrocephala K. Schum., Pflanzenr., Zing. 350 (1904).
Type. Fiji, xii 1877, *Horne* s.n. (K).
FIJI: Cakaudrove, Navonu Ridge, 150 m, 30 iv 1969, *Flora of Fiji* 16883 (K).

The type material of *A. macrocephala* bears no complete cincinni or even single flowers suitable for study. The inflorescence is, however, massive, c. 10 cm across, held on a 1·5 cm diameter peduncle and surrounded at the base by large, apparently sterile bracts; the true primary bracts are c. 6 cm long, narrowly lanceolate and the tubular bracteoles only a little shorter. Bracts and bracteoles become fimbriate with age. There is evidence of very long pedicellate flowers.

The more recent collection cited above shows the calyx to be exserted from the bracteoles (by reason of the long pedicels) and much exceeding the corolla tube in length. There is a linear labellum which flares into a small round apical crest. Elsewhere, only in *A. elegans* of sect. *Eubractea* subsect. *Kolowratia* have such long pedicellate flowers been observed; in that species too, bracts and bracteoles become fimbriate with age and a possible affinity should not be discounted.

ALPINIA sect. JAVANA K. Schum., Pflanzenr., Zing., 359 (1904).
Type. *A. javanica* Bl., Enum. Pl. Javae 59 (1827).

Inflorescence with or without large primary bracts; corolla tube not exserted from the calyx; labellum showy 4–5 cm long, broadly ovate.
Java, Sumatra, Malay Peninsula, Borneo.

29. A. javanica Bl., Enum. Java: 59 (1827).
Type. Java: prov. Bantam, *Blume* (L).
Syn.: *A. involucrata* Griff., Not. 3: 422 (1851). Type: Malacca, *Griffith* 5697 (K).
A. campanaria Ridl. in Journ. Str. Br. As. Soc. 86:308 (1922). Type: Malay Peninsula, Negri Sembilan, Bukit Tangga, *Ridley* s.n. (K).

The erect or more or less drooping inflorescence of this well-known species is surrounded at the base by 2 or 3 broad sheaths but the primary bracts are small and rounded, often no more than 1 cm long.

The cincinni are usually borne on long stalks (up to 6 cm) each with 3–6 tubular bracteolate flowers. The corolla tube is a little shorter than the funnel shaped calyx and the labellum is 4–5 cm long, broadly ovate with crisped margins, the basal part orange with red spots and stripes.

30. A. capitellata Jack, Malay. Misc. 2: No. 7, 4 (1820).
Type. Sumatra: near Benkoelen, *Jack* s.n. (n.v.).
MALAY PENINSULA: prov. Wellesly, Ara Kuda, xii 1895, *Ridley* 7015 (K).

A. capitellata was placed in sect. *Amomiceps* by K. Schumann. Despite the presence of large involucre-like primary bracts it is in no way allied to *A.*

macrocephala. Schumann himself remarked on its resemblance to *A. javanica* Blume and this is further underlined by Holttum who states that the structure of the cincinnus is identical.

31. A. grandiceps Ridl. in Journ. Str. Br. As. Soc. 50: 148 (1908).
Type. Sarawak: Kuching, xi 1907, *Hewitt* s.n. (K).
SARAWAK: Kuching, viii 1908, *Hewitt* s.n. (K).

This species is very close to and perhaps not distinct from *A. capitellata*. It is, therefore, here transferred to sect. *Javana*.

ALPINIA sect. MEDUSULA K. Schum., Pflanzenr., Zing. 351 (1904).
Lectotype: *A. calycodes* K. Schum. in Bot. Jahrb. 27:295, t.4, fig. A (1889) et Pflanzenr., Zing. 351 (1904).

Inflorescence tightly compressed, primary bracts small, calyx lobes linear, 2 cm long.
New Guinea.

Sect. *Medusula*, which was distinguished from *Amomiceps* by the smaller inflorescence and long calyx teeth, originally comprised two species one of which *A. euastra* (no. 20) has been tentatively placed in subsect. *Eustales*. *A. seticalyx*, assigned to sect. *Medusula* by Loesener, is here reduced to *A. strobilacea* K. Sch. (no. 21) and tentatively transferred to subsect. *Eustales*.

32. A. calycodes K. Schum. in Bot. Jahrb. 27:295 (1899) et Pflanzenr., Zing. 351 (1904).
Type. New Guinea, West: near Andai, *Beccari* 589 (n.v.).

The following material probably belongs here :—
NEW GUINEA, WEST: near Prauwen bivouac, forest, flower rose-lilac, 210 m, 19 viii 1920, *H. J. Lam* 823 (K); Dozai, E of Sukarnapura, flowers and fruit white, 50 m, 18 viii 1966, *Kostermans & Soegeng* 408 (K, L).
NEW GUINEA, EAST: NW of Kilifas, Amanab sub-distr., West Sepik distr., 3° 12′ S, 141° 21′ E, on ridge in lowland rain forest, 1 m high, flowers reddish-brown, 320 m, 30 iii 1970, *Foreman & Kumul*, Lae 48332 (LAE).

The Lae collection has good flowers which do not differ seriously from Schumann's description. The inflorescence is made up of very tightly clustered many-flowered cincinni and it is impossible to distinguish the primary bracts (Schumann described them as small). The calyx lobes are up to at least 2 cm long, the flowers reddish-brown, and the young capsule is more or less globose. *Kostermans & Soegeng* 408 has white flowers and a more robust habit but is in other respects identical with the other specimens cited.

PART II

Because they fall outwith the sections enumerated above (as here defined), species 33–52 are, for the time being, regarded as 'sectionless'. Several have large primary bracts, and almost all were once placed in sect. *Eubractea*.

The types (and some other species) of Ridley's genera *Eriolopha* and *Adelmeria* are considered here, together with three species from Sri Lanka that were originally placed in *Amomum*.

33. A. flagellaris (Ridl.) Loesen., Pflanzenfam., 2 Aufl. 15a:622 (1930).
Basionym: *Eriolopha flagellaris* Ridl. in Hook., Ic. Pl. t. 3067 (1916) and in Trans. Linn. Soc. Bot. 9:219 (1916).
Type. New Guinea, West: Mt Carstenz expedition, 1912–1913, camps VIb and VIc and VIII to IX, 1300–1800 m, *Boden Kloss* s.n. (BM, K).
Type species of *Eriolopha* Ridl. in Hook., Ic. Pl. t. 3067 (1916).

It will by now be clear that the nine species described by Ridley in *Eriolopha* do not, despite the presence in all of a hairy anther-crest, form a group of closely interrelated species. The type is characterised by the remote cincinni which are borne in the axils of rather stiff primary bracts and comprise about 20 tubular-bracteolate flowers. These cincinni elongate considerably with age becoming, as Ridley remarked 'catkin-like'. Such elongation hardly deserves generic status, and as we have seen, Ridley described several other species in *Eriolopha* which lack this feature (nos. 18–21). Exactly the same elongation occurs in those species described by Valeton in his subsect. *Kolowratia* (nos. 36–39 below), probably to some extent in sect. *Oligocincinnus*, and is also to be found in some species (*A. pulchra* for example) of sect. *Pycnanthus*. Critical study of these groups would almost certainly lead to a reduction in names but much type material is lost and Ridley's specimens although available are often unsatisfactory. Elucidation lies some years ahead but good new collections are essential. Whilst some of the species involved, including *A. flagellaris*, have conspicuous persistent primary bracts, in many they are small and caducous.

34. A. tristachya (Ridl.) Loesen. in Pflanzenfam., 2 Aufl., 15a:622 (1930).
Basionym: *Eriolopha tristachya* Ridl. in Trans. Linn. Soc. Bot. 9:218 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–1913, Camp VIa, 1000 m, *Boden Kloss* s.n. (BM, K).

The inflorescence of *A. tristachya* bears elongated cincinni similar to those of *A. flagellaris*. No primary bracts remain on the Kew sheet; they are described as only 5–10 mm long.

35. (A.) Eriolopha juliformis Ridl. in Trans. Linn. Soc. Bot. 9:219 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–1913, Camp VIa and between camps VII and VIII, 1000 m, *Boden Kloss* s.n. (BM, K).
Similar in habit to and probably not distinct from *A. flagellaris*.

36. A. decockii Val. in Nova Guinea (Botanique) 8:949, t. CLXX B (1913).
Type. New Guinea, West: Goliath-Gebirge, 1350 m, *de Kock* 1911 (n.v.).
See no. 39 below.

37. A. gracillima Val., *l.c.* 948.
Syntypes. New Guinea, West: Hellwig-Gebirge, 1650 m, *von Römer* 763, 1108 (n.v.); NW Fluss, 800 m, *Exploratie-Detachement*, 1912 (n.v.).
See no. 39 below.

38. A. manostachys Val., *l.c.* 949.
Type. New Guinea, West: Hellwig Gebirge, 1350–1650 m, *von Römer* 1152 (n.v.).
See no. 39 below.

39. A. leptostachya Val., *l.c.* 947, t. CLXX A.
Type. Dutch New Guinea: Resi-Berg, 900 m, *Versteeg* 1642 (L).

No material of species nos. 36–38 has been seen. Together with *A. leptostachya*, Valeton considered that they formed a distinct group, characterised by the elongated cincinni, and were probably allied to the Philippine *A. elegans*. For this group he proposed subsect. *Kolowratia*. Had Valeton seen material of *A. elegans* he would not have taken this course for it is clear that his species are allied to and may, in some cases, be identical with the preceding species of *Eriolopha* Ridl. (nos. 33–35). The isotype of *A. leptostachya* shows elongated, remotely placed cincinni; no primary bracts remain but they are described as up to 6 cm long and deciduous.

40. A. domatifera Val. in Nova Guinea (Botanique) 8:955, t. CLXXII (1913).
Type. New Guinea, West: Arfak mts, 800 m, *Gjellerup* 1022 (L).
Syn.: *Eriolopha meyeri* Ridl. in Trans. Linn. Soc. Bot. 9:218 (1916). Type: New Guinea West, Geelvink Bay, iv 1873, *Meyer* 10 (K).
NEW GUINEA, WEST: Arfak mts, flowers red, 2000 m, xii 1913, *Gibbs* 6132 (K).

There is no doubt that the above species are conspecific. Their unification underlines that sect. *Oligocincinnus*, to which Valeton referred *A. domatifera*, must be considered in the future unravelling of *Eriolopha* and Valeton's New Guinea element of subsect. *Kolowratia*.

The cincinni of *A. domatifera* elongate as the inflorescence matures and are borne close together on the short main axis. Few primary bracts remain on the material; they are described as 1–2 cm long.

41. (A.) Eriolopha rigida Ridl. in Trans. Linn. Soc. Bot. 9:217 (1916).
Type. New Guinea, West; Mt Carstenz expedition 1912–13, camp VIa, 1000 m, *Boden Kloss* s.n. (BM)

Here the robust inflorescence bears 2-flowered cincinni. Ridley describes the 'exterior bracts' [exterior bracteoles?] as tubular, the bracteoles similar but smaller.

42. A. paradoxa (Ridl.) Loesen., Pflanzenfam., 2 Aufl., 15a:620 (1930).
Basionym: *Hornstedtia paradoxa* Ridl. in Govt. Lab. Publ. Philip. 35:85 (1905).
Type. Philippine Islands: Luzon, *Elmer* 6629 (K).
Syn.: *Elmeria bifida* Ridl. in Leafl. Philip. Bot. 2:568 (1909), *nom. illegit.*
Adelmeria bifida Ridl. op. cit. 603 and in Philip. Journ. Sci. 4: 179 (1909), *nom. illegit.*
Adelmeria paradoxa (Ridl.) Merr. in Philip. Journ. Sci. 9:444 (1914).
Type species of *Adelmeria* Ridl. in Leafl. Philip. Bot. 2:603 (1909).
PHILIPPINE ISLANDS: Luzon, Tayabas prov., Lucban, v 1906, *Elmer* 7396 (E); Benguet prov., Baguio, iii 1907, *Elmer* 8568 (E).

A. paradoxa has a more or less globose, congested inflorescence with large persistent primary bracts which Ridley considered generically significant. Unfortunately no cincinni suitable for dissection remain on the Kew material. It was placed in sect. *Amomiceps* by Loesener but examination of *Elmer* 7396 (which was cited by Ridley) suggests that *A. paradoxa* may lie between sect. *Guillainia*, with which it shares the slender, exserted corolla tube, and sect *Eubractea* which it resembles in the nodding inflorescence and fleshy labellum. Ridley described the lip as 'deeply bilobed into 2 linear excurved lobes, convolute when dry' but in *Elmer* 7396 the lip is quite entire, rather oblong and bears short, fleshy lateral staminodes at the base. There is some indication however, that, as the flower ages, the lip tends to curl and split, but it is not naturally bilobed.

43. (A.) Adelmeria alpina Elm. in Leafl. Philip. Bot. 8:2885 (1915).
Syntypes. Philippine Islands: Mindanao, Davas distr., Todayo, v 1909, *Elmer* 10642 (n.v.); *ibidem*, *Elmer* 10534 (n.v.).
See No. 46 below.

44. (A.) Adelmeria gigantifolia (Elm.) Elm. in Leafl. Philip. Bot. 8:2963 (1919).
Basionym: *Zingiber gigantifolium* Elm., *l.c.* 2916 (1918).
Type. Philippine Islands: Luzon, prov. Tayabas, Luchan, v 1907, *Elmer* 9282 (n.v.).
See no. 46 below.

45. A. oblonga (Merr.) Loesen., Pflanzenfam., 2 Aufl., 15a:620 (1930).
Basionym: *Adelmeria oblonga* Merr. in Philip. Journ. Sc. 9:433 (1914).
Type. Philippine Islands: Luzon, subprov. Bontoc, Bauco, 1300 m, iv 1913, *Vanoverbergh* 3108 (n.v.).
Syn.: *Adelmeria albida* Elm., Leafl. Philip. Bot. 8:2964 (1919).
Alpinia albida (Elm.) Loesen., Pflanzenfam., 2 Aufl., 15a:620 (1930).
See no. 46 below.

46. A. pinetorum (Ridl.) Loesen., Pflanzenfam., 2 Aufl., 15a:620 (1930).
Basionym: *Elmeria pinetorum* Ridl. in Leafl. Philip. Bot. 2:569 (1909).
Type. Philippine Islands: Luzon, Benquet prov., 1600 m, *Elmer* 8548 (n.v.).
Syn.: *Adelmeria pinetorum* (Ridl.) Ridl. in Philip. Journ. Sci. 4:180 (1909).

No material has been seen of these species. *A. oblonga* and *A. pinetorum* were placed in *Alpinia* sect. *Amomiceps* by Loesener.

47. A. rufa (Presl) K. Schum. in Bot. Jahrb. 27:293 (1899) et Pflanzenr., Zing. 361 (1904).
Basionym: *Hellenia rufa* Presl, Reliq. Haenk. 1:114, t. 21 (1830).
Type. Philippine Islands: Luzon, *Haenke* (n.v.).
PHILIPPINE ISLANDS: Luzon, prov. Tayabas, Lucban, v 1907, *Elmer* 9078 (E); prov. Laguna, San Antonio, viii 1910, *Ramos* 10934 (E); Quezon, 300 m, xi 1970, *Hernaez* 164–70 (E); Negros, Cuernos mts, iii 1908, *Elmer* 9578 (E); Polillo, viii 1909, *Robinson* 9207 (E); Mindanao, prov. Agusan, Cadadbaran, x 1912, *Elmer* 14051 (E); Leyte, 5 vi 1913, *Wenzel* 284 (E).

K. Schumann placed this species in sect. *Oligocincinnus* and although in general facies the inflorescence is similar to that of *A. domatifera* Val. (no. 40), and therefore to some species of *Eriolopha* Ridl., the structure of the labellum and filament is most unusual.

The flowers are long pedicellate and the slender corolla tube is long exserted from the calyx. The free part of the labellum consists of 2 linear lobes and in its lower half it forms a distinct 3–4 mm tube with the bottom part of the long, slender filament. Small subulate lateral staminodes arise on either side at the base of the free part of the filament. The narrowly lanceolate primary bracts of *A. rufa* are often more or less equal in length to the cincinni. As already remarked *A. rufa* is perhaps most closely allied to sect. *Presleia* Val. of subgenus *Alpinia*.

48. A. himantoglossa Ridl. in Trans. Linn. Soc. Bot. 9:212 (1916).
Type. New Guinea, West: Mt Carstenz expedition 1912–13, Camp VIb, 1300 m, *Boden Kloss* s.n. (BM, K).

Ridley saw a slight resemblance to *Eriolopha* in *A. himantoglossa* which presumably explains why Loesener assigned the species to subsect. *Eustales*. The material is very poor but the primary bracts are small and caducous and the inflorescence is paniculate. It may perhaps belong to sect. *Pycnanthus*.

49. A. arctiflora F. Muell., Fragm. 8:25 (1872).
Type. Australia: Queensland, Rockingham Bay, *Dallachy* (K).
AUSTRALIA: Queensland, Kuianda, 28 ii 1922, *White* 1547; Bargal, 1904, *Bellenden Ker Expedition* s.n.; Bellenden Ker, i 1923, *White* s.n.; Daintree river, 22 ii 1932, *Brass* 2213; Theresa Creek, Millaa Millaa, 17 vii 1960, *Trapnell* 255; Cook district, Smithfield, 20 iii 1961, *Hyland* 1835.
Cult. Brisbane Bot. Gard., vii 1961 *Trapnell* s.n. (all BRI).

No flowers remain on the type specimen of *A. arctiflora* and in the material cited above only a single flower has been found. The species has an unbranched inflorescence with primary bracts up to 6 cm long. These bracts are much exceeded by the elongated, c. 6-flowered cincinni. The flowers are long pedicellate and therefore well exserted from the bracteoles and the slender corolla tube exceeds the trilobed calyx. There is a more or less obovate petaloid labellum (2 × 2 cm) and the almost sessile anther has a prominent, entire crest. The capsule is cylindrical.

K. Schumann misinterpreted the structure of the inflorescence of *A. arctiflora* and placed it in sect. *Allughas*, amongst some not closely related species. Its true position is problematic; the slender corolla tube and petaloid labellum might seem to indicate sect. *Guillainia* but *A. arctiflora* differs in the long pedicels and elongated cincinni.

50. Alpinia fax Burtt & Smith, **nom. nov.**
Type. Sri Lanka: Central province, 1300–1900 m, *Thwaites* 3019 (PDA, K).
Syn.: *Elettaria involucrata* Thwait., Enum. Pl. Zeyl. 319 (1861)—non *Alpinia involucrata* Griff., Notul. 3:422 (1851).
Amomum involucratum (Thwait.) Trimen, Syst. Cat. 92 (1885) et Fl. Ceyl. 4:250 (1898)—excl. descr.

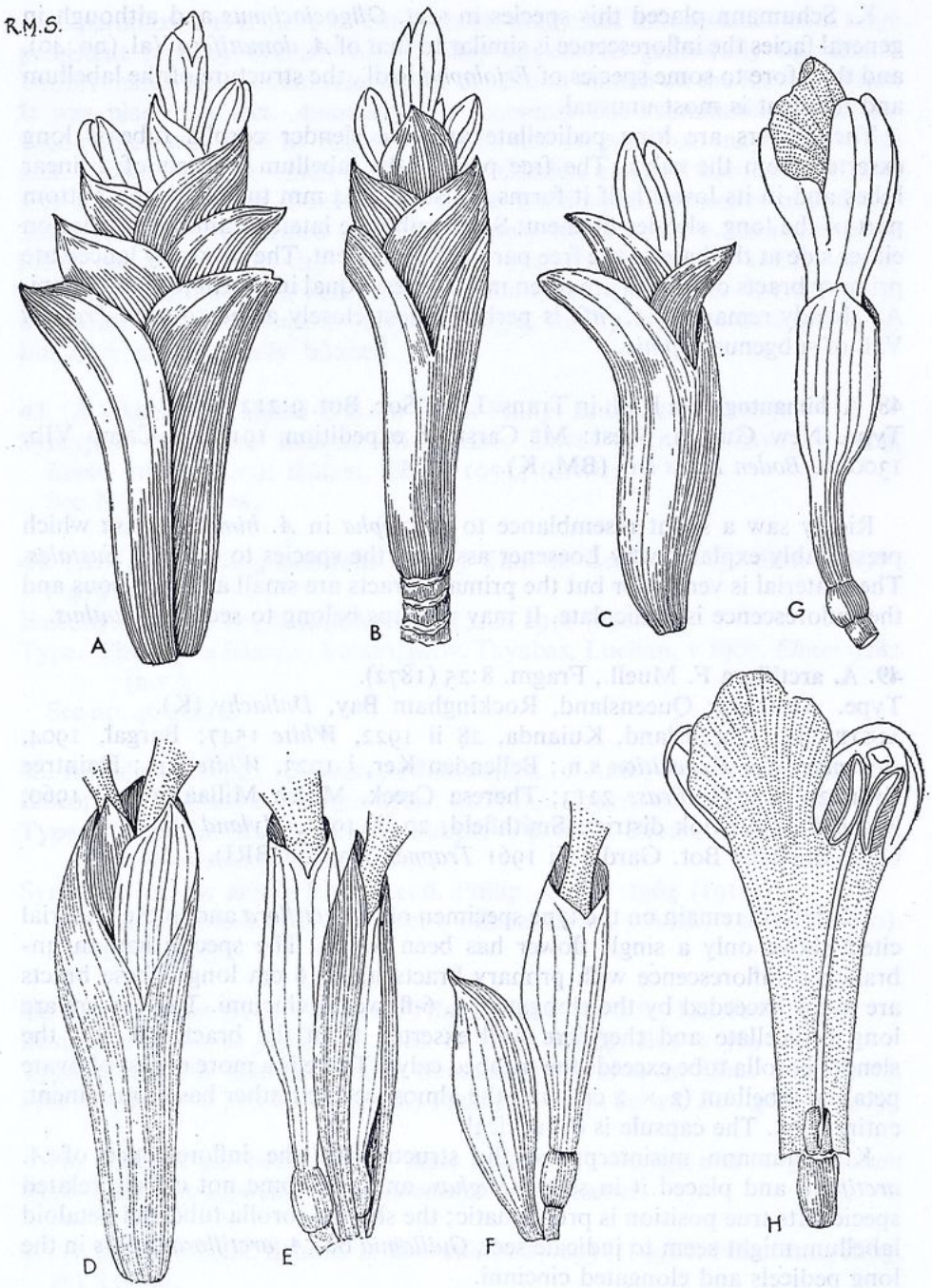

FIG. 5. *Alpinia abundiflora* Burtt & Smith: A, 7-fld cincinnus with first 3 bracteoles open to the base; B, same cincinnus, first 3 bracteoles removed, remaining bracteoles tubular; C, cincinnus from same inflorescence, bracteoles all tubular (from spirit material of *Burtt & Townsend* 58); D, cincinnus showing first tubular bracteole; E, same cincinnus, first bracteole removed, showing second bracteole open to the base; F, same cincinnus, second bracteole removed, showing third (and also non-tubular) bracteole which encloses remainder of cincinnus (from spirit material of *Burtt & Townsend* 105); G, flower; H, flower, dissected (from spirit material of *Grierson* 1099). All × 2.

SRI LANKA: Matale distr., Kalupahana Forest, 80° 48′ E, 7° 27′ N, 1300 m, frond to 3 m; bracts reddish purple, corolla white; seeds taste of cardamon, 5 vii 1973, *Jayasuriya* 1217 (E, PDA); Badulla distr., Tangamatai Forest Reserve, Haputale, 80° 55′ E, 6° 46′ N, 1650 m, frond 2.5 m tall, corolla white to pale green, 19 vii 1973, *Jayasuriya & Nowicke* 1236 (E, PDA).

See no. 51 below.

51. Alpinia abundiflora Burtt & Smith, **nom. nov.**, Fig. 5.

Type. Sri Lanka: Ambagamuva mts, 1000–1300 m, *Thwaites* 3374 (PDA, K, BM).

Syn.: *Elettaria floribunda* Thwait., Enum. Pl. Zeyl. 319 (1861)—non *Alpinia floribunda* K. Schum., Pflanzenr., Zing. 439 (1904).

Amomum floribundum (Thwait.) Trimen, Syst. Cat. 92 (1885) et Fl. Ceyl. 4:250 (1898)—excl. descr.

SRI LANKA: Central province, Nuwara Eliya distr., Horton Plains track to Kirigalpotta, 2300 m, inflorescence basal on stalks to 50 cm, bracts glossy crimson, flowers white with crimson streaks on upper lobe, 12 iii 1969, *Grierson* 1099 (E, PDA); *ibidem*, track between Horton Plains and North Cove between Old Chimney Pool area and S shoulder of Kirigalpotta, 4 iii 1973, *Townsend* 73/164 (E, PDA); Kandy distr., forest on E of Adams Peak above Moray tea estate, flowers white with magenta patch on lower lip, 8 ii 1973, *Burtt & Townsend* 94 (E, PDA); *ibidem*, additional to *B. & T.* 94, from higher up the hill, *Burtt & Townsend* 105 (E, PDA); Kandy distr., Watawalla, 7 ii 1973, *Burtt & Townsend* 58 (E, PDA); Kandy distr., Kotagala, just outside Hattan, flowers white with magenta patch on middle of lip, 7 ii 1973, *Burtt & Townsend* 66 (E, PDA); Matale distr., Kalupahana forest, 80° 48′ E, 7° 27′ N, 1450 m, frond 3 m tall, bracts dark red, corolla hyaline-white, labellum bright pink-purple 5 viii 1973, *Jayasuriya & Balasubramaniam* 1221 (E, PDA).

The inflorescence of these closely related species is surrounded by an involucre of showy, sterile bracts. Such bracts are unknown in *Amomum*. Superficially they closely resemble those of the Malesian *Nicolaia* but the Ceylon plants are quite dissimilar in floral detail. In both *A. fax* and *A. abundiflora* the cincinni are usually 2–7-flowered, although the outermost primary bracts may be single flowered. In *Amomum*, as so far understood, the primary bracts throughout the inflorescence each subtend a single flower. Both were described as having the inflorescence borne separately from the leafy shoot, but it is now known that, in *A. abundiflora* at least, both radical and terminal inflorescences may occur. Such diversity of habit is already known in Zingiberaceae, both at specific (*Zingiber wightianum*, *Costus* spp.) and generic level (*Renealmia*, *Riedelia*). In *A. fax* the cincinni are pubescent and have tubular bracteoles; there is an ovoid capsule and the inflorescence elongates considerably with age. *A. abundiflora* has glabrous cincinni and the bracteoles are usually open to the base but this is not a constant character and tubular bracteoles are frequently found (see introduction and fig. 5). In both species the corolla tube is equal to or slightly exceeds the calyx and the fleshy labellum may show signs of lateral lobing. The fruit is more or less globose.

52. A. rufescens (Thwait.) K. Schum., Pflanzenr., Zing. 322 (1904).
Type. Sri Lanka: Dickoya, *Thwaites* 3732 (PDA, K, BM).
Basionym: *Elettaria rufescens* Thwait., Enum. Pl. Zeyl. 430 (1864).
Syn.: *Amomum rufescens* (Thwait.) Trim., Syst. Cat. 92 (1885) & Fl. Ceyl. 4:256 (1898).

K. Schumann placed *A. rufescens* in *Alpinia* subgenus *Alpinia*. The type specimen shows it to be similar in inflorescence structure to the preceding species. It has not been re-collected.

Part III

Species transferred to sections outwith those dealt with in part I.

53. A. gigantea Bl., Enum. Pl. Java 59 (1827).
Type. Moluccas: Ternate, *Reinwardt* s.n. (L).

The above specimen lacks foliage but the inflorescence is clearly that of sect. *Myriocrater*. Valeton, who annotated the sheet, observed the presence of 'male and female flowers'. Blume incorrectly referred *Globba sylvestris major* (Rumphius, Herb. Amb. 6:140, t.6) to *A. gigantea*; the elucidation of the Rumphius plant is dealt with by Valeton (1917) and was discussed above under *A. nutans* (No. 5 above).

Blume cites a second Reinwardt collection, from Celebes, which consists of a single pubescent leaf. The label, in Reinwardt's hand, reads '*A gigantea* v. *villosa*'. K. Schumann was of the opinion that this single leaf was that of an *Amomum*; why he should have taken this view is not clear as there is no reason to suppose that it is anything other than an *Alpinia*.

54. A. vulcanica Elm., Leafl. Philip. Bot. 8: 2971 (1919).
Type. Philippine Islands: Luzon, *Elmer* 16168.
Syn.: *Languas vulcanica* (Elm.) Merr., Enum. Phil. Pl. 1:234 (1922).
PHILIPPINE ISLANDS, Bucas Grande, vi 1919, *Ramos & Pascasio* 35051 (K).

Elmer placed *A. vulcanica* in sect. *Eubractea*, but, although the type has not been seen it is quite clear from the collection cited above, which was verified by Merrill, that the species belongs to sect. *Myriocrater* K. Schum., thus extending the distribution of this interesting section.

55. A. racemigera F. Muell., Fragm. 8:27 (1872); Benth., Fl. Austral. 6:265 (1873).
Type. Australia: Queensland, Rockingham Bay, *Dallachy* (K).
AUSTRALIA: Queensland, Cook distr., near Deeral, 8 xi 1954, *Simmonds* s.n.; Russell River, 2 vii 1960, *Trapnell* 67; Wongabel Forest Reserve, 5 miles E of Atherston, xi 1964, *Hyland* 3508; 18 miles N of Mossman, on Bailey Creek Road to Cape Tribulation, 16° 15′ S, 142° 25′ E, 15 xi 1967, *Boyland & Gillieatt* 378 (all BRI).

It is difficult to understand why K. Schumann placed *A. racemigera* in sect. *Eubractea*. The caducous primary bracts are very small, 3 mm long and there are no tubular bracteoles. The manner in which the inflorescence emerges laterally from the top of the leafy stem, and the structure of the flower, leaves no doubt that this species must now be referred to sect. *Pleuranthodium*, a section hitherto recorded only from New Guinea.

The plate given by Bailey (Compr. Cat. of Queensland Plants 542, t. 16, 1913) which is captioned *A. arctiflora* is, in fact, a representation of *A. racemigera*.

Only four or five species of *Alpinia* are as yet known from Australia; they do not form a closely related group (see also *A. arctiflora*, no. 49 above).

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References

Burtt, B. L. & Smith, R. M. (1972a). Key species in the taxonomic history of Zingiberaceae. *Notes R.B.G. Edinb.* 31:177–227.

——(1972b). Monoecism in Alpinia. *l.c.*, 32:29–43.

Holttum, R. E. (1950). The Zingiberaceae of the Malay Peninsula. *Gard. Bull. Sing.* 13:1–249.

Loesener, T. (1930). Zingiberaceae. Engler & Prantl, *Natürlichen Pflanzenfamilien*, 2 Aufl., 15a:541–640.

Ridley, H. N. (1916). Report on the Wollaston Expedition to Dutch New Guinea, 1912–13. Zingiberaceae. *Trans. Linn. Soc. Bot.* 9:209–226.

Schumann, K. (1904). Zingiberaceae. *Das Pflanzenreich* 20 Heft (iv. 46).

Valeton, T. (1913). Zingiberaceae. *Nova Guinea* (*Botanique*) 8:923–988.

——(1917). Zingiberaceae in Merrill, E., *Interpretation of Rumphius Herbarium Amboinense* 151–165.

INDEX OF SPECIFIC NAMES

The numbers are those given to the species in the text; synonyms are italicised.