

MONOGRAPH OF THE TRIBE APOSTASIEAE (ORCHIDACEAE)

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SUMMARY

This paper embraces a full taxonomic revision of the tribe *Apostasieae*.

The introduction is followed by an ample discussion of the taxonomic position of the *Apostasieae* and the affinities within the tribe.

The tribes *Apostasieae* and *Cypripedioeae* are regarded as forming together the subfamily *Cypripedioideae* of the *Orchidaceae*.

Notes are given on the morphology and an evaluation is given on systematic characters and their value for specific delimitation. Two characters were formerly underestimated in *Neuwiedia*, notably the indument (maximal length of the glandless hairs) and the structure (texture) of the pericarp.

The systematic treatment provides descriptions of the tribe, the genera, and the species, keys for identification, full synonymy, typification, geographical distribution, and an index to specimens examined.

The *Apostasieae* range from Ceylon to the Ryukyus through to the Louisiades and North Queensland. Ranges are drawn on maps.

Two genera are distinguished, *Apostasia* and *Neuwiedia*; *Adactylus* is reduced to sectional status under *Apostasia*.

In *Neuwiedia* 8 species are distinguished among which 4 are new, viz. 3 from Borneo and 1 from Siam. Under *N. zollingeri*, 2 varieties are recognized besides the type variety, both based on former species, viz. var. *javanica* (J.J.S.) de Vogel and var. *singaporeana* (Baker) de Vogel. One supposed new species is left unnamed because its flowers are yet unknown.

In *Apostasia* 7 species are recognized; many earlier names had to be reduced; 4 belong to sect. *Apostasia* and 3 to sect. *Adactylus* Endl.

INTRODUCTION

The affinities of *Apostasieae* within the *Monocotyledones* are still under discussion and there is, hence, no unanimity of opinion about their status, though the group itself has never been disputed to represent a coherent natural entity.

The first monograph was written by Rolfe (1889) who gave, besides an enumeration of species, general remarks on their morphology and distribution. Taking into consideration the material Rolfe had at his disposal, his work was very satisfactory indeed. He proves to have had a clear vision of the important systematic characters within the group. However, Rolfe had to cope with the difficulty that several species were based on incomplete material by which essential characters remained sometimes unknown.

Unfortunately, the two later monographs, by Kraenzlin (1897) and Pfitzer (1903) were largely copied from Rolfe, adding nothing new save a unsatisfactory key, but failed to add a study of the additional material collected in the preceding two decades.

Since that time two factors have blurred the systematics of the group. First, considerable confusion was caused by authors of several Floras who misinterpreted the older species. Second, for the same cause, some later orchidologists described new species without careful checking them with type material. Also, their descriptions were sometimes made from buds and in general they attached too much value to size in describing new taxa.

From this concise review it appears that the group was in urgent need of a revision, the more so as a fairly large amount of unnamed material had accumulated.

The revision given here is certainly not final. Novelty can still be expected, especially in *Neuwiedia*. But one should be very careful in describing new taxa in this group if material is incomplete; it can only be done if differences are very clear. Fruiting material is in general for this purpose insufficient; a *Neuwiedia* from the Batu Islands which I suspect to represent a new species is, consequently, left here unnamed.

The fairly abundant material now at hand has led me to reconsider the value of systematic characters in the group. The testing of these characters has revealed the value of the indument which had only occasionally been mentioned.

M. Siebe (1903), in his thesis: 'Ueber den Anatomischen Bau der Apostasiinae' (Heidelberg) gives an anatomic description of several species, in the meantime validating some ancient herbarium names. From the drawings (fig. 1—5) and descriptions of aerial roots, which have no velamen, appears that *Neuwiedia* and *Apostasia* are different, although closely related. No clear difference can be observed between *Apostasia* and *Adactylus*. He had but little, and ill-determined material at his disposal, so that much of the seemingly specific anatomic characters may be merely individual differences.

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The excellent drawings are from the hand of Miss R. van Crevel.

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Finally I wish to thank Prof. Dr C. G. G. J. van Steenis under whose supervision this revision was accomplished and who critically polished the final text.

By the kind cooperation of their directors and curators I could study the material contained in the following Herbaria:

AMES	Oakes Ames Orchid Herbarium, Cambridge, Massachusetts, U.S.A.
BM	British Museum (Natural History), London, United Kingdom.
BO	Herbarium Bogoriense, Bogor, Java, Indonesia.
BRI	Department of Agriculture and Stock, Brisbane, Australia.
E	The Royal Botanic Garden, Edinburgh, Scotland, United Kingdom.
G	Conservatoire et Jardin Botaniques, Genève, Switzerland.
HBG	Staatsinstitut für allgemeine Botanik, Hamburg, Germany.
K	Herbarium of the Royal Botanic Gardens, Kew, Richmond, United Kingdom.
KAG	Herbarium Kagoshima University, Kagoshima, Japan.
L	Rijksherbarium, Leiden, Netherlands.
MAK	Faculty of Science, Tokyo Metropolitan University, Tokyo, Japan.
MEL	National Herbarium of Victoria, Melbourne, Australia.
P	Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris, France.
SING	The Herbarium of the Botanic Gardens, Singapore.
TI	Botanical Institute, Faculty of Science, University of Tokyo, Tokyo, Japan.
U	Botanisch Museum & Herbarium, Utrecht, Netherlands.
W	Naturhistorisches Museum, Vienna, Austria.

TAXONOMICAL POSITION OF THE APOSTASIEAE

There have been differences of opinion about the position of this group, although most authors agree that it has served as an ancestral stock of the *Orchidaceae*. Important historical reviews were given by Rolfe (1889) and by Vermeulen (1966).

Blume (Bijdr. 1825, 423), when describing the first species of *Apostasia*, placed it, apparently without reservation, under the *Orchidaceae*. R. Brown in 1830 assigned *Apostasia* tribal rank in the same family. He was followed by Rolfe (1889), who gave the first revision of the group, by Kraenzlin (1897) and Pfitzer (1903) who gave the next revisions, and by modern authors such as Holttum (1953), Dressler & Dodson (1960), and Melchior in the 12th edition of Engler's *Syllabus* (1964).

The first to consider *Apostasiaceae* as a separate family — in juxtaposition to *Orchidaceae* — was Lindley in 1833. He was followed by Blume (1833), who described the first *Neuwiedia* and placed it next to *Apostasia*, Endlicher (1837), Meisner (1842), Schlechter (1905), Ridley (1907), Godfery (1932), Gagnepain (1934), Hutchinson (1934), Backer (1949), Pulle (1952), Hutchinson (1959), Schweinfurth (1959), and Vermeulen (1966).

Bentham (1880), in his precursor to the *Genera Plantarum* (1883), accommodated *Apostasia* and *Neuwiedia* in the *Cypripedieae*.

Garay (1960) regards the group as a subfamily of the *Orchidaceae*.

A quite different opinion on the affinity stems from some authors who regard it as a separate family but not in juxtaposition to *Orchidaceae*. F. von Mueller (1867) described *Niemeyera stylioides* (= *Apostasia stylioides*) in the *Hypoxidaceae*, a segregate from *Amaryllidaceae*. This relation had already been hinted at by Lindley as early as 1840 in a note on *Apostasia*. This non-Orchidaceous affinity has in recent years been considered by Hutchinson (1959) and Takhtajan (1959). The former considered *Apostasia* as ancestral to the *Burmanniaceae* (notably linked to *Campylosiphon*).

Let us first consider the last suggestions, affiliating the group with non-Orchidaceous families.

A near relation of *Apostasia* with the *Burmanniaceae* (*sensu* Hutchinson) seems not likely. In the latter (notably *Campylosiphon*) the latrorse anthers are placed in the inner whorl, the outer whorl being completely absent. The tendency of reduction seems reverse in comparison with that of *Apostasiae* in which the 2 lateral anthers of the outer whorl and the median anther of the inner whorl are aborted. Also the dehiscence is here introrse.

The supposed relation with the *Hypoxidaceae* (*sensu* Hutchinson), especially *Curculigo*, seems largely based on a resemblance in habit and leaves, which are folded lengthwise. This is, however, found in several other families of the *Monocotyledones*. In the *Hypoxidaceae* the stamens with introrse anthers are placed in 2 whorls of 3, while in the family only a tendency towards the reduction of the outer whorl can be observed. There is also no tendency towards fusion of the stamens. The seeds are entirely different from those of the *Apostasiae*. A near relation to *Curculigo* seems therefore not likely, although there is a certain resemblance with respect to the pollen.

Let us now consider the systematic position of the group in their relation to *Orchidaceae*, in the first place considering whether there is sufficient evidence to rank them as a separate family in juxtaposition.

As mentioned above this status has been given to them by various authors on account of their primitive flower structure as compared with the more specialized *Orchidaceae*.

Within *Orchidaceae* they must be affiliated with the *Cypripedieae* on account of the similar structure of the androecium, the symmetry (occurrence of a labellum) being less pronounced but in essence present in *Neuwiedia*. Furthermore, in *Apostasia* the same stamen



Fig. 7. Flower diagrams of a. *Neuwiedia*, b. *Apostasia* sect. *Apostasio*, and c. *Apostasia* sect. *Adactylus*.

is reduced as in *Cypripedieae*, whereas reversely *Apostasia* and *Neuwiedia* have never been doubted to be manifestly closely allied.

The main difference with *Cypripedieae*, on the other hand, is the powdery pollen in *Apostasiaeae*, to which is sometimes added a difference in resupination.

As to the pollen, however, it must be remarked that there is diversity within *Cypripedieae*, as *Phragmopedium* possesses pollinia as in genuine *Orchidaceae*, but the three other genera have no pollinia but sticky pollen.

As to the resupination, the device of this character is so variable in *Orchidaceae sensu lato* that it must be abandoned as providing a difference between *Apostasiaeae* and *Orchidaceae*: in *Apostasia* there is no resupination, in *Neuwiedia* resupination is caused by the twisting of the pedicel, in *Cypripedieae (pro parte)* resupination is caused by the twisting of the ovary (as in many orchids), in 1-flowered *Cypripedieae* resupination occurs through the nodding of the ovary, while, finally, in *Orchidaceae sensu stricto* resupination caused by a twisted ovary occurs or does not occur at all.

There is, hence, a manifest affinity with *Cypripedieae*, *Selenipedium* in particular. It also follows that *Apostasiaeae* together with *Cypripedieae* should be considered in juxtaposition to *Orchidaceae sensu stricto*, for which we should then use the names *Cypripedioideae* (formerly *Diandrae*) and *Orchidoideae* (formerly *Monandrae*).

The principal difference between these taxa is that in *Cypripedioideae* there are at least two lateral stamens of the inner whorl and a median stamen of the outer whorl (reduced in *Apostasia* sect. *Adactylus* and abortive as a staminode in *Apostasia* and in *Cypripedieae*), whereas in *Orchidoideae* there is only one stamen, viz. the median of the outer whorl. As said above no sharp distinction can be obtained from the presence or absence of pollinia, and still less from resupination.

Vermeulen (1966) also advanced the presence of a rostellum in *Orchidaceae*, but this is in my opinion a specialisation connected with the particular flower biology (pollination), and further it is a generalisation because he admits that a rostellum is absent in *Caladenia* and *Cephalanthera*.

Also in other important characters there is variability within the group, for example whether the ovary is celled or not. In *Orchidaceae sensu stricto* it is 1-celled, with parietal placentation, in *Apostasiaeae* it is 3-celled, but in the doubtless inseparable *Cypripedieae* both sorts of ovary occur. This also pleads against Vermeulen's opinion that the three groups should be accepted as three distinct families.

The conclusion must therefore be that the affinity of *Cypripedioideae* and *Orchidoideae* is so close that they should be considered to represent together one family in which various tendencies towards reduction and bilateral symmetry are represented.

Unless further evidence is brought forward (embryology, anatomy, palynology) towards sharp distinction I prefer to visualize the *Orchidaceae* as one whole which is differentiated into two subfamilies, *Orchidoideae* and *Cypripedioideae*, in which the latter can be further subdivided into two tribes, *Apostasiae* and *Cypripedieae*, of which the former are the most primitive, *Neuwiedia* being the most primitive genus of all.

This view on systematical arrangement is consistent with that held, onwards of R. Brown (1830) by Rolfe, Kraenzlin, Pfitzer (as *Diandrae*), Pfitzer and Holtum (as *Pleonandrae*), and by Dressler & Dodson and Melchior who use the correct subfamily name *Cypripedioideae*.

NOTES ON MORPHOLOGY

1. *Habit*.—The habit of both *Neuwiedia* and *Apostasia* is rather uniform within the genus. In *Apostasia*, sect. *Apostasia* and sect. *Adactylus* cannot be separated by the habit.

2. *Rhizome*.—In *Neuwiedia* a rhizome is absent, the base of the stem persists with the remains of the sheaths of the lower leaves. In *Apostasia* a real rhizome is present, provided with scales (fig. 12a).

3. *Leaves*.—In *Neuwiedia* the leaf-index cannot be used for specific delimitation. In *Apostasia* sect. *Apostasia* this index is useful only for *A. nipponica* and *A. parvula* and in sect. *Adactylus* for *A. elliptica* and *A. latifolia*. *A. wallichii* has minutely 'dentate' leaves in specimens found in East Malesia (fig. 10c), but the dentation in the Bornean materials is either hardly visible or entirely wanting. All *Apostasia* species possess at the tips of their leaves a filiform, tube-like prolongation, formed by the fusion of the leaf-margins (fig. 12a).

4. *Inflorescence*.—In *Neuwiedia* the raceme is usually stout, erect, shorter than the leaves and unbranched, but very contracted in *N. zollingeri* var. *zollingeri* and in some specimens of *N. zollingeri* var. *javanica*. In *N. veratrifolia* the racemes are longer than the leaves. In *Apostasia* the raceme is usually slender, pendulous, sometimes branched, but erect in *A. parvula* and contracted in *A. nipponica*.

5. *Hairs*.—*Neuwiedia* has two types of persistent hairs: some species only possess glandless hairs, others have glandular hairs besides glandless ones (fig. 7c, e). The glandular hairs entirely cover the inflorescence in some species, whereas in others they are mostly restricted to the perianth, but always a few can then be found scattered between the glandless hairs in other parts of the raceme. In very old herbarium specimens glandular hairs are sometimes difficult to observe, but can always be found. Both types of hairs are of different length. The measurements of the longest non-glandular hairs appeared to be important for specific delimitation. *Apostasias* are entirely glabrous.

6. *Flowers*.—In *Neuwiedia* there are two sizes of flowers: some species have small flowers, up to 2.2 cm, with oblong anthers, a short column with the style much overtopping the anthers (fig. 8b, f), others possess large flowers, larger than 2.5 cm, with lanceolate to linear anthers, a long column with the style not overtopping the anthers (fig. 4b, g).

These two flower sizes are neither correlated with the type of fruit, nor with the type of pubescence, nor with the type of the seed. The flowers of *Apostasia* are in appearance rather uniform.

7. *Pedicels*.—In *Neuwiedia* the pedicels are twisted, by which the resupination of the flower is caused. In *Apostasia* the pedicel is not twisted, and no resupination occurs. In *A. wallichii* the pedicels are curved in the patent or recurved partial racemes, thereby turning the flowers erect.

8. *Perianth*.—Both genera possess rather similar but still clearly distinguishable sepals and petals, each provided with a subulate cusp (fig. 4c, e, 12c, e). In *Neuwiedia* the median petal has a tendency towards forming a lip, being much broader than the lateral petals (fig. 4e).

9. *Column*.—As column is here understood the fused part of filaments and style. In *Neuwiedia* the column is straight. In the small-flowered species it is rather thick and fleshy (fig. 8f), in the large-flowered ones it is rather elongate (fig. 4g), the flat, connate filaments can well be distinguished also where they are adnate to the style. In *Apostasia* the column can be straight or recurved within the same species. *A. odorata* has a very characteristic column (fig. 12g, i).

10. *Stamens*.—A tendency can be observed towards the reduction of the number of stamens. *Neuwiedia* has 3 stamens, representing the median one of the outer whorl and the two lateral ones of the inner whorl. *Apostasia* sect. *Apostasia* has the median anther reduced to a slender staminode adnate to the style with the exception of its tip. In *Apostasia* sect. *Adactylus* this staminode is wanting. In fig 1 diagrams are drawn.

11. *Filaments*.—A tendency towards adnation to the style can be observed. In large-flowered *Neuwiedias* the filaments are for a large part connate, and this body is for a large basal part adnate to the style (fig. 4g). In small-flowered *Neuwiedias* the filaments are still more connate, and the fusion with the style is more complete (fig. 8f). In *Apostasia* sect. *Apostasia* the base of the filaments is fused with the style to a greater extent, the two components forming a completely fused solid body. The filaments of *Apostasia* sect. *Adactylus* are almost entirely adnate to the style.

12. *Anthers*.—In *Neuwiedia* oblong anthers are present in the small-flowered species, and lanceolate to linear anthers in the large-flowered ones. The median anther has equal basal lobes, in the lateral anthers the lobe of the theca facing the median anther is shorter (fig. 8f). In *Apostasia* sect. *Apostasia* the shape of the anthers is rather uniform; the linear loculi are basally unequal (fig. 12h), with the shorter loculus facing the staminode, but in some Ceylon specimens the loculi are at base equal, or the loculus facing the staminode is the longer. In *Apostasia* sect. *Adactylus* the loculi are at base (sub)equal (fig. 10m, l).

13. *Ovary*.—I agree with all authors that the ovary in *Apostasiaeae* is 3-celled, either with a single placenta (fig. 7g) or a double one (fig. 10d), both of course axial. Vermeulen (1966, 249, pl. 4 fig. 9) recorded that *Neuwiedia veratrifolia* would have a 1-celled ovary (in bud) with 3 thick placentas closely pressed together. Whether this 1-celledness was assumed because of a small cavity in the centre is not clear. In a mature flower the ovary of this species is definitely 3-celled.

14. *Fruits*.—In *Neuwiedia* several types of fruits occur which are characteristic for the species groups. The fruit is either thin-walled or fleshy (in the last case it has a more or less wrinkled surface when dry); this is sometimes hard to observe in the herbarium. Most fruits disintegrate when ripe; in *N. veratrifolia* they open with 3 valves (fig. 4j). In cross-section the fruit is either rounded in outline (fig. 7g) with 3 constrictions, or triangular with distinct ribs on the edges (fig. 4i). In *Apostasia* the fruits are uniform: linear, more or less triangular in cross-section.

15. *Seeds*.—In *Neuwiedia* the fruits, which are triangular in cross-section, contain seeds with two characteristic appendages (fig. 4 l, r), one of them being the funicle, whereas fruits of other species have seeds which much resemble those found in *Apostasia*, but there they possess a longer funicle (compare fig. 7h and 12j). In *Apostasia* the seeds are uniform: roundish, with a short funicle and apically with a minute appendage, the testa being sticky, alveolate, dark brown when ripe.

Tribus APOSTASIEAE

R. Brown in Wallich, *Pl. As. Rar.* 1 (1830) 74; Benth., *Fl. Austr.* 6 (1873) 395; Pfitz. in E. & P., *Nat. Pfl. Fam.* 2, 6 (1888) 80, '*Apostasiinae*'; Rolfe, *J. Linn. Soc. Bot.* 25 (1889) 230; *Orch. Rev.* 2 (1894) 70; *ibid.* 4 (1896) 329; Kraenzl., *Orch. Gen. & Spec.* 1 (1897) 6; Pfitz., *Pfl. Reich Heft* 12 (1903) 1; J. J. Smith, *Orch. Jav.* (1905) 14; Holtz., *Rev. Fl. Malaya* 1 (1953) 62; Dressl. & Dods., *Ann. Mo. Bot. Gard.* 47 (1960) 31; Melchior in *Engl., Syll. ed.* 12, 2 (1964) 616; Lanjouw, *Compendium* (1968) 300.

Apostasiaceae (family) Lindl., *Nixus Pl.* (1833) 22; Blume in v. d. Hoeven & de Vriese, *Tijd. Nat. Gesch. Phys.* 1 (1834) 139; *Ann. Sc. Nat.* II, 2 (1834) 91; Lindl., *Nat. Syst. Bot. ed.* 2 (1836) 342; Endl., *Gen. Pl.* (1837) 220; Lindl., *Orch. Pl.* (1840) xvi; Meisn., *Pl. Vasc. Gen.* 1 (1842) 387; Schnitzl., *lc. Fam. Nat. Regn. Veg.* 1 (1843—46); Lindl., *Veg. Kingd.* (1846) 184; Miq., *Fl. Ind. Bat.* 3 (1859) 748; Schltr in K. Sch. & Iaut., *Nachtr.* (1905) 72; Ridl., *Mat. Fl. Pen.* 1 (1907) 231; *Fl. Mal. Pen.* 4 (1924) 295; Godf., *Orch. Rev.* 40 (1932) 355; Hutch., *Fam. Fl. Pl.* 2 (1934) 170; Gagn., *Fl. Gén. I.-C.* 6 (1934) 647; Back., *Bekn. Fl. Java (em. ed.)* 10B (1949) fam. 240, p. 1; Pulle, *Compendium ed.* 3 (1952) 199; Hend., *Mal. Wild Fl. (Monoc.)* (1954) 11; Mitra, *Fl. Pl. East. India* 1 (1958) 260; Hutch., *Fam. Fl. Pl. ed.* 2, 2 (1959) 680; Schweinf. in Withner, *Orch.* (1959) 511; Takhtajan, *Evol. Ang.* (1959) 270; Vermeulen, *Act. Bot. Neerl.* 15 (1966) 235; Back. & Bakh. *f.*, *Fl. Java* 3 (1968) 210.

Apostasioideae (subfamily) Garay, *Bot. Mus. Leafl.* 19 (1960) 86.

Notes. *Niemeyera* (= *Apostasia*) was reckoned to the *Hypoxidaceae* by F. v. Mueller, *Fragm. Phyt. Austr.* (1867) 96.

Apostasia and *Neuwiedia* were reckoned to the tribe *Cypripedieae* by Bentham (*J. Linn. Soc. Bot.* 18, 1880, 360; Benth. & Hook. *f.*, *Gen. Pl.* 3, 1883, 634) and Hooker *f.* (*Fl. Br. Ind.* 6, 1890, 174).

Erect or ascending, at base usually woody, terrestrial herbs. Rhizome scaly or absent. *Aerial roots* penetrating the base of the lower leaves or the rhizome-scales (if present) or both, mostly for a short part pressed against the lower part of the stem or the rhizome, terete, longitudinally grooved or ribbed, their subterranean part branched, sometimes tubercled, swollen, or woolly. *Stem* branched or unbranched, terete to irregularly angular or ribbed. *Leaves* spirally arranged, spaced or the lower ones crowded, entire, those at the stem-base usually dying off, decrescent; sheath shortly connate; blade with or without

longitudinal folds, herbaceous to papyraceous, all nerves prominent beneath, but some more distinctly so. *Racemes* peduncled, terminal, simple or branched. Bracts persistent, as the upper leaves, but smaller. *Flowers* slightly zygomorphic, yellow(ish) to white. Pedicels short, twisted or not. Torus oblique or not. *Sepals* 3, free, in bud overlapping the petals with the exception of their keels, under which the margins of the sepals are clasped, the midrib forming a thick ridge on the outside ending in a subulate cusp below the incurved apical margin. *Petals* 3, free, narrowed to the base or not, the midrib forming a thick, fleshy, projecting keel on the outside separated from the underlying tissue by a constriction and ending in a free subulate cusp below the incurved apical margin; lip broader or not different. *Column* straight to strongly curved, formed by the fusion of the style, the base of the filaments, and the staminode (if present), smooth, glabrous. *Stamens* 2 or 3, the median one (if present) alternipetalous, the lateral ones epipetalous; mostly the filaments apically partly free from the style; anthers with 2 equal or unequal thecae, each of them bilocular, dorsifixed or sub-basifixed, introrse. *Staminode* if present median, alternipetalous. *Ovary* cylindrical or ellipsoid, 3-angular to terete, not twisted, 3-celled with axillary placentation. Ovules ∞ in each ovary cell, minute, on a single or double placenta. *Style* free in the upper portion, cylindrical, fleshy; stigma terminal, rounded or pyramidal or 2—3-lobed, flattened at the top. *Fruit* a thin-walled or fleshy, 3-locular capsule, disintegrating or (in 1 sp.) opening loculicidally with 3 valves. *Seeds* very numerous in each cell, more or less ovoid to elliptic, usually on a shorter to longer stalk, apically provided with a minute appendage, but in 2 spp. the apical appendage very long or thick; testa dark when ripe, usually alveolate or reticulate, sticky when dry.

Distribution. India (the Himalayas and Ceylon), Burma, Thailand, Indo-China, S. China, Hainan, Japan, the Ryukyus, the Malesian Archipelago, the Louisiades, and N. Queensland. Fig. 2.

Ecology. Undergrowth of lowland and hill forests, up to c. 1700 m, under everwet climatic conditions.

KEY TO THE GENERA

1. Raceme usually unbranched, erect. Leaves usually rather wide. Anthers 3, free from each other. Filaments connate in the lower part. Ovary and fruit (long)ellipsoid to roundish, apically strongly contracted **1. Neuwiedia**
1. Raceme usually branched, usually more or less recurved. Leaves usually narrow. Anthers 2, connate with 1 or both margins. Filaments free from each other. Ovary and fruit narrowly cylindrical, apically not contracted **2. Apostasia**

1. NEUWIEDIA

Blume in v. d. Hoeven & de Vriese, Tijds. Nat. Gesch. Phys. 1 (1834) 140; Ann. Sc. Nat. II, 2 (1834) 93; Meisn., Pl. Vasc. Gen. 1 (1842) 387; *ibid.* 2 (1842) 290; Miq., Fl. Ind. Bat. 3 (1859) 748; Benth., J. Linn. Soc. Bot. 18 (1880) 360; Benth. & Hook. f., Gen. Pl. 3 (1883) 635; Pfitz. in E. & P., Nat. Pfl. Fam. 2, 6 (1888) 80; Rolfe, J. Linn. Soc. Bot. 25 (1889) 231; Hook. f., Fl. Br. Ind. 6 (1890) 175; Rolfe, Orch. Rev. 4 (1896) 328; Kraenzl., Orch. Gen. & Spec. 1 (1897) 2; Pfitz., Pfl. Reich Heft 12 (1903) 4; J. J. Smith, Orch. Java (1905) 14; Ridl., Mat. Fl. Mal. Pen. 1 (1907) 231; Fl. Mal. Pen. 4 (1924) 295; Gagn., Fl. Gén. I.-C. 6 (1934) 649; Back., Bekn. Fl. Java (em. ed.) 10B (1949) fam. 240, p. 1; Holtt., Rev. Fl. Malaya 1 (1953) 62; Back. & Bakh. f., Fl. Java 3 (1968) 210.

Erect or ascending, glabrous to hairy herbs, without rhizome. Aerial roots glabrous to

woolly. *Stem* rarely branched, upper part hairy or glabrous. *Leaves* at first crowded at the base, afterwards more spaced, those at the stem-base dying off, those along the stem gradually passing into the bracts; blade papyraceous, mostly longitudinally plicate, without tubular-contracted apex. *Racemes* mostly unbranched, rigid. *Flowers* mostly containing white crystals in their tissue. Pedicels clearly set off against the ovary, ascending, twisted. Torus oblique. Perianth rather nodding, little expanded. *Sepals* slightly convex, fleshy, the midrib somewhat projecting; median sepal symmetric, the lateral ones slightly asymmetric. *Petals* slightly convex, herbaceous, very delicate the fleshy midrib excepted, lateral nerves flabellately branched; lateral ones slightly asymmetric, the lip broader, symmetric, folded. *Column* straight. *Stamens* 3; filaments connate at base, for a large part adnate to the style; anthers not clasping the style, free from each other, (basi)dorsifixed, usually the median one shorter than the lateral ones; loculi of the median anther equal, those of the lateral ones with unequal base, the loculus which faces the median anther being the shorter. *Ovary* ellipsoid, apically strongly contracted, more or less triangular to rounded with 3 grooves in \emptyset . *Fruit* distinctly accrescent, beaked. *Seeds* with a distinct, thin-celled, light-coloured funicle, usually reticulate, dark brown when ripe, apically provided with a single, minute, rarely very long hair-like or very broad appendage.

Distribution. Eight species in SE. Asia, Malesia as far as and including the W. Louisiades. Fig. 3, 5, and 6.

Ecology. Primary or secondary forest, sometimes along streams or in swamps, 20—1300 m.

Note. There is possibly a ninth species, but the specimen is only in fruit; pending additional flowering material it is left unnamed. It is not inserted in the key.

KEY TO THE SPECIES

1. Hairs absent from the raceme.
 2. Raceme loose, rather elongated. Fruit thin-walled 4. *N. annamensis*
 2. Raceme very contracted. Fruit fleshy 6a. *N. zollingeri* var. *zollingeri*
1. Hairs present in the raceme (sometimes very few).
 3. Hairs not glandular.
 4. Racemes longer than the leaves. Hairs narrowly triangular when dry, up to 0.14—0.17 mm long. Capsule triangular in \emptyset , opening with 3 valves. Seeds on a long hair-like funicle, apically with an appendage resembling the funicle 1. *N. veratrifolia*
 4. Racemes not longer than the leaves. Longest hairs 0.25 mm or more. Capsule (as far as known) disintegrating.
 5. Flowers up to 2.2 cm long, white. Anthers oblong. Column up to 2 mm long.
 6. Fruit and ovary (rather) triangular in cross-section, distinctly ribbed at the edges. Hairs up to 0.25—0.35 mm long. Seeds on a rather thick funicle, at the top provided with a similar outgrowth, which is taller than the funicle. Stigma little enlarged, up to 0.5 mm wide. 2. *N. griffithii*
 6. Fruit and ovary roundish in cross-section, with 3 constrictions, without ribs. Hairs up to 0.19—0.26 mm long. Seeds obovoid, with a thin funicle, apically with a minute appendage. Stigma much enlarged, up to 1—1.2 mm wide. 3. *N. borneensis*
 5. Flowers c. 3 cm long, yellow. Anthers linear. Column 5 mm long or longer. Fruit (as far as known) rounded in cross-section with 3 shallow constrictions, without ribs at the edges.
 7. Hairs very few, up to 0.3 mm, present only on the rachis of the inflorescence and on the bracts. Flowers and fruits glabrous. Fruit thin-walled. Raceme rather elongated. 4. *N. annamensis*
 7. Hairs rather numerous, up to 0.5 mm, on inflorescence, bracts, and flowers. (Fruit unknown). Raceme rather contracted 5. *N. siamensis*
 3. Part of the hairs glandular (especially on the perianth).
 8. Flowers c. 1.5 cm long. Anthers oblong. Column c. 1 mm long. 8. *N. inae*
 8. Flowers at least 2.3 cm long. Anthers lanceolate to linear. Column at least 4 mm long.

9. Raceme longer than 20 cm. Flowers at least 4 cm long. Fruit thin-walled. Hairs mostly glandular throughout the raceme 7. *N. elongata*
 9. Raceme 6—17 cm long. Flowers 2.3—3.8 cm long. Fruit fleshy. Hairs on the perianth both glandular and glandless, outside the perianth seldom glandular. 6. *N. zollingeri*

I. *Neuwiedia veratrifolia* Blume in v. d. Hoeven & de Vriese, *Tijd. Nat. Gesch. Phys.* 1 (1834) 142; *Ann. Sc. Nat.* II, 2 (1834) 94; *Miq., Fl. Ind. Bat.* 3 (1859) 748; Rolfe, *J. Linn. Soc. Bot.* 25 (1889) 231; *Orch. Rev.* 4 (1896) 329; Kraenzl., *Orch. Gen. & Spec.* 1 (1897) 3; Pfitz., *Pfl. Reich Heft* 12 (1903) 5; J. J. Smith, *Orch. Java* (1905) 15; Ames, *Philip. J. Sc.* 2 (1907) Bot. 311; *Koord., Exk. Fl. Java* 1 (1911) 350; J. J. Smith, *Bull. Jard. Bot. Btzg II*, 14 (1914) 1; *ibid.* III, 5 (1922) t. 18, f. 1; in Fedde, *Rep.* 32 (1933) 129; Back., *Bekn. Fl. Java* (em. ed.) 10B (1949) fam. 240, p. 2; Holtt., *Rev. Fl. Malaya* 1 (1953) 63; Hend., *Mal. Wild Fl. (Monoc.)* (1954) 11, f. 5; Back. & Bakh. *f.*, *Fl. Java* 3 (1968) 210. — Type: *Blume s.n.* (lectotype L, dupl. L). — Fig. 4 i—l.

Neuwiedia spec. (Borneo, Low), in nota sub *N. zollingeri* Reichb. *f.*, *Bonplandia* 5 (1857) 58; *Xenia* 2 (1874) 14. — Materials in K, W.

N. calanthoides Ridl., *J. Bot.* 24 (1886) 355, f. 271; Rolfe, *J. Linn. Soc. Bot.* 25 (1889) 233; *Orch. Rev.* 4 (1896) 329; Kraenzl., *Orch. Gen. & Spec.* 1 (1897) 2; Pfitz., *Pfl. Reich Heft* 12 (1903) 4; Schltr. in *K. Sch. & Laut., Nachtr.* (1905) 72; J. J. Smith, *Nova Guinea* 8, 1 (1909) 3. — Type: *Forbes s.n.* (BM, *n.v.*).

N. lindleyi Rolfe, *J. Linn. Soc. Bot.* 25 (1889) 232; Hook. *f.*, *Fl. Br. Ind.* 6 (1890) 175; Ridl., *J. Linn. Soc. Bot.* 31 (1893) 305; Hook. *f.* in Curtis, *Bot. Mag.* III, 50 (1894) 416; Ridl., *J. Linn. Soc. Bot.* 32 (1894) 416; Rolfe, *Orch. Rev.* 4 (1896) 329; Ridl., *J. Str. Br. R. As. Soc.* 33 (1900) 165; Pfitz., *Pfl. Reich Heft* 12 (1903) 5; Ridl., *Mat. Fl. Mal. Pen.* 1 (1907) 231; Merr., *En. Born.* (1921) 134; Ridl., *Fl. Mal. Pen.* 4 (1924) 295. — Syntypes: *Curtis* 469 (lectotype SING, dupl. K, BO); *Low s.n.* (Penang) (*n.v.*).

N. cucullata J. J. Smith, *Bull. Dép. Agric. Ind. Néerl.* 45 (1911) 1; *Nova Guinea* 8, 3 (1911) 522, t. 75. — Type: *Gjellerup* 291 (lectotype BO, dupl. in alc. BO).

N. amboinensis J. J. Smith, *Bull. Jard. Bot. Btzg II*, 13 (1914) 1; *ibid.* III, 10 (1928) 89; *ibid.* (1930) *Suppl.* 2, t. 1 f. 1. — Type: *J. J. Smith s.n.* a. 1900 (lectotype BO, dupl. L, U, in alc. BO).

Erect herb, 70—120 cm. Aerial roots 1—5 mm \varnothing , sometimes woolly. *Leaves* lanceolate to linear, acuminate, 7—78 by 0.7—6.7 cm, 7—51-nerved, 5—7 of which are more prominent; upper ones glabrous or with hairs along the margin and scattered over the blade; hairs eglandular, narrowly triangular when dry, of different length, the longest 0.14—0.17(—0.2) by 0.035—0.06 mm. *Racemes* 25—52 cm, surpassing the leaves in length, 48—80-flowered, rather strongly hairy like the upper leaves. Bracts (ovate-oblong-linear, acute, 0.8—7 by 0.1—1 cm, 5—9-nerved, less hairy than the rachis. *Flowers* 2.4—3.5 cm long, yellow (sometimes with green nerves), fragrant. Pedicels 3—7 by *c.* 1 mm. *Sepals* outside hairy; lateral ones obovate-lanceolate(—linear), 12—20 by 2.5—4 mm, 5—7-nerved, cusp 0.6—1.5 by 0.2 mm; median one lanceolate, 12—20 by 2.5—4 mm, 5—7-nerved, cusp 0.6—1.3 by 0.2 mm. *Petals* hairy on the keel; lateral ones obovate-lanceolate, 12—20 by 4.5—6.5 mm, 7-nerved, cusp 0.2(—0.8) by 0.2 mm; lip obovate-oblong to obovate-lanceolate, longitudinal median thickened (when fresh), 10—18 by 5—7 mm, 7-nerved, cusp 0.2—0.5 by 0.2 mm. *Column* 5—7 by *c.* 1 mm. Free part of the filaments flattened, lateral ones 2—4.3 by 0.2—0.5 mm, median one 3.5—5.3 by 0.2—0.5 mm; anthers linear; lateral ones 6—8 by 0.9—1.2 mm, basally the long loculus *c.* 0.5 mm longer; median one 5.2—5.8(—7.5) by 0.8—1.2 mm. *Ovary* long-ellipsoid, 8—13 by 2.5—3.7(—5) mm. Free part of the style 5—6(—7.5) by 0.3—0.7 mm, overtopped by the median anther by 0.5—2 mm; stigma enlarged, rounded to obscurely

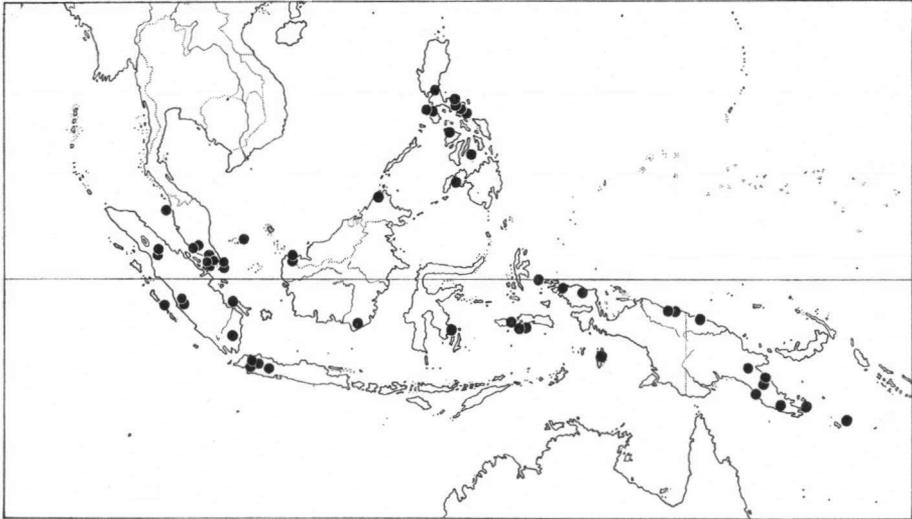


Fig. 3. Localities of *Neuwiedia veratrifolia* Blume.

3-lobed, 0.7—1 by 0.7—1 mm. *Fruit* a thin-walled capsule, loculicidally opening with 3 valves from the top downwards, leaving a cage of 3 ribs, \pm triangular in \emptyset , on the sides with a longitudinal groove, on the edges with a distinct rib, 10—14 by 6—10 mm, with a beak 1—2 by 0.7—1.1 mm. *Seeds* roundish to ellipsoid, with a long, hair-like funicle up to 0.6—0.7 mm, apically with a long hair-like appendage, up to 0.6—0.7 mm.

Distribution. Malesia: Sumatra (also Mentawai Is.), Banka, Riouw Arch., Malay Peninsula, W. Java, Borneo, Anambas Is., Philippines, SE. Celebes, Moluccas, New Guinea, Aru Is., SE. Louisiades. Fig. 3.

Ecology. Undergrowth of primary and secondary (sometimes open) forest, occasionally on riverside, also recorded from soggy or rocky soils; in the Malay Peninsula once found in a rubber protective belt; 20—1200 m alt. Fl. fr. Jan.—Dec.

Vernacular names. *Singkub*, Sum. (Karoland), *hunus*, *hunus ramba*, Sum. (Asahan). *pokò jambá*, Mal. Pen.

Notes. 1. The lectotype of *N. veratrifolia* is a fruiting specimen, the duplicate is sterile.

2. The Low collection (Borneo; K), cited by Reichenbach *f.* in a note under the original description of *N. zollingeri* belongs to *N. veratrifolia*.

3. *Forbes s.n.*, the type of *N. calanthoides*, is not present at K, BM, or SING. It is clear from the drawing that it must be *N. veratrifolia*.

4. For the description of *N. cucullata* a very young bud from the detached top of the raceme, preserved in alcohol, was used. The other part of the raceme is fully in fruit. The anthers of that young bud are 2.25 mm long; a somewhat older bud has anthers 4 mm long. There are no important differences in all other aspects with *N. veratrifolia*.

5. *N. amboinensis* has slightly more asymmetric lateral sepals and a somewhat more contracted base of the petals than typical *N. veratrifolia*.

2. *Neuwiedia griffithii* Reichb. *f.*, Xenia 2 (1874) 215; Rolfe, J. Linn. Soc. Bot. 25 (1889) 235; Hook. *f.*, Fl. Br. Ind. 6 (1890) 176; Ridl., J. Linn. Soc. Bot. 32 (1894) 416; Hook. *f.* in Curtis, Bot. Mag. III, 51 (1895) f. 7425; Rolfe, Orch. Rev. 4 (1896) 329;

Kraenzl., *Orch. Gen. & Spec.* 1 (1897) 4; Ridl., *J. Str. Br. R. As. Soc.* 33 (1900) 165; Pfitz., *Pfl. Reich Heft* 12 (1903) 5; Ridl., *Mat. Fl. Mal. Pen.* 1 (1907) 231; J. J. Smith, *Nova Guinea* 8, 3 (1911) 522; Ridl., *Fl. Mal. Pen.* 4 (1924) 296. — Syntypes: *Maingay 2950 (K.D. 1682)* (lectotype K, dupl. BM, L, W); *Griffith s.n. (K, W)*. — Fig. 4p-r.

Erect or ascending herb up to 25–60 cm long. Aerial roots 2–3 mm \varnothing , sometimes woolly, longest hairs 1–1.3 by 0.015–0.018 mm. *Leaves* ovate-oblong to broadly linear, acuminate, 6–32 by 3.3–5 cm, 9–37-nerved, 7 of which are more prominent; upper ones glabrous or hairy, in the latter case the hairs occurring along the margin and scattered over the blade; hairs hyaline, linear, flattened when dry, of different length, the longest 0.25–0.35 by 0.03–0.04 mm. *Racemes* 4.5–15 cm long, shorter than the leaves, 40–50(–65)-flowered, densely hairy like the upper leaves, Bracts ovate-lanceolate to broadly linear, acute, 13–20 by 0.5–6 mm, 5–9-nerved, less hairy than the rachis. *Flowers* 13–17 mm long, white, rarely yellow, tipped with green. Pedicels 3 by 0.8–1 mm. *Sepals* lanceolate, densely hairy outside; lateral ones 7.7–8.5 by 2–3.5 mm, 5-nerved, cusp. 0.6–0.8 by 0.2 mm; median one 7.7–8.5 by 2–3 mm, 5-nerved, cusp 0.5–0.8 by 0.2 mm. *Petals* densely hairy on the keel, otherwise glabrous; lateral ones oblong, 7.7–8.5 by 2.5–4.5 mm, 5-nerved, cusp 0.4–0.5 by 0.2 mm; lip elliptic, 7.7–8.5 by 3–5 mm, (3–)5–7-nerved, cusp 0.5 by 0.2 mm. *Column* 1(–2) by 0.5–1.5 mm. Free part of the filaments flattened, the lateral ones 1–1.3 by 0.3–1 mm, median one 1 by 0.3–0.5 mm. *Anthers* oblong; lateral ones 2–3 by 1–1.5 mm, obliquely sagittate at the base, basal lobes 0.4–0.6 and 0.3–0.4 mm respectively; median one 2–3.5 by 1–1.5 mm, equally sagittate at the base, basal lobes 0.4–0.5 mm. *Ovary* ellipsoid, \pm triangular in cross-section, with \pm distinct ribs along the edges, with rather numerous hairs, 5 by 2–3 mm. Free part of the style 5–6 by 0.3–0.4 mm, overtopping the anthers; stigma little enlarged, obscurely 3-lobed to roundish, 0.5 by 0.5 mm. *Fruit* a thin-walled disintegrating capsule, more or less triangular in cross-section, edges with a distinct rib, sides with a distinct groove, 8–10 by 3.5–5 mm, beak 1–3 by 0.5 mm. *Seeds* roundish (incl. funicle and appendage), 0.6–0.75 by 0.2 mm, with a very broad funicle, apically provided with a broad appendage.

Distribution. Malasia: NE. Sumatra (Deli, Asahan), Malay Peninsula (Pahang, Selangor, Negri Sembilan, Malacca, Johore, Singapore). Fig. 5.

Ecology. Undergrowth of primary and secondary forest, in swamps, swamp forests, and along streams; up to 150 m alt. Fl. fr. Jan.—Dec.

Note. In the original description the Maingay collection is only cited by its Kew Distribution number. The sheet at Kew shows the original collection number.

3. *Neuwiedia borneensis* de Vogel, *sp. nov.* — Type: Ridley a. 1915 (K). — Fig. 7i.

N. veratrifolia (non Blume) Hook., *Ic. Pl.* III, 10 (1891) f. 1987; Pfitz., *Pfl. Reich Heft* 12 (1903) 5, f. 3, p.p.; Merr., *En. Born.* (1921) 134.

N. zollingeri (non Reichb. f.) Merr., *En. Born.* (1921) 134.

Herba erecta, 40 cm alta. *Folia* linearia, usque ad 44 cm longa et 5.2 cm lata. *Racemus* subelongatus, 13 cm longus, c. 75-florus, pilis eglandulosis usque ad 0.26 mm longis et 0.035 mm latis. *Flores* albidi, 18 mm longi. *Sepala* obovato-oblonga, lateralia 9 mm longa, 3 mm lata; sepalum medianum 9 mm longum, 4 mm latum. *Petala* ovato-oblonga, lateralia 9 mm longa, 3.2 mm lata, labio 9 mm longo et 3.5 mm lato. *Columna* 1 mm longa et lata. *Antherae* laterales breviter lanceolatae, 3.3 mm longae et 1 mm latae; anthera mediana 3.2 mm longa, 1 mm lata. *Ovarium* ellipsoideum, 6 mm longum, 4 mm crassum. Stigma incrassatum, rotundum usque 3-lobum, 1.2 mm diam.

Erect herb, 35–60 cm. Aerial roots 2–4 mm \varnothing , the ends of the side-roots sometimes

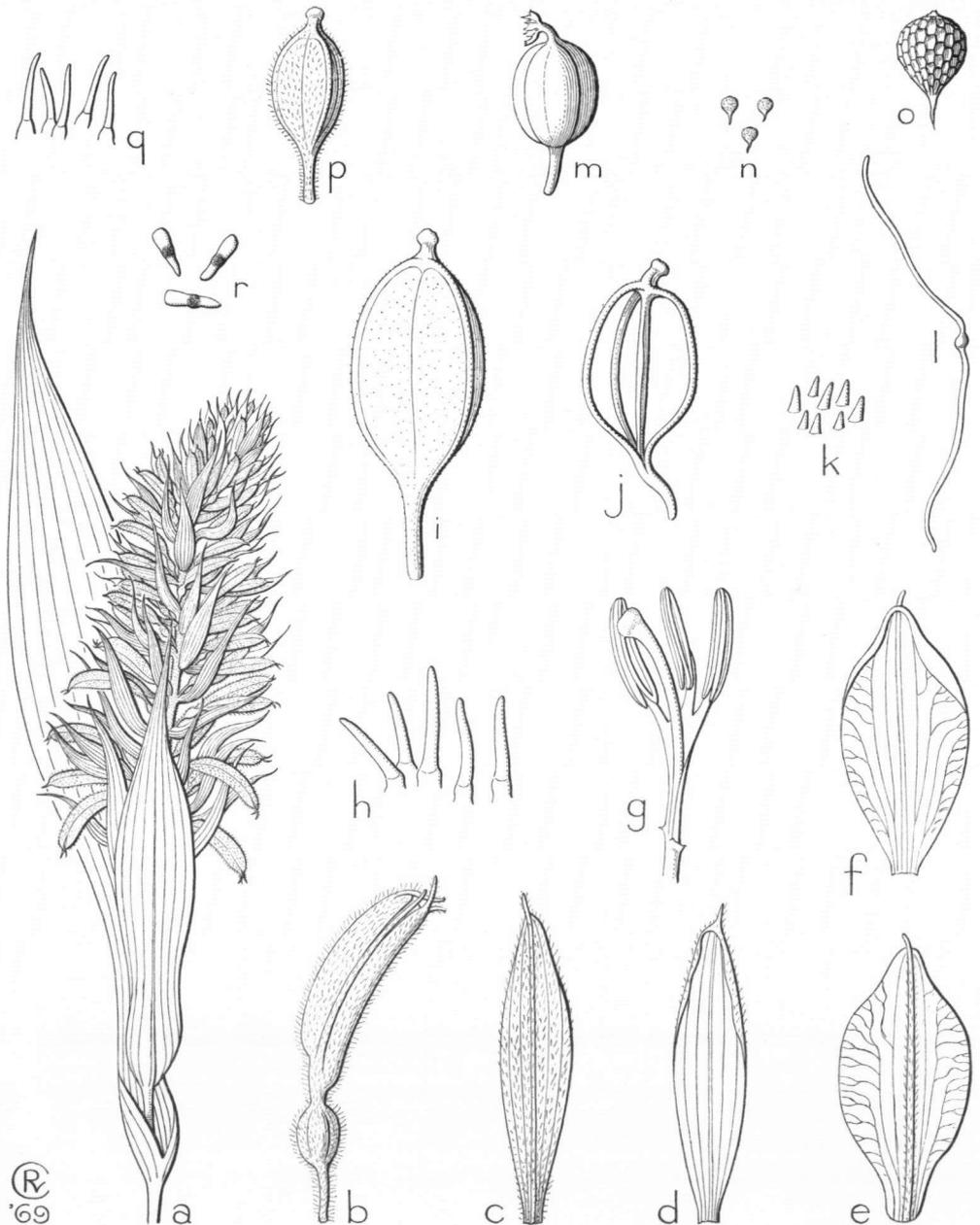


Fig. 4. *Neuwiedia siamensis* de Vogel. a. Inflorescence, $\times \frac{3}{2}$; b. flower bud, $\times 2$; c & d. sepal, $\times 2$; e & f. lip, $\times 2$; g. column, $\times 2$; h. hairs, $\times 40$. — *N. veratrifolia* Blume. i. Fruit, $\times 2$; j. remains of the fruit after dehiscence, $\times 2$; k. hairs, $\times 40$; l. seed, $\times 10$. — *N. annamensis* Gagn. m. Fruit, $\times 2$; n. seeds, $\times 10$; o. seed, $\times 40$. — *N. griffithii* Reichb. f. p. Fruit, $\times 2$; q. hairs, $\times 40$; r. seeds, $\times 10$. (a—h *Kostermans 800*, i, k, l *Boet 546*, j *Bünnemeijer 6413*, m—o *Poilane 4937*, p—r *Docters van Leeuwen 3268*).

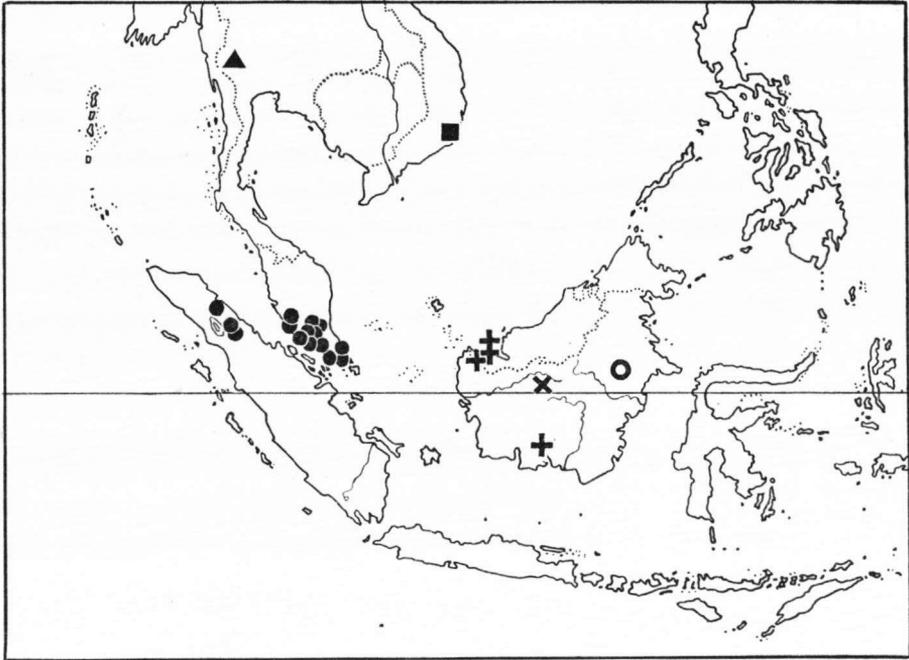


Fig. 5. Localities of *Neuwiedia griffithii* Reichb. f. (●), *N. siamensis* de Vogel (▲), *N. annamensis* Gagn. (■), *N. borneensis* de Vogel (+), *N. inae* de Vogel (x), and *N. elongata* de Vogel (⊙).

swollen. *Leaves* linear, 2.5–4.5 by 0.5–5.5 cm, 9–31-nerved, 7 of which are more prominent. Racemes somewhat elongate, shorter than the leaves, up to 8–13 cm, 40–75-flowered, hairy; hairs linear, few to rather much, of different length, the largest 0.19–0.26 by 0.035 mm. Bracts linear, acute, 5–20 by 1–5 mm, 4–7-nerved, laxly hairy to glabrous. *Flowers* 16–21 mm long, white. Pedicels 2–4 by 0.5–0.8 mm. *Sepals* hairy to nearly glabrous, ovate-oblong, lateral ones 8–12 by 3–4 mm, 5–7-nerved, cusp 0.5–0.8 by 0.2–0.3 mm; median one 8–12 by 3–4 mm, 5–7-nerved, cusp 0.4–0.8 by 0.2 mm. *Petals* on the keel with few to many hairs, oblong, lateral ones 8–12 by 3.2–4.5 mm, 5–7-nerved, cusp 0.4–1 by 0.2 mm; lip 8–12 by 3.5–4.5 mm, 5–7-nerved, cusp 0.4–1 by 0.2 mm. *Column* 1–2 by 0.8–1 mm. Free part of the filaments 0.5–1.5 by 0.2–0.5 mm. Anthers short-lanceolate, 3.2–3.3 by 1 mm; basal lobes of the lateral ones 0.3–0.4 and 0.2 mm respectively, free, those of the median one 0.2–0.4 mm, free. *Ovary* ellipsoid, 6 by 3–4 mm, provided with few to many hairs. Free part of the style 5–6 by 0.4–0.6 mm, overtopping the median anther by 2–3 mm. Stigma much enlarged, roundish to 3-lobed, 1–1.2 by 1–1.2 mm. *Fruit* fleshy, probably disintegrating, rounded in cross-section, 8–9 by 4–5 mm, with a beak 1.5–2 by 0.5–0.7 mm. *Seeds* obovoid, with a thin funicle up to 0.25 by 0.04 mm, apically with a minute appendage.

Distribution. Malesia: Borneo (Sarawak, Sampit).

Ecology. Sandy, wet, poor soil. Fl. fr. Jan., Sept., Nov.

Note. This species differs from *N. griffithii*, with which it has the small flowers and the glandless hairs in common, in the fleshy, rounded, enlarged ovary and fruit and in the different seeds and in the enlarged stigma. One specimen was entirely glabrous.

4. *Neuwiedia annamensis* Gagn., Bull. Soc. Bot. Fr. 80 (1933) 350; Fl. Gén. I.-C. 6 (1934) 649. — Type: *Poilane 4937* (P). — Fig. 4m—o.

Erect herb, up to 45 cm. Aerial roots 2—3 mm \varnothing , woolly. *Leaves* ovate-lanceolate to linear, acuminate, 10—30 by 3—7 cm, 10—36-nerved, 5—7 of which are more prominent, glabrous. *Racemes* 8—11 cm, shorter than the leaves, \pm 30—60-flowered, glabrous or with very few hairs on rachis and bracts; hairs linear, flattened when dry, of different length, the largest 0.3 by 0.035 mm. Bracts ovate-lanceolate to broadly linear, acuminate, 10—30 by 3—7 mm, 5—7-nerved, glabrous or with very few hairs. *Flowers* 32 mm long, yellow, scentless. *Pedicels* 5 by 0.5 mm, glabrous. *Sepals* glabrous; lateral ones broadly lanceolate, 23 by 5 mm, 5-nerved, cusp 1.2 by 0.2 mm; median one lanceolate, 20 by 4.6 mm, 5-nerved, cusp 0.8 by 0.2 mm. *Petals* glabrous; the lateral ones oblanceolate, 23 by 6.5 mm, 7-nerved, cusp 0.6 by 0.2 mm; lip obovate-oblong, 20 by 9 mm, 7-nerved, cusp 0.6 by 0.2 mm. *Column* 10 by 0.8 mm. Free part of the filaments flattened, lateral ones 2 by 0.6 mm, median one 3 by 0.6 mm. *Anthers* linear; lateral ones 7.5 by 1 mm, the long loculus at base 0.5 mm longer; median one 6.5 by 1 mm. *Ovary* with numerous crystals in its tissue, 5 by 3 mm. Free part of the style 5 by 0.4 mm, overtopped by the median anther by 3 mm. *Stigma* enlarged, probably roundish, 1 by 1 mm. *Fruit* thin-walled, probably disintegrating, roundish in \varnothing , with 3 longitudinal grooves, 4 by 4 mm, white, with a beak 2 by 0.4 mm. *Seeds* obovoid, 0.28 by 0.22 mm, the thin funicle up to 0.14 mm, apically with a minute appendage.

Distribution. South Vietnam ('Annam'): near Nha-trang.

Ecology. Forest; on rocky soil; 200—600 m alt. Fl. fr. May and Oct.

5. *Neuwiedia siamensis* de Vogel, *sp. nov.* — Type: *Kostermans 866* (holotype L). — Fig. 4a—h.

Herba erecta, 80 cm alta. *Folia* ovato-oblonga usque linearia, 9—60 cm longa, 3—7 cm lata. *Racemus* 10 cm longus, floribus c. 70 dense aggregatis, pilis eglandulosis, usque ad 0.5 mm longis et 0.03 mm latis. *Flores* 30 mm longi. *Sepala* lateralia lanceolata, 21 mm longa, 4.5 mm lata; sepalum medianum lineare, 20 mm longum, 4 mm latum. *Petala* obovato-oblonga; lateralia 17 mm longa, 7 mm lata, labellum 18 mm longum, 7 mm latum. *Columna* 7 mm longa, 1.2 mm crassa. *Antherae* lineares, laterales 7 mm longae, 1.2 mm latae; anthera mediana 6 mm longa, 1.2 mm lata. *Ovarium* 5 mm longum, 3 mm crassum.

Erect herb, 80 cm. Aerial roots 2—4 mm \varnothing . *Leaves* ovate-oblong to linear, 9—60 by 3—7 cm, 12—46-nerved, 7 of which are more prominent, the upper ones hairy mainly along the nerves; hairs glandless, linear, the longest 0.5 by 0.03 mm. *Racemes* 10 cm long, dense, rather contracted, shorter than the leaves, \pm 70-flowered, much hairy. Bracts ovate-oblong to ovate-lanceolate, acute, 10—40 by 3—10 mm, 5—9-nerved, much hairy. *Flowers* 30 mm long, ? yellow. *Pedicels* 3 by 0.8 mm, densely hairy. *Sepals* outside hairy; lateral ones lanceolate, 21 by 4.5 mm, 5-nerved, cusp 2.7 by 0.25 mm; median one linear, 20 by 4 mm, 5-nerved, cusp 1.3 by 0.25 mm. *Petals* hairy on the keel, otherwise glabrous; lateral ones obovate-oblong, 17 by 7 mm, 5-nerved, cusp 0.7 by 0.25 mm; lip obovate-oblong, 18 by 7 mm, 5-nerved, cusp 0.7 by 0.25 mm. *Column* 7 by 1.2 mm. Free part of the filaments flattened, lateral ones 3 by 0.8 mm, median one 4 by 0.8 mm. *Anthers* linear; lateral ones 7 by 1.2 mm, the long loculus at base 0.2 mm longer; median one 6 by 1.2 mm. *Ovary* 5 by 3 mm. Free part of the style 6.5 by 0.6 mm, overtopped by the median anther by c. 1 mm. *Stigma* enlarged, 3-lobed, 1 by 1 mm. *Fruit* unknown.

Distribution. Thailand, SW. Prov., Kanchanaburi Dist., Kwai Noi Basin, Pan Pannng River valley.

Ecology. River valley; 400—800 m alt. Fl. June.

Note. Differing from *N. veratrifolia* by the 0.5 mm long, linear hairs, the denser raceme which is shorter than the leaves, the longer bract-like leaves below the raceme, and, judging from the ovary, the shape and possibly structure of the fruit.

6. *Neuwiedia zollingeri* Reichb. f., *Bonplandia* 5 (1857) 58; *Xenia* 2 (1874) 13; Rolfe, *J. Linn. Soc. Bot.* 25 (1889) 234; *Orch. Rev.* 4 (1896) 329; Kraenzl., *Orch. Gen. & Spec.* 1 (1897) 5; Pfitz., *Pfl. Reich Heft* 12 (1903) 5; J. J. Smith, *Orch. Java* (1905) 16; *Atlas* (1908) f. 1; *Koord., Exk. Fl. Java* 1 (1911) 350; J. J. Smith, *Bull. Jard. Bot. Btzg* II, 14 (1914) 3, *p.p.*; *ibid.* III, 5 (1922) t. 18, f. 2; Back., *Bekn. Fl. Java (em. ed.)* 10B (1949) fam. 240, p. 2; Back. & Bakh. f., *Fl. Java* 3 (1968) 210. — Type: *Zollinger 2808* (fragm. W). — Fig. 7d—h.

KEY TO THE VARIETIES

1. Plant glabrous. Raceme always contracted, 7—9 cm long. Lateral anthers (3.2—)4—5 mm long. Column 4—8 mm long. Fruit white a. var. *zollingeri*
1. At least the bracts, but as a rule the entire inflorescence hairy. Raceme usually elongated, sometimes contracted.
2. Fruit white. Lateral anthers 5—7.5 mm long b. var. *javanica*
2. Fruit orange to red. Lateral anthers 4.3—5(—8) mm long c. var. *singaporeana*

a. var. *zollingeri*. — Fig. 7f—h.

Entirely glabrous, erect herb, 45—70 cm. Aerial roots 2.5—4 mm \varnothing , sometimes woolly, occasionally the ends of the side-roots thickened. *Leaves* lanceolate to linear, 4—53 by 1—7.5 cm, 7—55-nerved, 7 of which are more prominent. *Racemes* 7—9 cm, contracted, 40—80-flowered. Bracts lanceolate to linear, acuminate, 10—35 by 2—8 mm, 5—10-nerved. *Flowers* 25—30 mm long, yellow, fragrant. Pedicels 2—5 by 0.5—0.6 mm. Lateral *sepals* (obovate-)lanceolate, (13—)15—18 by 3—4 mm, 5—7-nerved, cusp 1.4—2.2 by 0.2—0.25 mm; median one (lanceolate-)linear, (12—)14—18 by 3—3.5 mm, 5—7-nerved, cusp 1—1.5(—2.3) by 0.2—0.25 mm. Lateral *petals* obovate-oblong to oblanceolate, (13—)15—18 by 5—7 mm, 5—7-nerved, cusp 0.5—1(—1.2) by 0.2 mm; lip obovate-oblong(-oblanceolate), (13—)16—17 by 5—7 mm, 5—7-nerved, cusp. 1—1.2 by 0.2 mm. *Column* 4—8 by 0.7—0.8 mm. Free part of the filaments more or less flattened, lateral ones 2 by 0.3—0.7 mm, median one 2.5—4 by 0.3—0.7 mm. Lateral anthers lanceolate to linear, (3.2—)4—5 by 1—1.4 mm, long loculus at base 0.2 mm longer; median one oblong to lanceolate, 2.4—4.5 by c. 1 mm. *Ovary* 4—6 by 2—3.5 mm. Free part of the style 3—5 by 0.3—0.4 mm, overtopped by the median anther by 0.5—2.3 mm. Stigma more or less obscurely 3-lobed, 1 by 0.7—1 mm. *Fruit* a fleshy, white, berry-like (probably disintegrating) capsule, roundish in cross-section, with 3 longitudinal grooves, (alc. sol.) 8—10 by 6—9 mm, with a beak 2—3 by 2 mm. *Seeds* obovoid, 0.35 by 0.25—0.3 mm, with a thin funicle up to 0.3 by 0.04 mm, apically with a minute appendage.

Distribution. Malesia: W. and E. Java (Mt Salak and Tjampea; Mt Idjen). Fig. 6.

Ecology. Forest; 700—1300 m alt. Fl. Febr., March, July.

Vernacular names. *Tjongkok*, Java (Sundanese).

Note. For *Low s.n.* (Borneo), cited in the original description of *N. zollingeri*, see *N. veratrifolia*, note 2.

b. var. *javanica* (J. J. Smith) de Vogel, *comb. nov.* — Fig. 7 d—e.

N. zollingeri (non Reichb. f.) J. J. Smith, *Orch. Java* (1905) 16, *p.p.* — *N. javanica* J. J.

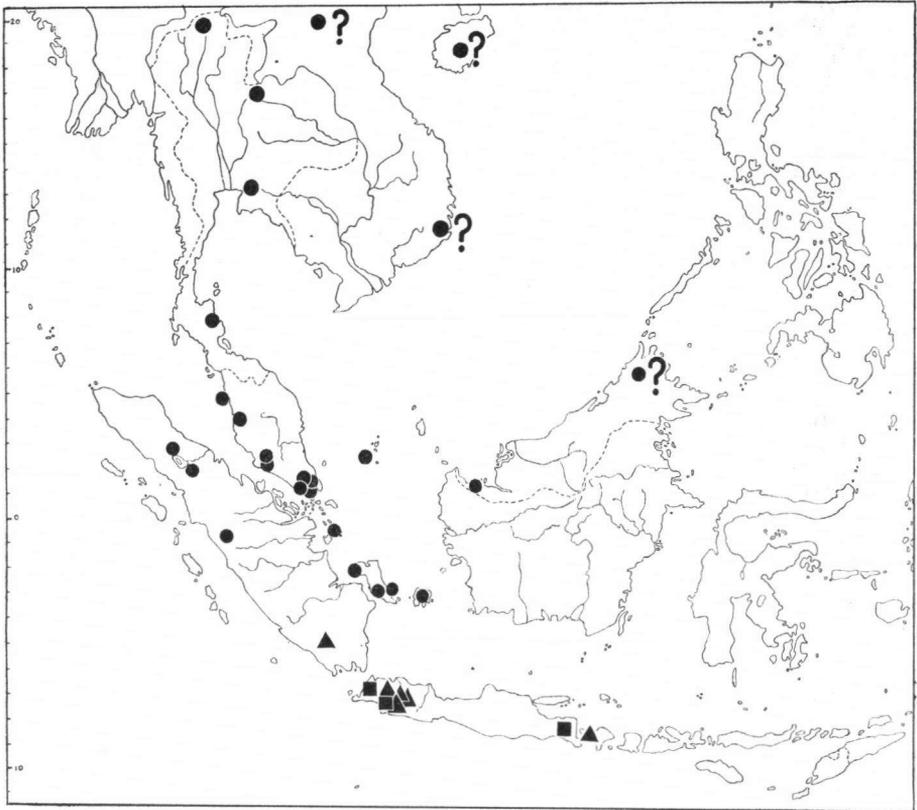


Fig. 6. Localities of *Neuwiedia zollingeri* Reichb. f. var. *zollingeri* (■), var. *javanica* (J.J.S.) de Vogel (▲) and var. *singaporeana* (Baker) de Vogel (●). Question marks explained under var. *singaporeana*.

Smith, Bull. Jard. Bot. Btzg II, 14 (1914) 5; Back., Bekn. Fl. Java (em. ed.) 10B (1949) fam. 240, p. 2; Back. & Bakh. f., Fl. Java 3 (1968) 210. — Syntypes: J. J. Smith s.n. a. 1900 (lectotype BO, dupl. BO); Koorders 39518b (*Mantri Tirto*) (BO, L); Backer 8816 (BO).

The pubescence consisting of 2 types of hairs of different length; longest glandular hairs 0.45–0.65 by 0.03–0.05 mm, and glandless hairs 0.35 by 0.03–0.05 mm; the glandless ones usually forming the bulk of the hairs on the upper leaves, rachis, bracts, pedicels, and ovaries, the glandular ones usually more abundant on the perianth. *Raceme* 6–17 cm long, 30–60-flowered. *Flowers* 30 mm long, yellow, fragrant. *Lateral sepals* 18.5–20 by 4 mm, median one 18–20 by 3.5–4.5 mm. *Lateral petals* 16–19 by 5 mm, lip 17–19 by 5–6 mm. *Column* 4–6 by 0.5–1 mm. *Lateral anthers* 5–7.5 mm long, median one 3.5–6 mm long, the long loculus at base 0.2–0.4 mm longer. Free part of the style 5–6 mm long. *Fruit* white.

Distribution. Malesia: S. Sumatra, W. Java, Bali. Fig. 6.

Ecology. Primary and secondary forest, also found on watersides and on very dry places; 450–1200 m alt. Fl. fr. probably Jan.–Dec.

c. var. *singaporeana* (Baker) de Vogel, *comb. nov.*

Tupistra singaporeana [Wall., Cat. 5195, ex] Baker, J. Linn. Soc. Bot. 14 (1874) 581; Ridl., Mat. Fl. Mal. Pen. 1 (1907) 232, in syn. *sub N. curtisii*; Fl. Mal. Pen. 4 (1924) 297. — *N. singaporeana* Rolfe, Kew Bull. (1907) 412; Holtz., Rev. Fl. Malaya 1 (1953) 63; Hend., Mal. Wild Fl. (Monoc.) (1954) 12; Larsen, Nat. Hist. Bull. Siam Soc. 22 (1969) 330, fig. 1. — Type: *Wallich 5195* (K, herb. Wallich).

N. curtisii Rolfe, J. Linn. Soc. Bot. 25 (1889) 233; Hook. f., Fl. Br. Ind. 6 (1890) 175; Ridl., J. Linn. Soc. Bot. 32 (1894) 416; Rolfe, Orch. Rev. 4 (1896) 329; Kraenzl., Orch. Gen. & Spec. 1 (1897) 4; Ridl., J. Str. Br. R. As. Soc. 33 (1900) 165; Pfitz., Pfl. Reich Heft 12 (1903) 6; Ridl., Mat. Fl. Mal. Pen. 1 (1907) 232; Fl. Mal. Pen. 4 (1924) 297; J. J. Smith, Bull. Jard. Bot. Btzg III (1930) Suppl. 2, t. 1 f. II; in Fedde, Rep. 32 (1933) 129. — Syntypes: *Curtis 1185* (lectotype SING; dupl. K); *Curtis 55* (K).

N. ocrea Ridl., J. Str. Br. R. As. Soc. 86 (1922) 308; Fl. Mal. Pen. 4 (1924) 296. — Type: *Ridley s.n. a. 1920* (K).

N. balansae Gagn., Bull. Soc. Bot. Fr. 80 (1933) 350; Fl. Gén. I.-C. 6 (1934) 649. — Type: *Balansa 2000* (P).

The pubescence as in var. *javanica*. Racemes 12—17 cm long, 30—75-flowered. Flowers 23—35(—37) mm long, yellow, sometimes buff-ochre or white, scented. Lateral sepals 18—23(—24) by 4—5(—6) mm, median one 16—20(—24) by 3—5(—6) mm. Lateral petals 16—20(—23) by 5—8(—10) mm, lip 16—21(—23) by 5.5—11 mm. Column (3.5—) 6—9 by 0.5—1.5 mm. Lateral anthers (4.3—)5—5.5(—7.5) mm long, long loculus at base 0.2—1 mm longer, median one 3—4.3(—5.5) mm long. Free part of the style 4—5 (—7) mm long. Fruit orange to red (green when young).

Distribution. Annam, Hainan, in Malesia: Sumatra, Banka, Billiton, Lingga Arch., Malay Peninsula, N. Borneo. Fig. 6.

Ecology. Forest, on poor to rich soil; 60—600(—900) m alt. Fl. fr. probably Jan.—Dec.

Vernacular names. *Balik sumpah*, Sum. (NW. Karolands) (Karo Batak).

Notes. 1. The fruiting specimens *Evrard 508* (P, AMES) and *Poilane 3408* (AMES), the latter cited as *N. annamensis* by Gagnepain (Fl. Gén. I.-C.), have smaller fruits than *N. zollingeri* var. *singaporeana* and the bracts are rather broad. As the material is only in fruit, and there are no other characters present in the material to distinguish them from this variety I tentatively consider them to belong to the same taxon.

2. *Balansa 2000* (P), holotype of *N. balansae*, differs in the larger, white flowers, broader sepals and petals, and in the longer anthers and style from typical *N. zollingeri* var. *singaporeana*. I only tentatively consider it conspecific, until more material is collected.

3. *How 73122* from Hainan is in young fruit. As I cannot find differences in the scarce, incomplete material, I tentatively consider it to belong here.

4. *Wood & Charrington SAN 16370* is in flower, but very badly preserved. As I cannot find any differences in the material I only can tentatively consider it conspecific.

7. *Neuwiedia elongata* de Vogel, *sp. nov.* — Type: *Kostermans 12988* (holotype L, dupl. K) (BO, AMES, *n.v.*). — Fig. 7a—c.

Herba erecta, 80 cm alta. *Folia* ovata usque linearia, 3.5—7.5 cm longa, 2—6.5 cm lata. *Racemus* elongatus, c. 100-florus, 27 cm longus, pilis eglandulosis et imprimis glanduliferis. *Flores* saturate lutea, c. 42 mm longi. *Sepala* lateralia lanceolata, 22 mm longa, 5 mm lata; sepalum medianum lanceolatum usque lineare, c. 20 mm longum, 4 mm latum. *Petala* lateralia oblanceolata, 22 mm longa, 7 mm lata, labio obovato-oblongo, 22 mm longo, 10 mm lato. *Columna* 7 mm longa, 1 mm crassa. *Antherae* lineares, laterales 9 mm longae, 1 mm latae; anthera mediana 8 mm longa, 1 mm lata. *Ovarium* 5 mm longum,

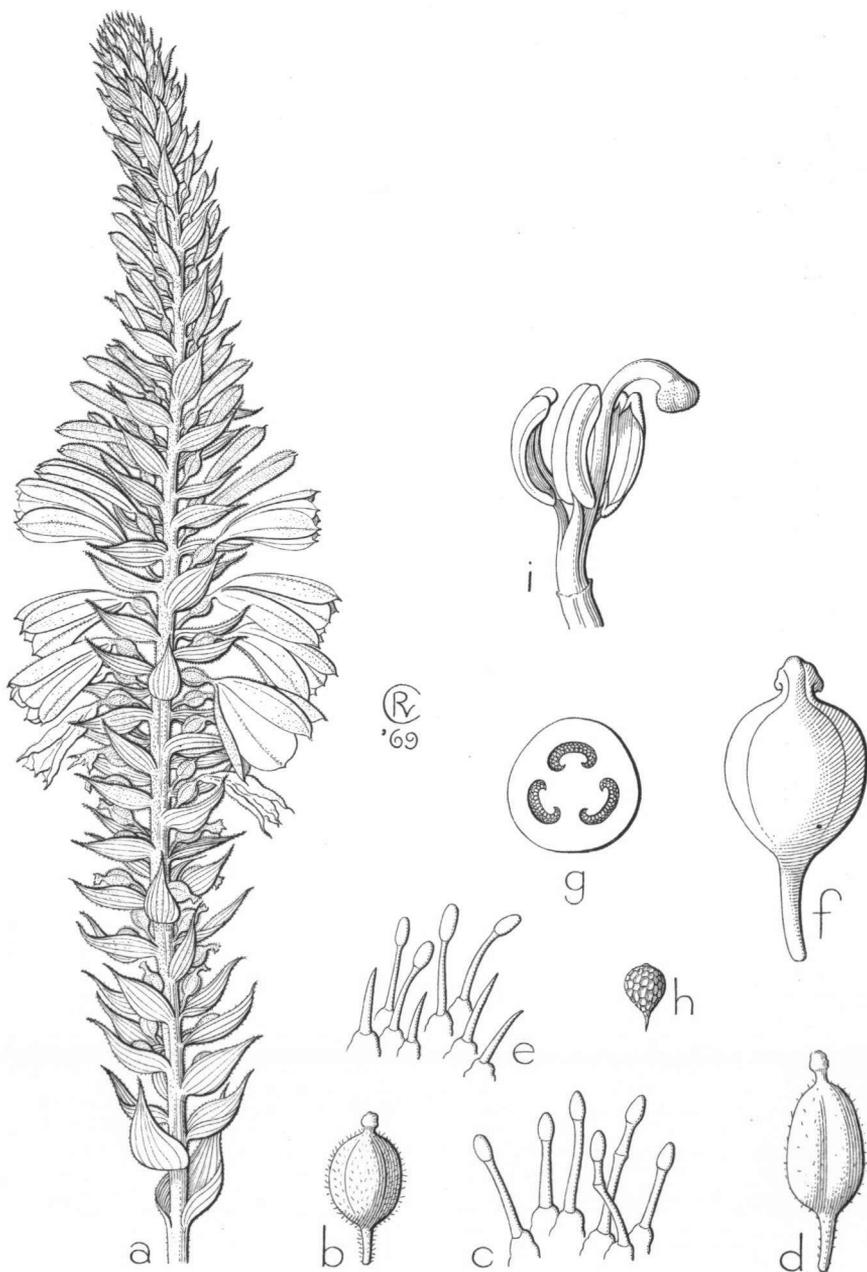


Fig. 7. *Neuwiedia elongata* de Vogel. a. Inflorescence, $\times \frac{2}{3}$; b. young fruit, $\times 2$; c. hairs, $\times 40$. — *N. zollingeri* var. *javanica* (J.J.S.) de Vogel. d. Fruit, $\times 2$; e. hairs from perianth, $\times 40$. — *N. zollingeri* var. *zollingeri* Reichb. f. f. Fruit, $\times 2$; g. cross-section through ripe fruit, $\times 2$; h. seed, $\times 20$. — *N. borneensis* de Vogel. i. Column, $\times 6$. (a—c Kostermans 12988, d, e J. J. Smith a. 1900, type, f—h culture, Herb. Bogor 09916 in alc., i Ridley a. 1915, type).

3 mm crassum. *Fructus* immaturus pariete tenui, diam. rotundatus, sulcis 3 longitudinalibus, 7 mm longus, 4.5 mm latus. *Semina* immatura minute appendiculata funiculo tenui.

Erect herb, 80 cm. Aerial roots 4 mm \varnothing . *Leaves* ovate to linear, 3.5—75 by 2—6.5 cm, 15—42-nerved, 7—9 of which are more prominent, the upper ones hairy over the blade and along the margin; the pubescence consisting of 2 types of hairs of different length; glandular hairs sometimes with jointed stalk, up to 0.6 by 0.05 mm, and shorter glandless hairs, the former forming the bulk of the hairs on every part of the inflorescence. *Racemes* 23—27 cm, elongate, shorter than the leaves, 75—100-flowered, hairy. Bracts ovate to ovate-lanceolate, acuminate, 10—30 by 2—20 mm, 5—9-nerved, hairy. *Flowers* c. 42 mm long, dark yellow. Pedicels 6 by 1 mm, hairy. *Sepals* outside hairy; lateral ones lanceolate, 22 by 5 mm, 7-nerved, cusp 1 by 0.2 mm; median one lanceolate to linear, c. 20 by 4 mm, 7-nerved, cusp 1.2 by 0.2 mm. *Petals* hairy on the keel, otherwise glabrous; lateral ones obovate-lanceolate, 22 by 7 mm, 7-nerved, cusp 0.8 by 0.2 mm; lip obovate-oblong, 22 by 10 mm, 7-nerved, cusp 0.6 by 0.2 mm. *Column* 7 by 1 mm. Free part of the filaments flattened, lateral ones 3 by 0.5 mm, median one 5 by 0.5 mm. Anthers linear; lateral ones 9 by 1 mm, the long loculus at base 0.4—0.5 mm longer; median one 8 by 1 mm. *Ovary* 5 by 3 mm. Free part of the style 8 by 0.4 mm, overtopped by the median anther by 2.5 mm. Stigma enlarged, obscurely 3-lobed, c. 1 by 1 mm. *Young fruit* a thin-walled capsule, rounded in cross-section, with 3 longitudinal grooves, 7 by 4.5 mm, with a beak 3 by 1 mm. *Young seeds* obovoid, with a thin funicle, apically with a minute appendage.

Distribution. Malesia: E. Borneo (West Kutei, Mt Palimasan).

Ecology. Agathis-forest, on waterlogged, sandy, acid soil; 500 m alt. Fl. fr. Sept.

Note. This species differs from *N. zollingeri* var. *singaporeana* by the much longer raceme, by the longer perianth and anthers, and by the thin-walled fruit; moreover, it has a pubescence which almost entirely consists of glandular hairs.

8. *Neuwiedia inae* de Vogel, *sp. nov.* — Type: *Winkler 1485* (HBG). — Fig. 8.

Herba erecta, 55 cm alta. *Folia* lanceolata usque linearia, 1.7—40 cm longa, 0.4—4.7 cm lata. *Racemus* c. 35-florus, 6 cm longus, pilis eglandulosis et praecipue glanduliferis. *Flores* albidii, 15 mm longi. *Sepala* lateralia anguste oblonga, 6.5 mm longa, 3 mm lata; sepalum medianum oblongum, 7 mm longum, 2.5 mm latum. *Petala* obovata, lateralia 6 mm longa, 3.8 mm lata; petalum medianum 6 mm longum, 3.5 mm latum. *Columna* 1 mm alta, 0.8 mm crassa. *Antherae* ellipsoideae, laterales 2.5 mm longae, 1.2 mm latae; anthera mediana 2.5 mm longa, 1.8 mm lata. *Ovarium* 3 mm longum et latum.

Erect herb, 55 cm. Aerial roots 3 mm \varnothing . *Leaves* lanceolate to linear, 1.7—40 by 0.4—4.7 cm, 9—27-nerved, 7 of which are more prominent; upper ones hairy, hairs scattered over the base and along the margin; pubescence consisting of 2 types of hairs of different length; longest glandular hairs 0.25 by 0.017—0.025 mm, glandless hairs shorter, the former composing the bulk of the hairs. *Racemes* 6 cm, shorter than the leaves, 35-flowered, hairy. Bracts ovate to ovate-oblong, acuminate, 3—10 by 2—3 mm, 5—7-nerved, hairy. *Flowers* 15 mm long, white. Pedicels 3 by 0.7 mm long, nearly glabrous. *Sepals* outside hairy; lateral ones narrowly oblong, 6.5 by 3 mm, 5-nerved, cusp 0.4 by 0.15 mm; median one oblong, 7 by 2.5 mm, 5-nerved, cusp 0.2 by 0.1 mm. *Petals* obovate, hairy on the keel, otherwise glabrous; lateral ones 6 by 3.8 mm, 3-nerved, cusp 0.5 by 0.15 mm; lip 6 by 3.5 mm, 3-nerved, cusp 0.5 by 0.15 mm. *Column* 1 by 0.8 mm. Free part of the filaments flattened, triangular in outline, 0.5 by 0.8 mm. Anthers ellipsoid; lateral ones 2.5 by 1.2 mm, obliquely sagittate at the base, the basal lobes 0.8 and 0.7 mm long respectively; median one 2.5 by 1.8 mm, equally sagittate at the base, basal lobes 0.5 mm.

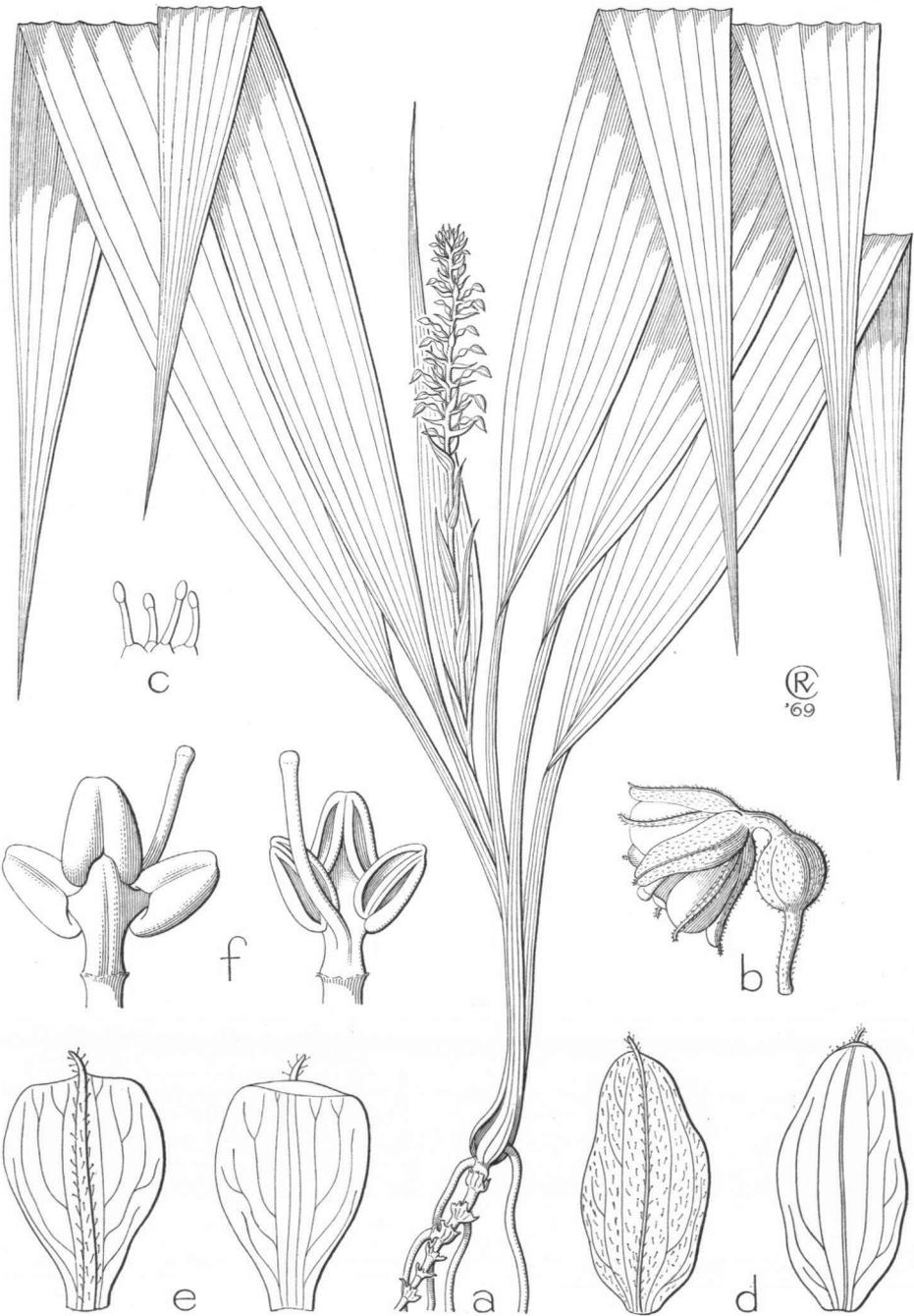


Fig. 8. *Neuwiedia inae* de Vogel. a. Habit, $\times \frac{1}{2}$; b. flower, $\times 3$; c. hairs, $\times 60$; d. lateral sepal, $\times 6$; e. lip, $\times 6$; f. column, $\times 6$. (Hans Winkler 1485).

Ovary with few hairs, 3 by 3 mm. Free part of the style 4 by 0.4 mm, overtopping the anthers by 1 mm. Stigma 3-lobed, 0.5 by 0.5 mm. *Fruits* unknown.

Distribution. Malesia: W. Borneo (Bukit Tilung).

Ecology. Primary forest; 750 m alt. Fl. Febr.

Notes. 1. This species is named after my wife, Ina Ravestijn.

2. It differs from *N. griffithii* and *N. borneensis* by having glandular hairs, by its less stout inflorescence, and by its small, round, swollen ovary.

9. *Neuwiedia* sp.

Stem unknown. *Leaves* ovate to broadly linear, 4—50 by 2.2—8.5 cm, 16—130-nerved, 9 of which are more prominent, the upper ones hairy on the nerves and along the margin; pubescence consisting of 2 types of hairs of different length; longest glandular hairs 0.5 by 0.03—0.04 mm, glandless hairs 0.35 by 0.03—0.04 mm, the latter forming the bulk of the hairs on leaves, rachis, bracts, pedicel, and ovary, the former more abundant on the perianth. *Racemes* 13—14 cm long, \pm 50-flowered, densely hairy. Bracts ovate-oblong to linear, 1—2.5 by 0.15—1 cm, 5—7-nerved, densely hairy. Only a few very young *buds* in the apical portion of the raceme. *Young fruit* a thin-walled capsule, more or less rounded in cross-section, with 3 longitudinal grooves, 11 by 6 mm, with a beak 1—2 by 1 mm. *Seeds* obovoid, 0.25 by 0.2 mm, with a thin funicle up to 0.35 by 0.02 mm, apically with a minute appendage.

Distribution. Malesia: W. off Sumatra: Batu Islands (P. Mana).

Ecology. Fr. Sept.

Note. The collection, *Raap 146* (BO), consisting of 2 racemes and some loose leaves is insufficient as the basis for a new species. It differs from *N. zollingeri* var. *singaporeana* by the broader leaves with up to 130 nerves and the thin-walled fruits which are longer than in that variety.

2. APOSTASIA

Blume, *Bijdr.* (1825) 423; R. Brown in Wallich, *Pl. As. Rar.* 1 (1830) 74; Blume, *Ann. Sc. Nat.* II, 2 (1834) 93; Miq., *Fl. Ind. Bat.* 3 (1859) 748; Benth., *Fl. Austr.* 6 (1873) 395; J. Linn. Soc. Bot. 18 (1881) 360; Benth. & Hook. *f.*, *Gen. Pl.* 3 (1883) 635; Pfitz. in E. & P., *Nat. Pfl. Fam.* 2, 6 (1888) 80; Rolfe, *J. Linn. Soc. Bot.* 25 (1889) 236; Hook. *f.*, *Fl. Br. Ind.* 6 (1890) 174; Rolfe, *Orch. Rev.* 4 (1896) 329; Kraenzl., *Orch. Gen. & Spec.* 1 (1897) 6; Trim., *Handb. Fl. Ceyl.* 4 (1898) 238; Pfitz., *Pfl. Reich Heft* 12 (1903) 8; J. J. Smith, *Orch. Java* (1905) 17; Ridl., *Mat. Fl. Mal. Pen.* 1 (1907) 232; *Fl. Mal. Pen.* 4 (1924) 297; Gagn., *Fl. Gén. I.-C.* 6 (1934) 650; Back., *Bekn. Fl. Java* (em. ed.) 10B (1949) fam. 240, p. 2; Holtt., *Rev. Fl. Malaya* 1 (1953) 64; Back. & Bakh. *f.*, *Fl. Java* 3 (1968) 211.

Niemeyera F. v. M., *Fragm. Phyt. Austr.* 6 (1867) 96; Reichb. *f.*, *Flora* 55 (1872) 278, 'Neumayera'.

Mesodactylis ['Wall., *Pl. As. Rar.* 1 (1830) 74, in obs.'] *Index Kew.* 2 (1895) 217, 'Mesodactylus'.

Adactylus (Endl.) Rolfe, *Orch. Rev.* 4 (1896) 329; Pfitz., *Pfl. Reich Heft* 12 (1903) 8.

Erect, entirely glabrous, rhizomatous herbs. Aerial roots glabrous. Rhizome scaly; scales gradually passing into the cauline leaves, shortly amplexicaul, obliquely spatheaceous, pergamentaceous, the dried persistent top often split; nerves thick and raised. Stem often branched, thin. *Leaves* distinctly interspaced, the lower ones smaller or dying off; blade herbaceous, not plicate, margins apically forming a filiform tubular prolongation. *Racemes* mostly branched and pendulous. Pedicels not clearly set off against the ovary, not twisted,

sometimes curved, irregularly ribbed. Torus not oblique. Perianth \pm erect. *Sepals* boat-shaped, slightly fleshy, 3—5-nerved. *Petals* narrowed into a short, broad claw or not; blade shallowly boat-shaped, (1—)3(—5)-nerved; median one usually not different from the laterals, sometimes slightly more convex and larger. *Column* straight or curved. *Stamens* 2, median one of the inner whorl staminodial or absent; filaments adnate to the style to various degree; anthers clasping the style; loculi distinctly unequal or subequal. *Ovary* narrowly cylindrical, obtusely to acutely 3-angular in cross-section, glabrous, longitudinally grooved, the sepaline midribs continued on the ovary as 3 longitudinal ribs. *Fruit* slightly accrescent, disintegrating. *Seeds* on a minute funicle, provided with a very small appendage at the apex.

Distribution. See distribution of the tribe.

Ecology. Undergrowth of primary forest; (20—)100—1700 m alt.

Note. The genus *Adactylus* has been reduced here to *Apostasia* but retained on the sectional level. It differs from sect. *Apostasia* properly only in the short filaments, the absence of a staminode, and the coherence of the sub-basifixed anthers. Besides these technical characters, the species of both sections cannot be distinguished. The differences between *Apostasia* and *Neuwiedia*, on the other hand, are of a more complicated nature and they can easily be distinguished at a glance, even in sterile state. It follows that the three taxa cannot be put on one level, e.g. as distinct genera, as Rolfe and Pfitzer have advocated. It seems preferable to maintain *Adactylus* on the sectional level.

KEY TO THE SPECIES

1. Staminode present, for a large part adnate to the style (sometimes replaced by a third stamen). Anthers dorsifixed. A. Sect. *Apostasia*
 2. Column hardly flattened with 2 longitudinal projecting wings below the staminode, to strongly median flattened and enlarged. Fig. 10h, 12i. 4. *A. odorata*
 2. Column neither flattened and enlarged nor with 2 wings below the staminode. Fig. 10c.
 3. Leaves 10—50 cm long. 3. *A. wallichii*
 3. Leaves up to 5 cm long.
 4. Inflorescence strongly contracted. Leaf-blade (ovate-)oblong, 5.5—13.5 mm wide. 2. *A. nipponica*
 4. Inflorescence not contracted. Leaf-blade linear, 1—1.5 mm wide. Staminode often replaced by a third stamen 1. *A. parvula*
1. Staminode absent. Anthers sub-basifixed B. Sect. *Adactylus*
 5. Almost always a tuft of sterile bracts at the base of the raceme (fig. 10j). Connective prolonged with entire tip (fig. 10l) 7. *A. nuda*
 5. No tuft of sterile bracts at the base of the raceme. Connective without tip, stunted, bifid at apex (fig. 13k).
 6. Anthers semi-orbicular in \varnothing . Leaf-blade oblong 5. *A. elliptica*
 6. Anthers elongate-semi-elliptic in \varnothing . Leaf-blade lanceolate 6. *A. latifolia*

A. Sect. *Apostasia*

A. sect. Mesodactylus Endl., Gen. Pl. (1837) 221; Pfitz. in E. & P., Nat. Pfl. Fam. 2, 6 (1888) 82; Rolfe, J. Linn. Soc. Bot. 25 (1889) 236; Kraenzl., Orch. Gen. & Spec. 1 (1897) 6; J. J. Smith, Orch. Java (1905) 17.

Racemes pendent or not. Flowers yellow, rarely whitish. Filaments partly free from the column, present as 2 more or less curved awns after the anthers are shed; anthers usually mutually coherent with the margin opposite to the side of the staminode, dorsifixed, ovate-oblong to lanceolate, each of them either with (sub)equal base and apex, or with both unequal base and apex; loculi mostly unequal, the loculus opposite to the staminode

being usually the longer, but sometimes (sub)equal, the loculus facing the staminode the longer. Staminode present, shorter than the style, adnate to it with exception of the nearly always free apex, long-subulate, fleshy.

Distribution. As the range of the tribe. One species endemic in the Ryukyus.

Ecology. Undergrowth of primary forest; (20—)250—1700 m.

1. *Apostasia parvula* Schltr, Bull. Herb. Boiss. II, 6 (1906) 295; Merr., En. Born. (1921) 134. — Type: *Schlechter 13562 (n.v.)*. — Fig. 10a—b.

Herb, 10—20 cm. Aerial roots emerging from the scales, 0.5 mm \varnothing . Rhizome 1 mm \varnothing . Scales up to 4 mm long, 12—17-nerved. *Leaves* rather closely set, linear, acute, 30—54 by 1—1.5 mm, 11—13-nerved, 3 of which are more prominent; sheath not marked off. *Racemes* erect, simple or with one branch, overtopping the leaves, with 5—11 flowers along each branch. Bracts triangular to lanceolate, acute, with a filiform tip 0.1—0.2 mm long, 1.5—9 by 0.5—1.5 mm, 1—7-nerved. *Flowers* 1—1.4 cm long, yellow. *Sepals* recurved, 4 by 0.6 mm, 3-nerved, cusp 0.4 by 0.1 mm. *Petals* recurved, all equal, 3.8 by 0.7 mm, 3-nerved, cusp 0.3 by 0.1 mm. *Column* 1 by 0.2 mm, strongly curved. *Stamens* obviously 3; free part of the filaments 0.4 by 0.2 mm; the longer anthercell at base 0.2 mm

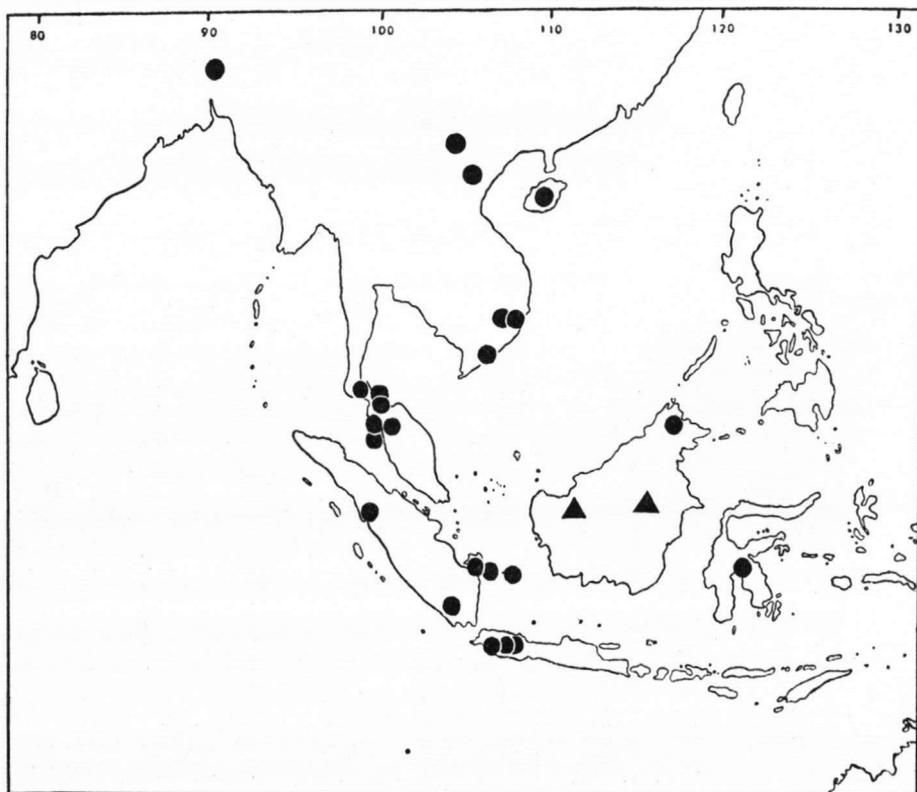


Fig. 9. Localities of *Apostasia parvula* Schltr (▲) and *A. odorata* Blume (●).

longer. *Ovary* 10 by 1 mm with a curved apex. Free part of the style 2 by 0.15 mm. Stigmas obscurely 3-lobed. *Fruit* 11 by 1—1.5 mm. *Seeds* alveolate.

Distribution. Malasia: Borneo (E. and W. part).

Ecology. Primary forest. Fl. fr. Aug.—Dec.

Note. According to Schlechter there is mostly a third stamen instead of a staminode, which I can confirm.

2. *Apostasia nipponica* Masamune, J. Jap. Bot. 11 (1935) 46; Ohwi, Fl. Japan (1965) 321. — Type: *Suzuki s.n. (n.v.)*. — Fig. 10i.

Herb, 5—15 cm. Aerial roots emerging from the scales and the lower leaves, 1 mm \varnothing . Rhizome 1.5 mm \varnothing . Scales 3—3.5 mm long, 5—7-nerved. *Leaves* ovate to ovate-oblong, acute (with a filiform tip 0.2—0.5 mm), 30 by 5.6—13.5 mm, 10—15-nerved, 3 of which are more prominent; sheath clearly marked off. *Racemes* more or less erect, strongly contracted, with a few side-branches; 3—7 flowers along each branch. Bracts oblong to ovate-oblong, acute, 3—4.5 by 1.5 mm, sometimes the lower ones with a filiform tip 0.2—0.7 mm long, 1—5-nerved. *Flowers* 1.2—1.9 cm, yellow. *Sepals* 4—5 by 1.1—1.4 mm, 3-nerved, cusp 0.6 by 0.15—0.2 mm. *Petals* all equal, 4—5 by 1—1.7 mm, 3-nerved, cusp 0.5 by 0.15 mm. *Column* 0.9—1 by 0.5—0.7 mm, straight. *Stamens* 2.5—3.5 by 0.5—0.8 mm; free part of the filaments 0.2—0.5 by 0.2 mm; the shorter anthercell entirely connate with the longer one, at both ends 0.2 mm shorter. *Staminode* 2.4—3 by 0.3—0.4 mm; free apical portion with a rounded tip, 0.1—0.5 mm long. *Ovary* 7.5—11 by 1.1—1.8 mm. Free part of the style 2.5—4 by 0.3—0.4 mm, with 2 more or less distinct longitudinal ribs, overtopping the anthers by 0.5—0.7 mm. *Stigma* orbicular to 2-lobed. *Fruit* 6—16 by 1—1.5 mm. *Seed* alveolate.

Distribution. Ryukyus (Tanegashima, Yakushima, Okilawa).

Ecology. In the hills; 700 m alt. Fl. fr. July—Aug.

Vernacular names. *Yakusima-ran*.

Note. The type is said to have the sepals and petals 3.5 by 1 mm.

3. *Apostasia wallichii* R. Brown in Wallich, Pl. As. Rar. 1 (1830) 75, t. 84; Bauer & Lindl., Illustr. Orch. Pl. (1832) t. XV, f. 16—20; Blume in v. d. Hoeven & de Vriese, Tijds. Nat. Gesch. Phys. 1 (1834) 140; Ann. Sc. Nat. II, 2 (1839) 93; Miq., Fl. Ind. Bat. 3 (1859) 748; Miq., Sumatra (1860—61) 276, 617; Thwait., En Pl. Zeyl. 4 (1861) 315; Rolfe, J. Linn. Soc. Bot. 25 (1889) 237; Hook. f., Fl. Br. Ind. 6 (1890) 175; Ridl., J. Linn. Soc. Bot. 32 (1894) 415; Rolfe, Orch. Rev. 4 (1896) 329; Kraenzl., Orch. Gen. & Spec. 1 (1897) 7; Trim., Handb. Fl. Ceyl. 4 (1898) 238; King & Pantling, Ann. Bot. Gard. Calc. 9 (1901) 68, t. 84; Pfütz., Pfl. Reich Heft 12 (1903) 7; J. J. Smith, Orch. Java (1905) 18; Ridl., Mat. Fl. Mal. Pen. 1 (1907) 232; Ames, Philip. J. Sc. 2 (1907) Bot. 311; J. J. Smith, Bull. Dép. Agric. Ind. Néerl. 13 (1907) 1; Merr., En. Born. (1921) 134; J. J. Smith, Bull. Jard. Bot. Btzg III, 5 (1922) t. 18 f. III; Ridl., Fl. Mal. Pen. 4 (1924) 297; J. J. Smith, Mitt. Inst. Allg. Bot. Hamb. 7 (1927) 10; in Fedde, Rep. 32 (1933) 131; Gagn., Fl. Gén. I.—C. 6 (1934) 651; Masamune, J. Jap. Bot. 11 (1935) 46; Back., Bekn. Fl. Java (em. ed.) 10B (1949) fam. 240, p. 3; Holt., Rev. Fl. Malaya 1 (1953) 64; Mitra, Fl. Pl. East. India 1 (1958) 261; Back. & Bakh. f., Fl. Java 3 (1968) 211. — *Mesodactylis deflexa* Wall., Pl. As. Rar. 1 (1830) 74, *nom. inval., in syn.* — *A. odorata* (non Bl.) Schnitzl., Ic. 1 (1846) f. 67. — Type: *Wallich 4448* (lectotype K, herb. Wallich, dupl. K, E). — Fig. 10 c—g.

Niemeyera stylidioides F. v. M., Fragm. Phyt. Austr. 6 (1867) 96. — *A. stylidioides* Reichb. f., Flora 55 (1872) 278; Benth., Fl. Austr. 6 (1873) 396; Reichb. f., Xenia 2 (1874) 215; Rolfe, J. Linn. Soc. Bot. 25 (1889) 237; Orch. Rev. 4 (1896) 329; Kraenzl., Orch.

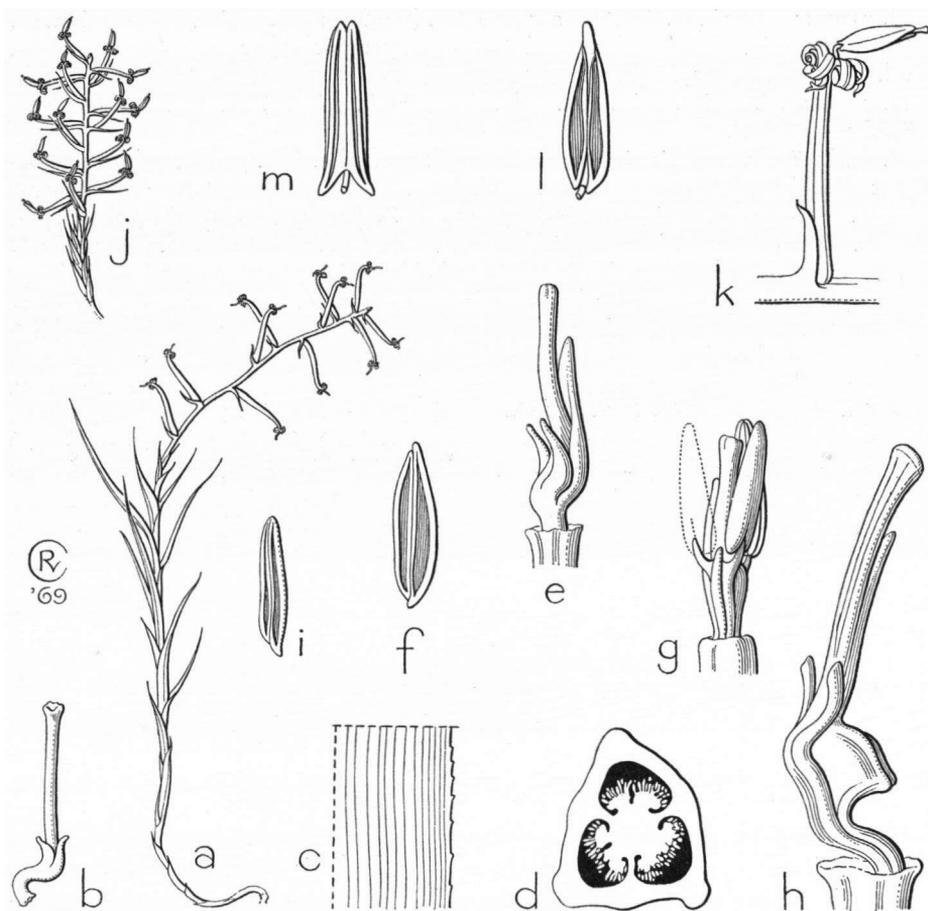


Fig. 10. *Apostasia parvula* Schltr. a. Habit, $\times \frac{2}{3}$; b. column, $\times 6$. — *A. wallichii* R. Brown. c. 'Dentation' of the leaf margin in East Malesian specimens, $\times 6$; d. cross-section through ovary, $\times 8$; e. column, $\times 6$; f. anther, $\times 6$; g. abnormal column showing 3 fertile stamens of the inner whorl; of the outer whorl the staminode and the initiation of the lateral stamens are present, $\times 6$. — *A. odorata* Blume. h. Column of '*A. thorellii* Gagn.' — *A. nipponica* Masamune. i. Anther, $\times 6$. — *A. nuda* R. Brown. j. Inflorescence, $\times \frac{2}{3}$; k. flower, $\times 3$; l. anther, $\times 6$. — *A. latifolia* Rolfe. m. Anther, $\times 6$. (a—b Hallier 1258, c Vink 8421, d van Royen 3400, e—f Backer 11460, g Thwaites 2744, in BM, h Poilane 22045, i Hak-chin Shim a. 1936, j—l Bakhuizen van den Brink f. 3413, m Ridley a. 1908)

Gen. & Spec. I (1897) 8; Pfitz., Pfl. Reich Heft 12 (1903) 7; Domin, Bibl. Bot. 22 (1915) 551. — Type: *Dallachy s.n.* (lectotype MEL, dupl. K, n.v., fragm. W).

A. gracilis Rolfe, J. Linn. Soc. Bot. 25 (1889) 242; Ridl., J. Linn. Soc. Bot. 31 (1893) 305; Rolfe, Orch. Rev. 4 (1896) 329; Pfitz., Pfl. Reich Heft 12 (1903) 8; Merr., En. Born. (1921) 134. — Type: *Korthals s.n.* (L).

A. alba Rolfe, Orch. Rev. 4 (1896) 329. Pfitz., Pfl. Reich Heft 12 (1903) 8; Merr., En. Born. (1921) 134. — Syntypes: *Barber s.n.* (lectotype & dupl. K); *Motley 95* (K).

Apostasia lucida Bl. ex Siebe, Anat. Bau Apost. (1903) 16, 24, 34, 41, 49, 56, 59, f. 3.

A. papuana Schltr in K. Sch. & Laut., Nachtr. (1905) 72; J. J. Smith, Nova Guinea 12, 3 (1916) 174; *ibid.* 12, 4 (1916) t. LV f. 89. — Syntypes: *Schlechter 13871* (lectotype BM, dupl. P); *Schlechter 14488* (*n.v.*).

A. curvata J. J. Smith, Mitt. Inst. Allg. Bot. Hamb. 7 (1927) 11, t. 1, f. 1. — Type: *Winkler 595* (*n.v.*).

A. wallichii var. *seraweiensis* J. J. Smith, Mitt. Inst. Allg. Bot. Hamb. 7 (1927) 10. — Type: *Winkler 268* (lectotype HBG, dupl. BO).

Herb, 10—100 cm. Aerial roots emerging from the lower leaves and the scales, 0.5—5 mm \varnothing . Rhizome 2—3.5 mm \varnothing . Scales 2—10 mm long, 5—15-nerved. *Leaves* closely set, linear, 10—50 by 0.3—1.8(—2) cm, acute (filiform tip up to 2 cm); margin entire or minutely dentate and glandular (hand-lens); 15—60-nerved, 3 or 5 of which are more prominent; sheath not marked. *Racemes* pendent, sometimes \pm erect, with 1—6 side-branches; 5—25(—30) flowers along each branch. Bracts triangular to lanceolate, acute [usually the lower with a filiform tip up to 0.5 (0.9) mm], margin as that of the leaves, 2—15(—24) mm long, (1—)3—7(—10)-nerved. *Flowers* 1—2.2(—2.7) cm long, yellow, rarely whitish. *Sepals* 4—6.5 by 0.6—1.7 mm, 3—5(—7)-nerved, cusp 0.4—1.2(—1.7) by 0.1—0.25 mm. *Petals* 3.7—6 by 0.5—1.5 mm, (1—)3(—5)-nerved, cusp 0.2—0.8(—1.2) by 0.1 mm, median one sometimes broader and more convex. *Column* straight to strongly curved, 0.7—1.5(—1.8) by 0.2—0.6(—0.7) mm. *Stamens* (2—)3—4(—5) by 0.6—1 mm; free part of the filaments 0.5—1 by 0.2—0.25 mm; anthers with an unequally bilobed to (oblique) entire tip; the longer anthercell opposite the staminode 0.1—0.4(—1) mm longer at the base and up to 0.5 mm longer at the apex; the shorter anthercell free from the longer one by 0—0.3 mm at the tip. In Ceylon specimens the base of the anthers may be equal, or the loculus facing the staminode may be slightly longer (see note 9). *Staminode* 1.3—3(—4) by 0.2—0.6 mm; entirely adnate or with an obtuse tip up to 1 mm free. *Ovary* 10—22 by 1—2 mm. Free part of the style straight, occasionally curved, 2.5—4.8 by 0.2—0.5 mm, sometimes irregularly longitudinally ribbed, mostly overtopping the anthers by up to 0.4 mm, but sometimes overtopped by the anthers by up to 0.6 mm. *Stigma* 2—3-lobed, sometimes suborbicular. *Fruit* 12—25 by 1.4—2 mm. *Seeds* alveolate to nearly smooth.

Distribution. Ceylon, Nepal, Assam, Burma, Thailand, Cambodia, Vietnam, through Malesia to Queensland, in Malesia: Sumatra (incl. Batu Is), Banka, Malay Peninsula, Java, Borneo, Philippines, Buru, and New Guinea.

Ecology. Undergrowth of primary forest, sometimes along streams; (20—)250—1200 (—1700) m alt. Fl. fr. Jan.—Dec.

Uses. Used as an antidiabetic in the Malay Peninsula.

Vernacular names. *Si sarsar bulung*, Sum., *hanching fatimah*, *kenching fatimah*, Mal. Pen., *segalol*, Waigeo (Selogof lang.), *momoroka*, New Guinea (Sorong, NW. New Guinea).

Notes. 1. Due to a gradual change of the set of characters through the area from west to east I cannot distinguish races or subspecies.

2. *A. wallichii* s.s. applies to rather stout plants, with entire leaf-margin, rather broad leaves; the stigma is usually 3-lobed, sometimes rounded, mostly overtopping the anthers (Nepal, Sumatra, Malay Peninsula, Java).

3. '*A. papuana*' applies to rather stout plants with rather broad leaves, the leaf-margin minutely glandularly dentate (hand-lens); the stigma is usually rounded, sometimes 3-lobed, mostly overtopped by the anthers (Philippines, New Guinea).

4. '*A. gracilis*' applies to rather small plants with narrow leaves, part of the material showing a finer dentation than in '*A. papuana*', whereas others have entire margins (Borneo).

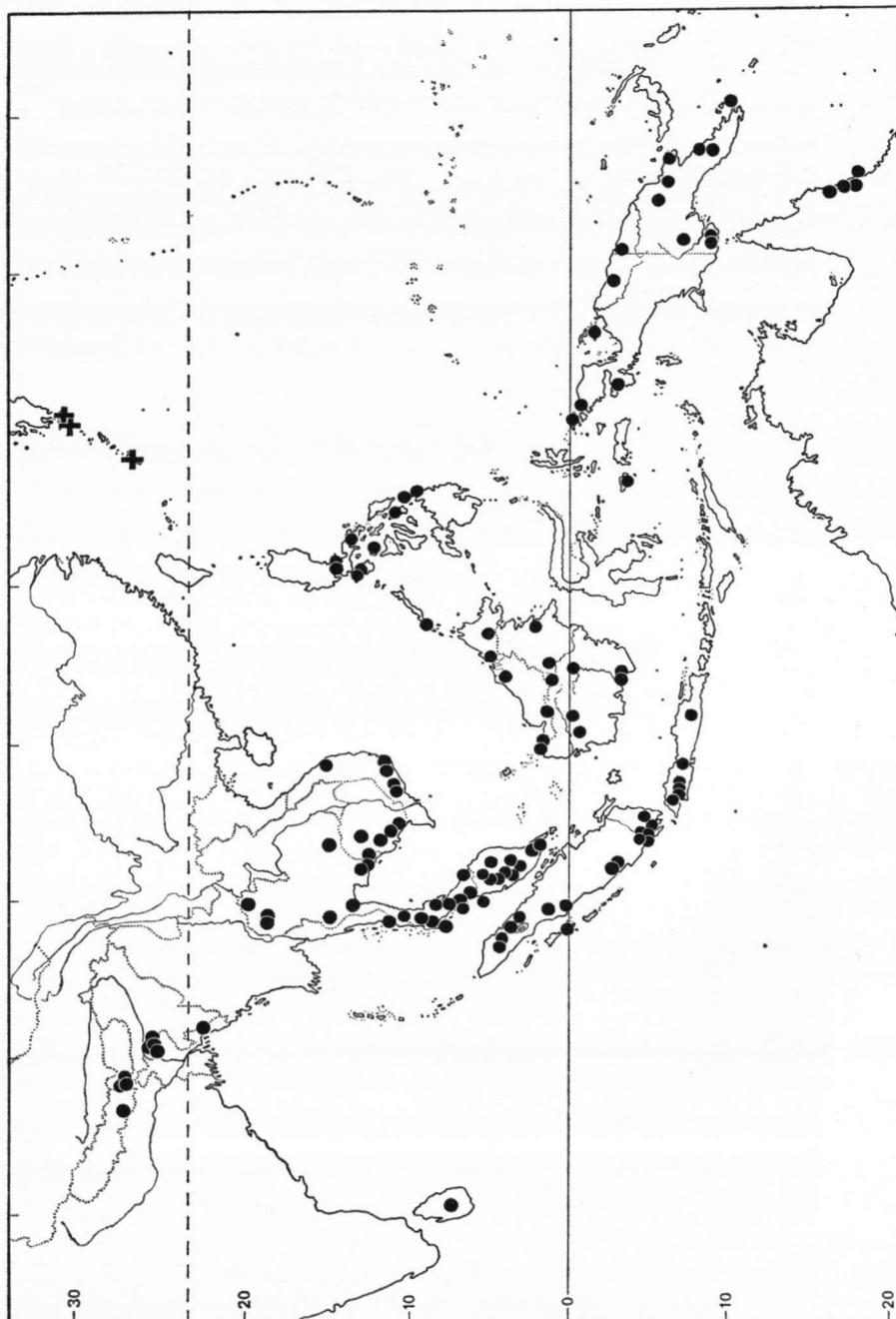


Fig. 11. Localities of *Apostasia nipponica* Masamune (+) and *A. wallichii* R. Brown (●).

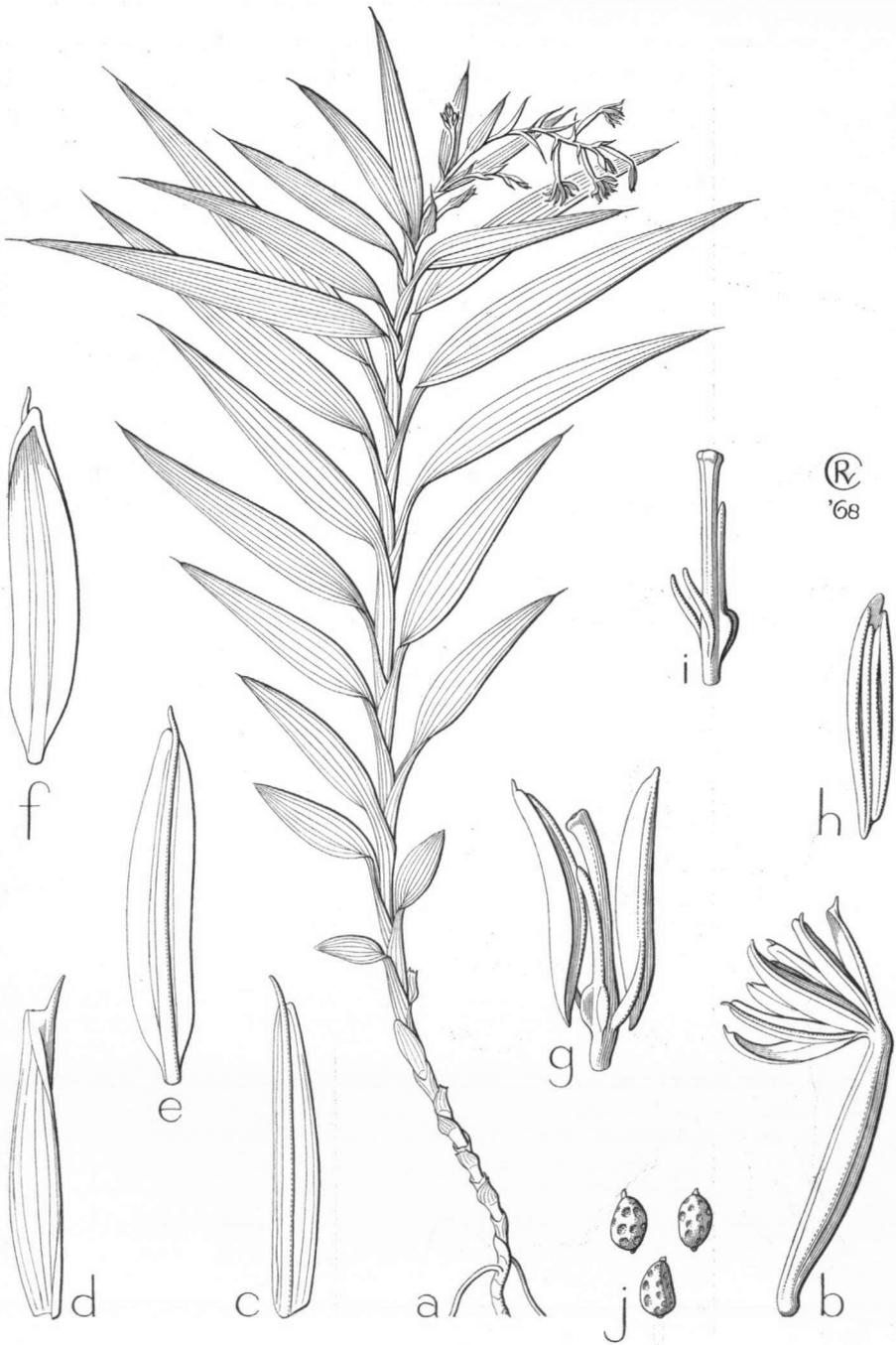


Fig. 12. *Apostasia odorata* Blume. a. Habit, $\times \frac{1}{3}$; b. flower, $\times 3$; c & d. sepal, $\times 6$; e & f. petal, $\times 6$; g. column, the anthers loosened from each other, $\times 6$; h. anther, inside, $\times 6$; i. column, $\times 6$; j. seeds, $\times 20$. (a—i Bakhuizen van den Brink f. 4136, j Beccari 10570).

5. '*A. stylidioides*' applies to small plants, which very well fit '*A. papuana*' as to the dentation of the leaves and '*A. gracilis*' as to the small stature and the narrow leaves (N. Queensland, New Guinea).

6. '*A. alba*' applies to small plants, in general appearance much alike '*A. gracilis*' but with the raceme very contracted. The fruits are barren, hence these specimens are probably abnormal (Borneo).

7. Materials from Sikkim and Assam differ in their lower stature, with small, rather broad leaves with up to 26 nerves.

8. In Annam and Burma some specimens show broad leaves up to over 2 cm wide, sometimes with dentate margins.

9. In Ceylon specimens (*Thwaites 2744*) the anthers usually have the thecae with equal base, sometimes even the theca on the side of the staminode longer than the other one. In the BM specimen, however, the thecae opposite the staminode are the longer like in typical *A. wallichii*.

10. *Thwaites 2744* (BM) showed one flower in which the 3 anthers of the inner whorl are present (one lateral anther shed, but the filament still present). Of the outer whorl the median one is present as the staminode, while the lateral ones are represented by 2 rather broad wing-like processions, exceeding but little the insertion of the inner whorl of stamens (fig. 10g).

4. *Apostasia odorata* Blume, Bijdr. (1825) 423; Tab. en Pl. Jav. Orch. (1825) f. V; in v. d. Hoeven & de Vriese, Tijds. Nat. Gesch. Phys. 1 (1834) 139; Ann. Sc. Nat. II, 2 (1834) 93; Miq., Fl. Ind. Bat. 3 (1859) 748; Rolfe, J. Linn. Soc. Bot. 25 (1889) 236; Orch. Rev. 4 (1896) 329; Kraenzl., Orch. Gen. & Spec. (1897) 7; Pfitz., Pfl. Reich Heft 12 (1903) 6; J. J. Smith, Orch. Java (1905) 17; Atlas 1 (1908) f. II; Back., Bekn. Fl. Java (em. ed.) 10B (1949) fam. 240, p. 3; Back. & Bakh. f., Fl. Java 3 (1968) 211. — Type: *Blume s.n.* (lectotype & dupl. L). — Fig. 10 h, 12.

A. platystylis J. J. Smith, Bull. Jard. Bot. Btzg III, 2 (1920) 16; *ibid.* (1930) Suppl. 2, t. 1, f. V; in Fedde, Rep. 32 (1933) 130; *Holt.*, Rev. Fl. Malaya 1 (1953) 65. — Type: *Bunnemeijer 378* (BO).

A. selebica J. J. Smith, Bot. Jahrb. 65 (1933) 449; Bull. Jard. Bot. Btzg. III (1941) Suppl. 3, t. 141, f. III. — Type: *Kjellberg 2714* (L).

A. thorelii Gagn., Bull. Soc. Bot. Fr. 80 (1933) 350; Fl. Gén. I.-C. 6 (1934) 650. — Type: *Thorel 3335* (P).

Herb. 20—50 cm. Aerial roots emerging from the lower leaves and the scales, 1.5—4 mm \varnothing . Rhizome 2—4 mm \varnothing . Scales 2.5—10 mm long. 5—10-nerved. *Leaves* rather closely set, ovate-oblong to linear, acute to acuminate (with a tip 0.5—2 cm), (7.5—)11—35 by 1—2(—3) cm; margin sometimes minutely dentate; 20—37-nerved, 3—5 of which are more prominent; sheath often marked. *Racemes* pendent, with 1—5 side-branches; 10—20 flowers per branch. Bracts ovate to ovate-lanceolate, acute, 0.2—5 cm long, 3—13-nerved, the lower ones with a filiform tip 2 mm long. *Flowers* 1.8—3.8 cm long, usually yellow, sometimes white. *Sepals* 6.5—11 by 1.2—2.2 mm, median sometimes smaller, 3—5-nerved, cusp 0.5—1.5 by 0.1—0.4 mm. *Petals* 6.5—11 by 1—2 mm, 3—5-nerved, cusp 0.4—0.8 by 0.1—0.2 mm, the median one sometimes smaller, or broader and more convex, up to 2.2 mm wide. *Column* 0.8—2 by 0.3—0.5 mm, straight or strongly curved at base, hardly flattened and with 2 longitudinal, projecting wings at the staminodial side (fig. 12i, g) to flattened and enlarged just below the staminode median (fig. 10h); enlarged part elliptic to quadrangular in outline, with 2 longitudinal ridges to small wings separated by a groove at the staminodial side. *Stamens* (3—)4—6.5

by (0.7—)1—1.5 mm; free part of the filaments (0.6—)1—2 by 0.2 mm; the longer anthercell often non-polliniferous at the tip, 0.2—0.4 mm longer at the base and 0.1—0.3 mm at the tip; the shorter one entirely adnate to the longer one, or the apical portion up to 0.1 mm free. Staminode 2.5—4.5 by 0.2 mm; free apical portion with an obtuse tip, up to 0.4 mm long. *Ovary* 10—20 by 1—1.7 mm. Free part of the style 4.5—6 by 0.3—0.4 mm, with 4—6 more or less distinct longitudinal ribs corresponding with the lobes and incisions (if present) of the stigma; either overtopping the anthers by 0.5 mm at most, or overtopped by the anthers by up to 1.5 mm; overtopping the staminode by up to 1 mm. Stigma slightly enlarged, shallowly 3-lobed to suborbicular. *Fruit* 20 by 1.5—2(—2.6) mm. *Seeds* alveolate.

Distribution. Assam, Yunnan, N. and S. Vietnam, S. Thailand, in Malasia: W. Sumatra, Banka, Billiton, NW. Malay Peninsula (incl. Penang and Langkawi Is), W. Java, N. Borneo, Celebes.

Ecology. Primary forest; (750—)1000—1400(—1700) m alt., in Thailand, Yunnan, and Sumatra 250—600 m. Fl. fr. Jan.—Dec.

Vernacular names. *Tan moi*, Thailand (N. Srithamarat), *bungah siani ruisbo*, W. Sum., *antjing plandok*, Billiton.

Notes. 1. The *A. selebica* collection is a dwarf, having the broad leaves and the flower characters of *A. odorata*.

2. Linear leaves occur in specimens from S. Thailand, Sumatra, Banka, and the Malay Peninsula (formerly *A. platystylis*), and in Hainan.

3. The plants with an elliptic column are the former *A. platystylis*.

4. The plants with rather broad leaves and a quadrangular column are the former *A. thorelii*.

B. Sect. *Adactylus*

Endl., Gen. Pl. (1837) 221; Pfitz. in E. & P., Nat. Pfl. Fam. 2, 6 (1888) 82; Rolfe, J. Linn. Soc. Bot. 25 (1889) 238; Kraenzl., Orch. Gen. & Spec. 1 (1897) 7; J. J. Smith, Orch. Java (1905) 19.

Adactylus (Endl.) Rolfe, Orch. Rev. 4 (1896) 329; Pfitz., Pfl. Reich Heft 12 (1903) 8.

Racemes pendent. Flowers yellow or white. Filaments only for a very short part free from the column; anthers mutually coherent with their margins, sub-basifixed, ovate-oblong, sagittate, with equal or slightly unequal base, loculi equal to subequal. Staminode absent.

Distribution. Tenasserim, Peninsular Thailand, W. Malasia.

Ecology. Undergrowth of primary forest; 100—1300 m alt.

5. *Apostasia elliptica* J. J. Smith, Bull. Jard. Bot. Btzg III, 2 (1920) 15; *ibid.* (1930) Suppl. 2, t. 1, f. IV; in Fedde, Rep. 32 (1933) 130. — *Adactylus ellipticus* (J. J. Smith) Cretz., J. Jap. Bot. 17 (1941) 408. — Type: *Bünnemeijer 107* (lectotype in alc. BO, dupl. BO). — Fig. 13.

Herb, up to 35 cm. Aerial roots from the rhizome-scales, 2 mm \varnothing . Rhizome 3 mm \varnothing . Scales 8 mm long, 13—17-nerved. *Leaves* rather remote, oblong to ovate-oblong, more or less acuminate, up to 11 by 2.3 cm; nerves up to 36, 5 of which are more prominent; sheath distinct. *Racemes* pendulous, 10—20-flowered, without sterile bracts at the base. Fertile bracts triangular, not with a filiform tip at the acuminate apex, 4 by 2 mm, 3—5-nerved. *Flowers* 1.5 cm long, white. *Sepals* 4.5 by 1.2 mm, 3-nerved, cusp 0.2 by 0.1 mm. *Petals* 4.5 by 1.2 mm, 3-nerved, cusp 0.4 by 0.2 mm, all equal. *Column* straight, 1 by

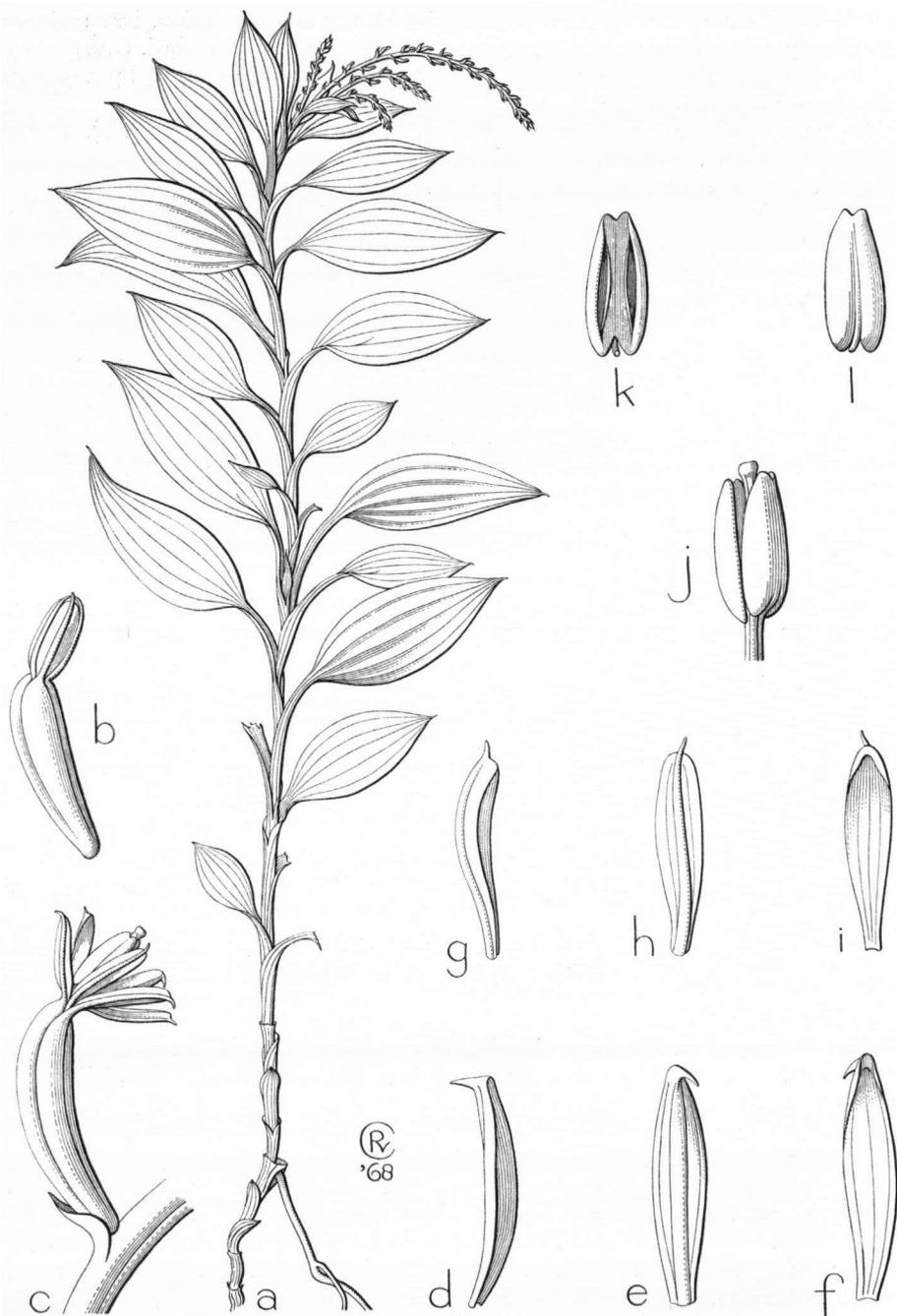


Fig. 13. *Apostasia elliptica* J. J. Smith. a. Habit, $\times \frac{1}{4}$; b. flower bud, $\times 3$; c. flower, $\times 3$; d—f. sepal, $\times 6$; g—i. petal, $\times 6$; j. column, $\times 6$; k & l. anther, inside and outside, $\times 6$. (a *Md. Haniff* 4019, b—l *Bünnemeijer* 107, alc. material).

0.25 mm. *Stamens* 3.3 by 1 mm; anthers semi-orbicular in cross-section, base sagittate with slightly unequal, 0.5 mm long lobes, apex of anther obtusely bilobed. *Ovary* 11 by 2.5 mm. Free part of the style overtopping the anthers by 0.4—0.6 mm, 3.5 by 0.25 mm, with 2 obscure longitudinal ribs. *Stigma* 3-lobed. *Fruit* unknown.

Distribution. Malesia: Sumatra (Westcoast Res., Ophir Dist., N. of Talu), Malay Peninsula (Perak, G. Kerbau). Twice collected.

Ecology. Forests; about 700 m alt. Fl. May.

Note. Smith's description was based on a single herbarium specimen (*Bünnemeijer 107* from Sumatra) and on flowers, preserved in alcohol, from cultivated plants (grown from seeds of the Sumatra collection). I selected the flowering alcohol material as the lectotype (BO).

6. *Apostasia latifolia* Rolfe, J. Linn. Soc. Bot. 15 (1889) 242; Hook. f., Fl. Br. Ind. 6 (1890) 175; Ridl., J. Linn. Soc. Bot. 32 (1894) 415; Kraenzl., Orch. Gen. & Spec. 1 (1897) 10; Ridl., Mat. Fl. Mal. Pen. 1 (1907) 233; Fl. Mal. Pen. 4 (1924) 297; Gagn., Fl. Gén. I.-C. 6 (1934) 651; Holtt., Rev. Fl. Malaya 1 (1953) 65. — *Adactylus latifolius* Rolfe, Orch. Rev. 4 (1896) 329; Pfitz., Pfl. Reich Heft 12 (1903) 8. — Syntypes: *Scortechini 868* (lectotype K); *Wray 1605* (K). — **Fig. 10m.**

Herb, up to 35 cm. Aerial roots from the lower leaves, 2.5—3 mm \varnothing (rhizome and scales not seen). *Leaves* rather spaced, (narrowly) ovate-lanceolate, acuminate (filiform tip 3—6 mm), 10—30 by 1.8—3 cm; nerves 30—50, 5 of which are more prominent; sheath not distinctly marked against the leaf-blade, 3—9 cm long. *Racemes* pendulous, with 1—5 side-branches, 13—27-flowered, without sterile bracts at the base. Bracts narrowly triangular, acuminate (filiform tip up to 0.5 mm), 3—8 by 1—2 mm, 1—5-nerved. *Flowers* 1.4—2.4 cm, with recurved perianth. *Sepals* 3.7—5 by 0.8 mm, 3-nerved, cusp 0.3—0.4 by 0.1 mm. *Petals* all equal, 3.7—5 by 0.8 mm, 3-nerved, cusp 0.3—0.4 by 0.1 mm. *Column* straight, 0.8—1.2 by 0.3 mm. *Stamens* 2.1—3.8 by 1 mm; anthers elongate-semi-elliptic in cross-section, base sagittate with unequal to sometimes equal lobes, longer one 0.4—0.5 mm, shorter one 0.2—0.5 mm, apex of anther obtusely bilobed. *Ovary* 10—18 by 1.5—1.8 mm. Free part of the style overtopping the anthers by 0.2—0.7 mm, with a few fine longitudinal ribs or with 2 length grooves. *Stigma* obscurely 2—3-lobed. *Fruits* 11—18 by 1.7—1.8 mm, pale green. *Seeds* regularly alveolate.

Distribution. Malesia: Malay Peninsula (Perak, Pahang, Malacca).

Ecology. Forests, mountains and hills. Fl. fr. Aug—Dec.

Note. I selected *Scortechini 868* (K) as the lectotype, as the material carries both buds and fruits, while *Wray 1605* is only in fruit.

7. *Apostasia nuda* R. Brown in Wallich, Pl. As. Rar. 1 (1830) 76; Bauer & Lindl., Illustr. Orch. Pl. (1832) t. XV, f. 1—16; Blume in v. d. Hoeven & de Vriese, Tijds. Nat. Gesch. Phys. 1 (1834) 140; Ann. Sc. Nat. II, 2 (1834) 93; Miq., Fl. Ind. Bat 3 (1859) 748; Rolfe, J. Linn. Soc. Bot. 25 (1889) 239; Hook. f., Fl. Br. Ind. 6 (1890) 175; Ridl., Trans. Linn. Soc. Lond. II, Bot. 3 (1893) 378; J. Linn. Soc. Bot. 32 (1894) 305, 415; Kraenzl., Orch. Gen. & Spec. 1 (1897) 9; Ridl., J. Str. Br. R. As. Soc. 33 (1900) 165; J. J. Smith, Orch. Java (1905) 19; Ridl., Mat. Fl. Mal. Pen. 1 (1907) 233; J. J. Smith, Orch. Java, Atlas (1908) f. IV; Ridl., J. Str. Br. R. As. Soc. 59 (1911) 202; Fl. Mal. Pen. 4 (1924) 297; Gagn., Fl. Gén. I.-C. 6 (1934) 650; Holtt., Rev. Fl. Malaya 1 (1953) 65; Hend., Mal. Wild Fl. (Monoc.) (1954) 13; Mitra, Fl. Pl. East. India 1 (1958) 261. — *Adactylus nudus* Rolfe, Orch. Rev. 4 (1896) 329; Pfitz., Pfl. Reich Heft 12 (1903) 8; Merr., En. Born. (1921) 135. — Type: *Porter s.n.* = *Wallich 4449* (lectotype K, dupl. K, herb. Wallich). — **Fig. 10j—l.**

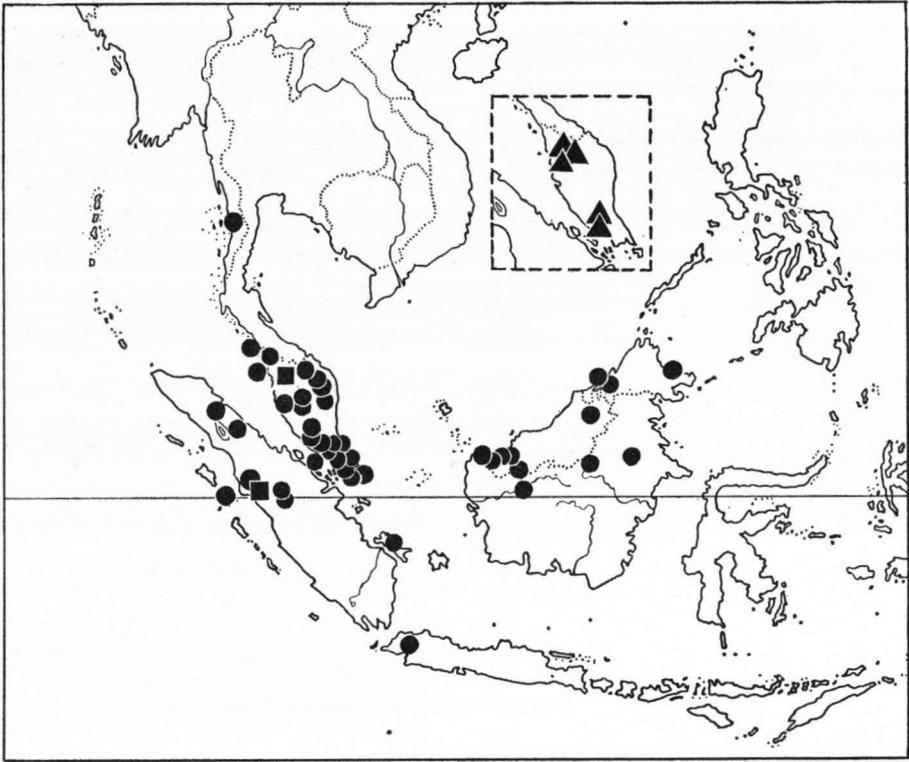


Fig. 14. Localities of *Apostasia nuda* R. Brown (●), *A. elliptica* J. J. Smith (■), and *A. latifolia* Rolfe (▲ on inset of Malay Peninsula).

A. odorata (non Blume) Lindl., *Veg. Kingd.* (1846) 184, f. 125.

A. brunonis Griff., *Notul.* 3 (1851) 234; *lc. Pl. As.* 3 (1851) f. CCLXXXII; J. J. Smith, *Bull. Jard. Bot. Btzg III* (1930) *Suppl.* 2, t. 1, f. III; *ibid.* III, 11 (1931) 83; in Fedde, *Rep.* 32 (1933) 130; Back., *Bekn. Fl. Java* (em. ed.) 10B (1949) fam. 240, p. 3; Back. & Bakh. *f., Fl. Java* 3 (1968) 211. — *Adactylus brunonis* [Pfitz., *Pfl. Reich Heft* 12 (1903) 9, *nomen in syn. sub Adactylus nudus*] Cretz., *J. Jap. Bot.* 17 (1941) 407. — Type: Griffith 5604 (lectotype K, dupl. P).

A. lobbii Reichb. *f.*, *Flora* 55 (1872) 278; Rolfe, *J. Linn. Soc. Bot.* 25 (1889) 238; Ridl., *J. Linn. Soc. Bot.* 31 (1893) 305; Kraenzl., *Orch. Gen. & Spec.* 1 (1897) 9. — *Adactylus lobbii* Rolfe, *Orch. Rev.* 4 (1896) 329; Pfitz., *Pfl. Reich Heft* 12 (1903) 8; Merr., *En. Born.* (1921) 135. — Type: Lobb *s.n.* (lectotype K, dupl. P).

Adactylus nudus var. *valida* Bl. ex Siebe, *Anat. Bau Apost.* (1903) 12, 33, f. 4.

Adactylus nudus var. *laxa* Bl. ex Siebe, *Anat. Bau Apost.* (1903) 29, 45, 59.

Herb, 40—60(—70) cm. Aerial roots from the lower leaves and the scales, 2—3 mm Ø. Rhizome 2—3 mm Ø. Scales (3—)5(—7) mm long, (5—)10—22-nerved. Leaves spaced to closely set, linear-lanceolate, acute (filiform tip 6—13 mm), (13—)17—27 (—45) by

(0.45—)0.6—1.3(—1.5) cm; nerves (13—)18—80(—92), (3—)5 of which are more prominent; sheath not marked. *Racemes* pendulous, almost always a tuft of sterile bracts at the base, with 2—12 side-branches mostly emerging from between the sterile bracts; 15—25(—32) flowers along each branch. Bracts narrowly triangular to lanceolate, acute (filiform tip up to 0.5 mm); sterile bracts up to 20 by 4 mm, mostly smaller, fertile ones 2—10(—16) by 1—1.5 mm, 3(—5)-nerved. *Flowers* 1.2—1.4(—1.9) cm, white or yellow, with recurved perianth. *Sepals* 3.3—4.5 by 0.6—1 mm, 3-nerved, cusp 0.3—0.4(—0.5) by 0.1 mm. *Petals* all equal, 3.3—4.5 by 0.5—0.6(—1) mm, (1—)3(—5)-nerved, cusp 0.3(—0.6) by 0.1 mm. *Column* 0.5—1.1 by 0.2—0.3 mm, strongly curved, rarely straight. *Stamens* 3.2—3.5(—4) by 0.7—1.2(—1.4) mm; anthers elongate-semi-elliptic in cross-section, base sagittate with equal to slightly unequal lobes 0.2—0.3 mm long, connective prolonged for 0.4—0.7 mm. *Ovary* 8—11 by 0.8—1 mm. Free part of the style 3.6—4 by 0.2 mm with 2 more or less obscure longitudinal ribs, overtopping the anthers by (0.1—)0.4—0.8 mm. Stigma broadened at the base, either flattened, orbicular to irregularly quadrangular, sometimes 3-lobed, or conical. *Fruit* 1.2—1.5 by 1 mm, green. *Seeds* regularly alveolate to nearly smooth.

Distribution. Burma, Cambodia and S. Vietnam, in Malasia: Sumatra (also incl. Batu Is.), Banka, Malay Peninsula, W. Java, and Borneo.

Ecology. Undergrowth of primary forest, mostly on hills and in the mountains; 100—1300 m, rarely at lower altitude. Fl. fr. Jan.—Dec.

Uses. In the Malay Peninsula the roots are boiled and used against diarrhoea and sore eyes. Also in favour as a medicine for dog biting.

Vernacular names. *Si sarsar bulung*, *si marsari-sari*, *duhut bane-bane*, Sum. (Eastcoast), *pokô pulampas budak*, *dudalu ingâp*, *kniching pelandok*, Mal. Pen., *carmion*, Singapore; all inconstant names.

Notes. 1. According to J. J. Smith the difference between *A. nuda* and *A. brunonis* is merely the yellow and non-recurved perianth in the former and a white and recurved perianth in the latter. This criterion, however, does not hold: the non-recurved perianth is due to the fact that Wallich had only buds at his disposal. He made a note on it at the end of his description.

2. In the Malay Peninsula the flowers are mostly white, sometimes yellow (*Beccari 1406*, *Ridley s.n.*, coll. 1892, SING) or cream (*Burkill 1360*).

3. *A. lobbii* are the stouter plants with larger leaves, which, according to Ridley (J. Linn. Soc. Bot. 31, 1893, 305) are growing among specimens of typical *A. nuda*. The characters of the flower and especially those of the anthers do not differ from those of *A. nuda*.

4. *Porter s.n.*, *Wallich herb. 4449* (K) is a mixtum containing 1 specimen of *A. nuda* and 2 of *A. wallichii*. The lectotype and other isotypes are in the main Orchid Herbarium at Kew.

EXCLUDED GENERIC NAMES

Rhynchanthera (paniculata) Blume, Tab. en Pl. Jav. Orch. (1825) t. 78, *nom. gen. rej.*, was tentatively referred with a question mark to the *Apostasiaceae* by Lindley, Veg. Kingd. (1846) 184 = *Corymborchis veratrifolia* Bl.

Schaenomorphus (capitatus) Thorel ex Gagn., Bull. Soc. Bot. Fr. 80 (1933) 351; Fl. Gen. I.—C. 6 (1934) 652, f. 62 14—17, f. 63 1—6, '*Schoenomorphus*'; Shaw in Willis, Dict. ed. 7 (1966) 1016, '*Schoenomorphus*'; is according to the figure distinctly an *Orchidoideae*, but by both Gagnepain and Shaw arranged under *Apostasiaceae*. According to Mansfeld it belongs to *Tropidia*, cf. Fedde, R.ep. 36 (1934) 58—59.

IDENTIFICATION LIST

This list contains all numbered specimens seen. The unnumbered specimens have been included only if they were dated and if no confusion can be caused. The type specimens are marked with (T). Institutional series are provided with the collector's name between brackets, and are cross-referenced with these. For abbreviations used for the series, see Jacobs, Fl. Mal. Bull. 22 (1968) 1571.

The numbers in this list correspond with those in the text.

- Adelbert 461: *N6a*. Aet & Idjan 260: *A3*. Ajoeb 35 (p.p.): *A3*, 230: *A3*. d'Alleizette s.n. a. 1909: *A*. sp., a. 1919: *A4*. Alvins 410: *A7*, 1283: *A7*, 2163: *A7*, 2324: *N1*. Amdjah 185: *A7*, 774: *A3*. Anderson 180: *A7*. Anta & Kostermans 681: *A7*. Armit s.n.: *A3*. Atasrip 229: *N1*.
- Backer 8816: *N6b* (T), 9049: *N1*, 11453: *A3*, 11460: *A3*, 11570: *A3*, 15066: *N6b*, a. 1913 (Cult. Bog.): *N1*. Bakhuisen van den Brink 186: *N1*, 434: *A3*, 691: *A4*, 1307: *A4*, 2821: *A3*, 3669: *A4*, 4136: *A4*, 4172: *N1*, 4183: *A7*, 4590: *N6b*, 6450: *N1*, 6685: *N6b*, 7082: *A7*, 7131: *A7*, 7141: *A7*, 7712: *N1*, 7764: *A7*. Bakhuisen van den Brink f. 609: *N1*, 1310: *N6b*, 2789: *N6b*, 3413: *A7*, 3707: *A4*. Balansa 2000: *N6c* (T). Barber s.n.: *A3* (T). Bartlett 6421: *N2*, 6439: *N1*. Bartlett & LaRue 76: *N1*. Batten Pool a. 1939: *A7*. Bauerlen a. 1885: *A3*. Beccari PB 569: *N3*, PB 1147: *N3*, PB 1298: *A3*, PB 1406: *A7*, PB 1610: *A7*, PB 1734: *A3*, PB 2836: *N1*, PP 79: *A3*, 10570: *A4*, a. 1874: *N1*, a. 1878: *N1*, a. 1878: *A3*. Berthand a. 1882: *A3*. Best see SF. Blake 18840: *A3*. Boerlage a. 1900: *N1*. Brass 1426: *N1*, 2075: *A3*, 5971: *A3*, 8428: *A3*, 25533: *A3*, 25570: *A3*, 25829: *N1*. Brooke 8490: *A3*, 9141: *A.sp.*, 10156: *A3*, 10205: *A3*, 10683: *A3*, 10900: *N3*. Brung see S. BS series: 13547 (Loher): *N1*, 14669 (Loher): *N1*, 14683 (Loher): *A3*, 14890 (Loher): *A3*, 23496 (Ramos): *N1*, 23639 (Ramos): *N1*, 33470 (Ramos & Edaño): *N1*, 34123 (Ramos & Edaño): *A3*, 35052 (Ramos & Pascasio): *A3*, 35210 (Ramos & Pascasio): *A3*, 36994 (Ramos & Edaño): *N1*, 39505 (Ramos & Lopez): *A3*, 39561 (Ramos): *N1*, 45995 (Edaño): *N1*, 75828 (Edaño): *N1*, 84168 (Ramos & Convocar): *A3*, 84169 (Ramos & Convocar): *A3*. Bünnemeijer 107: *A5* (T), 378: *A4* (T), 494: *A3*, 1426: *N1*, 14266: *N6c*, 2020: *A4*, 2041: *N6c*, 2192 (p.p.): *A3*, 2192 (p.p.): *A3*, 2324: *A3*, 3293: *N1*, 6160: *A7*, 6413: *N1*, 7841: *N1*, 7855: *N1*. Burkill see SF. Buwalda 5065: *N1*, 7742: *N3*. BW series: 8421 (Vink): *A3*.
- Carr (see also SF) 76: *N2*, 3090: *A4*, 3387: *N1*, 10655: *A3*, 10663: *N1*. Castillo 614: *A7*. CF series: 1177 (Foxworthy): *A7*. Chalmers a. 1885: *A3*. Chang a. 1969: *A3*. Chew, Corner & Stainton 1670: *A4*, 2764: *A4*. Clarke 36988: *A3*, 44442: *A3*. Clemens 101: *N1*, 576: *A4*, 988: *A3*, 10724: *A3*, 20906: *N1*, 26882: *N1*, 26883: *N1*, 27696: *N1*, a. 1932: *A.sp.*, a. 1933: *A4*. Corner (see also SF) a. 1941: *A4*. Corner & Nauer a. 1941: *A3*. Cowan a. 1923: *A3*. Cumberlage (C) 897: *A.sp.*. Curran 3470: *N1*. Curtis 55: *N6c* (T), 469: *N1* (T), 925: *A3*, 1185: *N6c* (T), a. 1899: *N6c*.
- van Daalen 66: *A3*, 351: *A3*. Dakkus 281: *N1*. Dallachy s.n.: *A3* (T). Darling see SF. Daud 11309: *A7*. Derry 105: *N1*, 1079: *N1*. Dockrill a. 1962: *A3*. Docters van Leeuwen 3253: *A7*, 3268: *N2*. Edaño see BS. Elmer 13141: *A3*. Elsener H85: *N1*. Endert 2880: *A3*, 3641: *A7*, 4792: *A3*. Evans & Gordon see FMS. Evrard 508: *N6c* (T), 1469: *A3*, 2214: *A3*.
- FB series: 18750 (Darling): *A3*, 18836 (Franco): *A3*. Fleury 37777: *A4*. FMS series: 118 (Evans & Gordon): *A7*, 356 (Seimund): *A7*, 382 (Seimund): *A7*, 7865 (Hume): *A7*, 8181 (Hume): *A3*, 12289 (Kloss): *A7*, 13125 (Robinson & Kloss): *A7*. Foxworthy see CF. Franco see FB.
- Galoengi 484: *N6c*. Gaudichaud 106: *N2*, a. 1837: *A3*. Gjellerup 291: *N1* (T), 642: *A3*. Goodenough 1510: *N2*, a. 1889: *A7*. Griffith 100 (K.D. 5604): *A7* (T).
- Hallier 231: *A7*, 1258: *A1*, 2312: *A7*, 2949: *A7*, 3276: *A7*. Hamel 1141: *N1*. Haniff 4019: *A5*, a. 1901: *A3*. Haniff & Nur see SF. Hansen & Smitinand 12400: *A3*. Harmand & Godefroy 577: *A3*. Haslan a. 1916: *A4*. Hatusima a. 1952: *A2*. Hatusima & Sako 29680A: *A2*. Haviland s.n.: *A7*. Henderson (see also SF) a. 1929: *N2*. Henry 13738: *A4*. Hewitt 23: *A7*, a. 1908: *N1*. den Hoed & Kostermans 934: *A3*. Holtum see SF. Hooker f. & Thomson a. 1850: *A4*, s.n.: *A.sp.*. How 73122: *N6c*. Hullelt 866: *A7*, a. 1884: *A7*, a. 1893: *N.sp.*. Hume see FMS.
- Iboet 546: *N1*. Ismail & Millar see KL.
- Jacobs 8513: *A3*. Jacobson a. 1918: *N1*. Jaheri 519: *A3*. Jenkins (Herb. East Ind. Comp.) 5603: *A3*, a. 1845: *A3*. Kartanak a. 1919: *A3*. Keenan, U Tun Aung, Rule 983: *A3*. Kerr 033: *A3*, 0526: *A3*, 0586: *A4*, 0621: *A3*, 1274: *A3*, 3698: *A3*, 4851: *A3*, 6851: *A3*, 15940: *N6c*, a. 1914: *A3*, a. 1930: *A7*. Kiah (see also SF) a. 1938: *A4*. King's Collector 6015: *N.sp.*, 10629: *A3*. Kingdon Ward see SF. Kjellberg 2714: *A4* (T). KL series: 275 (Ismail & Millar): *A3*. Kleinhooite 674: *N6c*. Kloss (see also FMS) a. 1913: *N1*. Kobus 45: *A4*. Koorders 22366: *A7*, 22368: *A7*, 39510: *A4*, 39518: *N6b* (T). Kornassi 1157: *N1*. Kostermans 866: *N5* (T), 12988: *N7* (T), 21177: *A3*. Kostermans & Anta 928: *N6c*, 982: *A.sp.*. Krukoff 4160: *N2*. Kuhl & van Hasselt s.n.: *A.sp.*
- Lake & Kelsall a. 1892: *A7*. Loher see BS.
- McClure 2965: *A4*. Maingay 2950 (K.D. 1682): *N2* (T), 3245 (K.D. 1680): *A7*. Maradjo 298: *A7*. Marcan 1265: *A3*. Marshall a. 1918: *N1*. Mendoza see PNH. Merrill 5521: *A3*, 5639: *A3*, 5681: *N1*. Meijer (see

- also SAN) 4203: *A7*. Micholitz a. 1898: *N1*. Millar see NGF. Morgan s.n.: *A7*. Motley 95: *A3* (T), 840: *A3*. Moulton see SF. von Mueller s.n.: *A3*. Muller 1470: *A3*.
- Native Collector 25: *A7*, 1302: *N3*. Nauer see SF. Ngadiman see SF. NGF series: 7691 (Womersley & Millar): *A3*, 23361 (Millar): *N1*. Nieuwenhuis s.n.: *A3*. Nur see SF.
- Pantling 414: *A3*. Pierre 6583: *A3*, s.n.: *A3*. Pleyte 340: *A3*. PNH series: 18283 (Mendoza): *N1*. Poilane 3408: *N6c*, 3808: *A3*, 4937: *N4* (T), 6180: *N4*, 7277: *A3*, 17504: *A3*, 17604: *A3*, 22045: *A4*, 31671: *A3*. Poore 1216: *N2*. Porter s.n. (= Wallich 4449): *A7* (T). Purseglove 5070: *A7*. Put 562: *A3*, 759: *A3*, 1651: *A3*. van der Pijl 367: *A3*.
- Raap 146: *N9*, 242: *A4*, 304 (p.p.): *A7*. Rabil 11: *A3*. Rachmad 70: *A7*. Rahmat si Boeca 282: *N1*, 822: *N2*, 1365: *N1*, 1491: *N6c*, 5859: *A3*, 9018 (p.p.): *A7*, 9018 (p.p.): *A3*, 9045: *A7*, 9295: *A3*, 9400: *A7*, 9847: *A7*, 9984: *N1*, 10013: *N1*. Ramos (see also BS) 2719: *N1*. Ramos & Convocar see BS. Ramos & Edaño (see also BS) 3271: *N1*, 3926: *A3*. Ramos & Lopez see BS. Ramos & Pascasio see BS. Rant 687: *N1*, 753: *N1*. Ridley 2375: *N2*, 2376: *A7*, 2826: *N6c*, 3133: *A7*, 3871: *A7*, 3896: *N2*, 4145: *N6c*, 5125: *A7*, 7782: *A3*, 9998: *N6c*, 12153: *N1*, 12154: *N6c*, 12524: *A7*, 14975: *A.sp.*, 16192: *A7*. Robinson 6280: *A4*, a. 1913: *A7*. Robinson & Kloss (see also FMS) 2450: *A7*. van Royen 3400: *N1* p.p., *A3* p.p., 5520: *A3*. van Royen & Sleumer 7504: *N1*.
- S series: 17511 (Brunig): *A7*. SAN series: 15288 (Wood): *A7*, 16370 (Wood & Charrington): *N6c*, 19893 (Meijer): *A3*. Sarip 296: *N6b*. Schlechter 13871: *A3* (T), 19222: *N1*, 19382: *N1*, 19929: *A3*. Scortechini 868: *A6* (T), a. 1854: *A3*. Seimund see FMS. SF series: 1360 (Burkill): *A7*, 2896 (Burkill): *N6c*, 3270 (Burkill): *N1*, 4558 (Burkill): *N1*, 6420 (Burkill): *N1*, 6870 (Moulton): *A7*, 7180 (Haniff & Nur): *A3*, 7714 (Best): *A7*, 7841 (Best): *N2*, 8110 (Haniff & Nur): p.p. *A7*, p.p. *A3*, 9638 (Holtum): *A7*, 9918 (Holtum): *N6c*, 10268 (Nur): *N2*, 10608 (Holtum): p.p. *A7*, p.p. *A3*, 10856 (Holtum): *N6c*, 11596 (Nur): *N6c*, 11692 (Nur): *A7*, 19334 (Holtum): *N6c*, 20109 (Henderson): *N1*, 20407 (Henderson): *N6c*, 21050 (Haniff): *A3*, 22639 (Henderson): p.p. *A7*, p.p. *A3*, 24054 (Henderson): *N1*, 27083 (Carr): *A4*, 27823 (Carr): *N1*, 28802 (Symington & Kiah): *A7*, 30721 (Corner): *N2*, 32463 (Corner): *N2*, 36758 (Ngadiman): *N2*, 37243 (Kiah): *N1*, 37572 (Kingdon Ward): *A4*, 38019 (Nauer): *A3*, 38304 (Holtum): *N2*, 39630 (Sinclair): *N2*, 40029 (Sinclair): *N1*. Hak-chin Shim a. 1930: *A2*. Sinclair see SF. E. Smith 505: *A4*. J. J. Smith 743: *A7*, 752: *A4*, 852: *N6b*, a. 1906: *A3*, a. 1908: *A3*, a. 1909: *N6a*. L. S. Smith N.G. 120: *N1*. Sørensen, Larsen & Hansen 482: *A.sp.* van Steenis 3391: *A4*. Surbeck 32: *A3*, 46: *N2*. Symington & Kiah see SF.
- Teysmann 54: *N1*, 1821 H.B.: *A3*, 3993 H.B.: *N1*, 4449 H.B.: *A3*, a. 1870: *N1*. Thomson a. 1917: *A3*. Thorel 3335: *A4* (T). Thwaites 2744: *A3*.
- Vink see BW. de Voogd 429: *A3*, 494: *A3*, 527: *N6b*. Vorderman a. 1888: *N6c*.
- Wallich 4448: *A3* (T), 5195: *N6c* (T). Wenzel 383: *A3*, 600: *A3*, 653: *A3*. Willmott a. 1911: *N1*. Winckel 1386B: *A3*, 1513B: *A3*, 2088B: *N6b*, 2089B: *A4*. Winit 1148: *A3*. Winkler 268: *A3* (T), 1485: *N8* (T). Womersley & Millar see NGF. Wood see SAN. Wood & Charrington see SAN. Wray 1114: *A7*, 1361: *A7*, 1605: *A6* (T), 5318: *A7*, a. 1890: *A3*.
- Yates 2285: *N2*.
- Zollinger 2808: *N6a* (T), 3711: *N6a*.