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Author(s): P. J. M. Maas

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FLORA NEOTROPICA

Monograph No. 18

RENEALMIA

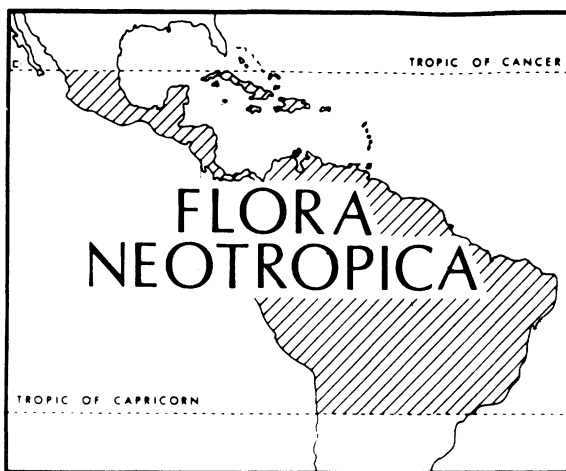
(Zingiberaceae — Zingiberoideae)

COSTOIDEAE (Additions)

(Zingiberaceae)

by

P. J. M. MAAS



Published for

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RENEALMIA

(ZINGIBERACEAE—ZINGIBEROIDEAE)

P. J. M. MAAS¹

INTRODUCTION

In 1971 after having finished the revision of the Costoideae for Flora Neotropica, I started revising the genus *Renealmia*. I was fortunate enough to receive funds for botanical expeditions to the following countries: Amazonian Brazil (with Dr. G. T. Prance, 1971), Colombia (1972 and 1974), Panama (1972 and 1974), Honduras (1974), Venezuela (1972 and 1974), Suriname (1971 and 1974), and French Guiana (1974), which proved indispensable for an understanding of the genus. Thanks to the assistance of many local botanists (see Acknowledgments) I was able to assemble many new data about floral structure, colour of various parts of the inflorescence, and variability. After study of many species in the field, the revision of the genus *Renealmia* was less problematic than the earlier one of *Costus*, which was based on a small amount of field work only. Except for living material, herbarium material from the following herbaria was investigated (herbarium abbreviations according to Index Herbariorum, 1975; herbaria personally visited marked with an asterisk): AAU*, B, BBS*, BM*, BR*, BRI, C*, CAL, CAY*, CGE, COL*, CR*, CUZ, DAV, DUKE, E, EAP*, ECON, F, FI, FLOR, G, GB, GH*, GOET, IAN, IJ*, INPA*, K*, KIEL, L*, LE, LIL, LINN, M, MBM, MG, MICH, MO, MPU, MY*, NA, NY*, OXF, P*, PR, R, RB, S, SP, TRIN*, U*, UC, UCWI*, US*, VALLE*, VEN*, W, WAG*, WIS, and Z.

The present revision dealing with 55 species 22 of which are recently described (Maas 1976) will, I hope, present a solution to many taxonomic problems, but I am aware that in some complex species (like *R. thyrsoides* and *R. petasites*) the problematic situation is only described, but not at all solved. This still remains to be done with the indispensable help of field work.

HISTORICAL SURVEY

The first known description of the genus *Renealmia* is that of Marcgraf in his *Historiae Rerum Naturalium Brasiliae* in 1648. He described and depicted a plant called "*Paco Seroca*;" although I am not entirely sure, I suppose this to be a species related to *R. alpinia* or *R. petasites*.

Around 1700 three Antillean species of *Renealmia* were well described and illustrated by Plumier in an unpublished manuscript (deposited at Paris) under the names *Alpina racemosa alba cannacori foliis*, *Paco Seroca*, and *Paco seroca minor multicaulis*. In 1809 they were adopted and validly published by Jacquin.

Plumier's description of *Alpina racemosa alba cannacori foliis* and his description of *Alpina* (1703) formed the basis of Linnaeus' genus *Alpinia* in 1753, with as type species *A. racemosa*. Later botanists included also many Old World species in *Alpinia*. At present the name *Alpinia* is conserved for the Asiatic species as *Alpinia*

¹Botanical Museum and Herbarium, State University of Utrecht, Utrecht, Netherlands.

Roxburgh (Asiat. Res. 11: 350. 1810), the type species being *Alpinia galanga* (Linnaeus) Willdenow. The neotropical (and African) species are now placed in *Renealmia*, a genus described by Linnaeus filius (1781). The genus name *Renealmia* Linnaeus filius (type species *R. exaltata*) is also conserved against *Renealmia* Linnaeus (Sp. Pl. 286. 1753); the name in Linnaeus the Elder's interpretation belongs to the Bromeliaceae. For further comments on the typification of the genera *Alpinia* and *Renealmia* see Burt & Smith (1972).

In 1775 Aublet gave a very brief, unsatisfactory description of his *Alpinia aromatica*, based on collections from French Guiana. That species, the identity of which is still unknown, has always been incorrectly referred to the present *R. occidentalis*.

A drastic name-change was caused by Rottboell's (1775) *Amomum alpinia*, a species based on plant material collected by Rolander in Suriname. The name *Amomum alpinia* has always been neglected or misapplied. Gagnepain (1902), for example, suggested a relationship with *R. occidentalis*: "Il s'agit évidemment d'une scape radicale aphyllée et le racemo longissimo qui termine donne à la plante tout à fait l'aspect du *Renealmia occidentalis* Griseb." After having studied both Rottboell's description and plate, I am quite convinced that his name is an earlier synonym of *R. exaltata*, the type species of the genus *Renealmia*. Consequently the well-known name *Renealmia exaltata* had to be replaced by the awkward combination *Renealmia alpinia* (Rottboell) Maas.

At the end of the XVIII and beginning of the XIX century some species were described by Ruiz & Pavón (1798), Jacquin (1809), and Poeppig & Endlicher (1838).

A first summary of the species described until then was given by Horaninow (1862) in his *Prodromus Monographiae Scitaminearum*, where he enumerated 11 species.

A much better attempt to revise the genus *Renealmia* was O. G. Petersen's (1890) treatment of the Zingiberaceae in Martius, *Flora Brasiliensis*. He described 17 species, six of which were new.

Gagnepain (1902, 1903) published precise descriptions of a few new species; moreover, in his article of 1903 he made a very careful analysis of the nomenclatural history of *Renealmia antillarum* (the present *R. jamaicensis*) and *Renealmia racemosa* (the present *R. pyramidalis*).

The best taxonomic treatment of the genus *Renealmia* was that of K. Schumann (1904) in his revision of the Zingiberaceae for Engler's *Pflanzenreich*. He divided the genus into two (unnatural) series, *Terminales* and *Scaposae*, subdividing the latter into two subseries, *Racemosae* and *Paniculatae*. Schumann described 39 neotropical species of *Renealmia*, of which 11 names are still valid; of the remaining 28 names, 23 had to be put into synonymy, whereas two names (*R. pycnostachys* and *R. angustifolia*) could not be applied with certainty.

After Schumann's revision the only valuable contributions to the knowledge of the genus *Renealmia* were those of Loesener in Engler & Prantl's *Nat. Pflanzenfam.* ed. 2. (1930) and in some articles in *Notizbl. Bot. Gart. Berl.* (1927, 1931). One of his odd decisions, however, was the establishment of the new subgenus *Gigantalmia* (comprising only one species, *Renealmia nicolaioides*), which he based on vague characters of nectarial glands and anther. In reality *R. nicolaioides* is a close relative of both *R. alpinia* and *R. thyrsoidea*.

After this, the only event in the history of the genus *Renealmia* worth mentioning

is the generally known loss of the collections of Berlin and Vienna during World War II.

MORPHOLOGY

The rhizomes of *Renealmia* are sympodially branched; in most species thick and almost woody in texture, but occasionally quite thin (*R. helenae*). The rhizomes are nearly always subterranean, but in some species (eg, *R. helenae*) they are often supported above the ground on slender stilt-roots. The roots are fleshy and a few millimeters thick.

All New World species of *Renealmia* are terrestrial; rarely plants grow on dead logs. A collection of *R. fragilis* (*Jameson sn*) is labelled as being an epiphyte, but this plant may have been growing on a fallen tree (?).

The leafy stems, formed by closely clasping, very compact, open leaf-sheaths are from 20 cm up to 6 m tall. Plants of most species are from 1-3 m tall, a few, however, lower, never exceeding 1 m in height (eg, *R. monosperma* and *R. helenae*); and some may even reach a height of 6 m (eg, *R. alpinia* and *R. nicolaioides*).

The leaves consist of sheath, ligule, petiole, and lamina.

The structure of the sheaths is rather important for identification. In most species the longitudinal veins are slightly raised, thus causing the sheath to be striate; in other species these raised, longitudinal veins are connected with each other by transverse, raised veinlets, thus forming a reticulate pattern (cf the species name *R. reticulata*). In few species the longitudinal veins are not raised at all; I have called such sheaths smooth (eg *R. alpinia* and *R. lucida*). As the just discussed sheath characters can easily be observed even by unexperienced botanists, and as they are rather constant within the species, they are of great help for identification. The indument of the sheaths (see p. 7) -is composed of very small, erect, thick-walled, brownish hairs, called prickles (0.01-0.1 mm long) and appressed, stiff, needle-like hairs (to 1 mm long). In living specimens the colour of the leaf-sheaths is often green, but they may also be tinged with red-purple (eg *R. urbaniana*). In herbarium material the sheaths in species like *R. floribunda* and *R. guianensis* often show discolorations towards dark-brown.

The ligule is a small, entire or slightly emarginate rim, in most species only 1-2 mm long, in a few species, however, to 14 mm (eg, *R. ligulata* and *R. ferruginea*). In nearly all species the ligule is densely hairy.

It is often difficult to judge if a petiole is present or not. In many species the base of the lamina is gradually decurrent into the sheath and a clear demarcation between lamina and petiole can hardly be observed. In species like *R. sessilifolia*, however, which has a broadly cuneate leaf-base, it is quite evident that a petiole is absent (Fig 50). In other species the petiole may reach a length of 80 (*R. cuatrecasatii* and *R. urbaniana*) and even 125 mm (in *R. nicolaioides*).

The leaves are distichous and the lamina points slightly upward. The basal part of the shoot is covered with leafless sheaths (cathaphylls). The apical leaves are strongly reduced in length as well as in width, and in the descriptions the three upper leaves are not included. The length of the lamina varies from 5 to 150 cm, the width from 1.5 to 25 cm. In outline it is more or less narrowly elliptic; the base is cuneate to attenuate, the apex acuminate to acute, rarely caudate. In nearly all species the leaves are green, only in *R. helenae* and *R. urbaniana* the lower side is tinged with

purple. In various species the primary veins or the space between them are slightly raised, thus giving the lamina a plicate appearance. This can be best observed in the living plant. It is most conspicuous in *R. pluriplicata*. To the unaided eye the leaves (and sheaths) of most species of *Renealmia* appear glabrous, but when observed with a light microscope many (and possibly all) species prove to be hairy. In only a few species the indument characters of the lamina are of importance for identification (eg *R. vallensis* having an indument of stellate hairs on the lower side of the lamina and of simple hairs on the upper side). In *R. concinna* and related species the lower side of the lamina has an indument of compass-needle hairs. For further details see p. 7.

The inflorescence of *Renealmia* is either terminal on the leafy shoot or (usually) terminal on a separate leafless shoot sprouting from the base of the plant. In the case of a basal inflorescence one or even two inflorescences may originate from the base of one leafy shoot. Both characters (terminal on a leafy shoot and terminal on a separate, leafless shoot) are very constant within the species; therefore they are of great importance for identification. The inflorescence consists of a scape the basal part of which is covered with sheaths (cataphylls) and a fertile part, the axis (=rachis) of which is covered with spirally arranged bracts. The axils of the bracts bear 1- to many-flowered cincinni. The following inflorescence types can be distinguished:

1. Thyrses. Cincinni stalked, many-flowered.
 - a. Open thyrses. Cincinni far apart (eg, *R. occidentalis* and *R. floribunda*).
 - b. Congested, spiciform thyrses. Cincinni and bracts densely congested, thus giving the thyrses a spiciform appearance.

Although the two extremes of these types can easily be distinguished, it may be difficult in practice to decide, especially in a young inflorescence, whether the thyrses is congested or not.

2. Raceme. Cincinni 1-flowered (eg, *R. petasites* and *R. thyrsoides*). In *R. alpinia* racemes as well as thyrses occur.
3. Spike. This inflorescence type is only found in *R. cernua*.

The bracts are herbaceous in nearly all species; only in *R. cernua*, *R. densiflora* and *R. dolichocalyx* are they chartaceous to slightly coriaceous. In the last three species the bracts are persistent, in many others long-persistent but eventually deciduous in a third, rather large group of species the bracts are soon deciduous, falling in early anthesis. The colour of the bracts is green, orange, to red, rarely yellow, and in very few species white (eg, *R. pyramidalis*).

In the axil of the bracts there is the basal part of the cincinnus, here called peduncle; its length (measured from the bract to the first bracteole) is of importance for identification.

At the apex of the peduncle a bracteole is situated. Two bracteole types may be distinguished (see Fig 1): 1, tubular bracteole, completely enclosing the part of the cincinnus beyond it, initially closed but ruptured in anthesis. This type is met with in most species; 2, cup-shaped bracteole, open from the beginning. Only found in some racemose species (eg, *R. dermatopetala* and *R. thyrsoides*). In *R. cernua*, the only spiciform species, the bracteole is cup-shaped, and also carinate.

Inside each bracteole there is one pedicel; its length (varying from 1 to 60 mm) may be important for identification.

The characters of the calyx are of the greatest taxonomic importance. Three types occur (Fig 2): 1, tubular calyx; 2, turbinate calyx; 3, urceolate calyx. The tubular and turbinate are the most common calyx types, the urceolate one is en-

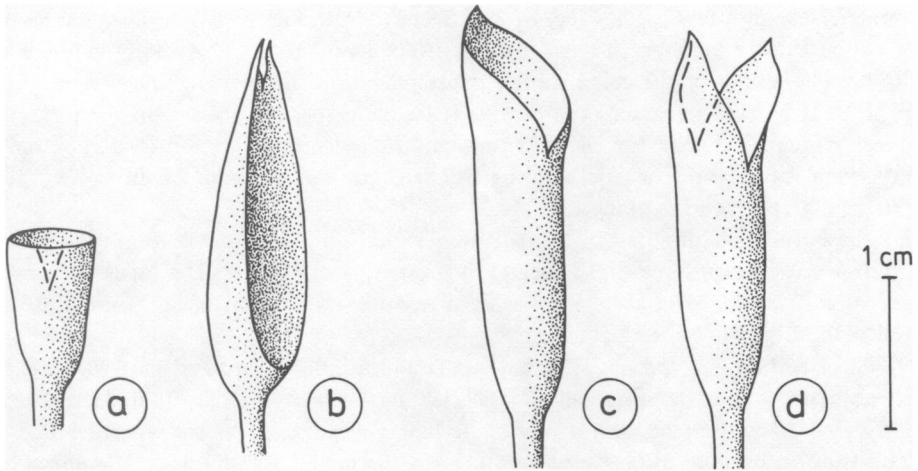


FIG 1. Bracteole types in *Renealmia*. a, truncate bracteole, open from the beginning (*R. thyrsoides* subsp. *thyrsoides*); b, tubular bracteole, deeply split (*R. urbaniana*); c-d, tubular bracteole (*R. alpinia*).

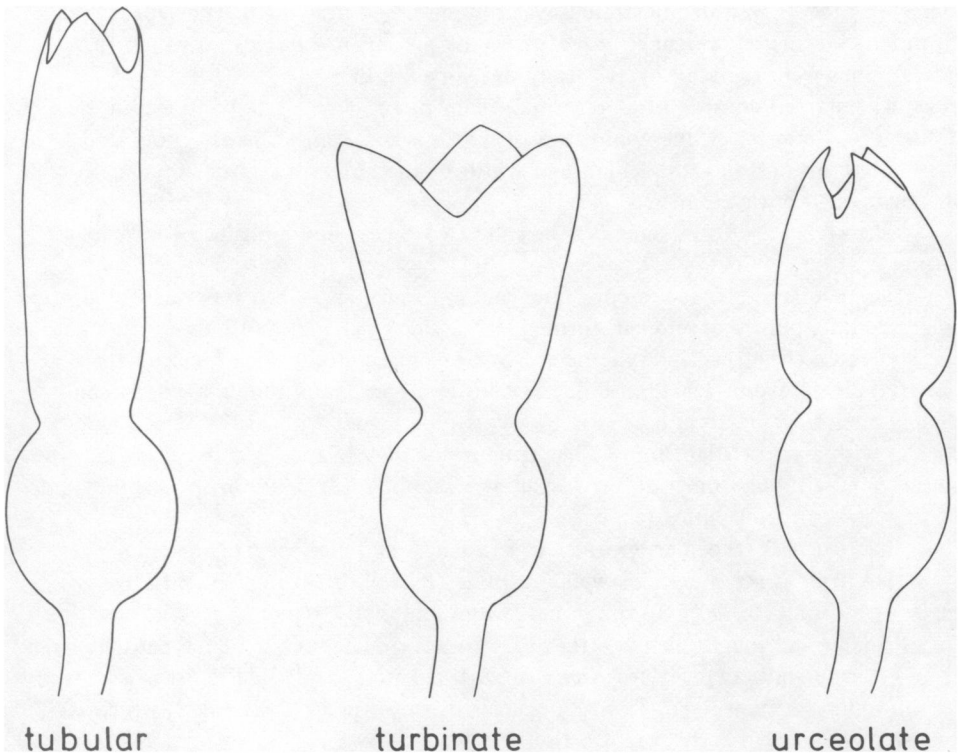


FIG 2. Calyx types in *Renealmia*. a, urceolate calyx (*R. dressleri*); b, turbinate calyx (*R. chalcoclora*); c, tubular calyx (*R. oligosperma*).

countered only in a few species (eg, *R. breviscapa*). Although it is not always clear to which type a calyx belongs, in most cases it offers a very useful character for identification. The length of the calyx, rather constant within the species, can also be of help in identification. The calyx is persistent in many species, but in some it partly and irregularly breaks off with age (*R. mexicana* and *R. guianensis*), and in *R. alpinia* only a very small, basal rim of it is left during fructification. The colour of the calyx varies from green, yellow, orange, to red.

The corolla is composed of a small tubular part and three ovate to elliptic lobes, the dorsal of which is somewhat larger than the two lateral ones. The lobes are contorted in aestivation. The corolla is fleshy in texture, its colour varying from white to red with all possible intergradations.

The labellum is composed of a basal part and a limb. The basal part which is relatively narrow and therefore called basal claw has in many species its inner surface densely covered with erect, simple or furcate hairs; at its base it bears on either side a small filiform outgrowth (1-2 mm long), called the lateral staminodes. The apical part or limb may be erect or horizontally spreading; it is often hairy towards the middle. Its middle part is fleshy, with almost parallel, slightly anastomosing veins and an entire or bilobulate, often reflexed apex. On both sides of this middle part there are two lateral lobes with strongly anastomosing veins forming an angle up to 90° with the veins of the middle lobe. In species with an erect limb the lateral lobes are involute (tubular flower); in those with a spreading limb the lateral lobes spread horizontally. I did not investigate the origin of the labellum, but its derivation from stamens is rather well demonstrated by an unpublished drawing of Gagnepain made from an abnormal flower of *R. goyazensis* (the present *R. alpinia*), in which the lateral lobes were replaced by two fully developed anthers.

The stamen consists of a very small filament (ca 1 mm long) and a dithecic anther (2-13 mm long), the connective of which is sometimes slightly prolonged. In the descriptions only the length and width of the anther are given, the length of the filament is always omitted.

The style is filiform, runs between the two thecae and ends in a cup-shaped stigma.

The nectarial glands are epigynous and 1-4 mm long. Two types can be distinguished: 1, poorly developed, forming a one-sided cylinder and only partly enclosing the style base (Fig 9). This type occurs in all (? insect-pollinated) species with a horizontally spreading labellum limb; 2, well developed, multilobulate glands completely enclosing the style base (Fig 6). This type is met with in (?bird-pollinated) species with a tubular labellum. The structure of these glands is constant within the species, and although they are very small and cannot easily be investigated, they are of importance for classification.

The ovary is trilocular, green, red, to orange, and globose to ellipsoid.

The fruit is a rather thick-walled capsule (its wall 0.2-8 mm thick in living material but only 0.1-1.5(-3) mm in herbarium material). It is tardily dehiscent (loculicidally and longitudinally) from base to apex. The colour of the capsule varies from green, yellow, orange (cf *R. aurantifera*), red, to (purple-)black. It is globose to ellipsoid, 3-40 mm long. In many species it is crowned by the calyx, which is persistent or shed in early fructification.

A very important taxonomic character is the number of seeds, which varies from 1 to 200. In (racemose) species like *R. alpinia* and *R. thyrsoides* there are up to 200

seeds per capsule, in species like *R. vallensis* the number of seeds is reduced, down to 1. The seeds are brownish, ellipsoid to globose, 2-5 mm in diameter. An (often yellowish) hilum is well developed and attached to it is a large, lacerate, white, yellow, or orange, sometimes sweet aril.

In contrast to the genera *Monocostus*, *Dimerocostus*, and *Costus*, the rhizomes, leaves, and floral parts of *Renealmia* are aromatic. The aromatic smell is easily perceived when the leaves are crushed.

INDUMENT

Soon after starting the revision of the genus *Renealmia*, it became evident that the indument was of importance for the classification of the genus. In the past the indument of Zingiberaceae was studied to a greater or lesser extent by Petersen (1893), Schlesinger (1895), Stauderman (1924), Solereder & Meyer (1930), and by Tomlinson (1956, 1969). The most important contribution, however, was that by Olatunji (1972) in his thesis entitled: "Taxonomic studies in the Zingiberaceae with special reference to vegetative characters." He investigated 15 species of *Renealmia*, both neotropical and African. Olatunji has prepared an article on the indument of *Renealmia* which according to plan should have been incorporated in this revision, but for reasons unknown to me he never sent me the manuscript.

The student J. Meys and I studied the indument of all neotropical species of *Renealmia*. We mainly concentrated, however, on the rhachis, leaf-sheaths, and lamina, as these three parts showed the most interesting hair-covering. The structure of the hairs was studied with the aid of the following microscope types: 1, Stereozoom dissecting microscope; 2, compound microscope; 3, scanning electron microscope.

All hairs in the genus *Renealmia* are unicellular; the following main types can be distinguished:

A. Thick-walled hairs.

1. Prickles. Erect, brownish, sharply pointed (or sometimes blunt), breaking off easily, base subepidermal, 0.01-0.1 mm long. They occur on the leaf-sheaths of nearly all species, and are rarely found on other parts. The prickles types fall in the following four categories:
 - a. Simple prickles (Fig 3c, 4a)
 - b. Furcate prickles (Fig 3i).
 - c. Stellate/plurifurcate prickles (Fig 3p, s, 4b). As it is not certain whether this type is of furcate or stellate origin, and because they superficially look stellate, I have called them stellate prickles in the descriptions.
 - d. Stellate, amoeboid scales (Fig 3t, u). They represent a compressed form of a stellate prickles and they have more or less the shape of an amoeba. They occur on the flattened margins of the leaf-sheaths (eg, *R. helenae*).

Prickles are not of any importance for specific delimitation, as they occur in nearly all species of *Renealmia*. Besides, types a, b, and c often occur in one and the same species, and even on one and the same plant! They are, however, an important generic character. According to Olatunji prickles have a rather limited distribution in the Zingiberaceae; he observed them in only a few species of the genera *Aframomum*, *Alpinia*, *Cautleya*, *Cenolophon*, *Hornstedtia*, and *Riedelia*.

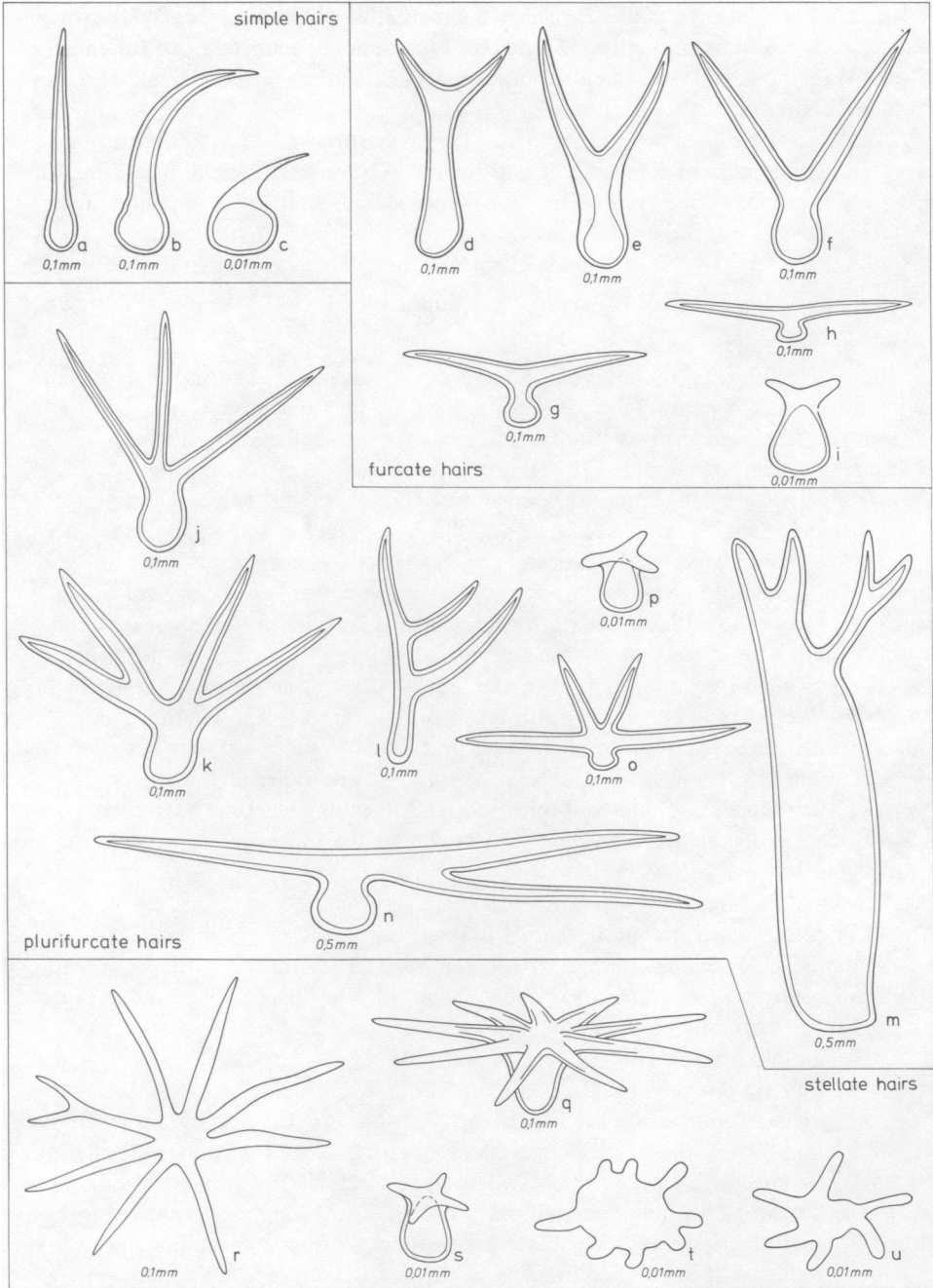


FIG 3. Hair types in *Renealmia*.

2. Needle-like (or acicular) hairs. Appressed, often brownish, easily breaking off, 0.1-1 mm long. This hair type is commonly found on the leaf-sheaths (particularly on the cross-connecting veins) and towards the ligule and the leaf-base.

B. Thin-walled hairs.

1. Simple hairs (Fig 3a, b). Mostly erect, more or less flexible, base relatively small, 0.1-1 mm long. This hair type is common on the lower side of the lamina (particularly the midrib region) and on the rhachis.
2. Furcate hairs. As the preceding type, but branched once and mostly shorter (rarely to 0.5 mm long). Branching may take place in the apical part (Fig 3d), at the middle (Fig 3e, f), or in the basal part (Fig 3g, h, 4d). A furcate hair with a basal branching is called a sessile, furcate hair in the descriptions. A modification of the latter is the compass-needle (or malpighioid) hair (0.1-0.5 mm wide) in which the basal branches are completely deflexed and run parallel to the leaf surface (Fig 3g, h, 4d). When seen from above they look exactly like a compass-needle. They have a very limited distribution in the genus and occur in a few species only. They can best be observed on the lower side of the lamina where they all have the same orientation, namely perpendicular to the midrib; this orientation may be functional and serve for water-storage. These compass-needle hairs closely resemble the branched/stellate hairs of *Rhynchanthus beesianus* as illustrated by Olatunji (Fig 14k-1).
3. Plurifurcate hairs (Fig 3j-1, n, o, 4c). As the preceding type, but with one or more extra furcations. This type is less common than type 2. An aberrant form is the inflated, plurifurcate hair found in *R. fragilis* only. These hairs, occurring on the rhachis and the leaf-sheaths, together with other hair types (Fig 3m, 4e), are white, compressed, strongly inflated, often irregularly and repeatedly branched, and rather long (to 0.5 mm).
4. Stellate hairs, composed of a short, basal stalk, with several apical branches (Fig 3q, r, 4f). They are often confused with plurifurcate hairs (as in *R. stellulata* which has an indument of plurifurcate and furcate hairs, but which lacks true stellate hairs). The only species having this hair type is *R. vallisensis*, where these hairs form a thick indument on the lower side of the lamina.

POLLEN MORPHOLOGY

In 1972 an investigation of the pollen grains of *Renealmia* was carried out by the student W. A. P. van Oostrum (supervised by Dr. W. Punt). He planned to continue the pollen-studies for a number of months, but as the first results were not encouraging, the investigation was discontinued after a few days.

Van Oostrum treated pollen grains of *R. alpinia* (*A. C. Smith 3184* (S) from Guyana) with the acetolysis method of Erdtman (1960). However, during this treatment the protoplasm as well as the pollen wall were completely dissolved. Better results were obtained by boiling the pollen in water and staining with saffranine.

The pollen grains are more or less regularly globose, their size (in *R. alpinia*) varies from 45-60 μ . They consist of protoplasm (stainable with saffranine) surrounded by a hyaline layer (not stainable with saffranine). This layer does not show any structure; its thickness varies from 5-25 μ .

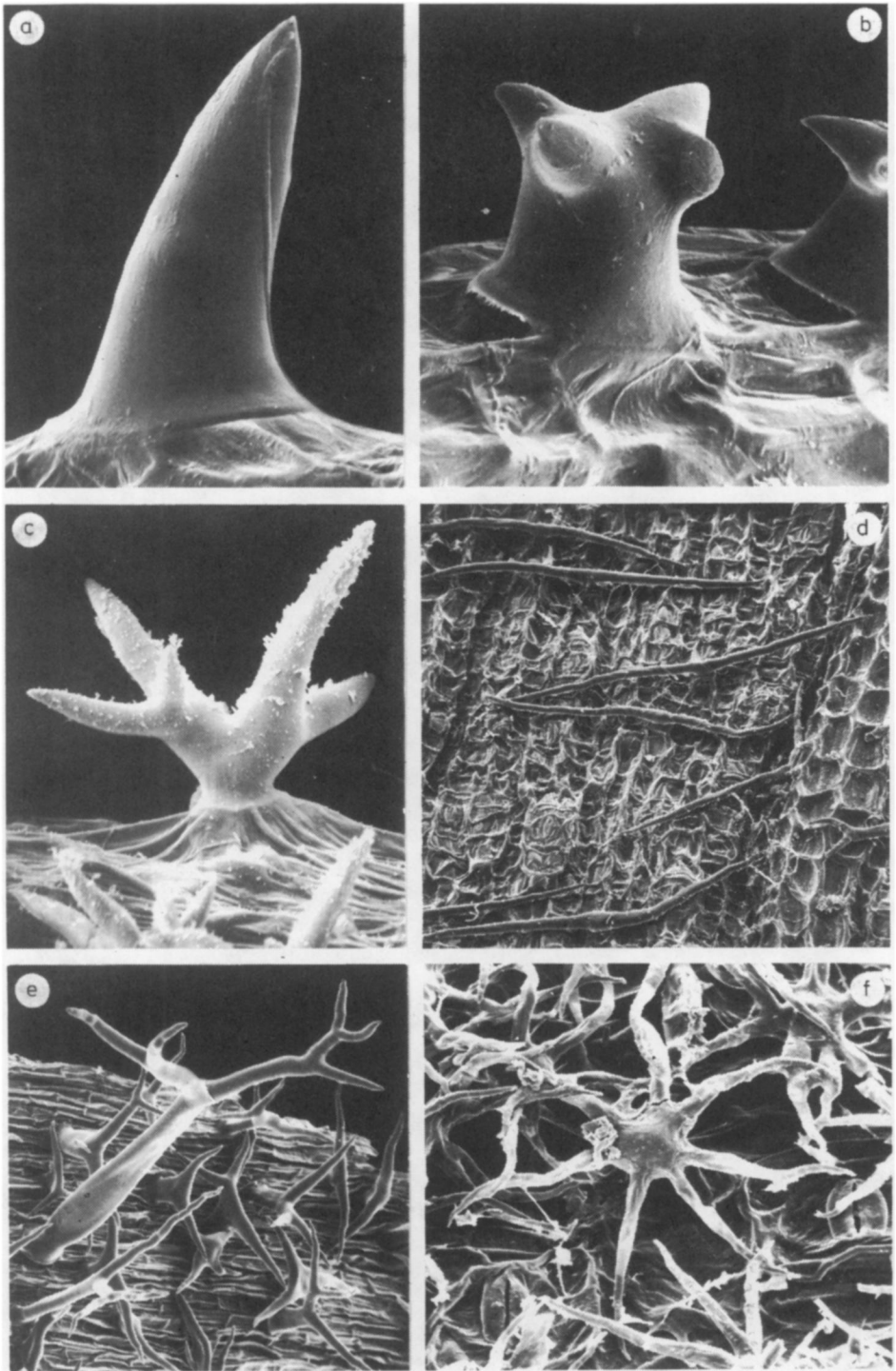


FIG 4. Hair types in *Renealmia*, S. E. M. photographs (a-b, *R. floribunda*, Prance et al 1518; 1000 X; c, *R. racemosa*, Bang 1658; 700 X; d, *R. concinna*, Terry & Terry 1449; 200 X; e, *R. fragilis*, Bristol 417; 200 X; f, *R. vallisensis*, Cuatrecasas 14044; 500 X). a, simple prickly; b, stellate prickly; c, plurifurcate hair; d, compassneedle hair; e, various types of furcate hairs, the largest hair somewhat inflated; f, stellate hair.

CYTOLOGY

Before this revision hardly anything was known about the chromosome numbers of *Renecalmia*. Only three African species had been investigated, by S. & G. Mangenot (1962) and Gadella (1972). In the present revision the chromosome numbers of 11 neotropical and 2 African species are reported. All counts were carried out in close collaboration with Dr. E. Kliphuis.

The chromosome counts were made from root-tip mitoses; the root-tips were taken from seedlings cultivated in the botanical garden "Sandwijck," fixed in Carnoy with pre-treatment of Para-dichlorobenzene (during 1½ hour at room temperature), squashed, and stained according to the Feulgen method.

The results are summarized in Table I. For the vouchers of the neotropical species see the taxonomic part under the species concerned.

Table I

Previous and present records of chromosome numbers in *Renecalmia*

Species		Author
<i>Renecalmia alpinia</i> (Plowman et al 4361 & 4456)	44	Kliphuis & Maas
<i>R. breviscapa</i> (Plowman & Davis 5013)	44	Kliphuis & Maas
<i>R. caucana</i> (Maas & Plowman 2153)	44	Kliphuis & Maas
<i>R. guianensis</i> (Maas et al 2317)	44	Kliphuis & Maas
<i>R. ligulata</i> (Maas 1500)	44	Kliphuis & Maas
<i>R. nicolaioides</i> (Plowman 4367 and Maas & Badillo 2170)	22, 44	Kliphuis & Maas
<i>R. occidentalis</i> var <i>occidentalis</i> (Plowman 4296)	44	Kliphuis & Maas
<i>R. pallida</i> (Plowman & Davis 5046)	44	Kliphuis & Maas
<i>R. puberula</i> (Plowman & Davis 4484)	22	Kliphuis & Maas
<i>R. scaposa</i> (Maas 1332)	44	Kliphuis & Maas
<i>R. thyrsoides</i> subsp <i>thyrsoides</i> (Plowman & Davis 4473)	44	Kliphuis & Maas
African species:		
<i>R. africana</i>	44	Gadella (1972)
<i>R. battenbergiana</i>	44	S. & G. Mangenot (1962)
<i>R. maculata</i>	44	S. & G. Mangenot (1962)
<i>R. polypus</i> (Breteler 1571)	44	Kliphuis & Maas

As is evident from these data the basic chromosome number of *Renecalmia* is 11. Most species are tetraploid, only two species having a diploid chromosome number.

POLLINATION AND DISPERSAL

Within the genus *Renecalmia* two main floral types may be distinguished, the characters of which are given below:

	TUBULAR FLOWER	EXPOSED FLOWER
1. Anthesis	Diurnal	Diurnal
2. Inflorescence	Racemose (rarely thyrsoid)	Thyrsoid
3. Bracts	Reddish	Generally green
4. Labellum	Tubular	Base tubular, limb horizontally spreading
a. Colour	One-coloured, yellow, (white or pink)	Basic colour white to yellow, lateral lobes often purplish-veined, middle lobe yellow in the centre
b. Middle lobe	Entire	Bilobulate
c. Texture	Relatively firm and fleshy	Rather delicate
d. Callosed zone	Absent	Often two slightly raised, callose lines in the middle lobe, running towards the bilobulate apex

	TUBULAR FLOWER	EXPOSED FLOWER
5. Anther	Mostly yellow	Often purplish-red
6. Nectarial glands	Pronouncedly developed	Faintly developed
7. Species	<i>R. acreana</i> , <i>R. alpinia</i> , <i>R. brasiliensis</i> , <i>R. cernua</i> , <i>R. chrysotricha</i> , <i>R. densiflora</i> , <i>R. dermatopetala</i> , <i>R. fragilis</i> (?), <i>R. nicolaioides</i> , <i>R. petasites</i> , <i>R. reticulata</i> , <i>R. thyrsoides</i> , <i>R. sylvestris</i> , <i>R. species B</i>	<i>R. concinna</i> , <i>R. congesta</i> , <i>R. costaricensis</i> , <i>R. floribunda</i> , <i>R. guianensis</i> , <i>R. helenae</i> , <i>R. matogrossensis</i> , <i>R. mexicana</i> , <i>R. monosperma</i> , <i>R. orinocensis</i> , <i>R. pyramidalis</i> (?), <i>R. racemosa</i> , and <i>R. urbaniana</i>

The characters of the tubular flower type, as listed above, show a strong resemblance to those given by Dodson & van der Pijl (1966) for orchidaceous hummingbird flowers. Particularly the racemose inflorescence, the tubular, relatively firm flowers, and the well-developed nectarial glands are a strong indication for its adaptation to hummingbird pollination. After I had written this paragraph, my suppositions were confirmed by Dr. F. Gary Stiles (personal communication), who found that the flowers of both *R. cernua* and *R. alpinia* are visited and pollinated by hummingbirds:

	Pollinator	Country
<i>R. alpinia</i>	<i>Amazilia tzacatl</i> <i>Amazilia amabilis</i> <i>Phaethornis longemareus</i> and at least 4 other hummingbird species	Costa Rica, La Selva Costa Rica, La Selva Costa Rica, La Selva Costa Rica, La Selva
<i>R. cernua</i>	<i>Phaethornis longuemareus</i> female <i>Thalurania furcata</i>	Costa Rica, La Selva Costa Rica, La Selva

In the second floral type, where the labellum is composed of a tube and a horizontally spreading limb, good conditions are found for insect-pollination, probably for bee-pollination. Here the horizontally spreading part of the labellum apparently serves as a landing platform for insects. Other adaptations to visiting insects are the various nectar guides: the purplish-veined lateral lobes of the labellum, the purple-red anther, and the callose zone on the middle lobe of the labellum. Besides, the nectarial glands are only faintly developed and the colour of the bracts is less vivid (mostly greenish). There are no observations to confirm insect-pollination. Stiles (personal communication) observed at La Selva a species of *Renealmia* with "dark red inflorescence and pale yellow flowers" (possibly *R. pluriplicata*) and suggests: "I think it is pollinated by the hummingbirds, at least in part; Euglossine bees are other probable pollinators I have observed."

As shown by this discussion the subject of pollination has until now been much neglected, and it is hoped that future field workers will communicate all observed data in this very important field.

The fruit of *Renealmia* is an aromatic, tardily dehiscent, more or less fleshy capsule. In living material the thickness of its wall varies from 0.2 to 8 mm, in herbarium material from 0.1 to 1.5(-3) mm. The thickest fruit wall is met with in racemose species like *R. thyrsoides* and *R. nicolaioides*; thin-walled fruits are frequent in thyrsoid species. According to Stiles the fruits of *Renealmia* are dispersed chiefly by birds: caciques, grosbeaks, tanagers, manakins and flycatchers. They may be attracted by the shining, mostly red to black wall and the orange or red-coloured aril, which is so often present in the genus. In few species the aril is white; rarely it is sweet and tasty. The fruit

may be attractive to ground inhabiting animals, as the old infructescence is very often prostrate, partly covered by leaves and soil. Some vernacular names might give an indication on the dispersal:

Fruto de mono (Colombia), suggesting that the fruit is eaten by monkeys;
Comida de veado (Brazil), may be eaten by deer; Tamay de puerco (Mexico), possibly eaten by wild pigs.

SUBDIVISION OF THE GENUS

Schumann (1904) divided the genus *Renealmia* as follows:

Series *Terminales*

Series *Scaposae*

Subseries *Paniculatae* (as "*Panniculatae*")

Subseries *Racemosae*

The same division into series and subseries was followed by Loesener (1930), but he split the genus into two subgenera, *Eunealmia* and *Gigantalmia*; the latter cannot be maintained as it was based on a misinterpretation of *R. nicolaioides* (see under that species).

The Series *Terminales* is a very artificial one and must be rejected; it includes all species with a terminal inflorescence, but most species sharing that character are not at all related to each other, eg *R. sessilifolia*, *R. jalapensis* (the present *R. mexicana*), and *R. cernua*. The subdivision of the Series *Scaposae* into the Subseries *Paniculatae* and *Racemosae* is more natural. According to my opinion, however, this series can be more accurately subdivided, as demonstrated below. I have avoided the use of terms like section and series, and preferred the term group. Within a few years, when I hope to have studied all species in detail, a more natural subdivision of the genus can perhaps be given.

I. *Renealmia cernua* group

Inflorescence a terminal spike or spiciform raceme; bracts coriaceous to chartaceous; bracteole laterally keeled; labellum with an erect, tubular limb; nectarial glands multilobulate, completely enclosing the style-base; fruit thin-walled; number of seeds 8-30. Mexico, Central America, Hispaniola (Haiti), and western South America.

Species: *R. cernua* and *R. densiflora*.

II. *Renealmia alpinia* group

Inflorescence a basal raceme or thyrses; bracts herbaceous; bracteole never laterally keeled; labellum with an erect, tubular limb; nectarial glands multilobulate, completely enclosing the style-base; fruit generally thick-walled; number of seeds 5-200.

A. *Renealmia alpinia* subgroup

Inflorescence a raceme (in *R. alpinia* sometimes a thyrses); bracteole initially closed. Throughout the Neotropics.

Species: *R. alpinia*, *R. species B*, *R. petasites*, *R. chrysotrichia*, *R. brasiliensis*, and *R. reticulata*.

B. *Renealmia thyrsoides* subgroup

Inflorescence a raceme; bracteole open from the onset. Jamaica, Central America, western South America, western Amazonia, Guianas, and central Brazil.

Species: *R. dermatopetala*, *R. pallida*, *R. sylvestris*, *R. thyrsoides*.

C. *Renealmia ligulata* subgroup

Inflorescence a thyrses, bracteole initially closed. Western South America to Costa Rica.

Species: *R. lucida*, *R. ligulata*, *R. ferruginea*, *R. caucana*, *R. scaposa*, *R. wurdackii*, and *R. nicolaioides*.

III. *Renealmia acreana* group

Inflorescence mostly a basal raceme; bracts herbaceous; bracteole never laterally keeled; labellum with an erect, tubular limb; nectarial glands multilobulate, completely enclosing the style base; fruit thin-walled; number of seeds 8-13(-40?).

Species: *R. acreana*, *R. krukovii*, *R. fragilis*, *R. urbaniana*, and *R. erythrocarpa*.

IV. *Renealmia occidentalis* group

Inflorescence a basal or terminal thyrses; bracts herbaceous; bracteole never laterally keeled; labellum with a horizontally spreading limb; nectarial glands only partly enclosing the style base; fruit thin-walled; number of seeds 1-30 (in *R. cuatrecasii* 60-100).

A. *Renealmia occidentalis* subgroup

Inflorescence an open thyrses; calyx tubular to turbinate; number of seeds 1-30-(100). Neotropic-wide.

Species: *R. mexicana*, *R. racemosa*, *R. occidentalis*, *R. floribunda*, *R. guianensis*, *R. monosperma*, *R. matogrossensis*, *R. orinocensis*, and *R. cuatrecasii*.

B. *Renealmia breviscapa* subgroup

Inflorescence a congested or open thyrses; calyx urceolate, tubular, or turbinate; number of seeds 1-10. Central America and western South America.

Species: *R. asplundii*, *R. pluriplicata*, *R. species A*, *R. vallensis*, *R. costaricensis*, *R. breviscapa*, *R. concinna*, *R. congesta*, *R. helenae*, *R. dressleri*, *R. chiriquina*, and *R. puberula*.

C. *Renealmia chalconchlorella* subgroup

Inflorescence an open or congested thyrses; calyx tubular to turbinate; number of seeds 2-12. Andean regions of western South America.

Species: *R. chalconchlorella*, *R. alticola*, *R. sessilifolia*, *R. dolichocalyx*, *R. oligosperma*, *R. aurantifera*, *R. stellulata*, and *R. oligotricha*.

Two Antillean endemics, *R. jamaicensis* and *R. pyramidalis* do not completely fit into any one of these groups. They are certainly related to group II, sharing the structure of their nectarial glands, but they show also some relationship to group IV A, with a similar labellum structure.

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY

Renealmia is a genus of ca 75 species, ca 25 of which inhabit tropical Africa and ca 55 the Neotropics. In the New World the genus is distributed from northern Mexico (to ca 22°N lat), Cuba, and the Bahamas in the North to Bolivia and Southern Brazil (to ca 30°S lat) in the South.

The species of *Renealmia* are nearly all confined to forests: lowland rain forest, montane rain forest, gallery forest (*R. dermatopetala*), várzea forest (*R. urbaniana*), fresh-water swamp forest, or secondary forest. In the forests they often grow in clearings or along streams; some species are also very common along large rivers (*R. cernua*, *R. thyrsoidea* subsp. *thyrsoidea*) where they occur together with other large-

leaved Zingiberales like *Costus* spp, *Heliconia* spp, and *Calathea* spp (cf Maas (1972), p 14).

The altitudinal range of *Renealmia* extends from sea-level up to 2500 m; two species are recorded from still higher elevations: the Colombian *R. ferruginea* from 2400-2700 m and another Colombian species, *R. alticola*, from 2600 m up to 3000 m! Most species are confined to altitudes below 1500 m (ca 40 species), only 13 species occur between 1500 and 3000 m. This number of 13 species is still high when compared with the number of 2 species of Costoideae recorded from that altitude (*Dimerocostus argenteus* and *Costus montanus*). The specific altitudinal range is rather variable: generally it extends from 0-1000 m, but in some exceptional cases it may even exceed 1000 m and reach 1500 m (*R. jamaicensis*, *R. mexicana*, *R. occidentalis*, *R. thyrsoides*).

Unlike *Costus*, *Renealmia* does not occur in Paraguay and Argentina. A distribution map for *Renealmia* (Fig 5) has been compiled in the same way as that of *Costus* (Maas 1972, p 14); thus the area was divided into squares of ca 40 000 km² and the number of species collected in each square counted and marked on the map by as many dots. In *Renealmia* there is one large distribution centre, extending from Costa Rica in the North, through Panama and western Colombia to Ecuador in the South. Apart from this main distribution centre, 11 other distribution types could be distinguished:

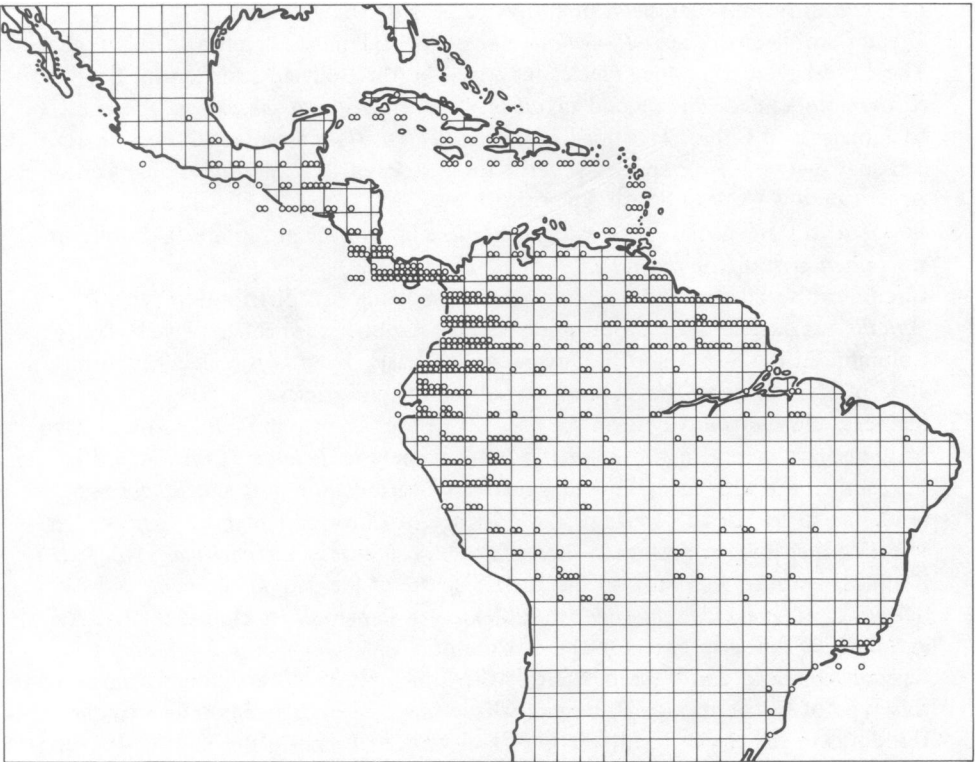


FIG 5. Distribution of *Renealmia* in the New World.

DISTRIBUTION TYPES OF RENEALMIA

	number of species, varieties, and subspecies
1. Neotropic-wide	1
2. Greater Antillean	3
3. Lesser Antillean	2
4. Circum-caribbean	1
5. Mexican and Central American	8
6. Central American and western South American	6
7. Western South American	21
a. Andean	16
b. Lowland	6
8. Guianan	3
9. Guianan and Amazonian	2
10. Western Amazonian	3
11. Bolivian and Central Brazilian	2
12. Southeastern Brazilian	4

1. Neotropic-wide species. The only species of this group, *R. alpinia*, has its centre of distribution in Central America, South America, and the Lesser Antilles; its range extends from Mexico in the North to Southeastern Brazil and Northern Peru in the South. It is rather peculiar that *R. alpinia* is common in the Lesser Antilles and Puerto Rico, but that no collections are known from Hispaniola, Cuba, or Jamaica. The distribution pattern of this species may not be a natural one, because it has long been in cultivation for its spicy fruit.
2. Greater Antillean species. *Renalmia sylvestris* of Jamaica belongs to this type. The closest relative of that species may well be the Bolivian and Central Brazilian *R. dermatopetala!* The second taxon is *R. jamaicensis* var *jamaicensis*, restricted to Jamaica and Cuba. The third species is *R. densiflora* from south-western Haiti. This narrowly endemic species is very closely related to *R. cernua* of the Central American and Western South American type.
3. Lesser Antillean species. The two taxa belonging to this group are *R. jamaicensis* var *puberula* and *R. pyramidalis*.
4. Circum-caribbean species. The only species showing this distribution type, *R. occidentalis* var *occidentalis*, is not purely circum-caribbean, since its range extends to Colombia in the South and to Guyana in the East. Even two collections from the state of Mato Grosso, Brazil, seem to belong to this species.
5. Mexican and Central American species. Eight species belong to this group. Two of them have a very restricted distribution, namely *R. helena* (Cerro Jefe, Panama: in cloud forest with many endemic species of various families) and *R. chiriquina* (endemic to the cloud forests of the province of Chiriquí, Panama). Another interesting distribution pattern is shown by *R. occidentalis* var *pacifica*. This variety is almost entirely restricted to the Pacific coasts of Mexico, Guatemala, and El Salvador. *R. mexicana* extends from Mexico to Panama. Its closest relative *R. asplundii*, is found in Ecuador and S. Colombia.
6. Central American and Western South American species. A very good example of this type of distribution is *R. cernua* whose range extends from (?Mexico) and Honduras in the North to Middle Peru and western Brazil in the South. In Venezuela this species is restricted to the north-western parts. It is quite puzzling that *R. cernua* seems to occur in Suriname; the two collections from that country are

the type collections of *R. cernua* and *Maranta strobilifera*, respectively. It is quite possible that this range extension is only caused by mislabelling! (see p. 49). *Renealmia thyrsoidea* subsp. *thyrsoidea*, part of the most complicated species of the whole genus, has its main centre of distribution in the Andes but extends to Costa Rica. In the lowlands of the western Amazon Basin, however, the species also occurs, but the forms found there may merit specific or subspecific rank. A satisfactory resolution of this taxonomic problem cannot be given in the present revision.

7. Western South American species.
 - a. Andean species. This is by far the largest group in the genus; it includes 16 species.
 - b. Lowland species. Six species belong to this group. *Renealmia breviscapa* has a rather large distribution, ranging from Colombia in the North to Central Bolivia in the South; it extends also to Acre and Mato Grosso, Brazil.
8. Guianan species. A group including only 3 species. *Renealmia guianensis* has its distribution centre in the Guianas, but it is also known by two collections from Pernambuco and Bahia, Brazil.
9. Guianan and Amazonian species. Two common species, *R. floribunda* and *R. monosperma*, belong to this category. The range of *R. monosperma* even extends to Panama (province of Darién).
10. Western Amazonian species. As in group 8 and 9, this type is very poor in species, only represented by *R. acreana*, *R. krukovii*, and *R. urbaniana*.
11. Bolivian and Central Brazilian species. This group includes *R. matogrossensis*, a vicariant of *R. monosperma* (Guianan and Amazonian), and *R. dermatopetala*, occurring in Central Brazil and Eastern Bolivia.
12. Southeastern Brazilian species. Four species belonging to this group are all closely related to the Neotropic-wide *R. alpinia*.

CULTIVATION AND CONSERVATION

Species of *Renealmia* are mostly confined to primary rain forest, between sea level and ca 2500 m, in contrast to the Costoideae which often inhabit secondary forest at low elevations, very rarely over 1500 m. The primary forests of the Neotropics, the lowland forest as well as the montane forest, are being more and more rapidly destroyed and therefore it is absolutely necessary to establish forest reserves in all countries (as is done in Suriname). I should advise every plant taxonomist dealing with the Flora Neotropica to summarize all species (of his group) which are in danger of extinction. Subsequently all these data can be collated by local botanists and may encourage foundation of forest reserves in those regions where many endemic species occur.

In the following table all endangered regions where rare species of *Renealmia* occur are summarized. In some cases a rare species may prove not to be rare, but only poorly collected. Species marked with an asterisk are already under cultivation at the botanical garden "Sandwijck" of the State University of Utrecht.

CENTRAL AMERICA

- R. chiriquina*: A species restricted to the cloud forests of the prov. of Chiriquí, (1800-2200 m).
- R. helenae*: Confined to the Cerro Jefe Region, prov. Panamá, Panama, where many endemic species occur. The forests around the Cerro Jefe have already been badly destroyed during the last years.

HAITI

R. densiflora: this extremely rare species has only twice been collected near Morne de la Hotte.

JAMAICA

R. sylvestris: not in danger of extinction yet, but as it is one of the few endemic species from the West Indies it is worthwhile keeping it in cultivation.

COLOMBIA

R. alticola: only once collected near Las Vegas, Santander; no other species of *Renealmia* occurs at so high an elevation (2600-3000 m).

R. caucana: only known from Cauca, 2100 m. Locally rare.

R. chalcoclora: although this species has been collected several times in the past in Cundinamarca and Boyacá (between 1800 and 2400 m), now it seems to be rare. I looked myself several days, in vain, for this species.

*R. ferruginea**: known from only two collections in Cauca and Antioquia (between 2400 and 2700 m).

VENEZUELA

*R. species B**: occurs in Aragua, near Choroni, 1550 m (the collection *Maas & Badillo 2171* which should have served as type was lost during the airmail transport from Venezuela to Utrecht!).

BRAZIL

R. brasiliensis, *R. chrysotricha*, and *R. reticulata*: all known by very few collections from SE Brazil (Espírito Santo, Minas Gerais, Guanabara).

R. pycnostachys: Only known from the type collection (*Schwacke 11952*, Serra Pedra Bonita, Rio Novo, Minas Gerais). Extinct?

ECUADOR

R. oligotricha and *R. dolichocalyx*: Both collected in the montane forests of the province of Pichincha (apparently rare).

PERU

R. pallida: Only one collection from prov. Manu, dep. Madre de Dios.

R. wurdackii: Twice collected in the montane forests of the departments Ayacucho and Amazonas (between 2000 and 2400 m).

USE AND VERNACULAR NAMES

According to the annotations on the field labels different parts of *Renealmia* plants are used by natives for various purposes:

1. Leaf. Extracts of the leaves are used as a remedy for different fevers (pulmonary complaints, typhoid) and against snake-bites (according to *Plowman 2058*, *R. nicolaioides* from Colombia). The way of preparing these extracts is described by Stern (*Stern et al 87* from Panama) and *A. C. Smith (2838, Guyana)*: The leaves or the whole plant are boiled in water and the boiled mixture is used for a bath against

fevers. According to *Steyermark* (55807 and 61409 from Venezuela) dry leaves are applied by the Indians to painful places.

A rather amusing use is that of the Chocó Indians, as described by *Duke* (8388 from Panama), who use the leaves as an underarm-deodorant!

2. Fruit. Extracts of the fruit-wall of species like *R. alpinia*, *R. nicolaioides*, and *R. thyrsoides* (which all have a thick, fleshy, often purple-black fruit wall) are often used by native people for preparing ink. This use is clearly understandable because the same effect is produced when fruits of *R. alpinia* are dried: when dry plants are taken out of the press, the newspaper around the fruit is completely stained purplish-black.
3. Seeds and arils. The parts of the plants most commonly used are the seeds and their aril. Aril extracts of *R. alpinia* and *R. thyrsoides* subsp *thyrsoides* are mixed with rice-meals or can be added to soup, imparting to both a pleasant flavour. In Suriname seeds of *R. alpinia* are used for preparing an oil which can be used for frying. According to *Fernández* (311 from Venezuela), seed extracts produce an oil which is a good remedy against sickness. Toasted and mashed seeds of *R. thyrsoides* subsp *thyrsoides*, taken in coffee, serve for curing chills and cold, or helping childbirth (*Steyermark* 55807 from Venezuela).

The vernacular names do not seem to be specific, but only generic; and some names are even used for other genera. For example, the names Achira and Caete are also used for species of *Canna*, the name Cañagria is the common name for species of *Costus*, whereas the name Platanillo is mostly applied to representatives of the genus *Heliconia*. In the Table II the local names used in the different parts of the Neotropics are given.

Table II

Vernacular names for *Renealmia* spp

Achira (Colombia, Peru)	Hadira (Colombia)
Alegritto (West Indies)	Hoja de anguilla (West Indies)
A-marma-yek (Venezuela)	Hoja de mona (Colombia)
Arnica (Mexico)	Hoja huehuchucha (Central America)
Assafrão brabo (Brazil)	Ho-tee-á (Colombia)
A-yetsa (Guyana)	Huasmole (Mexico)
Azucena (West Indies)	Huele mole commarón (Mexico)
Bijao (West Indies)	Ishusme (Central America)
Bosmasoesa (Suriname)	Istri (Venezuela)
Caete (Brazil)	Jazmin de monte (Central America)
Calamus (Peru)	Junjambre (West Indies)
Cañagria (Central America)	Koru-wati, Krowatti, Kurawatti,
Cañagria chica (Colombia)	Kuquatti (Guyana)
Cañagria cimmarona (Colombia)	Kumpia (Peru)
Cañuela (Colombia)	Lavande rouge (West Indies)
Chihuango (Peru)	Lavanne (West Indies)
Chilalaga (Mexico)	Mangurataia braba (Brazil)
Chipiri sarandánk'o (Ecuador)	Masoesa (Suriname, French Guiana)
Chisgua (Colombia)	Matandrea (Colombia)
Ciáy (Peru)	Ma-woo (Costa Rica)
Coan (Ecuador)	Mil Peso Hadira (Colombia)
Coité (Brazil)	Mishqui-panga (Peru)
Cojaté (West Indies)	Moghog kionog (Mexico)
Colonia cimmarona (West Indies)	Munchi (Venezuela)
Comida de veado (Brazil)	Murrapo or Murrapa (Colombia)
Conopia (Venezuela)	Narciso (West Indies)
Cono-wara (Venezuela)	Patúkû ocre (Bolivia)

Cujatillo (West Indies)	Peniyoka (Colombia)
Curuwati (Guyana)	Pidohaus (Central America)
Djindji masoesa (Suriname, French Guiana)	Platanillo (Central America, Colombia, Peru)
Essopiabil (Central America)	San Juan (Ecuador)
Fruto de mono (Colombia)	San Juanito (Colombia)
Gengibre cimmaron (West Indies)	Sarandank'o (Ecuador)
Gingembre (grand) bois (West Indies)	Siringdango (Colombia)
Gingembre marron (West Indies)	Tamay de puerco (Mexico)
Gingembre sauvage (French Guiana)	Uchi chiag or Uči člay (Peru)
Gingibre braba (Brazil)	Vindeca, Vindecáa, Vindeca (Brazil)
Gingibrillo (West Indies)	Wana-xedi (Venezuela)
Gingiflón (Central America)	Wild ginger (West Indies)
Grand gingembre (West Indies)	Wild banana (West Indies)
Guilimul or Guirimul (Mexico)	Wuek-mote (Mexico)
	Ya-dua-dua (Mexico)

TERMINOLOGY

A few notes have to be made on some technical details of the specific descriptions and citations.

For terms applying to shape and form I have followed the terminology recommended in Taxon 11: 145-156. 1962.

Many floral measurements had unfortunately to be taken from herbarium material, but of the following 29 species pickled flowers and fruit were investigated: *R. acreana*, *R. alpinia*, *R. aurantifera*, *R. caucana*, *R. cernua*, *R. concinna*, *R. congesta*, *R. costaricensis*, *R. cuatrecasasii*, *R. dolichocalyx*, *R. dressleri*, *R. ferruginea*, *R. flori-bunda*, *R. guianensis*, *R. ligulata*, *R. mexicana*, *R. monosperma*, *R. nicolaioides*, *R. occidentalis*, *R. oligosperma*, *R. orinocensis*, *R. pallida*, *R. petasites*, *R. pluriplicata*, *R. puberula*, *R. racemosa*, *R. scaposa*, *R. thyrsoides*, and *R. urbaniana*. This implies that especially the labellum structure of all species of which only (poorly preserved) dried material was studied is still insufficiently known.

The indument of the inflorescence (except labellum and anther) of each species is always given in the middle of the specific description. As the indument on most floral parts is at least qualitatively more or less similar, I have preferred to describe the indument as follows: "Sheaths, bracts, peduncles, bracteoles, pedicels, ovary, calyx, and fruit densely covered with furcate hairs" over describing the indument of all these parts separately. This also avoids very lengthy and hardly readable descriptions. For indument terms see page 7.

As the length of the filament and the shape of the stigma are nearly the same for all species of *Renalmia*, I have omitted them from the specific description and only mentioned them in the general diagnosis.

Following the description of each species a complete list of localities is cited only if that species is known by a few collections. Otherwise only country and state (department or province) are cited. States only are mentioned in Bolivia, Brazil, Colombia, Ecuador, Mexico, Peru, and Venezuela.

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SYSTEMATIC TREATMENT

- Renealmia** Linnaeus filius, Suppl. Pl. Syst. Veg. 7. 1781; Poeppig & Endlicher, Nov. Gen. & Sp. Pl. 2: 25. 1838; Horaninow, Prodr. 32. 1862; O. G. Petersen in Engler & Prantl, Nat. Pflanzenfam. 2(6): 24. 1888 (as "*Renealmia* L."); O. G. Petersen in Martius, Fl. Bras. 3(3): 39. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 282. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 608. 1930; not of Linnaeus 1753.
- Paco Seroca* Marcgraf, Hist. Rer. Nat. Bras. lib 1: 48. 1648.
- Alpinia* Linnaeus, Sp. Pl. ed. 1. 1: 2. 1753; Linnaeus, Gen. Pl. ed. 5. 2. 1754; Plumier, Nov. Pl. Americ. Gen. 26. t. 11. 1703 (as "*Alpina*"); nomen rejiciendum.
- Amomum* Ruiz & Pavón, Fl. Peruv. & Chil. 1: 1. 1798; not of Linnaeus 1753.
- Ethanium* Salisbury, Trans. Hort. Soc. London 1: 281, 282. 1812. Type species. *Ethanium racemosum* (\equiv *Alpinia racemosa* Swartz, Observ. Bot. 5. 1791, not of Linnaeus); nomen subnudum.
- Gethyra* Salisbury, Trans. Hort. Soc. London 1: 282. 1812. Type species. *Gethyra occidentalis*; nomen subnudum.
- Peperidium* Lindley, Nat. Syst. Bot. ed. 2. 446. 1836; nomen nudum.
- Siphotria* Rafinesque, Fl. Tellur. 1: 50. 1837. Type species. *Siphotria squamosa* (\equiv *Alpinia tubulata*); superfluous name.

Tall to low, unbranched, aromatic, perennial herbs with sympodial, subterranean rhizomes. Leaves distichous. Leaf-sheaths open, striate, reticulate, or sometimes smooth, in nearly all species covered with prickly-like hairs (less than 0.1 mm long). Petiole small to long, sometimes absent. Ligule truncate, usually very small. Lamina more or less narrowly elliptic in outline, its base cuneate, the apex acuminate to acute, mostly superficially glabrous, but the lower side nearly always covered with microscopic hairs. Inflorescence a thyrs, raceme, or very rarely a spike, terminating a separate leafless shoot and its scape provided with leafless sheaths (cataphylls), sometimes terminal on a leafy shoot. Indument of inflorescence: nearly always present and composed of simple, furcate, or plurifurcate, one-celled hairs (stellate, irregularly branched hairs and compass-needle hairs rare). Bracts herbaceous to membranous, persistent, often soon deciduous, rarely chartaceous to coriaceous; bracts subtending one flower (racemose species) or cincinni of 2-10(-17) flowers (thyrsoid species). Basal stalk of cincinnati (=peduncle) and pedicels small to relatively long. Bracteole herbaceous, tubular and closed before anthesis, or in some species cup-shaped and open even before anthesis. Calyx tubular, turbinate, or less often urceolate, persistent or rarely deciduous, the 3 lobes deltate to triangular. Corolla tubular at the base, the tube somewhat longer than the calyx, the 3 lobes imbricate in bud, narrowly elliptic, the dorsal one somewhat larger than the 2 lateral ones. Labellum: basal part (=basal claw) narrowed, often hairy, with 2 very small, toothlike, lateral staminodes; apical part (=limb) composed of two rounded lateral lobes and a middle lobe with an entire to two-lobed apex; lateral lobes involute (tubular flower) or horizontally spreading (gullet flower). Stamen one, with a very small filament (ca 1 mm long) and a dithecic, yellow to red anther. Style filiform, enclosed between the two thecae. Stigma cup-shaped placed at the top of the anther. Nectarial glands implanted at the top of the ovary, partly or completely surrounding the style base. Ovary trilobular, ellipsoid to globose, ovules few- ∞ , biseriate.

Capsule often black or red, trilocular, globose to ellipsoid, more or less fleshy, mostly crowned by the persistent calyx, longitudinally loculicidally dehiscent from base to apex; seeds 1-250, glossy brown, more or less irregularly ellipsoid, provided with a large, yellow to orange or white (sometimes sweet) aril. Chromosome number $2n = 22$ or 44.

TYPE SPECIES. *Renealmia exaltata* Linnaeus filius.

Explanation of the Identification Key

During my revision of *Renealmia* I often tried to construct analytical keys to various groups of species; every time I had finished such a key, however, I was rather dissatisfied with its usefulness, since many species could only be keyed out by a combination of characters. Moreover, some of the important key-characters are difficult to understand for a botanist with not too much experience with the genus; this applies particularly to the leaf-sheaths (striate versus reticulate), the inflorescence (thyse open or congested), and the indument, often composed of submicroscopic hairs. However, the species with a terminal inflorescence (group I) could be rather easily keyed out with an analytical key. An article by Leenhouts (1966) on keys in biology lead to the construction of a new type of synoptical key, which proved to be very successful for identifying the many species of *Renealmia*. This key was tried out by various students and senior botanists, and in most cases the results were very good. The key has the great advantage over an analytical key that the user is completely free where to start, choosing only those characters which are completely clear to him.

The couplets of the key are numbered 1 up to 30. The most useful and most easily interpretable characters are at the beginning; the end of the key deals with features that are less important for identification, and such characters as are rarely observable, eg, characters of labellum and anther. These two characters are important for the classification of the species, but since most herbarium material lacks these two structures its characters will rarely be used in herbarium practice. For field workers, however, these floral characters are of much value.

The following instructions to the use of the key need to be given:

1. All species names are abbreviated to 3-letter symbols; the explanation of these abbreviations is given on p. 152.
2. Names cited under more than one lead of a couplet are underlined; if the character in one of these two or more leads occurs only very rarely the species abbreviation is placed in brackets. The next example illustrates the situation: in the description of *R. alpinia* the width of the lamina is given as (6-)8-18(-23) cm; the couplet dealing with the lamina width (group II, number 12) is divided into three leads; in the lead "a. less than 7 cm" this species is cited as (alp), thus indicating that this situation is only rarely met with; in the leads "b. 7-12 cm" and "c. more than 12 cm," the species is indicated as *alp*.
3. When a given character is not known for a certain species, its name is included in all leads of the couplet but cited in double brackets (cf group III, couplet 29. . . ((A)) and ((ery)).
4. When a couplet consists of only two leads, the one which comprises the smallest number of species is given, whereas the contrasting situation is cited in brackets (cf group II, couplets 3 and 8). If such a couplet consisting of two leads was highly important for identification, however, I have preferred to maintain both leads (cf group II, couplets 1 and 4).

The synoptical key can be used in several ways, two of which may be briefly explained as follows: the first way is to make a list of all species of the group concerned and then to strike out after each couplet those species which do not correspond with the character of the specimen. Instead of striking out the names of the species negative for the character concerned, one may also give the species possessing the character concerned a positive mark (eg,+). If, finally, a name has all positive marks, that should be the correct one; it may happen, however, that by incorrect interpretation of one of the characters of the specimen studied the species with the next highest amount of positive counts is the correct one. Therefore, beside the positive sign +, one should also score the corresponding number of the couplets. It is highly advisable to start with those characters which readily separate as many species as possible.

Key to the Species of *Renealmia*

- | | |
|--|------------|
| 1. Inflorescence terminal on a leafy stem. | Group I. |
| 1. Inflorescence on a separate leafless shoot. | |
| 2. Inflorescence a raceme (the bracts subtending only 1 flower). | Group II. |
| 2. Inflorescence a thyrses (the bracts subtending 2-20 flowers, the upper cincinni sometimes 1-flowered by reduction). | Group III. |

ANALYTICAL key to the species of Group I (inflorescence terminal)²

- | | |
|---|------------------------------|
| 1. Inflorescence a spike or raceme; bracts coriaceous to chartaceous. | |
| 2. Inflorescence a spike; leaf-sheaths reticulate. Central and western South America. | 9. <i>R. cernua</i> . |
| 2. Inflorescence a raceme; leaf-sheaths striate. Hispaniola, Haiti. | 17. <i>R. densiflora</i> . |
| 1. Inflorescence a thyrses; bracts herbaceous. | |
| 3. Ligule 3-4 mm long; capsule 10-17 mm long; calyx 7-11 mm long. Lesser Antilles. | 43. <i>R. pyramidalis</i> . |
| 3. Ligule 1-2 mm long; capsule 4-10 mm long; calyx 3-13 mm long. | |
| 4. Calyx 3-6 long; capsule 3-4-seeded; lamina 6-20 X 1.5-3.5 cm; inflorescence 2-5 X 1.5-2 cm; pedicels 0-2 mm long. Panama. | 26. <i>R. helena</i> . |
| 4. Calyx 3-11(-13) mm long; capsule 3-25 seeded; lamina and inflorescence usually much larger; pedicels 1-15(-20) mm long. | |
| 5. Lamina sessile, base strongly sheathing, the lower side densely covered with compass-needle hairs (use lens!); calyx tubular becoming urceolate with age; Panama and (?) Colombia. | 20. <i>R. dressleri</i> . |
| 5. Lamina shortly stalked or sessile, base never sheathing, lower side glabrous or covered with simple hairs; calyx tubular to turbinate. | |
| 6. Lower side of lamina glabrous. Greater Antilles. | 27. <i>R. jamaicensis</i> . |
| 6. Lower side of lamina covered with simple hairs. Ecuador. | 47. <i>R. sessilifolia</i> . |

²Very exceptionally, the inflorescence of *R. occidentalis* is terminal.

SYNOPTICAL key to the species of group II (basal raceme)

(Species abbreviations: see p. 152)



1. Bracteole
 - a. Initially completely enclosing floral buds ($\bigcirc \rightarrow \bigcirc$): acr-alp-bra-chr-fra-kru-nic-pet-ret-B
 - b. Cup-shaped from onset (\bigcirc) : der-pal-syl-thy

2. Length of calyx
 - a. 7-10 mm: *alp-der-fra-pet-ret-thy*
 - b. 11-20 mm: *acr-alp-bra-chr-der-fra-kru-(nic)-pal-pet-ret-syl-thy-B*
 - c. more than 20 mm: *acr-(alp)-bra-chr-nic-(syl)-thy*
3. Shape of calyx
 - a. turbinate (versus tubular): *der-pet*
4. Leaf-sheaths
 - a. reticulate: *bra-chr-der-kru-nic-pal-(pet)-ret-thy*
 - b. striate or smooth: *acr-alp-chr-der-fra-nic-pet-syl-thy-B*
5. Length of capsule
 - a. 3-12 mm: *(alp)-fra-pet-ret-syl*
 - b. 13-20 mm: *alp-chr-der-kru-nic-pet-syl-thy-B*
 - c. more than 20 mm: *acr-alp-bra-der-kru-nic-pal-pet-thy-B*
6. Number of seeds
 - a. 1-20: *acr-bra-fra-kru-pet-ret-syl*
 - b. 21-50: *acr-alp-bra-chr-pet-thy-B*
 - c. more than 50: *alp-der-nic-pal-pet-thy*
7. *Distribution*
 - a. Central America: *alp*
 - b. Antilles: *alp-syl*
 - c. W South America (Andes): *alp-der-fra-nic-thy-t-B*
 - d. Amazon River Region: *acr-alp-kru-nic-pal-thy-t*
 - e. Guianas: *alp-thy-c*
 - f. SE and Central Brazil: *alp-bra-chr-der-pet-ret*
8. Altitudinal range
 - a. above 1500 m (versus 0-1500 m): *fra-thy-B*
9. Length of peduncle
 - a. more than 6 mm (versus 0-6 mm): *alp-der-fra-kru-(nic)-pet-thy-c-B*
10. Length of pedicel
 - a. 0-4 mm (versus more than 4 mm): *acr-alp-chr-der-kru-nic-pal-ret-syl-thy-B*
11. Length of lamina
 - a. less than 26 cm: *acr-chr-(der)-fra-kru-(pet)-ret-B*
 - b. 26-50 cm: *acr-alp-bra-chr-der-(fra)-kru-pet-ret-syl-thy-B*
 - c. more than 50 cm: *alp-bra-der-nic-pal-pet-syl-thy*
12. Width of lamina
 - a. less than 7 cm: *acr-(alp)-chr-der-fra-kru-(pet)-ret-(syl)-thy-B*
 - b. 7-12 cm: *acr-alp-bra-chr-der-fra-kru-nic-pet-syl-thy*
 - c. more than 12 cm: *alp-bra-nic-pal-pet-syl-thy*
13. Stature
 - a. less than 1 m (versus more than 1 m): *bra-((chr))-fra-kru-pet-ret-thy-B*
14. Length of bracts
 - a. more than 40 mm (versus less than 40 mm): *alp-chr-der-fra-kru-nic-pal-pet-(syl)-thy*
15. Width of bracts
 - a. 2-10 mm: *acr-alp-bra-chr-(der)-fra-kru-(nic)-pet-ret-(sy)-thy-B*
 - b. 11-20 mm: *(acr)-(alp)-chr-der-kru-nic-pal-pet-syl-thy-B*
 - c. more than 20 mm: *nic-(syl)-thy*
16. Persistence of bracts
 - a. soon deciduous (versus long persistent): *alp-bra-fra-ret-(thy)*
17. Rhachis
 - a. glabrous (or hairs less than 0.1 mm long): *acr-alp-ret-syl-(thy)*
 - b. simple hairs: *alp-bra-chr-(der)-fra-kru-(nic)-pet-ret-thy-(B)*
 - c. furcate to plurifurcate hairs: *(alp)-der-fra-kru-nic-thy-B*
 - d. inflated hairs: *fra*
18. Length of anther
 - a. 9-12 mm (versus 5-8 mm): *acr-alp-der-kru-nic-pal-thy*
19. Length of style
 - a. 11-20 mm (versus more than 20 mm): *alp-bra-der-thy*
20. Length of ligule
 - a. more than 3 mm (versus less than 3 mm): *(alp)-fra-nic*
21. Length of petiole
 - a. more than 20 mm (versus 0-20 mm): *alp-chr-der-kru-nic-ret-syl-thy*

22. Length of scape
 a. less than 30 cm: *acr-alp-chr-der-fra-kru-nic-pet-ret-syl-thy-B*
 b. 30-75 cm: *alp-bra-chr-der-fra-nic-ret-syl-thy*
 c. more than 75 cm: *pal-thy*
23. Colour of bracts
 a. yellow (versus red to orange): *thy*
24. Length of corolla
 a. less than 20 mm (versus more than 20 mm): *der-(pet)-thy*
25. Length of labellum
 a. less than 10 mm (versus more than 10 mm): *pet-ret-syl-thy-B*

SYNOPTICAL key to the species of group III (basal thyrse)

(Species abbreviations: see p. 152)

1. Length of calyx
 a. 3-6mm: *asp-bre-cha-coc-cog-cos-cua-dre-flo-gui-mat-mex-mon-occ-ori-plu-rac-val-A*
 b. 7-10 mm: *alt-aur-cha-chi-cog-cos-cua-dre-ery-flo-fra-gui-mex-(mon)-occ-ols-olt-ori-plu-pub-sca-ste-urb-val*
 c. 11-15 mm: *alp-aur-chi-cog-(fer)-fra-lig-ols-olt-sca-ste-urb-wur*
 d. 16-20 mm: *alp-cau-dol-fer-fra-luc-urb-wur*
 e. more than 20 mm: *alp-cau-fer-luc*
2. Shape of calyx
 a. tubular: *alp-asp-aur-cau-chi-cos-dol-dre-ery-fer-fra-gui-lig-luc-mat-mon-ols-ori-rac-sca-ste-urb-val-wur-A*
 b. turbinate: *alt-aur-cha-cos-cua-flo-gui-luc-mex-occ-olt-ori-plu-pub-ste-wur*
 c. urceolate: *asp-bre-coc-cog-dre-plu-pub*
3. Length of capsule
 a. 3-7 mm: *asp-aur-bre-cha-chi-coc-cog-cos-dre-flo-fra-mat-mex-mon-occ-ols-(ori)-plu-pub-rac-ste-val-A*
 b. 8-12 mm: *(alp)-alt-asp-aur-bre-cau-cha-chi-coc-cog-cua-dol-dre-flo-fra-gui-mat-mex-mon-occ-ols-olt-ori-plu-(pub)-rac-ste-(urb)*
 c. 13-20 mm: *alp-alt-cau-cua-dol-ery-(flo)-gui-lig-(mex)-occ-ori-sca-urb-wur*
 d. more than 20 mm: *alp-cau-fer-lig-luc-sca*
4. Number of seeds
 a. 1-5: *alt-asp-bre-cha-coc-cos-dol-dre-gui-mat-mex-mon-ols-plu-pub-val-A*
 b. 6-20: *asp-aur-bre-cha-chi-coc-cog-cos-dol-ery-flo-fra-gui-mat-mex-mon-occ-ols-olt-ori-plu-pub-rac-ste-urb-wur*
 c. 21-50: *alp-cau-fer-flo-gui-occ-ori*
 d. more than 50: *alp-cau-cua-fer-lig-luc-sca*
5. Length of ligule
 a. more than 3 mm (versus less than 3 mm): *alp-alt-asp-aur-dol-fer-fra-gui-lig-luc-ori-sca-ste-A*
6. Nectarial glands:
 a.  : *alp-alt-aur-cau-cha-chi-dol-fer-lig-luc-ols-olt-sca-ste-urb*
 b.  : *asp-bre-coc-cog-cos-cua-dre-ery-flo-gui-mat-mex-mon-occ-olt-ori-plu-pub-rac-val-wur-A*
7. Leaf-sheaths
 a. reticulate: *alt-cha-cua-flo-gui-(lig)-mat-mex-mon-ols-ori-plu-urb-val*
 b. striate or smooth: *alp-alt-asp-aur-bre-cau-cha-chi-coc-cog-cos-dol-ery-fer-fra-lig-luc-mat-mon-occ-olt-ori-plu-pub-rac-sca-ste-wur-A*
8. Distribution
 a. Central America: *alp-chi-coc-cog-cos-dre-ery-lig-mex-mon-occ-plu-sca-A*
 b. Antilles: *alp-occ*
 c. W South America (Andes): *alp-alt-asp-aur-bre-cau-cha-coc-cos-cua-dol-dre-fer-fra-lig-luc-occ-ols-olt-plu-pub-rac-ste-val*
 d. Amazon River Region: *alp-asp-bre-flo-gui-mon-occ-ori-urb-wur*
 e. Guianas: *alp-flo-gui-mon-occ-ori*
 f. SE and Central Brazil: *alp-bre-mat-occ*
9. Altitudinal range
 a. 0-1500 m: *alp-asp-bre-coc-cog-cos-cua-dol-dre-ery-flo-fra-gui-lig-luc-mat-mex-mon-occ-ols-ori-plu-pub-rac-sca-ste-urb-val-A*
 b. above 1500 m: *alt-aur-(bre)-cau-cha-chi-coc-dol-fer-fra-lig-luc-mex-olt-pub-sca-ste-wur*

10. Persistence of bracts
 a. soon deciduous (versus rather long persistent): *alp-asp-cua-flo-fra-gui-lig-mex-mon-occ-ols-ori-sca*
11. Inflorescence
 a. a more or less open thyrese: *alp-asp-cau-coc-cua-flo-fra-gui-lig-luc-mex-occ-ols-olt-ori-rac-ste-urb-A*
 b. a congested thyrese: *alt-aur-bre-cha-chi-cog-cos-dol-dre-ery-fer-fra-mat-mon-plu-pub-sca-val-wur-A*
12. Number of flowers per cincinnus
 a. more than 3 (versus (1-)2-3): *alp-asp-aur-bre-cau-coc-cog-cua-dol-dre-fer-flo-(gui)-luc-mat-mex-occ-ols-olt-ori-plu-rac-(sca)-ste-wur-A*
13. Length of pedicel
 a. less than 3 mm: *(alp)-chi-coc-cos-dol-ery-mat-plu-urb-val-A*
 b. 3-4 mm: *alp-asp-bre-coc-dol-mat-occ-ols-plu-(sca)-(urb)-wur*
 c. more than 4 mm: *alp-alt-asp-aur-bre-cau-cha-cog-cua-dre-fer-flo-gui-lig-luc-mat-mex-mon-occ-ols-olt-ori-pub-rac-sca-ste-wur*
14. Length of peduncle
 a. less than 3 mm (versus more than 3mm): *aur-bre-cau-coc-cog-cos-dol-dre-ery-flo-(gui)-mat-mon-ols-plu-pub-sca-val-A*
15. Upper side of lamina
 a. densely covered with simple hairs (versus glabrous or nearly so): *cau-val*
16. Lower side of lamina
 a. glabrous or nearly so, or hairs less than 0.1 mm long: *alp-alt-asp-bre-cha-chi-cua-dol-dre-ery-fer-flo-gui-lig-luc-mat-mex-mon-occ-ols-olt-ori-(plu)-rac-ste-urb-wur*
 b. simple hairs: *alp-aur-(bre)-cau-cos-fra-luc-plu*
 c. (pluri) furcate hairs: *(bre)-cos-fra-(plu)*
 d. compass-needle hairs: *coc-cog-pub-A*
 e. stellate hairs: *val*
17. Rhachis
 a. glabrous (or hairs less than 0.1 mm long): *aur-(bre)-cha-cos-dre-luc-occ-olt-wur*
 b. simple hairs: *alp-(alt)-(asp)-aur-(bre)-cau-(cha)-cos-(cua)-(dol)-ery-(fer)-flo-fra-gui-lig-mat-(mex)-mon-occ-ols-ori-plu-sca-(ste)-urb*
 c. (pluri) furcate hairs: *(alp)-alt-asp-bre-cau-(cha)-chi-coc-cog-cos-cua-dol-(ery)-fer-flo-fra-gui-lig-(mat)-mex-mon-(occ)-(ols)-ori-plu-pub-rac-sca-ste-urb*
 d. compass-needle hairs: *coc-(lig)-pub-A*
 e. stellate hairs: *val*
18. Length of scape
 a. less than 11 cm: *asp-bre-cau-coc-cog-ery-lig-mat-mex-mon-ols-(ori)-(plu)-urb*
 b. 11-30 cm: *alp-asp-aur-bre-cau-chi-coc-cog-cos-cua-dre-ery-fer-flo-fra-gui-lig-mex-(mon)-occ-ols-ori-plu-pub-rac-sca-ste-urb-val-wur-A*
 c. more than 30 cm: *alp-alt-aur-bre-cha-chi-cog-cos-cua-dol-flo-fra-gui-luc-mex-occ-olt-ori-rac-sca-ste*
19. Stature
 a. less than 1 m (versus more than 1 m): *((alt))-asp-bre-chi-coc-cos-dre-ery-fra-lig-mat-mon-(occ)-ols-plu-ste-A*
20. Length of petiole
 a. more than 20 mm (versus 0-20 mm): *alp-asp-bre-cos-cua-(flo)-gui-lig-luc-mex-plu-urb-val-((A))*
21. Length of lamina
 a. less than 26 cm: *asp-bre-cha-chi-(coc)-(cog)-cos-ery-fer-fra-gui-(lig)-(luc)-mat-mex-mon-occ-ols-olt-plu-pub-rac-ste-urb-val-A*
 b. 26-50 cm: *alp-alt-asp-aur-bre-cau-cha-(chi)-coc-cog-cos-(cua)-dol-dre-fer-flo-fra-gui-lig-(luc)-mex-occ-ols-ori-plu-pub-rac-sca-ste-urb-val-wur*
 c. more than 50 cm: *alp-cau-cos-cua-dol-dre-fer-flo-lig-luc-mex-occ-ori-plu-sca-wur*
22. Width of lamina
 a. less than 7 cm: *(alp)-asp-bre-cha-chi-coc-(cog)-cos-dre-ery-(fer)-flo-fra-gui-lig-mat-mex-mon-occ-ols-olt-(ori)-plu-(pub)-rac-ste-urb-(wur)-A*
 b. 7-12 cm: *alp-alt-asp-aur-bre-cau-chi-coc-cog-cos-cua-dol-dre-fer-flo-fra-gui-lig-mat-mex-occ-ols-ori-plu-pub-rac-sca-ste-urb-val-wur-A*
 c. more than 12 cm: *alp-aur-bre-cau-cog-cos-cua-dol-(lig)-luc-(mex)-ori-plu-pub-sca-(urb)-val*
23. Colour of bracts
 a. green (versus red to orange): *bre-chi-coc-cog-cos-cua-((dol))-dre-ery-flo-mat-mex-occ-o-((olt))-pub-rac-urb-val*

24. Length of bracts
 a. less than 21 mm: *(alp)-asp-aur-bre-cau-cha-chi-coc-cog-cos-cua-dol-dre-ery-flo-fra-gui-lig-mat-mex-mon-occ-ols-olt-(ori)-plu-pub-rac-ste-urb-val-(wur)-A*
 b. 21-40 mm: *alp-alt-asp-aur-bre-cau-cha-coc-cog-cos-cua-dol-dre-ery-fer-flo-fra-gui-lig-luc-mex-occ-olt-ori-plu-pub-rac-sca-ste-urb-wur*
 c. more than 40 mm: *alp-aur-cua-fer-fra-gui-lig-luc-(mex)-occ-ori-rac-sca-ste-urb*
25. Width of bracts
 a. 2-10 mm: *(alp)-alt-asp-aur-bre-cau-cha-chi-coc-cos-cua-dre-ery-flo-fra-gui-lig-luc-mat-mex-mon-occ-ols-olt-(ori)-(plu)-pub-rac-ste-urb-(val)-(A)*
 b. 11-20 mm: *alp-aur-bre-cau-coc-cog-cos-cua-dol-dre-fer-lig-luc-(mex)-ols-ori-plu-sca-val-wur-A*
 c. more than 20 mm: *cog-cos-fer-lig-luc-sca-val-wur*
26. Length of bracteole
 a. less than 11 mm: *asp-aur-bre-cha-chi-coc-cog-cos-cua-dre-ery-flo-mat-mex-mon-occ-ols-(olt)-plu-pub-rac-urb-val-A*
 b. 11-20 mm: *alp-alt-asp-aur-bre-cau-cha-cog-cos-cua-dol-dre-flo-gui-lig-luc-mex-occ-ols-olt-ori-plu-rac-sca-ste-urb-wur*
 c. more than 20 mm: *alp-fer-luc-ori*
27. Length of corolla
 a. more than 20 mm (versus less than 20 mm): *alp-cau-cha-dol-(ery)-fer-lig-luc-occ-sca-ste-urb-wur-(A)*
28. Length of labellum
 a. more than 10 mm (versus less than 10 mm): *alp-((asp))-aur-cau-cos-cua-dol-(ery)-flo-gui-lig-luc-mex-mon-occ-ols-ori-plu-sca-ste-urb-(A)*
29. Length of anther
 a. 2-4 mm: *alt-asp-aur-bre-cha-chi-coc-cog-cos-dre-(ery)-flo-gui-mat-mex-mon-ols-ori-plu-pub-rac-val-(A)*
 b. 5-8 mm: *(alp)-asp-cau-chi-cua-dol-(ery)-fer-flo-gui-lig-occ-ols-olt-sca-ste-urb-wur-(A)*
 c. 9-12 mm: *alp-(ery)-luc-(A)*
30. Length of style
 a. 5-10 mm: *asp-bre-coc-cog-cos-(ery)-flo-gui-mat-mex-mon-olt-ori-plu-pub-rac-(A)*
 b. 11-20 mm: *alp-alt-aur-cha-chi-cos-cua-dre-(ery)-fer-lig-occ-ols-sca-ste-urb-val-wur-(A)*
 c. more than 20 mm: *alp-cau-dol-(ery)-fer-lig-luc-sca-(A)*

1. ***Renalmia acreana*** Maas, Acta Bot. Neerl. 24: 473. 1976.

Fig 6.

Plants 1-2.5 m tall. Rhizomes 5-10 mm thick. Sheaths striate, 5-15 mm wide, up to 25 mm at the base of the plant, glabrous or covered with simple, furcate, or stellate prickles (<0.1 mm long) in the deeper grooves. Ligule less than 1 mm long. Petiole 0-20 mm long, glabrous. Lamina narrowly elliptic, acute to acuminate at the apex (acumen 10-20 mm long), cuneate at the base, (11-)20-28(-37) cm long, (1.5-)3-7(-8.5) cm wide, covered with simple, furcate, or stellate prickles (less than 0.1 mm long) on both sides. Scape prostrate, 13-25 cm tall, up to 3 mm thick, beset with sheaths up to 3.5-6 cm long and 0.5-1 cm wide. Inflorescence a basal raceme 5-25 cm long and 3-5 cm wide, rhachis pinkish red. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, and calyx very sparsely covered with simple, furcate, or stellate prickles (<0.1 mm long); corolla, ovary, and capsule glabrous. Bracts pinkish-red, rather long persistent, narrowly triangular, acute, 10-40 mm long, 2.5-6(-12) mm wide. Peduncles 2-5 mm long. Bracteole red, 8-15 mm long. Pedicels ca 1 mm long. Calyx pinkish-red, tubular, 11-22 mm long, to 6 mm wide, the lobes shallowly triangular-ovate, 1.5-3 mm long, 3-5 mm wide. Corolla yellow, 37 mm long, the tube 24 mm long, the lobes 12-15 mm long, 6-9 mm wide. Labellum yellow, 15 mm long and 10 mm wide when spread out, basal part opposite the anther densely covered with simple and furcate hairs (to 0.5 mm long), limb erect, 8 mm long, 10 mm wide, lateral lobes involute, rounded, 5 mm long, 3 mm wide, middle lobe entire and rounded, basal claw 7 mm long, 4 mm wide, lateral staminodes ca 2 mm long. Anther 12 mm long,

5 mm wide, glabrous. Style 33 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2 mm long. Ovary green to pinkish-red, ellipsoid. Capsule green, maturing red, ellipsoid, 23-25 X 13-15 mm, its wall 0.1-0.2 mm thick when dry, 10(-40?)-seeded, seeds 2.5 X 3 mm, aril white.

TYPE. *France, Maas, Kubitzki, Steward, Ramos, Pinheiro & Lima 12430* (holotype, INPA; isotypes, K, NY, U), Serra da Moa, Acre, Brazil; in forest on steep mountain-side.

DISTRIBUTION (Fig 59). Acre and Amazonas, Brazil; in forests on terra firme or in swamp forest; at low elevation.

BRAZIL. ACRE: Serra de Moa, swamp forest, *Maas et al 12703* (paratypes, F, GH, INPA, MG, MO, NY, P, R, U, US, VEN); a sterile collection from Periquito, Juruá-Mirim, forest on terra firme, *Maas et al 13143* (INPA, NY, U). AMAZONAS: Rio Javari, behind Palmeiras Army Post, *Lleras et al 17198* (INPA, NY, U).

This new species is closely related to *R. krukovii*, differing, however, by its striate instead of reticulate leaf-sheaths, its acute instead of obtuse bracts, and by its almost glabrous inflorescence.

2. **Renealmia alpinia** (Rottboell) Maas, Act. Bot. Neerl. 24: 474. 1976. Fig 7.
Paco Seroa Plumier, Mscr. 5: t. 25 (\equiv *Alpinia pacoseroca*), not of Marcgraf.
Costus nr. 2 Aublet, Hist. Pl. Guian. Franç 1: 2. 1775 (\equiv *Alpinia pacoseroca*), nomen nudum.
Amomum alpinia Rottboell, Soc. Med. Havn. Coll. 2: 245, 248, t. 1. 1775; Gagnepain, Bull. Soc. Bot. France 50: 194. 1903; K. Schumann in Engler, Pflanzenreich 4. 46: 258. 1904 (name only).
Myrisma 64. nova Alm, Pl. Surinam. 151. 1775; Alm in Linnaeus, Amoen. Acad. 8: 251. 1785 (\equiv *Renealmia exaltata*).
Renealmia exaltata Linnaeus filius, Suppl. Pl. Syst. Veg. 79. 1781 (syn. excl.); Roscoe, Monandr. Pl. t. 65. 1828; Horaninow, Prodr. 33. 1862; O. G. Petersen in Engler & Prantl, Nat. Pflanzenfam. 2.6: 25. 1888; O. G. Petersen in Martius, Fl. Bras. 3(3): 41. 1890 (in part); Duss. Fl. Ant. Franç. 581. 1896; K. Schumann in Engler, Pflanzenreich 4. 46: 296. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 609. 1930; Standley, Field Mus. Nat. Hist. Bot. Ser. 18: 190. 1937; Woodson, Ann. Missouri Bot. Gard. 32: 62. 1945; Standley & Steyermark, Fieldiana: Botany 24(3): 202. 1952; not of Blanco, Fl. Filip. ed. 2. 1. 1845 (see also K. Schumann in Engler Pflanzenreich 4. 46: 308, 352. 1904); nor of O. Kuntze, Rev. Gen. Pl. 1: 430. 1891. Type. *Dahlberg 64* (holotype, LINN, photograph seen), Suriname.
Amomum renealmia Lamarck, Encycl. Méth. Bot. Illustr. Gen. 1: 5. 1791; K. Schumann in Engler, Pflanzenreich 4. 46: 259. 1904 (name only), superfluous name for *Renealmia exaltata*.
Alpinia paco seroca Jacquin, Fragm. Bot. 54. t. 76. 1809; K. Schumann in Engler, Pflanzenreich 4. 46: 370. 1904 (name only, and as "*A. paco secora*"). Type. The two drawings of Plumier's *Paco Seroa* (deposited at Paris, copies at Utrecht), taken from a plant from St. Vincent.
Costus secundus Roemer & Schultes, Syst. Veg. 1: 13. 1817 (\equiv *Alpinia pacoseroca*), nomen nudum. In K. Schumann (Engler, Pflanzenreich, 4. 46: 425. 1904) incorrectly assigned to *Renealmia occidentalis*.
Alpinia exaltata (Linnaeus filius) Roemer & Schultes, Syst. Veg. 1: 21, 563. 1817; G. F. W. Meyer, Fl. Esseq. 4. 1818; Miquel, Linnæa 22: 79. 1849; K. Schumann in Engler, Pflanzenreich 4. 46: 370. 1904 (name only).
Alpinia renealmia J. E. Smith in Rees, Cyclop. 39(1). 77: no. 14. 1818; K. Schumann in Engler, Pflanzenreich 4. 46: 370. 1904 (name only), (\equiv *Renealmia exaltata*).
Alpinia tubulata Ker, Bot. Reg. 777. 1824; Curtiss, Bot. Mag. 2494. 1824; K. Schumann in Engler, Pflanzenreich 4. 46: 296, 371. 1904. Type *Plate 777* in *Botanical Register* of 1824, as no herbarium material seems to be preserved. The type is originally from Demerara, from where seeds were sent to Lambert and cultivated in the hothouse of Boyton.

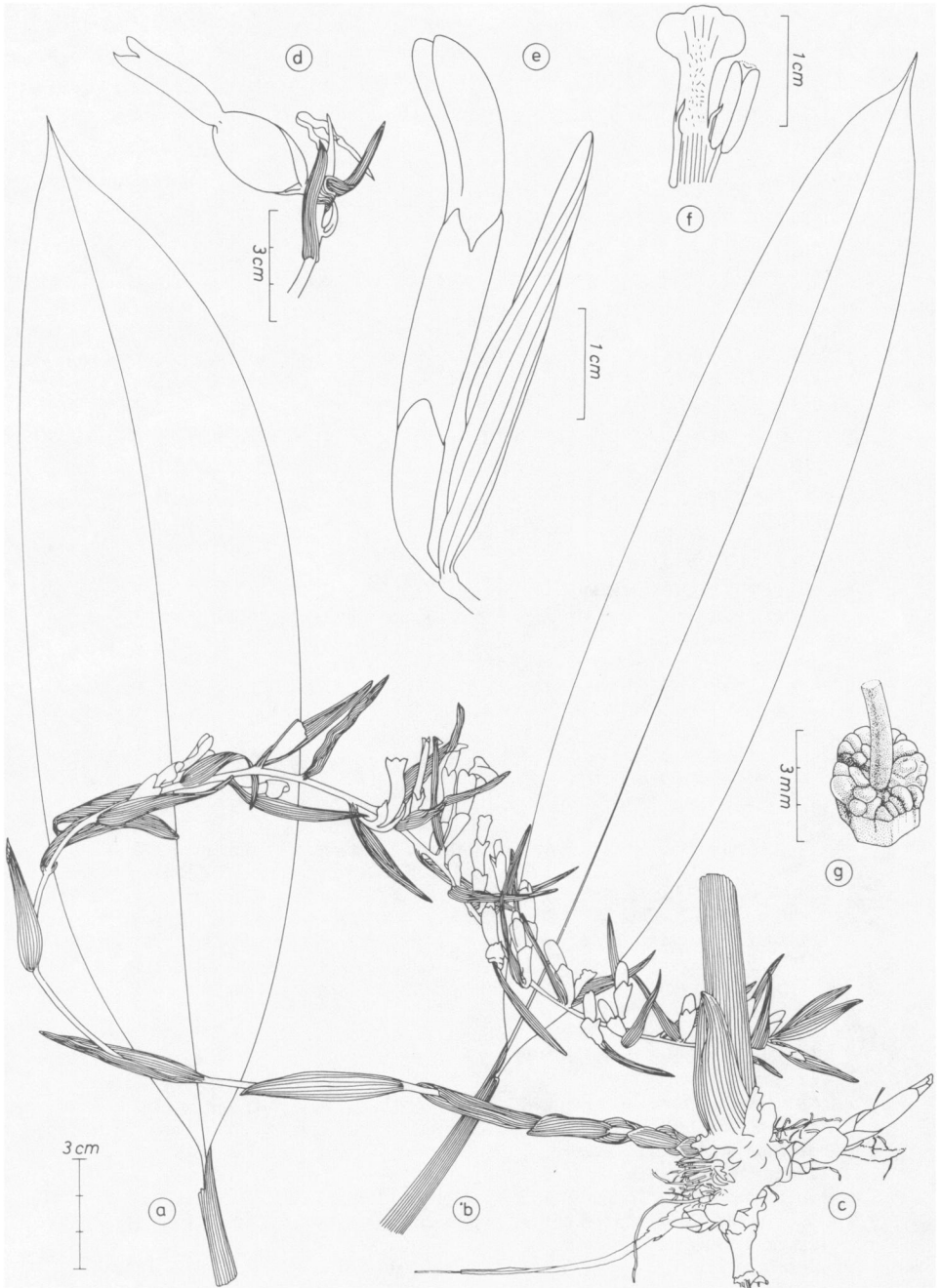


FIG 6. *Renealmia acreana*. (a-b, *Prance et al 12703*; c-g, *Prance et al 12430*). a-b, leaves; c, inflorescence; d, young fruit; e, flower with bract and bracteole; f, labellum and stamen; g, nectarial glands.

- Siphotria squamosa* Rafinesque, Fl. Tellur. 4: 50. 1838 (= *Alpinia tubulata*).
- Renealmia macrantha* Poeppig & Endlicher, Nov. Gen. & Spec. 2: 25. t. 134. 1838; Horaninow, Prodr. 33. 1862; O. G. Petersen in Martius, Fl. Bras. 3(3): 43. 1890; K. Schumann in Engler, Pflanzenreich 4.46: 306. 1904; Macbride, Field Mus. Nat. Hist. Bot. Ser. 13: 729. 1936. Type. *Poeppig sn, July 1830* (holotype, W), Tocache, R o Huallaga, San Mart n, Peru.
- Renealmia pacoseroca* (Jacquin) Horaninow, Prodr. 32. 1862 (as "*Renealmia paco-secora*").
- Renealmia bracteosa* Grisebach, Fl. Br. W. Ind. Isl. 601. 1864; O. G. Petersen in Martius, Fl. Bras. 3(3): 42. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 306. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930; not of Hodge, Lloydia 17: 177. 1954 (as synonym of "*R. racemosa* (L.) A. Rich"). Type. *Imray sn, anno 1859* (holotype, GOET; isotype, K), Dominica.
- Renealmia occidentalis* (Swartz) Sweet var δ *pacosero*ca (Jacquin) O. G. Petersen in Martius, Fl. Bras. 3(3): 45. 1890 (as "*var δ paco-secora* Grisebach"); Grisebach, Fl. Br. W. Ind. Isl. 601. 1864 (as " *β paro-secora* Grisebach").
- Renealmia raja* O. G. Petersen in Martius, Fl. Bras. 3(3): 44. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 296. 1904. Type. *Engel sn* (holotype, LE), M rida, Venezuela.
- Ethanium pacoseroca* (Jacquin) O. Kuntze, Rev. Gen. Pl. 1: 689. 1891.
- Ethanium exaltatum* (Linnaeus filius) O. Kuntze, Rev. Gen. Pl. 1: 689. 1891.
- Ethanium macranthum* (Poeppig & Endlicher) O. Kuntze, Rev. Gen. Pl. 1: 689. 1891.
- Ethanium bracteosum* (Grisebach) O. Kuntze, Rev. Gen. Pl. 1: 690. 1891.
- Renealmia foliosa* S. Moore, Trans. Linn. Soc. ser. 2. 4: 482. 1895. Type. *Spencer Moore 204* (holotype, BM), Serra da Chapada, Mato Grosso, Brazil.
- Renealmia goyazensis* Gagnepain & K. Schumann, Bull. Soc. Bot. France 49: 23. 1902; K. Schumann in Engler, Pflanzenreich 4. 46: 303. 1904. Type. *Glaziou 22183 a* (lectotype, P; isolectotypes, P), Cabeceira do Rio Gama, Goi s, Brazil. Of the three syntypes (*Glaziou 22183 a*, *Gaudichaud 324*, and *Weddell 2985*) this one is selected as lectotype. *Gaudichaud 324* belongs to *Renealmia chrysotricha*.
- Renealmia exaltata* Linnaeus filius var β *gracilis* K. Schumann in Urban, Symb. Ant. 4: 158. 1903. Syntypes. *Eggers 888* (BR, GH, L, M, P, PR, W) and *Eggers 1161* (US, C in part), both from Luquillo Mts., Puerto Rico.
- Renealmia rubroflava* K. Schumann in Engler, Pflanzenreich 4. 46: 297. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 609. 1930; not of Woodson, Ann. Missouri Bot. Gard. 32: 62. 1945. Type. *Eggers 15121* (holotype, B destroyed; lectotype, L; isotypes, GH, LE, P, PR, US), El Recreo, Balao, prov. Manabi, Ecuador.
- Renealmia coelobracte*a K. Schumann in Engler, Pflanzenreich 4. 46: 307. 1904. Type. *Lindman A 2401* (holotype, S), Palmeiras, Sta. Cruz da Barra, Mato Grosso, Brazil.
- "*Alpinia macrantha* Poeppig & Endlicher," K. Schumann in Engler, Pflanzenreich 4. 46: 370. 1904 (name only).
- Renealmia latevagina* Macbride, Field Mus. Nat. Hist. Bot. Ser. 11: 50. 1931; Macbride, Field Mus. Nat. Hist. Bot. Ser. 13: 728. 1936. Type. *Killip & Smith 27099* (holotype, F; isotypes, NY, US), Iquitos, Loreto, Peru.

Stout plants 1-6 m tall. Rhizomes 10-30 mm thick. Sheaths smooth, 10-20 mm wide, up to 50 mm at the base of the plant, glabrous or sparsely covered with needle-like hairs (to 0.5 mm long), the grooves often covered with simple prickles (< 0.1 mm long). Ligule 1-2(-4) mm long, hairy like the sheaths. Petiole often absent, but sometimes up to 30(-45) mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen 5-15 mm long), cuneate at the base, 30-110 (-150) cm long, (6-)8-18 (-23) cm wide, upper side glabrous, lower side glabrous or sometimes covered with erect, simple hairs (to 0.3 mm long). Scape erect, reddish, 15-50 (-70) cm tall, 0.3-1 cm thick, beset with sheaths up to 6-21 cm long and 1-2.5 (-3.5) cm wide. Inflorescence a basal raceme or sometimes a basal thyrses with 2-6-flowered cincinni, 12-55 cm long, 4-8 cm wide, rhachis 3-6(-9) mm thick. Indument of inflorescence: rhachis, peduncles, bracteoles, pedicels, calyx, ovary, and young capsule densely covered with erect, simple (very rarely furcate) hairs (to 0.5 mm long), sheaths, bracts, and mature capsule less densely so or even glabrous, corolla glabrous. Bracts pink to red, membranous, soon withering and then becoming brown, narrowly (ovate-) triangular to (ovate-) triangular, (15-)20-100(-170) mm long, 3-10(-20) mm wide. Peduncles pink to red, (5-)10-20(-35) mm long in 1-flowered cincinni, 5-25 mm in several-flowered cincinni. Bracteole pink to red, 15-30(-35) mm long in 1-flowered cincinni, 15-20(-25) mm in several-flowered cincinni. Pedicels pink to red, 2-8(-10) mm long in 1-flowered cincinni, 2-15(-20) mm long in several-flowered cincinni. Calyx pink to red, tubular, membranous, soon circumscissile to just above the base, (12-)15-20(-25) mm long, 4-8(-10) mm wide in 1-flowered cincinni, 10-15 mm long in several-flowered cincinni. Corolla yellow, orange, or red, 27-32 mm long in 1-flowered cincinni, 18-24 mm in several-flowered cincinni, the tube 12-17 mm long, the lobes 13-15 mm long, 8-11 mm wide in 1-flowered cincinni, ca 10 mm long and 5-7 mm wide in several-flowered cincinni. Labellum yellow, 12 mm long and 10 mm wide when spread out in 1-flowered cincinni, 10-12 mm long and 6-7 mm wide in several-flowered cincinni, basal part opposite the anther densely covered with simple (and stalked, furcate) hairs (up to 0.5 mm long), limb erect, 5-6 mm long, 6-10 mm wide, lateral lobes involute, rounded, 3-5 mm long, 2-3 mm wide, middle lobe entire and rounded, basal claw 5-6 mm long, 3-5 mm wide, lateral staminodes ca 2 mm long. Anther dark yellow, 8-12 mm long, 3-5 mm wide, its back, sides, and the groove between the thecae often with the same indument as the labellum. Style 25-30 mm long in 1-flowered cincinni, 18-24 mm in several-flowered cincinni. Nectarial glands multilobulate, completely surrounding the style base, 1.5-2 mm long. Ovary ellipsoid, red. Capsule red, maturing black-purple, ellipsoid (to subglobose), crowned by the circumscissile calyx, (10-)15-35(-40) mm long, (6-)8-20(-25) mm wide, its wall fleshy, 2-8 mm thick in living material, 0.3-1.5 mm thick when dry, number of seeds (30-)50-100 (-160), seeds 2-4 mm in diameter, aril orange.

TYPE. A collection of *Rolander* from Suriname (not seen). If no herbarium material of the *Rolander* collection should prove to be preserved, *table 1 of Rottboell's original description of Amomum alpinia* has to be designated as lectotype.

DISTRIBUTION (Fig 58). Tropical South America, the lesser Antilles, Central America, and Mexico; rather common in secondary forest, inundated forest, swamps, or on stream banks, usually at low elevation, up to 500 m (few collections up to 1500 m).

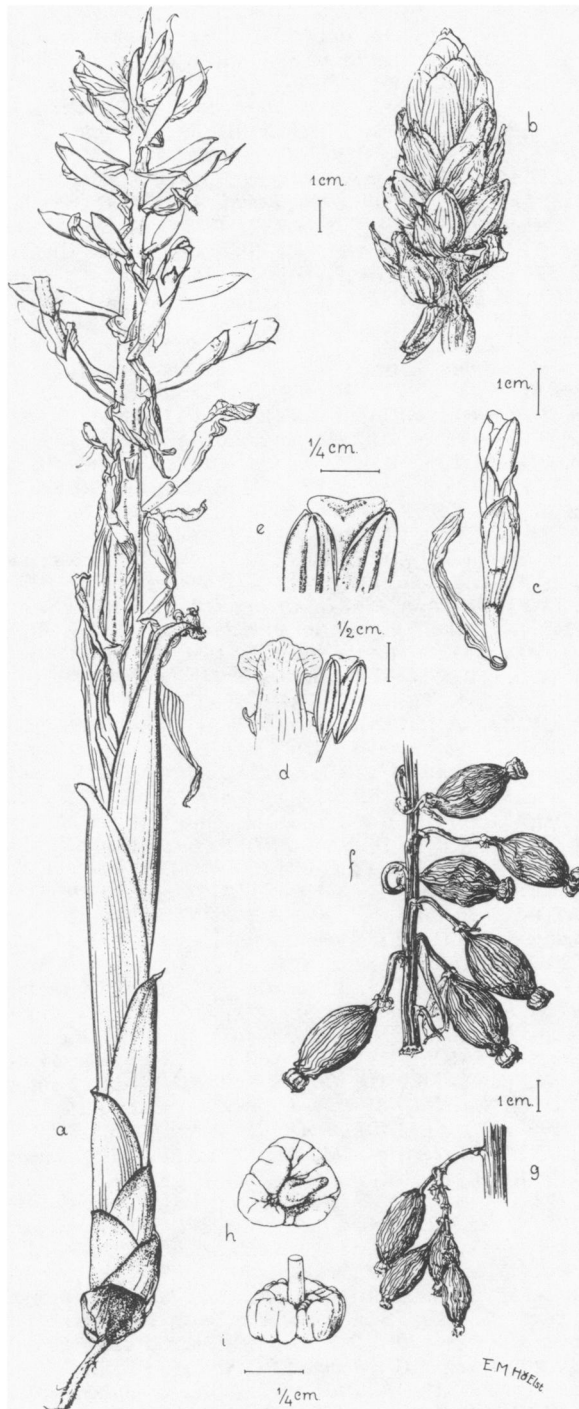


FIG 7. *Renealmia alpinia* (a, c, d, e, h, i, Hort. Bot. Utrecht 63-54; b, Skutch 8; f, Maas 3399; g, Bartlett & Lasser 16850). a, inflorescence; b, top of inflorescence showing obtuse bracts; c, flower with bract and bracteole; d, labellum and stamen; e, stigma and apical part of anther; f, part of inflorescence; g, fruiting cincinnus; h-i, nectarial glands seen from above and aside.

MEXICO. CHIAPAS: *Matuda* 17472 (F), 17603 (F, K, NY). OAXACA: *Conzatti* 3780, 3795 (US). VERA CRUZ: *Dressler & Q. Jones* 46 (MICH).?: *Karwinsky* 854 (LE); *Liebmann* 14737 (C), 14738 (C, US). GUATEMALA. *Aguilar H.* 320 (MICH, NY); *Cook & Griggs* 362 (US); *Kellerman* 4572 (US); *Rodríguez* 353 (P); *L. Rodríguez* 1633 (P); *J.D. Smith* 2044 (GH, K, M, NY, P, US); *Standley* 60460, 68744, 78530 (F); *Steyermark* 31338, 33515, 48014, 49191 (F); *von Türckheim* 8017 (GH, K, NY, US). BRITISH HONDURAS. *Gentle* 1739 (K, MICH, MO, NY), 2723 (F, MICH), 9148 (S); *Lundell* 6743 (MICH, NY); *Schipp* 379 (BM, F, GH, MO, NY). HONDURAS. *Allen et al* 6568 (F); *Bangham* 348 (GH); *Clewell* 3193 (EAP); *Molina R.* 2978, 8377 (F); *Standley* 183, 14239 (F), 26307 (EAP); *Thieme* 404 (5514) (US); *P. Wilson* 514 (NY); *Yuncker, Koepfer & Wagner* 8339 (F, GH, NY, S, US). COSTA RICA. *Brenes* 19259 (20) (F); *Burger & Liesner* 7276 (F, U); *Cook & Doyle* 367 (US); *Maas* 757 (CR, U); *Pittier* 3666 (US), 11133 (BR); *Raven* 21529 (F); *Shank* 8 (EAP); *Solis R.* 198 (BM, F), 226 (CR, F); *Tonduz* 9436 (BR, CR, US), 12960 (CR, P, US). PANAMA. *P.H. Allen* 364 (F, MO); *Bartlett & Lasser* 16850 (MICH, MO); *Duke, Blum, Dwyer & Tyson* 4813 (U); *Foster* 562 (DUKE); *Kenoyer* 238 (US); *Maas & Dressler* 707 (COL, U); *C.E. Moore* 24 (F); *Salvoza* 915 (GH); *Shattuck* 1112 (F); *Skutch* 8 (US); *C. E. Smith, Morgan Smith & Arrauz* 3289 (F, US); *Standley* 28673, 31081, 41061 (US); *Starry* 43 (F); *von Wedel* 668 (MO), 983 (GH, MO), 1364 (BM, GH, US), 2521 (MO), 2785 (GH, MO, US); *Woodson et al* 1905 (GH, MICH, MO, NY). PUERTO RICO. *Britton sn* (NY); *Heller* 1044 (NY); *Heller & Heller* 594 (US); *Shafer* 3132 (NY, US); *Sintenis* 1591 (C, F, L, LE, M, MO, NY, P, S, US), 2551b (BM, GH, K, US), 2608 (GH), 6626 (BM, GH, K, L, US); *Stahl* 685 (L, S, US); *R. J. Wagner* 709 (BM, GH, IJ, LE, S, US), 1323 (DUKE, U); *P. Wilson* 337 (F, NY, US). ST. KITTS. *Britton & Cowell* 289 (NY). MONTSERRAT. *Proctor* 19161 (IJ); *Shafer* 594 (F, NY, US). GUADELOUPE. *Duchassaing sn* (GOET, P); *Duss* 3328 (NY); *Forsström sn* (S); *Quentin* 829 (P). DOMINICA. *Lloyd* 676 (K, NY). MARTINIQUE. *Plee sn* (P). ST. VINCENT. *Anderson sn* (K). GRENADA. *Eggers* 6066 (US); *Simmonds sn*, 30 Aug 1948 (K). TOBAGO. *Broadway* 4347 (F, L); *Eggers* 5729 (K); *Sandwith* 1723 (K); *R. O. Williams sn* (TRIN 11141, K). TRINIDAD. *Britton et al* 394 (GH, NY, US); *Broadway* 5406 (K, MO), *sn*, 25 Oct. 1931 (BM), *sn* (TRIN 9409); *Fendler* 798 (BM, K, P); *Handbusbey sn*, 5 Jun 1925 (F); *Hart sn* (K, TRIN 1346), *sn* (TRIN 3857); *O. Kuntze* 660 (NY); *Maas* 3399 (U); *Richardson sn* (TRIN 15807); *Simmonds* 355 (K, TRIN), 18 (TRIN), *sn* (TRIN 14773 and 14902); *H. H. & G. W. Smith* 1965 (K). COLOMBIA. ANTIOQUIA: *Archer* 1473 (US); *Bro. Daniel* 1333 (F); *Gutiérrez V. & Barkley* 17 C 158 (COL); *Hodge* 6790 (GH). CAQUETA: *Cuatrecasas & Soderstrom* 27122 (US). CHOCÓ: *Cuatrecasas & Llano* 24155 (US); *Duke & Idrobo* 11312 (6) (DUKE, U); *von Sneidern A* 57 (S), *sn*, 13 Jun 1940 (COL). META: *Cuatrecasas* 7775 (COL, F); *Killip* 34407 (COL, US); *Philipson* 2398 (BM, COL); *Pinto et al* 198 (COL); *Pinto E. & Bernal Q.* 1668 (P); *Thomas, et al* 1481 (P); *Vogel* 197 (B); NORTE DE SANTANDER: *Cuatrecasas* 12954 (COL, US); *García Barriga & Lozano-C.* 18328 (COL). SANTANDER: *Haught* 1438 (NY, US); *Niemeyer* 7 (US). EL VALLE: *Killip* 35548 (COL, US). STATE?: *Mutis* 2221 (US); *H.H. Smith* 2765 (GH, K, NY). VENEZUELA. AMAZONAS: *Bunting et al* 3494, 3819 (MY, U); *Holt & Gehriger* 278 (F, NY, US, VEN); *Maguire & Maguire* 34622 (U); *L.I. Williams* 14098, 15664 (F, US, VEN). ANZOÁTEGUI: *Pittier* 15065 (US, VEN). APURE: *Geay sn*, anno 1892 (P); *Steyermark et al* 101291 (U, VEN). ARAGUA: *Badillo* 5377 (MY); *BARINAS: Aristeguieta* 1573 (US, VEN); *Schulz* 22 (U). BOLÍVAR: *Cardona* 2111 (US, VEN); *Fernández* 1716 (MY); *Killip* 37364 (NY, US, VEN); *Koyama & Agostini* 7427 (NY); *Simpson* 91 (VEN); *Steyermark* 98193 (U); *Tamayo* 3011 (US, VEN); *Trujillo* 2306 (MY); *Vareschi & Foldats* 4525 (NY, VEN). CARABOBO: *F. Fernández* 57 (VEN). DELTA AMACURO: *Trujillo* 4462 (MY). MÉRIDA: *Sergent* 33 (US, VEN); *Steyermark* 56725 (F, NY, US); *Velasco & Ramia* 458 (MY). MONAGAS: *Pursell, Curry & Kremer* 8229 (NY, US). PORTUGUESA van Rooden & Akkermans 6 (U); ZULIA: *Bunting* 2811 (MY); *Foldats* 2452 (VEN); *Steyermark* 99944 (U, VEN). STATE?: *Aristeguieta* 24155 (US); *Ginés* 5044 (US); *Lasser* 1687 (VEN); *Rusby & Squires* 407 (= 409?) (BM, K, NY). GUYANA. *Anderson* 227 (K); *Appun* 611 (K); *de la Cruz* 3856 (NY); *Gleason* 292 (GH, NY, US), 561 (GH, K, NY, US); *Harrison* 824 (TRIN), 1682 (NY, TRIN). *For. Dep.* 3995 (K); *A. S. Hitchcock* 17076 (GH, NY, S, US); *Irwin BG-15* (235) (US); *Jenman* 1697 (K); *Parker sn* (K); *Persaud* 268 (F); *Sandwith* 645 (K), 1564 (U); *A. C. Smith* 3184 (F, GH, K, LE, LIL, MO, NY, P, S, US); *Tillett & Tillett* 45397 (NY); *unknown collector* 16 (LE); *unknown collector*, anno 1887 (US). SURINAME. *Berthoud-Colon* 59 (BM); *Coll. indig.* 165 (U); *van Donselaar & Lems* 1002 (U); *Florschütz & Maas* 2692 (U); *Focke* 801 (U); *Jonker & Jonker* 189 (U); *Kramer & Hekking* 2086 (NY, U, VEN); *Maas & Tawjoeran*, LBB 11033 (U); *Mennega* 245, 315 (U); *Rombouts* 91 (U); *Samuels sn*, anno 1916 (US); *Splitgerber* 316 (L, P); *Tulleken* 413, 571 (L); *Went* 234 (U); *Wullschlägel* 1134 (BR, U); *unknown collector* 439, 21 Aug. 1891 (KIEL). FRENCH GUIANA. *Benoist* 1711 (P); *Mélinon sn*, anno 1840 (P); *Perrottet sn* (P); *L. C. Richard sn* (P); *Sagot* 854 (BM, P, S, US). BRAZIL. AMAPA: *Black & Ivaldo Lobato* 50-9602 (IAN); *Ducke* 2517 (MG); *Geay sn* (P); *Huber* 1201 (BM, MG). AMAZONAS: *Ducke* 6846 (MG); *Froës* 21429 (K, US); *Oliveira* 2866 (IAN); *Prance et al* 4323 (INPA, NY, US); *Prance et al* 15132 (INPA, MO, NY, U, W), 15926 (INPA, K, NY, U); *W. Rodrigues* 175 (INPA); *Tate* 144 (NY).

BAHIA: *Blanchet B3* (BM), 1406 (BM), 2989 (BM, G, LE). CEARÁ: *Ducke 1672* (MG). DISTRITO FEDERAL: *Irwin et al 10194* (NY). ESPÍRITO SANTO: *Bello 491* (R). GOIÁS: *Burchell 6743* (K); *Duarte 9313 A* (RB); *Glaziou 22182 a* (BR, C, G, K); *Irwin et al 11936* (NY); *Macedo 4736* (S, US); *Oliveira 1497* (IAN); *Prance & Silva 59593* (F, NY, P, S, U). MATO GROSSO: *Malmé 2481* (S). MINAS GERAIS: *Macedo 4276* (IAN, RB, US). PARÁ: *Archer 8107* (COL, US); *Ducke 10503* (MG); *Oliveira 2434* (IAN); *Prance, Pennington & Silva 1307* (GH, NY, U, US). RIO BRANCO: *Prance et al 10642* (COL, INPA, NY, U, VEN). RONDÔNIA: *Maas & Maas 397* (U). MATO GROSSO or GOIÁS: *Weddell 2890, 2895* (P). ECUADOR. GUAYAS: *Camp 3600* (F, GH, K, MO, NY, P, US); *Harling 4803* (S); *Hitchcock 20541* (GH, US). MANABI: *Eggers 14143* (L, M, US). MORONA-SANTIAGO: *Harling & Anderson 12888* (GB); *Sparre 19237* (S). NAPO: *Harling et al 6984* (GB, U); *Lugo 2808, 2859* (GB, U), 3317 (GB); *Pinkley 8* (ECON) PICHINCHA: *Plowman & Wade Davis 4456* (GH, U). LOS RIOS: *Asplund 5363* (GH, S, US); *Sparre 14481* (S). ZAMORA-CHINCHIPE; *Sparre 16399* (S). PERU. AMAZONAS: *Berlin 525* (MO, U); *Kayap 781* (MO). LORETO: *Asplund 14399* (S, US); *Dodson 2805* (MO, US); *Ferreyra, 3380* (US); *Killip & Smith 27998* (F, NY, US); *Ll. Williams 1157, 2174, 3591* (F). SAN MARTÍN: *Poeppig sn, anno 1830* (W). STATE ? : *O. F. Cook 1060* (US).

Renealmia alpinia is a species which can hardly be confused with any other, although it superficially looks like *R. thyrsoides*. Its main differentiating character is the membranous calyx, which is very soon circumscissile a few millimeters above the base. In the shape of the bracts there is a slight difference between the plants from the northern part of the area (Central America) and the southern part, the bracts in the northern part being wider and often obtuse (Fig 7), those in the southern always relatively narrow and acute.

In most of the investigated herbarium material the lower side of the leaves is glabrous, but in a few specimens (mostly from SE Brazil, one from Venezuela, and one from Mexico) it is covered with erect, simple hairs.

The inflorescence of *R. alpinia* is often a raceme, but (mainly in the western part of South America and in Central America) there are some specimens with a paniculate thyse, the cincinni being 2-6-flowered! It is not impossible that these many-flowered forms are due to introgression of *R. occidentalis* var *occidentalis*.

The indument of the inflorescence is rather constant, its rhachis very often covered with simple, erect hairs; only in a few collections from Panama and Colombia there occur some scattered, furcate hairs on the rhachis.

The lectotype of *R. goyazensis*, *Glaziou 22183 a* (P), exactly agrees with *R. alpinia* in its inflorescence, but the leaves are aberrant in being much narrower (4.5-5 cm wide) and in having a relatively long petiole (40-45 cm long). It seems doubtful if these leaves really belong to the specimen.

3. *Renealmia alticola* Maas, Acta Bot. Neerl. 24: 474. 1976.

Fig 8.

Plants of unknown height. Rhizomes ca 10 mm thick. Sheaths slightly tuberculate, ca 10 mm wide, rather densely covered with simple or furcate prickles (ca 0.1 mm long) and with simple hairs (0.5 mm long). Ligule 1-3 mm long, hairy like the sheaths. Petiole 5-15 mm long, hairy like the sheaths. Lamina narrowly elliptic, shortly acuminate at the apex (acumen ca 10 mm long), cuneate at the base, 27 cm long, 9.5 cm wide, glabrous on both sides; ca 10 prominent veins on each side of the midrib, 4-12 mm apart. Scape erect, 57 cm tall, up to 5 mm thick, beset with sheaths up to 15 cm long and 0.5-0.7 cm wide. Inflorescence a basal thyse 6-7 cm long and 3.5 cm wide, with 3-flowered cincinni. Indument of inflorescence: rhachis, peduncles, bracteoles, pedicels, basal part of calyx, and ovary rather densely covered with furcate (simple or plurifurcate) hairs (0.1-0.2 mm long), the bracts and capsule sparsely so, corolla glabrous; the apical part of calyx, bracts, bracteoles, and sheaths covered with simple hairs. Bracts deep red, narrowly ovate-oblong, 20-30 mm long, 6-10 mm wide. Peduncles 5-7 mm

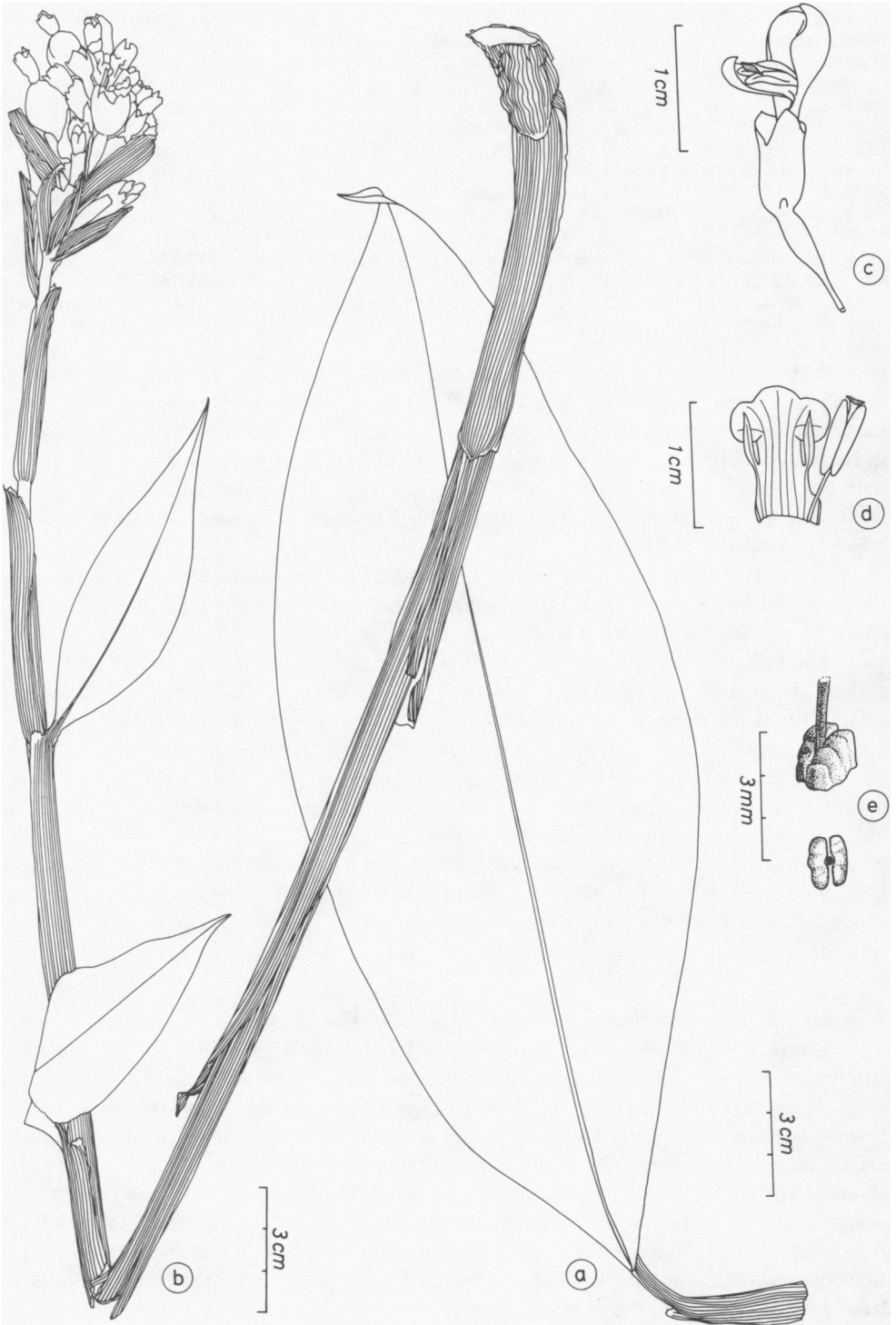


FIG 8. *Renealmia alticola* (a-e, Killip & Smith 16052). a, leaf; b, inflorescence; c, flower; d, labellum and stamen; e, nectarial glands seen from aside and above.

long, the lower ones concaulescent, the adnate part 11 mm long. Bracteole red, 15-17 mm long. Pedicels 5-8 mm long. Calyx red, turbinate, 8-9 mm long, 5-8 mm wide, the lobes depressed ovate, 2-3 mm long, 4-5 mm wide. Corolla pale yellow, 15-16 mm long (in bud), the tube 7 mm long, the lobes 8 mm long, 5-6 mm wide. Labellum pale yellow (?), 7-8 mm long and 6 mm wide when spread out (in bud), glabrous, limb 4 mm long, 6 mm wide, lateral lobes rounded, 3 mm long, 1.5 mm wide, middle lobe entire and rounded, 1 mm long, 3 mm wide, basal claw 4 mm long, 3 mm wide, lateral staminodes ca 3 x 1 mm. Anther 5 mm long, 3 mm wide, glabrous. Style 15 mm long (in bud). Nectarial glands multilobulate, completely surrounding the style base, ca 2 mm long (in bud). Ovary red, ellipsoid. Capsule red, ellipsoid, 12-13 X 7-9 mm, its wall 0.1 mm thick when dry, 5-seeded, seeds 3 X 4 mm.

TYPE. *Killip & Smith 16052* (holotype, NY; isotype, US), vicinity of Las Vegas, Santander, Colombia, 2600-3000 m.

DISTRIBUTION (Fig 61). Only known from the type; in dense woods along a stream.

Renealmia alticola occurs at the highest elevation ever recorded for the genus. It is related to *R. chalconchloa* and differs from that species in its much wider leaves (9.5 cm vs 2.5-6 cm), its very fragile calyx, and in the indument of the rhachis, that of *R. chalconchloa* being almost entirely glabrous, that of *R. alticola*, in contrast, rather densely covered with (mainly) furcate hairs.

4. ***Renealmia asplundii*** Maas, Acta Bot. Neerl. 24: 474. 1976. Fig 9.

Plants 0.50-0.75 cm tall. Rhizomes 3-11 mm thick. Sheaths striate, 5-8 mm wide, to 12 mm at the base of the plant, densely covered with plurifurcate prickles (ca 0.1 mm long) and with needle-like hairs (to 1 mm long). Ligule 1-3 mm long, densely covered with needle-like hairs. Petiole (5-)20-60 mm long, hairy like the sheaths. Lamina narrowly elliptic to narrowly ovate, acuminate at the apex (acumen 10-20 mm long), cuneate at the base, 20-47 cm long, 4.5-9.5 cm wide, margins densely covered with brown, simple hairs (0.2-0.5 mm long), midrib on upper side glabrous or sparsely covered with prickle-like hairs, lower side glabrous. Scape 7-13 cm tall, up to 4 mm thick, beset with sheaths up to 2.5 cm long and 1 cm wide. Inflorescence a basal thyrse 8-12 cm long and 4-10 cm wide, with 2-5-flowered cincinni, rhachis red. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule rather densely covered with plurifurcate (appearing stellate) hairs (less than 0.1 mm long); towards the apex of bracts and sheaths mixed with furcate (and simple) hairs; corolla glabrous. Bracts red, quickly deciduous, narrowly triangular-ovate to triangular-ovate, acute, 7-25 mm long, 4-7 mm wide. Peduncles 5-8 mm long, red. Bracteole 5-11 mm long. Pedicels 3-10(-15) mm long, red. Calyx purple, urceolate to tubular, 4-6 mm long, 3-4 mm wide, the lobes triangular to shallowly triangular, 1-2 mm long. Corolla white, ca 10 mm long. Labellum unknown. Anther 3.5-5 mm long, 1.5 mm wide, glabrous. Style 8-9 mm long. Nectarial glands 2 mm long, forming a one-sided cylinder, only partly surrounding the style base. Ovary globose to ellipsoid. Capsule red, globose to ellipsoid, 6-9 mm long and wide, its wall 0.1-0.2 mm thick when dry, 4-6-seeded, seeds 3 X 4 mm.

TYPE. *Asplund 9376* (holotype, S, 2 sheets), between Tena and Napo, prov. Napo, Ecuador.

DISTRIBUTION (Fig 60). Amazonian parts of Colombia and Ecuador; in primary rain forest, from sea-level to 1000 m.

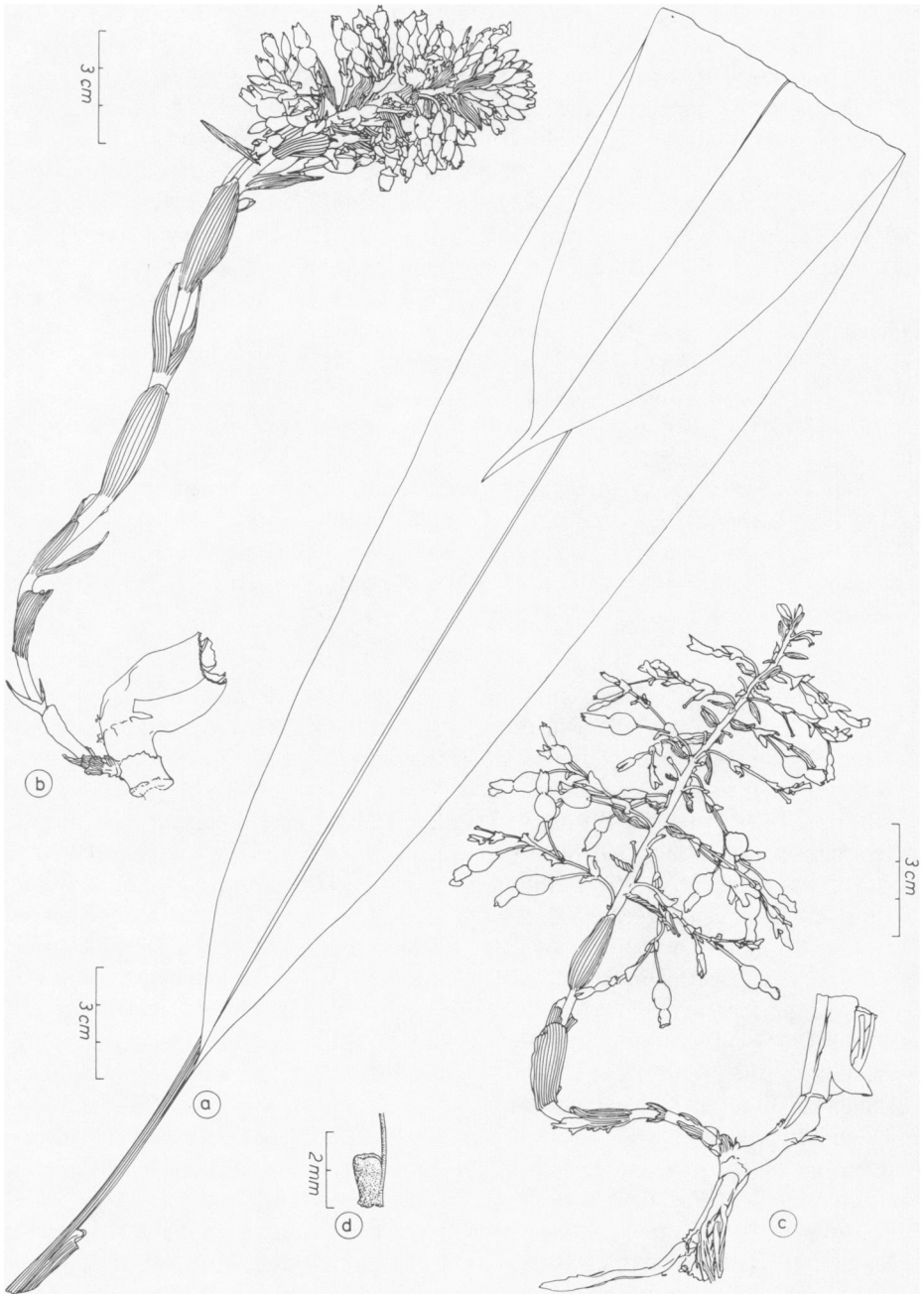


FIG 9. *Renealmia asplundii* (a-b, Asplund 9376; c, Cazalet & Pennington 7800; d, Cuatrecasas 10900). a, leaf; b, inflorescence; c, infructescence showing ripe fruit; d, nectarial glands.

COLOMBIA. CAUCA: El Tambo, La Costa, 1000 m, *von Sneider 1611* (S). PUTUMAYO: 40 km NW of Puerto Asis, 330 m, *King & Guevara 6084* (US); Río San Miguel, near mouth of Río Conejo, 300 m, *Cuatrecasas 10900* (COL, US). ECUADOR. NAPO: Río Aguarico, 30 km E of Sta. Cecilia, *Harling et al 7692* (GB, U); Dureno, Río Aguarico, *Pinkley 83* (ECON). SANTIAGO-ZAMORA: Taisha, 500 m, *Cazalet & Pennington 7800* (K, NY, US).

The closest relative of *R. asplundii* is *R. mexicana*, which shares the long-petiole lamina, the structure of the inflorescence, and the size of calyx and capsule. It diverges from that species, however, by its striate sheaths, its longer anther (3.5-5 mm vs 2.5-3 mm), the smaller bracteole (5-11 mm vs 9-16(-19) mm), and the indument. Future field studies in this group might show that the two are no more than varieties of one species.

Renalmia asplundii is also akin to *R. pluriplicata*, differing, however, in the following characters: sheaths striate (vs reticulate), lamina practically glabrous, and longer petioles.

5. ***Renalmia aurantifera*** Maas, Acta Bot. Neerl. 24: 474. 1976.

Fig 10.

Plants 1.5-3 m tall. Rhizomes ca 10 mm thick. Sheaths striate, 8-12 mm wide, sparsely to rather densely covered with white, flexible, simple (or rarely furcate) hairs (0.2-0.6 mm long) and with stellate prickles (< 0.1 mm long). Ligule 4-10 mm long, hairy like the sheaths, but densely so. Petiole absent. Lamina narrowly elliptic, shortly acuminate at the apex (acumen ca 10 mm long), cuneate at the base, 32-48 cm long, 7.5-14 cm wide, ca 15-plicate, upper side glabrous, lower side sparsely to rather densely covered with white, flexible, simple hairs (0.2-0.6 mm long). Scape erect, 30-70 cm tall, up to 10 mm thick, beset with sheaths up to 13-25 cm long and 1-2 cm wide. Inflorescence a dense, basal thyrse 16-27 cm long and 7-9 cm wide, with 5-6(-9)-flowered cincinni, rhachis dark red. Indument of inflorescence: rhachis, bracts, peduncles, bracteoles, and pedicels sparsely covered with bifurcate or furcate hairs (< 0.1 mm long) and with simple, needle-like hairs (ca 0.5 mm long); calyx, corolla, ovary, and capsule glabrous or nearly so. Bracts dark red (lower ones) to pale greenish red (upper ones), in herbarium material green with brown margins, persistent, narrowly oblong-ovate to oblong-ovate, obtuse, 15-75 mm long, 7-10 mm wide. Peduncles 1-3 mm long, pale orange. Bracteole 10-17 mm long, pale orange. Pedicels 8-15 mm long, pale orange. Calyx (pale) orange, tubular to turbinate, 8-13 mm long, 2-5 mm wide, the lobes deltate to shallowly triangular with a mucronate point below the apex, 1-2 mm long, 2-3 mm wide. Corolla white or yellow, 18-19 mm long, the tube 10-12 mm long, the lobes 6-9 mm long, 3-7 mm wide. Labellum white, 10 mm long and wide when spread out, glabrous, the limb horizontally spreading, 6 mm long, 10 mm wide, lateral lobes rounded, 4 mm long, 3 mm wide, middle lobe undivided or bilobulate, lobules triangular, 3 mm long, 2 mm wide, basal claw 4 mm long, 3 mm wide, lateral staminodes 0.5-2 mm long. Anther 3-4 mm long, 1.5-3 mm wide. Style 15-17 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2 mm long. Ovary bright orange, ellipsoid. Capsule orange to orange-red, finally black, globose to ellipsoid, longitudinally ribbed, 7-12 X 5-9 mm, its wall ca 0.1 mm thick when dry, (0.5-1 mm in living material), 7-12-seeded, seeds 2-5 X 3 mm, aril deep yellow.

TYPE. *Asplund 17423* (holotype, S, 2 sheets), El Volante, on road from Chiriboga to Sto. Domingo de los Colorados, wet shady bank of rivulet, 1900m, prov. Pichincha, Ecuador.

DISTRIBUTION (Fig 61). Ecuador, prov. Pichincha, on forested slopes, from 1800-2400 m.

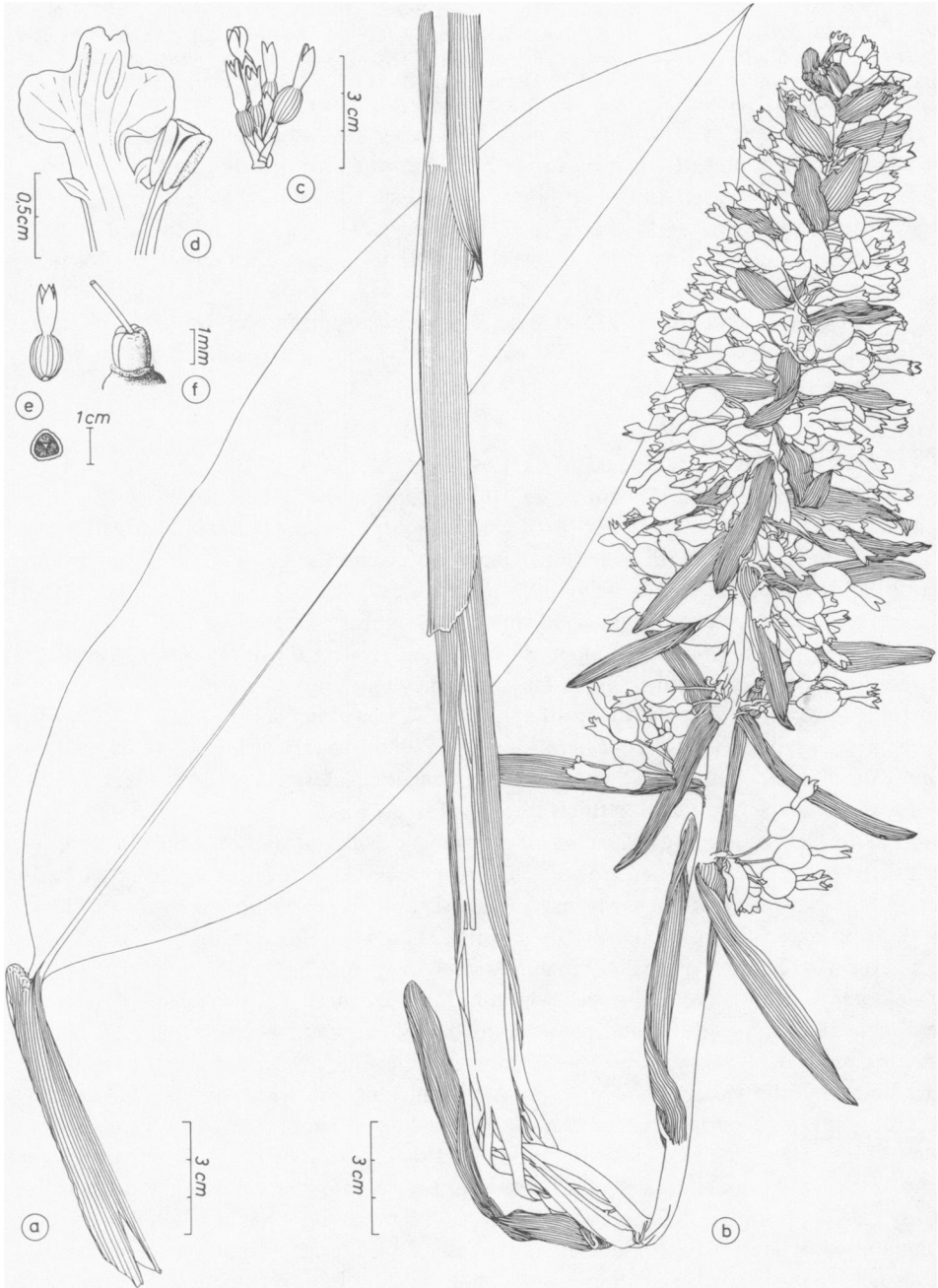


FIG 10. *Renealmia aurantifera* (a-b, *Asplund 17423*; c-f, *Plowman & Davis 4444*). a, leaf; b, inflorescence; c, a single cincinnus; d, labellum and stamen; e, fruit, seen from aside and transversally cut; f, nectarial glands.

ECUADOR. PICHINCHA: San Florencio, *André 3809* (K); Chiriboga, on road from Quito to Sto. Domingo de los Colorados, 1800 m, *Asplund 8663* (S); valley of Río Pilatón, below Garretas, 2200-2400 m, *Asplund 9720* (S); El Palmar, between Chiriboga and Sto. Domingo de los Colorados, 1950 m, *Asplund 17130* (S); near Tandayapa, 1900 m, *Harling & Andersson 11621* (GB, U); road Quito-Puerto Quito, between Nono and Tandayapa, km 42 from Quito, 2375 m, *Plowman & Wade Davis 4444* (GH, U); Río Saloya (between Volcán Pichincha and Volcán Atacaso), 1830-2430 m, *Steyermark 52499* (F).

This species has two close relatives, namely *R. dolichocalyx* and *R. stellulata*; it differs from the first by its very long ligule, the much shorter calyx (8-11 mm vs 16-20 mm), and its much longer bracts; besides, the lower leaf surface of *R. aurantifera* is covered with simple hairs, that of *R. dolichocalyx* with furcate to plurifurcate hairs. From *R. stellulata* it differs by the much larger leaves, 5-6-flowered (vs. 2-4-flowered) cincinni, and the indument of the inflorescence.

Camp E 3382 (F, GH, K, MO, NY, P, S, US) from Canon, Río Chanchan, 5 km N of Huigra, prov. Chimborazo, Ecuador, 1660-2160 m, might belong to this species. It differs, however, by its glabrous and smaller lamina (24-33 X 4.5-11 cm), its 3-4-flowered cincinni, much smaller inflorescence, and tuberculate leaf-sheaths. It also shares some characters with *R. oligosperma*, a species, restricted, however, to lower elevations (0-1300 m).

6. ***Renealmia brasiliensis*** K. Schumann emend. Maas

Fig 11.

Renealmia brasiliensis K. Schumann in Engler, Pflanzenreich 4. 46: 305. f. 38 a-c. 1904, in part; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930.

Renealmia spec., O. G. Petersen in Engler & Prantl. Nat. Pflanzenfam. 2.6: f. 19. 1888; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: f. 273. 1930.

Plants 0.5-2.5 m tall. Rhizomes 10-15 mm thick. Sheaths appearing very distinctly reticulate, the cross-connections formed by white, hardly elevated bands, the space between them brownish, 5-10 mm wide, to 20 mm at the base of the plant, densely to rather densely covered with simple (or furcate) prickles (less than 0.1 mm long) and needle-like hairs (to 0.3 mm long). Ligule ca 1 mm long. Petiole absent. Lamina narrowly elliptic to narrowly obovate, acuminate at the apex (acumen 5-10 mm long), cuneate at the base, 32-57 cm long, 7-13 cm wide, upper side glabrous, midrib on the lower side in the basal part sparsely covered with prickles. Scape erect, pink, 40-70 cm tall, up to 5 mm thick, beset with sheaths up to 7-9 cm long and 0.6-1.3 cm wide. Inflorescence a basal raceme 20-36 cm long and 3-8 cm wide. Indument of inflorescence: rhachis, bracts, peduncles, bracteoles, pedicels, and calyx sparsely to densely covered with erect, simple (rarely furcate) hairs (0.1-0.4 mm long), ovary sparsely so, corolla and capsule glabrous. Bracts pink, membranous, soon deciduous, narrowly elliptic-triangular, acute, 10-40 mm long, 5-8 mm wide. Peduncles 1-5(-9) mm long. Bracteole pinkish, 11-19 mm long. Pedicels 7-12(-15) mm long. Calyx pinkish, tubular, 14-22 mm long, 5-7 mm wide, the lobes deltate to triangular, 4-6 mm long, 3-4 mm wide. Corolla pink, 22 mm long, the tube 11-12 mm long, the lobes 10-11 mm long, 5-8 mm wide. Labellum 10-11 mm long and ca 8 mm wide when spread out, middle part and base densely hairy, the limb erect, 6-7 mm long, ca 8 mm wide, lateral lobes involute, rounded, middle lobe entire or divided into two lobules 2-2.5 mm long and 1.5-2 mm wide, basal claw 4 mm long, 2-3 mm wide, lateral staminodes 1-1.5 mm long. Anther 5-8 mm long, 2.5-3 mm wide, sparsely hairy at the base. Style 19 mm long. Nectarial glands completely surrounding the style base, 2-3 mm long. Ovary ellipsoid. Capsule scarlet, ellipsoid to globose, (9-)12-25 mm long, (6-)8-14 mm wide, its wall ca 0.2 mm thick when dry (in *Mexia 4645* to 0.5 mm thick), 20-25-seeded, seeds 3 X 4 mm.



FIG 11. *Renealmia reticulata* (a-c, e, g, Glaziou 20514; d, f, Brade 19940) and *Renealmia brasiliensis* (a'-c', h', Warming 505; d'-f', Hoehne 756; g', Hoehne & Gehrt sn). a, a', leaves; b, b', leaf-sheaths; c, c', inflorescences; d, d', flowers; e, e', labellum and stamen; f, f', nectarial glands; g, g', h', fruit.

TYPE. *Warming 505* (lectotype, C), Lagôa Santa, Minas Gerais, Brazil; the Warming collection is designated as lectotype as the two other syntypes (*Sellow sn*, Rio de Janeiro, Brazil and *Mendonça 612 b*, Serra da Urassanga, Brazil) were destroyed with the Berlin herbarium.

DISTRIBUTION (Fig 58). Southeastern Brazil, wet forests in Minas Gerais, Espirito Santo, and Guanabara.

BRAZIL. ESPIRITO SANTO: Colonia de Agria Blanca, 61 km of Colatina, *Kuhlmann 319* (RB); Sta. Barbara de Caparão, *Mexía 4091* (US). MINAS GERAIS: Piaú, *Heringer 756* (SP); Turvo, *Hoehne & Gehrt sn* (SP 17540); 26 km S of Matipo, *Magalhães 5156* (IAN); Viçosa, road E of Cha-Cha Valley, *Mexía 4645* (BM, F, GH, K, IAN, MO, NY, S, US); Carmo, Paquequer, *Neves Armond 124* (R); Itajuru, *Aug. de Saint-Hilaire sn, B4 281* (P, sterile).

Characteristics of this species are the brown-and-white-patterned leaf-sheaths, the shortly pedunculate flowers, the sessile leaves, and the membranous bracts. It is closely related to *R. reticulata* and *R. petasites*.

I am not quite sure of Schumann's concept of *R. brasiliensis*, as two of the three original collections were destroyed. I have studied the third syntype, *Warming 505* (C), and treat that specimen as the lectotype of *R. brasiliensis*. Arguments for this lectotypification are: 1, the citation by Schumann of the Warming collection in his original diagnosis of *R. brasiliensis* (he cited it as: "Staat Minas Geraes, bei Lagoa Santa (Warming)"; 2, the Warming collection completely agrees with a collection identified by Loesener as *R. brasiliensis* (*Hoehne & Gehrt sn* (SP 17540)). Granted that Loesener was a specialist in the Zingiberaceae and that he had all Schumann's original material at hand, this determination is presumably correct.

There are, however, also a few arguments against the selection of this lectotype: 1, it is not absolutely sure that the Warming collection cited by Schumann is indeed *Warming 505* from the Copenhagen herbarium (the collection was not annotated by Schumann), although it was Warming's only *Renealmia* collection from that locality; the specimen does not completely fit Schumann's description of *R. brasiliensis*, e.g. diverging in having bracts of 2-4 cm long (instead of "5-8 cm longae"); 2, Schumann identified the specimen *Lund sn, anno 1829* (C) as *R. brasiliensis*, but in my opinion it belongs to *R. petasites*. My conclusion is that *R. brasiliensis* K. Schumann comprises two different elements, namely *R. petasites* and a species which I now call *R. brasiliensis* K. Schumann emend. Maas. The only alternative is to describe the species under discussion as a new one.

7. ***Renealmia breviscapa*** Poeppig & Endlicher, Nov. Gen. & Sp. Pl. 2: 25. t. 135. 1838 (incl. var α & β); Horaninow, Prodr. 33. 1862; O. G. Petersen in Martius, Fl. Bras; 3(3): 46. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 300. 1904 (excl. syn.); Loesener, Notizbl. Bot. Gart. Berl. 11: 88. 1931. Fig 12.

Ethanium breviscapum (Poeppig & Endlicher) O. Kuntze, Rev. Gen. 1: 690. 1891.

Renealmia spicata Gagnepain Bull. Soc. Bot. France 49: 27. 1902; K. Schumann in Engler, Pflanzenreich 4. 46: 298. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930. Type. *Gay 865* (holotype and isotype, P), Peru, without locality, annis 1839-1840.

Plants 0.6-1.5 m tall. Rhizomes 3-10(-20)mm thick. Sheaths striate, 5-10 mm wide, to 15 mm at the base of the plant, glabrous to rather densely covered with simple, furcate, and stellate prickles (0.02-0.1 mm long), and with needle-like, simple hairs (to 0.3 mm long). Ligule ca 1 mm long, hairy like the sheaths. Petiole 20-60 mm long, hairy like the sheaths. Lamina narrowly obovate to narrowly elliptic, acute to shortly acuminate at the apex (acumen to 10 mm long), cuneate at the base, (8-)15-47 cm long, (3-)5-15 cm wide, upper side glabrous, lower side glabrous or sometimes covered with simple (or very

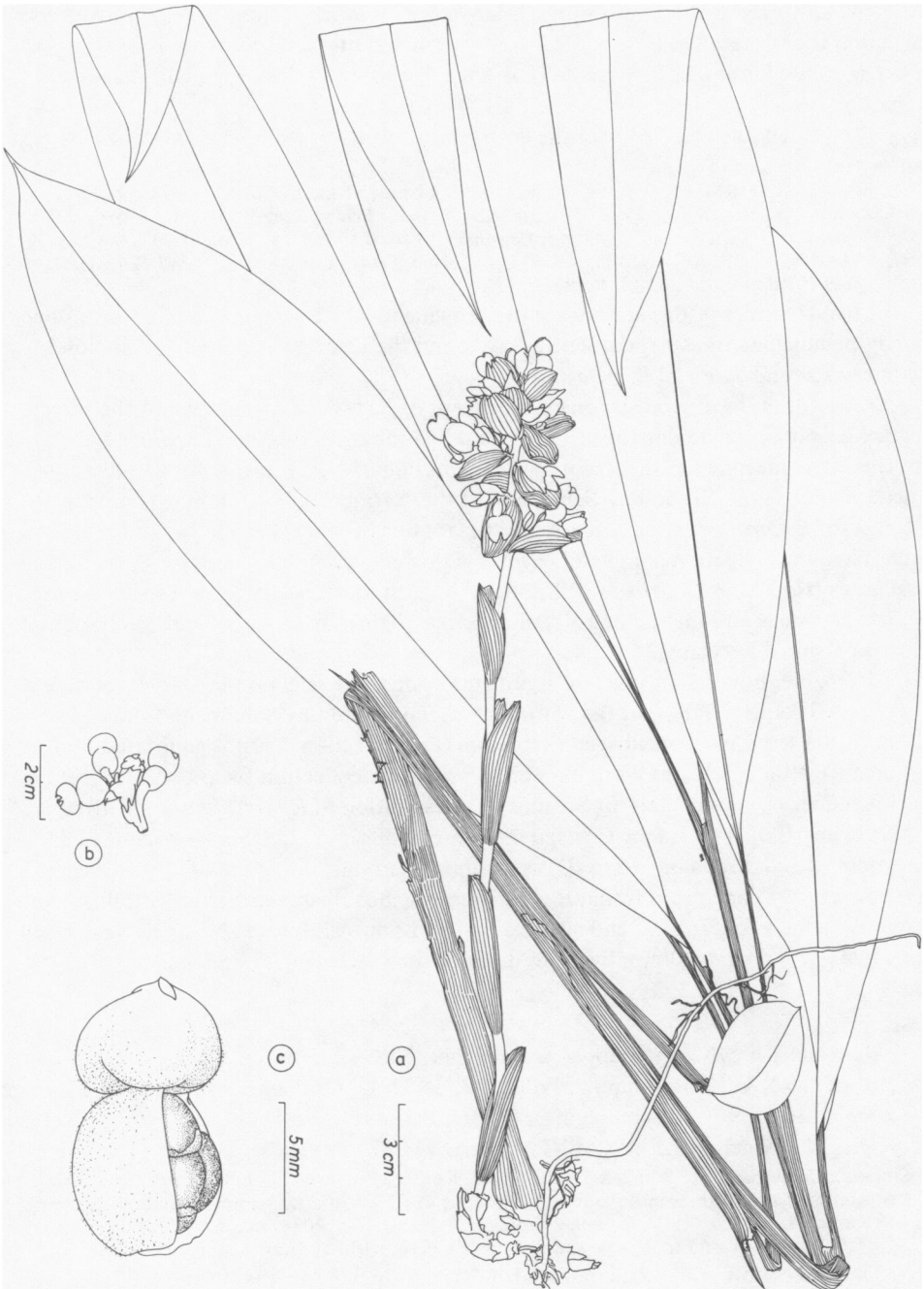


FIG 12. *Renealmia breviscapa* (a-c, Harling & Andersson 12863). a, habit; b, a single cincinnus; c, fruit.

rarely furcate) hairs (to 0.4 mm long), mainly along the midrib and margins. Scape erect, 10-55 cm tall, up to 3(-5) mm thick, beset with sheaths up to 2-6 cm long (in one plant to 14 cm) and 0.5-1 cm wide. Inflorescence a dense, basal thyrse 5-25 cm long and 1.5-3 (-6) cm wide, with 2-4-flowered (in one plant to 7-flowered) cincinni, rhachis orange. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, capsule, and ovary sparsely to rather densely covered with furcate, plurifurcate, or occasionally simple hairs (0.1-0.5 mm long), rarely glabrous. Bracts pale green, herbaceous, rather long persistent, ovate-triangular to broadly ovate-triangular, obtuse (sometimes acute), 5-25 mm long, 5-15 mm wide. Peduncles and pedicels orange, 3-7(-10) mm long. Bracteole 5-11 mm long. Calyx orange (to green), urceolate, 3-6 mm long and 3-9 mm wide, the lobes broadly to shallowly triangular-ovate, 1-2 mm long, 1.5-5 mm wide. Corolla 9-10 mm long, tube 4-5 mm long, the lobes 5 mm long, ca 3 mm wide. Labellum ca 8 mm long. Anther 2.5-3 mm long, ca 1.5 mm wide. Style 8 mm long. Nectarial glands only partly surrounding the style base, ca 2 mm long. Ovary orange, globose to ellipsoid. Capsule orange, maturing black, globose to ellipsoid, 4-9 mm long and wide, its wall ca 0.1 mm thick when dry (ca 0.5 mm in living material), 3-10-seeded, seeds 2-4 mm in diameter, aril orange.

TYPE. *Poeppig sn, anno 1830* (holotype, W), Pampayuco, Loreto, Peru.

DISTRIBUTION (Fig 61). Western part of tropical South America, from S Colombia to Bolivia, and one collection from Mato Grosso, Brazil; in rain forests, from sea-level up to 800(-1660) m.

COLOMBIA. AMAZONAS: *Sastre & Echeverry 609* (COL, P). CAQUETA: *Romero Castañeda 3982* (COL). CAUCA: *von Sneider 843* (S). PUTUMAYO: *Cuatrecasas 10650* (COL, US). BRAZIL. ACRE: *Prance et al 12559* (INPA, NY, P, U); *Maas et al 12950* (COL, F, INPA, K, MG, MO, NY, R, S, U, US, VEN); *Ule 6005* (MG), *9199* (K, MG), *9200* (K, MG). MATO GROSSO: *Lindman 2823a* (S). "Bras. Occid.": *Tamberlik 2* (W). ECUADOR. ?ESMERALDAS: *Gutiérrez V. 2640* (COL); NAPO: *Asplund 8889* (S); *Harling 3584* (S); *Harling & Andersson 12863* (GB, U); *Harling et al 6987* (GB, U), *7345* (GB), *7563* (GB), *7612* (GB, U); *Lugo 1033* (GB, U); *Pinkley sn* (ECON); *Whitmore 736* (K, NY). PERU. AMAZONAS: *Berlin 704* (MO); *Kayap 297* (MO). AYACUCHO: *Killip & Smith 22884, 23041* (US). CUZCO: *Plowman & Wade Davis 5013* (GH, U). JUNIN: *Killip & Smith 23884* (NY, US). HUANUCO: *Asplund 12695* (S); *Poeppig sn* (F, P, W); *Schunke V. 1196, 2973* (U). LORETO: *Ule 6605* (G, MG). MADRE DE DIOS: *Vargas C. 16097* (CUZ, US). SAN MARTIN: *Schunke V. 3738* (U), *5550* (NY, U). DEP. ? : *Mathews 13* (K). BOLIVIA. BENI: *Fleischmann 389* (US); *G. Meyer 43, 170* (Z). LA PAZ: *Rusby 2784* (NY); *Tate 521* (NY). SANTA CRUZ: *Steinbach 5533* (G), *7442* (BM, E, F, GH, K, LIL, MO, NY, S, U). DEP. ? : *R. S. Williams 524* (K, NY, US).

Renealmia breviscapa is readily recognized by its long-petiolate lamina, green, mostly obtuse bracts, and urceolate, mostly orange calyx. It has some affinity to *R. costaricensis* which differs, however, by its strongly imbricate bracts and its cylindrical, pinkish-red calyx. From *R. concinna* it can be distinguished by the more obtuse bracts and the absence of hairs of the compass-needle type on the lamina beneath.

8. ***Renealmia caucana*** Maas, Acta Bot. Neerl. 24: 474. 1976.

Fig 13.

Plants ca 3.75 m tall. Sheaths striate, ca 10 mm wide, more or less shining, sparsely covered with simple, appressed hairs (to 0.3 mm long) and with furcate prickles, rather densely so towards the ligule. Ligule ca 1 mm long, densely covered with appressed hairs (to 1 mm long). Petiole 5-15 mm long, glabrous or sparsely covered with simple (and furcate) hairs. Lamina narrowly elliptic, cuneate at the base, acuminate at the apex (acumen 15-20 mm long), 40-68 cm long, 12-19 cm wide, 25-30 plicate, both sides densely covered with erect, simple hairs (0.1-0.3 mm long). Scape erect, 5-15 cm tall, up to 10 mm thick, beset with deciduous sheaths up to 3.5-6 cm long, 1-2 cm wide, rhachis red. Inflorescence a thyrse 10-15 cm long and 3-5 cm wide (to 29 x 5 cm in fruit), with 5-9-flowered cincinni. Indument of inflorescence: lower sheaths rather densely covered with simple, appressed

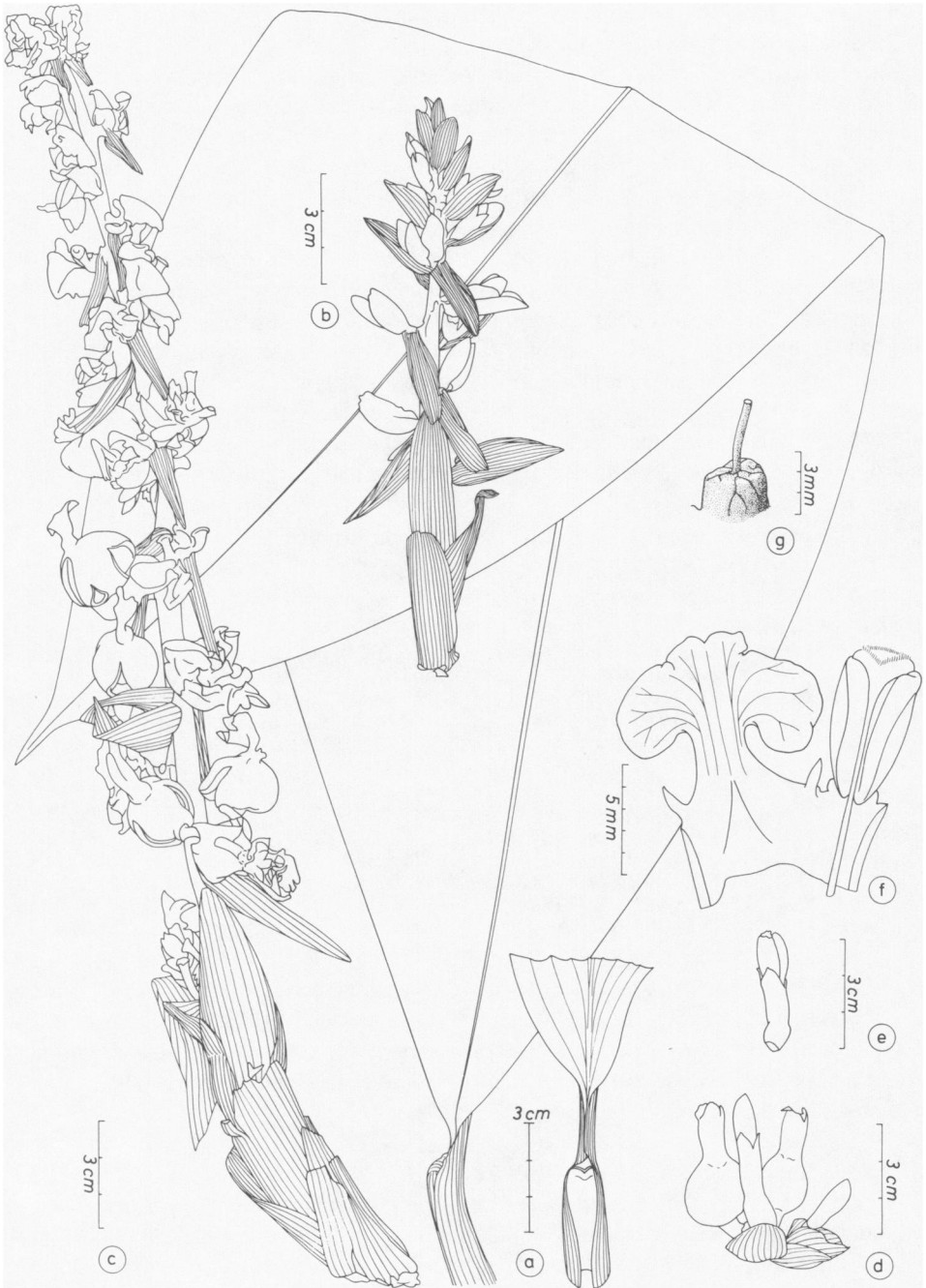


FIG 13. *Renealmia caucana* (a-g, Maas & Plowman 2153). a, leaf; b, young inflorescence; c, infructescence; d, cincinnus; e, flower; f, labellum and stamen; g, nectarial glands.

hairs (to 0.5 mm long) and furcate hairs (to 0.2 mm long), the upper ones sparsely so, rhachis, peduncles, and pedicels sparsely to rather densely covered with simple hairs (to 0.5 mm long) and furcate hairs (to 0.2 mm long), bracts and bracteoles glabrous or with an apical tuft of hairs, corolla glabrous, ovary and capsule very sparsely hairy at the base. Bracts red, deciduous at length, soon reflexed (when dry!), narrowly triangular to triangular, acute, 1.5-4 cm long, 0.5-1.8 cm wide. Peduncles red, 3-8 mm long. Bracteole red, 12-15 mm long. Pedicels red, 5-8 mm long. Calyx pinkish-red, tubular, 18-21 mm long, ca 6 mm wide, lobes 3-5 mm long, deltate. Corolla white, 30 mm long, tube 15 mm long, lobes 15 mm long, the dorsal one 12 mm wide, the two lateral ones 8 mm wide. Labellum white, glabrous, 16 mm long and wide when spread out, the limb erect, 8 mm long, 16 mm wide, the lateral lobes 6 mm long and wide, involute and forming a tube of ca 5 mm in diam, middle lobe entire, reflexed, basal claw 8 mm long, 4 mm wide, lateral staminodes ca 2.5 mm long. Anther 8 mm long, 5 mm wide. Style 28 mm long. Nectarial glands completely surrounding the style base, ca 2 mm long. Ovary red, ellipsoid. Capsule red, depressed globose, 12-18 mm in diameter, its wall 0.7-1 mm thick when dry, ca. 3 mm in living material, 30-60 seeded, seeds 3 X 3.5 mm, aril white.

TYPE. *Maas & Plowman 2153* (holotype, U; isotypes, COL, F, GH, K, NY), Cordillera Occidental, road from Timbío to Veinte de Julio, forest along roadside, 2100 m, Cauca, Colombia.

DISTRIBUTION (Fig 58). Only known from the type collection.

This new species was collected in the poorly explored department of Cauca, Colombia. In a future exploration trip the author hopes to make more collections in this highly interesting region. *Renealmia caucana* is characterized by its very wide, hairy lamina, and its many-flowered cincinni. Its closest relative is *R. ligulata*.

9. ***Renealmia cernua*** (Swartz ex Roemer & Schultes) Macbride, Field Mus. Nat. Hist. Bot. Ser. 11: 14. 1931; Standley, Field Nat. Hist. Bot. Ser. 18: 189. 1937; Woodson, Ann. Missouri Bot. Gard. 32: 58. f. 35. 1945; Standley, Fieldiana: Botany 24(3): 201. 1952. Fig 14 a-e.

Costus cernuus Swartz ex Roemer & Schultes, Syst. Veg. 1: 25. 1817; Horaninow, Prodr. 38. 1862; K. Schumann in Engler, Pflanzenreich 4. 46: 425. 1904.

Alpinia spicata auct. non Jacquin: Presl, Reliq. Haenk. 1: 109. 1830; K. Schumann in Engler, Pflanzenreich 4. 46: 307. 1904. (\equiv *Alpinia presliana* Steudel).

Renealmia strobilifera Poeppig & Endlicher, Nov. Gen. & Sp. 2: 25. t. 136. 1838; Horaninow, Prodr. 33. 1862; O. G. Petersen in Martius, Fl. Bras. 3(3): 48. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 289. f. 38p. 1904; K. Schumann in Engler, Pflanzenreich 4. 46: 371. 1904 (as "*Alpinia strobilifera*"); Loesener in Engler & Prantl, Nat. Pflanzenfam, ed. 2. 15A: 609. 1930; Standley, Contr. Nat. U. S. Nat. Herb. 27: 119. 1928; Jonker & Jonker, Acta Bot. Neerl. 4(2): 172. 1955. Type. *Poeppig sn* (holotype, W, destroyed; isotype, P), Maynas, near Yurimaguas, San Martín, Peru.

Alpinia presliana Steudel, Nomencl. Bot. ed. 2. 1: 62. 1840; Horaninow, Prodr. 34. 1862; K. Schumann in Engler, Pflanzenreich 4. 46: 307. 1904 (name only). Type. *Haenke sn* (holotype, PR), Mexico, locality unknown (\equiv *Alpinia spicata* sensu Presl, not of Jacquin).

Maranta strobilifera Miquel, Linnaea 22: 79. 1849. Type. *Kegel 1479* (holotype, GOET; isotype, U), Bigi Poika, Saramacca River, Suriname.

Phrynium strobiliferum (Miquel) K. Koch, Allg. Gartenzeit. 25: 147. 1857.

Calathea strobilifera (Miquel) Koernicke, Bull. Soc. Nat. Moscou 35(1): 143. 1862; O. G. Petersen in Martius, Fl. Bras. 3(3): 109. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 106. 1904; Jonker & Jonker, Acta Bot. Neerl. 4(2): 172. 1955.

Costus podocephalus Donnell Smith, Bot. Gaz. 23: 250. 1897; K. Schumann in Engler, Pflanzenreich 4. 46: 424. 1904. Syntypes. *Donnell Smith 4972* (K, US), Guápiles, Llanos de Sta. Clara, Comarca de Limón, Costa Rica, 250 m and *Tonduz 9238* (BR, CR, US), Shirores, Talamanca, Costa Rica, 100 m.

Plants 1-5 m tall. Rhizomes 7-15(-20) mm thick. Sheaths distinctly reticulate,

slightly scabrid to the touch, 4-10 mm wide, to 20 mm at the base of the plant, sparsely to rather densely covered with simple (rarely furcate and stellate) prickles (0.03-0.1 mm long); towards the ligule the indument denser and the hairs longer (to 0.2 mm long), exceptionally the reticulations covered with dense tufts of simple hairs (0.5-0.8 mm long). Ligule 2-6 mm long, densely covered with simple, appressed hairs (0.3-0.5 mm long). Petiole often absent or up to 15 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen 5-15 mm long), cuneate or slightly rounded at the base, (10-)22-43 cm long, (3.5-)5-12 cm wide, the uppermost lamina strongly reduced down to 2 cm long and 0.3 cm wide, glabrous on both sides. Inflorescence an ovoid or cylindrical, terminal spike (2-)4-14(-27) cm long, 2-6 cm wide, the rhachis 2-4(-7) mm thick. Indument of inflorescence: rhachis densely (to sparsely) covered with simple (and some furcate, sessile), appressed hairs (0.2-0.6 mm long); bracts and bracteole sparsely to rather densely so, corolla, ovary, and capsule glabrous to sparsely (rarely rather densely) hairy. Bracts coriaceous to chartaceous, persistent, of all shades from yellow to red (red, orange red, orange-yellow, or yellow), rarely greenish, narrowly triangular to triangular with an acute, sometimes pungent and callose (callus 1-3 mm long) tip, or narrowly triangular-ovate to triangular-ovate with an obtuse to acute apex, 15-35 mm long, 3-12(-19) mm wide. Peduncles and pedicels absent. Bracteole 8-13 mm long, keeled on the sides. Calyx colored like the bracts, tubular, chartaceous to coriaceous, 9-13 mm long, 3-5(-7) mm wide, the lobes deltate, acute, 2-4 mm long and wide. Corolla yellow (to white), 18-22 mm long, the tube 10-14 mm long, the lobes 8-9 mm long, 3-5 mm wide, dorsal petal divergent (angle ca 30°). Labellum yellow (to white), 7-8 mm long and 6 mm wide when spread out, more or less broadly ovate in outline, middle and basal part and margins densely covered with simple hairs (0.2-0.3 mm long), lateral lobes 1-3 mm long and 0.5-1.5 mm wide, middle lobe rounded or emarginate, lateral staminodes ca 1 mm long, densely hairy. Anther 5-6 mm long, 2.5-3.5 mm wide, glabrous. Style 19-20 mm long, upper part densely covered with simple hairs (0.2-0.3 mm long). Nectarial glands multilobulate, completely surrounding the style base, 2 mm long. Ovary green, ellipsoid. Capsule green, maturing orange and at last black (often glossy pale brown when dry), globose, 6-11(-23) mm in diameter, its wall 0.1-0.2 mm thick when dry, 8-15(-30)-seeded, seeds 2.5-4 X 2-2.5 mm.

TYPE. *Pihl sn* (holotype, S), Portobelo, Colón, Panama.

DISTRIBUTION (Fig 57). Mexico, Central America, South America from Colombia to Peru in the West and to Venezuela and Amazonian Brazil in the East; in forests (marsh forest, rain forest, cloud forest), along their margins, often bordering streams; from sea-level to 1400(-1800) m.

MEXICO. *Haenke sn* (PR). GUATEMALA. *Deam 6019* (F, GH, MICH, MO, NY, US).

NICARAGUA. *Lévy 1416* (P); *Long 46* (F); *Molina R. 2078* (F); *Oersted 14744* (C, F, GH, MICH, US), *14745* (C, GH, US), *sn*, Mar 1848 (C); *Shank & Molina R. 4789, 4871* (EAP); *Shimek & C. L. Smith 472* (EAP); *Standley 9116, 19522* (F); *Tate 410 (154)* (K); *Wullschlägel 1784* (BR). COSTA RICA. *Biolley 31* (F), *1078* (BR); *Brenes 19226* (CR); *Burger & Matta U. 4440* (CR, F, GH); *4510* (F), *4557* (CR, F); *Burger & Stolze 5182, 5920* (F); *coll. indigenes 13* (U); *Cook & Doyle 308, 531* (US); *Córdoba 421* (MO); *Debeaux sn* (P); *Dodge et al 8074* (MO); *Dodge & Goerger 10143* (MO); *Duróz 23182* (CR); *Echeverría 845* (CR, F); *Gillis 10138* (U); *Greenman & Greenman 5268* (MO); *Holm & Iltis 325* (GH, P, U), *729* (GH); *Jiménez M. 695, 1186, 2886* (CR, F); *Kupper 392* (MO); *Lankester K 314* (K); *Lent 68* (CR); *Léon 968* (US), *4612* (EAP); *Maas 872* (U); *Maas & Lent 1219* (COL, E, F, U); *Molina R. et al 17472* (CR, F), *17615* (F); *Mori & Anderson 170* (F, U, WIS), *Noguera 10899* (US); *Oersted sn, V-1847* (C); *Proctor Cooper 52* (F); *Raven 21814* (F); *Shank & Molina R. 4141* (EAP); *A. Smith 232* (F); *Solis R. 435* (BM, CR, F), *569* (CR, F); *Standley 33602, 35964, 36967, 37425* (US), *39920* (F, US); *Standley & Torres R. 51701, 51726* (US); *Standley & Valerio 45161* (US); *Stork 511* (US); *Tonduz 8369* (BR, US), *9946* (BR, US), *10899* (CR), *17884* (G, LE, US); *United Fruit Co. 367* (US); *J. Valerio R. 1346* (CR, F), *1380* (F), *1383* (CR); *M. Valerio 400* (BR, CR, F), *679, 766* (F); *Wilbur & Stone 10693* (DUKE);

Wilbur 14437 (DUKE). PANAMA. P. H. Allen 255 (F, GH, MO); Aviles 29 (F); Bartlett & Lasser 16354, 16636 (MICH, MO); Billberg 229 (S); Carleton 153 (GH, NY, US); Cowell 84 (NY); Davidson 1126 (F); Dodge 3487 (GH, US); Dodge & Allen 17475 (BM, MO); Duke 3854 (MO), 4823 (GH, MO, US), 5440 (MO), 12090, 13033 (U); Duke & Dwyer 13982 (MO); Duke & Kirkbride 14071 (U, WIS); Dunlap 153 (US); Elias & Kirkbride 1634 (MO); Elmore L 18 (MICH); Fendler 445 (MO, US); Foster 1707 (DUKE); Gentry & Dwyer 3466 (MO, U); Gentry & Mori 13609 (MO, U); Graham 323 (GH); Hunnewell 16416 (GH); I. M. Johnston 1638 (GH), 1639 (MO); Kenoyer 234 (F); Killip 39985 (US); Kirkbride 1064 (MO); Kirkbride & Bristan 1540 (MO); Kirkbride & Duke 1206 (MO); Lewis, MacBryde & Solis 2257 (MO); Luteyn 1549 (DUKE); Maas & Dressler 709 (U); Maxon 4668, 4706 (US); Maxon & Harvey 6702 (US); Maxon et al 6794 (US); Maxon & Valentine 6976 (US); Ostensfeld 93 (C); Piper 5779, 5904 (US); Seibert 600 (GH, MO, NY); Shattuck 23 (F, GH); Standley 26731, 27501, 28376, 31292 (US); Stern, Chambers, Dwyer & Ebinger 87 (GH, LE, MO, US); Stevens 1328 (US); Steyermark & Allen 17113 (MO, US); Stimson 5019 (DUKE); Terry & Terry 1473 (F); Tyson 867, 909, 2129 (MO); Tyson & Blum 3995 (MO); Tyson et al 4564 (MO); Wagner sn (MO); M. Wagner sn Jan 1856 & Jul 1858 (M); Weddell sn (P); von Wedel 27 (GH, MO), 977, 1204 (GH, MO, US), 1889 (BM, GH), 2320 (BM, GH, US), 2489, 2816 (GH, MO, US); C. L. Wilson 96 (F); Woodson & Schery 860 (MO, NY, US), 172, 877 (MO); Woodworth & Vestal 474 (F, GH); Young 27 (EAP).

COLOMBIA. ANTIOQUIA: Daniel & Tomás 3369 (US); Haught 4942 (BM, COL, US).

BOLÍVAR: van der Hammen 725 (COL); Lehmann sn (K); von Sneidern 5717 (S). BOYACÁ: Sastre 744 (P, U). CAQUETA: Cuatrecasas, Soderstrom & Soria 27173 (US); Pérez-Arbelaez 758 (COL, US), 762 (COL); Romero Castañeda 4025 (COL); von Sneidern A 1027, A 1103 (S); Uribe P. sn (US). CAUCA: Cardeñosa B. sn (COL); Fernández 2756 (COL); Lehmann K 359 (K); Triana 649 (1626) (BM, COL). CESAR: C. Allen 281 (MO). CHOCÓ: Archer 1896 (US); Cuatrecasas 16869 (F); Duke & Idrobo 11406 (U); Fernández 302 (COL, US, VALLE); Forero, Yaramillo & Mc. Elroy 1138 (COL, U); Pinto & Kotschwar 80 (COL). CUNDINAMARCA: García-Barriga 7678 (COL, US), 12463 (COL, US). HUILA: Rusby & Pennell 491 (NY, US).

MAGDALENA: H. H. Smith 2657 (BM, E, F, GH, K, MICH, MO, NY, P, S, US). META: Cuatrecasas 4700 (F), 7472 (COL, F, US); Gilliard sn (NY); Killip 34477 (US); Fr. Nicéphore-Marie 569 (MPU); Philipson 2367 (BM, COL); Philipson et al 1451 (BM, COL, S, US); Plowman et al 4207 (GH, U); Galen Smith & Idrobo 1478 (COL, GH, US); Vogel 101 (B). NORTE DE SANTANDER: Cuatrecasas 13160 (COL, F, US); García-Barriga & Lozano-C. 18227 (COL). SANTANDER: Haught 1381 (COL, US); Hodge 6501 (GH); Killip & Smith 14763 (NY, US). TOLIMA: Goudot sn (P); Grubb et al 49 (COL, K, US); Galen Smith 1282 (COL); Uribe Uribe 3163 (COL). EL VALLE: Cuatrecasas 15897, 16996, 22869 (F); Dryander 1953 (US), 2344 (BM, US), 2479 (F, US); Duque-Jaramillo 1393 (F), 4036-A, 4231-A, 4328-A, 4593 (COL); García-Barriga 6346 (COL, US); Kennedy 767 (U); Killip 33951 (US); Killip & Cuatrecasas 38716 (US); Killip & García-Barriga 33451 (COL, US); Killip et al 11705 (GH, NY); Maas & Plowman 1929 (COL, GH, U); Pennell, Killip & Hazen 8438 (GH, NY, US). STATE?: Bonpland sn (P); Mutis 2884 (US). VENEZUELA. APURE: Steyermark et al 101446 (U, VEN). BARINAS: Aristeguieta 3862 (VEN); Steyermark & Rabe 96494 (F, NY, U, US, VEN). TRUJILLO: Moritz 1289 (BM, BR, K, L); Reed 901 (US). ZULIA: Jangoux 10225 (U, VEN). BRAZIL. ACRE: Kuhlmann 810 (RB); Maas et al 13086 (INPA, NY, U, W). AMAZONAS: Huber 4397 (MG); Krukoff 5143, 5888 (NY). RONDÔNIA: Prance et al 6631 (INPA, NY, U). ECUADOR. ESMERALDAS: Harling 4599 (S). MORONA-SANTIAGO: Harling & Andersson 13068 (GB). SANTIAGO-ZAMORA: Camp E 896 (NY, US). PERU. HUANUCO: Schunke V. 2980 (US). LORETO: Killip & Smith 27783 (US); Ll. Williams 4116 (F, US), 5234 (F); Wurdack 2511 (US).

This species is very peculiar by its terminal, orange-red spike and its chartaceous to coriaceous, densely imbricate bracts. Superficially it resembles *Costus* in the shape and colour of the inflorescence, and because of these characters it has been described as *Costus cernuus* and *Costus podocephalus*. It is closely related to *R. densiflora*.

I have spent a considerable amount of time in detecting the type of *Renealmia cernua*. In the Swartz herbarium at Stockholm there is a specimen with the following annotations: *Costus cernuus* Sw. (in Swartz's handwriting) in Roem. & Schult. Syst. Veg. T. I., and on the back of the sheet: e Portobello "Eikl." (Bergius scripsit). . .Herb. Swartzii. . .*Costus cernuus* Swartz in Roem. & Schult. Syst. Veg. T. I. *Costus cernuus* was described in 1817 by Roemer & Schultes in their *Systema Vegetabilium*, and that description fits the specimen from the Swartz herbarium just cited very well. However, Roemer & Schultes indicated Suriname as type locality for the species, whereas the specimen under discussion had apparently been collected in Panama. I

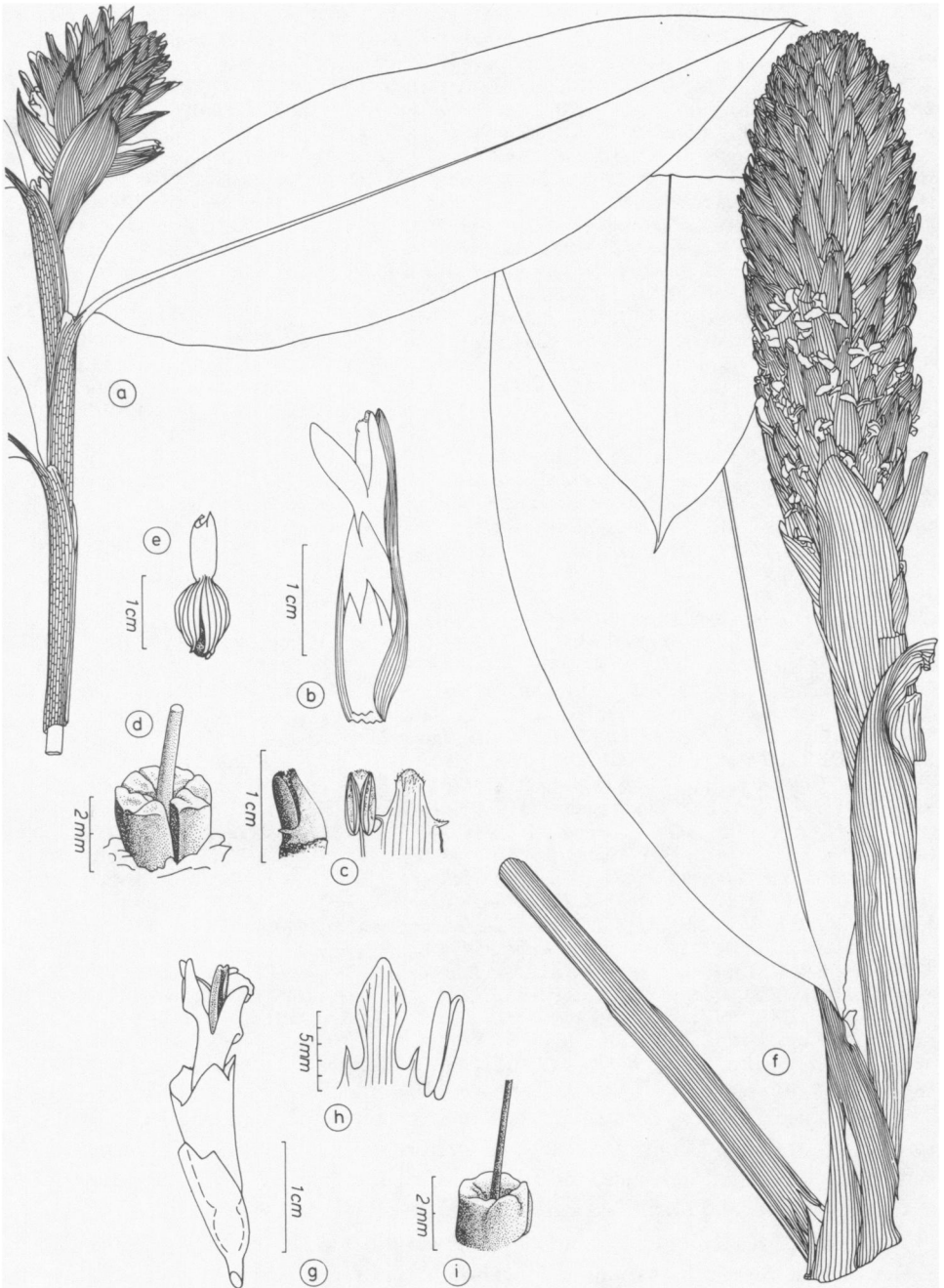


FIG 14. *Renealmia cernua* (a, Galen Smith 1478; b-d, Maas & Lent 1219; e, Dryander 2479) and *Renealmia densiflora* (f-i, Ekman H 8595). a, inflorescence and upper leaf; b, flower with bract and bracteole; c, labellum and stamen; d, nectarial glands; e, fruit; f, inflorescence and upper leaf; g, flower with bracteole; h, labellum and stamen; i, nectarial glands.

have the strongest suspicion, however, that this statement of Roemer & Schultes was an error, and that they misread *Costus cernuus* Sw. for *Costus cernuus* Sur, taking "Sur" for an abbreviation of Suriname. Who was the collector of the specimen? It was quite obvious that the collector was hidden in the abbreviation "Eikl." Reading of Lasègue's *Musée Botanique de M. Benjamin Delessert* (Reprint 1970) brought the solution to that problem. Page 469 of that book gave the following information on plant collectors in Colombia: "Pihl.-Un chirurgien suédois nommé Pihl a visité, il y a longtemps, Porto-Bello, dans la province de Panama, et recueilli là environ 50 espèces de plantes. Le professeur Bergius, auquel ces plantes furent remises, en trouva plusieurs nouvelles, qu'il a nommées dans son herbier." After an accurate look at the abbreviation "Eikl." I am convinced that it must be read as Pihl (this was confirmed by Dr. Benkt Sparre from Stockholm), who then is the collector of this specimen, which was named *Costus cernuus* by Bergius and Swartz later on, and which was described by Roemer & Schultes at last as "*Costus cernuus*. . . Swartz in litt." If this interpretation is correct this specimen constitutes the holotype of *Renealmia cernua*.

Realmia hygrophila, based on *Lehmann 5298* (holotype, B, destroyed; lectotype, K; isolectotype, F), from Cauca Valley, Colombia, 1000-1300 m, matches *R. cernua* in its terminal inflorescence and the shape of the bracts; it differs, however, by its glabrous, hardly reticulate leaf-sheaths, its distant bracts, its smaller calyx (6-7 mm long, 4 mm wide), and its 2-4-flowered cincinni. In my opinion this specimen is intermediate between *R. occidentalis* var *occidentalis* and *R. cernua* and may well be a hybrid. Some collections from the western parts of Colombia (El Valle, Chocó), a.o. *Maas & Plowman 1929* (COL, GH, U) diverge in having relatively wide and red bracts (in typical *R. cernua* the bracts are orange), and in its very large many-seeded capsule (to 23 X 18 mm, 30-seeded). Future fieldwork may prove these forms to be varietally or even specifically distinct.

10. *Renealmia chalcochlora* K. Schumann in Engler, Pflanzenreich 4. 46: 297. 1904.

Fig 15.

Plants 1-1.5 m tall. Rhizomes 5-8 mm thick. Sheaths striate or slightly tuberculate, 2-7 mm wide, to 15 mm at the base of the plant, glabrous or sparsely covered with simple, furcate, or stellate prickles (ca 0.1 mm long). Ligule ca 1 mm long, glabrous or towards the apex covered with simple, appressed hairs. Petiole 0-10 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate or very gradually tapering towards the apex, cuneate at the base, (8-)17-31 cm long, 2.5-6 cm wide, glabrous on both sides. Scape 35-60 cm tall, up to 4 mm thick, beset with sheaths up to 6-15 cm long and 0.4-0.7 cm wide, their apex obtuse or mucronate. Inflorescence a dense, basal thyrse 3-10 cm long and 1.5-5 cm wide, with 3-flowered cincinni, rhachis red. Indument of inflorescence: mostly none, but sometimes composed of some scattered, simple and furcate hairs (0.1-0.3 mm long); rarely sheaths, rhachis, bracts, peduncles, and pedicels (*Grant 10523*) rather densely covered with simple, furcate, and plurifurcate hairs (ca 0.1 mm long). Bracts red, long-persistent, narrowly ovate-elliptic to ovate-elliptic, 15-50 mm long, 6-10 mm wide. Peduncles red, 3-13 mm long, the lower ones sometimes concaulescent, the adnate part 10-15 mm long (*Uribe Uribe 5072* and *Apolinar-María 300*). Bracteole 10-14 mm long. Pedicels red, 8-15 mm long. Calyx red, turbinate, 5-9 mm long, 4-6 mm wide, the lobes depressed ovate, 1.5-2 mm long, 3-4 mm wide. Corolla white, 20-22 mm long, the tube 12 mm long, the lobes 8-10 mm long, 6-8 mm wide. Labellum white, 7-8 mm long and wide when spread out,

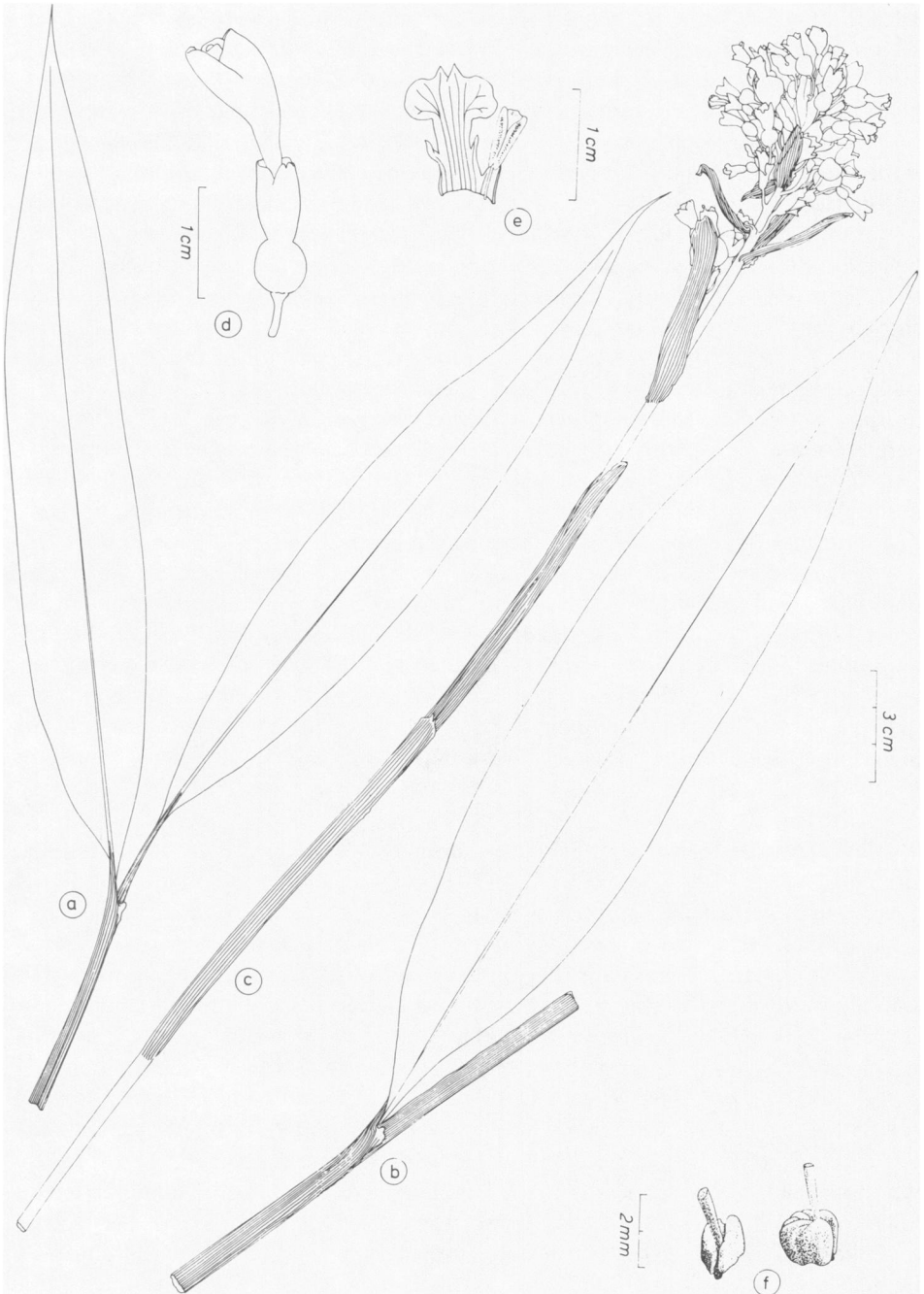


FIG 15. *Renealmia chalcochlora* (a-e, Uribe Uribe 5072; f, García-Barriga 12530). a-b. leaves; c, inflorescence; d, flower; e, labellum and stamen; f, nectarial glands.

glabrous, the limb 3-4 mm long, 7-8 mm wide, the lateral lobes rounded, 3 mm l 2-3 mm wide, the middle lobe consisting of two deltate lobules 2-3 mm long and wide, basal claw 4 mm long, 3 mm wide, lateral staminodes ca 1 mm long. Anther 4 mm long, 2 mm wide, glabrous. Style 16 mm long, nectarial glands multilobulate, completely surrounding the style base, 1.5 mm long. Ovary red, ellipsoid to globose. Capsule red, globose, 4-8 mm in diameter, its wall ca 0.1 mm thick when dry, 4-8 seeded, seeds 3-4 X 4 mm.

TYPE. *Lehmann 7320* (holotype, B, destroyed; lectotype, K; isotype, F), Pacho, Cundinamarca, Colombia, 1800-2400 m.

DISTRIBUTION. (Fig 61). Colombia, Cundinamarca and Boyacá, Cordillera Oriental; in forests between 1800 and 2400 m.

COLOMBIA. BOYACÁ: *Apolinar-Maria 300* (F). CUNDINAMARCA: *Ariste Joseph A 884* (US); *Céspedes sn* (P); *García-Barriga 12530* (COL, US); *Grant 10523* (US); *Grant & Fosberg 9363* (US); *Hernández C. 806* (COL); *Holton 207* (CAL, K, NY); *Romero Castañeda 3032* (COL); *Uribe Uribe 5072* (COL). STATE ? : *Mutis 4580* (F, K, US).

Renealmia chalconchlora is closely related to *R. alticola* and *R. sessilifolia*; some of the main differences between these three species are given below:

	<i>R. sessilifolia</i>	<i>R. chalconchlora</i>	<i>R. alticola</i>
Leaf-sheaths	striate	tuberculate to striate	slightly tuberculate
Petiole	absent	0-10 mm	5-15 mm
Size of lamina	15-32 X 2.5-5.5 cm	(8-)17-31 X 2.5-6 cm	27 X 9.5 cm
Apex of lamina	long-acuminate	long-acuminate	shortly acuminate
Lower side of lamina	covered with simple hairs	glabrous	glabrous
Inflorescence	terminal	basal	basal
Rhachis	densely covered with simple hairs	nearly glabrous	rather densely covered with mainly furcate hairs.
Peduncles	2-5 mm	5-13 mm	5-7 mm
Bracteoles	7-12 mm	10-14 mm	15-17 mm
Pedicels	5-6 mm	8-15 mm	5-8 mm
Corolla	30 mm, white	20-22 mm, white	more than 15 mm, yellow
Length of capsule	4-10 mm	4-8 mm	12-13 mm
Elevation	1400-2300 m	1800-2400 m	2600-3000 m

11. *Renealmia chiriquina* Standley, Field Mus. Nat. Hist. Bot. Ser. 22: 7. 1940;

Woodson, Ann. Missouri Bot. Gard. 32: 62. 1945.

Fig 16.

Plants 0.45-1.20 m tall. Rhizomes 6-10 mm thick. Sheaths striate, ca 10 mm wide, sparsely to rather densely covered with stellate (or furcate) prickles (less than 0.1 mm long). Ligule 1-2 mm long, rather densely covered with stellate prickles and simple, needle-like hairs. Petiole 0-10 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen ca 10 mm long), cuneate at the base, 8-26 cm long, 2.5-7 cm wide, glabrous on both sides. Scape (20-)40-65 cm tall, up to 6 mm thick, beset with sheaths up to 6-8.5 cm long and 0.5-1 cm wide. Inflorescence a basal thyrse 3-7 cm long and 3.5-4 cm wide, with 2-flowered cincinni, the rhachis green. Indument of inflorescence: sheaths, rhachis, peduncles, pedicels, and ovary densely covered with plurifurcate (appearing stellate) hairs (to 0.2 mm long), the corolla-tube, bracts, bracteoles, calyx, and capsule sparsely so to glabrous. Bracts green, quickly deciduous, ovate-triangular, obtuse, 10-20 mm long, 6-10 mm wide. Peduncles 4-8 mm long. Bracteole 7-8 mm long. Pedicels 1-2 mm long. Calyx yellow to greenish-yellow, tubular, 7-11 mm long, 5-8 mm wide, the lobes depressed-ovate,

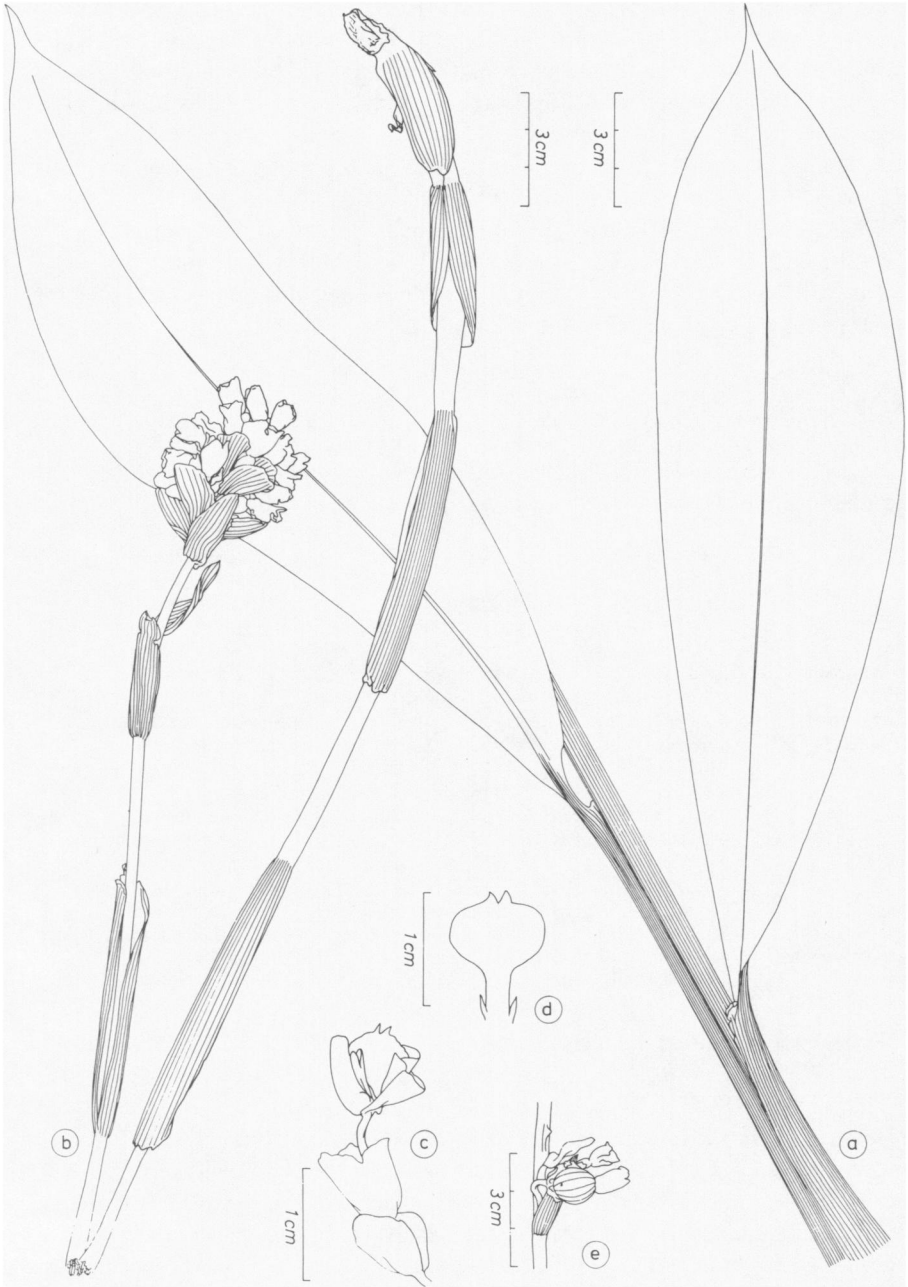


FIG 16. *Renealmia chiriquina* (a-b, Allen 4964; c-d, Davidson 386; e, von Hagen 2101). a, leaf; b, inflorescence; c, flower; d, labellum; e, fruit.

1.5-2.5 mm long, 3-5 mm wide. Corolla pale yellow to white, 17 mm long, the tube 9-10 mm long, the lobes 7-8 mm long, 5 mm wide. Labellum pale yellow to white, ca 8 mm long and 10 mm wide when spread out, the limb 4 mm long, 10 mm wide, lateral lobes rounded, ca 4 mm long, 3-3.5 mm wide, middle lobe with two deltate lobules 2 mm long, 1.5-2 mm wide, basal claw 4 mm long, 2 mm wide, lateral staminodes ca 1.5 mm long. Anther 4-5 mm long, 2 mm wide, glabrous. Style 16-17 mm long. Nectarial glands multilobulate, completely surrounding the style base, but sometimes open at one side, ca 1.5 mm long. Ovary ellipsoid. Capsule red (?), ellipsoid to globose, 7-10 mm long, 7-seeded, seeds 2-2.5 X 3-3.5 mm.

TYPE. *Davidson 386* (holotype, F; isotypes, F, GH), Bajo Chorro, 2000 m, Boquete District, prov. Chiriquí, Panama.

DISTRIBUTION (Fig 61). Panama, the province of Chiriquí; in cloud forest, 1800-2200 m.

PANAMA. CHIRIQUI: Cerro Horqueta, Robalo Trail, 1800-2100 m, *P. H. Allen 4964* (MO); Cerro Horqueta, 2200 m, *C. & W. von Hagen 2101* (MO); Chiriquito Calderas Trail, *Kirkbride & Duke 973* (MO); vicinity of Boquete, heavily forested slopes above the Rio Caldera, beyond Bajo Mono, 1800 m, *Wilbur et al 11063* (DUKE).

The characteristics of *R. chiriquina* are: 1, the relatively short pedicels (1-2 mm long); 2, a rather long, tubular calyx; 3, an indument of plurifurcate hairs on the rhachis. *Renealmia chiriquina* is related to *R. congesta*.

Brenes 5700 (CR, F), Cerro "La Muralla," San Ramón, El Socorro, Costa Rica could not be identified with certainty as it has characters of both *R. chiriquina* and *R. alpinia*.

12. ***Renealmia chrysotricha*** O. G. Petersen in Martius, Fl. Bras. 3(3): 42. t. 12.

1890; K. Schumann in Engler, Pflanzenreich 4: 46: 305. 1904. Fig 17.

Renealmia goyazensis Gagnepain & K. Schumann, Bull. Soc. Bot. France 49: 23. 1902, in minor part.

Plants of unknown height. Rhizomes 8-10 mm thick. Sheaths striate to slightly reticulate, or coarsely reticulate at the base (*Regnell 200*), 10-20 mm wide, sparsely to densely covered with simple or furcate prickles (< 0.1 mm long). Ligule 1-2 mm long. Petiole 0-30 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen ca 5 mm long), cuneate at the base, 29-36 cm long, 4.5-9.5 cm wide, upper side glabrous, lower side glabrous to sparsely covered towards the margins with simple or furcate prickle-like hairs (ca 0.1 mm long). Scape erect, 25-50 cm tall, 2-5 mm thick, beset with sheaths up to 8-12 cm long and 1-1.5 cm wide. Inflorescence a basal raceme 9-18 cm long and 3.5-7 cm wide. Indument of inflorescence: rhachis, bracts, peduncles, bracteoles, pedicels, calyx, and ovary densely velutinous, the hairs erect, dark brown (to brownish-white), simple or rarely furcate (to 0.2 mm long), the sheaths and corolla rather densely so (on the corolla furcate hairs rather frequent), capsule glabrous. Bracts reddish, rather long persistent, narrowly elliptic-obovate, obtuse, 20-65 mm long, 8-16 mm wide, like all other parts of the inflorescence dark brown in herbarium material. Peduncles 2-5 mm long. Bracteole (15-)22-32 mm long. Pedicels 2-6 mm long. Calyx tubular, (15-)18-25 mm long, 6-7 mm wide, the lobes deltate, 4-5 mm long. Corolla white? (*Schenk 2419*), 28-30 mm long, the tube 18-19 mm long, the lobes 9-12 mm long, 7-8 mm wide. Labellum white? (*Schenk 2419*), ca 11 mm long and 8-10 mm wide when spread out, basal part opposite anther densely hairy, the limb erect, ca 6 mm long, 8-10 mm wide, middle lobe entire or slightly emarginate, lateral lobes involute, 5-6 mm long, ca 2.5 mm wide, basal claw ca 5 mm long, 2 mm wide, lateral staminodes

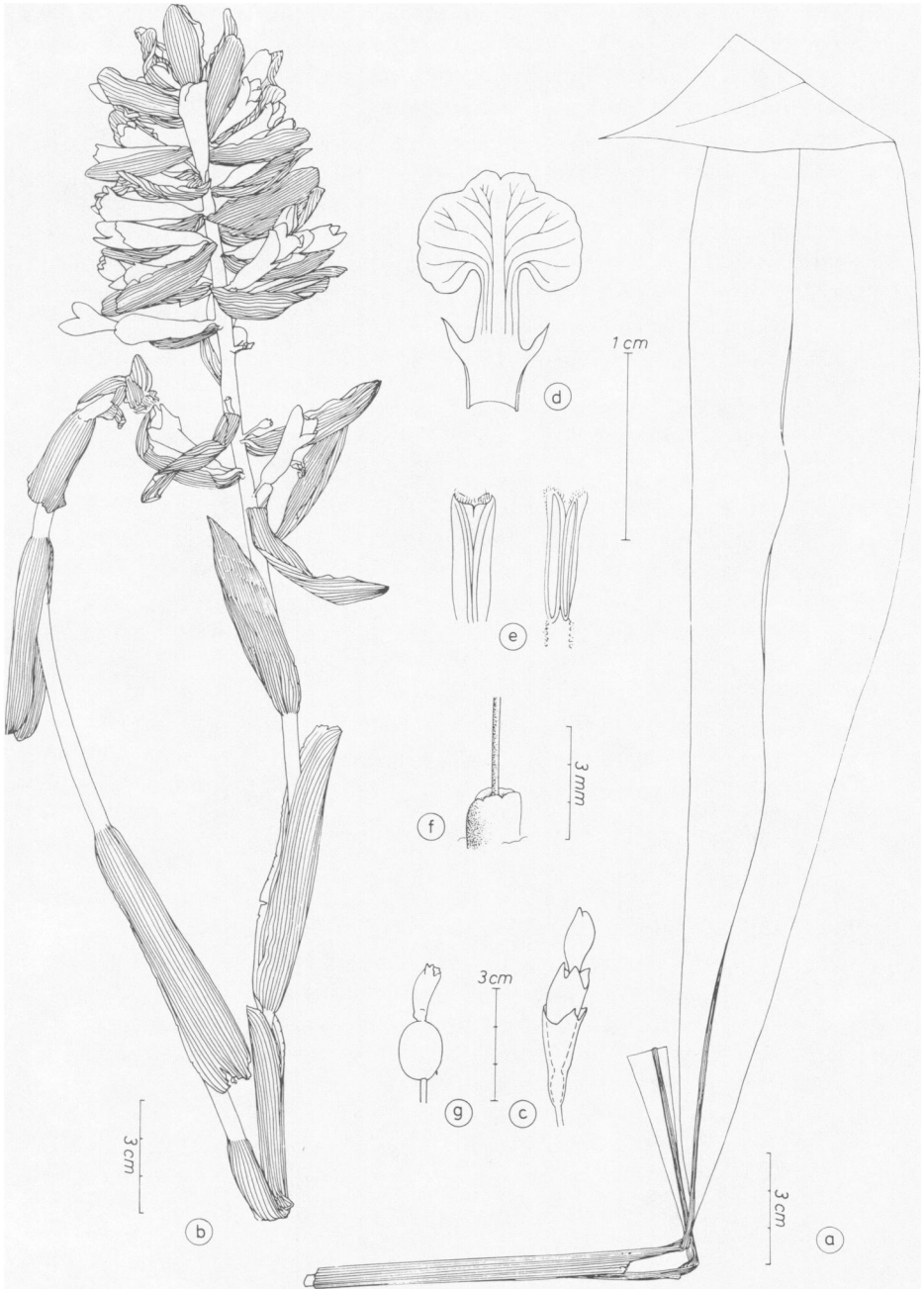


FIG 17. *Renealmia chrysotricha* (a, Gaudichaud 324; b, Regnell 200; c-f, Glaziou 3123 pp; g, Meirelles sn). a, leaf; b, inflorescence; c, flower with bracteole; d, labellum; e, anther; f, nectarial glands; g, fruit.

1.5 mm long. Anther 6 mm long, 2.5-3 mm wide, glabrous or slightly hairy. Style 23 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2-3 mm long. Ovary ellipsoid. Capsule ellipsoid, ca 15 mm long, 10 mm wide, its wall ca 0.2 mm thick when dry, ca 25-seeded, seeds 5 x 4 mm.

TYPE. *Schenk 2419* (holotype, B, destroyed; lectotype, *plate 12 in Fl. Bras.*, 1.c.), Rodeio, Rio de Janeiro, Guanabara, Brazil.

DISTRIBUTION (Fig 58). Apparently restricted to the forests of the Corcovado Mountain near Rio de Janeiro.

BRAZIL. GUANABARA: Corcovado, *Altamiro & Walter 188* (RB), *Burchell 1425* (K), *Riedel sn* (LE), *866* (BM, BR, FI, K, LE, P, US); Paineiras, Corcovado, *Schwacke 7183 pp* (RB); Rio de Janeiro, *Anderson sn, anno 1857* (S), *Gaudichaud 324* (syntype of *Renealmia goyazensis*, P), *Regnell 200* (S); Tijuca, *Glaziou 3123 pp*, 23 Feb 1869 (P), *Valle 73,109* (R). Without locality: *Bowie & Cunningham 88* (BM); ? *Meirelles ? sn* (P); *Sellow sn* (BM); *Widgren 1038* (S).

CULTIVATED SPECIMENS. Cult. at *Jardim Botânico* (RB 88699).

Although I have studied a series of specimens of this species, it is still poorly known, especially with regard to characters of stature and colour of the various floral parts. Most of the collections cited date from the XIX century, it was collected only twice in this century (*Altamiro & Walter* in 1945, and probably the collection *RB 88699*). *Renealmia chryso-tricha* is closely related to *R. petasites*, but herbarium specimens can readily be recognized by their dark brown and very densely hairy inflorescence, narrower leaves, and longer calyx.

Further data on the relationship of this species can only be obtained after extensive field studies; although some active botanists of the Rio de Janeiro region (Dorothy Araujo and Dimitri Sucre) have looked out for the species during the last two years, it has still not been rediscovered.

I have studied the flowers of the two Riedel collections cited above, and they completely fit my concept of *R. chryso-tricha*. The detached infructescence, however, probably belongs to *R. petasites* because of its indument and its long pedicels (20-40 mm long). If this suspicion proves wrong there should be every reason to unite *R. chryso-tricha* with *R. petasites*.

13. *Renealmia concinna* Standley, J. Wash. Acad. Sci. 17: 249. 1927; Standley, Field Mus. Nat. Hist. Bot. Ser. 18: 190. 1937; Woodson, Ann. Missouri Bot. Gard. 32: 60. 1945. Fig 18.

? *Renealmia foliifera* Standley, Field Mus. Nat. Hist. Bot. Ser. 22: 328. 1940. Type. *M. E. & R. A. Terry 1591* (holotype, F), crest of Cana-Cuasi Trail, Chipigana District, prov. Darién, Panama, ca 1800 m.

Plants 0.5-2 m tall. Rhizomes 6-10 mm thick, the roots 2-4(-7) mm thick, sometimes supported on stilt-roots. Sheaths striate, 5-10 mm wide, to 20 mm at the base of the plant, densely covered with furcate to stellate prickles (<0.1 mm long). Ligule ca 1 mm long. Petiole absent. Lamina narrowly elliptic, acute to acuminate at the apex (acumen 5-20 mm long), cuneate at the strongly sheathing base, (22-) 30-50 cm long, 5-8 cm wide, upper side glabrous, lower side sparsely to rather densely covered with hairs of the compass-needle type (hairs 0.2-0.4 mm wide). Scape erect, 3-40 cm tall, up to 3 mm thick, beset with sheaths up to 1-5(8) cm long and 0.5-0.7 cm wide. Inflorescence a basal thyrse (5-)7-20 cm long and (1-)2-5 cm wide, with (2-)4-5-flowered cincinni, rhachis green to greenish-yellow. Indument of inflorescence: sheaths, rhachis, peduncles, bracteoles, pedicels, calyx, ovary, and capsule sparsely to densely covered with hairs of the compass-needle type (0.2-0.5 mm wide), branches of the hairs simple or furcate; normal furcate and plurifurcate hairs also present; petals sparsely hairy at their cucullate tips. Bracts green, rather long persistent,



FIG 18. *Renealmia concinna* (a-b, d, Maas & Dressler 741; c, Donnell Smith 6822). a, leaf; b, inflorescence; c, part of infructescence; d, flower with bracteole.

narrowly (ovate-)triangular to (ovate-)triangular, acute, 8-25 mm long, 4-15 mm wide. Peduncles 2-6 mm long. Bracteole green, 7-10 mm long. Pedicels 2-5 mm long. Calyx green, urceolate, 3-6 mm long and wide, the lobes triangular, deltate, or shallowly triangular, 1-3 mm long and wide. Corolla white, ca 10 mm long, the tube ca 5 mm long, the lobes 5 mm long, 3 mm wide. Labellum white with yellow centre, 7-8 mm long and wide when spread out, the limb horizontally spreading, lateral lobes rounded, ca 4 mm long, 2.5 mm wide, middle lobe bilobulate, basal claw densely covered with simple and furcate hairs (ca 0.3 mm long), 4 mm long, 2 mm wide, lateral staminodes ca 1 mm long. Anther pink, 2.5 mm long, 2 mm wide, glabrous. Style 10 mm long. Nectarial glands forming a one-sided cylinder, only partly surrounding the style base, 1.5 mm long. Ovary orange, globose to ellipsoid. Capsule red or orange, maturing black, globose to ellipsoid, 4-8 mm long, its wall 0.1 mm thick when dry, 2-8 seeded, seeds 2-3 X 3-5 mm, aril orange.

TYPE. *Standley 37355* (holotype, US), vicinity of Guápiles, 300-500 m, prov. Limón, Costa Rica.

DISTRIBUTION (Fig 61). Costa Rica, Panama, and Colombia; in wet forests from sea-level to 1800 m.

COSTA RICA. *Jiménez M. 2810* (CR, F, NY); *J. D. Smith 6822* (GH, US); *Standley 37511* (US). PANAMA. *Maas & Dressler 741* (MO, U); *Maas et al 1740* (COL, K, U, VEN); *Pittier 5599* (NY); *Proctor Cooper 196* (F, NY); *C. E. & H. M. Smith 3391* (F, US); *M. E. & R. A. Terry 1449* (F, MO), 1594 (F). COLOMBIA. CHOCÓ: *Gentry & Mori 13727* (MO); *Idrobo & Kyburz 1991* (COL). NARIÑO: *Mora 4295* (COL). EL VALLE: *Cuatrecasas 15851* (F, US, VALLE); *Køie 4827* (C).

The closest relative of this species is *R. dressleri*, which shares the indument of compass-needles on lamina and inflorescence. *Renealmia concinna* differs from that species, however, by its basal inflorescence and its green instead of bright red calyx.

Renealmia foliifera possibly belongs to this species, but as the type material is very fragmentary, its status could not be determined with certainty (it shows also relationship with *R. congesta*).

Killip 35289 (COL, GH, US), from Chocó, Corcovada Region, upper Río San Juan, Yeracuí Valley, 200-275 m, Colombia, resembles this species by its indument, but differs by its distinctly petiolate lamina.

A. Smith 1595 (NY), from Alfaro Ruiz, Bella Vista de Zarcero, prov. Alajuela, Costa Rica, 1550 m, is closely related to *R. concinna*, deviating, however, by the indument of the rhachis, consisting of plurifurcate (appearing stellate) hairs.

Goudot 133 (K), from La Balsa, Quindío, Colombia, is somewhat intermediate between *R. concinna* and *R. puberula*.

14. *Renealmia congesta* Maas, Acta Bot. Neerl. 24: 475. 1976. Fig 19.

Plants 1-3 m tall. Rhizomes 15-20 mm thick. Sheaths striate, rather densely covered with stellate (to furcate) prickles and scales (less than 0.1 mm long) and with compass-needle hairs (towards the apex densely so). Petiole absent. Ligule 1-2 mm long. Lamina narrowly obovate to narrowly elliptic, 10-12-plicate, acute to acuminate at the apex (acumen to 20 mm long), gradually narrowed towards the base, 25-50 cm long, (6-)9-14 cm wide, upper side glabrous, lower side rather densely covered with hairs of the compass-needle type (hairs 0.3-0.5 mm wide). Scape erect, 10-40 cm tall, up to 5-13 mm thick, beset with sheaths up to 6-13 cm long and 1-2 cm wide. Inflorescence an ovoid to cylindrical, basal, spicoid thyrs (5-)8-28 cm long and 2-5 cm wide, with 3-5-flowered cincinni, rhachis green. Indument of inflorescence: sheaths, rhachis, pedicels, and peduncles densely to rather densely covered with plurifurcate

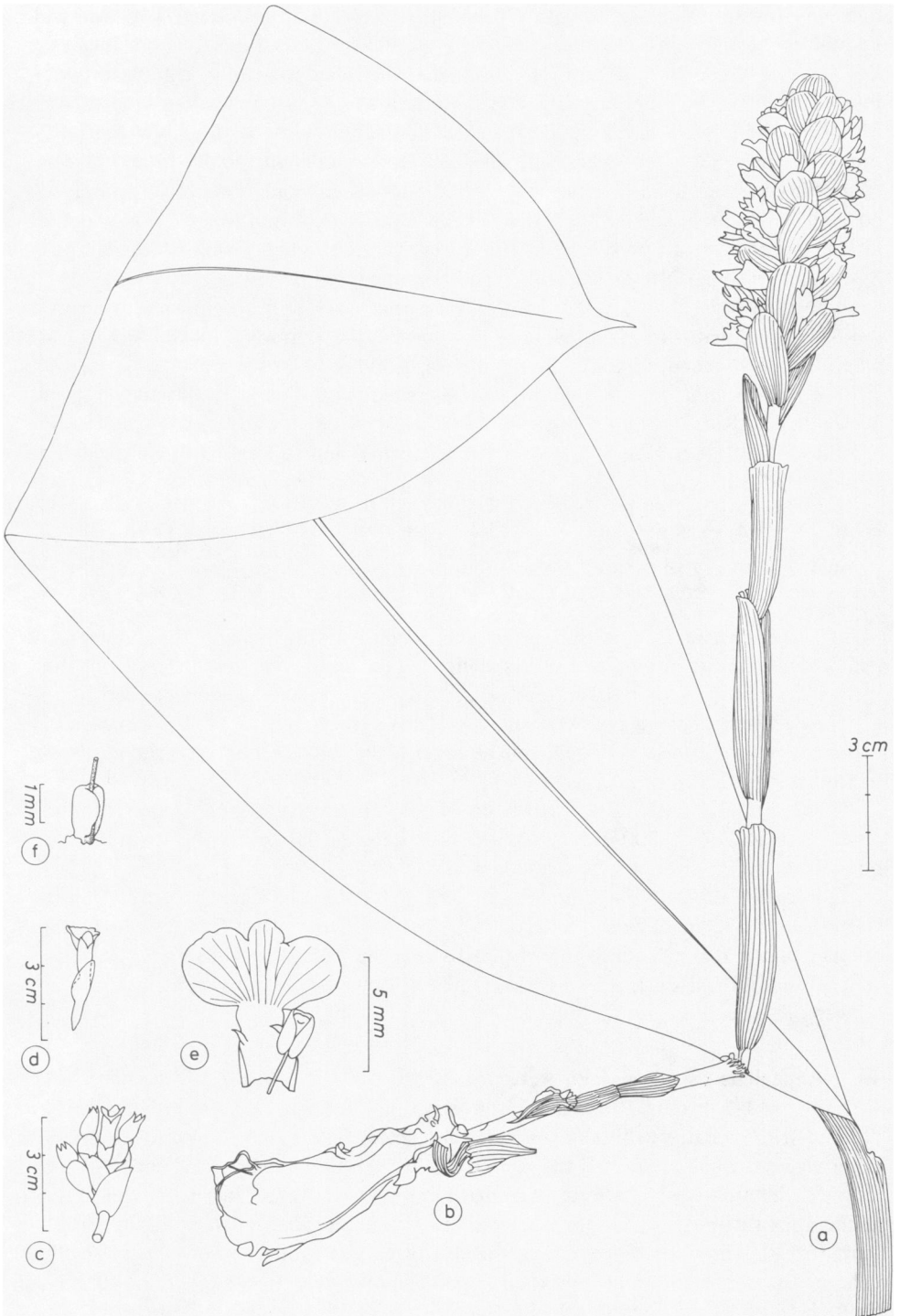


FIG 19. *Renealmia congesta* (a-f, Maas & Mc. Alpin 1390). a, leaf; b, inflorescence; c, cincinnus; d, flower with bracteole; e, labellum and stamen; f, nectarial glands.

(to furcate) hairs (to 0.2 mm long and to 0.2 mm wide), the apical part of the sheaths also covered with hairs of the compass-needle type; bracts, bracteole, calyx, ovary, and capsule often glabrous or sparsely (to rather densely) covered with plurifurcate (to furcate) hairs, the apical part of the bracts often covered with compass-needle hairs, corolla glabrous. Bracts pale green to green, persistent, broadly ovate to ovate, obtuse, 20-35 mm long, 15-30 mm wide. Peduncles green, 2-4 mm long, the lower ones concaulescent, the adnate part to 15 mm long. Bracteole green, 9-18 mm long. Pedicels green, 5-12 mm long. Calyx green, urceolate, 6-11 mm long, 4-7 mm wide, the lobes deltate to shallowly triangular, 2-4 mm long and 3-4 mm wide. Corolla white, 9-11 mm long, the tube 4-6 mm long, the lobes 5 mm long, the dorsal one 5 mm wide, the two lateral ones 4 mm wide. Labellum white with yellow centre and purplish base, 7.5-9 mm long and 9-12 mm wide when spread out, basal part opposite the anther densely covered with simple hairs, the limb horizonatally spreading, 5-6 mm long, 9-12 mm wide, lateral lobes rounded, 4-6 mm long, 3.5-4 mm wide, middle lobe reflexed, ca 1 mm long, 2-3 mm wide, slightly and irregularly bilobulate, basal claw ca 3 mm long, 2-2.5 mm wide, lateral staminodes 1-1.5 mm long. Anther (pale) pink, 3-3.5 mm long, 1.5-2 mm wide, glabrous. Style 7-8 mm long. Nectarial glands forming a one-sided cylinder, only partly surrounding the style base, 1.5-2 mm long. Ovary green, ellipsoid. Capsule black, globose, 7-8 mm in diameter, its wall ca 0.1 mm thick when dry (ca 0.5 mm in living material), 6-9 seeded, seeds 2.5-3 X 3-3.5 mm, aril orange.

TYPE. *Maas & McAlpin 1390* (holotype, U; isotypes, COL, CR, F, GH, K, MO, NY, US), Fila las Cruces, near San Vito de Java, 1400 m, Puntarenas, Costa Rica.

DISTRIBUTION (Fig 61). Costa Rica and Panama; in wet forests, from 700-1400 m. COSTA RICA. *Collector indigenes costaric. 14* (U); *Lent 1772* (F), 2269 (F, U); *Maas 1260* (U); *Maas & Lent 1212* (CR, E, F, MO, NY, P, U).

PANAMA. *Maas & Dressler 1662* (COL, MO, U).

This species is well marked by a spicoid, green inflorescence and hairs of the compass-needle type on the lower side of the lamina. From *R. costaricensis* it differs in its leaf-indument, green instead of pinkish to purplish-black calyx, and sessile lamina. *Renealmia concinna* is its closest relative, but that species differs in narrower leaves (5-8 cm vs (6-)9-14 cm), a rather lax inflorescence, and acute, rather narrow bracts.

15. *Renealmia costaricensis* Standley, Field Mus. Nat. Hist. Bot. Ser. 18: 190. 1937

(≡ *R. densiflora* Standley, non Urban); Woodson, Ann. Missouri Bot. Gard.

32: 61. 1945.

Fig 20.

Renealmia densiflora Standley, Jour. Wash. Acad. Sci. 17: 249. 1927, non Urban 1921.

Plants 0.5-3 m tall. Rhizomes 10-20 mm thick, the roots 2-4 mm thick. Sheaths striate, 5-20 mm wide, to 30 mm at the base of the plant, densely to rather densely covered with furcate to stellate prickles, mixed with simple, needle-like hairs. Ligule ca 1 mm long, hairy like the sheaths. Petiole 0-30 mm long, hairy like the sheaths. Lamina narrowly elliptic, shortly acuminate-cuspidate at the apex, cuneate at the base, 20-58 cm long, 6-16 cm wide, 12-13-plicate, upper side glabrous or somewhat puberulous along the midrib, lower side sparsely to rather densely covered with simple and furcate hairs (0.2-0.5 mm long). Scape erect, 15-35 (according to Standley to ca 75) cm tall, up to 5 mm thick, beset with sheaths up to 5 cm long and ca 1 cm wide. Inflorescence an ovoid to cylindric, basal, spiciform thyse 6-15 cm long and 2.5-4 cm wide, with 1-3-flowered cincinni. Indument of inflorescences: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule glabrous or

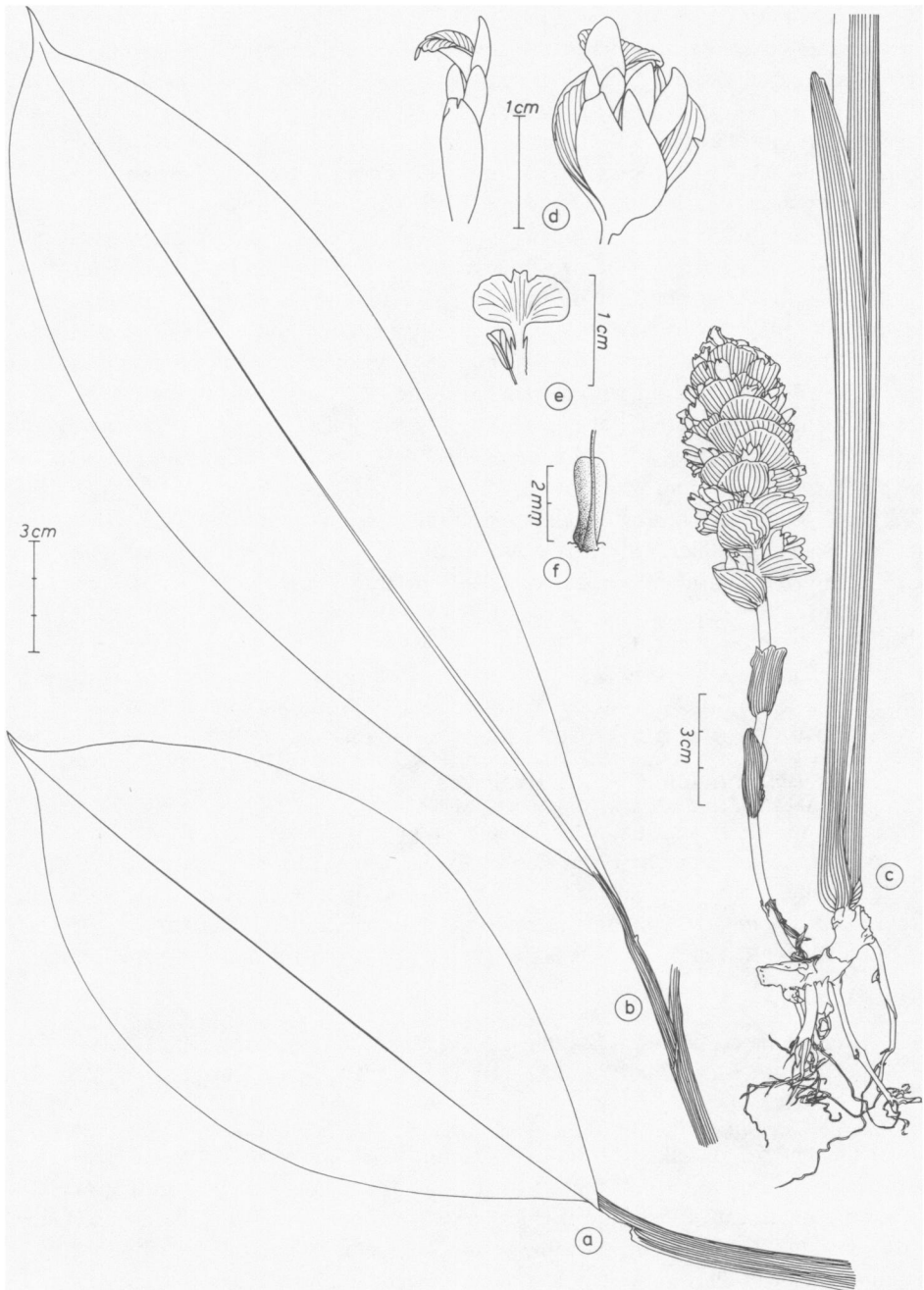


FIG 20. *Renealmia costaricensis* (a-c, Kennedy 1086; d-f, Maas 1135). a-b, leaves; c, inflorescence; d, flower with bract (right) and flower with bract removed (left); e, labellum and stamen; f, nectarial glands.

sparsely to densely covered with a mixture of simple and furcate to plurifurcate hairs (0.2-0.4 mm long), corolla glabrous. Bracts green, persistent, broadly ovate-obovate, obtusè, 10-30 mm long and wide. Peduncles and pedicels up to 2 mm long. Bracteole 10-13 mm long. Calyx pinkish-(to orange-)red, in fruit becoming purplish-black, tubular-turbinate, 6-8 mm long, 4-7 mm wide, the lobes cucullate, (very) shallowly ovate-triangular, 1-2.5 mm long, 4-6 mm wide. Corolla pale yellow to white, 13-14 mm long, the tube 5-6 mm long, the lobes 8 mm long, the dorsal one 6-8 mm wide, the two lateral ones 4-6 mm wide. Labellum (creamy) white with a yellow central stripe, 8-9 mm long and 8-12 mm wide when spread out, middle and basal part hairy, the limb horizontally spreading, 4-5 mm long, 8-12 mm wide, lateral lobes rounded, ca 3-5 mm long and wide, middle lobe reflexed, entire, broadly to transversely oblong, 1-2 mm long (rarely divided in two triangular-ovate lobules 1 mm long), basal claw 4 mm long, 1.5-1.8 mm wide, lateral staminodes pinkish, ca 0.5 mm long. Anther pinkish, 3-3.5 mm long, 1.5-2 mm wide, glabrous. Style 9-11 mm long. Nectarial glands forming a one-sided cylindre only partly surrounding the style base, 1-2 mm long. Ovary globose. Capsule green, maturing red to purple-black, globose, 5-8 mm diam, its wall ca 0.1 mm thick when dry (0.2 mm thick in living material), 4-7-seeded, seeds 3-4 mm diam, dark brown, aril orange.

TYPE. *Standley 36944* (holotype, US), La Colombiana Farm of the United Fruit Company, prov. Limón, Costa Rica, 70 m.

DISTRIBUTION. (Fig 61). From Costa Rica to northern Colombia; in forests, 0-150 m.

COLOMBIA. ANTIOQUIA: *Hodge 7001* (US). COSTA RICA. *Maas 767* (CR, F, U), *1135* (F, GH, U, Z); *Shank & Molina R. 4179* (GH). PANAMA. *Kennedy et al 1086* (U); *Maas et al 1555* (K, MO, U), *1580* (COL, E, MO, NY, U, VEN); *Pittier 4213, 4327* (US); *Woodson et al 1882* (GH, NY).

The relationship of this species is with *R. vallensis*, from which it clearly differs, however, by its indument and its capsules with more numerous seeds. Both species are strongly characterized by the ovoid, spiciform inflorescence, the red, tubular calyx, and the very short peduncles and pedicels. In *Maas 767* from Costa Rica all seeds germinated when they were still within the attached fruit.

16. ***Renealmia cuatrecasii*** Maas, *Acta Bot. Neerl.* 24: 475. 1976. Fig 21.

Plants 1-4 m tall. Rhizomes 10-25 thick, the roots 5-7 mm thick. Sheaths slightly reticulate, 10-20 mm wide, to 25 mm at the base of the plant, sparsely to rather densely covered with furcate and stellate prickles (<0.1 mm long). Ligule 1-2 mm long. Petiole 35-85 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen 8-15 mm long), cuneate at the base, 50-83 cm long, (7-)9-16(-19) cm wide, midrib on lower side rather densely to densely covered with simple, furcate, and plurifurcate hairs (to 0.1 mm long), otherwise glabrous. Scape 15-35 cm tall, up to 10 mm thick, beset with sheaths up to 5-10 cm long and 1-1.7 cm wide. Inflorescence an open, basal thyrsè 25-60 cm long and 6-13 cm wide (11 X 3 cm when young), its cincinni 2-10-flowered. Indument of inflorescence: sheaths, rhachis, bracts, and bracteoles densely covered with furcate, plurifurcate (and simple) hairs (to 0.2 mm long), peduncles, pedicels, corolla-tube, and calyx sparsely so, corolla-lobes, ovary, and capsule glabrous. Bracts green, soon deciduous, triangular-ovate to narrowly triangular-ovate, 7-55 mm long, 4-16 mm wide. Peduncles 7-30 mm long. Bracteole green, 7-14 mm long. Pedicels 5-30 mm long. Calyx pale green, turbinate, 4-7 mm long, 4-5 mm wide (ca 3 mm at the base), the lobes shallowly triangular-ovate, 1-3 mm long, irregularly abscissing with age. Corolla (creamy)

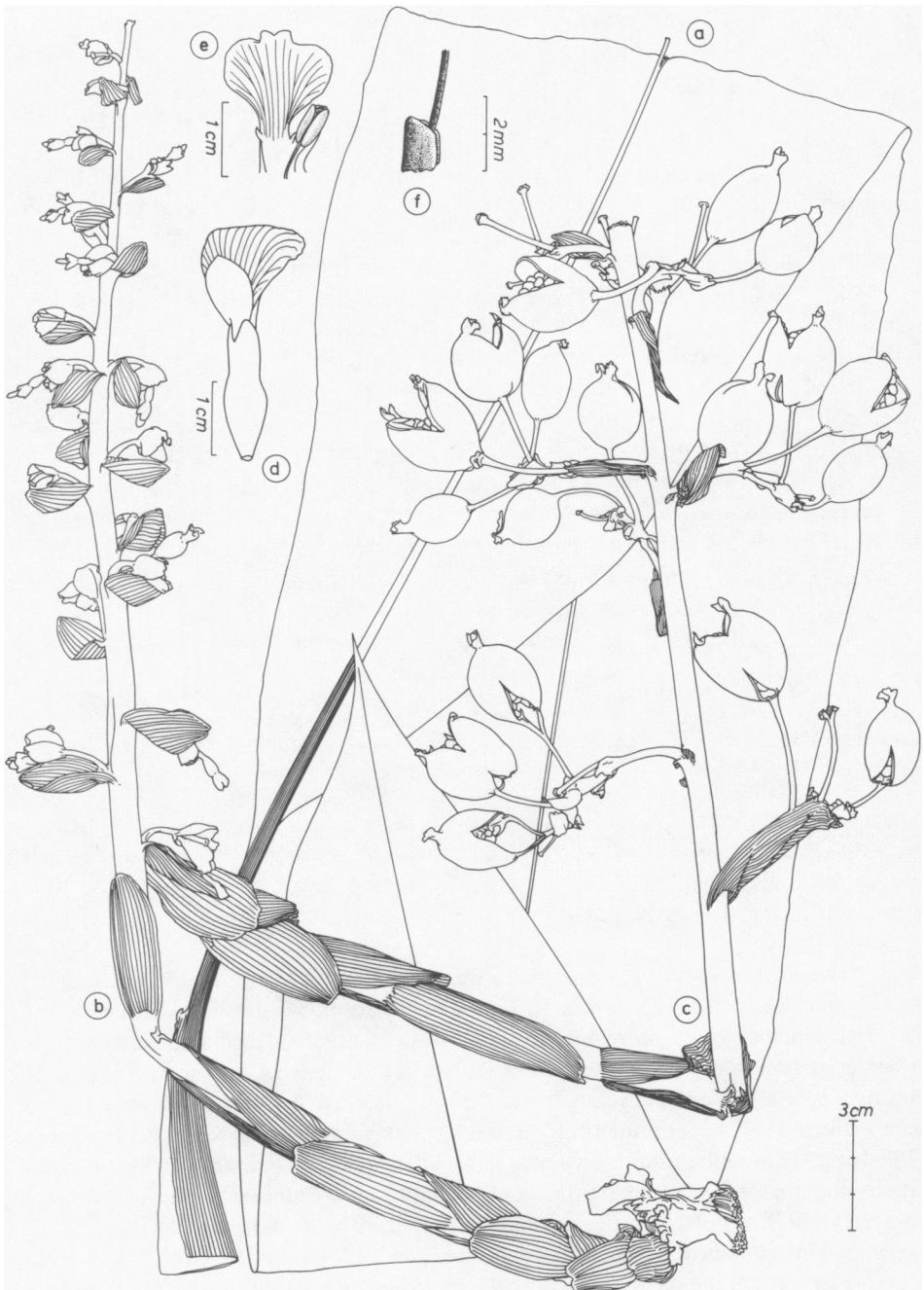


FIG 21. *Renealmia cuatrecasasi* (a-b, f, Killip & Cuatrecasas 38707; c, Killip 35423; d-e, Maas 2009). a, leaf; b, inflorescence; c, part of infructescence; d, flower; e, labellum and stamen; f, nectarial glands.

white to pale yellow, 19-20 mm long, the tube 6-7 mm long, the lobes 12-14 mm long, the dorsal one 8-9 mm wide, the two lateral ones 4-6 mm wide. Labellum yellowish to creamy white, yellow in the centre, 14-16 mm long and wide when spread out, basal part opposite anther densely hairy, the limb horizontally spreading, very gradually decurrent to the purplish base, lateral lobes 14-16 mm long, to 5 mm wide, lateral staminodes purplish, ca 1 mm long. Anther white, 5.5 mm long, 2 mm wide, glabrous. Style 15 mm long. Nectarial glands partly surrounding the style base, ca 1.5 mm long. Ovary green, ellipsoid. Capsule yellow, maturing orange to red, ellipsoid, 10-26 mm X 8-20 mm, its wall 0.5-1 mm thick when dry (2 mm thick in living material), 60-100-seeded, seeds 2-3.5 mm in diameter, aril white.

TYPE. *Killip & Cuatrecasas 38707* (holotype, US, 2 specimens + photograph of living plant; isotypes, COL, F, VALLE), Córdoba, N shore of Buenaventura Bay, non-inundable forests, 5-15 mm alt, El Valle, Colombia.

DISTRIBUTION. (Fig 60). Pacific coast of Colombia; forests, from sea level up to 75 m.

COLOMBIA. CHOCÓ: La Concepción, 15 km E of Quidbó, *Archer 1939* (NY, US); between Quidbó and Guayabal, *Forero et al 1151, 1426* (COL, U); Río Baudo, 15 km from Pizarro, *Fuchs et al 21710* (COL); mouth of Río Baudo, Puerto Pizarro, *Fuchs 21885* (COL); between Quebrada Guarapo and Mandingo, S of Río Condojo, *Killip 35423* (COL, US).

NARIÑO: Barbacoas, *Alston 8477* (BM). EL VALLE: Río Yurimangui, Veneral, *Cuatrecasas 15730* (F); Río Cajambre, *Cuatrecasas 17619* (F); Pulpapel, *Kennedy 784* (U); Córdoba, *Killip & García 33369* (BM, COL, GH, S, US); 7 km W of Sabaletas, along old road Buenaventura-Cali, *Maas 2009* (COL, E, GH, K, MO, NY, U).

The main characters of this species are the very large and long-petiolate leaves, the many-flowered cincinni, the small calyx, and the many-seeded capsules. It is somewhat related to *R. orinocensis*.

Maas & Plowman 1928 (COL, U), km 85, Boquerón, new road from Cali to Buenaventura, is related to this species, but aberrant by sessile leaves and thicker fruit (wall 3-4 mm vs 2 mm thick) with fewer (20-25 vs 60-100) seeds.

17. ***Renealmia densiflora*** Urban, Ark. Bot. 17(7): 18. 1921; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 609. 1930. Fig 14f-i.

Alpinia densiflora (Urban) Moscoso, Cat. Fl. Doming. 88. 1943.

Plants up to 2 m tall (according to *Urban*). Sheaths striate, 10-15 mm wide, glabrous except for some furcate to stellate prickles (<0.1 mm long). Ligule 1-2 mm long, rather densely covered with furcate to stellate prickles (<0.1 mm long). Petiole absent. Lamina narrowly elliptic, shortly acuminate at the apex, cuneate at the base, 25-42 cm long, 7-12 cm wide (the uppermost laminae just below the inflorescence varying from 3-13 cm long and 1.5-4 cm wide), glabrous on both faces. Inflorescence a terminal, spiciform raceme 8-16 cm long, 3-5 cm wide, rhachis 2-5 mm thick, beset with two or three sheaths 7-15 cm long, 1.5-2 cm wide. Indument of inflorescence: rhachis, peduncles, pedicels, and ovary densely covered with furcate (and some plurifurcate or simple) hairs (0.1-0.15 mm long), bracts, bracteoles, and calyx densely so only towards their base, the middle and apical part sparsely so or glabrous, corolla and sheaths glabrous. Bracts pale brown when dry, chartaceous, persistent, narrowly ovate-triangular, 20-35 mm long, 4-8 mm wide (the lowermost bracts up to 40 mm long and 15 mm wide). Peduncles 2-3 mm long. Bracteole 9-13 mm long. Pedicels 1.5-2 mm long. Calyx tubular, 10-13 mm long, 4-5 mm wide, the lobes deltate to shallowly triangular, 2.5-6 mm long, 3-5 mm wide. Corolla pale yellow, 21-23 mm long, the tube 12-13 mm long, the lobes 9-10 mm long, 3.5-4.5 mm wide. Labellum pale yellow (?), rhombic when spread out, 7-8 mm long and 3-4 mm wide, glabrous,

not distinctly differentiated into basal claw and limb, lateral staminodes ca 1 mm long. Anther 6 mm long, 2 mm wide, glabrous. Style 20-21 mm long. Nectarial glands multilobulate, completely surrounding the style base, ca 2 mm long. Ovary ellipsoid, 3-4 mm long. Capsule unknown.

TYPE. *Ekman H 149* (holotype, S), Morne de la Hotte, dép. du Sud, Haiti, Hispaniola; "in declivibus sept.-orient." at ca 800 m elevation; common.

DISTRIBUTION (Fig 57). Only known from Morne de la Hotte, Haiti, between 800 and 100 m.

HISPANIOLA. HAITI: Morne Rochelois, limestone, top at Quatre Chemins, Morne de la Hotte, *Ekman H 8595* (S, US).

Renealmia densiflora is closely related to *R. cernua* but can be distinguished by its striate (instead of reticulate) leaf-sheaths and by its inflorescence indument of (mainly) furcate instead of simple hairs.

18. *Renealmia dermatopetala* K. Schumann in Engler, Pflanzenreich 4. 46: 304.

1904.

Fig 22.

Renealmia latibracteata Loesener, Notizbl. Bot. Gart. Berl. 9: 153. 1924; Loesener in Engler & Prantl. Nat. Pflanzenfam. ed. 2. 15A: 610. 1930. Type. *von Lützelburg 412* (holotype, M; isotype, B, destroyed), Duro, in palm swamps, Goiás, Brazil.

Plants 1-3 m tall. Rhizomes 10-30 mm thick. Sheaths dark brown to pale brown, striate to reticulate, 5-10 mm wide, to 30 mm at the base of the plant, in the grooves densely covered with simple to furcate prickles (less than 0.1 mm long) or sometimes glabrous, at the cross-connections and towards the ligule sometimes covered with simple hairs (to 0.5 mm long). Ligule 1-2 mm long. Petiole 0-30(-50) mm long, glabrous to sparsely hairy (like the sheaths). Lamina narrowly elliptic, shortly acuminate at the apex (acumen 5-15 mm long), cuneate at the base, 25-75 cm long, 4-12 cm wide, glabrous on both sides, or midrib on lower side very sparsely covered with simple hairs. Scape erect, pink, 15-100 cm tall, up to 10 mm thick, beset with sheaths up to 4-12 cm long and 0.5-2 cm wide. Inflorescence a basal raceme (4-)10-22 cm long and 2.5-5 cm wide. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule densely to sparsely covered with ferruginous, sessile, furcate to plurifurcate hairs (0.1-0.2 mm long), sometimes mixed with simple hairs (to 0.5 mm long), corolla-tube sparsely hairy, the lobes glabrous. Bracts scarlet-red to pinkish-red, long-persistent (narrowly) ovate to broadly ovate, obtuse or sometimes acute, 13-45 mm long, 10-20 mm wide. Peduncles pink, slender, 2-10 mm long. Bracteole truncate, (9-)10-13 (-15) mm long. Pedicels pink, slender, 2-6 mm long. Calyx pink, tubular to slightly turbinate, 10-14 mm long, 6-7 mm wide, the lobes depressed ovate to shallowly triangular, 3-4 mm long, 5-6 mm wide. Corolla yellow to yellowish-orange, long-persistent, 20-27 mm long, the tube 10-17 mm long, the lobes 10-12 mm long, 7-11 mm wide. Labellum yellow to yellowish-orange, 10-12 mm long and 6-10 mm wide when spread out, basal part opposite anther densely covered with simple hairs (0.2 mm long), the limb erect, 5-7 mm long, 6-10 mm wide, lateral lobes involute, 2-3 mm long, 1.5-2.5 mm wide, middle lobe entire and rounded, basal claw 5-6 mm long, 3 mm wide, lateral staminodes ca 1 mm long. Anther 8-9 mm long, 3 mm wide, densely hairy. Style 20-25 mm long. Nectarial glands multilobulate, completely surrounding the style base, ca 1 mm long. Ovary ellipsoid. Capsule pink, ellipsoid, 20-30 X 8-15 mm, its wall 1.5-3 mm thick when dry, ca 75-seeded, seeds 2.5-3 X 3-4 mm; calyx, corolla, and other floral remnants often long persistent on the capsule.

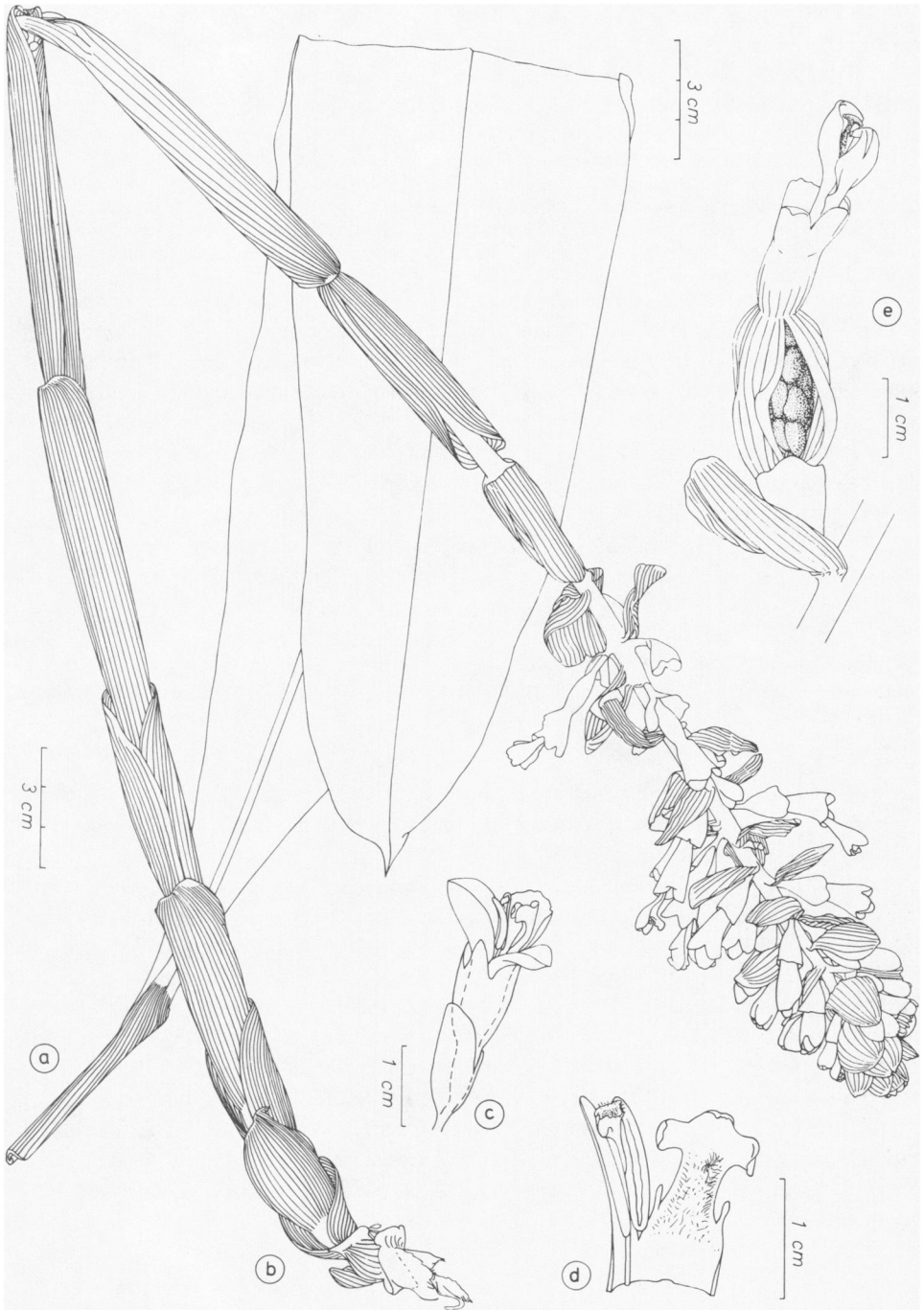


FIG 22. *Renealmia dermatopetala* (a-b, Irwin & Soderstrom 6451; c-d, Krukoff 11159; e, Prance et al 59141). a, leaf; b, inflorescence; c, flower with bracteole; d, labellum and stamen; e, fruit.

TYPE. *Bang 2566 pp* (holotype, B, destroyed; lectotype, BM; isotypes F, MICH, NY), unknown locality in Bolivia.

DISTRIBUTION (Fig 57). Central Brazil and western Bolivia; forests at middle elevations (up to 1400 m) in Bolivia, swamp forests or gallery forests (up to 550 m) in Brazil.

BRAZIL. GOIÁS: *von Lützelburg 1273* (RB). MATO GROSSO: *Argent et al 6317* (K, NY); *Emygdio 1933* (R); *Harley & Souza 10103* (K, U); *Hatschbach 34703* (MBM); *Irwin et al 16338* (NY); *Irwin & Soderstrom 6451* (NY, U); *Prance et al 59141* (NY, S, U, US); *Ratter et al 2132* (K); *Ratter et al 560* (K). PARA: *Pereira 1814* (RB, U); *Pires et al 6260* (IAN, NY). BOLIVIA. LA PAZ: *Krukoff 10221* (F, GH, MO, NY, S), *11159* (F, GH, LIL, MICH, MO, NY, S, US); *Buchtien 447 pp* (NY), *1281*, *7203* (US).

This species is very peculiar because of its long-persistent flowers (calyx as well as corolla and labellum) and its slender pedicels. It is closest to the *R. thyrsoidea* complex, from which it differs by the two characters just mentioned, and to which it is related by its truncate bracteoles. It is even more closely related to *R. pallida* (see under that species).

The Bolivian specimens differ in some minor vegetative characters from the Brazilian ones and the two forms might even represent distinct subspecies. I suspect, however, that future additional collections from regions between Mato Grosso and western Bolivia will show all kinds of intermediate characters between the two extremes. The main differences between the forms are given below:

	Bolivian forms	Brazilian forms
Colour of leaf-sheaths	often dark brown	pale brown
Leaf-sheaths	mostly reticulate	striate to slightly reticulate
Scape-length	15-35 cm	55-100 cm

19. *Renealmia dolichocalyx* Maas, Acta Bot. Neerl. 24: 475. 1976.

Fig 23.

Plants 1-3 m tall. Sheaths striate, 5 mm or more wide, rather densely covered with sessile and stalked, furcate hairs (ca 0.1 mm wide). Ligule ca 5 mm long, densely covered with appressed, simple hairs. Petiole 10-30 mm long, hairy like the sheaths. Lamina narrowly elliptic, shortly acuminate at the apex (acumen ca 5 mm long), cuneate at the base or gradually decurrent in the petiole, 33-60 cm long, 7-16 cm wide, upper side glabrous, lower side sparsely covered with sessile or shortly stalked, furcate or plurifurcate hairs (ca 0.1 mm wide). Scape erect, white to reddish, over 40 cm tall, up to 7 mm thick, beset with sheaths up to 9 cm long and 1.5 cm wide. Inflorescence a dense, basal thyrse 12-21 cm long and 5-8 cm wide, with 3-8-flowered cincinni. Indument of inflorescence: sheaths densely covered with shortly stalked or sessile, furcate to plurifurcate hairs (their apex densely covered with simple, needle-like hairs), rhachis, bracts, peduncles, bracteoles, pedicels, and calyx sparsely to rather densely so, corolla, ovary, and capsule glabrous or nearly so. Bracts greenish-red at the base, cinnamon-coloured towards the apex (according to André), rather firm and persistent, ovate, 20-35 mm long, 12-20 mm wide. Peduncles to 3 mm long, creamy white. Bracteole 12-15 mm long. Pedicels 5-7 mm long, creamy white. Calyx creamy white, rather firm and persistent, tubular 16-20 mm long, 1.5-4(-7) mm wide, the lobes deltate to triangular, 2-5 mm long, 2-3 mm wide. Corolla white, 26-28 mm long, the tube 18 mm long, the lobes 8-10 mm long, 3.5-4 mm wide. Labellum white(?), obtrilobate-obovate when spread out, 10 mm long, 8 mm wide, glabrous, the limb 7 mm long, 8 mm wide, basal claw 3 mm long, 2 mm wide, lateral staminodes ca 1 mm long. Anther 5 mm long, 2.5 mm wide, glabrous. Style 24-26 mm long. Nectarial glands multilobu-

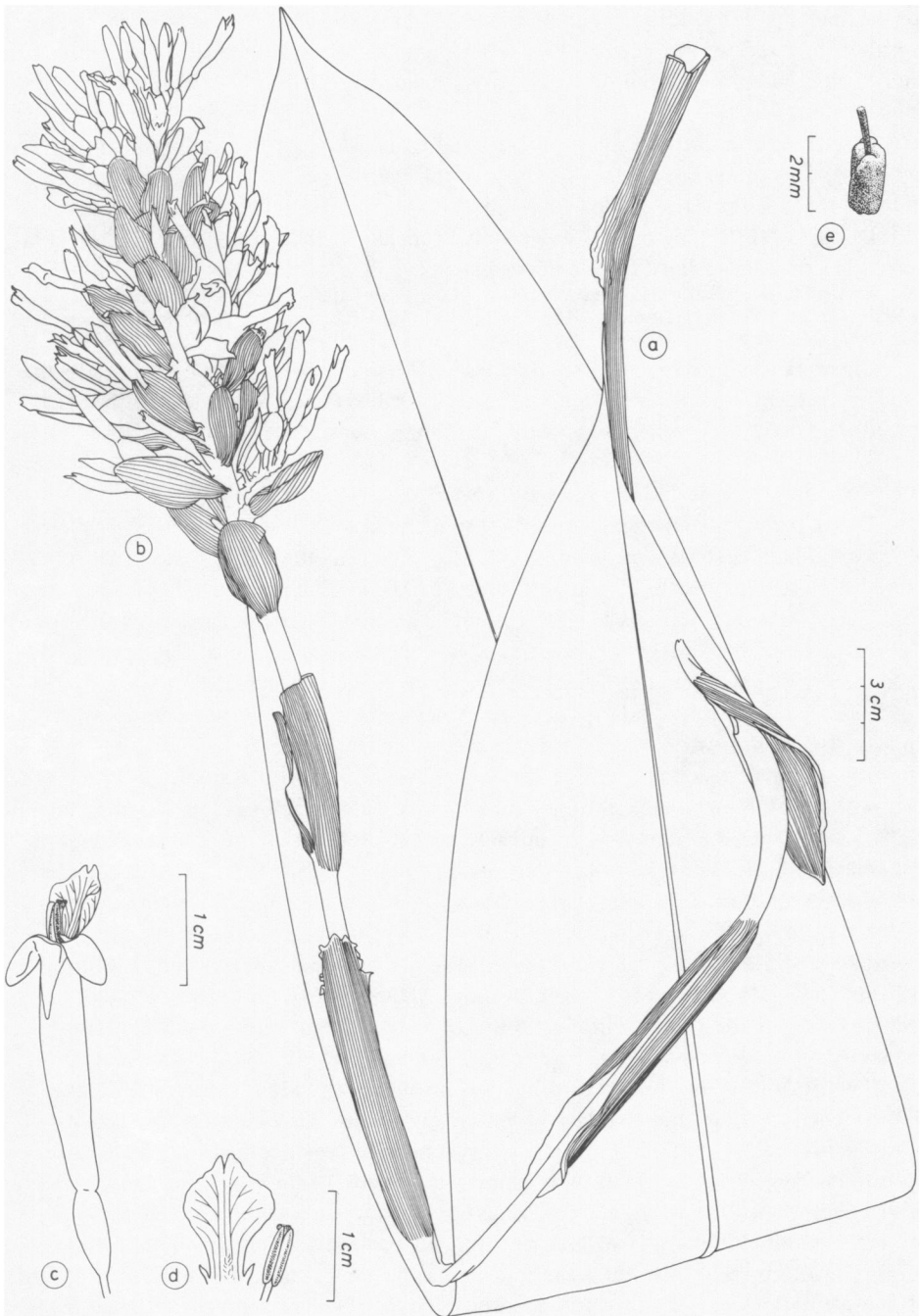


FIG 23. *Renealmia dolichocalyx* (a-e, Sparre 14028). a, leaf; b, inflorescence; c, flower; d, labellum and stamen; e, nectarial glands.

late, completely surrounding the style base, 2.5 mm long. Ovary creamy white, ellipsoid. Capsule bright red when ripe, ellipsoid, 10-15 mm X 5-9 mm, its wall 0.1-0.2 mm thick when dry (0.7-1 mm in living material), 3-9 seeded, seeds 4-7 X 3-4 mm, aril bright orange.

TYPE. *Sparre 14028* (holotype, S), road from Aloag to Santo Domingo de los Colorados, Tandápi (M. Cornejo Astorga), at the confluence of Río Tandapi and Pilatón, prov. Pichincha, Ecuador, 1500 m.

DISTRIBUTION (Fig 61). Known only from three collections from Ecuador; in subtropical rain and gallery forest, between 1200 and 1950 m.

ECUADOR. PICHINCHA: between Nanegal and Nanegalito, 1200-1500 m *Harling & Anderson 11581* (GB); San Florencio, 1950 m, *Andre 3666* (K); Tandápi, 1650 m, *Plowman & Wade Davis 4453* (U).

This new Ecuadorian species is related to *R. oligosperma* and *R. aurantifera*; it is well marked by its extremely long and narrow calyx (from which the epithet is derived) and its ovate, rather firm, wide (12-20 mm) bracts.

20. *Renealmia dressleri* Maas, Acta Bot. Neerl. 24: 476. 1976. Fig 24.

Plants 0.75-2 m tall. Rhizomes 6-10 mm thick, sometimes supported on slender stilt-roots. Sheaths striate, ca 10 mm wide, to 15 mm at the base of the plant, densely covered with sessile, furcate to plurifurcate hairs (0.01-0.03 mm wide.) Ligule ca 1 mm long. Petiole absent. Lamina narrowly elliptic, gradually narrowed towards the apex or acuminate (acumen to 15 mm long), cuneate at the strongly sheathing base, 35-80 cm long, 3.5-11 cm wide (the uppermost subtending the inflorescence 13 X 0.5 cm), upper side glabrous, lower side sparsely to rather densely covered with compass-needle hairs (0.01-0.05 mm wide). Inflorescence a terminal thyrse (5-)10-35 cm long and 2-4 cm wide, or occasionally a basal thyrse 10-25 cm long with a scape 15-30 cm tall, beset with sheaths up to 4-8 cm long and ca 1 cm wide, rhachis green, 1-3 mm thick, cincinni 3-7-flowered. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, corolla, ovary, and capsule densely to rather densely covered with sessile, furcate to plurifurcate hairs (0.01-0.05 mm wide). Bracts (pale) green to white, pale brown when dry, deciduous at length, narrowly triangular to triangular, 10-35 mm long, 5-15 mm wide. Peduncles green, 3-5 mm long. Bracteole 6-11 mm long. Pedicels green, 5-10 mm long. Calyx red to orange-red, tubular, becoming urceolate and fleshy with age, 5-8 mm long, 3-5 mm wide, the lobes deltate to shallowly triangular-ovate, 1-3 mm long, 2-3 mm wide. Corolla pale yellow to creamy-white, 11-12 mm long, the tube ca 6 mm long, the lobes 5-6 mm long, the dorsal one 4 mm wide, the two lateral ones 3 mm wide. Labellum creamy white with a yellow central part, 7 mm long and 8 mm wide when spread out, basal part opposite anther densely covered with simple hairs (ca 0.3 mm long), the limb horizontally spreading, ca 4 mm long, 8 mm wide, lateral lobes rounded, ca 4 mm long, 3 mm wide, middle lobe with two broadly ovate lobules ca 1.5 mm long, basal claw 3 mm long, 2 mm wide, lateral staminodes pink, ca 1 mm long, 0.3 mm wide. Anther red, 3-3.5 mm long, 1.5-2 mm wide, glabrous. Style 10-11 mm long. Nectarial glands partly surrounding the style base, 1.5 mm long. Ovary orange to yellow, globose to ellipsoid. Capsule red to reddish-orange, globose to ellipsoid, 4-8(-10) mm long, its wall 0.1-0.2 mm thick when dry (ca 0.5 mm in living material), 3-4-seeded, seeds 4 X 2.5-3 mm, aril orange.

TYPE. *Maas & Dressler 675* (holotype, U; isotypes, MO, US), La Eneida, Cerro Jefe Region, prov. Panamá, Panama, 750 m.

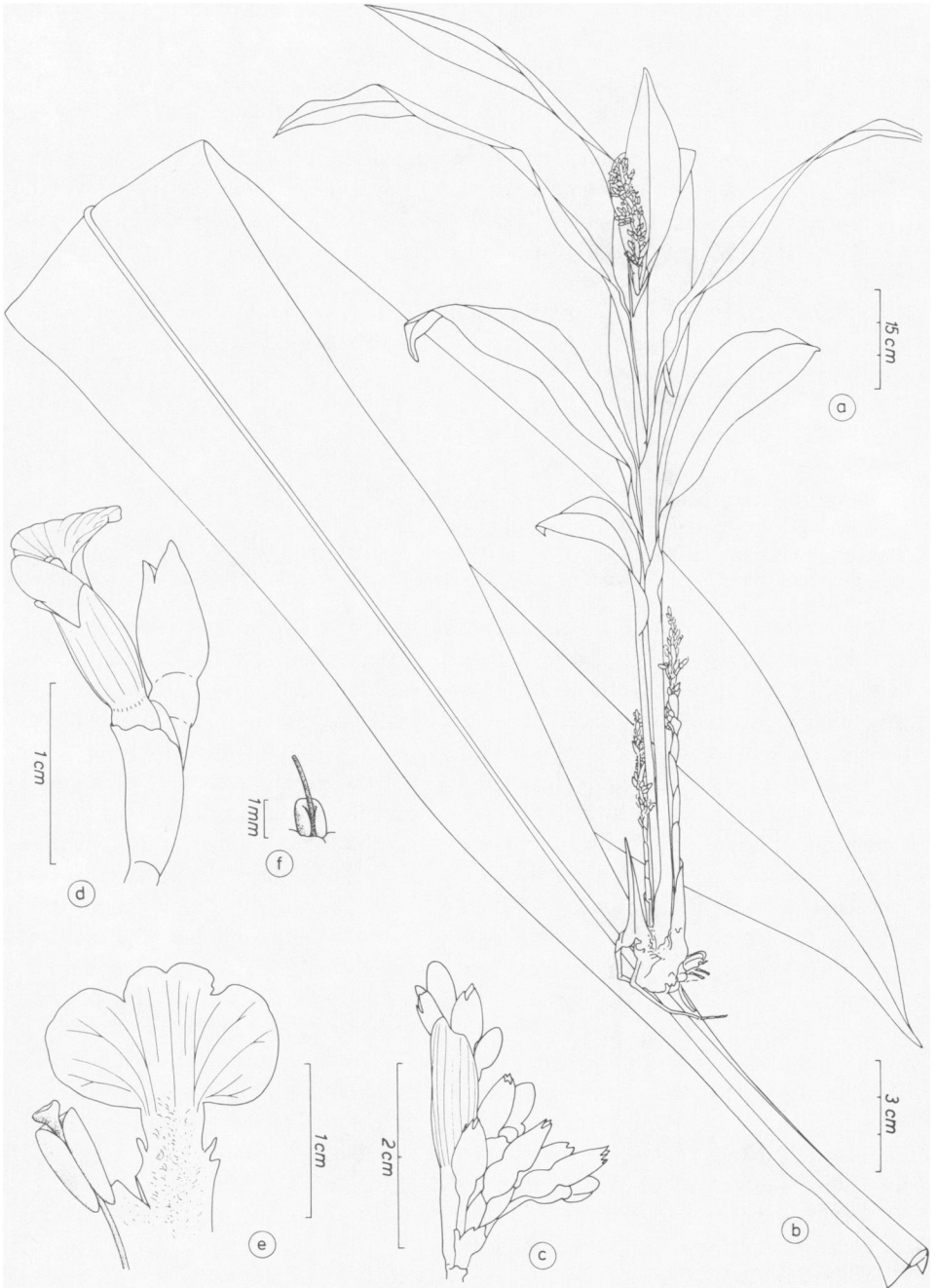


FIG 24. *Renealmia dressleri* (a-c, Maas & Dressler 675; d-e, Maas et al 1561). a, habit, inflorescence basal as well as terminal!; b, leaf; c, cincinnus, bract removed; d, cincinnus; e, labellum and stamen; f, nectarial glands.

DISTRIBUTION (Fig 61). Panama, Cerro Jefe Region, and probably Colombia, Choco; in forests, from 400-1400 m.

PANAMA. DARIÉN: Cerro Mali, 1300-1420 m, *Gentry & Mori 13631* (MO, U). PANAMÁ: El Llano-Carthi Road, km 10-12, 400 m, *Croat 26060* (MO), *Maas & Dressler 1692* (U); La Eneida, Cerro Jefe Region, 750 m, *Kennedy 1171* (DAV, F, U), *Kennedy et al 1113* (DAV, U), *Maas et al 1561* (K, U).

Renealmia dressleri (named after Dr. Robert Dressler who made possible all my field work in Panama) is characterized by its sessile, strongly sheathing leaves, its indument of compass-needle hairs on the lamina beneath (both characters also met with in the closely related *R. concinna*), a (mostly) terminal inflorescence and an orange-red to red calyx.

Killip 35134 (COL, US), from Rio Condoto, between Quebrada Guarapo and Mandinga, 120-180 m, Chocó, Colombia is related to this species; additional material is necessary.

21. *Renealmia erythrocarpa* Standley, J. Wash. Acad. Sci. 17: 248. 1927; Standley, Field Mus. Nat. Hist. Bot. Ser. 18: 190. 1937. Fig 25.

Renealmia molinae Standley & L. O. Williams, Ceiba 3: 190. 1953. Type. *Shank & Molina R. 4674* (holotype, EAP; isotypes, F, US), between Toro Bayo and Esquipulas, Ríos Júcaro and Esquipulas, Nicaragua, 130 m.

Plants 0.6-1.2 m tall. Rhizomes 2-5 mm thick. Sheaths striate, 2-5 mm wide, rather densely to sparsely covered with simple or stellate, but mainly furcate prickles (less than 0.1 mm long). Ligule ca 1 mm long, rather densely covered with simple, needle-like hairs. Petiole up to 15 mm long, hairy like the sheaths. Lamina narrowly elliptic, acute to long-acuminate (acumen 10-15 mm long) at the apex, cuneate at the base, 11-25 mm long, 2-4.5 cm wide, glabrous on both sides, lower side grayish-green (when dry). Scape green, 3-15 cm tall, up to 2 mm thick, beset with sheaths up to 2 cm long and 0.5 cm wide. Inflorescence a basal thyrses 3-5 cm long and 2-3 cm wide, with 1-3-flowered cincinni. Indument of inflorescence: sheaths, rachis, bracts, peduncles, bracteoles, pedicels, and calyx rather densely covered with simple hairs (to 0.2 mm long), furcate hairs rare, ovary and capsule glabrous or sparsely hairy. Bracts green, rather long persistent, narrowly triangular, acute, 6-25 mm long, 2-8 mm wide. Peduncles green, 2-3 mm long. Bracteole 8-9 mm long, laterally keeled. Pedicels green, to 1 mm long. Calyx green, tubular, 7-10 mm long, to 3 mm wide, the lobes narrowly triangular, ca 4 mm long, 1.5 mm wide. Corolla, labellum, stamen, and style unknown. Nectarial glands partly surrounding the style base, 2 mm long. Ovary ellipsoid, dark green. Capsule scarlet, ellipsoid, strongly narrowed towards the apex, longitudinally ribbed, 15-18 X 6-9 mm, its wall ca 0.1 mm thick when dry (ca 0.5 mm in living material), 8-13-seeded, seeds 3.5 X 2.5 mm.

TYPE. *Standley & Valerio 46373* (holotype, US), Naranjos Agrios, near Tilarán, prov. Guanacaste, Costa Rica, 600-700 m.

DISTRIBUTION (Fig 59). Nicaragua, Costa Rica, and Panama; in forests, at elevations from 130 to 900 m.

PANAMA. PANAMA: Slopes of Cerro Campana, 900 m, *Wilbur & Weaver 11306* (DUKE). VERAGUAS: Río Segundo Brazo, 630 m, *Maas & Dressler 1659* (COL, K, MO, NY, U).

This rare and very imperfectly known species is strongly characterized by its ellipsoid capsule which is gradually narrowed towards the apex, its rather narrow leaves, and its long calyx lobes. Its relationship is rather obscure; the closest relative might be the Amazonian *R. urbaniana*.



FIG 25. *Renalmia erythrocarpa* (a-c, Maas & Dressler 1659). a, habit; b, infructescence; c, young fruit with bract and bracteole.

22. ***Renealmia ferruginea*** Maas, Acta Bot. Neerl. 24: 476. 1976. Fig. 26.

Terrestrial or epiphytic (?) plants to 3 m tall. Rhizomes ca 10 mm thick. Sheaths striate, 5-10 mm wide, to 20 mm at the base of the plant, upper sheaths glabrous, the lower ones rather densely covered with furcate hairs. Ligule 8-14 mm (in youngest leaves 3-8 mm) long. Petiole absent. Lamina narrowly elliptic, shortly acuminate at the apex, cuneate at the base, (20-)37-55 cm long, (4-)8-12 cm wide, glabrous on both sides, or midrib of lower side covered with some simple hairs. Scape erect, 17-30 cm tall, up to 7 mm thick, beset with sheaths up to 4.5-11 cm long and 1.5-2.5 cm wide, rhachis pale red. Inflorescence a basal, dense thyrse 22-32 cm long and 5-10 cm wide (9 X 4 cm when young), with 3-4-flowered cincinni. Indument of inflorescence: rhachis, peduncles, bracteoles, pedicels, ovary, and capsule very densely covered with a velvety indument of ferrugineous, erect, furcate (or plurifurcate, rarely also simple) hairs (0.1-0.3 mm long), the bracteoles rather densely so, the calyx sparsely so, the sheaths and bracts glabrous to rather densely so, corolla glabrous. Bracts orange-red, persistent, ovate-triangular, 25-75 mm long, (15-)25-40 mm wide. Peduncles red-orange, 4-10 mm long. Bracteole orange-red, 25-32 mm long. Pedicels red-orange, 5-7 mm long. Calyx red, tubular, 15-32 mm long, 5-11 mm wide, the lobes deltate to triangular, 4-13 mm long, 4-8 mm wide. Corolla white, 35 mm long, the tube ca 20 mm long, the lobes 15 mm long, the dorsal one 17 mm wide, the two lateral ones 12 mm wide. Labellum white, 17 mm long and 15 mm wide when spread out, glabrous, limb erect, ca 8 mm long and 15 mm wide, middle lobe reflexed, entire or slightly emarginate, 3 mm long, 7 mm wide, lateral lobes rounded, 7 mm long, 5 mm wide, involute and forming a tube ca 8 mm in diameter, basal claw 9 mm long, 5 mm wide, lateral staminodes 3 mm long, 0.5 mm wide. Anther pink, 6-8 mm long, 2-4 mm wide, glabrous. Style 20-26 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2-3 mm long. Ovary rusty-orange, ellipsoid. Capsule red with rusty-orange indument, ellipsoid, 25-40 X (12-)20-35 mm, its wall ca 0.3 mm thick when dry (3-5 mm in living material), ca 50-seeded, seeds ca 2 X 3.5 mm.

TYPE. *Maas & Plowman 2074* (holotype, U; isotypes, COL, GH, K), km 55 of road from Timbío to Veinte de Julio, 2500 m, Cauca, Colombia, forested quebrada.

DISTRIBUTION (Fig 58). Colombia, Antioquia and Cauca; in subandean forest, the type collected between 2400 and 2700 m, the paratype from unknown elevation.

COLOMBIA. ANTIOQUIA: San José de San Andrés, *Correa & Velásquez V. 70* (paratype, US). CAUCA: Cord. Occ., San José, San Antonio, 2400-2700 m, *Pennell 7580* (GH, US).

This species is characterized by the dense, ferrugineous, velutinous indument of the inflorescence (the capsules included), a very long ligule (even longer than in *R. ligulata*), a long and tubular calyx, and relatively wide bracts (15-25 mm). It is very closely related to *R. ligulata*.

It is rather peculiar that *Pennell 7580* was said (according to Pennell) to be epiphytic. This phenomenon is very rare in the genus.

Maas & Plowman 2152 (COL, U), from roadsides between Timbío and Veinte de Julio, 2100-2300 m, Cauca, Colombia is related to this species by the indument of the fruits and by its long-ligulate leaves, and by most other floral characters. It is aberrant, however, by a shorter scape (10-15 long) and in being less hairy.

23. ***Renealmia floribunda*** K. Schumann in Engler, Pflanzenreich 4. 46: 300. 1904.

Fig 27.

Renealmia occidentalis (Swartz) Sweet var γ *longipes* O. G. Petersen in Martius, Fl. Bras. 3(3): 45. t. 12, f. 2. 1890 (\equiv *Renealmia floribunda*).

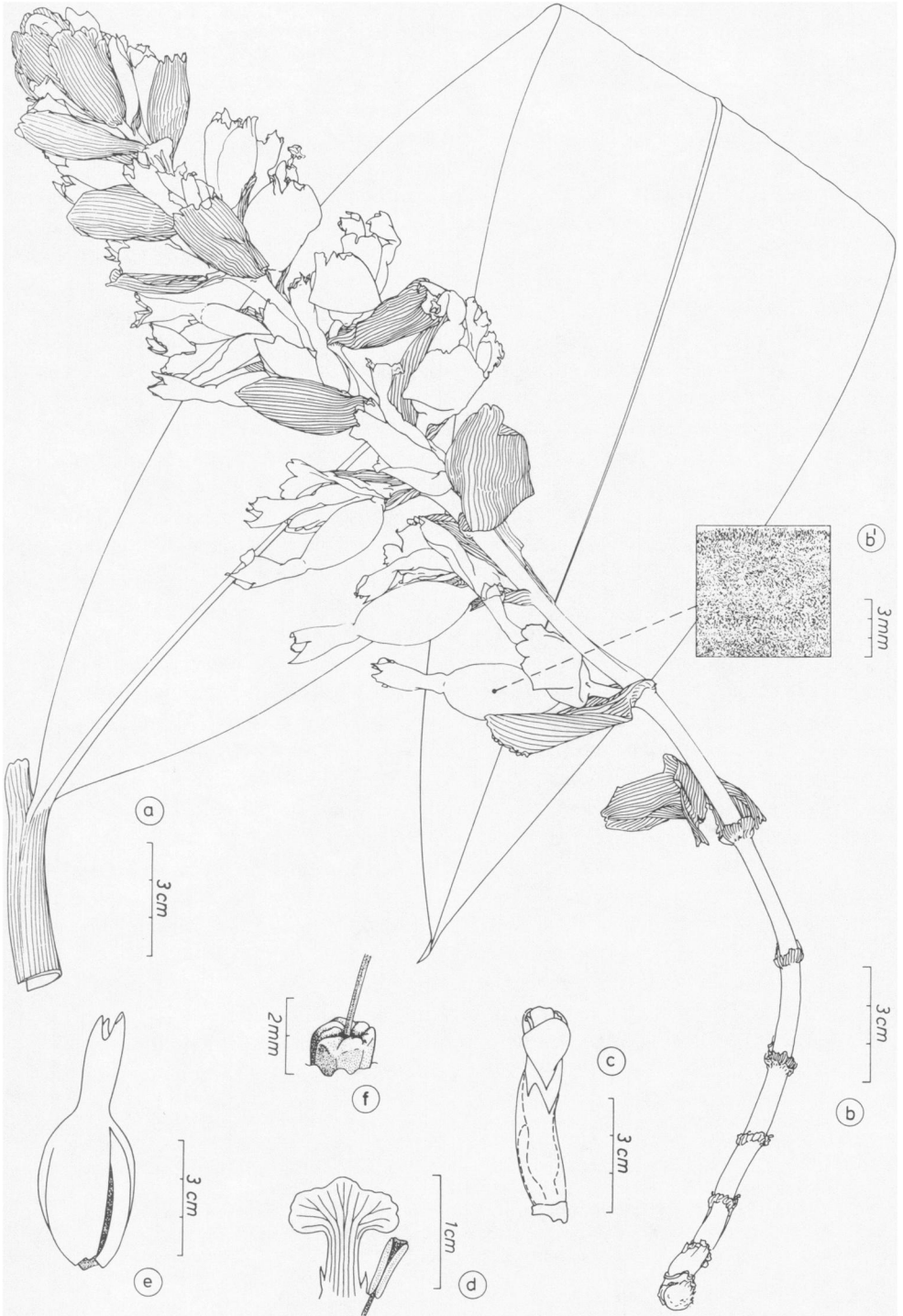


FIG 26. *Renealmia ferruginea* (a-c, e, Maas & Plowman 2074; b, b', Pennell 7580; d, f, Correa 70). a, leaves; b, inflorescence; b', detail of capsule indument; c, flower with bracteole; d, labellum and stamen; e, fruit; f, nectarial glands.

Renalmia pedicellaris Gleason, Bull. Torrey Club 52: 192. 1925; Gleason, Mem. New York Bot. Gard. 5: 271. 1925. Type. *Gleason 138* (holotype, NY; isotypes, GH, K, US), dense upland forest, Tumatumari, Guyana.

Plants 1-3 m tall. Rhizomes 5-15 mm thick. Sheaths reticulate, often chocolate-brown when dry, 5-15 mm wide, to 20 mm at the base of the plant, densely covered with simple, furcate, or stellate prickles (less than 0.1 mm long), and towards the reticulations with needle-like hairs (to 1 mm long). Ligule 1-2 mm long, densely covered with needle-like hairs. Petiole 0-15(-25) mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen 5-15 mm long), cuneate at the base, 30-75 cm long, 4-10 cm wide, upper side glabrous, lower side glabrous or sparsely covered with erect, simple hairs (to 0.5 mm long) particularly along the midrib. Scape erect or prostrate, 25-150 cm tall, up to 4(-5) mm thick, beset with sheaths up to 2-6(-9) cm long and 0.5-1 cm wide, rhachis green (sometimes purplish-red). Inflorescence a basal, occasionally branched thyrse 10-40(-65) cm long and (1-)4-9 cm wide, with 2-6(-10)-flowered cincinni. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule densely to sparsely covered with simple, furcate or plurifurcate hairs (to 0.5 mm long); ovary and capsule occasionally glabrous; corolla glabrous. Bracts pale green (in some collections red), membranous and very soon deciduous, narrowly triangular-ovate, 10-40 mm long, 5-10 mm wide. Peduncles green, 3-10(-20) mm long. Bracteole pale green, 10-20 mm long. Pedicels green, (5-)10-33 mm long. Calyx green (in some collections purple-red), turbinate, 3-6(-8) mm long, 3-4 mm wide, the lobes shallowly triangular, 1-2 mm long, 2-3 mm wide, persistent on capsule. Corolla pale yellow, ca 12 mm long, the tube 4-5 mm long, the lobes 7-8 mm long, 3-4 mm wide. Labellum yellow, 10-11 mm long and 8-11 mm wide when spread out, basal part opposite anther densely covered with simple hairs (ca 0.3 mm long), the limb horizontally spreading, 7-8 mm long, 8-11 mm wide, lateral lobes rounded, 6-8 mm long, 3-4 mm wide, middle lobe with two narrowly ovate-elliptic lobules 2-3 mm long, 1-1.5 mm wide, basal claw 3 mm long, 2-2.5 mm wide, lateral staminodes ca 1 mm long. Anther purple-red, 3-5 mm long, 1-2 mm wide, glabrous. Style 9-10 mm long. Nectarial glands only partly surrounding the style base, ca 2 mm long. Ovary globose, green. Capsule green, maturing black-purple, globose to ellipsoid, 4-10(-15) X 4-11 mm, its wall ca 0.1 mm thick when dry (1-1.5 mm in living material), 10-25-seeded, seeds 2-3 X 2.5-3 mm, aril orange.

TYPE. *Spruce 2250* (holotype, B, destroyed; lectotype, K; isotypes, BR, CGE, P), São Gabriel da Cachoeira, upper Rio Negro, Amazonas, Brazil.

DISTRIBUTION (Fig 59). Northern South America, including Trinidad and the Amazon River region; in rain forests, swamp forests, or forested savanna margins; at low elevations, up to 400 m.

TRINIDAD. *Broadway 9254* (BM); *Dannouse sn*, 2 Apr 1900 (TRIN), *sn*, *anno 1905* (TRIN); *R. O. Williams & Freeman 11490* (K, TRIN). COLOMBIA. AMAZONAS: *Schultes & Cabrera 16336* (US). VAUPÈS: *Cuatrecasas 6805* (COL, F, US), *7282* (COL, F); *Davis 16* (U); *García-Barriga et al 16080* (COL); *Romero Castañeda 3806* (COL); *Schultes & Cabrera 17311* (US). VENEZUELA. AMAZONAS: *Bunting et al 3586* (DAV, MY, U), *3796* (MY, U); *Holt & Blake 734* (US); *Maguire et al 29397* (NY, U); *Steyermark & Bunting 102689* (U, VEN); *Tate 152* (NY); *L. I. Williams 14232* (F, US, VEN), *15549* (F, NY, US, VEN). BOLÍVAR: *Cardona 768* (US, VEN); *Steyermark 75301* (NY, VEN), *75381* (NY), *Trujillo 3661* (MY). GUYANA. *Hohenkirk 9*, *277A* (K); *Rudge sn* (BM); *A. C. Smith 2613* (K, MO, NY, US); *Talbot sn* (K); *S. S. & C. L. Tillett 45787* (NY); ? *Gleason 626* (NY, US). SURINAME. *Florschütz & Maas 2691* (U); *Irwin et al 55522* (NY), *55889* (NY, U); *A. M. E. & F. P. Jonker 641* (U); *Kramer & Hekking 2701* (U); *Maas & Tawjoeran, LBB 10692* (U); *Lindeman 5868* (U); *Maas 3164*, *3271* (U); *Maguire & Stahel 24022* (F, GH, K, NY, U, US, VEN); *Mennega 562* (U); *Tulleken 464* (L); *Wessels Boer 1227 pp* (U). FRENCH GUIANA. *Martin 141* (P), *sn* (BM, F); *Oldeman B-2259* (CAY); *Poiteau*

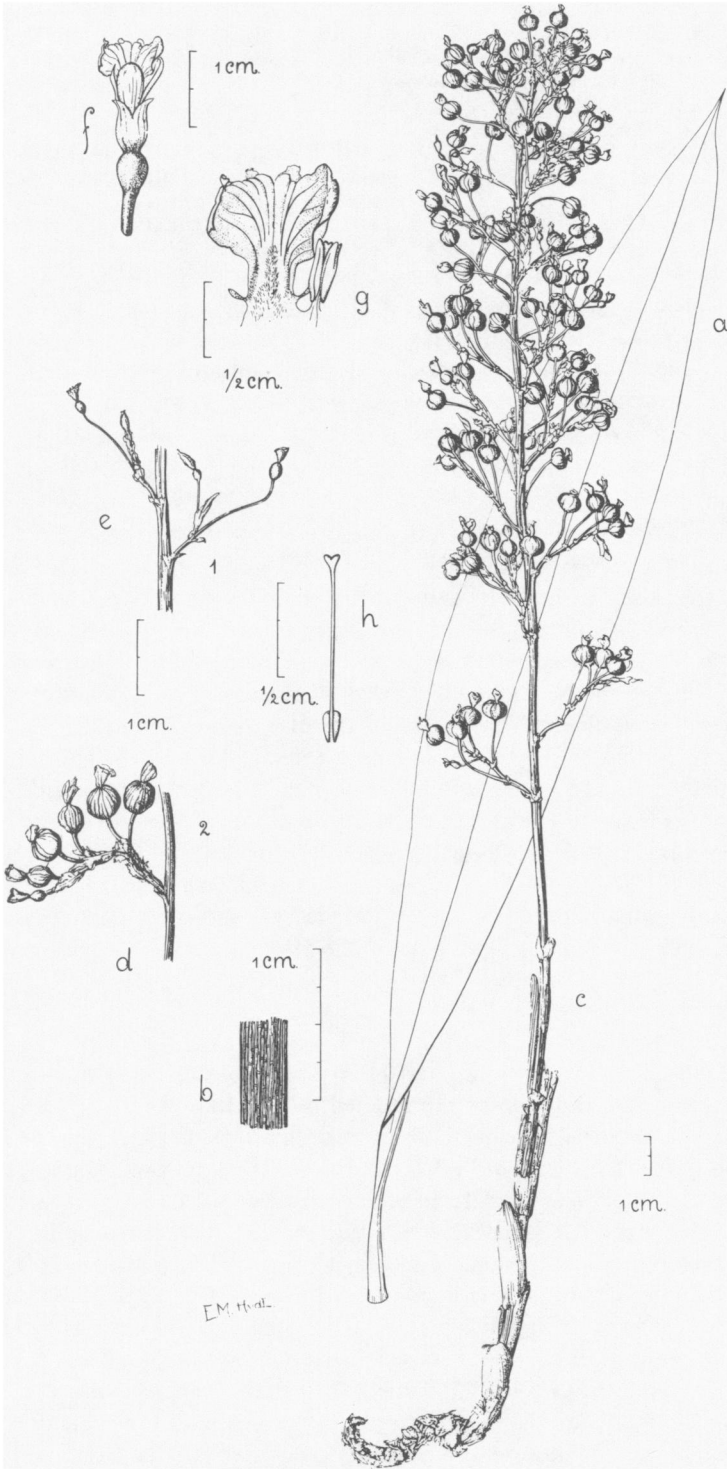


FIG 27. *Renealmia floribunda* (a-c, Spruce 2250; d, Maas 3271; e-h, Florschütz & Maas 2691). a, leaf; b, detail of leaf-sheath; c, infructescence; d, e, fruiting cincinni; f, flower; g, labellum and stamen; h, nectarial glands, style, and stigma.

sn (K); *L. C. Richard* sn (P). BRAZIL. ACRE: *Prance et al 11831* (AAU, E, F, GH, INPA, MG, MO, NY, P, R, U), 12241 (COL, DAV, INPA, MG, NY, U, W); *Ule 5590* (MG). AMAZONAS: *Chagas 701, 3621* (INPA, U); *Chagas & D. Coelho 3266* (INPA, U); *Ducke 7627* (BM, MG), *sn* (RB 23632); *Frões 26158, 28841* (IAN); *Hoehne 5120* (R); *Kuhlmann 951* (RB); *Labroy 118* (P); *P. J. M. & H. Maas 442* (INPA, U); *Pires 314* (IAN); *Prance et al 5133* (NY, U); *Prance et al 11500* (C, CR, IJ, INPA, LE, MG, NY, R, S, U, UC, VEN, WIS); *Prance et al 14600* (INPA, NY, U); *Prance et al 15360* (COL, DAV, E, INPA, K, MG, NY, R, U, US, VEN, W), 15374 (INPA, K, NY, U, US), 15929 (INPA, LL, NY, USF, U) 16431 (INPA, NY, U); *Rodrigues 7889, 10741* (INPA, U). PARA: *Oliveira 751* (IAN); *Pires et al 4140* (IAN); *Prance et al 1518* (NY, U); *Sneath-lage sn* (MG 10104). RONDÔNIA: *Prance et al 8932* (NY, U). RORAIMA: *Black 51-13517, 51-13900* (IAN); *Prance et al 10751* (INPA, LE, NY, U). STATE?: *Glaziou 758* (P). PERU. LORETO: *Schunke V. 2499* (U).

This species is very closely related to *R. guianensis* with which it shares leaf-size, reticulate, dark brown (when dry) leaf-sheaths, and most of the floral characters. The two species are quite different, however in the size and colour of the fruit, those of *R. floribunda* being 4-10 (-15) mm long, green when young and maturing black, and crowned with the persistent calyx. The fruits of *R. guianensis*, in contrast, are 8-20 mm long, reddish (brownish in herbarium material), and the calyx is deciduous during fructification.

Renalmia floribunda is rather variable in the size and branching of its inflorescence. In the past, two species were recognized because of these variable characters, namely *R. pedicellaris* (large fruits and inflorescence, few flowers per cincinnus) and *R. floribunda* (small fruits and inflorescence, many flowers per cincinnus). On a botanical trip in Suriname I collected on 26 Jan 1965 along forest margins near Heidoti, Coppename River some plants which showed all characters of *R. floribunda*, namely small, many-flowered cincinni and mature fruits of only 4-6 mm in diameter. Returning to Heidoti on 16 Mar. 1965 I saw to my great surprise that the inflorescence of the same rhizome at exactly the same place near the forest margin were different from those I found in January, namely, much longer, with few-flowered cincinni, and immature (green) fruits 8-10 mm in diameter, exactly the inflorescence-type of Gleason's *R. pedicellaris*. The "January type" arose from the rhizome after a long, dry period, thus producing a small inflorescence, whereas the "March type" was preceded by a month and a half of steady and heavy rainfall. Thus it becomes necessary to merge the two species as *R. floribunda*.

24. *Renalmia fragilis* Maas, Acta Bot. Neerl. 24: 476. 1976.

Fig 28.

Plants 0.8-2 m tall. Rhizomes ca 10 mm thick. Sheaths striate, 5-8 mm wide densely covered with white sometimes inflated, simple to plurifurcate hairs (0.2-0.5 mm long) and with sessile, furcate to plurifurcate hairs (ca 0.1 mm wide). Ligule 2-3 mm long, hairy like the sheaths. Petiole absent. Lamina narrowly elliptic, shortly acuminate at the apex (acumen 5-15 mm long), cuneate at the base, 7-40 cm long, 2.5-10 cm wide, upper side glabrous, lower side sparsely to rather densely covered with sessile, furcate to plurifurcate hairs (less than 0.1 mm wide), and sometimes along the midrib region with inflated, simple hairs (0.2-0.3 mm long). Scape 15-85 cm tall, up to 4 mm thick, beset with sheaths up to 5-20 cm long and 0.5-1 cm wide. Inflorescence a lax to dense basal thyse or raceme 6-16 cm long and 4.5-8 cm wide, with 1-2-flowered cincinni, rhachis red. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, margins of corolla-lobes, ovary, and capsule sparsely to rather densely covered with white, sometimes inflated, (simple, furcate, plurifurcate, or irregularly branched) hairs (0.1-0.4 mm long) often mixed with brownish, not inflated, shortly stalked, furcate to plurifurcate hairs and some brownish,

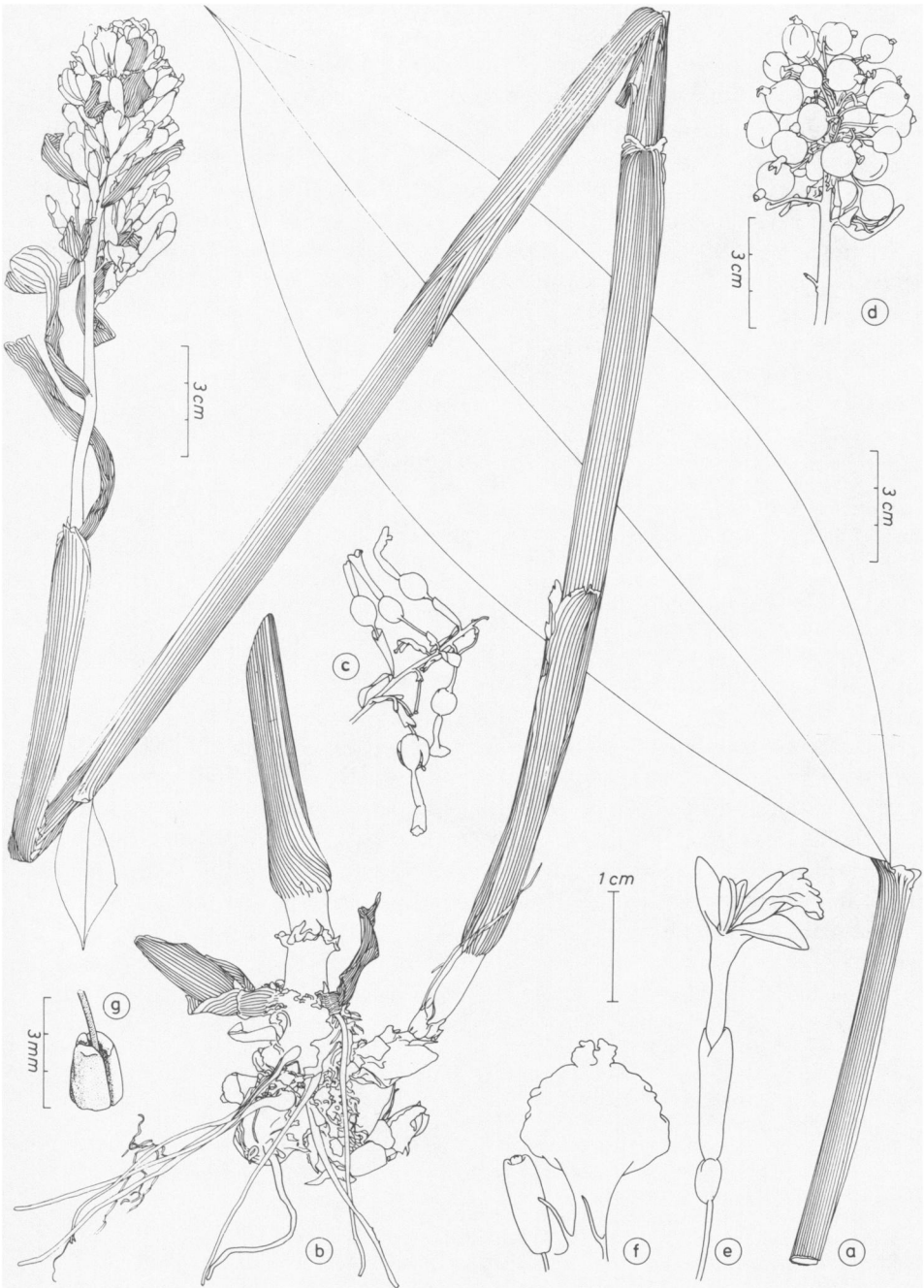


FIG 28. *Renealmia fragilis* (a-b, e-f, Bristol 417; c, von Sneidern 4652; d, g, Wiggins 10448). a, leaf; b, inflorescence; c-d, part of infructescence; e, flower; f, labellum and stamen; g, nectarial glands.

simple hairs; calyx, ovary, and capsule sometimes glabrous. Bracts red, fragile and very soon deciduous, narrowly obovate, obtuse, 16-50 mm long, 3-10 mm wide. Peduncles red, 3-14 mm long. Bracteole red, 12-15 mm long. Pedicel red, 5-15 mm long. Calyx red, tubular, fragile, 9-20 mm long, 3-4 mm wide, the lobes shallowly triangular to triangular, 2-6 mm long, 4 mm wide. Corolla white to yellow, 22-24 mm long, the tube 13-15 mm long, the lobes 9 mm long 4-5 mm wide. Labellum white (?), ca 12 mm long and 8-10 mm wide when spread out, glabrous, the limb ca 6 mm long, 8-10 mm wide, basal claw 6 mm long, 2-4 mm wide, lateral staminodes ca 2 mm long. Anther red, 5-6 mm long, 2-3 mm wide, glabrous. Style 22 mm long. Nectarial glands multilobulate, completely surrounding the style base, ca 2 mm long. Ovary red, globose. Capsule red (?), globose, 6-10 mm in diameter, its wall ca 0.1 mm thick when dry, 9-seeded seeds 3 X 4-5 mm.

TYPE. *Wiggins 10448* (holotype, US), along trail to San Pedro, on ridge S of Río Clavadero, E of Cayambe, prov. Imbabura, Ecuador, 2500 m.

DISTRIBUTION (Fig 59). Ecuador and Colombia; wet, forested slopes of the Andes, at higher elevations, from 1200 to 2600 m.

COLOMBIA. NARIÑO: between Altaquer and Junín, Cuyambe, 1200 m, *Idrobo & Kyburz 2349* (COL); El Palmar, 1500 m, *von Sneidern 4652* (S). PUTUMAYO: valley of Sibundoy, 1.5 km E of Sibundoy, 2200 m, *Bristol 417* (COL); Sibundoy, 2250 m, *Vogel 312* (B). ECUADOR. CARCHI: 13 km SE of Maldonado, 2600 m, *Harling & Andersson 12343* (GB, U). MORONA-SANTIAGO: between Limón and Gualaceo 2000-2300 m, *Harling & Andersson 12818* (GB). NAPO: between Sta. Barbara and La Bonita 2400 m, *Harling & Andersson 12504* (GB). W slopes of Andes, 7000 ft., epiphyte (?) *Jameson sn, anno 1854* (CGE).

This species, which is probably closest to *R. acreana* is characterized by inflated, white hairs on both leaf-sheaths and inflorescence, relatively long peduncles and pedicels (both to 15 mm long) and globose fruit 8-9 mm in diameter.

There is a considerable variation within this species: *Idrobo & Kyburz 2349* and *von Sneidern 4652* have small leaves (up to 3 cm wide) and a lax inflorescence; two other collections, *Bristol 417* and *Wiggins 10448*, have much wider leaves (up to 8.5 cm wide) and a dense inflorescence. The *Jameson collection* from Ecuador, however, is intermediate between these two forms in the structure of its inflorescence and the size of its leaves (up to 4 cm wide). As all of these plants possess the very typical inflated hairs, however, I prefer to treat them for the present as representing one species.

The specific epithet refers to the membranous, very fragile floral parts (bracts bracteole, and calyx).

25. ***Renealmia guianensis*** Maas, Acta Bot. Neerl. 24: 477. 1976. Fig 29.

Renealmia gracilis O. G. Petersen in Martius, Fl. Bras. 3(3): 47. 1890; K. Schumann in Engler Pflanzenreich 4. 46: 297. 1904, not of Blanco, Fl. Philip. ed. 1. 1. 1837.

? *Alpinia aromatica* Aublet, Hist. Pl. Guian. Franç. 1: 3. 1775. Type. *Aublet collections* from "crique Galibi" (N of St. Laurent du Maroni) and 'Ile de Caienne,' French Guiana (not seen, probably not preserved).

? *Alpinia multicaulis* Roemer & Schultes, Syst. Veg. 1: 21. 1817; K. Schumann in Engler, Pflanzenreich 4. 46: 299, 307. 1904. (≡ *Alpinia aromatica* Aubl.)

Renealmia occidentalis Lemée, Fl. Guy. Franç. 1: 345. 1955; not of (Swartz) Sweet.

Plants (0.5-)1-3 m tall. Rhizomes 5-12 mm thick. Sheaths reticulate, often chocolate-brown when dry, 5-10 mm wide to 20 mm at the base of the plant, densely covered with simple or (rarely) furcate prickles (less than 0.1 mm long) and mainly towards the reticulations with needle-like hairs (0.5-1 mm long). Ligule 1-3 mm long, densely covered with simple, needle-like hairs. Petiole 10-35 mm long, hairy like the sheaths but less densely so. Lamina narrowly elliptic, acuminate at the apex (acumen 10-25 mm long), cuneate at the base, 19-47 cm long, (2.5-)3.5-9 cm wide, upper side

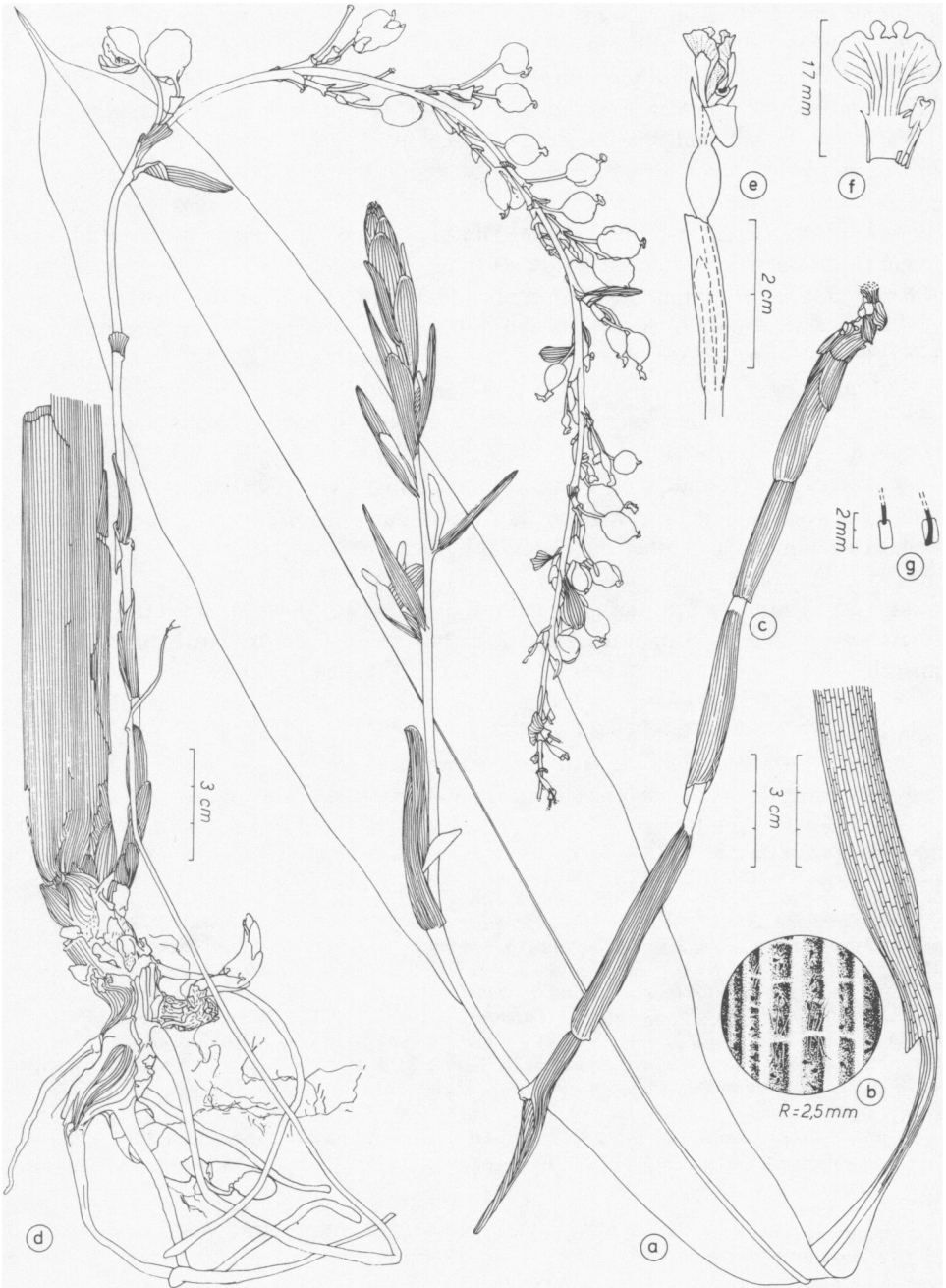


FIG 29. *Renalmia guianensis* (a-b, d, *Silva 608*; c, e-g, *Florschütz & Maas 3037*). a, leaf; b, detail of leaf-sheath; c, inflorescence; d, infructescence; e, flower with bracteole; f, labellum and stamen; g, nectarial glands.

glabrous, lower side glabrous to sparsely covered with simple hairs (up to 0.2 mm long) particularly along the midrib. Scape erect or prostrate, 20-35(-85) cm tall, up to 3(-4) mm thick, beset with purplish-red, deciduous sheaths up to 6-13 cm long and 0.5-1 cm wide. Inflorescence a basal thyrse (5-)15-45 cm long and 2-5 cm wide, with 1-3(-4)-flowered cincinni, rhachis green. Indument of inflorescence: sheaths, rhachis bracts, peduncles, bracteoles, pedicels, calyx, and ovary sparsely to rather densely covered with simple and furcate (rarely plurifurcate) hairs (0.1-0.5 mm long), capsule sparsely so, or mostly glabrous, corolla glabrous. Bracts dark red to purple-red, membranous, very soon deciduous, (narrowly) triangular-ovate, 15-50 mm long, 7-10 mm wide. Peduncles 3-10 mm long. Bracteole (12-)15-18(-21) mm long. Pedicels 5-30 mm long. Calyx pinkish-red to dark red, tubular to turbinate, 5-9 mm long, 2-5 mm wide, its lobes subobsolete, deciduous at length. Corolla yellow, 10-12 mm long, the tube 4 mm long, the lobes 6-8 mm long, 4-6 mm wide. Labellum yellow, 11 mm long and 10-12 mm wide when spread out, basal part opposite stamen densely covered with simple hairs (ca 0.3 mm long), the limb horizontally spreading, 8 mm long, 10-12 mm wide, lateral lobes rounded, ca 8 mm long, 4-5 mm wide, middle lobe with two lobules 2-3 mm long and wide, basal claw 3 mm long, 2-2.5 mm wide, lateral staminodes ca 1 mm long. Anther red, 4-5 mm long, 2 mm wide, glabrous. Style 9-10 mm long. Nectarial glands only partly surrounding the style base, 1-2 mm long. Ovary red. Capsule red to flesh-colored (10.0 RP 5/10), brownish when dry, ellipsoid to globose, 8-20 X 6-15 mm, its wall 0.1-0.2 mm thick when dry (to 1 mm in living material), 10-25-seeded, seeds 2.5-3 X 3.5 mm, aril orange to yellow.

TYPE. *L. C. Richard sn* (holotype, P; photograph, U), "in sylvis inter Couana et Approuague," French Guiana.

DISTRIBUTION (Fig 60). The Guianas and adjacent parts of Brazil and Venezuela, but also two Brazilian collections from the states of Pernambuco and Bahia; in rain forests, vrzea forests, swamps, or swamp forests, from sea-level up to 850 m.

VENEZUELA. BOLVAR: *Steyermark 89218* (NY, U, VEN) 89320 (NY VEN). DELTA AMACURO: *Steyermark 87669* (VEN). STATE ?: *Rusby & Squires 111* (K NY), 407 (NY). GUYANA. *Maguire & Fanshawe 22834* (NY); *Sandwith 1062* (K, U). SURINAME. *Boon 1014* (U); *van Donselaar 3312* (U); *J. & P. A. Florschtz 1859* (U); *Florschtz & Maas 2436, 2886, 3037* (U); *Irwin et al 55122* (NY); *Lanjouw & Lindeman 815* (U); *Lindeman 4614, 5869* (U); *Maas 3167* (NY, U), 3387 (U); *Maas et al 2352* (COL, F, K, U, VEN); *Maas & Tawjoeran, LBB 10894* (U); *Maguire 40708* (NY); *Maguire & Stahel 24149* (NY, U); *Versteeg 627* (U). FRENCH GUIANA. *de Granville C-35, 398* (CAY); *Lescure 31, 199* (CAY, U); *Oldeman T-548, 1296 B-1769, 2629, 2966, B-3010, B-4325* (CAY); *Sagot sn*, Aug 1856 (P). BRAZIL. AMAPA: *Irwin et al 47353* (NY, U); *W. Rodrigues 3828* (INPA, U); *Sastre 1618* (P, U). BAHIA: *Blanchet sn* (G). PARA: *Prance & Pennington 1907* (NY, U, US); *Silva 608* (MG, U). PERNAMBUCO: *Ridley et al sn* (BM).

Renealmia guianensis is closely related to *R. floribunda* (see under that species), but can readily be distinguished by its red (in dry material brown) instead of black fruits.

I am not sure of the identity of Aublet's *Alpinia aromatica*, which was described as follows:

Alpinia (aromatica) multicaulis

Paco-seroca minor, multicaulis Plum. Mss. 5. t. 27 et 28.

Cette plante crot au bord de l'eau à la crique Galibi, et dans l'le de Caienne: son fruit est peu succulent; ces graines ont un got fort rapprochant de celles du cardamome.

I have tried to locate the Aublet specimens cited, but they could not be traced at Paris, nor at the British Museum.

Plumier's "*Paco-seroca minor, multicaulis*" is the present *R. occidentalis* var *occidentalis*, a species occurring in the Antilles and from Mexico to Bolivia in the South and to Guyana in the East. It does not occur in Suriname and is apparently rare in Guyana, so it does not seem likely that the plants observed by Aublet in French Guiana and called *Alpinia aromatica* were of the same species as Plumier's "*Paco-seroca minor, multicaulis*." As the description of Aublet is absolutely insufficient and does not give any detail of the plant and, moreover, as no type material seems to be preserved, the name *Alpinia aromatica* cannot be applied.

26. **Renealmia helenae** Maas, Acta Bot. Neerl. 24: 477 1976.

Fig 30.

Plants 40-80(100) cm tall. Rhizomes 3-6 mm thick, sometimes supported on slender stilt-roots to 10 cm above the ground. Sheaths striate, 3-5 mm wide, sparsely to rather densely covered with stellate scales (less than 0.02 mm in diameter). Ligule 1-2 mm long, hairy like the sheaths. Petiole 0-10 mm long, hairy like the sheaths. Lamina linear to narrowly elliptic, lower side pale purple with dark purple veins, acute at the apex, cuneate at the base, 6-20 cm long, 1.5-3.5 cm wide, glabrous on both sides. Inflorescence a terminal, spiciform thyrse 2-5 cm long and 1.5-2 cm wide, with 2-flowered cincinni, rhachis green, 1-1.5 mm thick. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule densely to rather densely covered with sessile, furcate to plurifurcate hairs (ca 0.1 mm long), the branches of the hairs ascending or horizontally deflexed (the hairs then of the compass-needle type); corolla slightly hairy towards the apex. Bracts green, herbaceous, persistent, narrowly triangular-ovate to triangular-ovate, acute, 5-16 mm long, 3-6 mm wide. Peduncles less than 0.5 mm long. Bracteole 4-5 mm long. Pedicels 1-2 mm long. Calyx green to orange, tubular, 3-6 mm long, 2-3 mm wide, the lobes shallowly triangular-ovate, ca 1 mm long, 1.5-2 mm wide. Corolla pale yellow to white, 8 mm long, the tube 5 mm long, the lobes 3 mm long, 2 mm wide. Labellum white with a yellow centre and reddish near the insertion of the stamen, 5 mm long and 4 mm wide when spread out, basal part opposite anther densely covered with simple hairs (0.2-0.3 mm long), the limb horizontally spreading, ca 2.5 mm long and 4 mm wide, lateral lobes rounded, middle lobe slightly bidentate at the apex, basal claw 2.5 mm long, 1 mm wide, lateral staminodes ca 1 mm long. Anther red, 2.5 mm long, 1 mm wide, glabrous. Style 8 mm long. Nectarial glands partly surrounding the style base, 1.5 mm long. Ovary green, ellipsoid. Capsule greenish-orange, maturing black-purple, globose, 4-10 mm in diameter, its wall ca 0.1 mm thick when dry (ca 0.5 mm in living material), 3-4-seeded, seeds dark brown, 3 X 4 mm, aril orange-yellow.

TYPE. *Kennedy 424* (holotype, U; isotypes, F, K, MO, NY), Cerro Jefe, prov. Panamá, Panama.

DISTRIBUTION (Fig 61). Endemic to the Cerro Jefe region in Panama; in low cloud forest, 750-900 m.

PANAMA. PANAMA: Cerro Jefe, 900 m, *Foster & Kennedy 1894* (DUKE), *Gentry 6152* (MO, U), *Kirkbride & Crebbs 29* (MO); La Eneida, Cerro Jefe region, 750 m, *Kennedy et al 1110* (U), *Kennedy 1170* (GH, U, US, VEN, W), *Maas & Dressler 685* (COL, K, MO, U), *Maas et al 1562* (AAU, CR, E, EAP, GH, P, U, Z); 8 km above Goofy Lake, on road to Cerro Jefe, *Weaver & Foster 1493* (DUKE); slopes of Cerro Jefe, between Cerro Azul and La Eneida, *Wilbur, Almeda & Luteyn 15562* (DUKE, F, NY, P, U, US).

This new species is characterized by its very small, terminal, spiciform inflorescence and its linear leaves. It is also peculiar because of its rhizomes which are sometimes slightly raised above the ground by slender stilt-roots. Although I am not quite sure about its relationship it is probably closest to *R. concinna*.

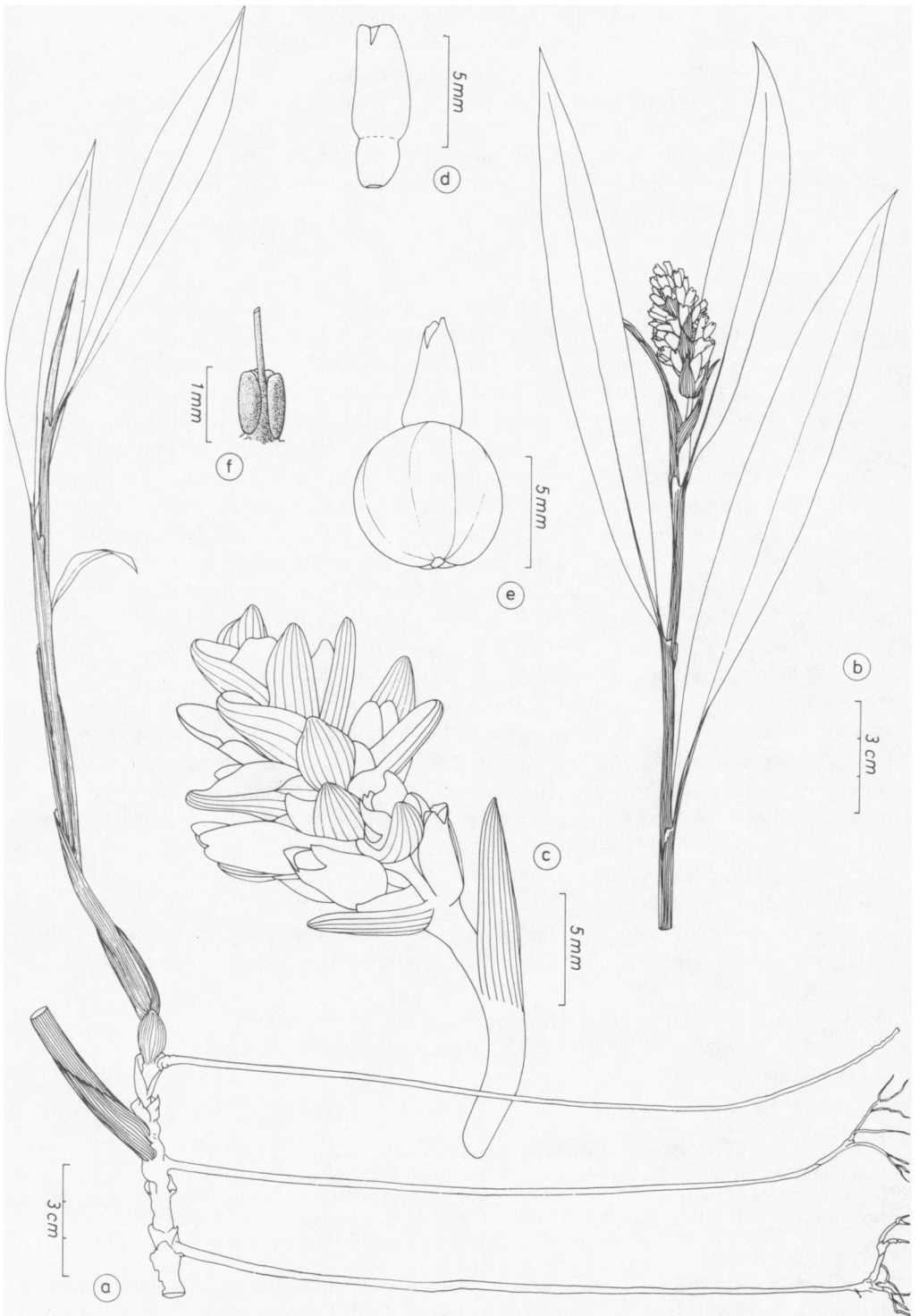


FIG 30. *Renealmia helenae* (a, c-f, *Maas et al 1562*; b, *Kennedy 424*). a, base of plant, note the stilt roots ! ; b, inflorescence with upper leaves; c, inflorescence, enlarged; d, calyx and ovary; e, fruit; f, nectarial glands.

The species is named after Helen Kennedy, eminent specialist in the related family Marantaceae.

27. *Renealmia jamaicensis* (Gärtner) Horaninow

Plants 0.4-3 m tall. Rhizomes 3-10 mm thick. Sheaths striate, 4-10 mm wide, glabrous or sometimes towards the ligule and near the margins covered with furcate and stellate prickles (to 0.1 mm long). Ligule 1-2 mm long, glabrous or covered with furcate to stellate prickles (to 0.1 mm long) and/or simple, appressed hairs (0.1-0.3 mm long). Petiole 0-12 mm long, hairy like the sheaths. Lamina narrowly elliptic, acute or shortly acuminate at the apex (acumen 5-10 mm long), cuneate at the base, 6-40 cm long, (1.5-) 2-7(-8) cm wide (the uppermost leaves often strongly reduced: 3-26 X 0.5-7 cm), glabrous on both sides. Inflorescence a terminal thyse 3-17 cm long and 1-8 cm wide, with (1-) 2-4(-5)-flowered cincinni, rhachis pink to red, 1-2(-3) mm thick. Indument of inflorescence: sheaths, rhachis, peduncles, and pedicels glabrous or densely covered with furcate (and plurifurcate) hairs, and mostly much fewer simple hairs (both hair types 0.1-0.4 mm long), bracts, bracteoles, and calyx sparsely so at their base, ovary and capsule glabrous to sparsely hairy, corolla glabrous (for the exceptional indument of *Ekman 214* see the discussion). Bracts red, pinkish-red, or scarlet, membranous, rather long persistent, ovate to triangular, acute to obtuse at the apex, 8-30(-40) mm long, 3-10(-15) mm wide (the lower, sterile ones 40-100 X 6-15 mm). Peduncles 2-10(-12) mm long. Bracteole red 4-10 (-13) mm long. Pedicels 2-15(-20) mm long. Calyx (bright) red, tubular to slightly turbinate, 5-11(-13) mm long, 3-6 mm wide, the lobes depressed-ovate, 1-2 mm long, 2-4 mm wide. Corolla white, 14-25 mm long, the tube 6-12 mm long, the lobes 6-13 mm long, 3-5 mm wide. Labellum white (according to Wright margins and lateral staminodes slightly tinged with purple), 5-8 mm long and wide when spread out, glabrous, the limb more or less transversally elliptic in outline, 3.5-6 mm long, 5-8 mm wide, the middle lobe obscurely divided into two broadly ovate-deltate to ovate-triangular lobules 0.5-1 mm long, basal claw 1-3 mm long, 1.5-4 mm wide, lateral staminodes 0.8-1.3 mm long, 0.3-0.5 mm wide. Anther red, 4-6 mm long, 1.5-3 mm wide, glabrous. Style (13-)16-23 mm long. Nectarial glands multilobulate, 1-2 mm long, completely surrounding the style base. Ovary red. Capsule red, maturing black, globose to ellipsoid, 5-10 X 5-8(-10) mm, its wall ca 0.1 mm thick when dry, 5-25 seeded, seeds 1.5-3 X 2-3.5 mm.

DISTRIBUTION (Fig 59). Greater Antilles; in forests at rather high elevation, up to 1500 m.

Key to the Varieties of *Renealmia jamaicensis*

1. Rhachis glabrous to sparsely hairy; calyx 5-7 mm long, 3-4(-5) mm wide. Jamaica, Cuba, Bahamas. var *jamaicensis*.
1. Rhachis densely (to sparsely) hairy, rarely glabrous; calyx (6-)7-11(-13) mm long, (3-) 4-6 mm wide. Hispaniola and Puerto Rico. var *puberula*.

27a. *Renealmia jamaicensis* (Gärtner) Horaninow var *jamaicensis*.

Fig 31a-c.

Zinziber sylvestre minus Sloane, Voy. Jamaica 1: 165. t. 105, f. 1. 1707.

Alpinia jamaicensis Gärtner, Fruct. & Sem. Pl. 1: 36. t. 12. 1788.

Zingiber uncinatum Stokes, Bot. Mat. Med. 1: 73. 1812; K. Schumann in Engler, Pflanzenreich 4. 46: 187. 1904 (name only). Type. *Broughton sn* (not present in the Bristol herbarium, apparently not preserved), Jamaica. Superfluous name for *Alpinia jamaicensis*.

Alpinia antillarum Roemer & Schultes, Syst. Veg. 1: 20. 1817; Steudel, Nomencl. Bot. ed. 2. 62. 1841; Horaninow, Prodr. 35. 1862; K. Schumann in Engler, Pflanzenreich 4. 46: 370. 1904 (name only). Type. A Swartz collection (lectotype, S), "Swartz *Alpinia Antillarum* Sw Herb. Swartzii Ind. Occ.: Swartz."

Renealmia amoena A. Richard in de la Sagra, Hist. Fís. Pol. Nat. Cub. Fanerogam. 2: 254. 1853; Gagnepain, Bull. Soc. Bot. France 50: 203. 1903; K. Schumann in Engler, Pflanzenreich 4. 46: 284. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 608. 1930; León, F1.

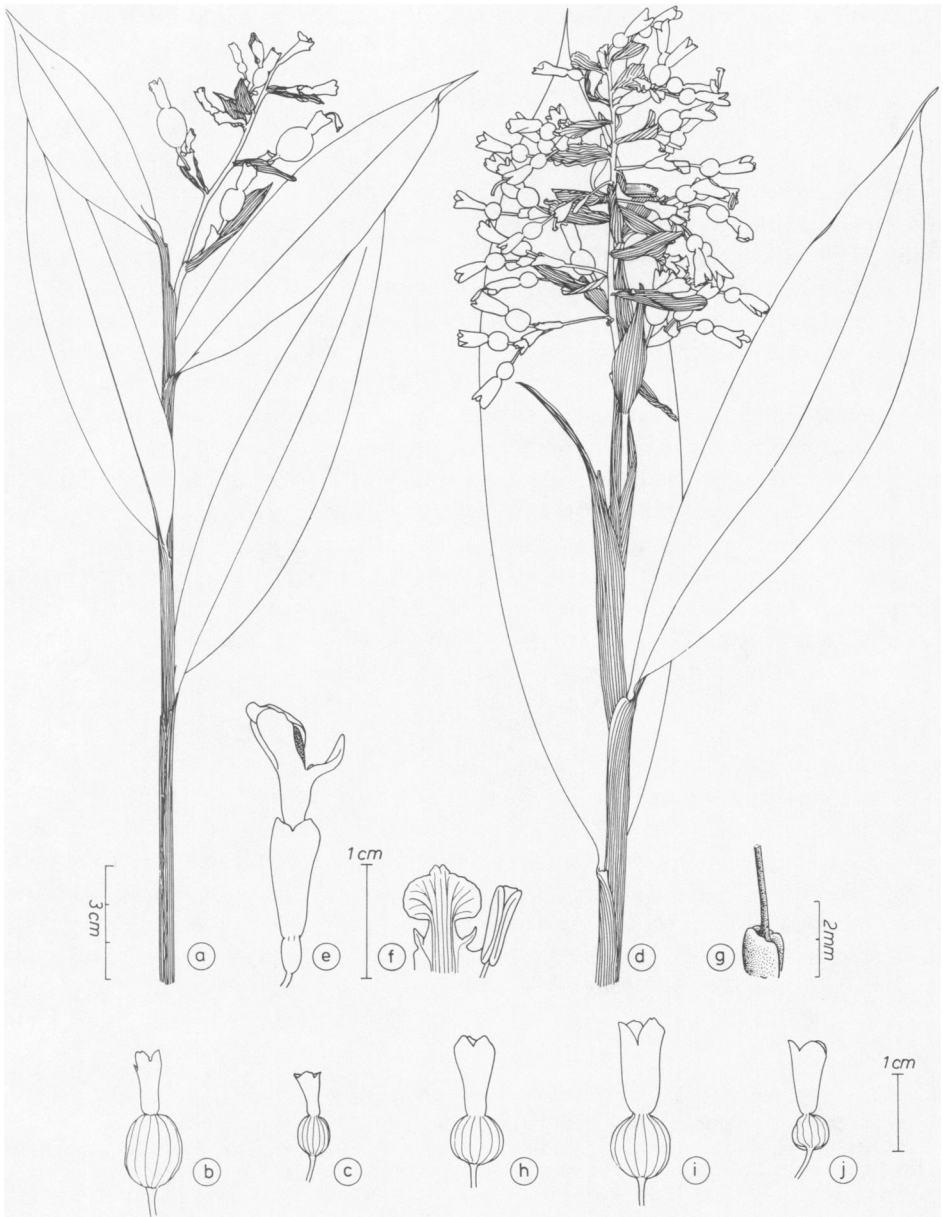


FIG 31. *Renealmia jamaicensis*. a-c, var *jamaicensis* (a-b, Jack 8099; c, Maxon 2875). a, habit; b-c, fruit; d-j, var *puberula* (d, Nieves & Yantin sn; e-g, Leonard 14508; h, Nash 497; i, Howard & Howard 8525; j, Stimson 3421). d, habit; e, flower; f, labellum and stamen; g, nectarial glands; h-j, fruit.

Cub. 1: 334. 1946. Type. *Linden 2041* (holotype, P; isotypes, BM, CGE, LE, W), Santiago de Cuba, Sierra Maestra, Cuba.

Renealmia jamaicensis (Gärtner) Horaninow, Prodr. 32. 1862.

Renealmia ventricosa Grisebach, Cat. Pl. Cub. 256. 1866; O. G. Petersen in Martius, Fl. Bras. 3(3): 48. 1890; Gagnepain, Bull. Soc. Bot. France 50: 203, 204, 1903; K. Schumann in

Engler, Pflanzenreich 4, 46: 288. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 608. 1930; León, Fl. Cub. 1: 334. 1946; not of Alexander, Addisonia 21: 51. pl. 698. 1942 (vs *Alpinia* sp). Type. *C. Wright 612 pp* (holotype, GOET; isotype, GH), Monte Verde, Oriente, Cuba, 12-1-1859.

Alpinia ventricosa (Grisebach) O. Kuntze, Rev. Gen. 1: 690. 1891.

Renealmia pauciflora Grisebach ex O. G. Petersen in Martius, Fl. Bras. 3(3): 47. 1890. Type. *C. Wright 611 pp* (lectotype, GH), Monte Verde, Oriente, Cuba, 13-1-1859. Of the three specimens annotated by Grisebach as *Renealmia pauciflora* Gr. n. sp., the above-cited is selected as lectotype. The other syntype is *C. Wright 611 pp* (GH, MO), Cuba orient., 1856-7.

Alpinia pauciflora (Grisebach ex O. G. Petersen) O. Kuntze, Rev. Gen. 1: 691. 1891.

Renealmis antillarum (Roemer & Schultes) Gagnepain, Bull. Soc. Bot. France 50: 200, 202.

1903; K. Schumann in Engler, Pflanzenreich 4. 46: 286. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 608. 1930; León, Fl. Cub. 1: 334. 1946; H & M. Stehlé, Fl. Ornam., in Fl. Agron. Ant. Franç. 1: 140. fig. at p. 141. 1958; Adams, Fl. Pl. Jamaica 58. 1972.

Alpinia racemosa auct. non Linnaeus: Swartz, Observ. Bot. 4. 1791; Willdenow, Sp. Pl. 1: 11. 1797 (in part).

Renealmia racemosa auct. non Linnaeus: Grisebach, Fl. Br. W. Ind. Isl. 601. 1864; Grisebach, Cat. Pl. Cub. 256. 1866; O. G. Petersen in Martius, Fl. Bras. 3(3): 47. t. 11, f. 3. 1890 (in part).

Plants 0.45-2.50 m tall. Rhizomes 3-5 mm thick. Lamina 6-27(-33) cm long, (1.5-)2-6 cm wide. Inflorescence a lax thyrse 3-13 cm long and 1-5 cm wide, (rarely dense and 3-6 cm long and 2-5 cm wide), with (1-)2-3(-4)-flowered cincinni. Indument of inflorescence: rhachis, peduncles, pedicels, and ovary glabrous to sparsely (rarely rather densely) covered with furcate, sessile hairs (to 0.2 mm long), simple hairs rare. Bracteole 4-10 mm long. Calyx 5-7 mm long, 3-4(-5) mm wide. Corolla (14-)17-19 (-21) mm long. Anther 4-5 mm long. Style (13-)16-18(-20) mm long.

TYPE. Table 12 from Gärtner's "de Fructibus et Seminibus Plantarum" (1788).

DISTRIBUTION (Fig 59). Jamaica, Cuba, and the Bahamas; in hill forest, up to 1175 m.

BAHAMAS. *Fraser sn* (CGE). CUBA. *Alain 2486, 6457* (GH, US); *Baker 3843* (GH, S); *Clemente 1862* (NY), *5096* (GH, US); *Ekman 1626* (F, S), *3865* (S), *3972* (S, US), *8170* (S), *9272* (K, S), *10245* (S), *10671* (S); *Jack 8099* (NY, US); *León 98* (NY), *4048* (GH, NY), *16629*; *León et al 10022* (GH, NY); *Pollard & Palmer 124* (F, MO, NY, US); *Sauvalle sn* (NY); *Shafer 4442, 8008* (NY, US), *8829, 8991* (NY); *Taylor 446, 522* (NY); *Underwood & Earle 704* (NY); *C. Wright 611, ann. 1856-57* (GH, MO), *611*, 13 Jun 1859 (GH), 21 Dec 1859 (GH), *611, anno 1860* (F, LE), *611, ann. 1860-64* (GH), *611* (NY, S, US), *612, anno 1860* (F, LE, MO), *612, ann. 1859-60* (S), *1710* (GH). JAMAICA. *Alexander sn* (K); *Britton 2302, 3390* (NY); *Cuming 96* (LE, W); *McFadyen sn* (K); *Fawcett sn* (IJ); *Fredholm 3205* (US), *3237* (NY, US); *Gosse sn* (BM); *Harris 9160* (F, IJ, NY), *9353* (IJ, NY); *Hooker sn* (P); *March 1286* (K); *Masson sn* (BM); *Maxon 2875* (US), *9034* (NY, US), *9247* (GH, S, US); *Moon sn* (IJ); *Nichols 157* (GH, K, MO, NY, US); *Proctor 10022* (IJ); *Purdie sn* (K); *J. Smith sn* (BM); *W. Wright sn* (BM); *Wullschlägel 1097* (M). IND. OCCID. *Swartz sn* (M, S, 3 collections, syntypes of *Renealmia antillarum*).

The type of *R. jamaicensis* (Gärtner's Plate 12) has always been left out of consideration because of its incompleteness (only a capsule with calyx, and seeds). The shape and the size of the calyx, however, leave no doubt about its identity, the only species with which it could be confused, *R. occidentalis* var. *occidentalis*, having a shorter and much wider calyx.

The material which is here assembled under this variety is rather heterogeneous, and this particularly holds true for the Cuban plants. At first glance it seems rather easy to split up the Cuban material into two groups, namely, one with very small leaves and a loose and few-flowered inflorescence (= *Renealmia amoena* type), and another with somewhat larger leaves and a very dense inflorescence (= *Renealmia ventricosa* type). The two "species" however, are connected by a long and gradual series of transitional forms which make it impossible to maintain both. Therefore I unite all these forms as *R. jamaicensis* var *jamaicensis*.

27b. *Renalmia jamaicensis* (Gärtner) Horaninow var *puberula* (Gagnepain) Maas, Acta Bot. Neerl. 24: 477. 1976. Fig 31 d-j.

Renalmia antillarum (Roemer & Schultes) Gagnepain var *puberula* Gagnepain, Bull. Soc. Bot. France 50: 203. 1903; K. Schumann in Engler, Pflanzenreich 4. 46: 286. 1904 (as var β); Urban, Symb. Antil. 8: 11. 1920.

Renalmia antillarum (Roemer & Schultes) Gagnepain var *Agrandiflora* K. Schumann in Engler, Pflanzenreich 4. 46: 286. 1904; Urban, Symb. Antill. 8: 110. 1920. Type. *Eggers 2013* (holotype, B, destroyed; lectotype, NY; isotypes, LE, US), Mt Barreo, 1200 m, Dominican Republic, Hispaniola.

Alpinia antillarum Roemer & Schultes var *puberula* (Gagnepain) Moscoso, Cat. Fl. Doming. 88. 1943.

Alpinia antillarum Roemer & Schultes var *grandiflora* (K. Schumann) Moscoso, Cat. Fl. Doming. 88. 1943.

Renalmia antillarum Urban, Symb. Antill. 8: 110. 1920 (quoad exsicc.): not of (Roemer & Schultes) Gagnepain.

Plants 1-3 m tall. Rhizomes ca 10 mm thick. Lamina 10-40 cm long, 3-8 cm wide. Inflorescence a dense thyrses 6-17 cm long and (1.5-)3-8 cm wide, with 2-4(-5)-flowered cincinni. Indument of inflorescence: rhachis, peduncles, and pedicels densely to sparsely covered with sessile (to shortly stalked), furcate (to plurifurcate) hairs (0.1-0.4 mm long) and often mixed with simple hairs; ovary and capsule sparsely hairy; bracts, bracteole, and calyx glabrous or sparsely hairy at their base. Bracteole (7-) 8-11(-13) mm long. Calyx 7-11(-13) mm long, (3-)4-6 mm wide. Corolla (15-)20-25 mm long. Anther 6 mm long. Style 20-23 mm long.

TYPE. *L. C. Richard sn* (lectotype, P), Dominican Republic, Hispaniola. A lectotype is chosen here as Gagnepain did not designate a holotype.

DISTRIBUTION (Fig 59). Hispaniola and Puerto Rico; in mountain forest, from 400 to 1550 m.

HISPANIOLA. HAITI: *Buch 668* (IJ); *Ekman 214* (S), *2799* (S, US); *Leonard 8376, 9119 a* (US), *9130* (GH, US); *Leonard & Leonard 14508* (US), *15128* (NY, US); *Nash 497* (F, NY); *Nash & Taylor 1069* (NY). DOMINICAN REPUBLIC: *Abbott 1843 a* (NY, US), *2077* (US); *Allard 18226, 18238* (US); *d'Arcy 2595* (GH); *Augusto 971* (NY), *1248* (GH, NY); *Batista 2026* (US); *Ekman 12864* (GH, S, US); *Fuertes 1527 b* (GH, NY, P, W); *Gastony et al 234* (NY); *Howard 12218* (GH, LE, S); *Howard & Howard 8525* (BM, GH, NY, P, US); *Humbert 27627* (NY); *Poiteau sn* (BM); *L. C. Richard sn* (P); *Rob. Schomburgk sn* (P), *63* (BM, K); *von Türckheim 2947* (BM, BR, F, GH, K, L, M, MO, NY, P, PR, S, U, US, W); *Valeur 14* (S, US), *995* (C, G, K, NY, US). PUERTO RICO. *d'Alleizette sn* (L); *Blauner 227, 234* (BM); *Britton & Britton 10132* (NY); *Britton et al 6572* (NY, US); *Britton & Cowell 4049* (NY, US); *Britton et al 5606* (NY, US); *Britton & Marble 1065* (F, NY, US), *2034* (NY, US); *Britton et al 6874* (NY); *Britton et al 2459* (NY, US); *Curtiss 136* (L); *Eggers 147* (MICH), *887* (BR, GH, L, M, P, PR), *1161 pp* (C), *1167* (US), *sn* (C); *Hess & Stevens 4453* (NY); *Jones 11023* (GH, US); *O. Kuntze 370, 485* (NY); *Nieves & Yantin sn* (MICH); *Otero 659* (NY); *Sargent 415* (US), *B 191* (IJ, US); *Shafer 2239* (NY), *3225* (NY, US); *Sintenis 216* (BM, GH, IJ, K, L, LE, LIL, M, NY, P, PR, S, US), *1578* (BM, E, F, GH, K, L, LE, MO, NY, P, S, US); *Stahl 965* (L), *1129* (S); *Stimson 1576* (DUKE, MICH, US), *3421, 3737, 4319* (DUKE); *Underwood & Griggs 341* (NY, US); *Vélez 1106* (NY); *R. J. Wagner 96* (U), *323* (BM, LE, U), *964* (DUKE, LE, WIS); *Webster et al 8638* (DUKE); *P. Wilson 88* (NY, US); *Wolcott 2820* (US).

This variety undoubtedly belongs to *R. jamaicensis*, differing distinctly, however, in the larger size of its floral parts and inflorescence and in its indument. In the material from Hispaniola the indument of the rhachis is somewhat denser than in that from Puerto Rico, but otherwise there are no differences which might point to varietal distinctness.

Some Puerto-Rican collections are aberrant in having a completely glabrous rhachis; this applies to some specimens collected around Maricao: *Sintenis 216*, *Stimson 3421*, and *Sargent 415*.

The indument of *Ekman 214* (S) from Morne de la Hotte, Haiti, 0-800 m, is also aberrant; the rhachis, peduncles, and pedicels are densely covered with mainly simple hairs, and apart from that, other floral parts like bracts, bracteoles, ovary, and

capsule are densely to very densely covered with a mixture of furcate and simple hairs; the calyx is sparsely hairy.

28. *Renealmia krukovii* Maas, Acta Bot. Neerl. 24: 477. 1976.

Fig 32.

Plants 0.50-1.25 m tall. Rhizomes 4-10 mm thick, roots 1-4 mm thick. Sheaths reticulate, 5-8 mm wide, to 15 mm at the base of the plant, rather densely covered with furcate to stellate (and simple) prickles (less than 0.1 mm long), and towards the reticulations with needle-like hairs. Ligule ca 1 mm long, hairy like the sheaths. Petiole 15-45 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen to 20 mm long), cuneate at the base, 20-45 cm long, 2.5-7 cm wide, upper side glabrous or with some scattered prickles along the midrib, lower side glabrous or sparsely covered with simple hairs (up to 0.3 mm long), or covered with sessile, furcate hairs (ca 0.1 mm long). Scape erect or prostrate, 15-25 cm tall, up to 4 mm thick, beset with sheaths up to 4-7.5 cm long and 0.5-0.8 cm wide. Inflorescence a basal raceme 17-40 cm long and 2.5-6 cm wide. Indument of inflorescence: rhachis, peduncles, and pedicels densely covered with a mixture of simple hairs (ca 0.5 mm long) and furcate to plurifurcate hairs (ca 0.1 mm long); sheaths, bracts, bracteoles, calyx, corolla, and ovary densely (to sparsely) covered with mainly furcate to plurifurcate hairs, simple hairs scarce, capsule sparsely hairy. Bracts red, long-persistent, narrowly obovate-elliptic, more or less spatulate, 15-70 mm long, 4-13 mm wide. Peduncles 2-10(-20) mm long. Bracteole 10-19 mm long. Pedicels 1-8 mm long. Calyx red, tubular, 11-18 mm long, 3-4 mm wide, the lobes deltate, 3-4 mm long and wide. Corolla yellow, 30-32 mm long, the tube 16-18 mm long, the lobes 14 mm long, 8-10 mm wide. Labellum yellow, 13 mm long and to 8 mm wide when spread out, basal part opposite anther densely covered with simple hairs (ca 0.3 mm long), the limb 6 mm long, 8 mm wide, lateral lobes rounded, 6 mm long, 2 mm wide, middle lobe entire and rounded, basal claw 7 mm long, 4 mm wide, lateral staminodes 2 mm long. Anther 10 mm long, 5 mm wide, glabrous. Style 28 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2 mm long. Ovary ellipsoid. Capsule red, ellipsoid, 15-22 X 7-10 mm, its wall ca 0.1 mm thick when dry, 8-10-seeded, seeds 4-6 X 3 mm.

TYPE. *Krukoff 8594* (holotype, S; isotypes, F, GH, K, NY, U), municipality São Paulo de Olivença, near Palmares, Rio Solimões, Amazonas, Brazil.

DISTRIBUTION (Fig 59). Amazonian region of Colombia, Peru, and Brazil; in várzea forests or in forests on terra firme; at low elevations, up to 300 m.

COLOMBIA. AMAZONAS: *Duque-Jaramillo 2081, 2236* (COL); *Sastre & Echeverry 661* (P); *Schultes 5858 g* (US), *6629* (COL, US), *6632* (US); *Schultes & Black 8420* (US); *Soejarto & Cardozo 702* (ECON). VAUPES: *Cuatrecasas 7089* (COL). BRAZIL. ACRE: *Prance et al 12430a* (U). AMAZONAS: *Jobert 593* (P). PERU. LORETO: *Fox 73* (K). CULTIVATED SPECIMENS. Cult. in Rio de Janeiro from material brought from Amazonas, Brazil, *Glaziou 10101* (C, P).

Renealmia krukovii is closely related to *R. urbaniana*, differing from that species by its 1-flowered (instead of 2-flowered) cincinni, its red (instead of greenish) bracts, its 10 mm long (instead of 5 mm long) anther and its labellum, the middle lobe of which is entire (instead of 2-lobulate).

The indument of the species is rather variable. In all Brazilian collections and in *Soejarto & Cardozo 702* from Colombia the rhachis is densely covered with mainly simple hairs (furcate hairs scarce); in most of the Colombian collections, however, the rhachis is covered with both simple and furcate hairs. As these differences are only of a quantitative character they are not used for splitting up this species into two varieties.



FIG 32. *Renealmia krukovii* (a-e, Krukoff 8594; f-g, Schultes 6629). a, top of leafy stem; b, part of inflorescence; c, flower; d, labellum and stamen; e, nectarial glands; f, fruit; g, seed.

29. *Renealmia ligulata* Maas, Acta Bot. Neerl. 24: 477. 1976.

Fig 33.

Plants 0.5-4 m tall. Rhizomes 25-40 mm thick. Sheaths striate (sometimes very slightly reticulate towards the ligule), 10-20 mm wide, to 30 mm at the base of the plant, sparsely to densely covered with simple, needle-like hairs (0.2-0.5 mm long) and sometimes in the grooves with furcate and simple prickles (less than 0.1 mm long). Ligule 4-8 mm long, densely covered with needle-like hairs. Petiole 5-25 mm long, hairy like the sheaths. Lamina narrowly elliptic, acute to acuminate at the apex (acumen to 15 mm long), cuneate at the base, (18-)30-54(-70) cm long, (3.5-)5-12(-15) cm wide, upper side glabrous, lower side glabrous or sparsely covered with simple and furcate hairs (less than 0.1 mm long). Scape erect or prostrate, 5-15(-20) cm tall, up to 8 mm thick, beset with sheaths up to 3-7 cm long and 1-1.5 cm wide, rhachis red. Inflorescence a basal thyrse 17-50 cm long and 3-8 cm wide (to 15 cm in fruit) with (1-)2-3-flowered cincinni. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, and ovary densely to sparsely covered with simple and/or furcate to plurifurcate hairs (0.2-0.5 mm long), capsule sparsely so to glabrous, corolla glabrous; on calyx, ovary, and capsule the furcate hairs often replaced by "compass-needles." Bracts red, soon deciduous, triangular-ovate, acute, 10-65 mm long, 5-30 mm wide. Peduncles red, 8-25(-30) mm long. Bracteole red, 13-16 mm long. Pedicels red, 10-25(-35) mm long. Calyx red, tubular, 11-15 mm long, 4-8 mm wide, the lobes deltate-ovate, 3-5 mm long and wide. Corolla white (Maas!) to yellow (*Killip 11613*), (18-)22-27 mm long, the tube 10-12 mm long, the lobes (8-)12-15 mm long, the dorsal one ca 10 mm wide, the two lateral ones 8 mm wide. Labellum white, the basal margins reddish-purple, glabrous, 12-18 mm long and wide when spread out, the limb erect, 5-9 mm long, 12-18 mm wide, the middle lobe reflexed, entire or with two triangular to deltate lobules 2-3 mm long, basal claw 7-9 mm long, 3-4.5 mm wide, lateral staminodes ca 2 mm long, 1 mm wide. Anther red to purple, 6-7 mm long, 3-4 mm wide, glabrous. Style 19-21 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2 mm long. Ovary red. Fruit globose to ellipsoid, 17-35 X 17-25 mm, its wall 1-1.5 mm thick when dry (3-4 mm thick in living material), 50-100-seeded, seeds ca 3 X 3.5 mm.

TYPE. *Maas, Plowman & Escobar 1826* (holotype, U; isotypes, COL, F, GH, K, MO, NY, P), Cordillera Central, Río Nima, above Tenjo, 1850 m, E1 Valle, Colombia.

DISTRIBUTION (Fig 58). Colombian Andes, Panama, and Costa Rica; in subandean forest, from 1000-2160 m.

COSTA RICA. *Maas 1500* (CR, F, U); *Maas & Cramer 1353* (U); *Wilbur & Stone 8844* (DUKE). PANAMA. *Woodson & Schery 601* (GH, MO). COLOMBIA. ANTIOQUIA: *Daniel 2998* (US). CALDAS: *García-Barriga 30* (COL); *Pennell 9065* (GH, NY, US). CUNDINAMARCA: *Silva & Valderama 241* (COL); *Uribe Uribe 1641* (COL). HUILA: *Vogel 203* (B). EL VALLE: *Core 259* (US); *Cuatrecasas 13902, 18215, 22660* (F); *Dryander 79* (M), *2479 a* (US); *Figuieras 8177* (US); *Idrobo 1776* (COL); *Killip 11613* (NY); *Maas & Escobar 608* (U).

This species can be recognized by its relatively long ligule, its short scape (only 5-20 cm tall), and its large, red fruit. From its nearest relative, *R. ferruginea*, it differs by almost glabrous fruit and smaller calyx.

Camp 1124 (NY), Cordillera Cutuçu, 860 m, prov. Santiago-Zamora, Ecuador, may belong to this species, but the material is too incomplete to be sure of its exact identity.

30. *Renealmia lucida* Maas, Acta Bot. Neerl. 24: 478. 1976.

Fig 34.

Plants 2-3 m tall. Rhizomes ca 20 mm thick, roots to 7 mm thick. Sheaths smooth to very slightly striate, more or less shining when dry, 12-20 mm wide, glabrous (or covered with simple hairs). Ligule 5-8 mm long, glabrous (or covered with simple hairs). Petiole 0-30 mm long, glabrous (or covered with simple hairs). Lamina narrowly elliptic,

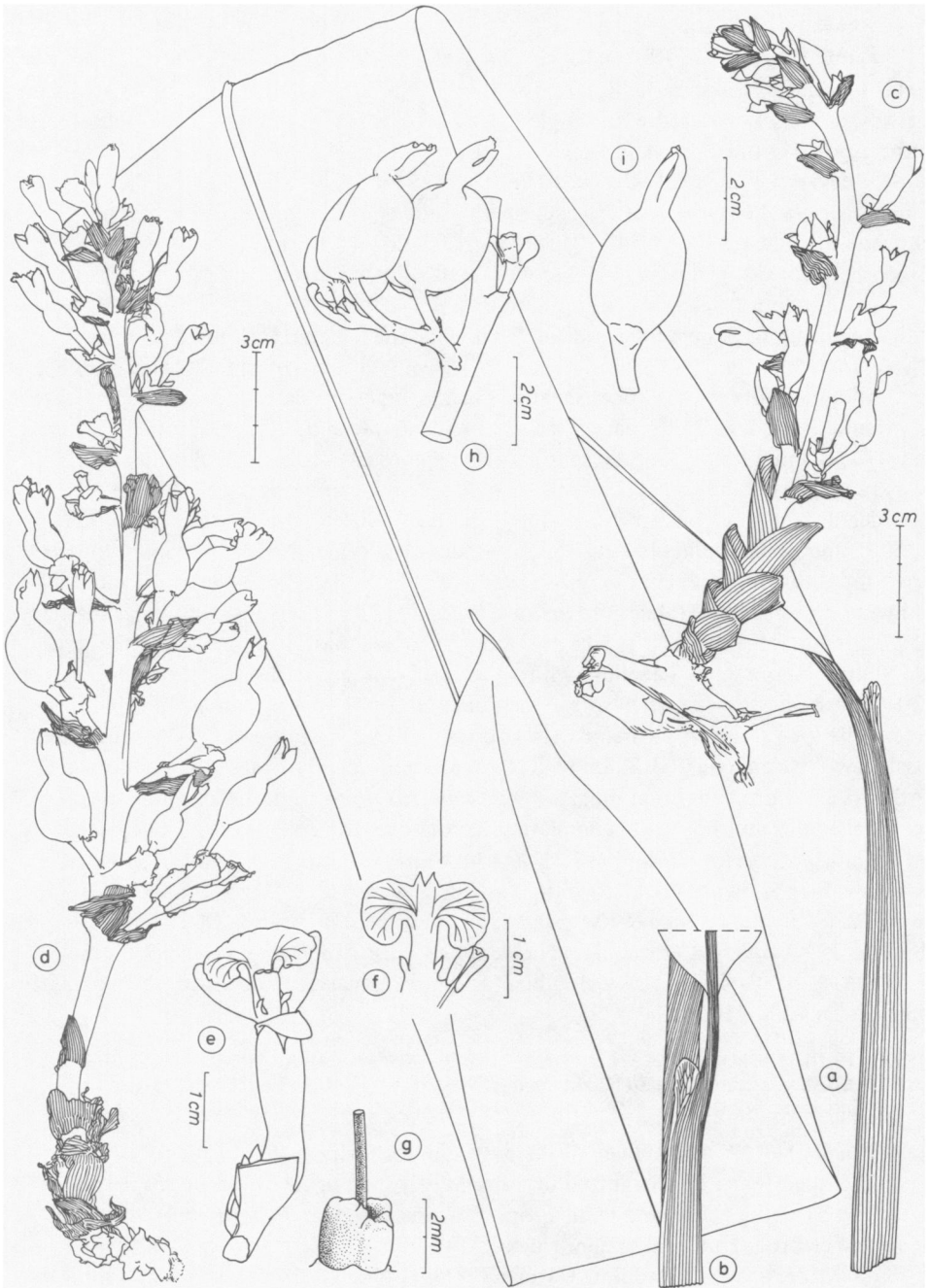


FIG 33. *Renealmia ligulata* (a-i, Maas & Escobar 608). a, leaf; b, leaf-base; c, young inflorescence; d, young infructescence; e, flower; f, labellum and stamen; g, nectarial glands; h, fruiting cincinnus; i, fruit.

acuminate at the apex (acumen 5-15 mm long), cuneate at the base, (16-)56-93 cm long, 14-21 cm wide, upper side glabrous, lower side glabrous to rather densely covered with simple hairs (0.1-0.3 mm long). Scape 40-75 cm tall, up to 8 mm thick, beset with more or less shining (when dry) sheaths up to 12-20 cm long and 1.5-2 cm wide. Inflorescence a basal thyse 40-75 cm long and 7-10 cm wide, with 2-6-flowered cincinni, rhachis red. Indument of inflorescence: none. Bracts (brilliant) red, more or less shining when dry, chartaceous, long-persistent, ovate-triangular to narrowly ovate-triangular, 25-125 mm long, 8-40 mm wide, the margins often involute. Peduncles red, 5-45 mm long. Bracteole 20-30 mm long. Pedicels red, 10-55 mm long. Calyx red, tubular to slightly turbinate, 20-26 mm long, 8-10 mm wide, the lobes deltate-ovate, 4-10 mm long, 6-8 mm long. Corolla pinkish-white to white, ca 35 mm long, the tube ca 15 mm long, the lobes (in bud!) ca 20 mm long, 10-11 mm wide. Labellum (in bud) ca 20 mm long, lateral staminodes 1.5 mm long, 0.1-0.2 mm wide. Anther (in bud) 9-13 mm long, 2-3.5 mm wide, glabrous. Style (in bud) 28 mm long. Nectarial glands multilobulate, completely surrounding the style base, ca 2 mm long. Ovary ellipsoid to globose. Capsule red, globose to ellipsoid, 30-40 X 20-25 mm, its wall ca 1.5 mm thick when dry, many-seeded (ca 100 seeds), seeds 2.5-3 mm in diameter.

TYPE *Cuatrecasas 23724* (holotype, F), Cordillera Occidental, mouth of Río Digua, left bank of Río San Juan, Queremal, 1350-1400 m, E1 Valle, Colombia.

DISTRIBUTION (Fig 58). Andean Colombia; in subandean forest, by riversides and roadsides from 1200-2000 m.

COLOMBIA. NARIÑO: between Altaquer and Junín, Cujambe, 1200 m *Idrobo & Kyburz 2337* (COL), ibidem, 1450 m, *Mora 4155* (COL); Ricaurté, between PIALAPI and E1 Arrayán, 1800-2000 m, *Mora 4044* (COL); Ricaurté, 1300 m, *von Sneiderm A 611, A 627* (S).

Renealmia lucida is characterized by its large calyx, bracteoles, bracts, peduncles, and pedicels, and by its often shining bracts and leaf-sheaths. It is closely related to *R. ligulata*.

I am not certain about the identity of *von Sneiderm 5496* (S) from Pueblo Rico, La Selva, 1500 m, Caldas, Colombia. Its characters are intermediate between those of *R. ligulata* and *R. lucida*.

31. *Renealmia matogrossensis* Maas, Acta Bot. Neerl. 24: 478. 1976. Fig 35.

Plants 0.60-1.10 m tall. Rhizomes 5-9 mm thick. Sheaths striate or very slightly reticulate, 5-8 mm wide, to 10 mm at the base of the plant, rather densely covered with simple and furcate prickles (less than 0.1 mm long). Ligule ca 1 mm long, hairy like the sheaths. Petiole absent. Lamina narrowly elliptic, shortly acuminate at the apex (acumen 5-10 mm long), cuneate at the base, 11-25 cm long, 2.5-7 cm wide, on both sides sparsely covered with simple, prickle-like hairs (less than 0.01 mm long). Scape 5-15 cm tall, up to 4 mm thick, beset with sheaths up to 2-4 cm long and 0.3-1 cm wide. Inflorescence a congested, basal thyse 3.5-9 cm long and 2-3.5 cm wide, with 3-5-flowered cincinni. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, and calyx sparsely to densely covered with simple (and furcate) hairs (0.1-0.2 mm long); calyx, ovary, and capsule sparsely to densely covered with mainly furcate hairs (less than 0.1 mm long), corolla glabrous. Bracts green with red margins, rather persistent, narrowly triangular-elliptic to triangular-elliptic, 7-19 mm long, 4-8 mm wide. Peduncles 2-3 mm long. Bracteole 7-10 mm long. Pedicels 2-7 mm long. Calyx tubular, 3-6 mm long, 3-4 mm wide, the lobes shallowly triangular to deltate, 1-2 mm long, 2-3 mm wide. Corolla creamy-yellow to white, 7 mm long, the tube 4 mm long, the lobes ca 3 mm long, 2 mm wide. Labellum 5-6 mm long and wide when spread out, hairy opposite

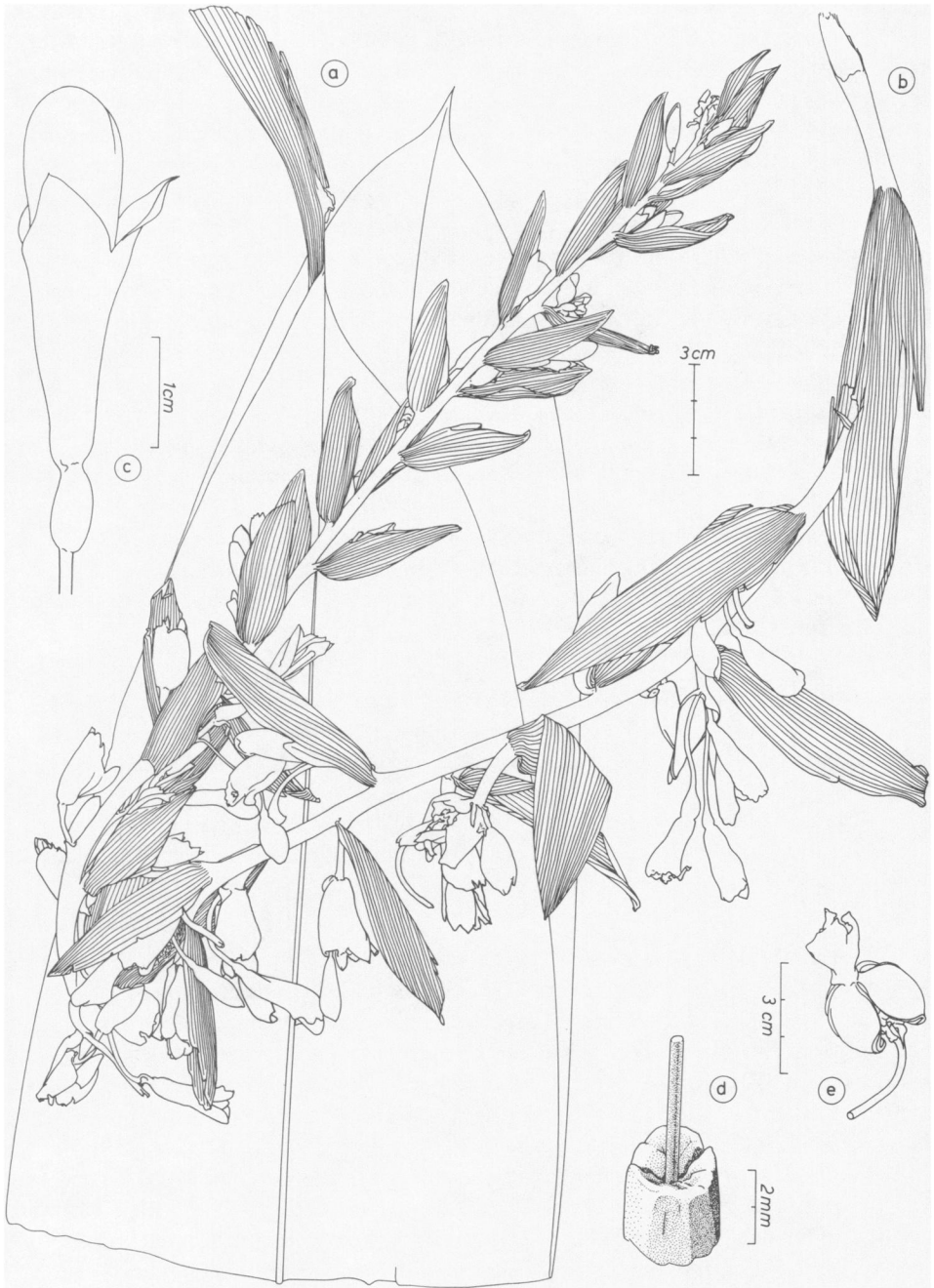


FIG 34. *Renealmia lucida* (a-b, von Sneidern A 611; c-d, Cuatrecasas 23724; e, Mora 4044). a, leaf; b, part of inflorescence; c, flower; d, nectarial glands; e, fruit.

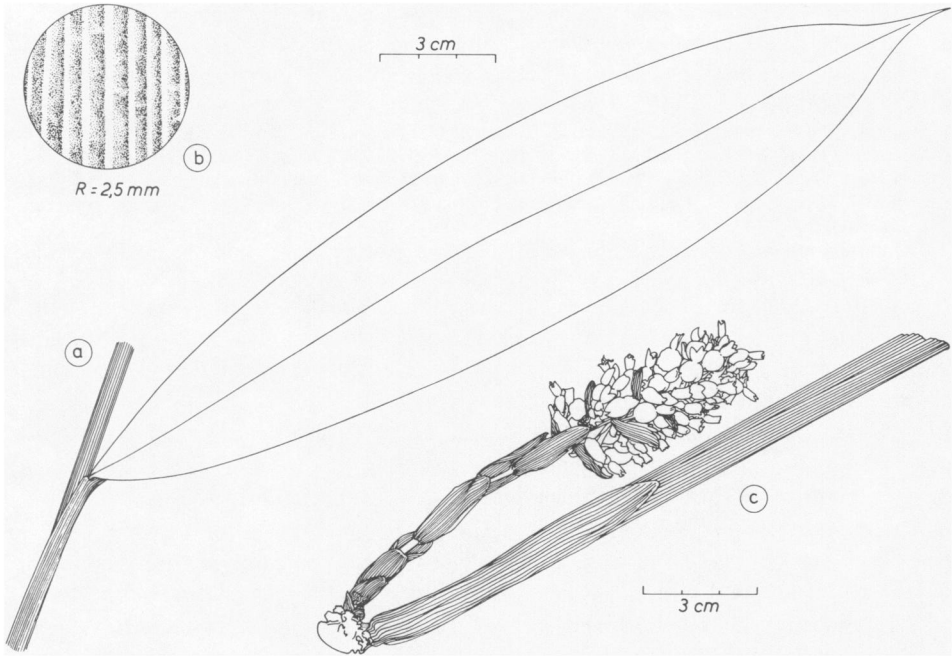


FIG 35. *Renealmia matogrossensis* (a-c, Philcox & Ferreira 4192). a, leaf; b, detail of leaf-sheath; c, infructescence.

the anther, limb 2.5-3 mm long, 4-5 mm wide, lateral lobes rounded, 2.5-3 mm long, 1.5-2.5 mm wide, middle lobe bilobulate, the lobules ovate, 1-1.5 mm long, ca 1 mm wide, basal claw ca 3 mm long, 1-2 mm wide, lateral staminodes 0.5 mm long. Anther 2-2.5 mm long, 1-1.5 mm wide, glabrous. Style 5-6 mm long. Nectarial glands partly surrounding the style base, 1-1.5 mm long. Ovary globose to ellipsoid. Capsule reddish, globose, 5-8 mm in diameter, its wall 0.1-0.2 mm thick when dry, 2-10-seeded, seeds 2.5 X 3 mm.

TYPE. *Philcox & Ferreira 4192* (holotype, U; isotype, K), wet gallery forest near Base Camp (12°49' S, 51° 46' W), 270 km N of Xavantina, Mato Grosso, Brazil.

DISTRIBUTION (Fig 60). Mato Grosso, Brazil; in dry or wet forest.

BRAZIL. MATO GROSSO: Base Camp (see Type locality), *Harley & de Castro 11288* (K, U), *Philcox et al 3465* (K), *3555* (K, U); *Ratter et al 867* (K); *Ratter et al 938* (K, U); *Ratter et al 1541* (K, U); Cataqui - lamain, campos dos Urupás, *Kuhlmann 1651* (R); sta. Cruz da Barra, *Lindman 2823b* (S).

This species, recently collected seven (!) times at the same locality, is a relative of *R. monosperma*; the differences between the two species are summarized below:

	<i>R. matogrossensis</i>	<i>R. monosperma</i>
Height	0.6-1.1 m	0.2-0.5(-0.7) m
Size of lamina	11-25 X 2.5-7 cm	(7-)-9-11(-17) X (0.7-)-1.5-3.5 cm
Thyrse	3.5-9 X 2-3.5 cm	2-5(-9) X (0.5-)-1-2(-3) cm
Number of flowers per cincinnus	3-5	1-3
Rhachis indument	most hairs simple	hairs furcate or simple.

32. *Renealmia mexicana* Klotzsch ex O. G. Petersen in Martius, Fl. Bras. 3(3): 45.

1890; K. Schumann in Engler, Pflanzenreich 4.46: 300. 1904; Standley, Field Mus. Nat. Hist. Bot. Ser. 18: 190. 1937; not of Woodson, Ann. Missouri Bot. Gard. 32: 60. 1945 (\equiv *Renealmia pluriplicata*). Fig 36.

Ethanium mexicanum (Klotzsch ex O. G. Petersen) O. Kuntze, Rev. Gen. 1: 690. 1891.

Renealmia jalapensis Gagnepain, Bull. Soc. Bot. France 49: 28. 1902; K. Schumann in Engler, Pflanzenreich 4. 46: 287. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2.15 A: 608. 1930. Type. *Galeotti 4990 pp* (holotype, P; isotypes, BR, F), "Jalapa" (= Xalapa), Veracruz, Mexico.

Renealmia aromatica Standley & Steyermark, Fieldiana. Botany 24(3): 199. f.36. 1952 (for the greater part); not of (Aublet) Grisebach ex K. Schumann & Urban.

Plants 1-2(-3) m tall. Rhizomes 5-20 mm thick. Sheaths slightly reticulate, 5-15 mm wide, to 25 mm at the base of the plant, sparsely to densely covered with needle-like hairs and with simple, furcate, or stellate prickles (less than 0.1 mm long). Ligule 1-2 mm long. Petiole sometimes absent, mostly distinct and up to 50(-85) mm long, hairy like the sheaths. Lamina narrowly elliptic, acute to shortly acuminate at the apex (acumen 5-15 mm long), cuneate at the base, (10-)25-58 cm long, (1.5-)4-11(-14) cm wide, glabrous on both sides. Scape erect, 5-25(-50) cm tall, up to 3 mm thick, beset with sheaths up to 2-7 cm long and 0.5-1(-1.5) cm wide. Inflorescence a basal thyse 5-25 cm long and 2-9 cm wide, with 3-11-flowered cincinni, rhachis green to greenish-red. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, and calyx densely to sparsely covered with furcate to plurifurcate hairs and some simple hairs (0.2-0.5 mm long), ovary and capsule sparsely so or often glabrous, corolla glabrous. Bracts green, very soon deciduous, narrowly triangular-ovate, acute, 10-40(-65) mm long, 4-8(-12) mm wide. Peduncles red, 4-8(-11) mm long. Bracteole 9-16(-19) mm long. Pedicels red, 5-7(-12) mm long. Calyx red, turbinate, 3-6(-8) mm long, the lobes 1-4 mm long, deltate, with irregular, acuminate tips. Corolla white (!Maas) to yellow, 10-11 mm long, the tube 4-5 mm long, the lobes 5-6 mm long, the dorsal one 4-6 mm wide, the two lateral ones 3-4.5 mm wide. Labellum white with a yellow central part (!Maas) or completely yellow, 8-10 mm long and 8-12 mm wide when spread out, basal part opposite anther densely covered with simple hairs, the limb horizontally spreading, 4-5.5 mm long, 8-12 mm wide, lateral lobes rounded, 6 mm long, 3-5 mm wide, middle lobe reflexed, with two (broadly) ovate-triangular lobules 2 mm long and 1-3 mm wide, basal claw 3-4 mm long, 2 mm wide, lateral staminodes ca 1 mm long. Anther 2-5-3 mm long, 1-1.5 mm wide, glabrous. Style 6-8 mm long. Nectarial glands partly surrounding the style base, ca 1.5 mm long. Ovary ellipsoid to globose. Capsule red or (! Maas) black, globose and then 4-7 mm in diameter or ellipsoid and 6-11(-15) X 4-6 mm, its wall 0.1-0.2 mm thick when dry, 3-11-seeded, seeds 2-3 X 2-3 mm, aril orange.

TYPE. *Schiede 836* (lectotype, LE), Barranca de Tioselo, Veracruz, Mexico. Of the two syntypes designated by O. G. Petersen, *Schiede 836* is selected as lectotype, as the other syntype, *Schiede 1032* from Hacienda de la Laguna, Veracruz, Mexico, was destroyed at Berlin.

DISTRIBUTION (Fig 60). From Mexico to Panama; in forests from sea-level up to 1650 m.

MEXICO. CHIAPAS: *Dressler 1554* (GH, MICH, US); *Matuda 1844 pp* (MO), 18016 (F); *Ton 3323* (F, MICH). OAXACA: *Martínez-Calderón 58* (GH, US), 434 (F, GH, MICH, US); *Schultes & Reko 944* (ECON, U); *L1. Williams 9273* (F), 9402 (F, P), 9495 (F), 9579 (F). SAN LUIS POTOSÍ: *Edwards 628* (F, MO); *Hitchcock & Stanford 7305* (MO, NY, US). TABASCO: *Barlow 30/144* (BM, F), 30/174 (MICH, WIS); *Gilly & Hernández X. 375* (MICH); *Matuda 3386 pp* (NY). VERACRUZ: *Conzatti 11* (GH, K), 171 (GH, US); *Dressler & Quentin Jones 34* (GH, US);

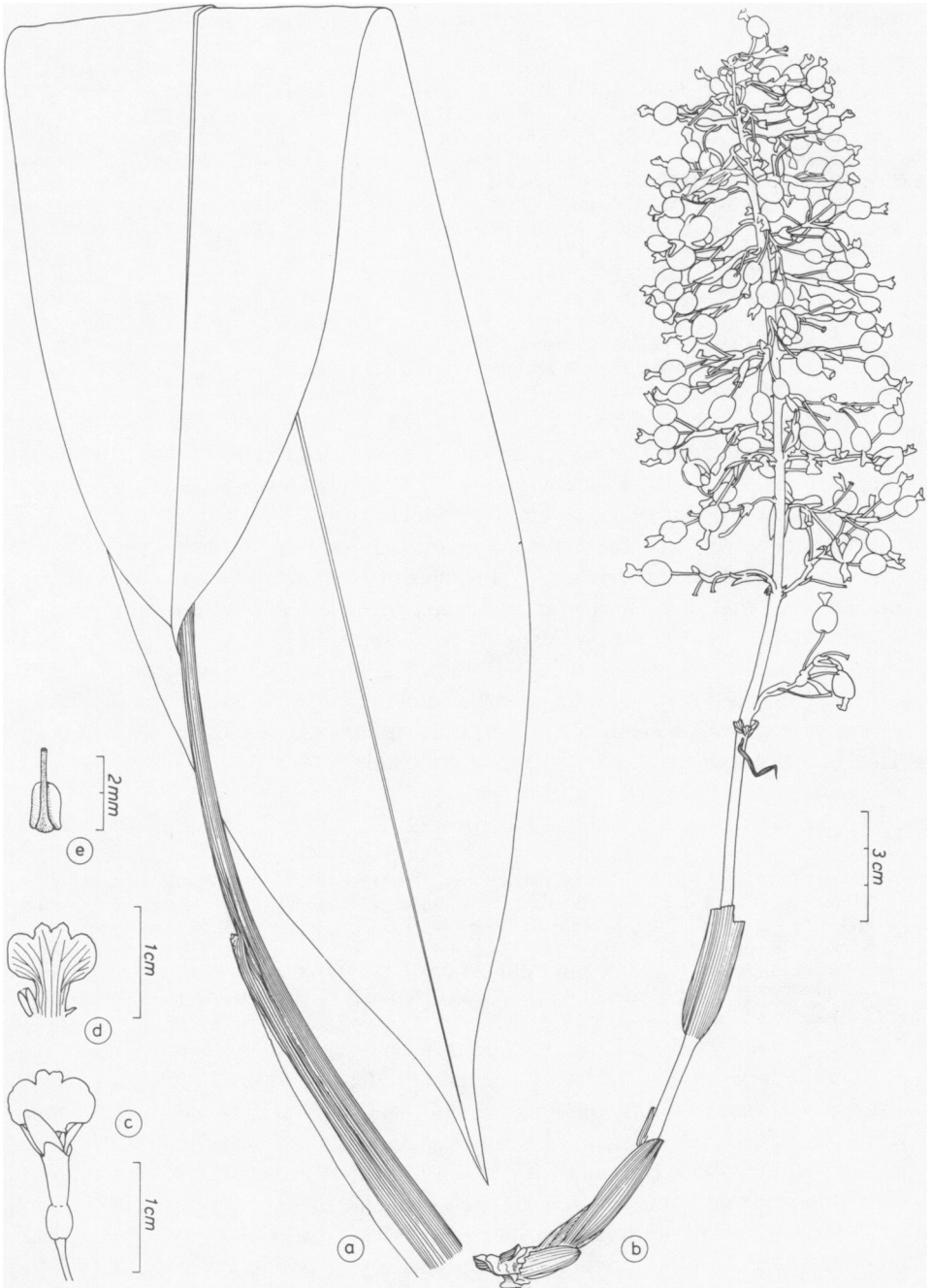


FIG 36. *Renealmia mexicana* (a-b, *Maas & Dressler 740*; c-e, *Kennedy & Luteyn 433*). a, leaf; b, inflorescence; c, flower; d, labellum and stamen; e, nectarial glands.

Matuda 981 (MICH, MO); *F. Müller* 2219 (NY); *Nevling & Gómez-Pompa* 144 (GH); *Purpus* 5774 (BM, F, GH, NY, US), 8050 (MO, US), 10793 (K, M, MICH, US); *Rzedowski* 20353 pp (WIS); *Ventura A.* 5424 (EAP); STATE ? : *Liebmann* 14739, 14740, 14741, 14742, 14743, 14749 (C, F). GUATEMALA. *Deam* 6035 (E, F, GH, MICH, MO, NY, US); *Johnston* 1647 (F); *Molina R.* 15576 (EAP); *Standley* 63555, 66853 (F); *Steyermark* 34535 (MICH), 39974, 48000, 48743, 49514 (F); *von Türckheim II-387* (BR), 2188 (US), 3776 (L, US), 8018 (GH, K, US); *C.L. Wilson* 226 (F). BRITISH HONDURAS. *Bartlett* 11926 (GH, MICH, NY, S, US); *Gentle* 2932 (MICH), 3620 (GH, MICH); *Lundell* 6323 (MICH); *Schipp* 342 (BM, F, GH, MICH, NY, S, US). HONDURAS. *Maas & Molina R.* 1055 (CR, K, MO, U); *Molina R.* 5708, 7168 (F), 7929 (EAP), 10845 (F, NY); *Molina R. & Molina* 26051 (EAP); *Standley* 52706, 54002 (F, US); *Yuncker* 4594 (F, MICH), 4849 (F, MO, MICH); *Yuncker et al* 6087 (F, GH, MO). NICARAGUA. *Molina R.* 15170 (F); *Molina R. & L. O. Williams* 20004 (F, NY, US, WIS); *C. L. Smith* 29 (F, MO, NY, US); *L. O. Williams, A. Molina R. & T. P. Williams* 24974 (F). COSTA RICA. *Brenes* 3907 (CR), 4437 (CR, F), 21967 (CR, F, NY), 22624 (F); *Burger* 7805 (F, U); *O. Kuntze* 2005 (NY, US). PANAMA. *Blum et al* 2522 (MO); *Ebinger* 902 (MO, US); *Gentry* 6107, 6242 (MO, U); *Kennedy & Luteyn* 433 (U); *Kirkbride & Hayden* 299 (MO); *Maas & Dressler* 648 (U), 740 (COL, F, K, NY, U), 1604 (COL, CR, K, MO, U, VEN); *Porter et al* 4256 (MO).

Renealmia mexicana is related to *R. occidentalis* and is often confused with it. However, it diverges from that species in the following characters: 1. reticulate (vs striate) sheaths; 2. lamina distinctly petiolate (vs petiole mostly absent); 3. scape + inflorescence rarely exceeding 50 cm in length (vs mostly longer than 50 cm); 4. calyx lobes acute, very irregularly abscissing with age (vs obtuse, never irregularly abscissing). Besides, the indument of the rhachis of *R. mexicana* is composed mainly of furcate hairs, that of *R. occidentalis* of simple hairs. Its closest relative, though, is *R. asplundii* (see under that species).

H. H. Smith 2318 pp (S) from Don Amo, Sta. Marta, Colombia, also belongs to this species. As all other duplicates of this number (from 7 different herbaria) belong to *R. occidentalis* var *occidentalis*, it seems possible that the Stockholm specimen is mislabelled. If not, *R. mexicana* extends to Colombia.

33. ***Renealmia monosperma*** Miquel, *Linnaea* 22: 80. 1849; Horaninow. Prodr. 33. 1862.

Renealmia humilis O. G. Petersen in Martius, F1. Bras. 3(3): 46. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 297. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930. Type. *L. C. Richard* sn (holotype, P), "in sylvis inter Couaña et Approuague," French Guiana.

Renealmia arundinaria Woodson, Ann. Missouri Bot. Gard. 29: 329. 1942; 32: 61. 1945. Type. *Pittier* 5597 (holotype, MO; isotypes, GH, US), foothills of Garagará, Sambú basin, Southern Darién, 30-500 m, Panama.

Low plants 0.2-0.5 (-0.75) m tall. Rhizomes 2-4 mm thick. Sheaths striate (to slightly reticulate), 2-5 mm wide, rather densely to densely covered with furcate and stellate prickles (less than 0.1 mm long). Ligule ca 1 mm long. Petiole 0.5(-20) mm long, hairy like the sheaths. Lamina narrowly elliptic, shortly acuminate at the apex (acumen 5-10 mm long), cuneate at the base, (7-9-11(-17) cm long, (0.7-)1.5-3.5(-4.5) cm wide, glabrous on both sides, 4-7 veins on each side of the midrib prominent. Scape erect, 3-10(-13) cm tall, up to 2 mm thick, beset with sheaths up to 1-4 cm long and 0.2-0.6 cm wide. Inflorescence a congested, basal thyrse 2-5(-9) cm long and (0.6-) 1-2(-3) cm wide, with 1-3-flowered cincinni, the rhachis purple-red to purplish-brown. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule sparsely to densely covered with simple and furcate hairs (ca 0.1 mm long), plurifurcate hairs rare; corolla glabrous. Bracts purple-red, soon deciduous, ovate-triangular, 5-15(-20) mm long, 2-6 (-8) mm wide. Peduncles 2-7 mm long. Bracteole (5-)-7-8 mm long. Pedicels 5-12(-18) mm long. Calyx pale green, tubular, (3-) 4-6(-8) mm long, 1.5-4 mm wide, the lobes deltate to triangular, 1.5-3 mm long, 2 mm

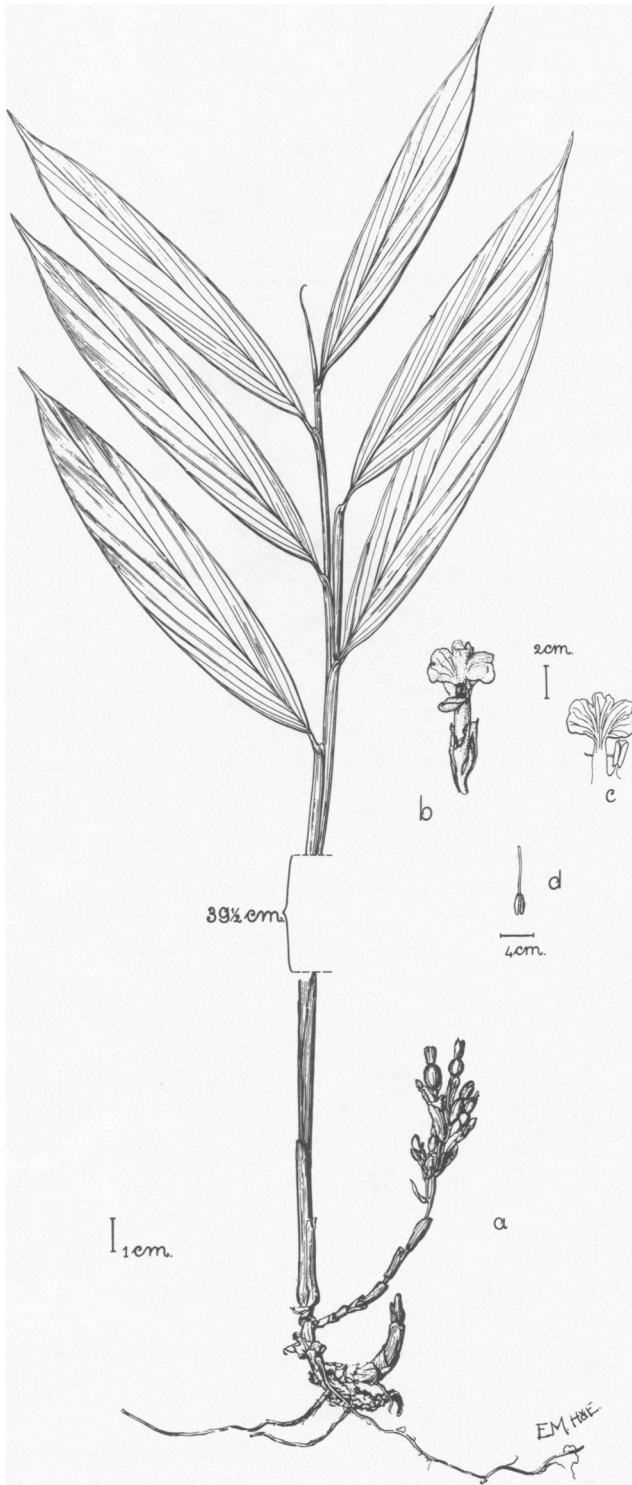


FIG 37. *Renealmia monosperma* (a-d, *Prance et al 12218*). a, habit; b, flower; c, labellum and stamen; d, nectarial glands.

long. Corolla white, 10-12 mm long, the tube ca 5 mm long, the lobes 5-7 mm long, 3 mm wide. Labellum white, purplish in the middle, 9-10 mm long and wide when spread out, basal part opposite the anther densely covered with simple hairs, the limb horizontally spreading, 6 mm long, 9-10 mm wide, lateral lobes rounded, 5 mm long, 4 mm wide, middle lobe bilobulate, lobules ovate-triangular, 2 mm long, 1.5 mm wide, basal claw 3 mm long, 2 mm wide, lateral staminodes ca 1 mm long. Anther red, 2-3 mm long, 1.5 mm wide, glabrous. Style 6-8 mm long. Nectarial glands only partly surrounding the style base, 1-2 mm long. Ovary globose to ellipsoid, red. Capsule glossy red (2.5 R 5/10), globose (to ellipsoid), (4-)5-7(-9) mm in diameter, its wall 0.1-0.2 mm thick when dry (ca 1 mm thick in living material), 1-6(-10)-seeded, seeds 2.5-3 X 3-4 mm.

TYPE. *Kegel 1470* (holotype, U), Saramacca River near Bigi Poika (= Groote Poika), Suriname.

DISTRIBUTION (Fig 60). Northern South America and adjacent southern Panama; in rain forests, one collection from a Euterpe swamp and one from a grass savanna, from sea-level up to 600 m.

COLOMBIA. CAQUETÁ: *von Sneidern sn, 4 Nov 1941*. META: *von Hermann 1131* (US); *Philpson, Idrobo & Fernández 1731* (BM, COL); *Vogel 320* (B). VAUPÉS: *P. H. Allen 3284 a* (US); *Fernández 1920* (COL, US). STATE?: *Triana sn* (COL). VENEZUELA. BOLÍVAR: *Bernardi 739, 1529* (NY); *Steyermark 60537* (F), *76033* (NY, VEN), *90598* (NY, US, VEN). DELTA AMACURO: *Steyermark 87136* (VEN). GUYANA. *Alston 499* (K); *Beckett 8631* (K, NY); *Jenman 2085* (K, U); *S. S. & C. L. Tillett 45761* (NY, U). SURINAME. *Irwin et al 54769* (NY, U); *Jonker & Daniels 787, 897* (U); *Kramer & Hekking 2700* (U); *Maas 3165* (U); *Maguire 24147* (NY), *40796* (NY, U); *Maguire & Stahel 23704* (NY, U); *Sastre 1558* (P). FRENCH GUIANA. *de Granville 170, B-3790* (CAY); *Mélinon 374* (F, GH, LE, NY, US), *367* (P), *sn, anno 1863* (P), *sn, anno 1865* (P); *Oldeman B-2117* (CAY), *2346* (P, S, US), *2763* (CAY); *Sagot 567* (P, S); *Sastre 1370* (P, U); *Wachenheim 148* (P). BRAZIL. ACRE: *Prance et al 12218* (INPA, NY, U), *12571* (COL, DAV, INPA, NY, U). AMAZONAS: *Fróes 23777* (IAN); *Prance et al 13420, 14608, 14651* (INPA, NY, U); *Prance et al 15776* (INPA, NY, U, US). PARÁ: *Ducke MG-16769* (MG). RORAIMA: *Prance et al 10782* (INPA, K, NY, U), *13625* (INPA, NY, U, US, W).

Renalmia monosperma is closest to *R. matogrossensis* (see under that species) and to *R. guianensis*.

There are a few specimens which slightly deviate from the typical form of *R. monosperma*:

1. *Prance, Maas et al 12218, 14651*, both from Brazil: the upper sheaths of the scape bear a reduced lamina.
2. *Wessels Boer 918* (U), from a forest near Oelemari-airstrip, Suriname and *Bénà 4040* (U), from Marowijne River, French Guiana, are both aberrant in having a rather elongate inflorescence (to 9 cm long!), like that of *R. guianensis*. It seems quite possible that both specimens represent hybrids between *R. monosperma* and *R. guianensis*.

34. *Renalmia nicolaioides* Loesener, Notizbl. Bot. Gart. Berl. **10**: 65. 1927; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **15A**: 611. 1930; Macbride, Field Mus. Nat. Hist. Bot. Ser. **13**: 729. 1936. Fig 38.

Stout plants, 2-5 m tall. Rhizomes 20-25 mm thick. Sheaths striate to slightly reticulate towards the ligule, 10-20 mm wide, to 35 mm at the base of the plant, glabrous to densely covered with simple hairs (up to 0.5 mm long), in the grooves and towards the margins often with furcate to stellate prickles (less than 0.1 mm long). Ligule 1-5 mm long, hairy like the sheaths. Petiole 30-125 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen 5-15 mm long), cuneate at the base, 65-125 cm long, 9-24 cm wide, upper side glabrous, lower side densely

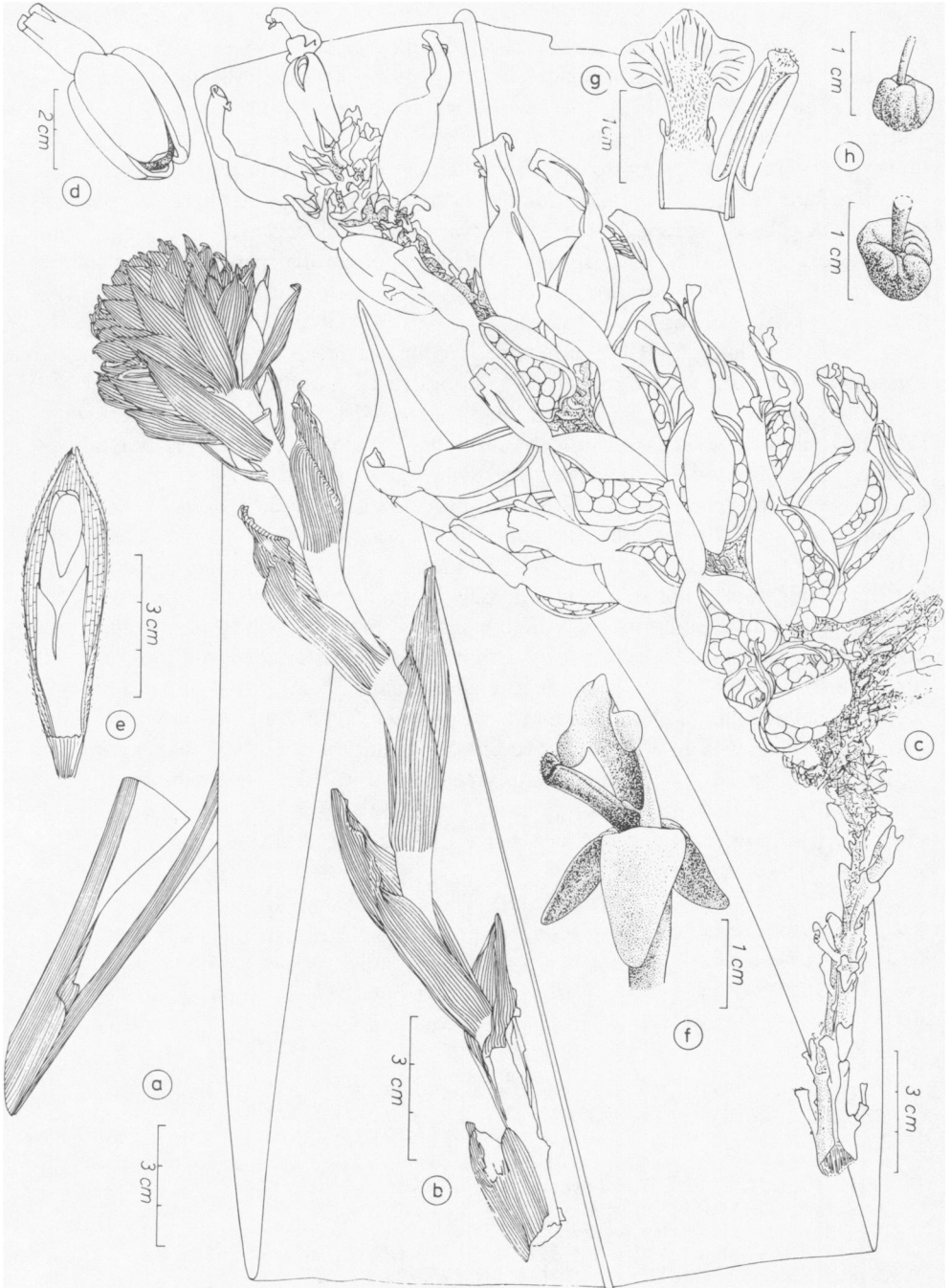


FIG 38. *Renealmia nicolaioides* (a, Maas & Badillo 2170; b-c, e, Steyermark 97558; d, f-h, van Rooden & Akkermans 102). a, leaf; b, inflorescence; c, infructescence; d, fruit; e, bract enclosing bracteole, calyx, and corolla; f, flower; g, labellum and stamen; h, nectarial glands.

covered with sessile, furcate to plurifurcate hairs (0.1-0.2 mm long and wide), simple hairs rare, midrib glabrous or sparsely covered with simple hairs (to 0.5 mm long) and/or furcate to plurifurcate hairs. Scape erect or prostrate, 8-50 cm tall, up to 1 m during fructification, to 15 mm thick, beset with sheaths up to 6-12 cm long and 1-3.5 cm wide. Inflorescence a basal spiciform raceme, 5-10 cm long and 4-12 cm wide, elongating during fructification up to 35 cm. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, and pedicels covered with a dense network of appressed (and erect), pale brown, sessile, furcate to plurifurcate hairs (0.1-0.4 mm long), simple hairs scarce; calyx, ovary, and capsule less densely so, corolla sparsely so to glabrous. Bracts red (5.0 R 7/8) to orange, turning brown, deciduous during fructification, narrowly ovate-triangular, narrowly triangular, or narrowly obovate-obtrullate, apex subulate, 25-65 mm long, (7-)12-28 mm wide. Peduncles and pedicels to 5 mm long, sometimes to 15 mm long (and 6 mm thick!) during fructification. Bracteole obliquely truncate, split on one side, 25-35 mm long. Calyx red to orange, tubular, persistent, (15-)23-41 mm long, 6-12 mm wide, young lobes deltate, 5-10 mm long, but calyx deeply split in age and the lobes then narrowly triangular and up to 30 mm long! Corolla yellow to yellowish-red, 37-50 mm long, the tube 25-30 mm long, the lobes yellow to pink, 12-20 mm long, the dorsal lobe 10-13 mm wide, the two lateral lobes 8-10 mm wide. Labellum yellow, 12-16 mm long and 10-15 mm wide when spread out, inner side and lateral staminodes densely covered with simple and furcate to plurifurcate hairs (to 0.2 mm long), the limb erect, 5-8 mm long, 10-16 mm wide, lateral lobes involute and forming a tube of 6-7 mm in diameter, rounded, 5-8 mm long, 2-5 mm wide, middle lobe 2-lobulate or entire and rounded, basal claw 7-8 mm long, 4-5 mm wide, lateral staminodes 1.5-2 mm long. Anther 10-13 mm long, 4-8 mm wide, glabrous. Style 30-45 mm long. Nectarial glands multilobulate, completely surrounding the style base, ca 2 mm long. Ovary green, ellipsoid. Capsule green, wine-red (5.0 R 5/12) to black, ellipsoid to globose, 15-40 X 13-30 mm, its wall ca 1 mm thick when dry (3-5 mm thick and fleshy in living material), 50-200-seeded, seeds 3.5 X 2.5-4 mm, aril orange, sweet.

TYPE. *Asplund 12281* (neotype, S), Tingo Maria, dep. Huánuco, Peru. The holotype, *Weberbauer 3435 (B)* from Monzon, prov. Huamalies, dep. Huánuco, 900-1000 m, Peru, having been destroyed in 1943, a neotype is chosen here.

DISTRIBUTION (Fig 58). Western part of tropical South America; in forests, often bordering streams or in open places, down to sea-level, but mostly between 500 and 1600 m.

COLOMBIA. CAQUETÁ: *von Sneidern A 1339 (S)*. PUTUMAYO: *Plowman 2058 (U)*. VENEZUELA. ARAGUA: *Lasser sn (U, VEN)*; *Maas & Badillo 2170 (COL, F, GH, K, MO, NY, U)*; *Schnee 1329 (MY)*; *Steyermark & Carreño Espinoza 105800 (VEN)*. DISTRITO FEDERAL: *Steyermark 91825 (US, VEN)*. MIRANDA: *van Rooden & Akkermans 102 (U)*; *Steyermark 97558 (U, VEN)*. BRAZIL. ACRE: *Prance et al 12486 (F, INPA, MO, NY, U, US)*. ECUADOR. PASATAZA: *Asplund 19541 (S)*; *Harling et al 9768 (GB, U)*; *Plowman & Wade Davis 4474 (GH, U)*. MORONA-SANTIAGO: *Harling & Andersson 12890 (GB, U)*. ZAMORA-CHINCHIPÉ: *Sparre 16387 (S)*. PERU. AMAZONAS: *Berlin 487, 844 (MO, U)*. CUZCO: *Vargas C. 15185 (CUZ, U)*. HUÁNUCO: *Ellenberg 2264 (U)*. SAN MARTÍN: *Schunke V. 3622 (U)*.

Renalmia nicolaioides is closest to *R. thyrsoides* subsp. *thyrsoides*. It is characterized by a brownish indument on most parts of the inflorescence, a long-petiolate, very large lamina (to over 1 m long!), and a long, tubular, persistent calyx, the lobes of which split deeply (to near its base) during fructification.

Loesener (1930) placed this species in a separate subgenus, *Gigantalmia*, because of its aberrant nectarial glands and its anther, which was said to split very easily into

two thecae. The nectarial glands are not aberrant, though, but are rather similar to those of *R. thyrsoidea* and *R. alpinia*. The splitting up into two thecae (described by Loesener as “. . . thecis . . . facile disjunctis . . . ita ut androecium bistaminale antheris monotheosis, simuletur”), is in my opinion a secondary phenomenon caused by the drying process. There is therefore no good reason for maintaining Loesener’s subgenus.

35. *Renealmia occidentalis* (Swartz) Sweet

Plants (0.8-)1-3(-4) m tall. Rhizomes 10-15 mm thick. Sheaths striate, 5-15 mm wide, to 30 mm at the base of the plant, glabrous. Ligule 1-2 mm long, glabrous or covered with simple, needle-like hairs (to 0.5 mm long) and furcate prickles (less than 0.1 mm long). Petiole absent or sometimes up to 10 mm long, glabrous. Lamina narrowly elliptic, acute or acuminate at the apex (acumen 10-20 mm long), cuneate at the base, 13-55 cm long, (2-)4-12 cm wide, glabrous on both sides. Scape (15-)40-65(-100) cm tall, up to 5 mm thick, beset with sheaths up to 4-15 cm long and 0.5-1.5 cm wide. Inflorescence a basal (very rarely terminal) thyrses 10-35 cm long and 2-7 cm wide, with 2-17-flowered cincinni, rhachis red. Indument of inflorescence: all parts glabrous to densely covered with simple hairs, furcate hairs rare, corolla glabrous. Bracts pale green to red, membranous and soon deciduous, narrowly triangular-ovate to triangular-ovate, acute or obtuse, often at an angle of 45-90° with the rhachis, 6-75 mm long, 3-10 mm wide. Peduncles red, 4-20 mm long. Bracteole 7-17 mm long. Pedicels red, 3-17 mm long. Calyx red, turbinate, 4-7 mm long and wide (ca 2 mm wide at the base), the lobes depressed ovate, obtuse, 1-3 mm long, 3-5 mm wide. Corolla yellow, 13-21 mm long, the tube 6-11 mm long, the lobes 7-10 mm long, 4-7 mm wide. Labellum yellow, 7-10 mm long and 5-9 mm wide when spread out, basal part opposite anther densely hairy (hairs to 0.5 mm long), the limb 4-7 mm long, 5-9 mm wide, lateral lobes rounded, 3-5 mm long, 1-2 mm wide, the middle lobe reflexed, rounded and entire, basal claw 3-4 mm long and 3-5 mm wide, lateral staminodes 1-1.5 mm long. Anther 5-7 mm long, 2-3 mm wide, glabrous. Style 14-19 mm long. Nectarial glands partly surrounding the excentric style base, 1-2 mm long. Ovary red. Capsule red (rarely purple-black), globose to ellipsoid, 4-18 X 4-9 mm, its wall 0.1-0.2 mm thick when dry (ca 1 mm in living material), 10-25-seeded, seeds 2-3 X 2-4 mm.

DISTRIBUTION (Fig. 59). Antilles, Mexico, Central America, and South America in the South to Bolivia and in the East to Guyana, Amazonian Brazil, and Mato Grosso; in forests, from sea-level up to 1500 m.

Key to the Varieties of *Renealmia occidentalis*

1. Rhachis densely to sparsely hairy; cincinni 3-17-flowered; peduncles 4-12(-14) mm long; capsule 4-12 mm long. var *occidentalis*.
1. Rhachis glabrous to sparsely hairy; cincinni 2-4(-5)-flowered; peduncles 6-20 mm long; capsule 12-18 mm long. var *pacifica*.

35a. *Renealmia occidentalis* (Swartz) Sweet var *occidentalis*.

Fig 39 a-e.

Paco seroca minor multicaulis Plumier, Mscr. 5: t. 27 & 28.

(≡ *Alpinia aromatica* Jacquin, not of Aublet).

Alpinia occidentalis Swartz, Prodr. Fl. Ind. Occ. 11. 1788; Swartz, Fl. Ind. Occ. 1: 9. 1797.

Gethyra occidentalis (Swartz) Salisbury, Trans. Hort. Soc. London 1: 282. 1812.

Renealmia occidentalis (Swartz) Sweet, Hort. Brit. ed. 2. 493. 1830; Grisebach, Fl. Br. W. Ind.

Isl. 601. 1864 (excl. β); O. G. Petersen in Martius, Fl. Bras. 3(3): 44: 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 299. f. 38k-m. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930.

Renealmia domingensis Horaninow, Prodr. 32. 1862. Type. Tables 74 and 75 from Jacquin’s

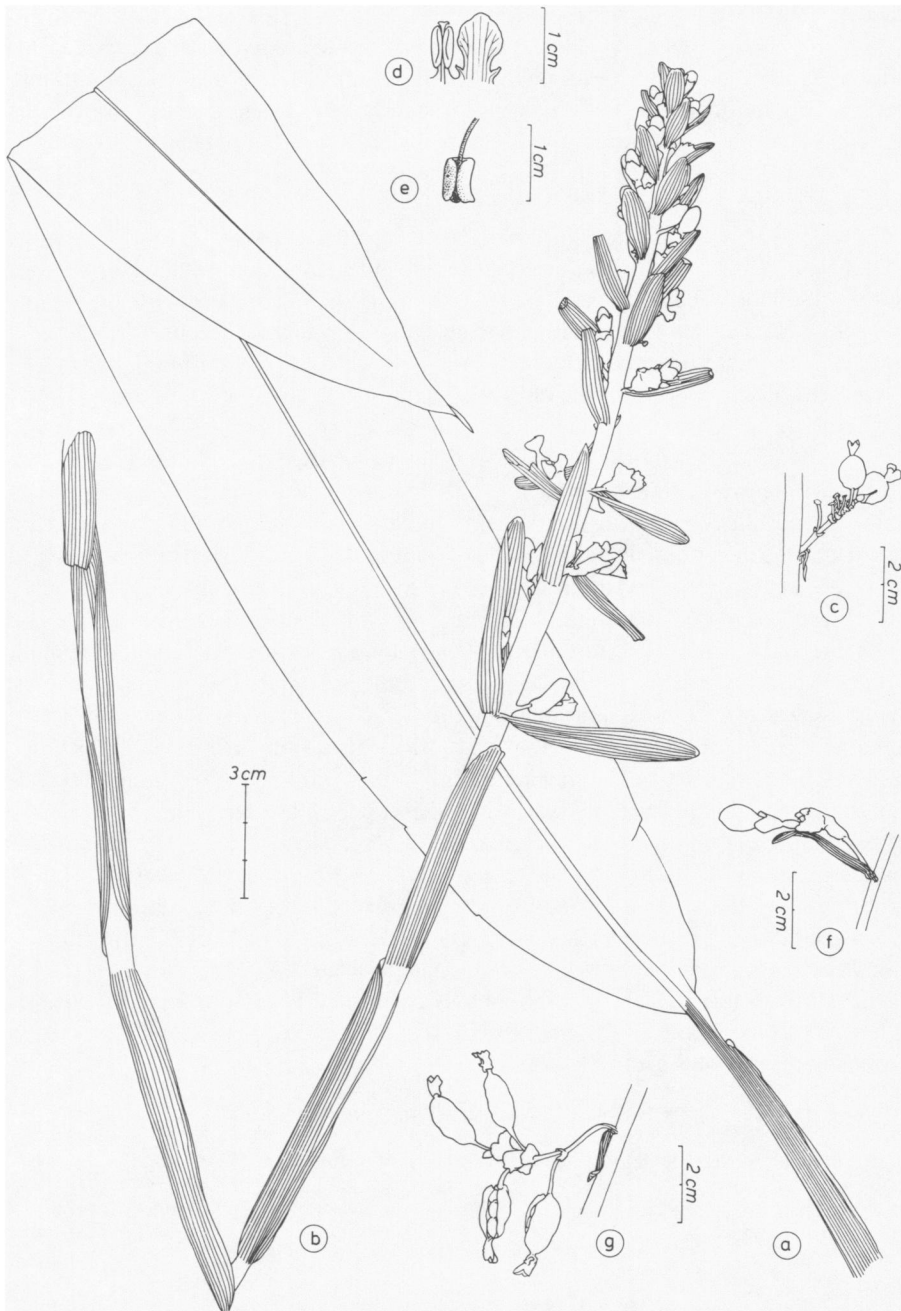


FIG 39. *Renealmia occidentalis*. a-e, var *occidentalis* (a, c, Ekman 14269; b, Ekman 15557; d-e, Duque-Jaramillo 4326-a). a, leaf; b, inflorescence; c, fruiting cincinnus; d, labellum and stamen; e, nectarial glands. f-g, var *pacifica* (f, Alexander 498; g, Matuda 18088). f, a single cincinnus with bract; g, fruiting cincinnus.

Fragmenta Botanica (1809), since no original herbarium material seems to be preserved. Both of Jacquin's tables were redrawn after Plumier, who collected the original plant in Hispaniola, Dominican Republic. (\equiv *Alpinia aromatica* Jacquin, not of Aublet).

Renealmia occidentalis (Swartz) Sweet var β *cylindrica* O. G. Petersen in Martius, Fl. Bras. 3(3): 45. 1890. Type. *R. H. Schomburgk 641* (lectotype, K; isotypes, BM, CGE, L), Guyana.

Renealmia holdeni Spencer Moore, Trans. Linn. Soc. ser. 2. 4: 483. 1895.

Type. *Spencer Moore 680 a* (holotype, BM), Santa Cruz, Mato Grosso, Brazil.

Renealmia lehmannii K. Schumann in Engler, Pflanzenreich 4. 46: 298. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930. Type. *Lehmann 1927* (holotype, B, destroyed), Río Dagua, El Valle del Cauca, alt to 1500 m, Colombia.

Renealmia lutea J. R. Johnston, Contr. Gray Herb. 29: 683. 1905; J. R. Johnston, Proc. Am. Acad. 40: 683. 1905; J. R. Johnston, Contr. Gray Herb. 37: 199. t. 26, f. 1. 1909. Type. *J. R. Johnston 298* (holotype, GH), Margarita Island, along Juan Griego Trail, Río Asunción, alt. 500 m, Venezuela.

Renealmia pilosa Gleason, Bull. Torrey Club 52: 193. 1925. Type. *H. H. Smith 2318 pp* (holotype, NY; isotypes, BM, BR, GH, K, MO, US), Don Ama, Sta. Marta, ca 600 m, Colombia.

Renealmia occidentalis (Swartz) Sweet var *macrocarpa* Loesener, Notizbl. Bot. Gart. Berl. 10: 63. 1927. Type. *Ule 8096* (lectotype, K; isolectotype, MG), Serra da Paraima, near Paraima, Rio Branco, Roraima, Brazil. Of the two syntypes recorded by Loesener, *Ule 8096* is here selected as lectotype; the other syntype is *Ule 7756* (K, MG), Rio Branco near San Marcos, Roraima, Brazil.

Alpinia aromatica Jacquin, Fragm. Bot. 53. t. 74, 75. 1809 (\equiv *Renealmia domingensis* Horaninow); Moscoso, Cat. Fl. Doming. 88. 1943; Britton, Sci. Surv. Porto Rico & Virg. Isl. 5: 172. 1924; not of Aublet.

Renealmia aromatica (Aublet) Grisebach ex K. Schumann & Urban, Symb. Ant. 8: 111. 1920; Standley Contr. U. S. Nat. Herb. 27: 119. pl. 16. 1928; Standley, Field Mus. Nat. Hist. Bot. Ser. 18: 189. 1937; Woodson, Ann. Missouri Bot. Gard. 32: 59. f. 36. 1945; León, Fl. Cub. 1: 334. f. 143. 1946; I. M. Johnston, Sargentia 8: 99. 1949; Standley & Steyermark, Fieldiana: Botany 24: 201. 1952 (pp, excl. f. 36).

Scape + inflorescence (25-)50-100(-140) cm tall. Cincinni 3-17-flowered. Indument of inflorescence: rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule densely to sparsely covered with erect, simple hairs (ca 0.5 mm long), rarely mixed with some furcate hairs (to 0.2 mm long); sheaths of the inflorescence covered with appressed, simple, needle-like hairs (to 0.5 mm long) and towards the apex densely covered with mainly furcate hairs (less than 0.1 mm long). Bracts pale green. Peduncles 4-10(-12) mm long. Pedicels 3-10(-17) mm long. Corolla 13-16 mm long. Labellum 7-9 mm long and 5-9 mm wide. Style 14-17 mm long. Capsule ellipsoid to globose, 4-12(-14) X 4-9 mm.

TYPE. A collection by Swartz collected in Jamaica (lectotype, M) and annotated "Alpinia occidentalis Prodrum." Two other Swartz collections (S), annotated by him "Alpinia occidentalis Sw. Ind. Occ.: Swartz" are syntypes.

DISTRIBUTION (Fig 59). Antilles; from Mexico in the North to Bolivia and Peru in the South and to the Guianas and Mato Grosso in the East; in forests, from sea-level up to 1500 m.

MEXICO. OAXACA: *Santos 2513* (MICH). TABASCO: *Matuda 3386 pp* (F, GH, MICH). VERACRUZ: *Bourgeau sn* (P); *Galeotti 4990 pp* (BR, F, LE, NY, US). GUATEMALA. *Bartlett 12450* (MICH, US), *12601* (F, MICH, US); *Cook & Martin 130* (US); *Friedrichsthal 1517* (G); *Kellerman 4577* (US); *Lundell 4296* (F, MICH, US). HONDURAS. *Bangham 347* (F, GH); *Molina R. 3648* (EAP); *Thieme 5514* (K, US), *5514 B* (US). BRITISH HONDURAS. *Gentle 937* (MICH, NY), *2379* (F, GH, MICH), *4184* (BM, GH, MICH); *Lundell 392* (F, US), *4292* (F, MICH, US); *W. C. Meyer 168* (F). EL SALVADOR. *Calderón 2588* (F). NICARAGUA. *Molina R. 15056* (EAP). COSTA RICA. *P. H. Allen 5344* (EAP, F, US); *Brenes 15707* (F, NY); *Oersted sn* (C); *Tonduz 14004* (BM); *M. Valerio 1740* (F). PANAMA. *P. H. Allen 763* (MO); *Bartlett & Lasser 16922* (MICH, MO); *Correa A. & Haines 260* (MO); *Correll 12247* (GH); *Croat 15128* (DUKE); *Dodge et al 16737* (BM); *Duchassaing sn* (GOET); *Duke 4570* (MO), *5020* (GH, MO), *5635* (MO), *8388* (MO, U), *11869* (U); *Dwyer 2325* (MO); *Erlanson 507* (GH, US); *Kennedy 1176*, *1191* (U); *Killip 3049*, *12074* (US); *Lewis et al 213* (MO); *Lewis et al 1625* (MO); *Lewis et al 2934*, *2950* (MO, NY); *Luteyn 955*, *1098* (DUKE); *Pittier 6691* (US); *Standley 26365*, *28875* (US); *Stern et al 910* (GH, LE, US); *Tyson 1343* (MO); *R. S. Williams 342* (NY); *Woodson et al 1463* (GH, MICH, MO, NY). CUBA. *Britton 2325* (NY); *Brit-*

ton et al 14406 (NY, US); Britton et al 13008 (NY, US); Britton et al 6483 (NY); Caldwell & Baker 7026 (F, GH, S); Clemente 6407 (IJ); Curtiss 425 (F, GH, MO, NY, US); Ekman 2028 (NY, S), 11816 (S); González 291 (GH); von Hermann 280 (F, NY); Hioram 2088 (NY); Hodge & Howard 4563 (GH); León 16949 (GH); León & Clemente 4012 (NY); Luna 365 (NY); Morton 4332 (US); Murlson 1612 (GH, S); Otto 341 (BR, L, P, W); Palmer & Riley 92 (NY, US); Rugel 274 (BM); Rutten-Pekelharig 334 (U); de la Sagra sn (P); Shafer 379 (NY), 544, 12201 (NY, US); Shafer & León 13545 (NY, P, US), 13541 (BM); Taylor 84, 197 (NY); Webster 4099 (GH, MICH); P. Wilson 9448 (NY, US); C. Wright 610 (BR, GH, MO, NY, US), 1710 pp (CGE, GH, LE, MO, P, S), 1711 (NY, S, US). JAMAICA. Britton 548, 3620 (NY); McFadyen sn (K); Fredholm 3199 (NY, US); Harris 6056 (BM, IJ); Hespeneheide et al 1589 (DUKE); Hitchcock sn, 29 Dec 1890 (MO); March 1287 (K); Proctor 9308 (IJ), 15624 (BM, GH, IJ), 15624 (BM, GH, IJ); N. Wilson sn (K); W. Wright sn (BM); Wulschlägel 1287 (GOET). HISPANIOLA. HAITI: Ekman H 6128 (S); Leonard 7623 (US), 9326 (GH, NY, US); Nash 645 (NY); Nash & Taylor 1795 (NY, US); Picarda 1616 (S). DOMINICAN REPUBLIC: Batista 1867 (US); Eggers 2808 (US); Ekman H 14269 (C, GH, S, US), H 15557 (GH, K, S, US); Fuertes 440 (BM, F, GH, K, LE, LIL, US); L. C. Richard sn (P); Rose et al 4186 (NY, US); Schomburgk sn, anno 1837 (K); Taylor 19 (NY); Valeur 89 (S, US). PUERTO RICO. Britton & Britton 7104 (NY); Britton & Cowell 1395 (NY); Eggers sn, anno 1883 (M); Gleason & Cook M-115 (NY); Heller 431 (F, K, NY, US); I. M. Johnston 855 (NY); O. Kuntze 370 (NY); Shafer 2881 (NY, US); Sintenis 493 (BM, C, GH, K, LE, LIL, M, P, S, US), 2619 (BM, GH, K, US, W); Stevenson 527 (US); Stimson 3527, 3657 (DUKE); Underwood & Griggs 343 (NY, US); R. J. Wagner 466 (U). TORTOLA. Fishlock 470 (NY). ST. THOMAS. Eggers 587 (BR, GH, L, M, P), 599 (US), sn, 16 Aug 1876 (GH); L. C. Richard sn (P). ST. CROIX. Benzón sn, anno 1821 (C), sn (C); Isert sn (C); Ravn sn (C); West sn (C, LE). ANTIGUA. Masson sn (BM). GUADELOUPE. Duchassaing sn (GOET, P); Duss 3328 b (F, LE, NY, US); L. C. Richard sn (P). MARTINIQUE. Plée sn (P). ST. LUCIA. West sn (LE). COLOMBIA. ANTIOQUIA: Bro. Tomás 983 (US). CAUCA: Duque-Jaramillo 4326-A (COL); Yepes-Agredo 1207 (COL). CHOCÓ: Romero Castañeda 6292 (COL). CUNDINAMARCA: André 696 (K); García-Barriga 7737, 11743 (COL); Tracey 247 (K); Triana "1631.2" (BM, COL). GUAJIRA: Saravia T. & de Saravia 3606 (COL, US). HUILA: Rusby & Pennell 528 (NY). MAGDALENA: Niemeyer 19 (NY, US); Pittier 1623 (US); Schlim 999 (BR, P). SANTANDER: Haught 1718 (COL, NY, US); Killip & Smith 14856 (GH, NY, US). TOLIMA: André 2014 (K, NY); Goudot sn (K). EL VALLE: Duque-Jaramillo 4325-A (COL); Fiquieras 8039 (US, VALLE); Pennell et al 8513 (GH, K, NY, US). STATE?: Goudot sn, anno 1844 (P); Jürgensen sn (K); Lehmann K 360 (F, K), K 361 (K). VENEZUELA. AMAZONAS: Vareschi 6561 (VEN); L1. Williams 13162 (F, US, VEN), 15999 (VEN). ARAGUA: Fendler 1495 (GH, K, NY); L1. Williams 10352 (F). BARINAS: Steyermark et al 102208 (U, VEN). BOLIVAR: Braun sn (VEN); Cardona 827 (US, VEN); Trujillo 2392 (MY). PORTUGUESA: Trujillo 1717 (MY). ZULIA: Ginés 2124 (US); Medina 929 (VEN). YARACUY: Trujillo 3453 (MY). GUYANA. Cook 208 (K, NY); A. C. Smith 3450 (GH, MO, NY, P). ECUADOR. MANABI: Haught 3494 (NY, US). PROV. UNKNOWN: Sinclair sn (K). PERU. SAN MARTÍN: Ferreyra 4623 (US); Woytkowski 5427 (F). BOLIVIA. BENI: Fleischmann 300 (S).

Renalmia occidentalis var occidentalis is closely related to *R. floribunda* and differs from that species by its striate leaf-sheaths, more numerous flowered cincinni and indument of the rhachis.

For the differences from the related *R. mexicana* see under that species.

A few specimens are aberrant in having a terminal instead of a basal inflorescence, namely, *C. Wright 610 pp* (NY), from Cuba; *Lewis et al 2934* (MO, NY), from Panama; and *Bartlett 12601 pp* (MICH, US), from Guatemala. Two duplicates of the Bartlett collection (F, MICH), however, have a basal inflorescence.

I am not sure about the identity of *Hoehne 1552* (R), from Tapirapoan, Rio Sepotuba, Mato Grosso, and *Hoehne 732* (R), from Rio Jaurú, Mato Grosso, Brazil. They match *R. occidentalis var occidentalis* in most characters, but they are aberrant in having a completely glabrous inflorescence (as in central American var *pacifica*).

35b. *Renalmia occidentalis* (Swartz) Sweet var *pacifica* Maas, Acta Bot. Neerl. 24: 478. 1976. Fig 39 f-g.

Scape + inflorescence 60-80 cm tall. Cincinni 2-4(-5)-flowered. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule glabrous to sparsely covered with simple (rarely furcate) hairs (0.1-0.3 mm long).

Bracts red. Peduncles 6-20 mm long. Pedicels 3-15 mm long. Corolla 19-21 mm long. Labellum 9-10 mm long and 5-6 mm wide. Style 18-19 mm long. Capsule ellipsoid, (9-)12-18 X 5-8 mm.

TYPE. *Alexander 498* (holotype, NY), Finca El Carmen, Oaxaca, Mexico.

DISTRIBUTION (Fig 59). Pacific slopes of Mexico, Guatemala, and El Salvador; in wet forests, from sea-level to 1300 m.

MEXICO. CHIAPAS: Mt. Ovando, *Matuda 1844 pp* (MICH); Colonia Jalapa, 16 km W of El Triunfo, Escuintla, *Matuda 18088* (F). NAYARIT: Cerro de la Gloria, 400 m, *Ortega 78* (US). OAXACA: Cerro Espino, 700-950 m, *Conzatti et al 3094* (MO, US); 5 km N of Matías Romero, *King 835* (MICH); Chiltepec, 200 m, *Martínez-Calderón 603* (MICH); Cafetal Concordia, 400-650m, *Morton & Makrinius 2400* (US); mun. Juquila, near Sta. Rosa, km 195 of road from Oaxaca to Puerto Escondida, 1300 m, *Rzedowski 19584* (MICH). GUATEMALA. Volcán Atitlán, above Finca Mocá, dep. Sololá, 1000-1250 m, *Steyermark 47894* (F). EL SALVADOR. San Salvador, market, *Calderón 691* (GH, MO, NY, US); top of Cerro de San Jacinto, *Calderón 2204* (US); without locality, *Krukoff 15545, 16032* (U).

This new variety differs from the typical variety in its few-flowered cincinni, longer peduncles, larger fruits, and indument.

King 835, Martínez-Calderón 603, Morton & Makrinius 2400, and Ortega 78 are aberrant by their rather densely hairy (instead of glabrous to sparsely hairy) inflorescence; they may represent transitional forms between the two varieties.

Hinton 10591 (F, IJ, MICH, NY, S, US) from Montes de Oca, Vallecitos, Guerrero, Mexico, oak woods, is undoubtedly related to var *pacifica* but differs by the indument of the inflorescence (simple and furcate hairs).

36. *Renealmia oligosperma* K. Schumann in Engler, Pflanzenreich 4. 46: 300. 1904.

Fig 40.

Plants 0.6-3 mm tall. Rhizomes 10-15 mm thick. Sheaths slightly reticulate, 5-10 mm wide, to 20 mm at the base of the plant, densely covered with simple (sometimes furcate to stellate) prickles (up to 0.1 mm long) and with simple, needle-like hairs (ca 0.5 mm long). Ligule 1-1.5 mm long, densely covered with simple, needle-like hairs. Petiole absent. Lamina narrowly elliptic, acuminate at the apex (acumen to 10 mm long), cuneate at the base, (6.5-)15-38 cm long, 4-10 cm wide, upper side glabrous, lower side glabrous or the midrib sometimes sparsely covered with simple (and furcate) hairs. Scape pale red turning pale green to brownish in age, erect, 8-30 cm tall, up to 4 mm thick, beset with sheaths up to 4-8 cm long and 0.4-1.2 cm wide. Inflorescence a basal thyse 7-20 cm long and 3.5-8 cm wide, with 3-5-flowered cincinni, rhachis green to red. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, and ovary sparsely to rather densely covered with simple (and some scattered, furcate) hairs (to 0.2 mm long), corolla glabrous. Bracts red turning pale brown, membranous, very quickly deciduous, narrowly oblong-ovate to oblong-ovate, 10-20 mm long, 4-12 mm wide. Peduncles pink, 2-4 mm long. Bracteole 8-15 mm long. Pedicels pink, 4-16 mm long. Calyx pink to red, tubular, 9-13 mm long, 2-3.5 mm wide, the lobes deltate to shallowly triangular, 1-2 mm long, 2-3 mm wide. Corolla white to yellow, 19-23 mm long, the tube 12-13 mm long, the lobes 7-10 mm long, the dorsal one 5-5.5 mm wide, the two lateral ones 3-4.5 mm wide. Labellum pale yellow, deeper yellow in the middle, 10-12 mm long and wide when spread out, basal part opposite anther densely covered with simple hairs (ca 0.3 mm long), the limb horizontally spreading, 7-8 mm long, 10-12 mm wide, the lateral lobes rounded, 4-5 mm long, 3-5 mm wide, middle lobe reflexed, bilobulate, the lobules ovate-triangular, 2.5-3 mm long, ca 1.5 mm wide, basal claw 3-4.5 mm long, 3 mm wide, lateral staminodes 1-1.5 mm long. Anther 4-5 mm long, 1.5-2 mm wide, glabrous. Style 18-20 mm long. Nectarial glands

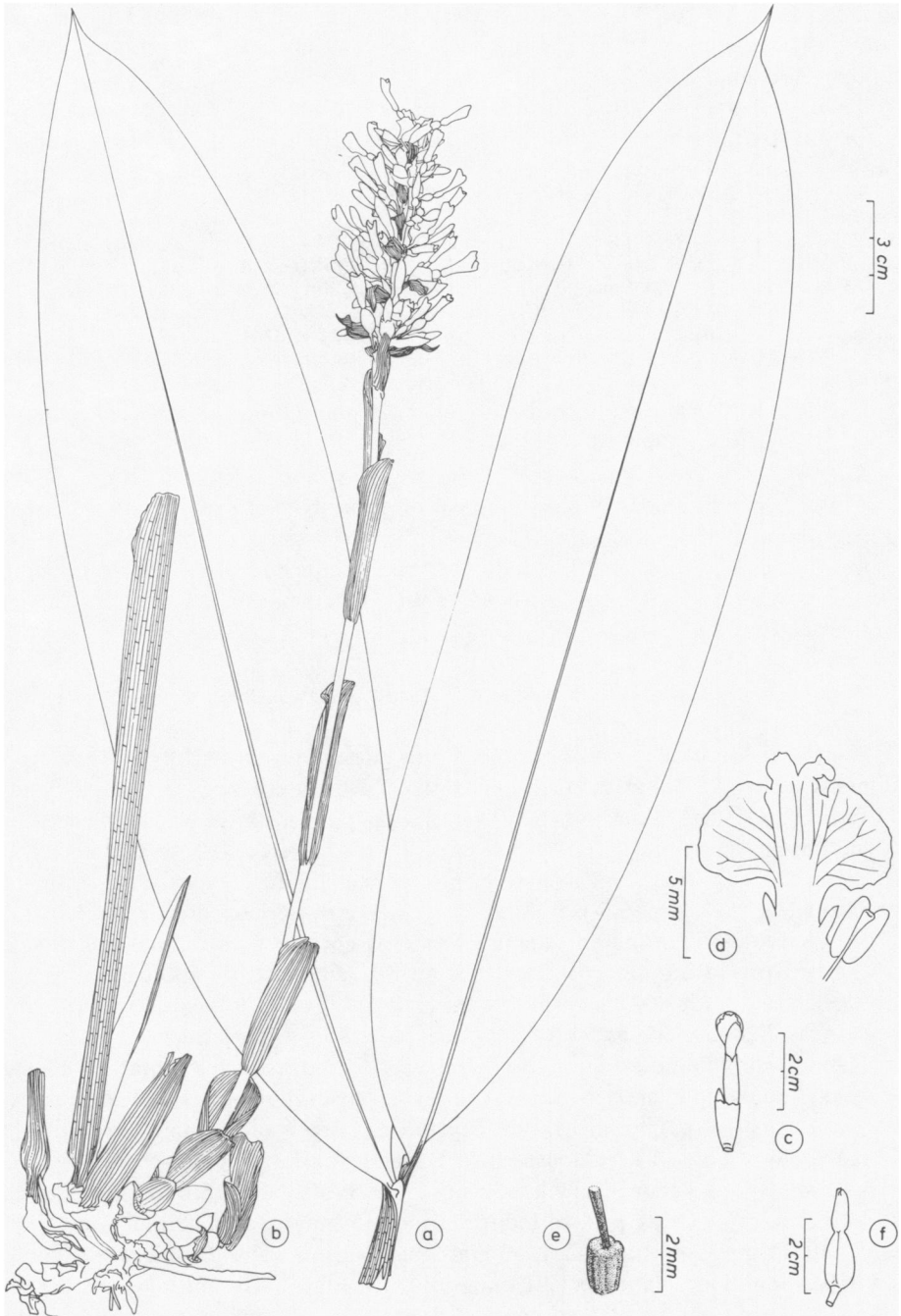


FIG 40. *Renealmia oligosperma* (a-b, Harling 478; c-f, Plowman & Davis 4459). a, leaves; b, inflorescence; c, bracteole enclosing 2 flowers of a cincinnus; d, labellum and stamen; e, nectarial glands; f, fruit.

multilobulate, completely surrounding the style base, ca 2 mm long. Ovary red to pink, ellipsoid. Capsule bright red, ellipsoid to globose, longitudinally grooved, 7-15 mm long, its wall ca 0.1 mm thick when dry (ca 1 mm in living material), 2-7-seeded, seeds 2-3 X 4-5 mm, aril orange.

TYPE. *Eggers 14685* (holotype, B, destroyed; lectotype, L; isotypes, LE, M), Balao, prov. Guayas, Ecuador.

DISTRIBUTION (Fig 61). Ecuador and (?) Bolivia; in forests, from sea-level to 1400 m.

ECUADOR. CAÑAR: *Dodson & Thien 2135*. EL ORO: *Harling & Andersson 14210* (GB, U). GUAYAS: *Hitchcock 20482* (GH, NY, US). LOS RÍOS: *Asplund 5563* (S); *Gentry 9530* (MO, U); *Harling 478* (S). PICHINCHA: *Acosta Solís 13642* (F); *Plowman & Wade Davis 4459* (GH, U); *Prescott 1216* (NY); *Sparre 15154* (S). PROV. ? : *André 594* (NY), *4241* (K, NY).

Renalmia oligosperma can be recognized by a combination of a long and very narrow calyx, few-seeded capsules, and membranous, very soon withering bracts. It is closest to *R. aurantifera* and to another species with a long and narrow calyx, *R. dolichocalyx*.

R. S. Williams 705 (NY), from Charopampa, La Paz, Bolivia, 530 m, probably belongs to this species, but differs in the indument of the rhachis which consists of furcate hairs only.

37. ***Renalmia oligotricha*** Maas, Acta Bot. Neerl. 24: 478. 1976. Fig 41.

Plants 1-2 m tall. Rhizomes 8-12 mm thick. Sheaths striate, 5-7 mm wide, to 10 mm at the base of the plant, glabrous. Ligule ca 1 mm long, glabrous. Petiole absent. Lamina narrowly ovate, caudate at the apex, cuneate at the base, 13-22 cm long, 3-5 cm wide, upper side and particularly the midrib region covered with simple (or furcate) hairs (less than 0.1 mm long), lower side glabrous. Scape 45-50 cm tall, up to 5 mm thick, beset with sheaths up to 8-10 cm long and 0.5-0.6 mm wide, mucronate at their apex. Inflorescence an open, basal thyrse 13-17 cm long and 8-10 cm wide, with 4-5-flowered cincinni. Indument of inflorescence: almost entirely wanting, only the rhachis covered with some scattered, sessile, furcate hairs (ca 0.1 mm long). Bracts persistent, narrowly triangular, acute, 17-40 mm long, 4-7 mm wide. Peduncles 7-20 mm long. Bracteole 10-18 mm long. Pedicels 5-15 mm long. Calyx slightly turbinate, 9-12 mm long, 5-6 mm wide, the lobes depressed ovate-triangular, 1.5-2.5 mm long, 3-4 mm wide. Corolla-bud 13 mm long, the tube 4 mm long, the lobes 9 mm long, 5-7 mm wide. Labellum (in bud) 8 mm long and wide, the limb 6 mm long, 8 mm wide, lateral lobes rounded, 4-5 mm long, 2.5-3 mm wide, middle lobe entire and rounded, 1-1.5 mm long and wide, basal claw 1 mm long, 2.5 mm wide, lateral staminodes 1.5-2 mm long. Anther (in bud), 6 mm long, 3 mm wide, glabrous. Style (in bud) ca 10 mm long. Nectarial glands (partly or) completely surrounding the style base, 1-1.5 mm long. Ovary ellipsoid. Capsule ellipsoid, 9-11 X 6-7 mm, its wall 0.1-0.2 mm thick when dry, 6-seeded, seeds 3 X 4-5 mm.

TYPE. *Bell 431* (holotype, BM, 2 sheets), Chaupi-Sagcha, Pululagua, prov. Pichincha, Ecuador, ca 2000 m, on bank by trail.

DISTRIBUTION (Fig 61). Only known from the type locality.

This species is closely related to another Ecuadorian species, *R. sessilifolia*; it can be distinguished in being almost entirely glabrous, by its basal inflorescence, and its much longer peduncles and pedicels.

A collection by *Sodi* from Ecuador (B, destroyed; photographs F, MO, etc.), distributed as *R. gracillima* Loes (nomen nudum) may well belong to this species.



FIG 41. *Renealmia oligotricha* (a-f, Bell 431). a, leaves; b, inflorescence; c, a single cincinnus; d, calyx and ovary; e, labellum and stamen; f, nectarial glands seen from 2 sides.

38. **Renealmia orinocensis** Rusby, Descr. New Sp. Americ. Pl. 8. 1920. Fig 42.

Plants 1.5-3.5 m tall. Rhizomes 20-25 mm thick. Sheaths reddish brown to dark red (in living plants), more or less shining when dry, slightly reticulate, 8-25 mm wide, densely covered in the grooves with simple, furcate and stellate prickles (less than 0.1 mm long) and towards the reticulations with needle-like, simple hairs (0.5-1 mm long). Ligule 1-2(-5) mm long, hairy like the sheaths. Petiole absent. Lamina narrowly elliptic, acuminate at the apex (acumen 10-15 mm long), cuneate at the base, 40-100 cm long, 6-20 cm wide, upper side glabrous, lower side sparsely to densely covered with furcate hairs (less than 0.1 mm long), the midrib densely to sparsely covered with simple hairs (0.1-1 mm long). Scape prostrate, (5-)15-70 cm tall, up to 6 mm wide, beset with sheaths up to 5-10 cm long and 1-1.5 cm wide. Inflorescence a basal thyrse (10-)20-80 (-130) cm long and (3-)9-13 cm wide, with (1-)6-10(-15)-flowered cincinni, rhachis red (2.5 R 3/10-4/10). Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule densely covered with a grayish tomentum of simple, furcate, and plurifurcate hairs (0.2-0.5 mm long), corolla glabrous. Bracts red (2.5 R 3/10-4/10), soon deciduous, narrowly triangular-ovate to triangular-ovate, 20-40 (-75) mm long, 10-15 mm wide. Peduncles (5-)10-40 mm long. Bracteole 13-27 mm long. Pedicels 10-50(-60) mm long. Calyx red (2.5 R 4/10), tubular to slightly turbinate, 5-10 mm long, 3-4 mm wide, the lobes subobsolete, shallowly triangular, ca 1 mm long, 2 mm wide. Corolla white, 13-14 mm long, the tube 7-8 mm long, the lobes ca 6 mm long, 5-7 mm wide. Labellum white with purple venation, dark yellow in the middle, 10 mm long and 12 mm wide when spread out, basal part opposite anther densely hairy, the limb horizontally spreading, 6 mm long, 12 mm wide, the lateral lobes rounded, 6 mm long, 5 mm wide, middle lobe bilobulate, the lobules triangular, ca 2 mm long, 1-1.5 mm wide, basal claw ca 4 mm long, 2 mm wide, lateral staminodes ca 1 mm long. Anther red-purple, 2-4 mm long, 2 mm wide, glabrous. Style 8 mm long. Nectarial glands partly surrounding the style base, 1-2 mm long. Ovary brownish to green, ellipsoid. Capsule glossy red (5.0 R 4/4), finally black (? according to Sandwith), ellipsoid (to globose), (5-)8-17 X (5-)8-13 mm, its wall 0.1-0.2 thick when dry (ca 1 mm in living material), 7-30-seeded, seeds 3-4 X 3.5-4 mm, aril orange-yellow.

TYPE. *Rusby & Squires 406* (holotype, NY), Eleanor Creek, Lower Orinoco River, Venezuela.

DISTRIBUTION (Fig 60). Northern South America, from Venezuela (Bolívar) in the West to French Guiana in the East; in rain forests, down to sea level, but often at higher elevations, up to 1030 m.

VENEZUELA. BOLIVAR: *Baumrucker & Calzadilla 9 A* (VEN); *Bunting 2945* (MY, U); *Steyermark et al 92996* (VEN). GUYANA. *Anderson sn* (BM); *de la Cruz 4023 pp* (F, GH, MO, NY, US); *Gleason 137* (GH, NY); *Hooker sn* (CGE); *Parker sn* (K); *Sandwith 42* (K), *1048* (K, U); *S. S. & C. L. Tillett 45020* (NY, U); *Whitton 42* (K). SURINAME. *Florschütz & Maas 2843*, *2894* (U); *Irwin et al 55110* (NY, U); *Lanjouw & Lindeman 2640* (U). FRENCH GUIANA. *Crevaux sn* (P); *Oldeman 1477* (CAY); *Sagot 820* (P).

This species is a relative of *R. guianensis* and *R. floribunda*, from both of which it can readily be distinguished by its much larger leaves and its longer peduncles and pedicels.

39. **Renealmia pallida** Maas, Acta Bot. Neerl. 24: 479. 1976. Fig 43.

Plants ca 6 m tall. Sheaths striate, glabrous. Ligule ca 1 mm long, glabrous. Petiole absent. Lamina narrowly elliptic, shortly acuminate at the apex, gradually narrowed towards the base, 99 cm long, 17 cm wide, glabrous. Scape prostrate, ca 150 cm long, up to 10 mm thick, beset with sheaths up to 40 cm long and 1.5 cm wide.

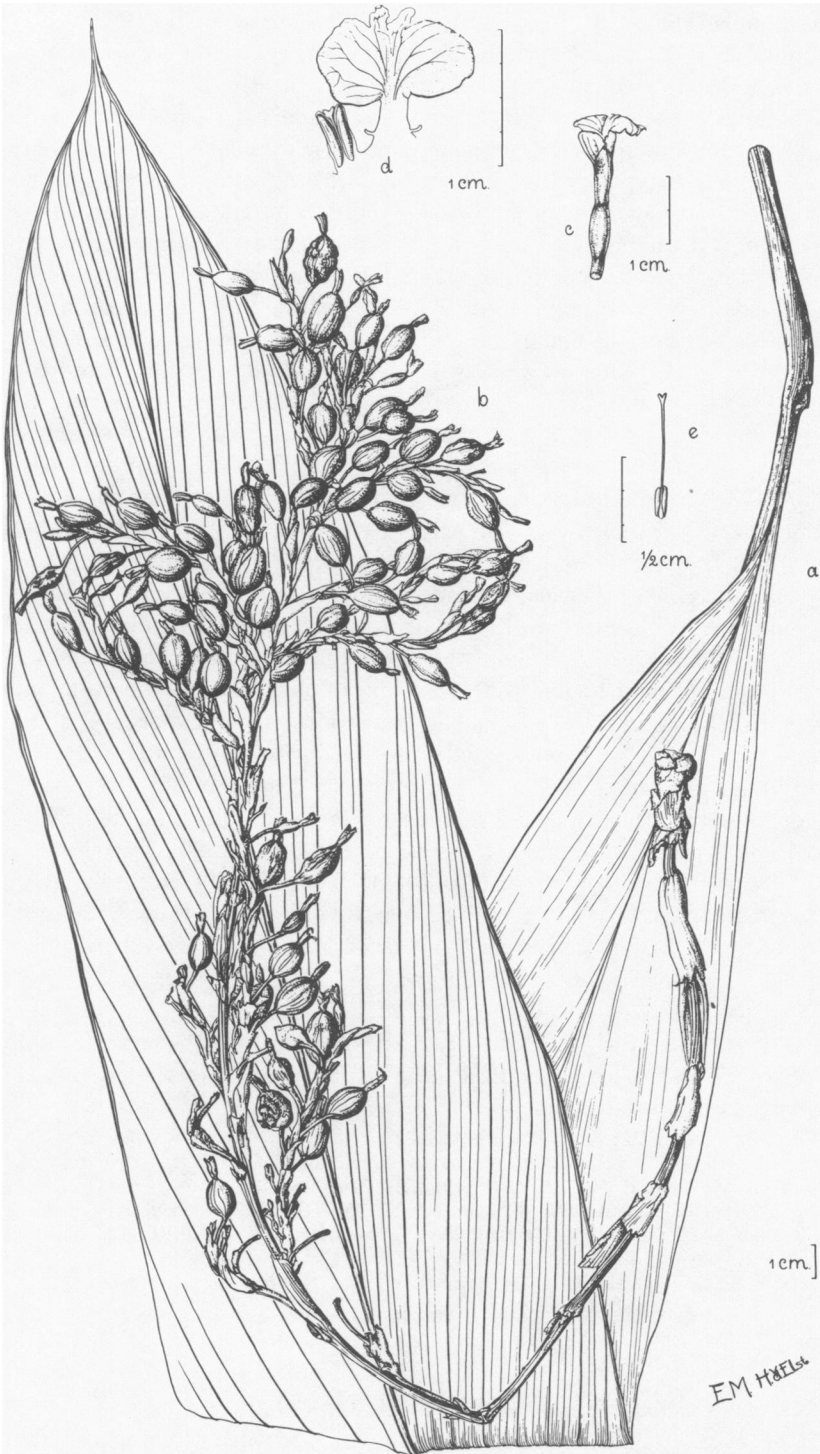


FIG 42. *Renealmia orinocensis* (a-c, Florschütz & Maas 2894). a, leaf; b, infructescence; c, flower; d, labellum and stamen; e, nectarial glands, style, and stigma.

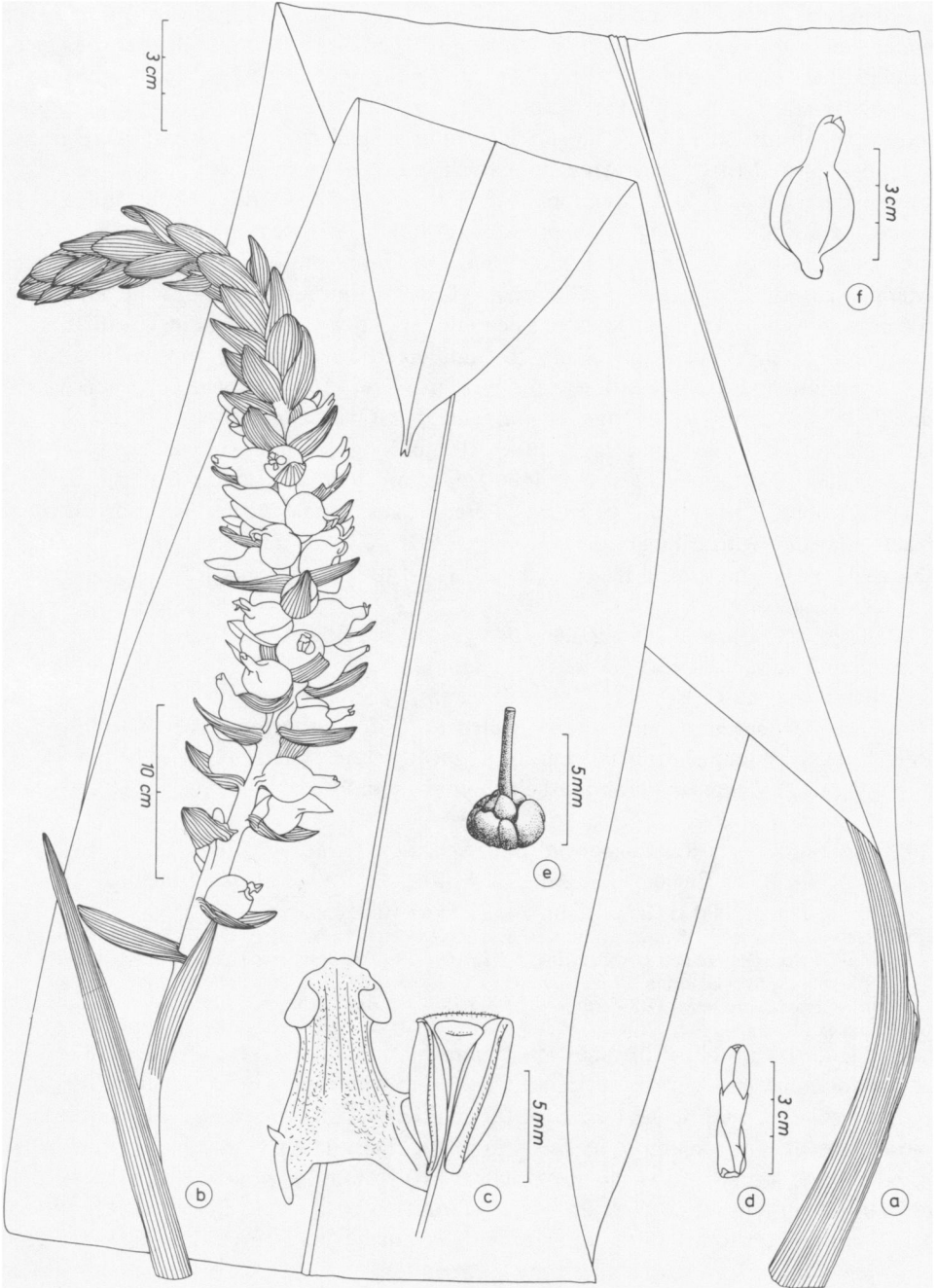


FIG 43. *Renealmia pallida* (a-e, Plowman & Davis 5046). a, leaf; b, part of inflorescence; c, labellum and stamen; d, flower with bracteole; e, nectarial glands; f, young fruit.

Inflorescence a basal raceme ca 40 cm long and 9 cm wide. Indument of inflorescence: none, except for very few (less than 10) simple hairs at the rhachis. Bracts pale green, speckled red (the lower ones) to pale pink, becoming pale creamy-yellow to greenish (the upper ones), narrowly ovate-triangular to ovate-triangular, long-persistent, acute to obtuse, 30-55 mm long, 12-19 mm wide. Peduncles and pedicels 1-2 mm long. Bracteole pale pink, base creamy-white, split to the base, 14-16 mm long. Calyx pale, creamy-pink, tubular, 12-15 mm long, 6-7 mm wide, the lobes depressed-ovate to broadly ovate, 2-5 mm long, 5-6 mm wide. Corolla pale yellow, 24-25 mm long, the tube ca 10 mm long, the lobes 14-15 mm long, the dorsal one 10 mm wide, the two lateral ones ca 8 mm wide. Labellum pale yellow, 13 mm long, 9 mm wide when spread out, basal part opposite anther densely covered with simple hairs (ca 0.5 mm long) and apically some furcate hairs, the limb erect, 5 mm long, 9 mm wide, lateral lobes involute and forming a tube 5-6 mm in diameter, 2-3 mm long, 2-2.5 mm wide, middle lobe ca 2 mm long (?) and 4 mm wide, basal claw 8 mm long, 5 mm wide, lateral staminodes ca 1 mm long. Anther 10 mm long, 5.5 mm wide, glabrous. Style 23 mm long. Nectarial glands multi lobulate, completely surrounding the style base, 1-1.5 mm long. Ovary globose, cream-colored. Capsule pale cream, maturing purple-black, ellipsoid, with 3 longitudinal grooves, 21-25 X 15-22 mm, its wall ca 0.5 mm thick when dry (2-5 mm in living material), 125-140 seeded, seeds 1.5-2 X 2.5-3 mm, aril red-orange.

TYPE. *Plowman & Wade Davis 5046* (holotype, U; isotype, GH), between Atalaya and Salvación, 650 m, pr. Manu, dep. Madre de Dios, Peru.

DISTRIBUTION (Fig 57). Only known from the type locality.

This new species is very closely related to *R. dermatopetala*. It is aberrant, though, by very long sheaths (40 cm long!) on the scape, relatively short peduncles and pedicels (1-2 mm long), and in being almost entirely glabrous.

40. ***Renalmia petasites*** Gagnepain, Bull. Soc. Bot. France **49**: 26. 1902; K. Schumann in Engler, Pflanzenreich **4**. 46: 302. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **15A**: 610. 1930. Fig 44.

Renalmia longipes K. Schumann in Engler, Pflanzenreich **4**. 46: 305. 1904. Syntypes. *F. Müller 462* (K), Itajaí, Sta. Catarina, Brazil; *Ule 249* (B, destroyed), São Francisco, Serra Laranjeira, Sta. Catarina, Brazil; *Ball sn.*, 21-23 Jul 1882 (K), Tijuca, Guanabara, Brazil.

Renalmia exaltata sensu O. G. Petersen in Martius, Fl. Bras. **3**(3): 41. 1890, in part; not of Linnaeus filius.

Plants 1-3 m tall. Rhizomes 10-20 mm thick, the roots 1-3 mm thick. Sheaths striate (or sometimes slightly reticulate), 7-20 mm wide, sparsely to rather densely covered with simple prickles (less than 0.1 mm long). Ligule ca 1 mm long. Petiole mostly absent, but sometimes up to 20 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen 10-15 mm long), cuneate at the base, (25-)40-62 cm long, (5-)8-16.5 cm wide, glabrous on both sides. Scape erect, pink, 15-50 cm tall, up to 8 mm thick, beset with sheaths up to 6-15 cm long and 0.6-1.5 cm wide. Inflorescence a basal raceme 4-25 cm long and 3-13 cm wide, rhachis pink. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, and ovary sparsely to rather densely covered with simple (and rarely some sessile, furcate), erect, white hairs (0.1-0.3 mm long), corolla sparsely so, capsule glabrous or nearly so. Bracts pink, rather long persistent, narrowly elliptic-obovate, obtuse or acute, (8-)12-70 mm long, (3-)5-16 mm wide. Peduncles pink, 3-10(-17) mm long. Bracteole pink, 13-25 mm long. Pedicels pink, 5-35 mm long. Calyx pinkish-red to pink, turbinate to tubular, its longitudinal veins often obsolete, 10-17



FIG 44. *Renealmia petasites* (a-c, Plowman 2778; d-g, Sucre 9990). a, leaf; b, inflorescence; c, infructescence; d, flower; e, labellum and stamen; f, stigma seen from 2 sides; g, nectarial glands.

mm long, (4-)6-12 mm wide, the lobes depressed-ovate, 2-4 mm long, 4-8 mm wide. Corolla white, 20-28 mm long, the tube 9-15 mm long, the lobes 10-13 mm long, 6-9 mm wide. Labellum white, tinged with pink towards the middle, 9-10 mm long and 8-10 mm wide when spread out, basal part opposite anther densely hairy, the limb erect, 5 mm long, 8-10 mm wide, lateral lobes involute, rounded, middle lobe entire or bilobulate, lobules very small and rounded, basal claw 4 mm long, 2-3 mm wide, lateral staminodes pinkish white, ca 2 mm long. Anther 6-7 mm long, 2.5 mm wide, densely hairy on the flanks. Style 22-23 mm long. Nectarial glands completely surrounding the style base, 2-2.5 mm long. Ovary red, ellipsoid. Capsule red, globose to ellipsoid, 10-25 X 8-16 mm, its wall ca 0.2 mm thick when dry, 15-55-seeded, seeds 2.5-4.5 mm diam.

TYPE. *Glaziou 20515* (lectotype, P; isolectotypes, C, K, P), Corcovado, 2 Nov 1893, Guanabara, Brazil. Of the three syntypes I select the collection just cited as lectotype. The other syntypes are: *A. de Saint-Hilaire sn, ann. 1816-1821* (P), Minas Gerais, Brazil, and *Weddell 359, anno 1843* (P), Corcovado, near Rio de Janeiro, Guanabara, Brazil.

DISTRIBUTION (Fig 58). Coastal rain forests of southeastern Brazil, from sea-level up to 700 m.

BRAZIL. ESPIRITO SANTO: *Brade 19230* (RB). GUANABARA: *André sn, 22 Aug 1890* (P); *Araujo 402* (RB, U); *Burchell 2389* (BR, K, P); *Dionisio & Otavio 230* (RB); *Duarte 8153, 8747* (RB); *Emygdio sn* (R); *Emygdio & Dansereau 387* (R); *Fromm 40* (R); *Gilt & Dionisio 1161* (RB); *Glaziou 3123 pp, 2 Dec 1869* (BR, P); *Guimarães 14* (RB); *Hoehne & Gehrt sn* (SP 17402); *Kuhlmann 6103* (RB); *Luschnath sn* (KIEL); *Martius 56* (M); *Miers 3094* (K), *sn* (BM); *E. Pereira 1964* (RB); *Plowman 2778 (= Sucre 5078)* (ECON); *Raben sn, ann. 1834-1838* (C); *Schwacke 5774* (RB); *Segadas Vianna 578* (R); *Sucre 9990* (RB, U); *Ule 4180* (R); *Usteri 11 b* (P, SP); *Vidal sn* (R46196); *Warming 506* (C); *Weddell 359, anno 1858* (G); *Wilkes sn, ann. 1838-1842* (GH). MINAS GERAIS: *Krieger 1031* (SP). PARANÁ: *Dusén 17132* (S); *Hatschbach 14712* (US), *27077* (MBM). SANTA CATARINA: *Klein & Bresolin 6115* (FLOR); *Klein et al 6786* (FLOR); *Reitz C 1801* (GH, US), *C 1912* (GH, S, US), *3684* (S); *Reitz & Klein 4027* (GH, NY, S, US); *Schwacke 5027* (RB). SAO PAULO: *Brade 7225* (SP); *Gehrt sn* (SP 3395); *Hoehne & Gehrt sn, 6 Oct 1936* (SP, US); *Kuhlmann sn* (RB 132076); *Kuhlmann & Lemos sn* (SP 45786); *Löfgren & Edwall 2698* (SP); *Usteri sn, 25 Jul 1907* (P, SP). WITHOUT LOCALITY. *Glaziou 8497* (P); *Lund 5a and 5b* (C), *sn, anno 1829* (C), *sn, ann. 1825-1827* (C); *Nadeaud sn* (P).

Renealmia petasites is a rather variable species: specimens from the Rio de Janeiro region are characterized by a rather compact inflorescence, whereas most of the material from Santa Catarina has a lax inflorescence. As many gradual transitions between these two inflorescence types exist, the extremes do not merit specific or even varietal rank. Its closest relative is *R. chrysotricha*.

Mosén 2966 (S), from Sorocaba, Santos, São Paulo, Brazil, is related to this species by its fruit, but it shows also some affinity to *R. brasiliensis* by its reticulation pattern, and to *R. chrysotricha* by its indument.

41. *Renealmia pluriplacata* Maas, Acta Bot. Neerl. 24: 479. 1976. Fig 45.

Renealmia mexicana sensu Woodson, Ann. Missouri Bot. Gard. 32: 60. 1945; not of Klotzsch ex O. G. Petersen.

Plants 0.75-1.80 m tall. Rhizomes to 10 mm thick. Sheathes distinctly reticulate, 5-10 mm wide, to 20 mm at the base of the plant, rather densely (to sparsely) covered with simple and furcate prickles (to 0.2 mm long). Ligule ca 1 mm long. Petiole up to 90 mm long, hairy like the sheathes. Lamina narrowly elliptic, shortly acuminate at the apex (acumen 5-10 mm long), cuneate at the base, 25-56 cm long, (5-)7-16 cm wide, strikingly 20-35-plicate, upper side glabrous or sparsely covered with simple hairs (0.1-0.2 mm long) along the midrib, lower side sparsely to densely covered with simple (rarely furcate) hairs (0.1-0.4 mm long) towards the margins,

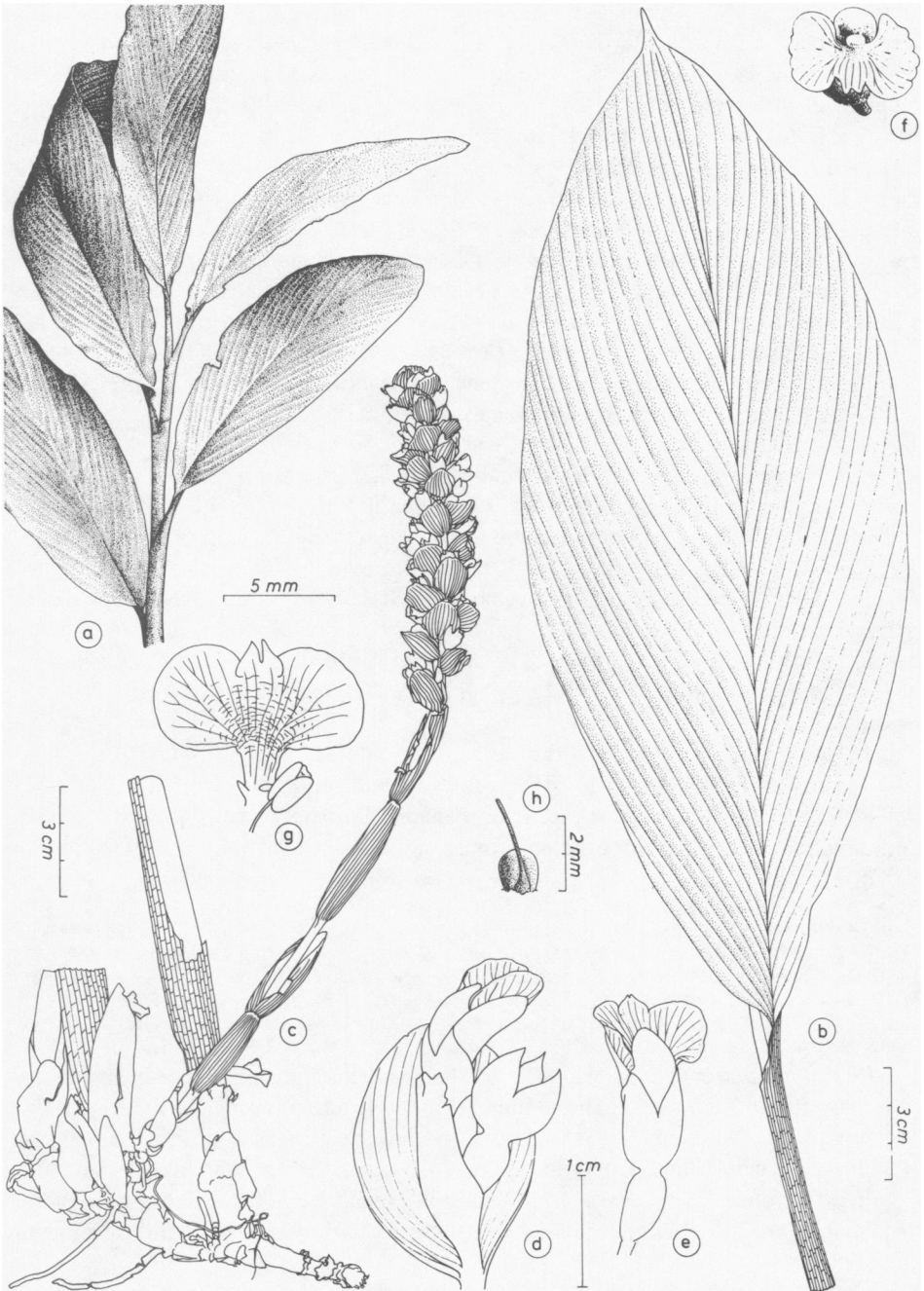


FIG 45. *Renealmia pluriplicata* (a, Maas & Dressler 674; b, c, Kennedy et al 1109; d-h, Maas 1521). a-b, leaves; c, inflorescence; d, bract with cincinnus; e, flower; f, flower; g, labellum and stamen; h, nectarial glands.

rarely glabrous. Scape erect, 10-30 cm tall, up to 4 mm thick, beset with red sheaths up to 3-7 cm long and 0.8-1.5 cm wide. Inflorescence a congested, basal thyrse (2.5-)8-22 cm long and (1.5-)3-5 cm wide, with 2-4-flowered cincinni, rhachis red. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, and calyx rather densely to densely covered with simple and furcate hairs (0.5-0.3 mm long), ovary and capsule glabrous or sparsely (to rather densely) hairy, corolla glabrous. Bracts pale to dark red, herbaceous, rather long persistent, ovate-triangular to broadly ovate-triangular, obtuse, 10-35 mm long, 10-20 mm wide. Peduncles pale red, to 5 mm long, the lower ones sometimes concaulescent, the adnate part to 8 mm long. Bracteole red, 8-12 mm long. Pedicels pale red, to 5 mm long. Calyx pale to dark red, turbinate to urceolate, 4-10 mm long and wide, the lobes triangular to shallowly triangular, 1-3 mm long, 2-3 mm wide. Corolla creamy-white to yellow, 12 mm long, the tube ca 5 mm long, the lobes 7 mm long, the dorsal one 6 mm wide, the two lateral ones 4-5 mm wide. Labellum creamy-white, dark yellow in the middle, 10 mm long and 14 mm wide when spread out, basal part opposite the anther densely covered with simple hairs, the limb horizontally spreading, its surface densely "wrinkled," 7 mm long, 14 mm wide, the lateral lobes rounded, 6.5 mm long, 4.5 mm wide, middle lobe reflexed, bilobulate, the lobules triangular-ovate, 1.5-2 mm long, basal claw 3 mm long, 2-2.5 mm wide, lateral staminodes pink, ca 0.5 mm long. Anther pale pink, 3 mm long, 1.5-2 mm wide, glabrous. Style 6-7 mm long. Nectarial glands partly surrounding the style base, 1.5 mm long. Ovary red, ellipsoid. Capsule red, maturing black, ellipsoid to globose, 5-10 mm long, its wall ca 0.1 mm thick when dry (ca 1 mm in living material), 1-7 seeded, seeds dark brown, 2-3 X 4 mm, aril orange.

TYPE. *Maas & Dressler 1679* (holotype, U; isotypes, CR, F, K, MO, NY), El Llano-Carthy Road, 8-10 km from El Llano, forest, 400 m, prov. Panamá, Panama.

DISTRIBUTION (Fig 61). Costa Rica, Panama, Colombia, Ecuador, and (?) Peru; in primary rain forests, in woods, along forest roads, from sea-level up to 1000 m.

COSTA RICA. *Burger & Burger 8011* (F, U); *Burger & Stolze 5854* (F); *Jiménez M. 2031* (CR, F, NY); *Maas 867, 1296* (U), *1521* (COL, P, U); *Pittier 16917* (K, US); *Raven 21554* (F); *Rowlee & Stork 677* (US); *Standley & Valerio 49005* (US). PANAMA. *P. H. Allen 2151* (MO), *3758* (EAP); *Croat 27073, 27178* (MO, U); *Kennedy & Dressler 1247* (DAV); *Kennedy et al 1109* (GH, COL, U); *Luteyn 1155* (DUKE); *Luteyn & Kennedy 1631, 1753* (DUKE); *Maas & Dressler 674* (K, MO, U); *Maas et al 1724* (U); *Rowlee & Stork 1012* (US); *Steyermark & Allen 16743* (MO); *Stork 131* (US). COLOMBIA. CHOCÓ: *Duke 11225, 11448* (U). ECUADOR. ESMERALDAS: *Sparre 18176* (S). PERU. CUZCO: *Vargas C. 15193* (CUZ, US)?

Renealmia pluriplicata is characterized by its distinctly reticulate leaf-sheaths and by its red, obtuse bracts. The indument of the lamina is completely different from that of its closest relative, *R. vallensis*, the lower side of leaf in the former being covered mainly with simple hairs, that of the latter, in contrast, with stellate hairs. In the field its pluriplicate leaves (from which the specific epithet is derived) are very conspicuous, but in herbarium material the plicae are only visible as slightly prominent veins.

The only Peruvian collection cited may represent a distinct variety, but the material is too incomplete to justify such a decision.

42. *Renealmia puberula* Steyermark, *Phytologia* 9: 340. 1964.

Fig 46.

Plants 1-2 mm tall. Rhizomes 10-15 mm thick. Sheaths striate, 7-15 mm wide, to 20 mm at the base of the plant, densely covered with hairs of the compass-needle type (0.3-0.5 mm wide) sometimes with the branches furcate, and mixed with stellate

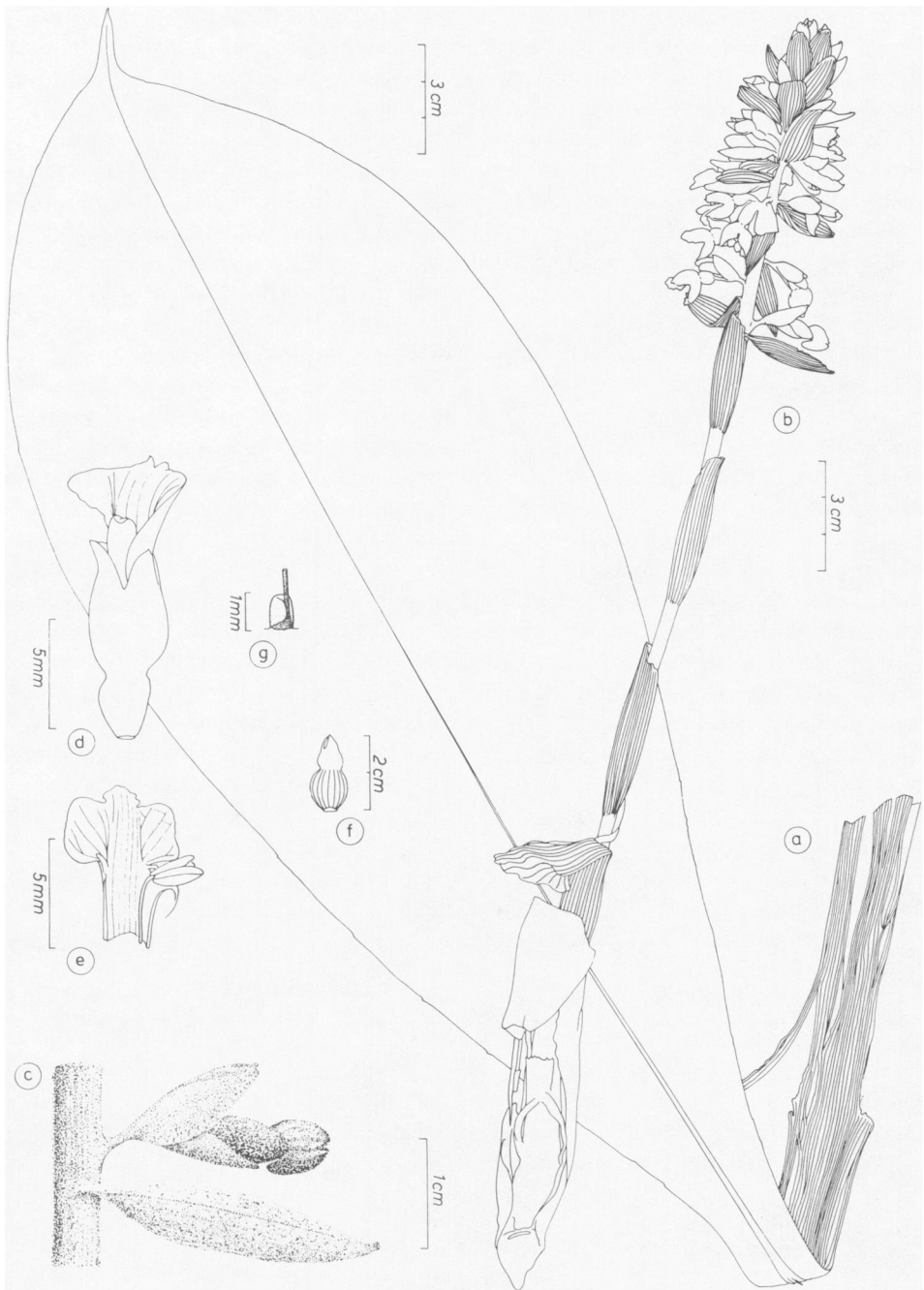


FIG 46. *Renealmia puberula* (a-c, *Asplund 19585*; d-g, *Plowman & Davis 4484*). a, leaf; b, inflorescence; c, bract with cincinnus, showing concourse of the basal stalk of the cincinnus with the rachis; d, flower; e, labellum and stamen; f, fruit; g, nectarial glands.

scales (less than 0.1 mm long). Ligule ca 1 mm long, hairy like the sheaths. Petiole absent. Lamina narrowly obovate, acuminate at the apex (acumen 5-15(-20) mm long), the base gradually decurrent into the sheath, (18-)25-45 cm long, 6-15.5 cm wide, upper side glabrous, but midrib and margins rather densely covered mainly with compass-needle hairs (to 0.6 mm wide) and (particularly towards the margins) with simple hairs, lower side densely covered with compass-needle hairs (0.2-0.5 mm wide). Scape green, 10-30 cm tall, up to 3 mm thick, beset with sheaths up to 3-10 cm long and 0.5-1 cm wide. Inflorescence a basal thyrse 5-10 cm long and 3.5-4.5 cm wide, with 3-flowered cincinni, rhachis green. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule rather densely to densely covered with shortly stalked, furcate to plurifurcate hairs (to 0.5 mm wide), the branches of the hairs ascending or appressed (compass-needle type); corolla sparsely hairy. Bracts green (but "dull brick reddish orange" in the type), persistent, triangular to narrowly triangular, acute, 10-25 mm long, 6-10 mm wide. Peduncles 1-3 mm long, the lower ones concaulescent, the adnate part to 5 mm long. Bracteole 8-9 mm long. Pedicels 5-10 mm long. Calyx red, becoming red-orange and fleshy in fruit, turbinate to urceolate, 4-7 mm long and wide, the lobes triangular to narrowly triangular, 1-3 mm long. Corolla white to pale yellow, 11-12 mm long, the tube 5-6 mm long, the lobes 5-6 mm long, 4-5 mm wide. Labellum white with a yellow blotch in the centre, 7.5-8 mm long and wide when spread out, basal part opposite the anther densely hairy, the limb horizontally spreading, 3.5-4.5 mm long, 7.5-8 mm wide, the lateral lobes rounded, ca 4 mm long, 3 mm wide, middle lobe bilobulate, the lobules irregularly deltate, 1-1.5 mm long, basal claw 3-4 mm long and 1.5-2 mm wide, lateral staminodes ca 1 mm long. Anther pale red, 3 mm long, 1.5-2 mm wide, glabrous. Style 9-10 mm long. Nectarial glands only partly surrounding the style base, ca 2 mm long. Ovary red, ellipsoid. Capsule red, globose, 3-7(-9) mm in diameter, its wall 0.1-0.2 mm thick when dry (ca 1 mm in living material), 3-7 seeded, seeds 2-2.5 X 3-4 mm.

TYPE. *Steyermark 54901* (holotype, F; isotypes, MO, NY), below Finca Black, along Río Pastaza, between Topo and Mera, 1212 m, prov. Pastaza, Ecuador.

DISTRIBUTION (Fig 61). Ecuador, the province of Pastaza and Tungurahua; in forests, between 900 and 1600 m.

ECUADOR. PASTAZA: *Asplund 18429, 19159, 19288, 19457, 19585* (S); *Harling 3823, 3899* (S); *Harling, Storm & Ström 10139* (GB, U); *Lugo 274* (S); *Plowman & Wade Davis 4484* (U). TUNGURAHUA: *Lugo 1920* (GB, U).

This species has its closest relative in *R. concinna*, with which it shares the very typical indument of compass-needle hairs on the lower side of the lamina.

Goudot 133 (K) from La Balsa, Quindio, Colombia is related to *R. concinna* and *R. puberula*, but differs from both in its terminal inflorescence.

43. *Renealmia pyramidalis* (Lamarck) Maas, Acta Bot. Neerl. 24: 479. 1976. Fig 47.

Alpina racemosa alba carnacori foliis Plumier, Mscr. 5: t. 48; Plumier, Nov. Pl. Americ. Gen. 26. t. 11. 1703; van Royen, Fl. Leyd. Prodr. 12. 1740; Plumier, ed. Burmann, Pl. Americ. 11. t. 20. 1755 (excl. syn). (\equiv *Alpina racemosa* Linnaeus).

Alpina racemosa Linnaeus, Sp. Pl. ed. 1. 1: 2. 1753; ? Gärtner, Fruct. Sem. Pl. 1788 (t. 12, f. 2 as *Alpina caribaea*); Roscoe, Trans. Linn. Soc. 8: 343. 1807; Roemer & Schultes, Syst. Veg. 1: 19. 1817; Horaninow, Prodr. 35. 1862; Wildenow, Sp. Pl. 1: 11. 1797 (in part); not of Swartz, Observ. Bot. 4. 1791; nor of Velloso, Fl. Flum. 1: t. 3, ed. Netto 2. 1881; nor of Sessé & Mociño, La Naturaleza Ser. 2. 2: 3. 1897.

Amomum pyramidale Lamarck, Encycl. Méthod. Bot. 1: 137. 1783; Descourtiz, Fl. Pitt. Med. Ant. 3: 91. t. 170. 1827 (syn. in part), (\equiv *Alpina racemosa* Linnaeus).



FIG 47. *Renealmia pyramidalis* (redrawn from Plumier, Mscr. t. 48 and Pl. Americ. t. 20. 1755).

Renalmia racemosa (Linnaeus) A. Richard in de la Sagra, Hist. Fis. Pol. Nat. Cub. Fanerogam. 11: 254. 1850; Gagnepain, Bull. Soc. Bot. France 50: 201. 1903; K. Schumann in Engler, Pflanzenreich 4. 46: 288. f. 38 n-o. 370. 1904; Hodge, Lloydia 17: 177. 1954; not of Poeppig & Endlicher, Nov. Gen. & Sp. 2: 26. 1838; nor of Grisebach, Cat. Pl. Cub. 256. 1866; nor of O. G. Petersen in Martius, Fl. Bras. 3(3): 47. t. 11, f. 3. 1890.

Renalmia caribaea Grisebach, Fl. Br. W. Ind. Isl. 601. 1864; O. G. Petersen in Martius, Fl. Bras. 3(3): 47. 1890; Duss, Fl. Ant. Franç. 3: 580. 1896. TYPE: *Imray 102* (holotype, GOET), Dominica.

Alpinia caribaea (Grisebach) O. Kuntze, Rev. Gen. 1: 690. 1891.

?*Alpinia plumieri* Krause, Beih. Bot. Centralbl. 32. 2: 338. 1914. Type. *Krause sn* (holotype, B, destroyed), Soufrière, St. Vincent.

Plants 1-3 m tall. Rhizomes 10-20 mm thick. Sheaths striate, 8-10 mm wide, to 20 mm at the base of the plant, glabrous. Ligule 3-4 mm long, glabrous. Petiole absent. Lamina narrowly elliptic, acuminate at the apex (acumen 10-20 mm long), cuneate at the base, (15-)25-45 cm long, (5-)8-12(-15) cm wide, glabrous on both sides. Inflorescence a terminal thyrse 6-25 cm long and 4-8 cm wide, with 2-4-flowered cincinni, rhachis 2-5 mm thick. Indument of inflorescence: rhachis, peduncles, bracteoles, pedicels, calyx, ovary, and capsule sparsely to densely covered with erect, simple hairs (0.1-0.2 mm long), bracts and corolla sparsely so or glabrous. Bracts white, deciduous during fructification, narrowly triangular-ovate to triangular-ovate, acute or obtuse, 10-50 mm long, 4-10 mm wide (the lower, sterile ones 60-200 X 10-15 mm). Peduncles 5-20 mm long. Bracteole white, 13-20 mm long (according to Gagnepain 6-8 mm long ??). Pedicels 5-20 mm long. Calyx white to pale green, slightly turbinate, 7-11 mm long, 5-8 mm wide, the lobes deltate to shallowly triangular, 2-4 mm long, 4-5 mm wide. Corolla white at the base, 15-19 mm long, the tube 8-10 mm long, the lobes white to pink, 7-9 mm long, 4-8 mm wide. Labellum pale pink to white, 8-10 mm long and 8-11 mm wide when spread out, glabrous, the limb horizontally spreading, ca 4 mm long, 8-11 mm wide, the lateral lobes rounded, 2-4 mm long, (3-)4-5 mm wide, the middle lobe bilobulate, the lobules triangular, 2-3 mm long, ca 2 mm wide, basal claw 4 mm long, 2-3 mm wide, lateral staminodes 1-1.5 mm long. Anther 4-6 mm long, 1-2 mm wide, glabrous. Style 15-16 mm long. Nectarial glands multilobulate, completely surrounding the style base, ca 2 mm long. Ovary green, narrowly ellipsoid. Capsule green, maturing red and finally black, ellipsoid, 10-17 X 5-10 mm, its wall ca 0.2 mm thick when dry (ca 2 mm in living material), 10-25-seeded, seeds 2-3 X 3-4 mm, aril orange.

TYPE. *Table 48* from an unpublished manuscript by *Plumier*, since the original herbarium material collected by Plumier or Surian in Martinique could not be located with certainty.

DISTRIBUTION (Fig 59). A common species in the Lesser Antilles; in lowland or mountain rain forest, from sea-level to 1300 m.

DOMINICA. *J. S. Beard 651* (GH); *P. Beard 1473* (GH, K, S, US); *Cowan 1609* (IJ, NY, P, US); *Crudy sn* (M); *Hodge 345* (BM, GH, US), *346* (BM), *347* (NY), *348* (BM), *1376* (GH), *2261* (NY), *2396* (GH), *3979* (GH), *W. H. & B. T. Hodge 1074, 1216, 1734, 1773, 2622, 2819, 3431, 3569* (GH); *Imray 418, sn* (K); *Lloyd 193* (F, NY); *Proctor Cooper 193* (GH, NY, US); *Ramage sn* (BM, K); *Shillingford 514* (DUKE); *A. C. Smith 10215* (GH, IJ, K, S, US); *Webster 13330* (DUKE); *Wilbur et al 7406, 8101, 8206* (DUKE); *Zuzi 284* (K). GUADELOUPE. *L. H. & E. Z. Bailey 158* (US); *Duchassaing sn* (P); *Duss 3328* (F, NY, US); *Forsström sn* (S); *Quentin 467* (P); *Questel 2270* (P, US); *L. C. Richard sn* (P); *L. Rodriguez 2777* (P, US), *4444* (P); *Thiébaud 9* (P). MARTINIQUE. *Bélanger 118, 327, 350* (P); *Duperrey sn* (P); *Duss 2217* (LE, NY, US); *Hahn 418* (K), *422* (BM, GH, K, P); *Isert sn* (C); *Mouret 577* (P); *Plée 690, sn* (P); *Rivoire sn* (P); *Rodriguez 3635* (P); *von Rohr (?) 44* (BM); *Sastre 378* (P); *Stehlé 3512* (US); *H. & M. Stehlé 4643* (US), *5813* (GH, LIL), *6186* (US). ST. LUCIA. *Beard 1158* (F, GH, S, US); *Box 1957* (BM); *Crudy sn* (M); *Proctor 17946* (GH, IJ). ST. VINCENT. *Anderson sn* (K); *Cooley 8297* (GH, IJ); *Eggers 6755* (L, S, US); *Howard 11155* (BM, GH, IJ); *Morton 5114* (US); *H. H. & G. W. Smith 817* (K, NY). "IND. OCC." *Forsström sn* (S); *de Ponthieu sn* (BM); *Surian 68* (P).

Renealmia pyramidalis is endemic to the Lesser Antilles; it cannot easily be confused with *R. jamaicensis* from which it differs by its white bracts, much larger leaves, and indument.

This species has often been incorrectly named *Renealmia racemosa* (Linnaeus) A. Richard. The names which have played an important role in this nomenclatural confusion are:

1. *Alpina racemosa alba*, Plumier, Mscr. 5: t. 48. This unpublished manuscript of Plumier now is deposited at Paris (Bibl. Centr. Mus. Hist. Nat.). In 1755 Plumier published this species in his *Plant. Americ.* (using his original drawing, with some minor alterations). His description of *Alpinia* (1703) was probably also based on the same material. The original Plumier herbarium material (+drawing) also served for Linnaeus' (1753) description of *Alpinia racemosa*. According to Gagnepain (1903), who made an excellent and intensive study of the nomenclature of the present, *R. pyramidalis* and *R. jamaicensis*, there is a herbarium specimen of Plumier's *Alpinia racemosa alba* preserved in the Paris herbarium: "Le genre *Alpinia* est fondé sur la plante figurée par Plumier, (*Amer. tab. 20*), l'*Alpinia racemosa* de Linné, dont il reste un spécimen dans son herbier..."
2. *Amomum racemosum* Lamarck (1783), a superfluous name for *Amomum cardamom* Linnaeus.
3. *Amomum racemosum* Ruiz & Pavón (1798), illegitimate name, since the heterotypic *Amomum racemosum* was already published by Lamarck fifteen years before.
4. *Renealmia racemosa* Poeppig & Endlicher (1838). Based on *Amomum racemosum* Ruiz & Pavón. This is the correct name for the Peruvian and Bolivian species, formerly called *R. micrantha* or *R. ruiziana*.
5. *Renealmia racemosa* (Linnaeus) A. Richard (1850). This combination is invalid since the name *Renealmia racemosa* Poeppig & Endlicher was already available. The next oldest basionym available for the species under discussion is Lamarck's *Amomum pyramidale* (1783), based on Linnaeus' *Alpinia racemosa*. Lamarck's epithet "pyramidale" is not invalid, since he had already given the name *Amomum racemosum* to another species (in the same paper, see under 2).

Conclusion: the combination *Renealmia pyramidalis* (Lamarck) Maas had to be made for this Lesser Antillean species.

44. ***Renealmia racemosa* Poeppig & Endlicher, Nov. Gen. & Sp. 2: 26. 1838. Fig 48.**
Amomum racemosum Ruiz & Pavón, Fl. Peruv. & Chil. 1: 2. t. 1 b. 1798, not of Lamarck 1783.
Alpinia ruiziana Steudel, Nomencl. Bot. ed. 2. 63, 78, 441. 1841 (≡ *Amomum racemosum* Ruiz & Pavón, not of Lamarck).
Renealmia ruiziana (Steudel) Horaninow, Prodr. 33. 1862; Loesener, Notizbl. Bot. Gart. Berl. 11: 88. 1931.
Renealmia micrantha K. Schumann in Engler, Pflanzenreich 4.46: 298. 1904; Macbride, Field Mus. Nat. Hist. Bot. Ser. 13: 729. 1936. Type. Of the three syntypes designated by K. Schumann the following is selected as lectotype: *Bang 1237* (lectotype, NY; isolectotypes, CAL, GH, K, M, MO, NY, US), Espíritu Santo, vicinity of Cochabamba, prov. Cochabamba, Bolivia.

Plants 1-2.5 m tal. Rhizomes 10-15 mm thick. Sheaths striate, 5-10 mm wide, to 15 mm at the base of the plant, glabrous. Ligule ca 1 mm long, glabrous. Petiole 0-10 mm long, glabrous. Lamina narrowly ovate-elliptic, acuminate at the apex (acumen 10-20 mm long), cuneate at the base, (15-)20-42 cm long, (2.5-)5-11 cm wide, glabrous on both sides. Scape 15-50(-90) cm tall, to 4 mm thick, beset with sheaths up to 7-16 cm long and 0.6-1 cm wide. Inflorescence a basal thyrses 10-30 cm long and 3.5-7 cm wide, with 2-4(-5)-flowered cincinni, rhachis olive-green. Indument

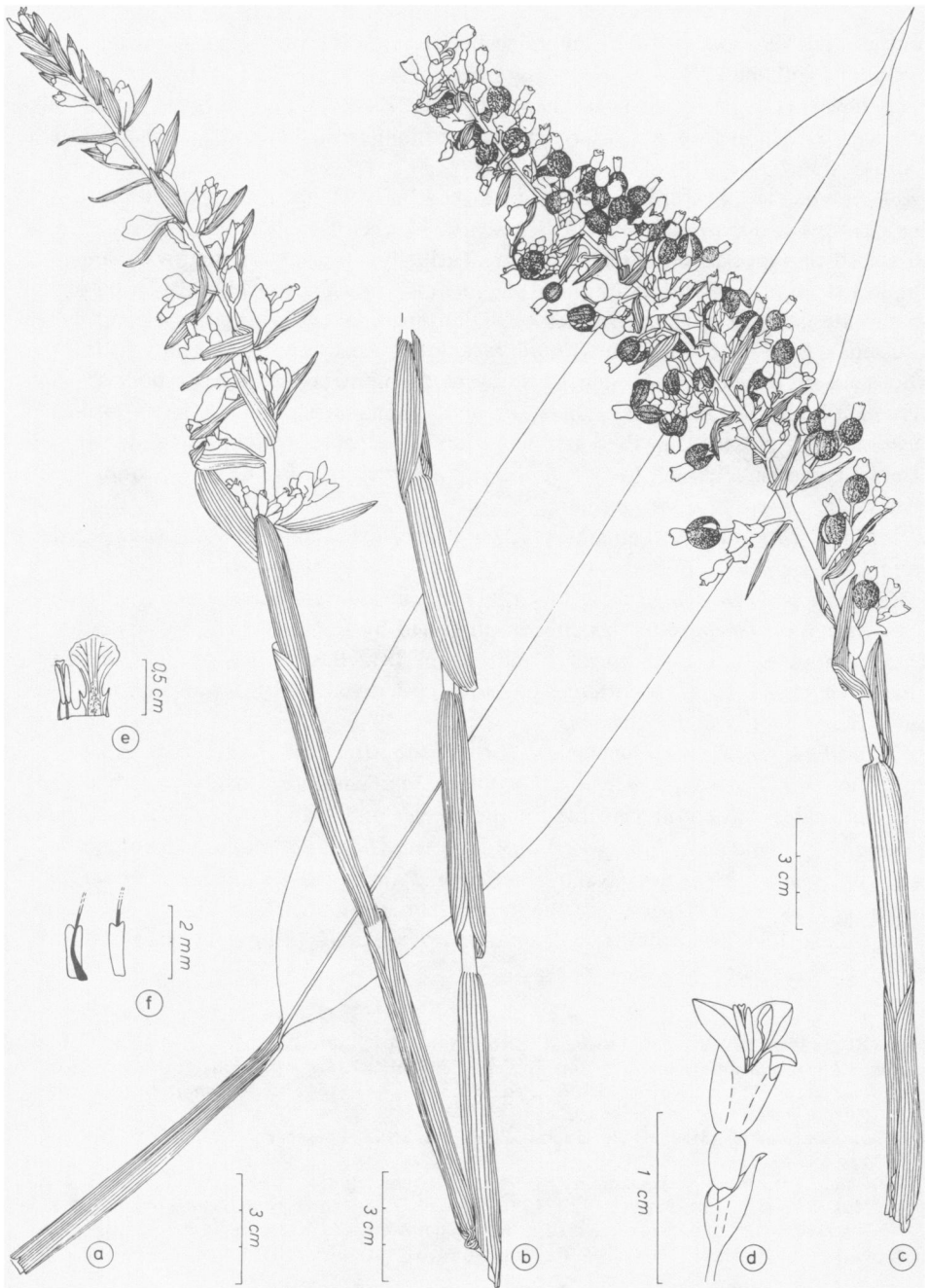


FIG 48. *Renealmia racemosa* (a-b, Bang 1658; c, Bang 1237; d-f, Buchtien 446). a, leaf; b, inflorescence; c, infructescence; d, flower with bracteole; e, labellum and stamen; f, nectarial glands seen from 2 sides.

of inflorescence; rhachis, base of bracts, peduncles, bracteoles, pedicels, calyx, and ovary densely covered with plurifurcate (appearing stellate) to furcate hairs (ca 0.2 mm long), the capsule sparsely so, corolla, sheaths, and apical part of bracts glabrous. Bracts olive-green, persistent, forming an angle of 60° - 120° with the rhachis, ovate-triangular, 8-55 mm long, 3-7.5(-10) mm wide. Peduncles 5-15 mm long. Bracteole (8-)10-15 mm long. Pedicels 5-10(-15) mm long. Calyx pinkish-red to orange, persistent, tubular, 4-5 mm long, 3-5 mm wide, the lobes shallowly triangular, 1-2 mm long, 3 mm wide. Corolla white to yellow, 9 mm long, the tube 4.5 mm long, the lobes 4.5 mm long, 2-3 mm wide. Labellum white to yellow (?), ca 5 mm long and 3 mm wide when spread out, more or less obtrullate in outline, densely hairy in the middle and basal parts, the limb 3 mm long, 5 mm wide, lateral lobes rounded, ca 2 mm long, 1 mm wide, middle lobe rounded and entire, basal claw 2 mm long, 1 mm wide, lateral staminodes ca 1 mm long. Anther ca 3 mm long, 1-1.5 mm wide, glabrous. Style ca 7 mm long. Nectarial glands partly surrounding the style base, ca 1.5 mm long. Ovary ellipsoid to globose. Capsule red, black at maturity, globose to ellipsoid, 6-8(-11) X (3-)5-8(-10) mm, its wall 0.1-0.2 mm thick when dry, 10-15 -seeded, seeds 2-2.5 X 3-3.5 mm, aril orange.

TYPE. *Ruiz & Pavón sn* (holotype, MA, not seen; isotype, B, destroyed), "Habitat copiose in Peruviae silvis ad vicos Cuchero, Chinchao, Muña et Pillao, locis umbrosis."

DISTRIBUTION (Fig 59). Peru and Bolivia, eastern part of Cordillera Oriental; rain forests, up to 1200 m.

PERU. AYACUCHO: *Killip & Smith 22620* (NY, US). HUÁNUCO: *Dombey sn* (P); *Macbride 5100* (F); *Poeppig sn, anno 1830* (W), *sn Aug 1829* (W); *Stork & Horton 9420* (F, GH, K). DEP. ? : *Mathews 2068* (CGE, K: syntypes of *R. micrantha*); *Poeppig sn* (LE). BOLIVIA. COCHABAMBA: *Bang 1658* (F, GH, K, LE, LIL, M, MO, MICH, NY, US: syntypes of *R. micrantha*); *Buchtien 2569* (US). LA PAZ: *Buchtien 446* (NY, US), *447 pp* (GH); *Plowman & Wade Davis 5165* (GH, U); *Rusby 2778* (NY). SANTA CRUZ: *Cárdenas 5916* (US); *Steinbach 5239* (F, GH, MO, NY, US). DEP. ? : *O. Kuntze sn* (NY).

Renealmia racemosa is somewhat akin to *R. occidentalis* var *occidentalis*. It can readily be recognized by the indument of its inflorescence, which is composed of plurifurcate (appearing stellate) hairs.

There has been some confusion about the correct name of this species. The earliest available for this taxon was *Amomum racemosum* Ruiz & Pavón (1798), but that was illegitimate when published, being a later homonym of *Amomum racemosum* Lamarck (1783). In 1838, however, *Amomum racemosum* Ruiz & Pavón was transferred to *Renealmia* by Poeppig & Endlicher and the specific epithet was (correctly) maintained. According to Article 72 of this International Code of Botanic Nomenclature (1966), the epithet *racemosa* in this combination is treated as new dating from 1838, and the binomial should be cited as *R. racemosa* Poeppig & Endlicher. Loesener (1931) rejected this name as being superfluous for *R. racemosa* (Linnaeus) A. Richard. This was incorrect, however, as Poeppig & Endlicher's *R. racemosa* was published eight years before A. Richard's illegitimate combination.

45. ***Renealmia reticulata*** Gagnepain, Bull. Soc. Bot. France 49: 25. 1902; K. Schumann in Engler, Pflanzenreich 4. 46: 303. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. Ed. 2. 15A: 610. 1930. Fig 11 a-g.

Plants 0.4-0.7 m tall. Rhizomes 4-5 mm thick. Sheaths reticulate, 3-15 mm wide, sparsely to rather densely covered with simple prickles (less than 0.1 mm long), and at the cross-connections with needle-like hairs (0.1-0.3 mm long). Ligule ca 1 mm

long. Petiole (5-)10-35 mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate at the apex (acumen 5-10 mm long), cuneate at the base, (6-)15-28 cm long, 2.5-6 cm wide, glabrous on both sides. Scape erect, pink, (12-)25-50 cm tall, to 4 mm thick, beset with sheaths up to 2.5-8 cm long and 0.5-1 cm wide. Inflorescence a basal raceme 2-8 cm long and 2-4 cm wide. Indument of inflorescence: rhachis, bracts, peduncles, bracteoles, and pedicels sparsely to densely covered with simple, erect hairs (0.1-0.2 mm long), sheaths, calyx, margins of corolla-lobes, and ovary sparsely so, corolla-tube and capsule glabrous. Bracts pink, membranous, soon deciduous, narrowly elliptic, acute to obtuse, 10-30 mm long, 4-5 mm wide. Peduncles 1-3 mm long. Bracteole membranous, soon deciduous, 8-13 mm long. Pedicels 4-9 mm long. Calyx pink, tubular, 10-16 mm long, 3-6 mm wide. Corolla 21-24 mm long, the tube 10-12 mm long, the lobes (6-)10-12 mm long, 6-7 mm wide. Labellum ca 8 mm long and 5-7 mm wide when spread out, middle part and basal part opposite the anther densely covered with simple hairs (to 0.3 mm long), the limb erect, 3.5-4 mm long, 5-7 mm wide, lateral lobes involute, rounded, middle lobe slightly emarginate, basal claw 3-4 mm long, 1.5-2 mm wide, lateral staminodes ca 1 mm long. Anther 5-6 mm long, 2 mm wide, glabrous. Style 21 mm long. Nectarial glands completely surrounding the style base, ca 1 mm long. Ovary ellipsoid. Capsule globose, 10 mm in diameter, its wall ca 0.2 mm thick when dry, 5-10-seeded, seeds 3.5 X 5 mm.

TYPE. *Glaziou 20514 pp* (holotype, P; isotypes, K, LE, P), Corcovado, Paineiras, Guanabara, Brazil.

DISTRIBUTION (Fig 58). Coastal rain forests of Guanabara and Espirito Santo.

BRAZIL. ESPIRITO SANTO: Cachoeira Concordia, *W. Bello 484* (R); mun. Cachoeira do Itapemirim, Vargem Alta, 700 m, *Brade 19940* (RB). GUANABARA: Corcovado, Lagoinha dos Porcos (?), *Glaziou 20514 pp* (C); Corcovado, Paineiras, *Netto sn* (R 50977), *Schwacke 7183 pp* (RB). Without locality: *Bowie & Cunningham 10* (BM); *Sellow 269* (BM).

Renealmia reticulata is very closely related to *R. brasiliensis* but is distinct in the different reticulation pattern of its leaf-sheaths (see Fig 11) and in its much narrower leaves. Additional material of this imperfectly known species is badly needed.

46. *Renealmia scaposa* Maas, Acta Bot. Neerl. 24: 479. 1976.

Fig 49.

Plants 2.5-5 m tall. Rhizomes (measured from alcohol material) ca 20 mm thick. Sheaths striate, 10-20 mm wide, sparsely to densely covered with simple, needle-like hairs (to 0.5 mm long) and in the grooves with furcate and simple prickles (less than 0.1 mm long). Ligule 1-3 mm long, hairy like the sheaths. Petiole 0-15 mm long, hairy like the sheaths. Lamina narrowly elliptic, acute to shortly acuminate at the apex, cuneate at the base, 42-61 cm long, (8-)11-14(-23) cm wide, upper side glabrous or covered with simple hairs towards the margin, lower side glabrous, or costa sparsely to densely covered with simple hairs (0.1-0.3 mm long). Scape erect (when young) to prostrate (in fruit), 30-45 cm tall, up to 8 mm thick, beset with sheaths up to (5-) 10-16 cm long, 1-2.5 cm wide, rhachis greenish-red. Inflorescence a basal thyrse 5-20 cm long and 2.5-8 cm wide, with 2-3(-6)-flowered cincinni. Indument of inflorescence: sheaths rather densely covered with simple furcate and plurifurcate hairs (to 0.1 mm long), mixed with simple hairs (to 0.5 mm long); basal sheaths densely covered with white or brown appressed, simple (or furcate) hairs (to 1 mm long), rhachis, peduncles, and pedicels glabrous or sparsely covered with furcate, plurifurcate or simple hairs (to 0.2 mm long), bracts, bracteoles, calyx, corolla, ovary, and capsule glabrous. Bracts pink, soon deciduous, ovate, obtuse, 25-60 mm long, 15-35 mm wide. Peduncles 2-5 mm long. Bracteole 15-19 mm long, soon deciduous. Pedicels (3-)10-20 mm long. Calyx

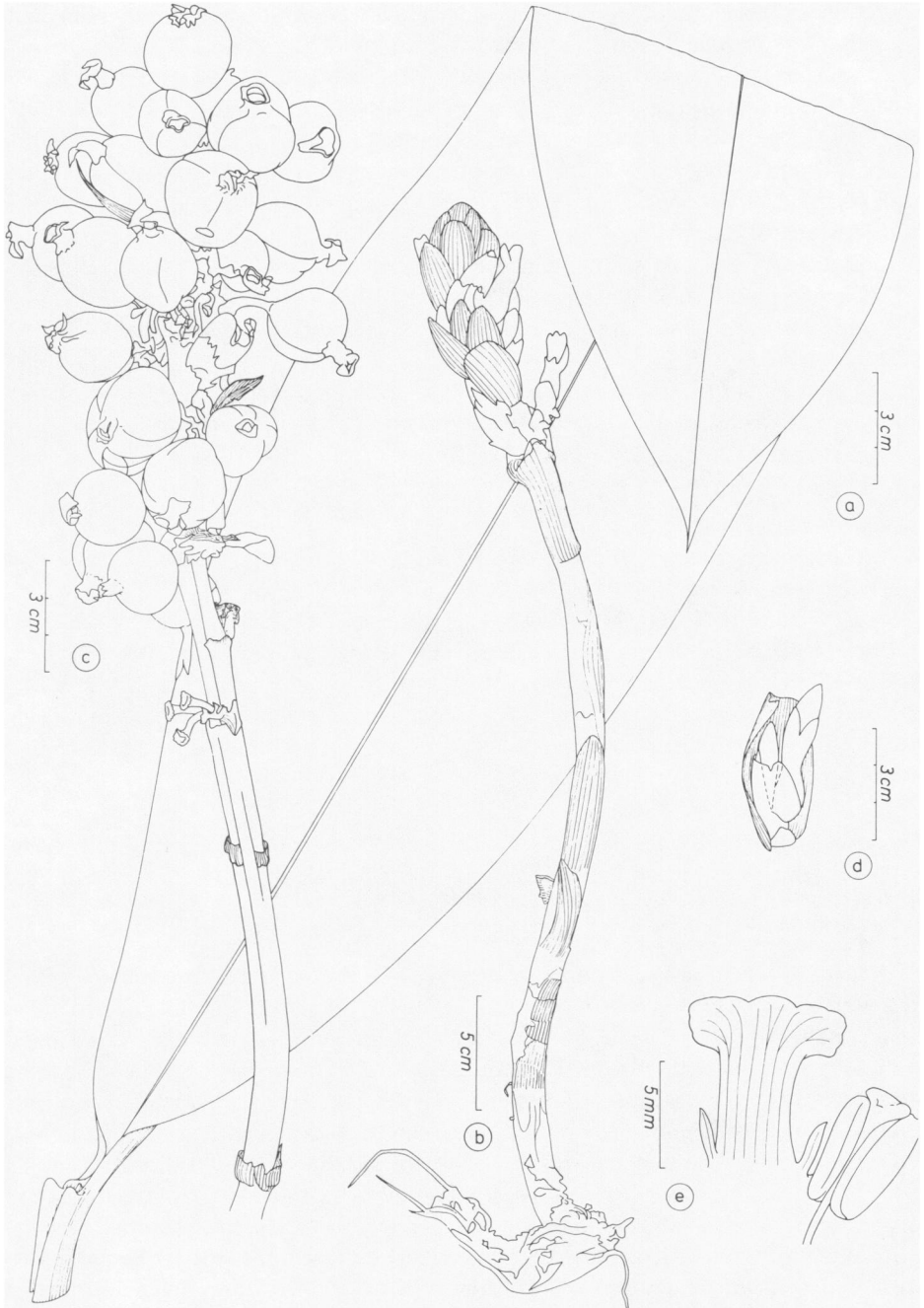


FIG 49. *Renealmia scaposa* (a-e, Maas 1332). a, leaf; b, inflorescence; c, infructescence; d, bract with cincinnus; e, labellum and stamen.

pink, tubular, 10-18 mm long, 5-8 mm wide, the lobes very broadly ovate-triangular, 4-6 mm long. Corolla white, 23-25 mm long, the tube 10-12 mm long, the lobes 13-14 mm long, the dorsal one 9-10 mm wide, the two lateral ones 7-8 mm wide. Labellum white, glabrous, 12 mm long and wide when spread out, the limb erect, 4 mm long, 12 mm wide, the lateral lobes 5 mm long, 4 mm wide, involute and forming a tube 7-8 mm in diameter, middle lobe entire, reflexed, 1 mm long, 4 mm wide, basal claw 7-8 mm long, 4-5 mm wide, lateral staminodes 3 mm long, 1 mm wide. Anther white, 6-7 mm long, 4.5-5 mm wide. Style 20-23 mm long. Nectarial glands multilobulate, completely surrounding the style base, ca 2 mm long. Ovary ellipsoid, red. Capsule pinkish red, globose to ellipsoid, 15-30 X (7-)14-32 mm, its wall ca 0.5 mm thick when dry (2-4 mm thick in living material), ca 100-seeded, seeds ca 3 X 3 mm.

TYPE. *Maas 1332* (holotype, U; isotypes, CR, F, K). Cinchona, ca 5 km S of Cariblanco, 1350 m, Heredia, Costa Rica, forested escarpment near creek.

DISTRIBUTION (Fig 58). Costa Rica, forests from 1000-1700 m.

COSTA RICA. *Burger & Burger 7667* (F, U); *Burger & Gentry 8743* (F, U); *Burger & Stolze 5629* (F), *6111* (F), *6862* (F, U); *Lent 1032* (F, US), *2182* (F, U); *Maas 1153* (F, U); *Maas & Gómez P. 832* (CR, E, F, U).

This species is closely related to *R. ligulata*. It differs in a smaller ligule, a much longer scape and larger, obtuse bracts.

Allen 1654 (GN, MO, NY, US), along stream near El Valle de Antón, 600-1000 m, Coclé, Panama (specimen cited by Woodson (1945) under *R. rubroflava*), probably belongs to this species, it is aberrant by larger and hairy leaves (up to 85 X 24 cm), and by a hairy ovary and calyx. The floral characters of *Maas 1153* are not included, as the inflorescences of that collection were still very young (scape: 5-15 cm, thyse 2-3 X 1-2 cm).

47. ***Renalmia sessilifolia*** Gagnepain, Bull. Soc. Bot. France **49**: 33. 1902; K. Schumann in Engler, Pflanzenreich **4**. 46: 287. 1904. Fig 50.

Renalmia porphyrobractea K. Schumann in Engler, Pflanzenreich **4**. 46: 287. 1904. Type *Lehmann 480* (holotype, B, destroyed; photographs F, GH, MO, U, US, etc.), Pilatón, Ecuador, 1500-2000 m.

Plants 1-1.5 m tall. Sheaths striate, 1.5-7 mm wide, glabrous to sparsely covered with simple hairs (to 0.5 mm long). Ligule ca 1 mm long. Petiole absent. Lamina narrowly ovate-elliptic, long-caudate to long-acuminate at the apex, narrowly to broadly cuneate at the base, 15-32 cm long, 2.5-5.5 cm wide (the uppermost leaves often reduced to 3-6 X 0.5-1 cm), upper side glabrous, lower side sparsely to rather densely covered with simple hairs (to 0.5 mm long). Inflorescence a terminal thyse 3-10 cm long and 3-5 cm wide, with 1-3-flowered cincinni, rhachis 1-3 mm thick. Indument of inflorescence: rhachis, peduncles, and pedicels densely covered with simple, ferruginous hairs (to 0.5 mm long), bracts, bracteoles, calyx, corolla, ovary, and capsule glabrous to sparsely covered with furcate and some scattered, simple hairs. Bracts soon deciduous, narrowly triangular-ovate, 10-55 mm long, 3-10 mm wide. Peduncles 2-5 mm long. Bracteole 7-12 mm long. Pedicels 5-6 mm long. Calyx red to pinkish-red, turbinate, 7-10 mm long, 5-7 mm wide, the lobes very shallowly triangular-ovate, 1-2 mm long, 4-6 mm wide. Corolla white, 25-30 mm long, the tube 15-20 mm long, the lobes 10-12 mm long, 7-9 mm wide. Labellum white, 10 mm long and 8 mm wide when spread out, the limb 7 mm long, 8 mm wide, the middle lobe entire or slightly emarginate, lateral lobes rounded, 5 mm long, 3 mm wide, basal claw 3 mm long, 2 mm wide, lateral staminodes 1.5-2 mm long.

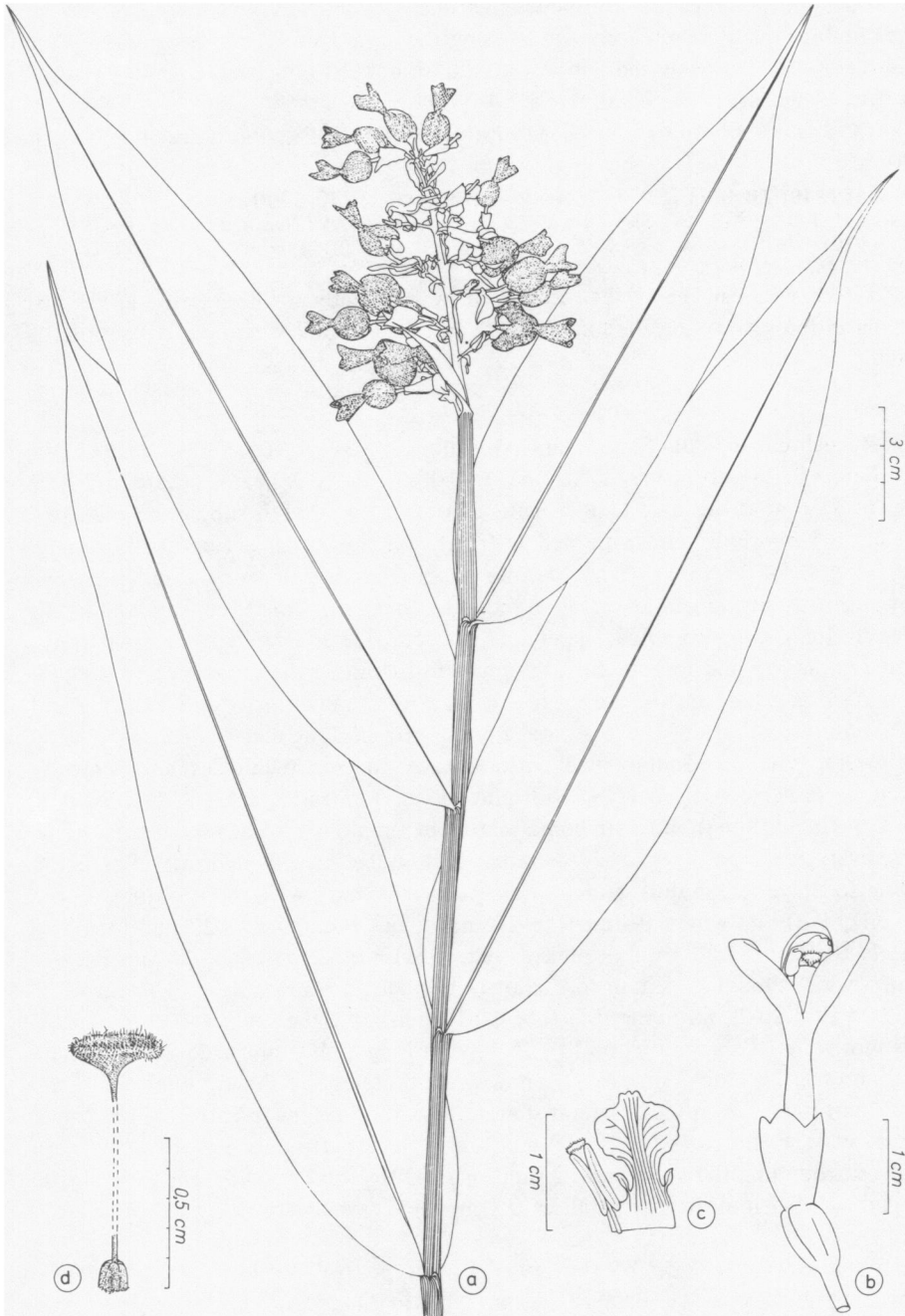


FIG 50. *Renealmia sessilifolia* (a, Sparre 14864; b-d, Sparre 13987). a, habit; b, flower; c, labellum and stamen; d, nectarial glands and stigma.

Anther 5-6 mm long, ca 2.5 mm wide, glabrous. Style 25-27 mm long. Nectarial glands multilobulate, completely surrounding the style base, 1 mm long. Ovary pinkish-red, ellipsoid. Capsule red, globose to ellipsoid, 4-10 mm long, its wall ca 0.1 mm thick when dry, 5-8-seeded, seeds 2-4 X 3-5 mm.

TYPE. *Jameson 558* (holotype, P; isotypes, BM, E, P), Andes near Quito, Ecuador, 2300 m.

DISTRIBUTION (Fig 61). Ecuador, in forests, 1380-2300 m.

ECUADOR. AZUAY: *Steyermark 52677* (F). BOLIVAR: *Harling et al 9671* (GB); *Rémy sn* (P). PICHINCHA: *Fagerlind & Wibom 1939, 1969* (S); *Sparre 13987, 14864* (S). PROV. ? : *André 3708* (K, NY).

This species can readily be recognized by its strictly sessile, narrow leaves, its terminal inflorescence, and its long-caudate to long-acuminate lamina. It is closely related to *R. oligotricha*.

48. ***Renealmia stellulata*** Steyermark, *Phytologia* 9: 341. 1964. Fig 51.

Plants 0.75-1.50 m tall. Rhizomes to 10 mm thick. Sheaths striate, 5-7 mm wide, to 15 mm at the base of the plant, densely covered with simple, needle-like hairs (to 0.5 mm long) and with stellate (rarely furcate) prickles (less than 0.1 mm long). Ligule 2-5 mm long, hairy like the sheaths. Petiole absent. Lamina narrowly elliptic, shortly acuminate at the apex (acumen to 10 mm long), cuneate at the base, 22-30 cm long, 4-8.5 cm wide, upper side glabrous, lower side glabrous or sparsely covered along the midrib with furcate (and plurifurcate) hairs (to 0.2 mm long). Scape 20-45 cm tall, up to 5 mm thick, beset with sheaths up to 7-13 cm long and 0.5-0.8 cm wide. Inflorescence a basal thyrse 7-10 cm long and 4-6 cm wide, with 2-4-flowered cincinni. Indument of inflorescence: rhachis, peduncles, and pedicels densely to rather densely covered with plurifurcate (appearing stellate) to furcate hairs (to 0.1 mm long) and with some scattered, simple hairs, sheaths, bracts, bracteoles, calyx, ovary, and capsule sparsely to rather densely so, corolla glabrous. Bracts (according to Steyermark) dull salmon-brick, persistent, narrowly ovate, obtuse, 12-50 mm long, 4-10 mm wide. Peduncles 5-10 mm long. Bracteole 15-20 mm long. Pedicels 10-15 mm long. Calyx pink to red, tubular or turbinate, 7-14 mm long, 3-6 mm wide, the lobes deltate to shallowly triangular, 1-3 mm long, 3-4 mm wide. Corolla white, 20-22 mm long, the tube 10-12 mm long, the lobes 8-10 mm long, 6.5-9 mm wide. Labellum white (?), 10-11 mm long and 8 mm wide when spread out, glabrous, the limb 5 mm long, 8 mm wide, middle lobe shortly bilobulate, basal claw 5 mm long, 3 mm wide, lateral staminodes 2-3 mm long. Anther 5 mm long, 2.5 mm wide, glabrous. Style 16-19 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2 mm long. Ovary pink to red, ellipsoid. Capsule red, globose, 7-9 mm diam, its wall ca 0.1 mm thick when dry, 9-seeded, seeds ca 3 X 4 mm.

TYPE. *Steyermark 53769* (holotype, F; isotype, NY), forested slopes along quebradas tributary to Río Palma (tributary to Río Amarillo), near Pampa de los Cedros, S of Cerro Chivo-Turco, prov. El Oro, Ecuador, 2135-2285 m.

DISTRIBUTION (Fig 61). Ecuador, in forests, from 900-2300 m.

ECUADOR. EL ORO: *Espinosa 1893* (NY); *Hitchcock 21170* (GH, NY, US). PICHINCHA: *Asplund 16209* (S). ZAMORA-CHINCHIPE: *Sparre 16424 bis* (S).

Renealmia stellulata is closely related to *R. aurantifera* (see under that species).

In *Sparre 16424 bis* (S) some of the sheaths of the inflorescence are provided with a reduced lamina (0.5-5 X 0.5-2.5 cm).



FIG 51. *Renealmia stellulata* (a-b, Asplund 16209; c-d, Steyermark 53769; e, Sparre 16424 bis). a, top of leafy stem; b, infructescence; c, flower; d, labellum and stamen; e, nectarial glands seen from above.

49. **Renealmia sylvestris** (Stokes) Horaninow, Prodr. 32. 1862; Grisebach, Fl. Br. W. Ind. Isl. 601. 1864; O. G. Petersen in Martius, Fl. Bras. 3(3): 42. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 304. 1904 (as "*silvestris*"); Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930 (as "*silvestris*"); Adams, Fl. Pl. Jamaica 58. 1972. Fig 52.

Zingiber sylvestre majus Sloane, Voy. Jamaica 1: 165. t. 105, f. 2. 1709.

Amomum sylvestre Swartz, Prodr. Fl. Ind. Occ. 11. 1788; not of Lamarck, Encycl. Méth. Bot. 1: 134. 1783.

Zingiber sylvestre Stokes, Bot. Mat. Med. 1: 67. 1812 (\equiv *Amomum sylvestre* Swartz).

Amomum striatum Stokes, Bot. Comment. 1: 159. 1830; K. Schumann in Engler, Pflanzenreich 4. 46: 259. 1904 (name only). (\equiv *Amomum sylvestre* Swartz).

Ethanium sylvestre O. Kuntze, Rev. Gen. Pl. 1: 689. 1891 (\equiv *Amomum sylvestre* Swartz).

Plants 1.5-2.5 m tall. Rhizomes 7-10 mm thick. Sheaths striate, 10-20 mm wide, glabrous or sparsely covered with simple or furcate prickles (less than 0.1 mm long). Ligule ca 1 mm long. Petiole 20-50 mm long, hairy like the sheaths. Lamina narrowly elliptic, shortly acuminate at the apex (acumen 5-10 mm long), cuneate at the base, (30-)40-66 cm long, (6-)10-16 cm wide, glabrous on both sides. Scape erect, 30-35 cm tall, up to 6 mm thick, beset with sheaths up to 6-10 cm long and 1-1.5 cm wide. Inflorescence a basal raceme 8-20 cm long and 3-5 cm wide. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, corolla, ovary, and capsule glabrous or sparsely covered with simple and sessile, furcate hairs (to 0.1 mm long). Bracts salmon-pink but soon discolored, brown, long-persistent, ovate to broadly ovate and sometimes narrowly ovate, obtuse (to acute), 15-40(-50) mm long, 10-20(-25) mm wide. Peduncles 2-5 mm long. Bracteole cup-shaped, 15-17(-20) mm long. Pedicels 2-5 mm long. Calyx pink to pinkish-white, tubular to slightly turbinate, (15-)18-20(-25) mm long, 7-8 mm (in *Proctor 22111* up to 12 mm wide) the lobes deltate, 3-6 mm long. Corolla white to yellowish-white, 22-24 mm long, the tube 14-15 mm long, the lobes 7-9 mm long, ca 5 mm wide. Labellum ca 8 mm long and 3 mm wide when spread out, the apex slightly cucullate, marginal parts on inner side densely covered with simple (and some furcate) hairs (0.1-0.3 mm long), back sparsely so to glabrous, lateral staminodes ca 1 mm long, densely hairy. Anther 8 mm long, 2 mm wide, densely covered with simple (and some furcate) hairs (0.1-0.5 mm long). Style 22 mm long. Nectarial glands multilobulate, completely surrounding the style base, 1.5 mm long. Ovary ellipsoid. Capsule blackish-brown (*Proctor 22707*), ellipsoid to globose, 10-20 X 8-10 mm, its wall 0.2-0.3 mm thick when dry, 17-20-seeded, seeds 2.5-3 X 3-4 mm.

TYPE. A collection of Swartz (holotype, M), from Jamaica, annotated "*Amomum sylvestre prod.*"

DISTRIBUTION (Fig 57). Jamaica, in rain forests, often in ravines or gullies, between 300 and 850 m.

JAMAICA. *Alexander sn, anno 1850* (GOET, K); *Britton 3532, 3942* (NY); *Fredholm 3252* (NY, US); *Harris sn, 6 Feb 1895* (F, NY); *Jam Plants No. 22* (BM, UCWI); *Lewis sn, 14 Nov 1946* (IJ); *Maxon 9111* (NY, US); *von der Porten sn, 20 Feb 1948* (IJ); *Proctor 5268, 10111, 10467* (IJ), *22111* (BM, GH, IJ, MICH), *22707* (BM, IJ); *Purdie sn, Aug 1843* (K); *Robbins sn, Aug 1952* (UCWI); *Stearn 232, 971* (BM); *Swartz sn* (S); *N. Wilson sn, anno 1861* (K); *W. Wright sn* (BM); *Wullschlägel 1096* (GOET, M).

This Jamaican endemic is closely related to *R. dermatopetala*. It is strongly characterized by its extremely narrow labellum, the lateral lobes of which are not developed.

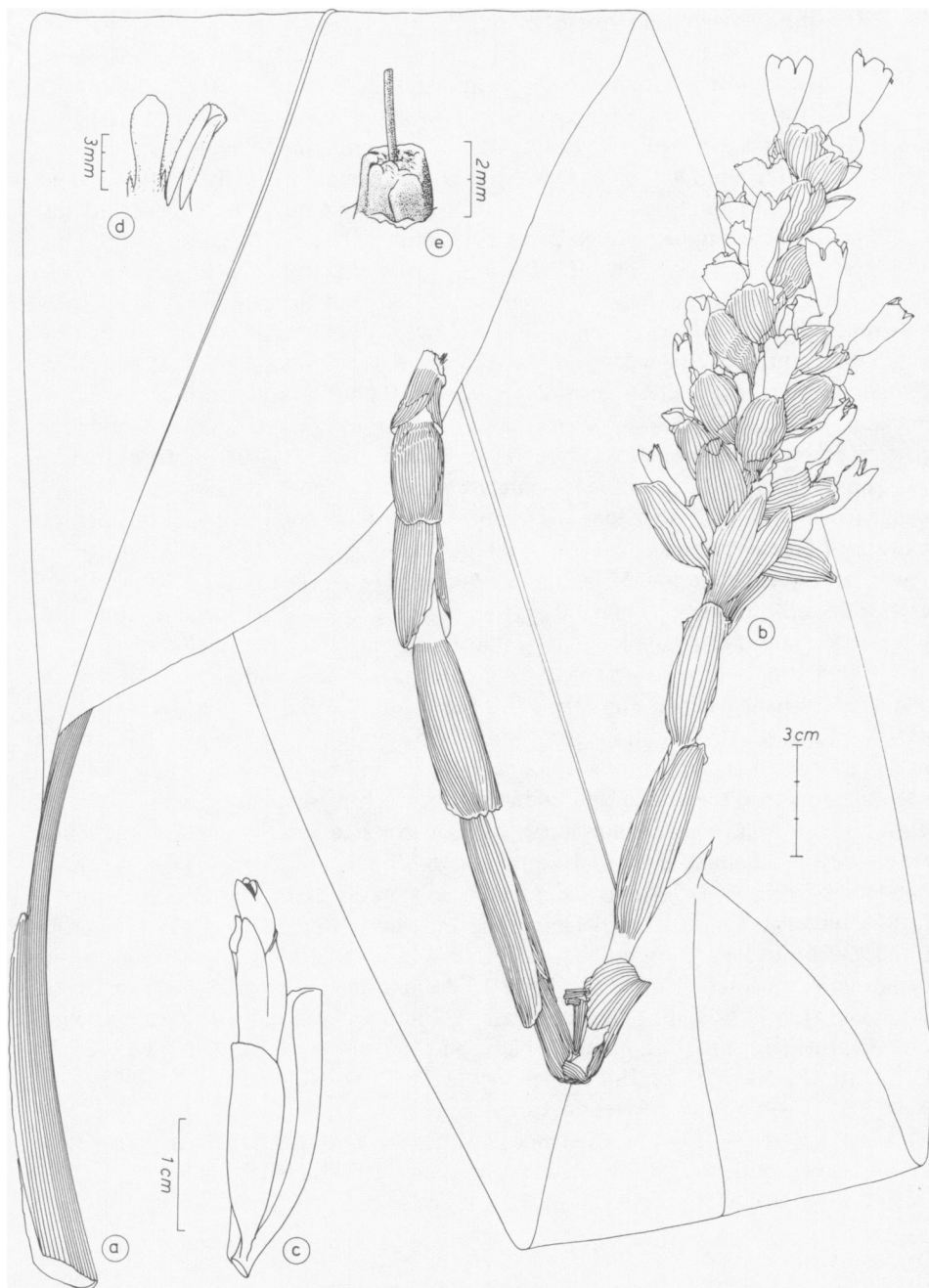


FIG 52. *Renealmia sylvestris* (a-b, Proctor 22111; c-e, Britton 3532), a, leaf; b, inflorescence; c, flower; d, labellum and stamen; e, nectarial glands.

50. *Renealmia thyrsoides* (Ruiz & Pavón) Poeppig & Endlicher.

Plants 0.8-5 m tall. Rhizomes 10-30 mm thick. Sheaths striate to reticulate, 5-15 mm wide, to 35 mm at the base of the plant, densely to sparsely covered with simple, furcate, and stellate prickles (less than 0.1 mm long) and towards the ligule and at the reticulations with needle-like hairs (to 1 mm long). Ligule 1-2 mm long. Petiole 0-30(-60) mm long, hairy like the sheaths. Lamina narrowly elliptic, acuminate (acumen 5-15 mm long) or rarely acute at the apex, cuneate at the base, 25-90 cm long, 5-22 cm wide, upper side glabrous or sparsely covered with sessile, furcate hairs (less than 0.1 mm long), lower side glabrous or sparsely covered with simple or sessile, furcate hairs (0.1-0.2 mm long), the marginal regions and the midrib often covered with simple hairs (to 0.5 mm long). Scape erect, 8-80 cm tall, to 6 mm thick, beset with sheaths up to 3-20 cm long and 0.8-3.5 cm wide. Inflorescence a basal, spiciform raceme 7-30 cm long and 3-6 cm wide. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, corolla, ovary, and capsule densely to sparsely covered with sessile, furcate (to plurifurcate) hairs (0.1-0.2 mm long) and/or with simple hairs (0.3-0.5 mm long), rarely completely glabrous. Bracts red, pink, orange-red, or yellow, rather long persistent or sometimes soon deciduous, broadly obovate to broadly ovate, obovate to ovate, or narrowly obovate to narrowly triangular, obtuse to acute, 10-50 mm long, 3-35 mm wide. Peduncles 1-2 mm long, rarely elongating to 10(-15) mm. Bracteole cup-shaped, obliquely truncate, often split on one side, 5-16(-20) mm long. Pedicels 1-3 mm long, rarely elongating to 10 mm. Calyx yellow to red, tubular, 9-23 mm long, 5-11 mm wide, the lobes deltate to shallowly triangular, 3-5 mm long, 4-10 mm wide. Corolla yellow, yellowish-orange, or orange, 19-33 mm long, the tube 6-18 mm long, the lobes 10-18 mm long, 6-14 mm wide. Labellum yellow to orange, 8-15 mm long and wide when spread out, basal part opposite the anther and middle part densely covered with simple, furcate, or plurifurcate hairs (0.2-0.5 mm long), its posterior side and the lateral staminodes less densely so, the limb erect, 4-10 mm long, 8-15 mm wide, lateral lobes involute, rounded, 3-5 mm long, 2-4 mm wide, middle lobe entire and rounded (very rarely slightly bilobulate), basal claw 4-7 mm long and wide, lateral staminodes 1-2 mm long. Anther 5-12 mm long, 3-6 mm wide, sides densely covered with the same hairs as on the labellum, back less densely so. Style 17-26 mm long. Nectarial glands multilobulate, completely surrounding the style base, 1-3 mm long. Ovary green to red, ellipsoid. Capsule (green to) red, maturing black-purple, globose to ellipsoid, 15-45 X 7-25 (-35) mm, its wall ca 1 mm thick when dry (3-7 mm in living material), 30-75-seeded, seeds 3-3.5 X 4-4.5 mm, aril yellow to red.

DISTRIBUTION (Fig 57). Subandean western to northern South America, from Bolivia in the South to Costa Rica, Venezuela, and Trinidad in the North; also in the neighbouring parts of the Amazon Basin, and in Guyana and Suriname.

Key to the Subspecies of *Renealmia thyrsoides*

1. Bracts and calyx red to orange (rarely yellow); bracts (except for the forms in Trinidad) long-persistent; peduncles and pedicels 1-2(-10) mm long; bracteoles 5-16(-20) mm long; calyx 9-17(-23) mm long; anther 5-12 mm long. subsp *thyrsoides*.
2. Bracts and calyx golden-yellow; bracts soon deciduous; peduncles 5-15 mm long; pedicels 1-4(-7) mm long; bracteoles 12-20 mm long; calyx 20-21 mm long; anther 9-10 mm long. subsp *chrysantha*.

50a. Renealmia thyrsoidea subsp thyrsoidea.

Fig 53.

Amomum thyrsoideum Ruiz & Pavón, Fl. Peruv. & Chil. 1: 2. t.2. 1798; K. Schumann in Engler, Pflanzenreich 4. 46: 259. 1904 (name only).

Renealmia thyrsoidea (Ruiz & Pavón) Poeppig & Endlicher, Nov. Gen. & Sp. 2: 25. t. 134. 1838; Horaninow, Prodr. 33. 1862; O. G. Petersen in Martius, Fl. Bras. 3(3): 44. 1890; K. Schumann in Engler, Pflanzenreich 4. 46: 302. 1904: Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. f. 272. 1930; Macbride, Field Mus. Nat. Hist. Bot. Ser. 13: 730. 1936.

Renealmia geostachys K. Schumann in Engler, Pflanzenreich 4. 46: 303. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930; Macbride, Field Mus. Nat. Hist. Bot. Ser. 13: 728. 1936. Type. *Ule 6188* (holotype, B, destroyed; photographs, F, MO, U, etc.), Leticia, Loreto, Peru.

Renealmia platycolea K. Schumann in Engler, Pflanzenreich 4. 46: 305. 1904. Type. *Fendler 1494* (holotype, B, destroyed; lectotype, GH; isotypes, K, MO, NY), Colonia Tovar, ca 1300 m, Aragua, Venezuela.

"*Alpinia thyrsoidea* Poeppig & Endlicher," K. Schumann in Engler, Pflanzenreich 4. 46: 371. 1904 (name only).

Alpinia silvicola Britton, Bull. Torrey Club 48: 329. 1922. Type. *Britton, Hazen & Mendelson 1301* (holotype, NY; isotype, TRIN 9482, W), Mt. Tucuche, Trinidad.

Renealmia cardenasii Rusby, Mem. New York Bot. Gard. 7: 219. 1927. Type. *M. Cárdenas 844* (holotype, NY), Rurrenabaque, Beni, Bolivia.

Renealmia uleana Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930 (nomen nudum).

Renealmia silvicola (Britton) Steyermark & Agostini, Acta Bot. Venez. 1(2): 33. 1966; Simmonds, Fl. Trin. & Tob. 3(2): 18. 1967.

Lamina narrowly elliptic, 20-90 cm long, 5-22 cm wide. Scape 8-80 cm long, the sheaths 3-20 cm long, 0.8-3.5 cm wide. Bracts pinkish to purplish-red, orange-red, or very rarely yellow, rather long persistent or rarely (Trinidad) soon deciduous, 10-50 mm long, 3-35 mm wide. Peduncles 1-2(-5) mm long. Bracteole 5-16(-20) mm long. Pedicels 1-2 mm long, rarely elongating up to 10 mm long. Calyx red to orange-red, 9-17(-23) mm long. Corolla yellow to orange, 19-33 mm long. Labellum yellow to orange, 8-15 mm long and wide. Style 17-26 mm long. Anther 5-12 mm long. Capsule 15-45 X 7-25(-35) mm, 30-75-seeded, aril yellow to red.

TYPE. *Ruiz & Pavón sn* (holotype, MA, not seen; isotype, KIEL), Cuchero, Chinchao, and Pozuzo, dep. Huánuco, Peru.

DISTRIBUTION (Fig 57). Subandean forest regions of Costa Rica, Panama, Trinidad, Venezuela, Colombia, Ecuador, Peru, and Bolivia, extending into the Amazon Basin; in cloud forest, between 600 and 2000(-3000) m, and in inundated or non-inundated lowland rain forest.

COSTA RICA. *Croat 22284* (MO); *Maas 1073* (COL, CR, F, MO, U), *1199* (CR, K, MO, U); *Maas & Cramer 1357* (U); *Maas & McAlpin 1529* (F, U). PANAMA. *Gentry & Mori 13625* (MO, U). TRINIDAD. *Britton & Freeman 2365* (GH, NY, TRIN 10041, US); *Broadway 6227* (F, S, US), *9910* (NY, TRIN, US); *Finlay sn* (TRIN 2881); *Maas 3426* (U); *Simmonds 45, 359* (TRIN), *sn* (K, TRIN 14904); *A. C. Smith 10042* (GH, IJ, K, NY, US); *R. O. Williams sn* (TRIN 11011). COLOMBIA. AMAZONAS: *Sastre 476** (P, U). ANTIOQUIA: *Domingo Penagos 3824* (US). CAQUETA: *Cuatrecasas 9079* (COL, F), *9192* (COL, US); von Sneidern A 1338 (S). CAUCA: *Maas & Plowman 2044* (COL, GH, U). CHOCO-EL VALLE: *Cuatrecasas 15577* (F). CUNDINAMARCA: *Cuatrecasas 9639* (COL, F); *García-Barriga 12577* (COL, US); *Pinto & Bernal O. 1605** (P); *Triana 650* (BM, P). MAGDALENA: *Barkley & Gutiérrez V. 1892* (COL, US); *Romero Castañeda 6939* (COL). META: *Cuatrecasas 4562** (F); *García-Barriga & Jaramillo 17115** (COL); *Idrobo & Jaramillo 2061* (COL); *Idrobo & Schultes 927* (COL, US), *1067** (COL), *1104** (COL, US); *Killip 34290* (COL, US); *Phillipson 2332* (BM); *Phillipson & Idrobo 2014** (BM, COL); *Phillipson et al 2152* (BM, COL, US); *Thomas, Hernández C. & Pinto E. 1425** (P). NARIÑO: *Mora 1052* (COL). NORTE DE SANTANDER: *Cuatrecasas 12955* (COL, US); *Cuatrecasas et al 12363* (COL, GH, NY); *Killip & Smith 20076* (GH, NY, US). PUTUMAYO: *Cuatrecasas 10635* (COL, US); *Kennedy 227* (U); *King & Guevara 6152* (US); *Schultes 3352* (COL, GH), *3399* (COL, F, GH); *Sprague 610* (K). SANTANDER: *Killip & Smith 15277* (NY, US), TOLIMA: *Goudot sn* (K, P). EL VALLE: *Cuatrecasas 16299* (COL) VAUPES: *Pinto E. & Sastre 1016** (U); *Schultes & Cabrera 14749** (COL). VICHADA: *Pinto E. & Sastre 1454* (U).

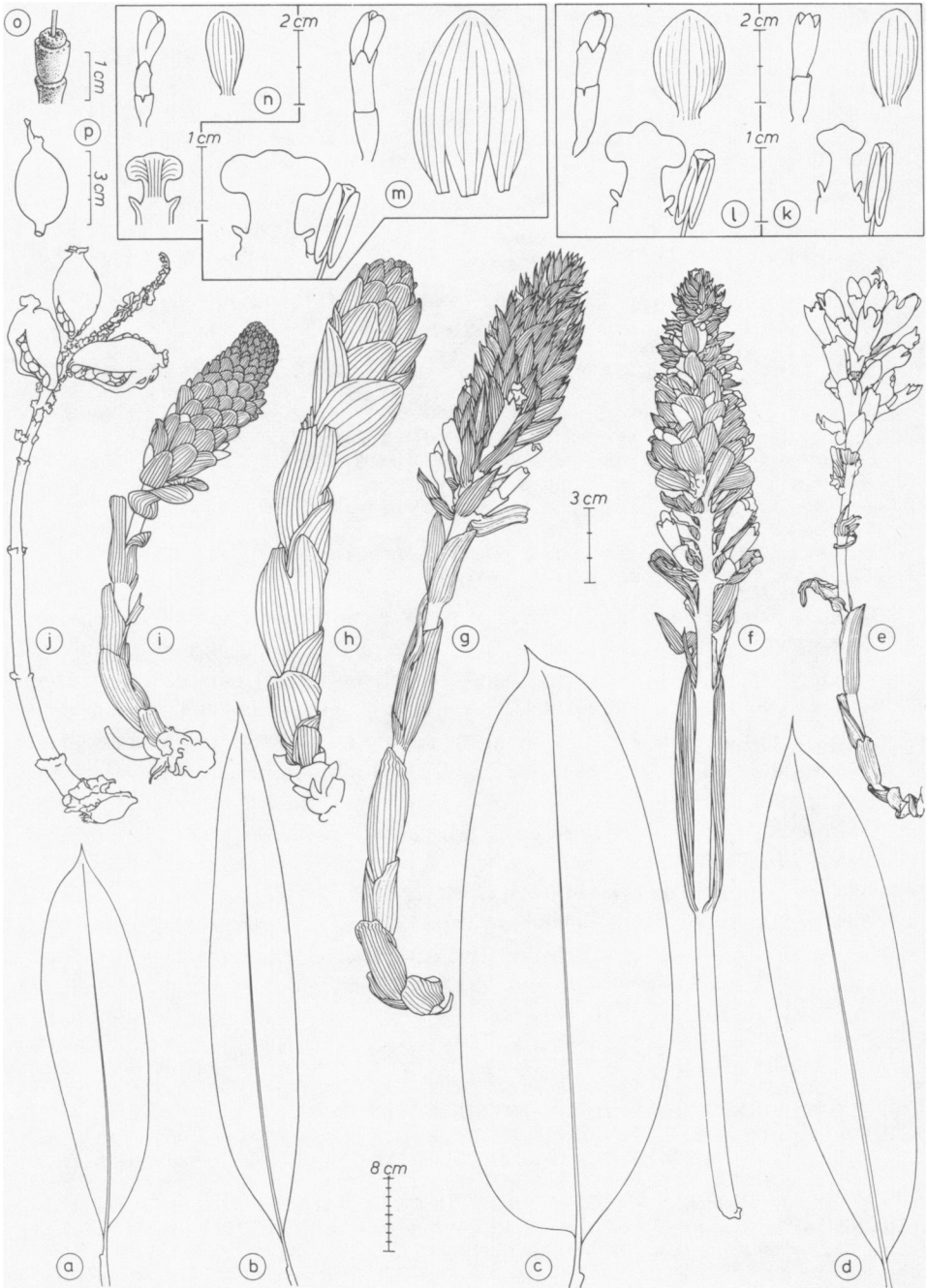


FIG 53. *Renealmia thyrsoides*. a-c, f-j, l-m, n, p, subsp. *thyrsoides* (a, i, j, Poelt & Oberwinkler 14775; b, h, m, Prance et al 11795; c, g, Killip & Smith 23447; f, Cuatrecasas 10635; 1, Prance et al 16343; n, p, van Rooden & Akkermans 8) and d-e, k, o subsp. *chrysantha* (d-e, k, o, Tillett & Tillett 44996), a-d, leaves; e-i, inflorescences; j, infructescence; k-n, floral details: bracts, flowers, labellum, and stamen; o, nectarial glands; p, fruit.

Triana 991 (COL). VENEZUELA. ANZOÁTEGUI: *Steyermark* 61409 (F, NY, US, VEN). ARAGUA: *Maas & Badillo* 2172 (MY, U). BARINAS: *van Rooden & Akkermans* 7 (U); *Wessels Boer* 1970 (U). DISTRITO FEDERAL: *Bro. Elias* 160 (F); *O. Kuntze* 1669 (NY); *Moritz sn anno* 1865 (BM); *Pittier* 9505, 10324 (GH, NY, US, VEN); *Steyermark* 55134 (F, NY, US). FALCÓN: *Steyermark* 98900 (U, VEN). LARA: *Steyermark et al* 103286 (U, VEN); *Steyermark et al* 110153 (U, VEN); *Trujillo* 1949, 2752 (NY); MÉRIDA: *Aristeguieta* 3269 (VEN); *Bernardi* (U, VEN); *de Bruijn* 1290 (U, WAG); *Engel sn* (LE); *Gehriger sn* (VEN 18982); *Poelt & Oberwinkler* 14775 (M); *Steyermark* 55807 (F, NY, VEN). MIRANDA: *Ginés* 4372 (US); *Tamayo* 2036 (US, VEN); *Velasco* 794 (MY). SUCRE: *F. Fernández* 311 (US, VEN); *Steyermark* 94891 (F, NY, U, US); *Steyermark & Agostini* 91071 (U, US, VEN); *Steyermark & Rabe* 96411 (U, VEN). TACHIRA: *Bunting* 2422 (MY); *Curran & Haman* 1018 (NY). TRUJILLO: *van Rooden & Akkermans* 8 (U); *Steyermark* 104724 (VEN). YARACUY: *Steyermark & Wessels Boer* 100482 (U, VEN). ZULIA: *Ginés* 321-R (MY), 1921 (US), 1964 (F), 2037 (US); *Steyermark et al* 105562 (VEN). BRAZIL. ACRE: *Maas et al* 13249* (COL, F, INPA, K, MG, NY, R, U, US); *Prance et al* 11795* (INPA, NY, U), 12084 (COL, INPA, K, MG, MO, NY, R, U, US). AMAZONAS: *Ducke* 6849* (MG); *Prance et al* 16343 (INPA, NY, U); *Trochon* 47 (P). ECUADOR. MORONA-SANTIAGO: *Harling & Andersson* 12792 (GB, U), 12970 (GB). NAPO: *Duke* 16044* (MO); *Fagerlind & Wibom sn* (S); *Harling* 3573 (S); *Harling & Andersson* 11780 (GB); *Harling et al* 7135, 7486, 7519 (GB, U), 7526 (GB); *Lugo* 1978, 2061, 3347, 3405 (GB, U). PASTAZA: *Asplund* 18313 (S); *Dodson & Thien* 914, 984, 1998 (WIS); *Harling* 3771 (S); *Harling et al* 9729 (GB, U); *Plowman & Wade Davis* 4473, 4553 (GH, U); *Sparre* 17638 (S). SANTIAGO-ZAMORA: *Camp* 1088 (NY, US); *Steyermark* 54650 (F, NY, S, US). ZAMARA-CHINCHIPE: *Harling & Andersson* 13747 (GB, U). PERU. AMAZONAS: *Berlin* 669* (MO); *Wurdack* 2273 (US). AYACUCHO: *Dudley* 11947 (NA). CUZCO: *Marin* 1800 (LIL, U); *Plowman & Wade Davis* 4755, 4984, 4993 (GH, U); *Vargas C.* 3464 (CUZ, GH), 14661, 15541 (CUZ, US), 20706 (US). HUANUCO: *Poeppig* 1230 (G), *sn, anno* 1830 (W); *Schunke V.* 1782, 1838 (U); *Wolfe* 12471 (NA). JUNÍN: *Iltis & Iltis* 301 (K, WIS); *Killip & Smith* 23447 (F, NY, US), 24913 (NY, US); *Macbride* 5243 (F, G); *Martinet* 1342 (P); *Sandeman sn* (F). LORETO: *Asplund* 14725* (S); *Dodson* 2861 (US); *Killip & Smith* 28838 (NY, US); *Kuhlmann* 2165 (RB); *Poeppig sn, anno* 1829 (W); *Schunke V.* 2706 (U); *Tessmann* 3114 (G, NY, S); *Ll. Williams* 3113 (F, US), 3468* (F); *Ule* 55p* (photographs F, MO, NY, etc.; incorrectly distributed as type-collection of *R. geostachys*). MADRE DE DIOS: *Plowman & Wade Davis* 5047 (GH, U). SAN MARTÍN: *Schunke V.* 3800 (U), 5634* (NY). ? : *Poeppig sn* (L, P). BOLIVIA. BENI: *Holiday* 57 (K). LA PAZ: *Buchtien* 3689 (NY, US); *O. E. White* 1030 pp (NY). STATE?: *Bang* 2566 pp (GH, K, M, NO, NY).

Renealmia thyrsoides is closest to *R. dermatopetala*. Up to a very late stage of this revision I had divided subspecies *thyrsoides* into two other subspecies, one being restricted to the subandean regions and the other to the lowlands. The main differences were in the scape length (somewhat shorter in the subandean form) and in the shape of the bracts (broader in the subandean form). But with every new specimen arriving for study these differences faded away and it proved impossible to maintain these two criteria. Finally I decided to unite the two forms in one subspecies, *thyrsoides*.

Renealmia silvicola from Trinidad looks different because of its early deciduous bracts and its relatively long scape. After having studied some recent collections from the nearby Peninsula de Paria in Venezuela, however, it became evident that there are many transitional forms towards this subspecies and thus it proved impossible to maintain *R. silvicola*.

A still more complex situation was met with during the study of *R. geostachys*. This species, originally described from lowlands near Leticia, Loreto, Peru, has as characteristics narrow leaves and distinctly reticulate leaf-sheaths (all specimens of this type are marked above with an asterisk). In Colombia (especially in the Sierra de la Macarena region), however, all kinds of intermediate forms between typical *thyrsoides* and *R. geostachys* are found, inducing me to place the latter also in subspecies *thyrsoides*.

I have not included the characters of *Ule* 9201 (G, K, MG) from Seringal São Francisco, Acre, Brazil in the description of this subspecies, as that collection is somewhat aberrant by relatively large leaves, a long scape, and yellow bracts.

Maguire et al 37360 (U) from Cerro de la Neblina, Venezuela (1700-2000 m) is related to this subspecies but deviates by very long petioles (to 9 cm long). The leaves very much resemble those of a sterile collection, *Prance et al 16140* (INPA, NY, U), from nearby Serra Curicuriari, Amazonas, Brazil. Fortunately living material of the last collection is under cultivation at our greenhouse "Sandwijck" (Utrecht).

Grubb et al 1042 (K) from Cerro Antisana, Ecuador (6000 ft) is related to subsp *thyrsoides*, but additional and better material is required before its identity can be ascertained.

In some specimens the floral parts are strongly reduced in size, eg *Vargas C. 14661* and *15541*; the strongest reduction has taken place in *Kuhlmann 2165* (RB) from Ilha de Iquitos, Peru and its floral characters (bracteole 5 mm long; corolla ca 10 mm long; labellum 7 X 7 mm) are not included in the description of the subspecies.

After having studied this very complex *R. thyrsoides* subsp *thyrsoides*, I am fully aware that the solution of the problem (uniting many species into subsp *thyrsoides*) is only a preliminary one. The group can only be fully understood after many field observations in the whole area of its distribution.

50b. *Renalmia thyrsoides* subsp *chrysantha* Maas, Acta Bot. Neerl. 24: 480. 1976.

Fig 53.

Lamina narrowly elliptic, 25-60 cm long, 7-12(-15) cm wide. Scape 15-30 cm long, the sheaths soon deciduous, 3.5-6 cm long and 0.8-1 cm wide. Bracts golden-yellow, soon deciduous, ovate-triangular (only one bract seen), 15 mm long, 8 mm wide. Peduncles 5-10 mm long, elongating to 15 mm after shedding of fruit. Bracteole 12-14 (the uppermost)-18-20 (the lowermost) mm long. Pedicels 1-4 mm long, up to 7 mm after shedding of fruit. Calyx golden-yellow, tubular, long-persistent, 20-21 mm long, 5-11 mm wide. Corolla (in bud) ca 20 mm long. Labellum (in bud) 10 X 6 mm. Anther 9-10 mm long. Style (in bud) 21 mm long. Capsule ellipsoid, 17-20 X 10-15 mm, ca 50-seeded.

TYPE. *S. S. & C. L. Tillett 44996* (holotype, U; isotypes, NY, US), mixed evergreen forest along NE side of Mt. Ayanganna, Upper Mazaruni R., Guyana.

DISTRIBUTION (Fig 57). Guyana and Suriname; in upland forest, mostly near the mountain tops, (300-)800-1080 m; locally common.

SURINAME. Emmaketen, Hendriktop, 1080 m, *BW 5697* (U); Bakhuis Mts., 1000 m, *Florschütz & Maas 3100* (U); 2 km S of Julianatop, 13 km NE of Lucie River, 300 m, *Irwin, Prance, Soderstrom & Holmgren 54689* (NY); Tafelberg, 1.5 km S of E-ridge, *Maguire 24597* (F, GH, NY, U, US).

This subspecies is named after its bracts and calyx, which according to the description on the label of the type are golden-yellow. All collections studied beside the type are very poor, and additional material for further investigation is necessary. It is close to subsp *thyrsoides* but differs by its golden-yellow (instead of red) bracts and calyx, longer peduncles and pedicels, and longer persistent calyx. The decision whether to treat this new taxon as a subspecies or as a distinct species is somewhat arbitrary.

51. *Renalmia urbaniana* Loesener, Notizbl. Bot. Gart. Berl. 10: 63. 1927; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 610. 1930. Fig 54.

Renalmia regnelliana Loesener, Notizbl. Bot. Gart. Berl. 10: 64. 1927. Type. *Ule 5589* (holotype, B, destroyed; lectotype, G; isotype, MG), Puritisaal, Juruá-Mirim, Acre, Brazil. Plants 1-2 m tall. Rhizomes 5-15 mm thick. Sheaths purple-red, mostly reticu-

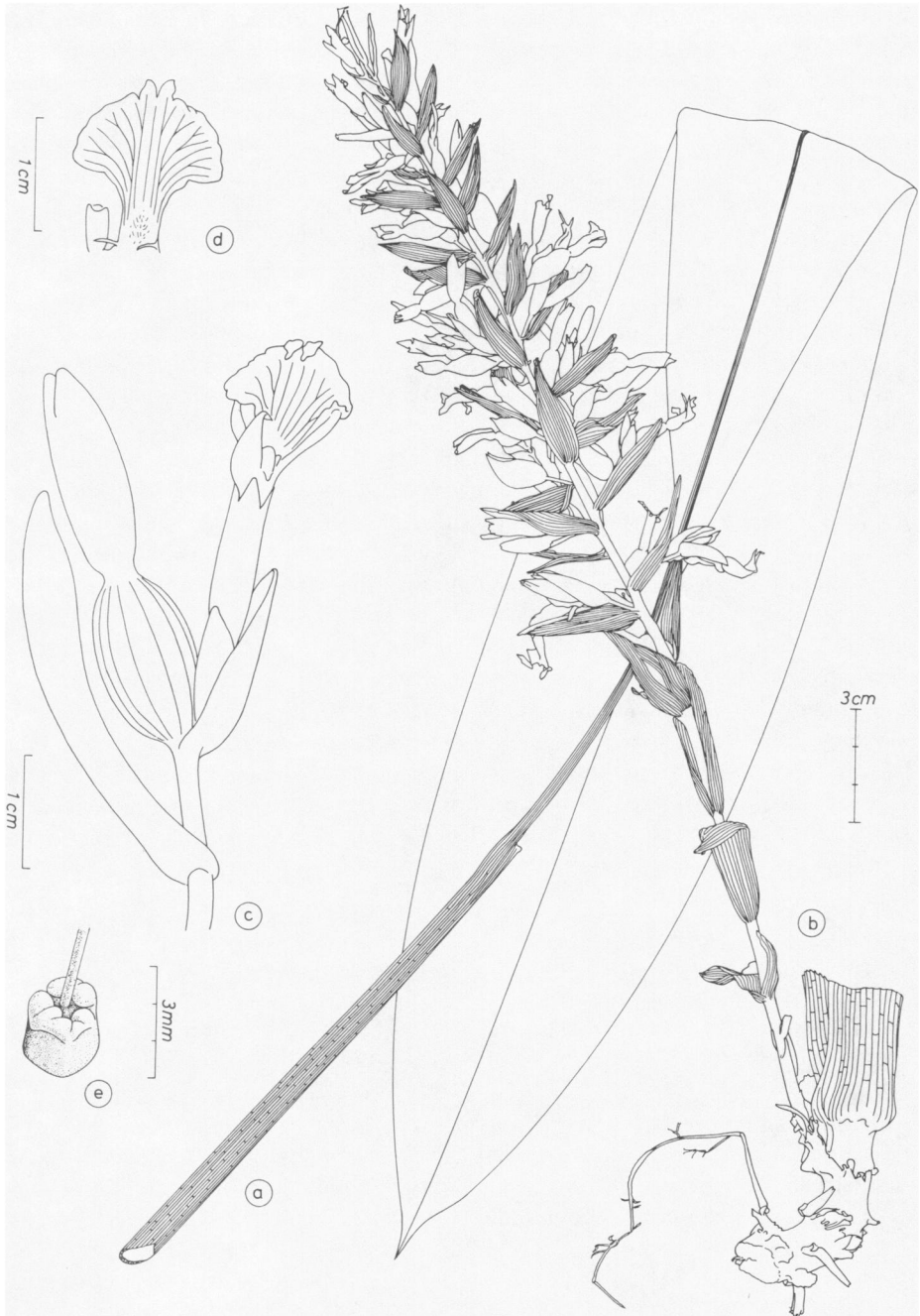


FIG 54. *Renealmia urbaniana* (a, Prance et al 2819; b-e, Prance et al 16333). a, leaf; b, inflorescence; c, bract with cincinnus; d, labellum and stamen; e, nectarial glands.

late, 10-15 mm wide, to 20 mm at the base of the plant, sparsely to rather densely covered with simple (and furcate) prickles (less than 0.1 mm long) and with some needle-like hairs. Ligule ca 1 mm long. Petiole 30-90 mm long, hairy like the sheaths. Lamina narrowly elliptic, acute to acuminate at the apex (acumen 10-15 mm long), cuneate at the base, 20-48 cm long, (5-)8-10(-13) cm wide, lower side tinged with purple, margins covered with simple hairs (up to 0.5 mm long), midrib on lower side glabrous or sparsely covered with simple (and furcate) hairs (to 0.2 mm long). Scape prostrate or erect, 5-15 cm tall, up to 4 mm thick, beset with sheaths up to 2.5-5(-7) cm long and 0.5-1 cm wide. Inflorescence a basal thyrse 15-25 cm long and 3-6 cm wide, with 2-flowered cincinni, rhachis purple-red. Indument of inflorescence: sheaths, rhachis, bracts, bracteoles, and basal part of calyx densely to sparsely covered with simple and furcate (rarely with some plurifurcate) hairs (0.1-0.3 mm long); peduncles, pedicels, apical part of calyx, ovary, and capsule densely to very densely covered with mainly simple hairs (to 0.4 mm long), furcate hairs less dominant; corolla glabrous. Bracts purplish-green, rather long persistent, narrowly triangular, acute, 15-45 mm long, 4-10 mm wide. Peduncles green, (5-)8-10(-13) mm long. Bracteole (8-)10-15(-20) mm long. Pedicels green, 1-2(-4) mm long. Calyx pale red, tubular, 8-18 mm long, 4-5 mm wide, the lobes triangular to deltate, up to 6 mm long. Corolla white to yellowish white, 25 mm long, the tube 15 mm long, the lobes 10 mm long, 4-6 mm wide. Labellum pale yellow dark yellow in the centre, ca 16 mm long and wide when spread out, middle and basal part densely covered with simple and some furcate hairs (0.2-0.3 mm long), the limb horizontally spreading, ca 10 mm long, 16 mm wide, lateral lobes rounded, 9-10 mm long, 5-6 mm wide, middle lobe bilobulate, lobules triangular, 3 mm long, basal claw 5 mm long, 3 mm wide, lateral staminodes ca 1 mm long. Anther 5 mm long, 2 mm wide, glabrous. Style 19 mm long. Nectarial glands multilobulate, completely surrounding the style base, 2 mm long. Ovary brownish-red, ellipsoid. Capsule purple-red, ellipsoid, 12-17 X 6-8(-11) mm, its wall 0.1-0.2 mm thick when dry (1.5-2 mm in living material), 13-seeded, seeds 3 X 3.5-4 mm, aril white.

TYPE. *Ule 5777* (holotype, B, destroyed; lectotype, G; isotype, MG), Juruá-Mirim, near Belém, Acre, Brazil.

DISTRIBUTION (Fig 59). Amazonian Colombia, Brazil, and Peru; mainly in várzea forests, from sea-level to 240 m.

COLOMBIA. CAQUETÁ: *Cuatrecasas, Soderstrom & Soria 27184* (US). VAUPÉS-META: *Cuatrecasas 7440* (COL). BRAZIL. ACRE: *Maas et al 12914* (E, INPA, MO, NY, U, W); *Prance et al 12060* (COL, DAV, INPA, K, MG, NY, U, US); *Prance et al 2819* (NY, U). AMAZONAS: *Huber 4433* (MG); *Krukoff 8595* (F, GH, NY); *Prance et al 16333* (COL, F, GH, INPA, K, MG, MO, NY, P, R, S, U, US, VEN). PERU. LORETO: *Asplund 14766* (S); *Ll. Williams 5245* (F).

This species is closest to *R. krukovii* and *R. erythrocarpa*. It is characterized by its narrowly triangular, greenish bracts, its long, tubular calyx (with lobes up to 6 mm long), its long petiole (30-90 mm long!), and its densely hairy capsule.

52. *Renalmia vallensis* Maas, Acta Bot. Neerl. 24: 480. 1976.

Fig 55.

Plants 1-1.5 m tall. Rhizomes 15-20 mm thick. Sheaths reticulate, 10-15 mm wide, to 25 mm at the base of the plant, densely covered in the grooves with stellate hairs, and towards the reticulations with tufts of both stellate and simple hairs. Ligule ca 1 mm long. Petiole 40-60 mm long, hairy like the sheaths. Lamina narrowly elliptic to elliptic-obovate, acute to shortly acuminate at the apex, cuneate at the base, 25-40 cm long, 10-14 cm wide, upper side rather densely covered with erect, simple hairs (0.2-0.5 mm long), lower side very densely covered with many-rayed, stellate

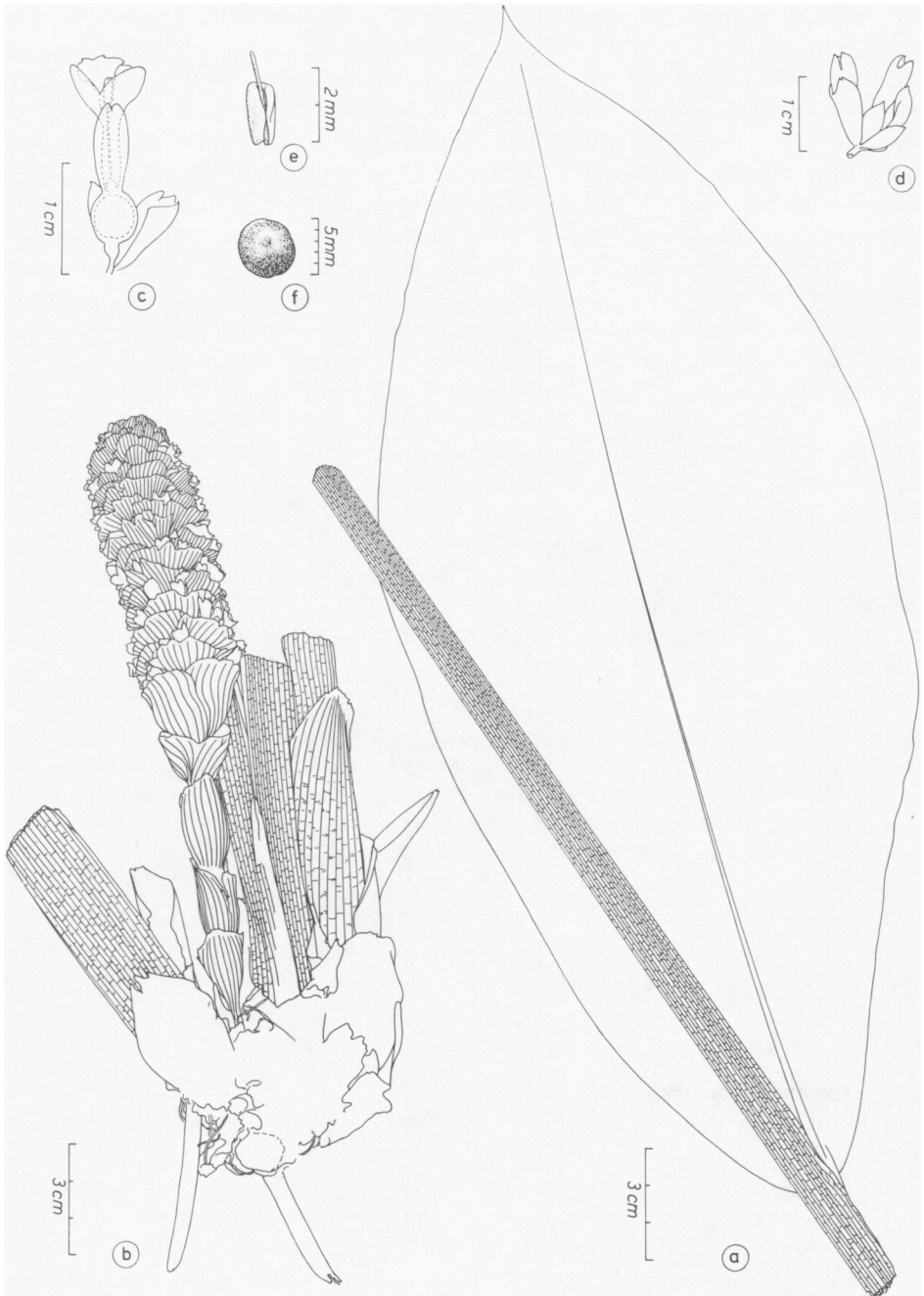


FIG 55. *Renealmia vallensis* (a-b, Cuatrecasas 19855; c-f, Killip & García-Barriga 33263). a, leaf, b, inflorescence; c, flower; d, cincinnus with bract removed; e, nectarial glands; f, seed from the 1-seeded capsule.

hairs (less than 0.1 mm long). Scape 12-22 cm tall, to 5 mm thick, beset with sheaths up to 6 cm long and 1.2 cm wide. Inflorescence a spiciform, basal thyrse 5-17 cm long and 2.5-3 cm wide, with 1-3-flowered cincinni. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, and pedicels densely covered with many-rayed, stellate hairs (less than 0.1 mm long) and simple to plurifurcate hairs (to 0.2 mm long), the bracts becoming glabrous at length; bracteoles, calyx, ovary, and capsule sparsely hairy to glabrous, corolla glabrous. Bracts greenish-red, long-persistent, broadly ovate-obovate, obtuse, 10-20 mm long, 10-25 mm wide. Peduncles less than 1 mm long. Bracteole 6-10 mm long. Pedicels ca 2 mm long. Calyx red to pink, tubular, 6-7 mm long, 2-4 mm wide, the lobes shallowly triangular-ovate, 1-2 mm long, 2-4 mm wide. Corolla white to yellow, 13 mm long, the tube 7 mm long, 1-1.5 mm wide, the lobes 6 mm long, 4 mm wide. Labellum white to yellow, red-striped, 6 mm long and 5 mm wide when spread out, basal and middle part densely hairy, the limb ca 3.5 mm long, 5 mm wide, lateral lobes rounded, middle lobe entire and rounded, basal claw 2.5 mm long, 2 mm wide, lateral staminodes ca 1 mm long. Anther 3 mm long, 1.5 mm wide, glabrous. Style 11 mm long. Nectarial glands partly surrounding the style base, ca 1 mm long. Ovary red, ellipsoid. Capsule red, globose, 4-6 mm diam, its wall ca 0.1 mm thick when dry, 1-seeded, seed 3 X 4 mm.

TYPE. *Cuatrecasas* 19855 (holotype, F), mouth of Río Dagua, near Córdoba, El Valle del Cauca, 39-60 m, Colombia.

DISTRIBUTION (Fig 61). Colombia, Costa del Pacífico of El Valle del Cauca; forests from sea-level to 80 m.

COLOMBIA. EL VALLE: Río Naya, Puerto Merizalde, Costa del Pacífico, *Cuatrecasas* 14044 (F); Río Cajambre, Barco, Costa del Pacífico, *Cuatrecasas* 17145 (F); Buenaventura, Pulpapel, *Kennedy* 780 (U); Sabaletas, km 29 of Highway Buenaventura-Cali, *Killip & Cuatrecasas* 38777 (F, US); 18 km E of Buenaventura, *Killip & García-Barriga* 33263 (US).

Renealmia vallensis is very peculiar for its one-seeded capsules and its indument of many-rayed, stellate hairs on the rhachis as well as on the lower side of the lamina. It is closely related to both *R. costaricensis* and *R. pluriplicata*.

Cuatrecasas 21143 (F) and *Schultes & Villarreal* 7357 (US), both from Quebrada de la Brea, Río Calima, El Valle, Colombia, match this species in many features, but their leaves are glabrous above, and the lower side is densely covered with hairs of the compass-needle type. Additional material may clarify the systematic position of these specimens.

53. *Renealmia wurdackii* Maas, Acta Bot. Neerl. 24: 480. 1976. Fig 56.

Plants 2 m tall, forming clumps of 20-30 arching stems, each with 15-20 leaves (*Madison* 10292-70). Rhizomes ca 15 mm thick, densely covered with mainly furcate hairs. Sheaths striate, 5-22 mm wide, densely covered with furcate, stellate, or simple prickles (less than 0.1 mm long) and towards the ligule mixed with needle-like hairs and furcate to plurifurcate hairs. Ligule ca 1 mm long, densely covered with needle-like and furcate to plurifurcate hairs. Petiole 0-20 mm long, hairy like the sheaths. Lamina narrowly elliptic, shortly acuminate at the apex (acumen to 10 mm long), cuneate at the base, 40-57 cm long, 6-9.5 cm wide, glabrous on both sides. Scape ca 15 cm tall, up to 7 mm thick, beset with sheaths up to 4-7 cm long and 1-1.5 cm wide. Inflorescence a spiciform basal thyrse 6-12 cm long and 3.5-8 cm wide, with 4-5-flowered cincinni, rhachis red-orange. Indument of inflorescence: rhachis rather densely to sparsely covered with very shortly stalked, furcate and plurifurcate hairs (ca 0.1 mm long) and some scattered, simple hairs; sheaths, bracts, peduncles, brac-

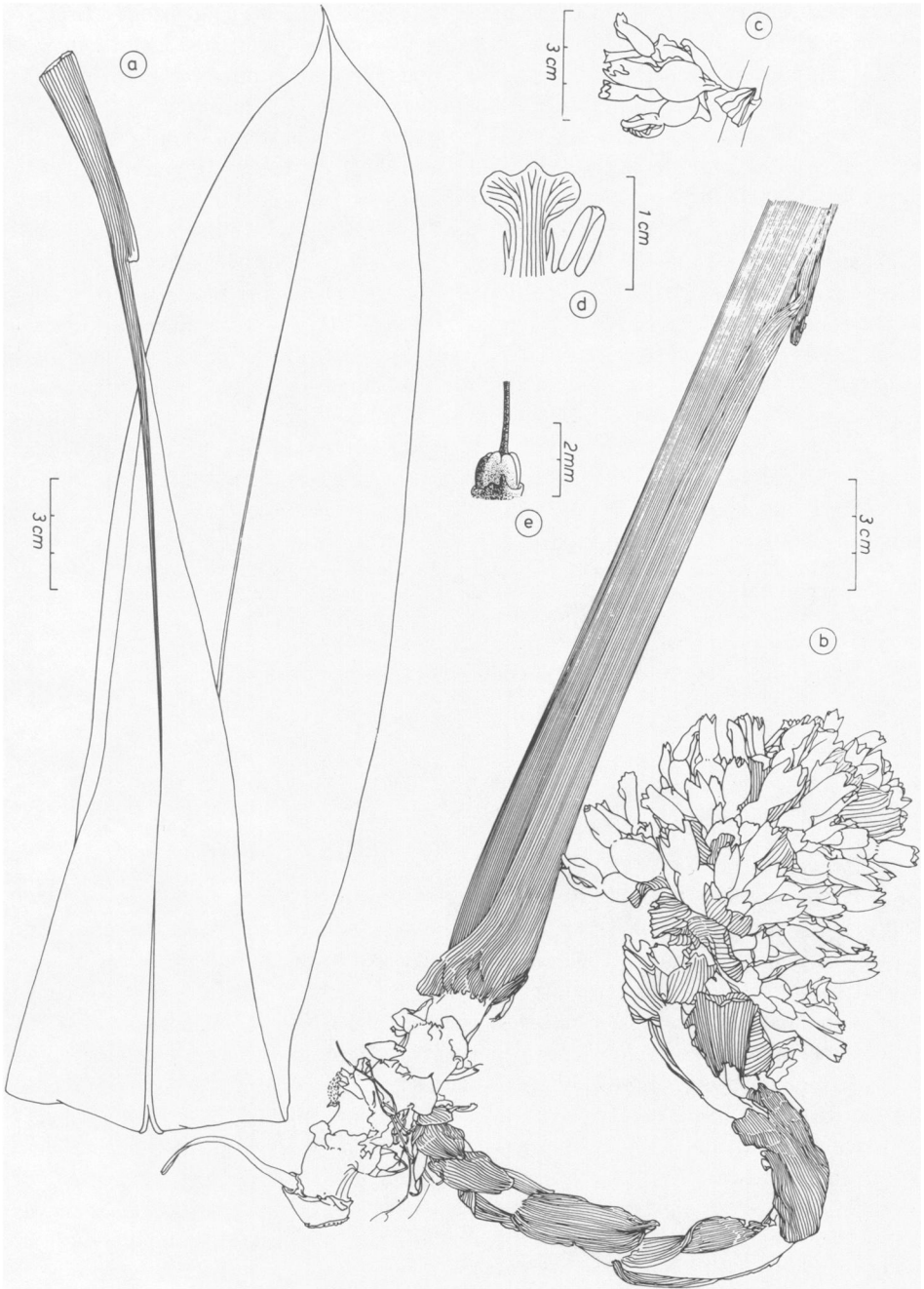


FIG 56. *Renalmia wurdackii* (a, *Madison 10292*; b-e, *Wurdack 1045*). a, leaf; b, base of plant with inflorescence; c, cincinnus; d, labellum and stamen; e, nectarial glands.

teoles, pedicels, calyx, and capsule sparsely so to glabrous, corolla glabrous. Bracts red to orange-red, rather long persistent, ovate to broadly ovate, 20-35 mm long, 15-23 mm wide. Peduncles 4-10 mm long. Bracteole 15-17 mm long. Pedicels 3-5 mm long. Calyx bright red, tubular to slightly turbinate, 12-16 mm long, 4-7(-10) mm wide, the lobes deltate to shallowly triangular, 2-4 mm long, 3-5 mm wide. Corolla yellow, 19-22 mm long, the tube 11-12 mm long, the lobes 8-10 mm long, 4-5 mm wide. Labellum 9 mm long and 8 mm wide when spread out, glabrous, the limb 4 mm long, 8 mm wide, middle lobe rounded and entire, basal claw 5 mm long, 3-4 mm wide, lateral staminodes 2-3 mm long, 0.2 mm wide. Anther 5-6 mm long, 2-3 mm wide, glabrous. Style 18-20 mm long. Nectarial glands multilobulate, completely surrounding the style base, 1.5 mm long (*Madison 10292-70*), or reduced to three small glands, one 1 mm long, another 0.2 mm long, the third stipitate, 0.5 mm long (*Wurdack 1045*). Ovary ellipsoid. Capsule black, ellipsoid, 13-15 X 8-11 mm, its wall 0.1-0.2 mm thick when dry, 10-20-seeded, seeds 3-3.5 X 2-2.5 mm.

TYPE. *Wurdack 1045* (holotype, US, 2 sheets), 1-5 km SSE of Yambrasbamba, prov. de Bongará, 2100-2400 m, Amazonas, Peru. In moist, high forest, rare.

DISTRIBUTION (Fig 58). Known only from 2 collections from Peru. In forests, between 2000 and 2400 m; uncommon.

PERU. AYACUCHO: prov. La Mar, cloud forest near Eastern Rihüana (1 km from Huanhuachayo) on the Capprichio-Puncu trail, on the west slope of the Río Apurimac Valley at ca 2050 m, *Madison 10292-70* (NA, paratype).

The relationship of this new species is quite uncertain.

According to Madison the flowers have a "powerful, pungent, unpleasant smell."

UNNAMED FORMS

54. *Renealmia spec A*

Plants ca 1 m tall. Sheaths striate, 5-15 mm wide, rather densely covered with stellate scales (0.02-0.04 mm wide) and compass-needle hairs (0.1-0.6 mm wide). Ligule 2-3 mm long, densely covered with needle-like hairs. Petiole 0-15 mm long, hairy like the sheaths. Lamina narrowly elliptic to narrowly obovate, shortly acuminate at the apex (acumen 5-7 mm long), cuneate at the base, 13-23 cm long, 5-7 cm wide, upper side glabrous except for some scattered, needle-like hairs along the midrib, lower side densely covered with compass-needle hairs (0.1-0.4 mm wide). Scape 13-20 cm tall, to 4 mm thick, beset with sheaths up to 5 cm long and 0.6 cm wide. Inflorescence a basal thyrse 7-11 cm long and 1.5-3.5 cm wide, with 3-4-flowered cincinni. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and capsule densely covered with compass-needle hairs, some of the hair branches furcate. Bracts red, finally deciduous, ovate (-triangular), obtuse, 10-18 mm long, 10-15 mm wide. Peduncles 2-4 mm long. Bracteole 7-8 mm long. Pedicels ca 2 mm long. Calyx red, tubular, 6 mm long, 4 mm wide, the lobes depressed ovate, 1-1.5 mm long, 2-3 mm wide. Corolla, labellum, stamen, and style unknown. Nectarial glands only partly surrounding the style base, ca 1 mm long. Ovary ellipsoid. Capsule red(?), globose, 4-5 mm in diameter, its wall 0.1 mm thick when dry, 3-4-seeded, seeds 2 X 3.5 mm.

DISTRIBUTION. Restricted to the Cerro Pirre Region, Darién, Panama; in cloud forests, at ca 1200 m.

PANAMA. DARIÉN: Cerro Pirre, *Duke 6109* (GH, US); Cerro Pirre, cloud forest, ca 1200 m, *Duke 6566* (MO).

I am fairly sure that both specimens cited represent an undescribed species, but as the material is very incomplete I refrain from naming it. It is closely related to *R. pluriplicata*, differing in striate instead of reticulate leaf-sheaths. Moreover, the indument is completely different, *R. pluriplicata* having simple hairs on the lower side of the lamina, the two above-cited specimens bearing, in contrast, compass-needle hairs.

Grubb, Lloyd, Pennington & Whitmore 1041 (K), from Cerro Antisana, NE of Borja, 2000 m, Ecuador, is related to this species by its striate leaf-sheaths, its indument, and the structure of its inflorescence.

55. *Renealmia* spec B

Plants 0.7-2 m tall. Rhizomes ca 5 mm thick (when dry). Sheaths striate, to 10 mm thick at the base of the plant, sparsely covered with simple to furcate prickles (less than 0.1 mm long). Ligule ca 1 mm long. Petiole up to 20 mm long, hairy like the sheaths. Lamina narrowly elliptic, long-attenuate at base and apex, (9-)31 cm long, (2.5-)5.5-6.5 cm wide, glabrous on both sides. Scape prostrate, 4-10 cm tall, up to 5 mm thick, beset with sheaths up to 5 cm long and 1.5 cm wide. Inflorescence a basal, unilateral raceme 6-10 cm long and 3-5 cm wide, rhachis pinkish red. Indument of inflorescence: sheaths, rhachis, bracts, peduncles, bracteoles, pedicels, calyx, ovary, and young capsule densely to rather densely covered with furcate to plurifurcate (and some simple) hairs (up to 0.3 mm long); corolla glabrous. Bracts pinkish-red, soon decoloring brown, persistent, ovate, obtuse, 10-25 mm long, 10-16 mm wide. Peduncles 2-10 mm long. Bracteole pinkish-red, 13-16 mm (in living material to 22 mm) long. Pedicels 2-3 mm long. Calyx 13-14 mm (in living material 16-18 mm) long, 5-7 mm wide tubular, pinkish-red, lobes deltate, 4-7 mm long. Corolla yellow, ca 27 mm long, tube ca 12 mm long, lobes ca 15 mm long, the dorsal one ca 10 mm wide, the two lateral ones 6-8 mm wide. Labellum yellow, ca 10 mm long and 5 mm wide when spread out, inner side densely covered with simple hairs (to 0.5 mm long), lateral lobes slightly involute, 2-3 mm long, 1-1.5 mm wide, middle lobe rounded, entire, basal claw absent, lateral staminodes ca 1.5 mm long. Anther 8 mm long, 3-4 mm wide. Style 23 mm long. Nectarial glands multilobulate, completely surrounding the style base. Ovary green, maturing pinkish-green, ellipsoid to globose. Young capsule pinkish-green, ellipsoid to globose, 15-25 X 15-20 mm, its wall ca 0.2 mm thick when dry, 2-3 mm in living material, 25-30-seeded, seeds ca 4 X 3 mm, young aril white.

DISTRIBUTION. Venezuela, Aragua, cloud forest; flowering in October.

VENEZUELA. Aragua: Parque Nacional Henry Pittier, Choroni, cloud forest near Regresiva del Diablo, 1550 m, *Foldats 3889* (VEN), *Maas & Badillo 2171* (MY).

In 1974 I made a field trip to Choroni under the guidance of Dr. Victor Badillo, director of the Herbarium of the Instituto de Botánica Agrícola at Maracay. He was so kind as to transport me to the place where this species was first collected by Foldats (in 1960). It appeared to be fairly common near Regresiva del Diablo, and herbarium material was collected in a large number of sets. Very unfortunately this material was lost in the air mail from Venezuela to Holland, and now the Maracay set is the only one left. Therefore I prefer to describe this species at a later date, after having collected it again (probably in 1977), when I hope to distribute a good set of duplicates.

Species B is related to *R. alpinia*.

INSUFFICIENTLY KNOWN SPECIES

Alpinia humilis Vellozo, Fl. Flum. 1: t. 4. 1827; Horaninow, Prodr. 33. 1862; Vellozo, Fl. Flum. in Arch. Mus. Nac. Rio de Janeiro 5: 2. 1881; K. Schumann in Engler, Pflanzenreich 4. 46: 370. 1904 (name only). Type. Not seen, probably not preserved—*Renealmia* spec.

Renealmia angustifolia K. Schumann in Engler, Pflanzenreich 4. 46: 304. 1904. Type. *Sellow 498* (holotype, B, destroyed; type-photographs, F, MO, NY, U, etc.), between Victoria and Bahia, Espirito Santo, Brazil. Relative of both *R. chrysotricha* and *R. petasites*.

Renealmia pycnostachys K. Schumann in Engler, Pflanzenreich 4. 46: 302. 1904; Loesener in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 15A: 609. 1930.

Plant of unknown height. Sheaths slightly reticulate, ca 15 mm wide. Petiole absent. Ligule ca 2 mm long. Lamina narrowly elliptic, acuminate at the apex, gradually narrowed towards the base, 60 cm long, 10 cm wide, glabrous on both sides. Inflorescence a terminal, dense, ovoid raceme 7 cm long and 6 cm wide, the uppermost sheath ca 20 cm long. Indument of inflorescence: rhachis and bracts subtomentose, bracteoles and calyx sericeous. Bracts pink, persistent (?), narrowly elliptic, obtuse, to 30 mm long and 15 mm wide. Length of peduncles and pedicels unknown, according to K. Schumann flowers subsessile. Bracteole obliquely truncate, ca 20 mm long. Calyx tubular, 16 mm long, 6 mm wide, the lobes deltate, ca 4 mm long. Corolla 22 mm long, the tube 15 mm long, the lobes 7 mm long. Labellum ?. Anther 5 mm long. Style ca 18 mm long. Nectarial glands 2 mm long. Ovary ellipsoid, 7 X 4 mm. Capsule ?.

TYPE. *Schwacke 11952* (holotype, B, destroyed; photographs F, MO, NY, U, etc), Serra Pedra Bonita, Rio Novo, Minas Gerais, Brazil.

DISTRIBUTION. Known only from the type locality in Minas Gerais; in virgin forest along stream.

Schumann placed this species near *R. thyrsoides* and *R. petasites*. Loesener, however, had quite a different opinion about its position, that it was closely related to *R. cernua*. I cannot place this species yet, since only a type-photograph has been available for study, but it is certainly not closely related to any of the species suggested by either Schumann or Loesener.

I highly recommend to future plant collectors in Central Brazil to pay attention to this species; it is the only Central Brazilian *Renealmia* with a terminal inflorescence.

EXCLUDED SPECIES

Renealmia spectabilis Rusby, Mem. New York Bot. Gard. 7: 218. 1927. Type. *M. Cárdenas 2039* (holotype, NY; isotypes, MICH, NY), Rurrenabaque, dep. Beni, Bolivia—=*Alpinia zerumbet* (Persoon) Burt & R. M. Smith (= *Alpinia speciosa* (Wendland) K. Schumann).

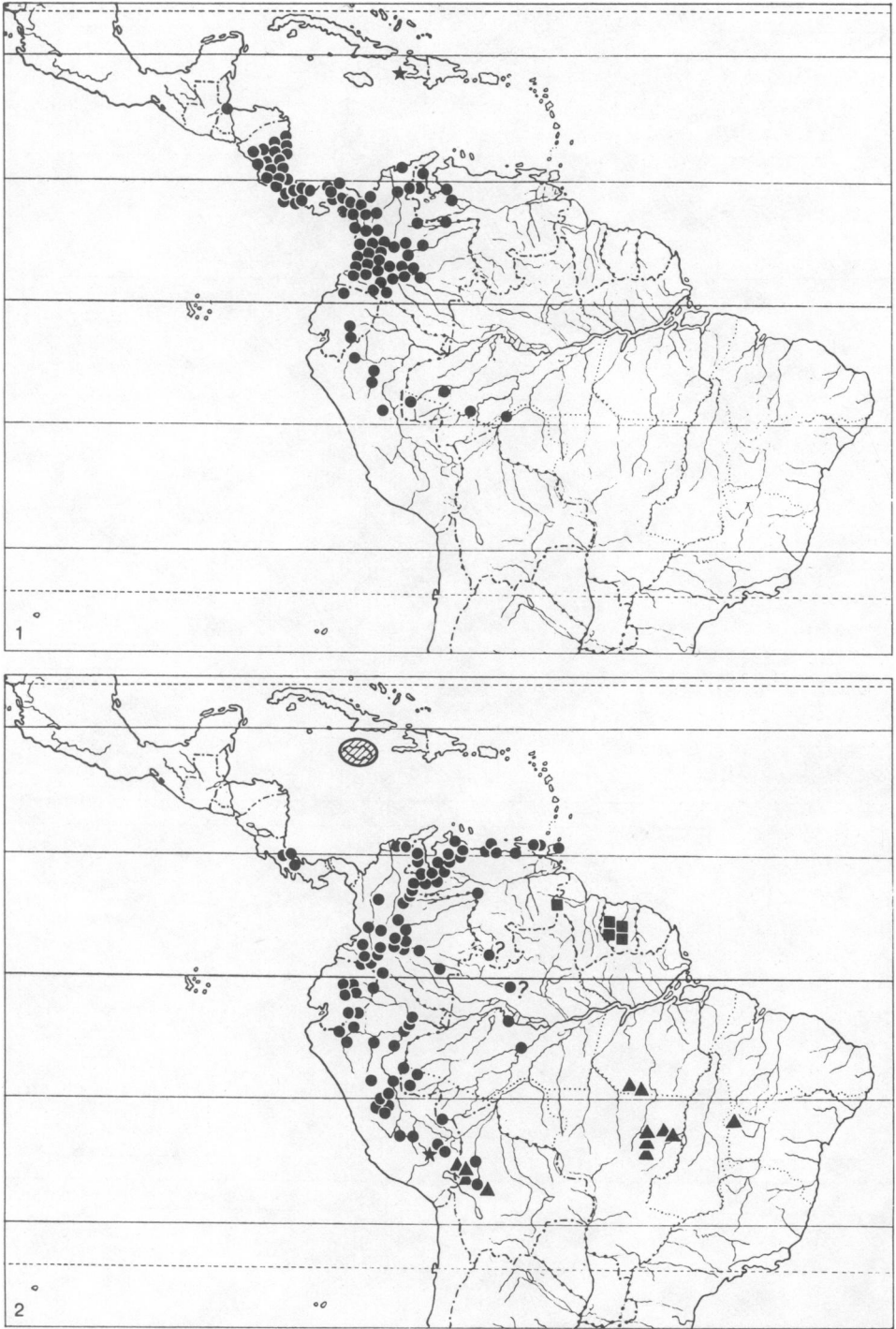


FIG 57. Distributional maps 1-2. 1, *R. cernua*: ●; *R. densiflora*: ★; 2, *R. thyrsoides* subsp *thyrsoides*: ●; *R. thyrsoides* subsp *chrysantha*: ■; *R. dermatopetala*: ▲; *R. sylvestris*: ●; *R. pallida*: ★.

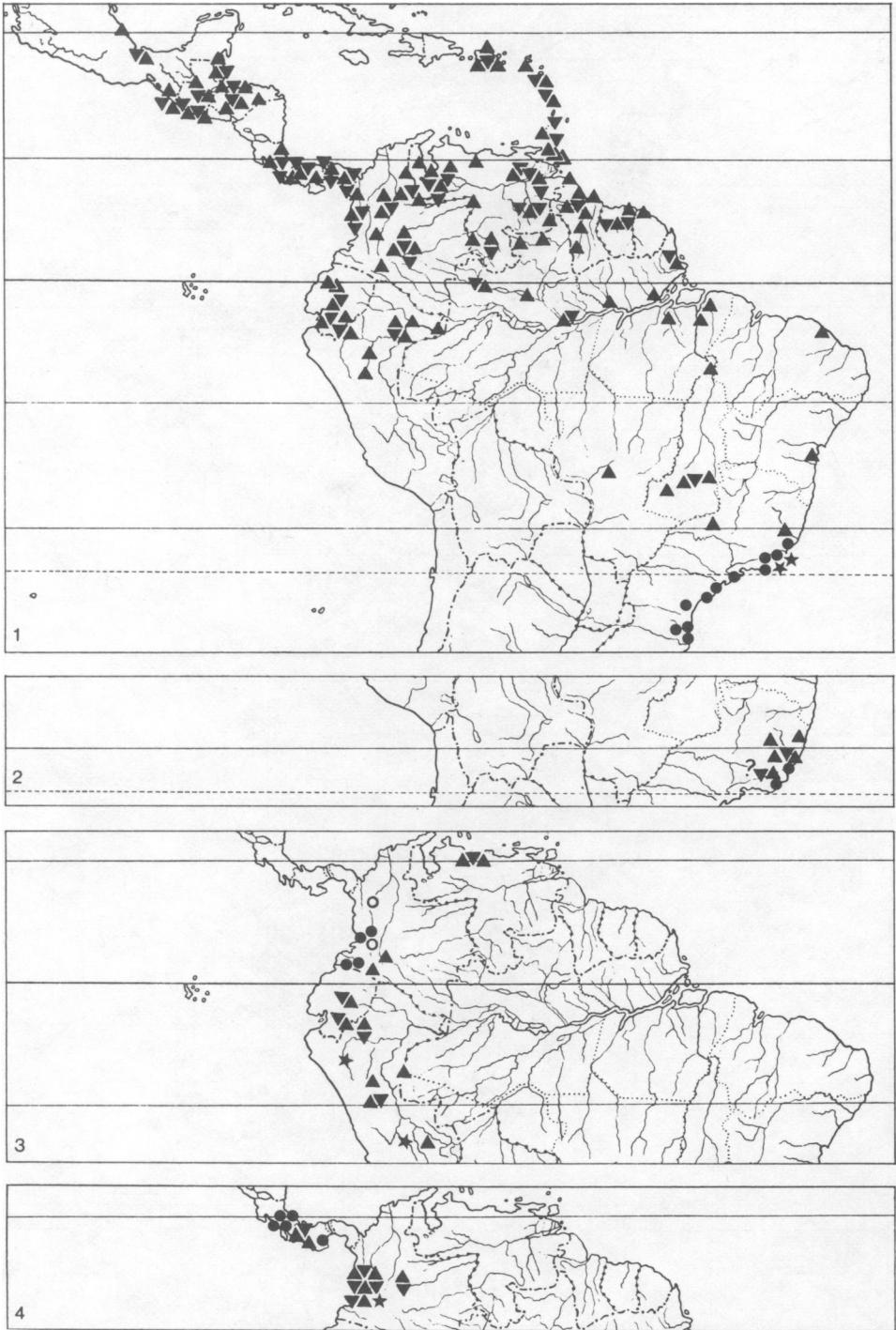


FIG 58. Distributional maps 1-4. 1, *R. alpina*: ▲ ; *R. petasites*: ● ; *R. chrysotricha*: ★ . 2, *R. brasiliensis*: ▲ ; *R. reticulata*: ● . 3, *R. lucida*: ● ; *R. ferruginea*: ○ ; *R. nicolaioides*: ▲ ; *R. wurdackii*: ★ . 4, *R. scaposa*: ● ; *R. caucana*: ★ .

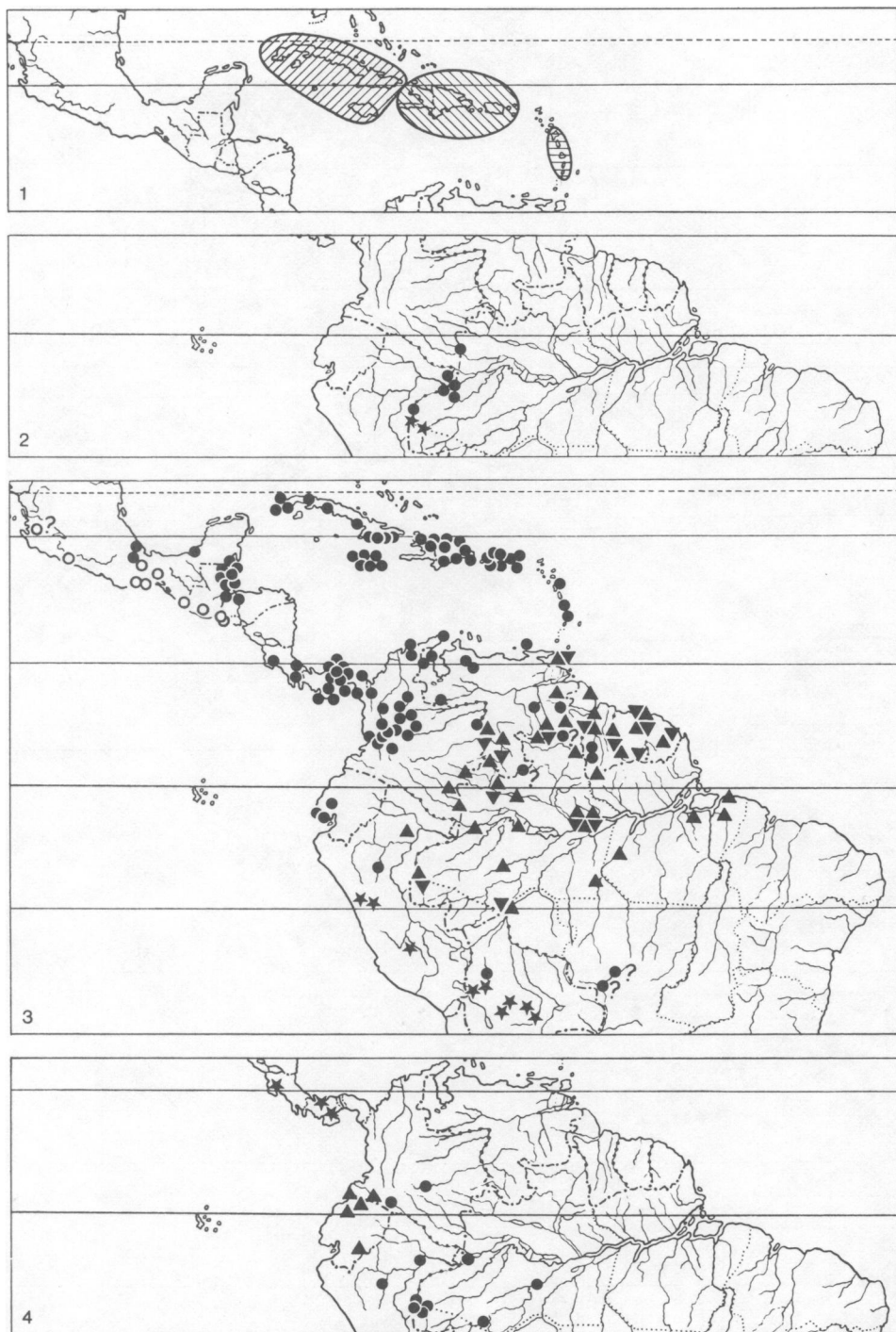


FIG 59. Distributional maps 1-4. 1, *R. jamaicensis* var *jamaicensis*: ◐; *R. jamaicensis* var *puberula*: ◑; *R. pyramidalis*: ◒. 2, *R. acreana*: •; *R. krukovii*: * . 3, *R. occidentalis* var *occidentalis*: •; *R. occidentalis* var *pacifica*: ○; *R. floribunda*: ▲. 4, *R. fragilis*: ▲; *R. racemosa*: *; *R. urbaniana*: •; *R. erythrocarpa*: * .

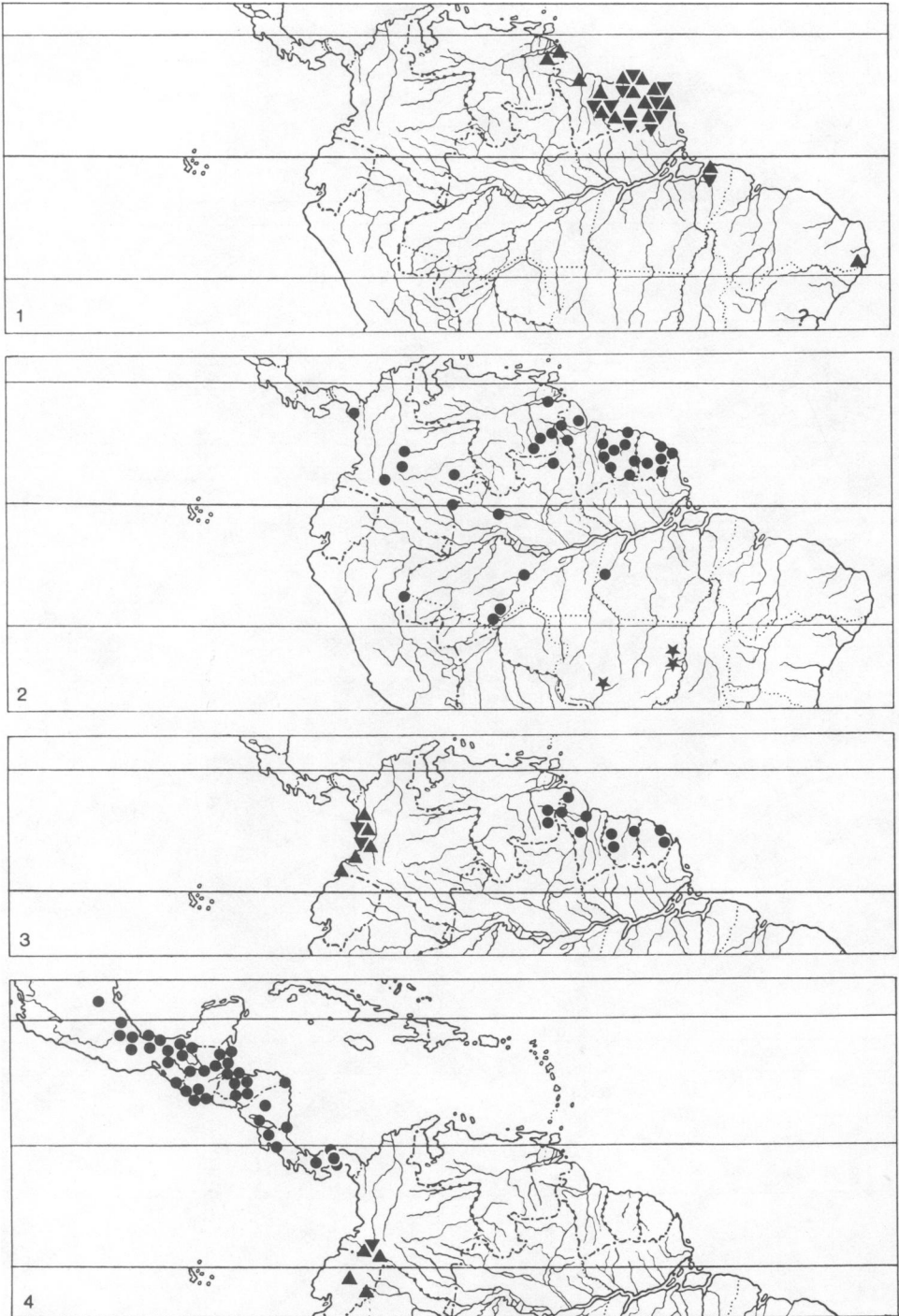


FIG 60. Distributional maps 1-4. 1, *R. guianensis*. 2, *R. monosperma*: ●; *R. matogrossensis*: ★. 3, *R. cuatrecasii*: ▲; *R. orinocensis*: ●. 4, *R. mexicana*: ●; *R. asplundii*: ▲.

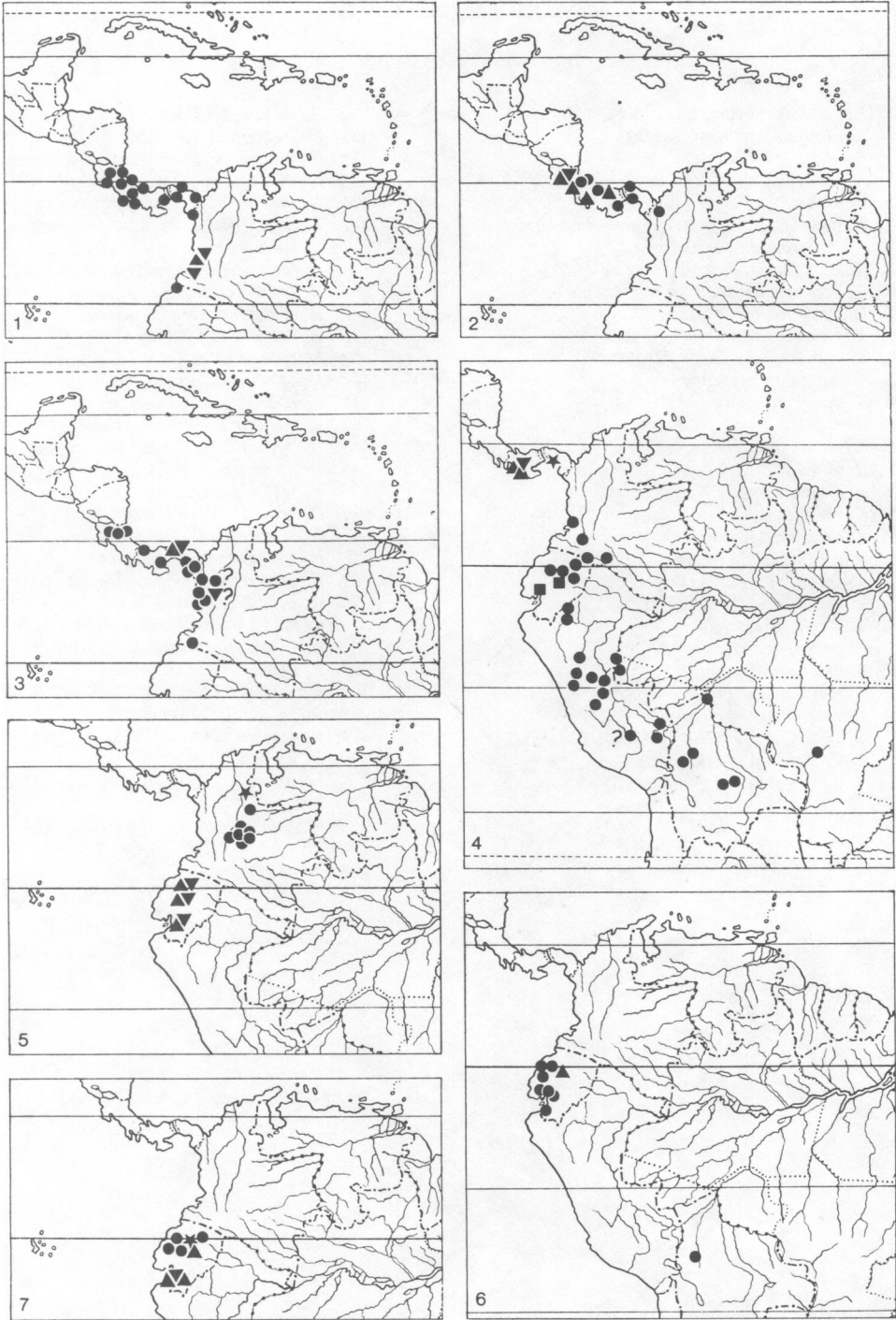


FIG 61. Distributional maps 1-7. 1, *R. pluriplicata*: ● ; *R. vallensis*: ▲ . 2, *R. congesta*: ▲ ; *R. costaricensis*: ● . 3, *R. concinna*: ● ; *R. dressleri*: ▲ . 4, *R. breviscapa*: ● ; *R. chiriquina*: ▲ ; *R. puberula*: ■ ; *R. helenae*: ★ . 5, *R. chalcochlora*: ● ; *R. alticola*: ★ ; *R. sessilifolia*: ▲ . 6, *R. oligosperma*: ● ; *R. dolichocalyx*: ▲ . 7, *R. aurantifera*: ● ; *R. stellulata*: ▲ ; *R. oligotricha*: ★ .

NUMERICAL LIST OF TAXA

Species abbreviations are given in parenthesis.

1. *Renealmia acreana* Maas (acr)
2. *R. alpinia* (Rottb.) Maas (alp)
3. *R. alticola* Maas (alt)
4. *R. asplundii* Maas (asp)
5. *R. aurantifera* Maas (aur)
6. *R. brasiliensis* K. Sch. emend. Maas (bra)
7. *R. breviscapa* P. & E. (bre)
8. *R. caucana* Maas (cau)
9. *R. cernua* (Sw. ex R. & S.) Macbr. (cer)
10. *R. chalconchloa* K. Sch. (cha)
11. *R. chiriquina* Standley (chi)
12. *R. chrysotricha* O. G. Pet. (chr)
13. *R. concinna* Standley (coc)
14. *R. congesta* Maas (cog)
15. *R. costaricensis* Standley (cos)
16. *R. cuatrecasii* Maas (cua)
17. *R. densiflora* Urban (den)
18. *R. dermatopetala* K. Sch. (der)
19. *R. dolichocalyx* Maas (dol)
20. *R. dressleri* Maas (dre)
21. *R. erythrocarpa* Standley (ery)
22. *R. ferruginea* Maas (fer)
23. *R. floribunda* K. Sch. (flo)
24. *R. fragilis* Maas (fra)
25. *R. guianensis* Maas (gui)
26. *R. helenae* Maas (hel)
27. *R. jamaicensis* (Gärtn.) Horan.
 - a. var *jamaicensis* (jam-j)
 - b. var *puberula* (Gagnep.) Maas (jam-p)
28. *R. krukovii* Maas (kru)
29. *R. ligulata* Maas (lig)
30. *R. lucida* Maas (luc)
31. *R. matogrossensis* Maas (mat)
32. *R. mexicana* Kl. ex O. G. Pet. (mex)
33. *R. monosperma* Miq. (mon)
34. *R. nicolaioides* Loes. (nic)
35. *R. occidentalis* (Sw.) Sweet (occ)
 - a. var *occidentalis* (occ-p)
 - b. var *pacifica* Maas (occ-o)
36. *R. oligosperma* K. Sch. (ols)
37. *R. oligotricha* Maas (olt)
38. *R. orinocensis* Rusby (ori)
39. *R. pallida* Maas (pal)
40. *R. petasites* Gagnep. (pet)
41. *R. pluriplicata* Maas (plu)
42. *R. puberula* Steyerem. (pub)
43. *R. pyramidalis* (Lam.) Maas (pyr)
44. *R. racemosa* P. & E. (rac)
45. *R. reticulata* Gagnep. (ret)
46. *R. scaposa* Maas (sca)
47. *R. sessilifolia* Gagnep. (ses)
48. *R. stellulata* Steyerem. (ste)
49. *R. sylvestris* (Stokes) Horan. (syl)
50. *R. thyrsoides* (R. & P.) P. & E. (thy)
 - a. subsp *thyrsoides* (thy-t)
 - b. subsp *chrysantha* Maas (thy-c)
51. *R. urbaniana* Loes. (urb)
52. *R. vallensis* Maas (val)
53. *R. wurdackii* Maas (wur)
54. *R. species A* (A)
55. *R. species B* (B)

LIST OF EXSICCATAE

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 Alexander, E. J. 498 (35b)
 Alexander, R. C. sn (27a, 49)
 Allard, H. A. 18226, 18238 (27b)
 Alleizette, Ch. de sn (27b)
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 3708 (47), 3809 (5), 4241 (36),
 sn (40)
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 Appun, C. F. 611 (2)
 Araujo, D. 402 (40)
 Archer, W. A. 1473 (2), 1896 (9), 1939
 (16), 8107 (2)
 Arcy, W. G. d' 2595 (27b)
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 Ariste-Joseph, Bro. A 884 (10)
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 (34), 12695 (7), 14399,
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 17130, 17423 (5), 18313 (50a), 18429,
 19159, 19288, 19457 (42), 19541
 (34), 19585 (42)
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 Badillo, V. 5377 (2)
 Bailey, L. H. & E. Z. 158 (43)
 Baker, C. F. 3843 (27a)
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 Bang, M. 1237, 1658 (44), 2566 (18 + 50a)
 Bangham W. N. 347 (35a), 348 (2)
 Barkley, F. A. & Gutierrez, V. G. 1892 (50a)
 Barlow, F. D. 30/144, 30/174 (32)
 Bartlett, H. H. et al 11926 (32), 12450, 12601
 (35a), 16354, 16636 (9), 16850 (2),
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 Baumrucker, J. & Calzadilla, M. 9A (38)
 Beard, J. S. 651 (43)
 Beard, P. 1158, 1473 (43)
 Beckett, J. E. 8631 (33)
 Bélanger, C. P. 118, 327, 350 (43)
 Bell, R. J. 431 (37)
 Bello, W. 484 (45), 491 (2)
 Bená, P. 4040 (aff. 25/33)
 Benoist, R. 1711 (2)
 Benzoni, P. E. sn (35a)
 Berlin, B. 487 (34), 525 (2), 669 (50a), 704
 (7), 844 (34)
 Bernardi, A. L. 356 (50a), 739, 1529 (33)
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 Billberg, J. E. 229 (9)
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 Black, G. A. et al 50-9602 (2), 51-13517,
 51-13900 (23)
 Blanchet, J. S. B3, 1406, 2989 (2), sn (25)
 Blauner, B. F. 227, 234 (27b)
 Blum, K. E. et al 2522 (32)
 Bonpland, A. J. 1753 (35a), sn (9)
 Boon, H. 1014 (25)
 Bourgeau, E. sn (35a)
 Bowie, J. & Cunningham, A. 10 (45), 88 (12)
 Box, H. E. 1957 (43)
 Brade, A. C. 7225, 19230 (40), 19940 (45)
 Braun, A. sn (35a)
 Brenes, A. M. 3907, 4437 (32), 5700 (aff.
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- Perrottet, G. S. sn (2)
- Persaud, A. C. 268 (2)
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- Philipson, W. R. et al 1451 (9), 1731 (33), 2014, 2152, 2332 (50a), 2367 (9), 2398 (2)
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- Pinkley, H. V. 8 (2), 83 (4) sn (7)
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- Stevens, F. L. 1328 (9)
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- Vidal, J. sn (40)
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- Wachenheim, H. 148 (33)
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COSTOIDEAE
(ZINGIBERACEAE)

Additions to Flora Neotropica Monograph 8: 1-139. 1972

P. J. M. MAAS

INTRODUCTION

In 1972, having finished my revision of the Costoideae I stated in the introduction that the revision was far from complete, and now, about five years later, that has proved to be more than true. In the intervening years I assembled much more information on the group, since I had been able to carry out additional field work. Many specific descriptions now could be completed, a number of additional species had to be described and the delimitation and circumscription of some complex species has become better understood.

In this additional part I have constructed a new, complete key, which will prove more practical than the old key with numerous additions. I have included all new species and new combinations. All new collections are cited in the Index of Exsiccatae; they are only cited in the text when they are new to a country. In the coming years I hope to do more field work in western South America, because our knowledge of the group in that region is still very incomplete.

MORPHOLOGY

In 1972 I found out that two stigmatic types occur in the Costoideae: 1, a bilamellate stigma, with two flat, semilunular, ciliate structures closely appressed to each other, and provided with a dorsal two-lobed appendage affixing it to the anther. This type, illustrated in Fig 62d, which occurs in all species of *Costus* subgenus *Costus*, needs no further explication; 2, a cup-shaped stigma. As is clear from the Fig 62a, b, and c, the cup in all cases is gradually narrowed towards the base, and this stigma should perhaps be termed funnel-shaped rather than cup-shaped. A peculiar feature of this stigma-type is the presence of a dorsal thickening corresponding with the two-lobed dorsal appendage of type I. In *Costus cuspidatus* this thickening is very poorly developed. In *Monocostus* it can hardly be distinguished in dried material, but in spirit material it is very obvious. In *Dimerocostus* it is very well developed; in some stigmas of *Dimerocostus* it was very slightly two-lobed (as in type I).

CYTOLOGY

The chromosome numbers of 17 taxa of Costoideae were recently reported (Maas, 1972). During the present investigation the chromosome numbers of 13 additional species (Table I) were determined.

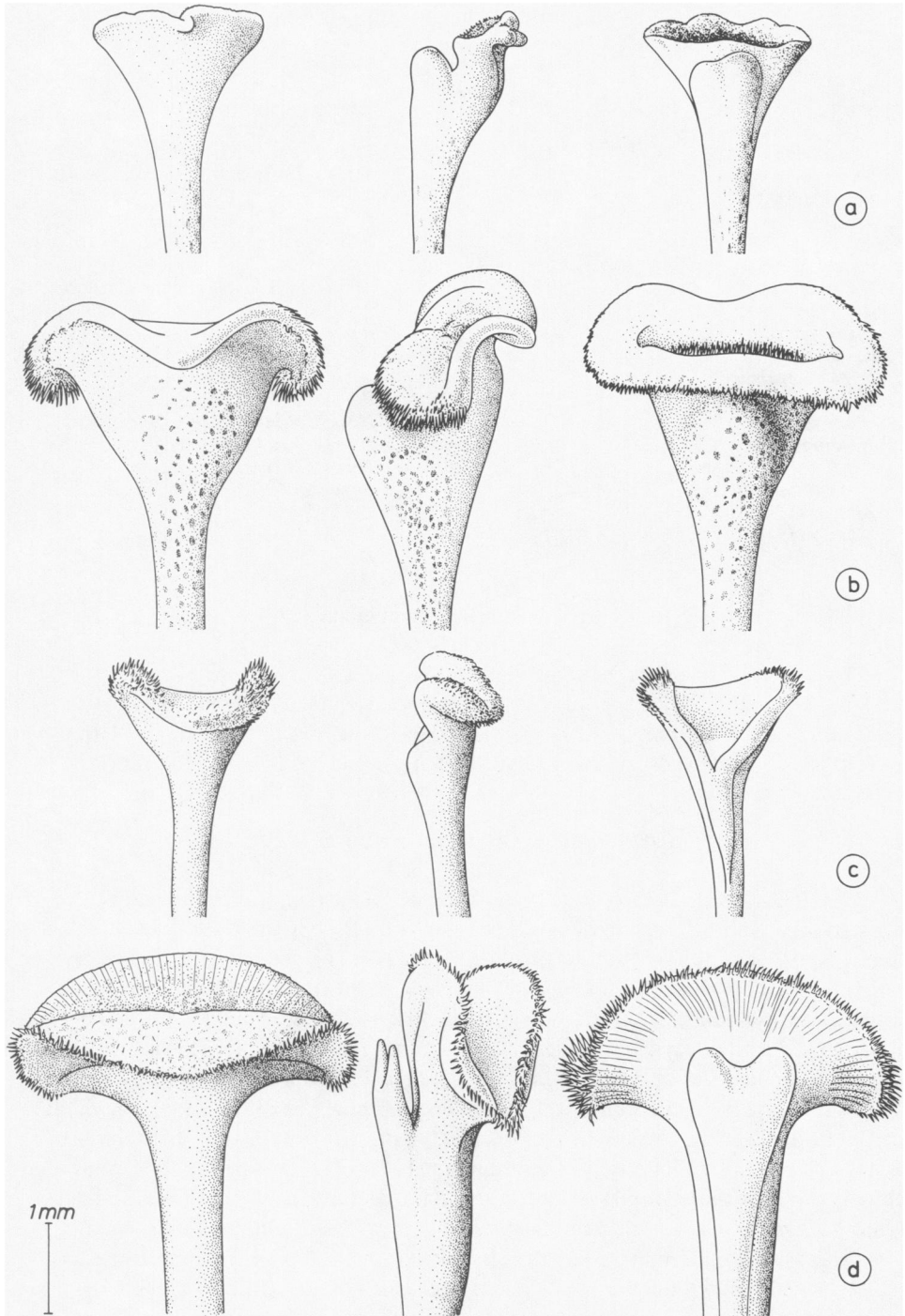


FIG 62. Stigmatic types in Costoideae. Stigmas seen from ventral, lateral, and dorsal side. a, *Monocostus uniflorus*; b, *Dimerocostus strobilaceus* subsp. *strobilaceus*; c, *Costus cuspidatus*; d, *Costus pulverulentus*.

TABLE I

Chromosome numbers in Costoideae

Species	2n	Source of the material
<i>Costus acreanus</i>	18	Prance et al 13155, Brazil
<i>C. allenii</i>	18	Maas & Dressler 708, Panama
<i>C. amazonicus</i> subsp <i>krukovii</i>	18	Prance et al 13684, Brazil
<i>C. arabicus</i>	18	Prance et al 11253, 11982, 15418, Brazil
<i>C. comosus</i> X <i>C. spiralis</i>	18	van Rooden & Akkermans 1, Venezuela
<i>C. guanaiensis</i> var <i>guanaiensis</i>	18	Prance et al 12952, 13047, Brazil
<i>C. guanaiensis</i> var <i>macrostrobilus</i>	18	van Rooden & Akkermans 18, Venezuela
<i>C. scaber</i>	18	Prance et al 11971, Brazil
<i>C. stenophyllus</i>	18	Maas & McAlpin 1444, Costa Rica
<i>C. varzearum</i>	18	Prance et al 12064, Brazil
<i>C. vinosus</i>	18	Maas et al 1600, Panama
<i>Dimerocostus argenteus</i>	28	Plowman & Davis 4725, Peru
<i>D. strobilaceus</i> subsp <i>strobilaceus</i>	28	Maas & Dressler 716, Panama
<i>Monocostus uniflorus</i>	28	Kress 75-65, Peru

Twenty neotropical species of *Costus* investigated have $2n = 18$, only a cultivated specimen of *Costus pictus* has $2n = 36$ (cf Maas, 1972).

Two additional counts for *Dimerocostus* confirm $2n = 28$ in that genus.

The diploid chromosome number for the monotypic genus *Monocostus* is $2n = 28$. This chromosome number came as a surprise to me, because the close relationship between *Monocostus* and *Costus* subgenus *Cadalvena* had made me to expect $2n = 18$ for *Monocostus* as well.

SUBDIVISION OF THE GENUS COSTUS

In 1972 I divided the genus *Costus* into two subgenera, *Cadalvena* and *Costus*, and I still maintain this subdivision. Now, five years later, I think the subgenus *Costus* should be divided into two sections based on labellum characters. The first section (section *Costus*) is characterized by a labellum with a short, rather broad tube, and a distinct, exposed limb; its colour varies from white to yellow, but the lateral lobes are often striped with red to purple. The bracts are mainly green. This section is adapted to pollination by bees (Maas, 1972, p 12). It comprises *Costus* subgenus *Costus*, species 8-18. According to F. G. Stiles (personal communication) one of the species of this section, namely *C. malortieanus*, represents a transition between bee-pollinated species (section *Costus*) and hummingbird-pollinated species (the following section): "it (*C. malortieanus*) produces abundant nectar and is visited and pollinated by both *Eulaema* and hermit hummingbirds, notably *Phaethornis superciliosus*."

The second section comprises species with a small, tubular labellum of yellow, orange, or reddish colour; the bracts are of the same colour, or rarely green. Because of its adaption to hummingbird pollination, I have called this section *Ornithophilus*. It comprises *Costus* subgenus *Costus*, species 19-36. One of the rare observations on hummingbird pollination was recently made by F. G. Stiles who found *C. pulverulentus* to be exclusively hummingbird-pollinated, mostly by hermit hummingbirds like *Phaethornis superciliosus*.

Since in herbarium material well-preserved flowers are rarely present, these section characters are not used in the key. In the key, however, all species belonging to section *Costus* are marked with an asterisk, the species belonging to section *Ornithophilus* with a circle.

CULTIVATION AND CONSERVATION

During my various field trips in the Neotropics I have made observations on a great number of species, and thanks to many colleagues (see Acknowledgments) I obtained field data on species not observed by myself. Some of the species studied have a rather extensive distribution (eg *Costus pulverulentus*, *C. scaber*, and *C. arabicus*), but a considerable number have a very restricted distribution. This last category needs some special attention. As the destruction of the tropical rain forest is still going on and on, these local species badly need some protection regulations. There are already botanical gardens which have introduced living material of endangered species. The most active in that respect is Las Cruces Botanical Garden, San Vito, Puntarenas, Costa Rica, where Mr. Robert Wilson, the director, has a large collection of neotropical Zingiberaceae (as well as Musaceae, Marantaceae, and many other families) in cultivation. Other botanical gardens cultivating material of the rarest species are those of Kew, Edinburgh, and Meise. In the botanical greenhouses of "Sandwijck," de Bilt, belonging to the State University of Utrecht, I brought together a very large collection of neotropical Zingiberaceae; this collection is now used for my own taxonomic studies as well as for teaching purposes. Below are listed those regions where the rarest and some endangered species of *Costus* and *Monocostus* occur: (species marked with an asterisk are in cultivation at "Sandwijck"):

COSTA RICA

*Costus stenophyllus**: only known from two localities on the Pacific Coast (near Esquinas, prov. Puntarenas). This species is very peculiar because of its linear, grasslike leaves and its basal, reddish inflorescence.

*C. barbatus** } both related species are restricted to the forests between 1300 and
*C. montanus** } 1800 m.

PANAMA

*C. glaucus**: rather rare in Panama, Costa Rica, and Colombia (Serra de la Macarena). Attractive in cultivation for its glaucous stems and leaves.

*C. vinosus**: only known from the Río Guanche, prov. Colón. This is one of the most beautiful species of *Costus*, well marked by its wine-red stems, leaves, and flowers, and its inflated basal leaf-sheaths.

COLOMBIA

*C. leucanthus**: known by only two collections from the lowland forests of the Pacific Coast of Colombia (El Valle), but locally rather common. Not yet in danger of extinction; worthy of cultivation because of its showy white flowers.

C. productus var *strigosus*: this poorly known variety is known only from the vicinity of Puerto Ospina, 230-250 m, Putumayo.

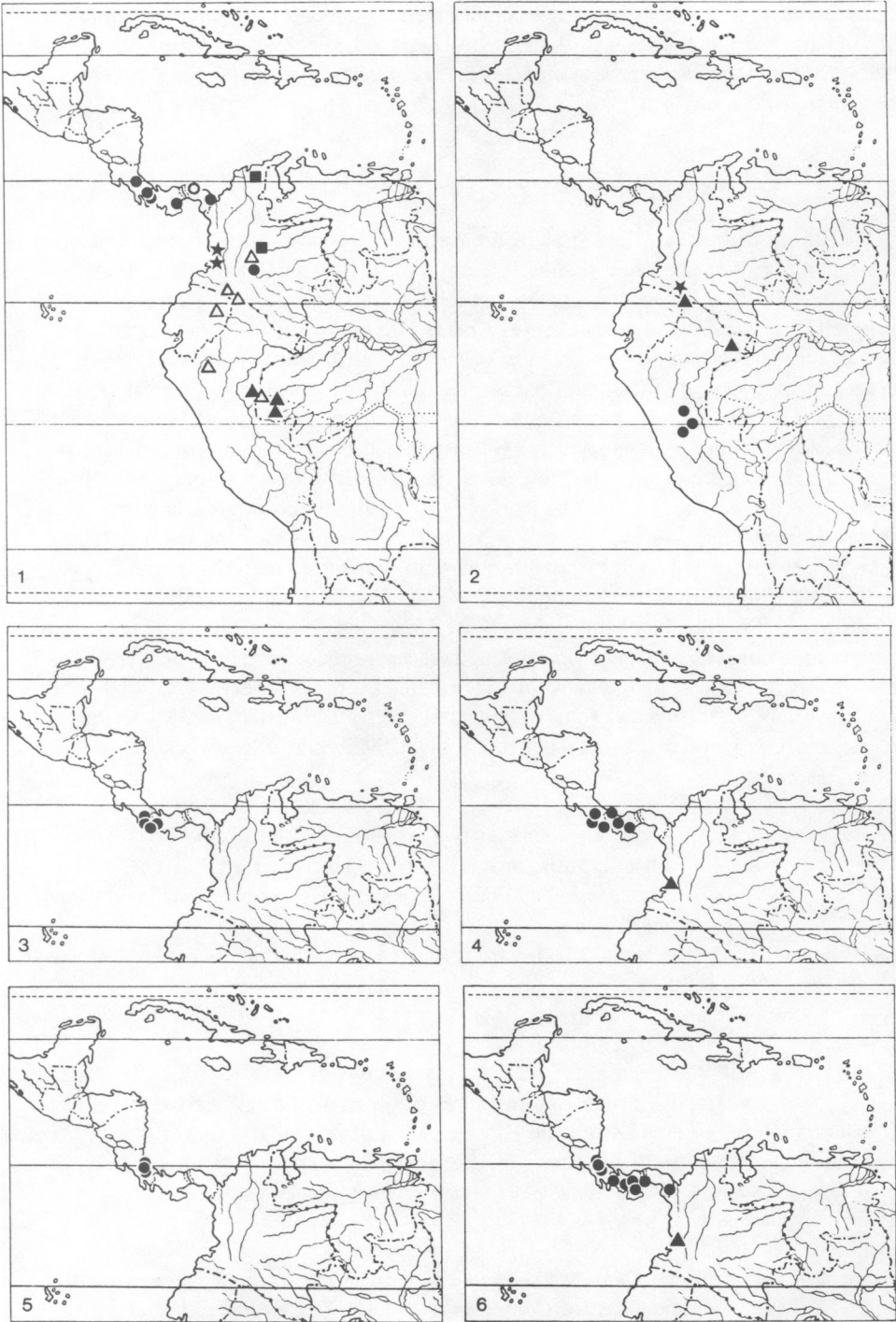


FIG 63. Distributional maps 1-7. 1, *Costus leucanthus*: ★; *C. glaucus*: ●; *C. vinosus*: ○; *C. aff. claviger*: ■; *C. erythrophyllus*: △; *C. varzearum*: ▲. 2, *C. cupreifolius*: ★; *C. productus* var *productus*: ●; *C. productus* var *strigosus*: ▲. 3, *C. wilsonii*. 4, *C. plicatus*: ●; *C. cordatus*: ▲. 5, *C. nitidus*. 6, *C. curvibracteata* ●; *C. plowmanii*: ▲.

- C. plowmanii*: this species has been twice collected near Queremal, Cordillera Occidental, 1300-1500 m, El Valle.
- C. cupreifolius*: once collected near San Diego de Colorado, above Puerto Asis, 650 m, Putumayo; it is rather attractive because of the coppery-colored lower side of its leaves.
- C. cordatus*: once collected in secondary lowland forest along the road Cali-Buenaventura, near km 85.

FRENCH GUIANA

- C. curcumoides*: a poorly known species with a yellow inflorescence; thus far only known from the interior of French Guiana.

BRAZIL

Three representatives of the subgenus *Cadalvena* are apparently rare:

- C. fusiformis* } both species inhabit the botanically hardly explored Río Tapajós,
C. fragilis } Pará-Amazonas.
- C. cuspidatus*: formerly known as *C. igneus*, and rather common in the greenhouse, where it is grown because of its orange flowers. In its native region, the states of Bahia and Espirito Santo, it is rare.

ECUADOR

- C. zamoranus*: this species has been only twice collected in the provinces of Santiago-Zamora and Morona-Santiago (between 1300 and 2000 m).

PERU

- Monocostus uniflorus** } both species are endemic to the region of Yurimaguas and
C. zingiberoides } Tarapoto, San Martín.
- C. productus* var *productus*: known from a few gatherings only in the provinces of Junín and San Martín, 375-700 m.

BOLIVIA

- C. quasi-appendiculatus*: only once collected near Calisaya, Río Bopi, dep. La Paz, 750-900 m.

SYSTEMATIC TREATMENT

p 18

1. **Monocostus uniflorus** (Poeppig ex O. G. Petersen) Maas Fig 64.

Add to the description: Corolla creamy-white, 60-70 mm long, tube 3-4 mm in diameter, lobes 8-10 mm wide, greenish towards the apex. Labellum yellow, white with brownish stripes in the middle, broadly obovate to broadly obtusate when spread out, 40-50 mm long, 50-60 mm wide, limb in living plant suborbicular in outline, ca 50 X 40 mm, margins crenulate. Stamen creamy-white, 25-40 mm long, 6-8 mm wide, anther 4-6 mm long, apex reflexed, yellow, slightly tinged with brown. Style ca 50 mm long. Stigma cup-shaped with an entire dorsal appendage. Capsule narrowly elliptic, 40-60 X 5-6 mm. Chromosome number $2n = 28$ (Kress 75-65).

Additional collection: PERU. SAN MARTIN: km 26 of road from Tarapoto to Juanjui, 0.5 km off road, in forest undergrowth, Kress 75-65 (living and pickled material only).

I am highly indebted to Mr. W. John Kress, who supplied me with several living rhizomes, collected near the type locality. This rare species is now in cultivation in Kew, Edinburgh, Meise, San Vito de Java, and Utrecht. The living plants at Utrecht came into flower very recently (Mar 1976).

p 23

1b. **Dimerocostus strobilaceus** O. Kuntze subsp **gutierrezii** (O. Kuntze) Maas

Add to the distribution: Colombia and Ecuador.

COLOMBIA. CHOCO: Ciudad Bolivar, between Medellin and Quibdó, 1400 m, *Forero, Jaramillo & McElroy 1062* (COL, U). ECUADOR. Zamora-Chinchipe: Namirez, ca 5 km N of Cumaraza, *Harling & Andersson 13960* (GB, U).

p 25

1c. **Dimerocostus strobilaceus** O. Kuntze subsp **appendiculatus** Maas

Add to the distribution: COLOMBIA. AMAZONAS, near Puerto Nariño, *Plowman et al 2357, 2336* (DAV, GH).

p 25

2. **Dimerocostus argenteus** (Ruiz & Pavón) Maas Fig 65 a-b.

Add to the description: Ligule with a salient, ciliate rim at the base. Labellum deep to pale yellow with golden-yellow hairs within, broadly obovate when spread out, 50-75 mm long and wide, margins fimbriate. Stamen creamy to yellowish-white, 40-60 mm long, 11-13 mm wide, anther 14-15 mm long. Stigma cup-shaped, with an entire to slightly 2-lobed dorsal appendage. Chromosome number $2n = 28$ (*Plowman & Davis 4725*).

Additional collection: PERU. AYACUCHO: Prov. La Mar, Río Apurimac, between San Francisco and Sta. Rosa, 630 m, *Plowman & Davis 4725* (GH, U).

p 30

1. **Costus warmingii** O. G. Petersen

During a visit to the herbarium of Meise (BR) I studied type material of *Globba subsessilis*. This is without any doubt an earlier synonym of *C. warmingii*, and thus has to replace it. *Globba subsessilis*, based on material of Wied-Neuwied from the state of Bahia, Brazil, was not cited in Martius' Flora Brasiliensis (1890), and that was one of the reasons that I earlier overlooked it. Moreover, the Asiatic genus *Globba* is not at all close to *Costus*. Thus, the name *C. warmingii* had to be replaced by:

Costus subsessilis (Nees & Martius) Maas, Acta Bot. Neerl. 24: 469. 1976.

? *Globba subsessilis* Nees & Martius, Nov. Acta Nat. Cur. 11: 29. 1823. Type. *Wied-Neuwied sn, anno 1817* (holotype, BR), "ad viam Felisbertiam," Bahia, Brazil.

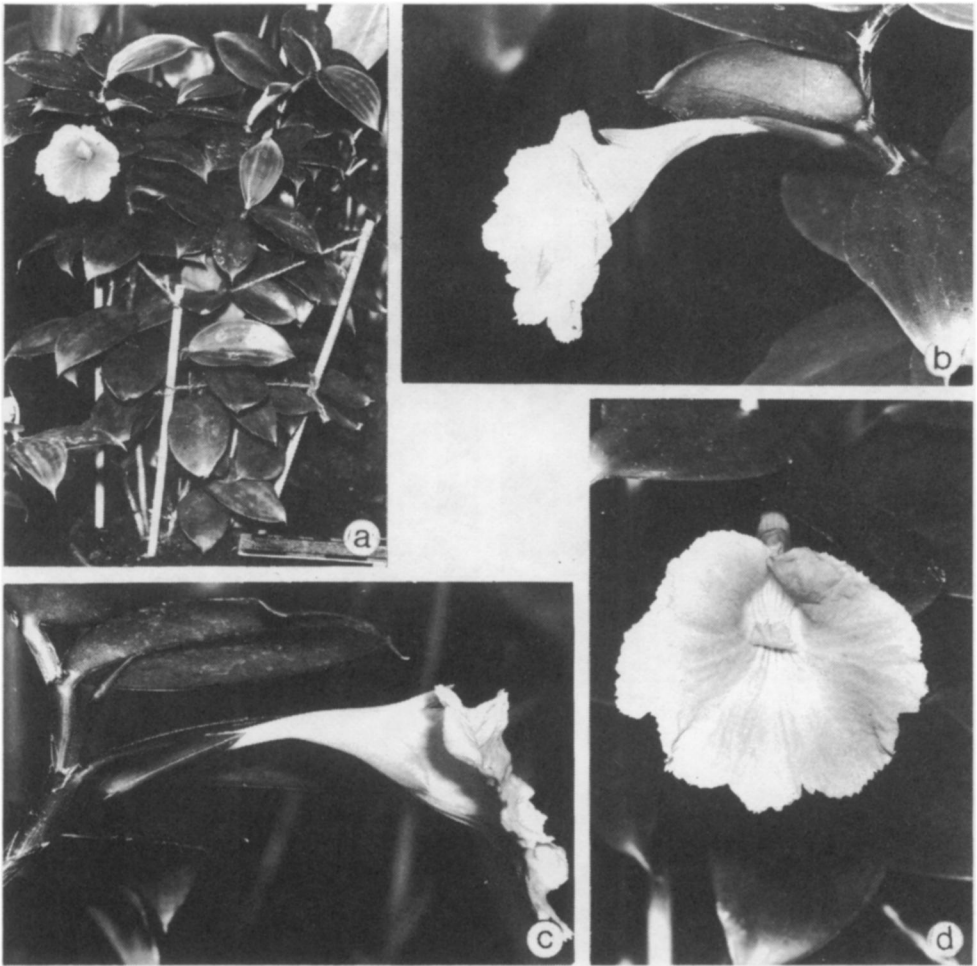


FIG 64. *Monocostus uniflorus* (a-d, *Hort. Bot. Utrecht*). a, habit; b-c, flower seen from aside, showing bracteole, calyx, corolla, and labellum; d, labellum and stamen seen from anterior side. Photographed by L. Y. Th. Westra.

Additional collections: various Brazilian ones from Acre, Bahia, Ceará, Goiás, Mato Grosso, and Rondônia.

p 33

2. *Costus igneus* N. E. Brown

This name had to be changed into:

Costus cuspidatus (Nees & Martius) Maas, *Acta Bot. Neerl.* 24: 469. 1976.

Globba cuspidata Nees & Martius, *Nov. Acta Nat. Cur.* 11: 28. 1823. Type. *Wied-Neuwied sn, anno 1817* (holotype, BR), "ad ripas fluminis Ilhéos, circa viam Felisbertiam," Bahia, Brazil.

p 34

3. *Costus curcumoides* Maas

Add to the description: Bracts orange to yellow. Flowers yellow.

Additional collection: FRENCH GUIANA, Chemin des Emerillons, dense forest, growing on granite, *Lescure 197* (CAY).

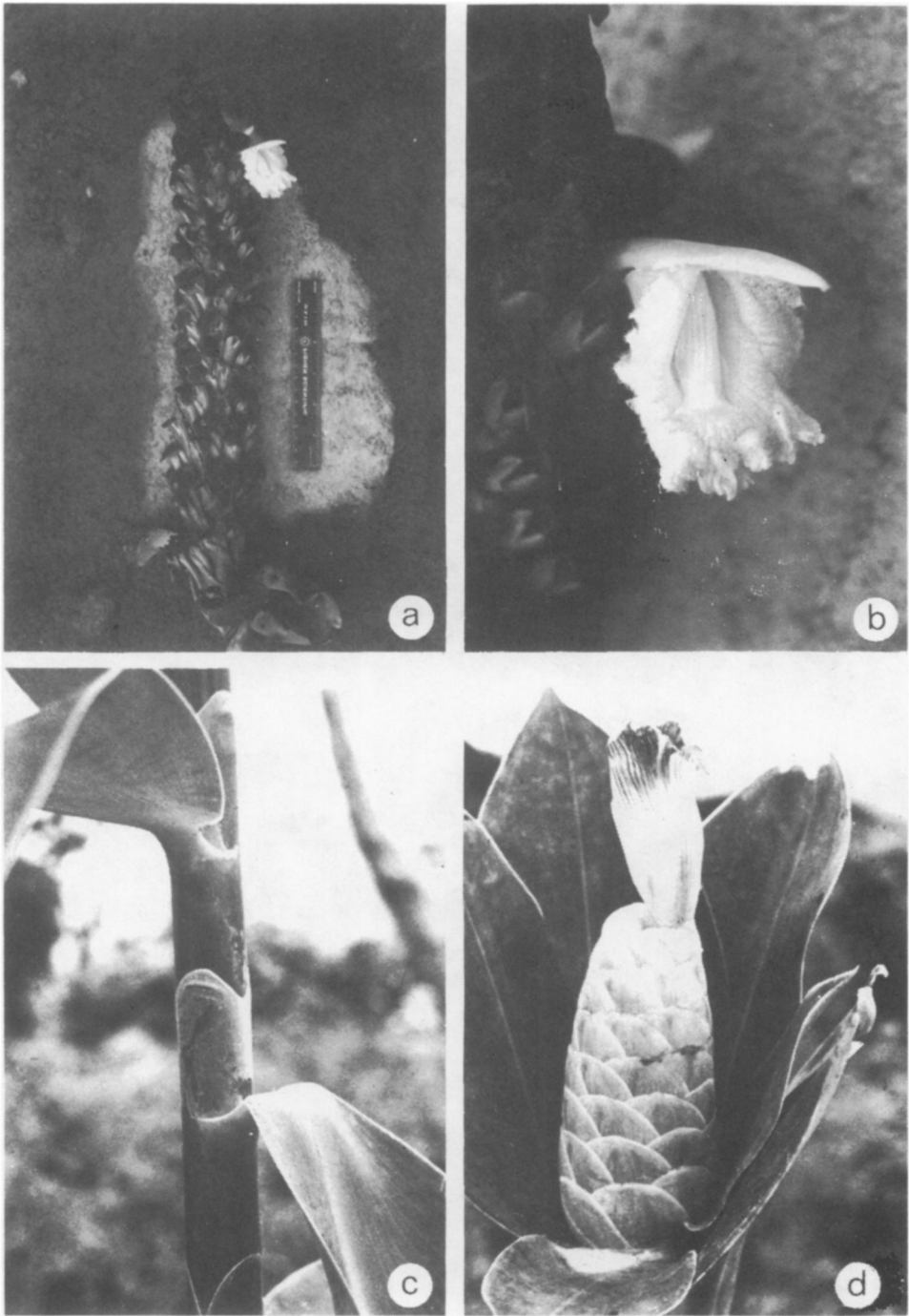


FIG 65. *Dimerocostus argenteus* (a-b, Plowman & Davis 4725). a, inflorescence; b, flower, showing dorsal petal, stamen and labellum. Photograph by T. Plowman. *Costus glaucus* (c-d, Maas et al 1727). c, detail of leaf-base and ligule; d, inflorescence. Photograph by P. J. M. Maas.

p 41

6b. *Costus lanceolatus* O. G. Petersen subsp *pulchriflorus* (Ducke) MaasAdd to the distribution: FRENCH GUIANA, Mt. Atachi, 750 m, *de Granville* 766 (CAY, P, U).

p 48

Costus subgen *Costus* sect *Costus*

Labellum composed of a small tube and a large, exposed limb, white to yellow, lateral lobes large, often reddish-striped. Bracts often green.

TYPE SPECIES. *Costus arabicus* Linnaeus.Key to the Sections of *Costus* subgen *Costus*

1. Labellum large, composed of a short, rather broad tube and a distinct, exposed limb, colour white to yellow, lateral lobes often striped with red to purple; bracts mostly green. Species 8-18. Section I. *Costus*.
1. Labellum small, tubular, yellow, orange, or reddish-coloured; bracts of the same colour, or rarely green. Species 19-36. Section II. *Ornithophilus*.

Species belonging to Section *Costus* are marked in the key with an asterisk, those belonging to Section *Ornithophilus* with a circle.

Key to the Species of *Costus* subgen *Costus*

1. All bracts provided with foliaceous, green or reddish appendages, or apices of all bracts reflexed. Group 1.
1. Bracts not appendaged, or only the lowest provided with appendages. Group 2.

Key to the Species of *Costus* Group 1

1. Appendages of bracts red; labellum small, tubular.
 2. Ligule (5-)15-40 mm long.
 3. Lobes of ligule acute; plant velutinous. Costa Rica. 36. *C. montanus*^o.
 3. Lobes of ligule rounded to obtuse.
 4. Margins of bracts, bracteoles, and calyx dilacerating into fibers. Costa Rica. 35. *C. barbatus*^o.
 4. Margins of bracts, bracteoles, and calyx entire.
 5. Plant glabrous to strigose; ligule 20-40 mm long; callus of bracts 6-12 mm long. Colombia and Peru. 22. *C. productus*^o.
 5. Plant densely sericeo-villose; ligule ca 15 mm long; callus of bracts sub-obsolete (ca 1 mm long). Colombia. 20A. *C. cupreifolius*^o.
 2. Ligule 1-10(-15) mm long.
 6. Ligule 5-10(-15) mm long; upper side of the leaves more or less scabrid to the touch. 19. *C. lima*^o.
 6. Ligule 1-6 mm long; upper side of the leaves not scabrid to the touch.
 7. Appendages of bracts triangular, acute, 15-40 mm long. 20. *C. comosus*^o.
 7. Tips of bracts slightly reflexed, forming a depressed-ovate appendage 3-8 mm long. Bolivia. 21. *C. quasi-appendiculatus*^o.
1. Appendages of bracts green; labellum with a large, spreading limb.
 8. Inflorescence terminal on a separate leafless shoot. Guianas. 18. *C. claviger*^{*}.
 8. Inflorescence terminal on a leafy stem.
 9. Ligule 55-70 mm long; labellum (and corolla) white. Colombia. 8A. *C. leucanthus*^{*}.
 9. Ligule 2-38 mm long.
 10. Labellum pure yellow, plant densely ferruginous-hirsute to strigose; leaf-base usually cordate. 8. *C. villosissimus*^{*}.
 10. Labellum white to yellow, very often striped with red; plant glabrous to strigose; leaf-base cuneate to rounded, rarely cordate.
 11. Ligule 20-38 mm long; leaves mostly reddish below.

12. Leaves distinctly 6-7-plicate; appendages of bracts 25-60 X 20-40 mm; calyx 11-16 mm long; corolla 70-85 mm long; labellum 60-65 X 60-65 mm. 18A. *C. erythrophyllus**
12. Leaves not plicate; appendages of bracts 5-15 X 8-16 mm; calyx 8-10 mm long; corolla 47-55 mm long; labellum 40-45 X 25-28 mm. 18B. *C. varzearum**
11. Ligule 2-10(-15) mm long; leaves green.
13. Lower side of leaves and ligule densely strigose-hirsute; appendages of bracts reflexed (in herbarium material); labellum white. Ecuador. 9A. *C. asplundii**
13. Lower side of leaves glabrous to villose; appendages of bracts mostly ascending (in herbarium material).
14. Ligule 5-10(-15) mm long; appendages of bracts 20-40(-100) X 15-20(-40) mm; labellum 75-110 X 60-70 mm. 9. *C. guanaiensis**
14. Ligule 2-5 mm long; appendages of bracts 5-30 X 10-15 mm; labellum 45-50 X 35-40 mm. 18. *C. aff. claviger**

Key to the Species of *Costus* Group 2

1. Inflorescence terminal on a separate leafless shoot.
2. Leaves linear, 0.8-2 cm wide; bracts red; calyx 15-16 mm long; flowers yellowish, ca 80 mm long. Costa Rica. 32. *C. stenophyllus*^O.
2. Leaves much wider than 2 cm.
3. Leaves cordate (to rounded) at the base; bracts green; flowers snow-white (labellum a little tinged with yellow and purple). Tropical South America. 10. *C. arabicus**
3. Leaves rarely cordate; flowers never snow-white (except for *C. acreanus*).
4. Bracts velutinous, exposed part green; calyx 16-22 mm long; labellum white, slightly tinged with yellow and red. 13. *C. acreanus**
4. Bracts never velutinous, but glabrous, puberulous, strigulose, or strigose.
5. Sheaths densely hirsute to strigose; bracteole 32-42 mm long; calyx 17-22 mm long. 15. *C. longebracteolatus**
5. Sheaths glabrous, sparsely strigulose, or sparsely villose-hirsute.
6. Calyx 6-8 mm long; labellum yellow, dark purplish-striped. 12. *C. laevis**
6. Calyx (7-)10-19 mm long.
7. Bracts green; labellum with a large, spreading limb, yellow with red venation. 14. *C. amazonicus**
7. Bracts red; labellum small and tubular (except for *C. zamoranus*).
8. Leaves 36-57 cm long, 13-20 cm wide; calyx 15-19 mm long; corolla and labellum reddish, ca 10 cm long. Ecuador. 33. *C. geothyrsus*^O.
8. Leaves rarely up to 47 cm long and 18 cm wide.
9. Margins of covered part of bracts dilacerating into fibers.
10. Flowers yellow; lower side of leaves strigulose. 31. *C. erythrocoryne*^O.
10. Flowers pinkish-red; leaves glabrous, often reddish below. 30. *C. aff. spiralis*^O.
9. Margins of bracts entire.
11. Leaves 20-26 X 4-9 cm, lower side glabrous; labellum with a large, spreading limb, reddish brown. Ecuador. 14bis. *C. zamoranus**
11. Leaves 25-47 X 11-18 cm, lower side densely hirsute-villose; labellum small and tubular, yellow. Colombia. 31A. *C. plowmanii*^O.
1. Inflorescence terminal on a leafy stem.
12. Leaves linear, 1.5-2 cm wide; bracts reddish-orange; calyx 7-9 mm long; corolla yellow, ca 30 mm long. Peru. 27. *C. zingiberoides*^O.
12. Leaves much wider than 2 cm.
13. Two bracteoles per bract; ligule with a salient, hairy rim at the base; calyx much exceeding the bracts. W. Africa, naturalized (?) in Martinique. 37. *C. lucanusianus*.
13. One bracteole per bract; salient rim absent.
14. Bracts pungent at the apex, red; lower side of leaves densely sericeous to puberulous; calyx 22-25 mm long; corolla white, sericeous; labellum very showy, white to pinkish-white. Indo-Malaysia, naturalized in the Antilles. 38. *C. speciosus*.

14. Bracts never pungent; calyx 3-22(-27) mm long.
15. Flowers snow-white; bracts green; leaves cordate (to rounded) at the base.
Tropical South America. 10. *C. arabicus**
15. Flowers never snow-white (except for *C. acreanus*).
16. Bracts thin, chartaceous; calyx 6-11 mm long (see also under *C. lasius*).
17. Bracteole 8-11 mm long; calyx 6-8 mm long; veins of the leaves not prominent. Amazonian Brazil. 25. *C. sprucei*^o.
17. Bracteole 15-18 mm long; calyx 9-11 mm long; veins of the leaves strongly prominent. Colombia. 26. *C. chartaceus*^o.
16. Bracts thick, coriaceous.
18. Ligule (5-)15-100 mm long.
19. Ligule 55-100 mm long; leaf-sheaths, lower side of leaves, corolla, and labellum wine-red. Panama. 12B. *C. vinosus**
19. Ligule up to 55 mm long.
20. Labellum with a large, spreading limb; stems, leaves, and bracts glaucous (particularly when young). Panama and Colombia. 12A. *C. glaucus**
20. Labellum small, tubular; plant never glaucous; bracts reddish.
21. Leaf-sheaths densely puberulous, villose, or velutinous; bracts often slightly appendaged (see also under group I). Costa Rica.
22. Lobes of ligule acute; plant velutinous. 36. *C. montanus*^o.
22. Lobes of ligule obtuse to rounded; plant puberulous to villose. 35. *C. barbatus*^o.
21. Leaf-sheaths glabrous or nearly so.
23. Lower side of leaves sericeous; leaf-base cordate; calyx 10-13 mm long. Colombia. 26A. *C. cordatus*^o.
23. Leaves glabrous; leaf-base cuneate; calyx 7-10 mm long.
24. Leaves strongly 6-8-plicate, 25-31 X 7-13 cm; plant not shining. Costa Rica and Panama. 30A. *C. plicatus*^o.
24. Leaves not plicate, 30-43 X 7-10 cm; plant shining. Costa Rica. 30B. *C. nitidus*^o.
18. Ligule 1-15 mm long.
25. Ligule hardly 1 mm long; leaves obovate to elliptic, densely villose to puberulous on both sides. Costa Rica and Nicaragua. 16. *C. malorteanus*^o, *
25. Ligule longer than 1 mm.
26. Inflorescence fusiform, strongly pointed at the apex; costa of the upper side of the leaves strigulose; margins of bracts usually dilacerating into fibers. 34. *C. pulverulentus*^o.
26. Inflorescence rarely fusiform, then the margins of the bracts not dilacerating into fibers.
27. Bracts densely velutinous; leaves glabrous to puberulous; calyx 16-22 mm long; labellum white, slightly tinged with yellow and pink. 13. *C. acreanus**
27. Bracts glabrous, villose, hirsute, or strigose.
28. Margins of bracts dilacerating into fibers; inflorescence (4-)6-7(-9) cm wide; corolla puberulous. Ecuador and Peru. 14a. *C. amazonicus* subsp *amazonicus**
28. Margins of exposed part of bracts entire.
29. Ligule 2-4(-8) mm long; bracts green, callus mostly inconspicuous; calyx 4-10 mm long; corolla yellow, ca 65 mm long; labellum red-stripped. Central America. 17. *C. pictus**
29. Ligule 2-15 mm long.
30. Calyx 3-7 mm long.
31. Sheaths and leaves ferruginous-hirsute; inflorescence often yellow; corolla 35-45 mm long. 23. *C. lasius*^o.
31. Sheaths and leaves glabrous to puberulous.

32. Margins of covered part of bracts dilacerating into fibers; costa on upper side of leaves strigulose; apical leaf-margins not involute; bracts often orange-red; labellum 20-30 X 15-20 mm. Neotropical-wide. 24. *C. scaber*^O.
32. Margins of bracts entire; costa glabrous; bracts often yellow (but also green, orange, or red); apical leaf-margins involute; labellum 33-35 X 25-28 mm, the lateral lobes often reddish-striped. Panama and Costa Rica, 1250-1850 m. 24a. *C. wilsonii*^O.
30. Calyx 6-15(-20) mm long.
33. Leaves strigose, hirsute, or villose on both sides.
34. Plant sparsely to densely villose; bracts red; corolla and labellum pinkish-red. Guianas and adjacent Brazil. 30b. *C. spiralis* var *villosus*^O.
34. Plant densely strigose to hirsute.
35. Flowers orange; bracts red to orange; calyx 11-12 mm long. Panama. *C. species B*^{O?}.
35. Flowers yellowish-white; labellum large, striped with red; bracts green; calyx 8-10 mm long. 11. *C. allenii**.
33. Upper side of leaves glabrous or nearly so.
36. Lower side of leaves hirsute-strigose; bracts orange, yellow, or red, their apices slightly curved outwards; calyx 10-15 mm long. Panama and Costa Rica. 35A. *C. curvibracteatus*^O.
36. Lower side of leaves glabrous, puberulous, or villose.
37. Leaves 8-26 X 4-11 cm, usually obovate to elliptic; leaf-base cordate; calyx 6-9 mm long; corolla orange to red, 30-40 mm long; plant glabrous throughout. 28. *C. woodsonii*^O.
37. Leaves usually much larger, narrowly ovate to narrowly obovate.
38. Leaves long-petiolate and long-acuminate, bracts often green; labellum with a distinct, spreading limb, dark purple to yellow. 12. *C. laevis**.
38. Leaves shortly acuminate; labellum small, tubular.
39. Flowers yellow to yellowish red; calyx 9-16 mm long; exposed part of bracts often greenish. Antilles. 29. *C. spicatus*^O.
39. Flowers pinkish-red; calyx 7-12 mm long; exposed part of bracts red. Tropical South America. 30a. *C. spiralis* var *spiralis*^O.

8. *Costus villosissimus* JacquinAdd to the distribution: Nicaragua, *Molina R. 15042* (EAP).

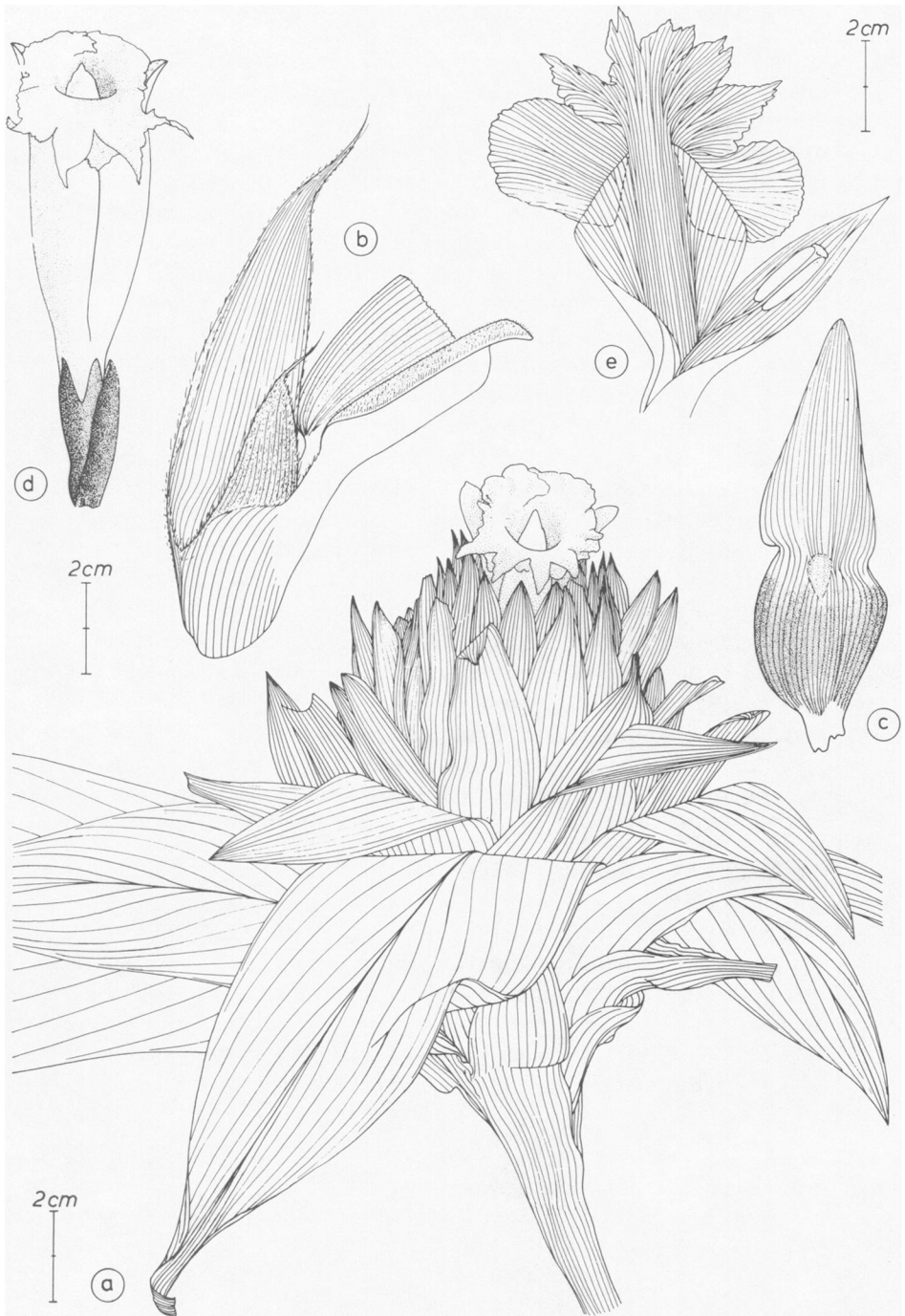


FIG 66. *Costus leucanthus* (a-e, Maas & Plowman 1920). a, inflorescence; b, ligule and leaf-base; c, bract; d, flower; e, labellum and stamen.

8A. *Costus leucanthus* Maas, Acta Bot. Neerl. 24: 469. 1976.

Fig 66.

Plants to 2.5 m tall. Sheaths, ligule, petiole, lamina, and appendages of bracts densely to rather densely hirsute. Sheaths 25-30 mm in diam. Ligule unequally and very deeply lobed, 55-70 mm long, the lobes deltate to triangular, acute. Petiole 10-15 mm long. Lamina narrowly elliptic, cuneate to rounded at the base, acute to acuminate at the apex (acumen up to 30 mm long), 40-55 cm long, 11-16 cm wide. Inflorescence ovoid to cylindrical, 10-17 cm long (elongating to 35 cm in fruit), 9-10 cm in diam (to 12 cm in fruit). Bracts coriaceous, red, broadly ovate, 3-5 cm long, 2.5-4 cm wide, adaxial side glabrous, abaxial side sparsely puberulous, callus 3-8 mm long, 2-4 mm wide, appendages foliaceous, green, the lower ones horizontally spreading, the upper ones vertically ascending, narrowly triangular to triangular, acute, 4-8 cm long, 1.5-3 cm wide (the 3-4 lower ones not measured). Bracteole red, apex green, 28-31 mm long, sparsely to rather densely puberulous. Calyx red, apex green, 16-20 mm long, 8-12 mm wide, sparsely to rather densely puberulous, the lobes deltate to triangular, 6-7 mm long. Corolla white, 80-85 mm long, glabrous, tube ca 20 mm long, lobes 60 mm long, the dorsal one 21-25 mm wide, the two lateral ones 15-17 mm wide. Labelum white, slightly tinged with yellow in the centre, broadly obovate when spread out, (60-)65-70 mm long, (45-)60-65 mm wide, margins fimbriate, middle lobe reflexed, irregularly trilobulate, the lobules irregularly dentate. Stamen white, 50-55 mm long, 15 mm wide, narrowed towards the slightly dentate apex, anther 15 mm long, 4 mm wide. Ovary 5-15 mm long, rather densely puberulous. Capsule ellipsoid, 15-17 mm long, rather densely puberulous, seeds black.

TYPE. *Maas & Plowman 1920* (holotype, U; isotypes, COL, F, GH, K, US), Limón, near km 71 of new road Cali-Buenaventura, 150 m, El Valle, Colombia.

DISTRIBUTION (Fig 63). Lowlands of El Valle, Colombia; along roadsides.

COLOMBIA. EL VALLE: Anchicaya, near the Hydro-electric Plant, *Kennedy 746* (paratype, U).

This beautiful species is very well marked by its showy white flowers and its very long ligule. It is closely related to *C. villosissimus* and *C. guanaiensis*.

Maas 2016 (COL, GH, U), from Sacaría, km 17 of old road Cali-Buenaventura, El Valle, Colombia, may be a hybrid between this species and *C. laevis*, agreeing with the former in its very long (but obtuse) ligule and with the latter in its inflorescence and flowers.

Maas 2017 (COL, GH, U), from the same locality may have some introgression of *C. laevis*, but with most characters (long ligule, white flowers, and appendaged bracts) of *C. leucanthus*.

9a. *Costus guanaiensis* Rusby var *guanaiensis*

Add to the distribution: Costa Rica and Brazil.

COSTA RICA. *Maas 1086* (U), *1196* (CR, F, U). BRAZIL. ACRE: *Prance et al 12234* (INPA, NY, U); *Maas et al 12952* (COL, DAV, F, IJ, INPA, K, MO, NY, S, U, US), *13047* (INPA, NY, U).

During some field trips to Costa Rica I collected the following three specimens: *Maas 873* (U), Guayacán, 600-650 m, prov. Limón; *Maas 1130* (U), Siquirres, 150 m, prov. Limón; *Maas 1291* (U), 3 km SW of Tirimbina, 200 m, prov. Heredia. This material completely matches the description of *C. bracteatus* Rowlee, a species previously placed by me in the synonymy of *C. guanaiensis* var *guanaiensis*. *Costus bracteatus* is aberrant, however, from typical var *guanaiensis* in having strongly plicate

leaves. The three specimens were past flowering, so a final solution of this problem can only be given when the living material of these Costa-Rican specimens (cultivated in the greenhouses at "Sandwijck") comes into flower.

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9b. *Costus asplundii* (Maas) Maas, Acta Bot. Neerl. 24: 470. 1976.

Costus guanaiensis Rusby var *asplundii* Maas, Fl. Neotrop. Monogr. 8: 52. 1972.

Plants 1.5-5 m tall. Sheaths glabrous or strigose-hirsute*, up to 35 mm in diam. Ligule truncate, 2-12 mm long, densely strigose-hirsute* towards the margin. Petiole 5-10 mm long, glabrous to strigose-hirsute*. Lamina narrowly elliptic, cuneate at the base, shortly acuminate at the apex (acumen to 10 mm long), 20-50 cm long, (3.5-)-5-8.5 cm wide, upper side glabrous or sparsely covered with appressed hairs, lower side densely covered with semi-appressed, brown, stiff hairs. Inflorescence ovoid, 6-15 cm long, 6-7 cm wide. Bracts red, coriaceous, broadly ovate, 2.5-4 cm long and wide, glabrous to rather densely puberulo-sericeous on both sides; appendages foliaceous, green, reflexed (in herbarium material) or horizontally spreading (in living plant), triangular, acute, 10-40 mm long and wide (the lowermost not measured), glabrous to densely puberulo-sericeous on both sides. Bracteole 25-30 mm long, glabrous to rather densely covered with semi-appressed hairs. Calyx bright red, 15-20 mm long, 11-15 mm wide, glabrous to rather densely covered with semi-appressed hairs, the lobes deltate to shallowly triangular, 3-7 mm long. Corolla white to pale pink, 65-80 mm long, glabrous, tube 10-25 mm long, lobes ca 55 mm long, the dorsal one ca 35 mm wide, the two lateral ones ca 25 mm wide. Labellum white, broadly obovate when spread out, 75 mm long, 70-80 mm wide, middle lobe reflexed, irregularly lobulate, blotched with yellow in the centre. Stamen pale pink, 45-60 mm long, 15-20 mm wide, anther 14-15 mm long. Ovary densely sericeous at base and apex. Capsule ellipsoid, 15-20 mm long, hairy at base and apex.

TYPE. *Asplund 19115* (holotype, S), Mera, Río Pastaza, ca 1000 m, prov. Pastaza, Ecuador.

DISTRIBUTION. Ecuador, along roadsides and streams, between 1000 and 1400 m.

ECUADOR. MORONA-SANTIAGO: Pachicutza, Río Zamora, 900-1000 m, *Holm-Nielsen et al 4436* (AAU). NAPO: Río Payamino, ca 10 km from mouth, 350 m, *Harling & Andersson 11837* (GB); Hacienda Cotapino (Concepción), 500 m, *Harling et al 6966* (GB, U); Río Aguarico, Dureno, 30 km E of Sta. Cecilia, *Harling et al 7697* (GB, U); Hacienda San Carlos, Río Napo, 15 km E of Coca, *Lugo 2756* (GB, U); Río Aguarico, Muñozlandia, Sta. Cecilia, 230 m, *Sparre 1312 pp* (S). PASTAZA: Mera, 1160 m, *Harling 3816* (S); Río Negro, 18 mls. E of Baños, on road to Mera, 1400 m, *Plowman & Davis 4475* (GH, U). TUNGURAHUA: Río Topo, *Harling et al 10075* (GB, U).

In 1972, when I described this entity as *C. guanaiensis* var *asplundii*, I already suspected it to be a distinct species. Now, after having studied pickled material and colour-slides of it, I feel quite sure it is indeed a species in its own right, well characterized by its white flowers, reflexed appendages of bracts (when dry), and very wide calyx. *The ligule and the adjacent part of the sheaths are covered with very long, erect (in living plant) or appressed (in herbarium material) needle-like hairs.

Berlin 365 (MO, U), from Aintami, Río Cenepa, 180 m, Amazonas, Peru, may belong to this species, but differs in its smaller calyx (10 mm long).

11. *Costus allenii* Maas

Fig 69a.

Add to the description: Plants up to 4 m tall. Petiole to 20 mm long. Lamina 15-41(-60) cm long, 4-17 cm wide. Inflorescence during fructification up to 30 X 12

cm (*Maas & Dressler 708*). Bracts green to yellowish-green in the exposed part, red to pinkish white in the covered part, 3-5 cm long and wide. Calyx pinkish-red. Corolla yellowish-white, 50-55 mm long, glabrous, tube 15 mm long, lobes 35-40 mm long, 15-20 mm wide. Labellum yellowish-white and yellow in the centre, broadly obovate when spread out, 50-55 mm long, 40-45 mm wide, middle lobe reflexed, lateral lobes reddish-veined. Stamen white, slightly tinged with yellow, 30-35 mm long, (7-)10-13 mm wide, apex red, recurved, anther 8-10 mm long, 4 mm wide. Chromosome number $2n = 18$ (*Maas & Dressler 708*).

Croat 25622 (MO) and *Maas & Dressler 1652* (F, K, MO, U), both from forests in the Santa Fé Region, Veraguas, Panama, are aberrant in having strongly plicate leaves and a ligule up to 20 mm long. As all other characters agree with *C. allenii*, I have included both specimens here.

Costus allenii is not a hybrid between *C. villosissimus* and *C. laevis* as I suggested in 1972. It is a rather common forest species in Panama, where I collected it myself in the provinces of Panama (El Llano-Carthy road and La Eneida), Coclé (El Valle de Antón), Canal Zone (Gamboa), Colón (Río Guánche), and Veraguas (Santa Fé Region).

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12A. *Costus glaucus* Maas, Acta Bot. Neerl. 24: 470. 1976. Fig 65 c-d, 67.

Plants 1.5-4 m tall. Young plants completely glaucous, in older plants only bracts, sheaths, and lower side of leaves glaucous. Sheaths glabrous, 6-20 mm diam. Ligule unequally 2-lobed, 17-55 mm long, the lobes rounded. Petiole 5-20 mm long, glabrous. Lamina glaucous, especially when young, narrowly ovate to narrowly obovate, cuneate to rounded at the base, acute to acuminate at the apex (acumen to 10 mm long), 20-43 cm long, 5-14 cm wide, glabrous on both sides. Inflorescence ovoid to cylindrical, 6-16 cm long (elongating to 22 cm in fruit), 3-8 cm wide. Bracts glaucous to pale green in the exposed part, pinkish in the covered part, coriaceous, ovate, obtuse, 4.5-6 cm long, 3-4 cm wide, callus absent, adaxial side glabrous, abaxial side covered with 1-celled, appressed hairs (0.1-0.3 mm long), scabrid to the touch, rarely glabrous. Bracteole 22-27 mm long, sparsely to rather densely puberulous, rarely glabrous. Calyx pink, 7-14 mm long, 9-11 mm wide, sparsely to rather densely puberulous, rarely glabrous, lobes very shallowly triangular to deltate, 1-2(-6) mm long. Corolla yellowish-red, 70 mm long, glabrous, tube 15 mm long, lobes 55 mm long, the dorsal one 26 mm wide, the two lateral ones 20 mm wide. Labellum (yellowish) white, broadly obovate when spread out, 70 mm long, 50 mm wide, middle lobe trilobulate, the lobules ca 15 X 10 mm, blotched with yellow in the centre, lateral lobes with pale to dark red venation. Stamen pinkish to yellowish-white, 50 mm long, 13 mm wide, apex red, obtuse, anther 13 mm long, 4 mm wide. Ovary sparsely to rather densely puberulous, mainly at base and apex. Capsule ellipsoid, 20-25 mm long, sparsely puberulous at the apex.

TYPE. *Maas 1535* (holotype, U; isotypes, CR, F), forested hills of Río Reventazón Valley, Turrialba, near grounds of IICA, 600m, prov. Cartago, Costa Rica.

DISTRIBUTION (Fig 63). Costa Rica, Panama, and Colombia; in secondary and primary forests, 500-750 m.

COSTA RICA. PUNTARENAS: along road from Villa Neilly to San Vito de Java, 500 m, *Maas & McAlpin 1462* (F, U). PANAMA. CANAL ZONE: Barro Colorado Island (introduced from El Valle de Antón), *Croat 8635* (MO), *Foster 948* (DUKE). COCLÉ: N of El Valle de Antón, 750 m, *Dressler 2936* (US), *Maas, Dressler & Mori 1727* (U). DARIÉN: between Quebr. Venado and Peje swamp, Río Tuqueza, *Bristan 1003* (MO, U). COLOMBIA. META: Cord. de la Macarena, between Río Güejar and Caño Guapayita, 500-600 m, *Idrobo & Schultes 834* (COL). CULTIVATED

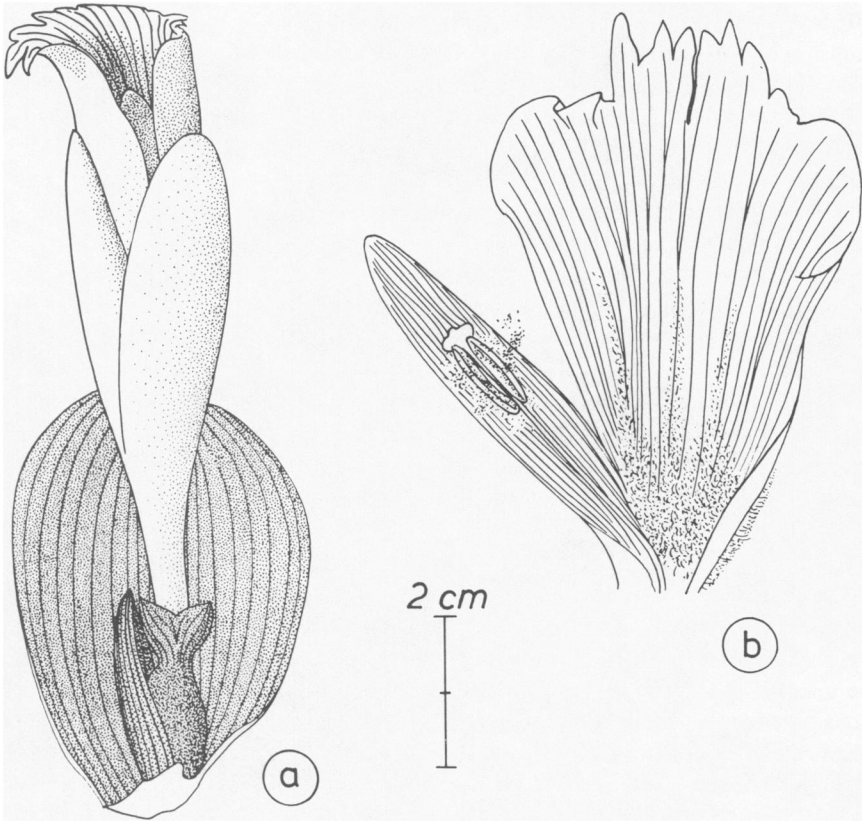


FIG 67. *Costus glaucus* (a-b, Maas 1430). a, bract with flower; b, labellum and stamen.

SPECIMENS. Costa Rica, Las Cruces Tropical Botanical Garden, prov. Puntarenas, originating from Rio Terraba, Costa Rica, *Maas 1430* (NY, U).

This species, one of the most attractive in the genus, is closely related to *C. laevis*. Its glaucous (young) stems, leaves, and bracts, long ligule, and scabrid bracts are highly characteristic.

Maas 1462 is aberrant in being glabrous throughout; besides, its calyx-lobes are much longer than normal (6 mm vs 1-2 mm).

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12B. *Costus vinosus* Maas, Acta Bot. Neerl. 24: 470. 1976.

Fig 68.

Plants 1.3-2 m tall. Sheaths purple-red, the basal leafless ones more or less cup-shaped, to 20 cm long, 3.5-8 cm wide, margins inflexed, glabrous to rather densely hirsute. Petiole 20-30 mm long, glabrous to sparsely hirsute. Ligule unequally and very deeply 2-lobed, 70-100 mm long, the lobes ovate-elliptic to narrowly ovate-elliptic, obtuse, rather densely hirsute. Lamina dark green or reddish-green above, purple-red to wine-red beneath, narrowly elliptic to narrowly obovate, cuneate at the base, acute at the apex, 38-55 cm long, 14-18 cm wide, upper side glabrous, lower side glabrous or costa covered with appressed hairs. Inflorescence ovoid, 8-13 cm long, 4-7 cm wide. Bracts dark red in the exposed part, greenish to pinkish-white in

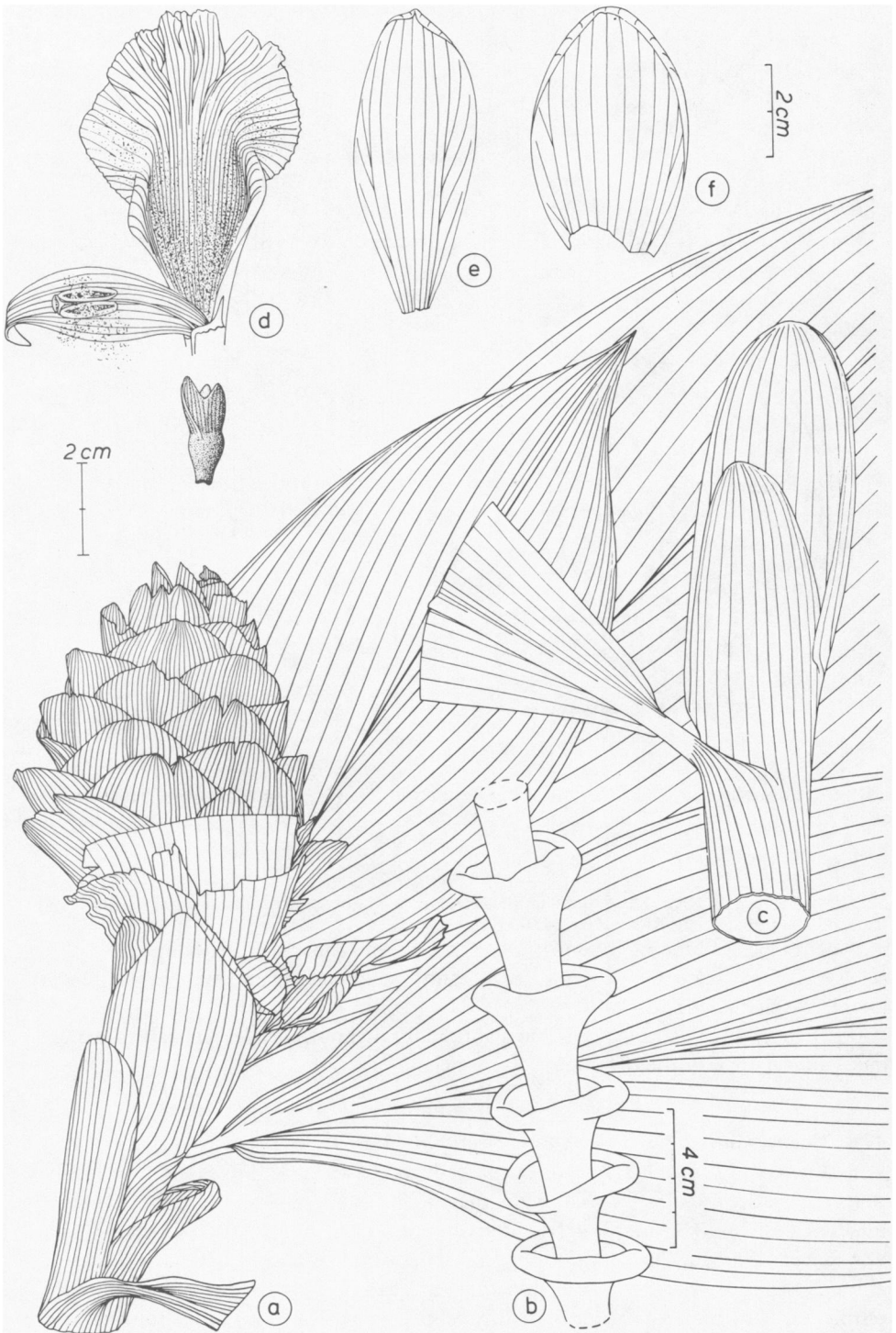


FIG 68. *Costus vinosus* (a, c, *Maas et al 1600*; b, d-f, *Dressler 4406*). a, habit; b, basal sheaths; c, ligule and leaf-base; d, calyx with adnate bracteole (!), labellum, and stamen; e, lateral petal; f, dorsal petal.

the covered part, coriaceous, broadly ovate, obtuse, 3.5-5 cm long and wide, adaxial part rather densely puberulous, abaxial part densely puberulous, callus 3-6 mm long. Bracteole pinkish-white, free or partly adnate to ovary and calyx (!), densely puberulous, 18-20 mm long. Calyx pinkish-white, densely puberulous, 9-10 mm long, 10-12 mm wide, the lobes very shallowly ovate-triangular, 2-3 mm long. Corolla creamy to pink, 75-80 mm long, glabrous, tube 10-15 mm long, lobes 60-70 mm long, the dorsal one 40 mm wide, the two lateral ones 25 mm wide. Labellum wine-red with two orange-yellow streaks in the middle, broadly obovate when spread out, 70 mm long, 60 mm wide, inner side and basal, dorsal side densely covered with yellow hairs, middle lobe irregularly 5-lobate. Stamen 50 mm long, 16 mm wide, apex reflexed, irregularly dentate, anther 11 mm long, 5 mm wide. Ovary densely puberulous to sericeous. Capsule ellipsoid, 18-20 mm long, densely puberulous. Chromosome number $2n = 18$ (Maas et al 1600).

TYPE. *Dressler 4406* (holotype, U; isotypes, F, MO), lower Río Guanche, Colón, Panama.

DISTRIBUTION (Fig 63). Only known from the type locality in the province of Colón, Panama; in rocky vegetation in forest shade, near river; in the same vegetation: *Heliconia imbricata*, *Calathea silvicola*, and *Cyclanthus bipartitus*; flowering in June; fruiting in Aug.-Sept.

PANAMA. COLÓN: lower Rio Guanche, *Dressler sn* (U); Rio Guanche, 50 m, *Maas et al 1600* (U).

This is certainly one of the most peculiar species of *Costus* with its cup-shaped, basal sheaths and its extremely long ligule (to 10 cm long).

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13. *Costus acreanus* (Loesener) Maas Fig 69 c-d.

Add to the description: Plants 1.5-2 m tall. Lamina 12-45 cm long, (4.5-)6.5-16 cm wide, upper side greyish-green, lower side often purplish. Inflorescence to 20 cm long and 8 cm wide. Indument of inflorescence brownish (when dry). Corolla white to pink, lobes to 28 mm wide. Labellum white, slightly tinged with yellow and purple in the throat, 50-75 mm long, 75-90 mm wide. Stamen white, apex pinkish, 45-55 mm long, 15-17 mm wide, anther 10-13 mm long, 5-6 mm wide. Chromosome number $2n = 18$ (*Prance et al 13155*).

Add to the distribution: Colombia.

COLOMBIA. AMAZONAS: *Duque-Jaramillo 2249* (COL), *2115* (COL, U); *Kennedy & Andrews 1358* (U).

Maas et al 13047 (INPA, NY, U), from Porangaba, Rio Juruá-Mirim, Acre, Brazil, is probably a hybrid with *C. guanaiensis* var *guanaiensis*, agreeing with *C. acreanus* in most characters, but with *C. guanaiensis* var *guanaiensis* in its hirsute stems and bracts some of which are appendaged.

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14a. *Costus amazonicus* (Loesener) Macbride subsp *amazonicus*

Add to the distribution: Colombia.

COLOMBIA. PUTUMAYO: Orito, *Kennedy & Andrews 1366* (U).

14b. *Costus amazonicus* (Loesener) Macbride subsp *krukovii* Maas

Add to the distribution: Amazonian Colombia.

COLOMBIA. AMAZONAS: *Duque-Jaramillo 2250* (COL); *Idrobo 4714* (COL); *Plowman et al 2337* (DAV, GH, U), *2429* (DAV, GH); *Sastre & Echeverry 579, 580, 622* (P). PUTUMAYO: *Idrobo & Ospina-Hernández 2392* (COL); *Schultes & Cabrera 18938 pp* (COL).



FIG 69. *Costus allenii* (a, Photograph by H. Kennedy). a, inflorescence.-*Costus laevis* (b, Maas 1356). b, habit. Photograph by P. J. M. Maas.-*Costus acreanus* (c-d, Plowman & Davis 5011). c, d, inflorescence. Photographs by T. Plowman.

Barclay 4733 (COL), collected between Puerto Asís and San Pedro, Putumayo, Colombia, falls within the concept of this subspecies except for its completely aberrant leaves, which are very narrow (16-18 X 2.5-3 cm) and minutely puberulous on both sides.

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14bis. *Costus zamoranus* Steyermark

Fig 70.

As I have excluded all Colombian specimens from this species, the specific description has to be changed:

Leafy stems 1.75-2.5 m tall. Sheaths 8-20 mm diam, glabrous. Ligule truncate, 1-5 mm long, glabrous. Petiole 10-20 mm long, glabrous. Lamina narrowly elliptic, shortly acuminate at the apex, cuneate at the base, 20-26 cm long, 4-9 cm wide, both sides glabrous except for some hairs near margins and apex. Flowering stems ca 50 cm tall, sheaths obliquely truncate, 2-5 cm long, 0.6-1.8 cm wide, glabrous. Inflorescence ovoid, obtuse, 9-10 cm long, 5.5-7.5 cm wide. Bracts red to reddish-brown, coriaceous, broadly ovate, obtuse, 3.5-4.5 cm long, 2-4 cm wide, glabrous, callus greenish, to 4 mm long. Bracteole 28-30 mm long, glabrous. Calyx red, 10-13 mm long, 6-8 mm wide, glabrous, the lobes shallowly triangular, 2-3 mm long. Corolla yellow, ca 70 mm long, glabrous. Labellum reddish-brown (according to Harling), broadly obovate when spread out, 50-60 mm long and wide. Stamen narrowly elliptic, ca 50 mm long and 10 mm wide, anther 8 mm long. Ovary 4-8 mm long, glabrous. Capsule ellipsoid, 15-20 mm long, glabrous.

TYPE. *Steyermark 54664* (holotype, F; isotypes, NY, US), Tambo Valladolid, 2000 m, prov. Santiago-Zamora, Ecuador.

Additional collection: ECUADOR. MORONA-SANTIAGO, Indanza-Limón (General Plaza), 1300-1500 m, *Harling & Andersson 12751* (GB).

Costus zamoranus is closely related to *C. laevis*.

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15. *Costus longibracteolatus* Maas.

Fig 73a.

Add to the description: Leafy stems 2-6 m tall. Rhizomes 20-25 mm thick, densely brownish-strigose. Ligule 10-30 mm long. Lamina 22-48 cm long, 6.5-17 cm wide, lower side densely, sometimes sparsely strigose. Inflorescence ovoid, 7-25 cm long, 5-10 cm wide. Bracts 4.5-7.5 cm long, 3-5 cm wide, apex slightly curved outwards (particularly in living plant), callus 5-15 mm long, sometimes obsolete. Bracteole 32-42 mm long. Calyx red to orange, 17-22 mm long. Labellum white, lateral lobes with wine-red venation. Stamen white, apex pink. Ovary 5-15 mm long.

Add to the distribution: PERU. LORETO, 2 km upriver from Puca Orquilla, Rio Ampiyacu, *Plowman 2463* (DAV, GH, U).

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16. *Costus malortianus* Wendland

Add to the description: Lamina 25-35 cm long, 11-18 cm wide.

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18. *Costus claviger* R. Benoist

Exclude from the synonymy: *C. erythrophyllus* and *C. fortalezae*.

Change in the description: Inflorescence borne on a separate leafless shoot 18-50 cm tall. Ligule truncate or slightly 2-lobed, 5-15 mm long. Callus of bracts obsolete, up to 10 mm long.

DISTRIBUTION. Guianas; in rain forest, on sandy to clayey soil and often on granitic outcroppings, from sea level to 1200 m.

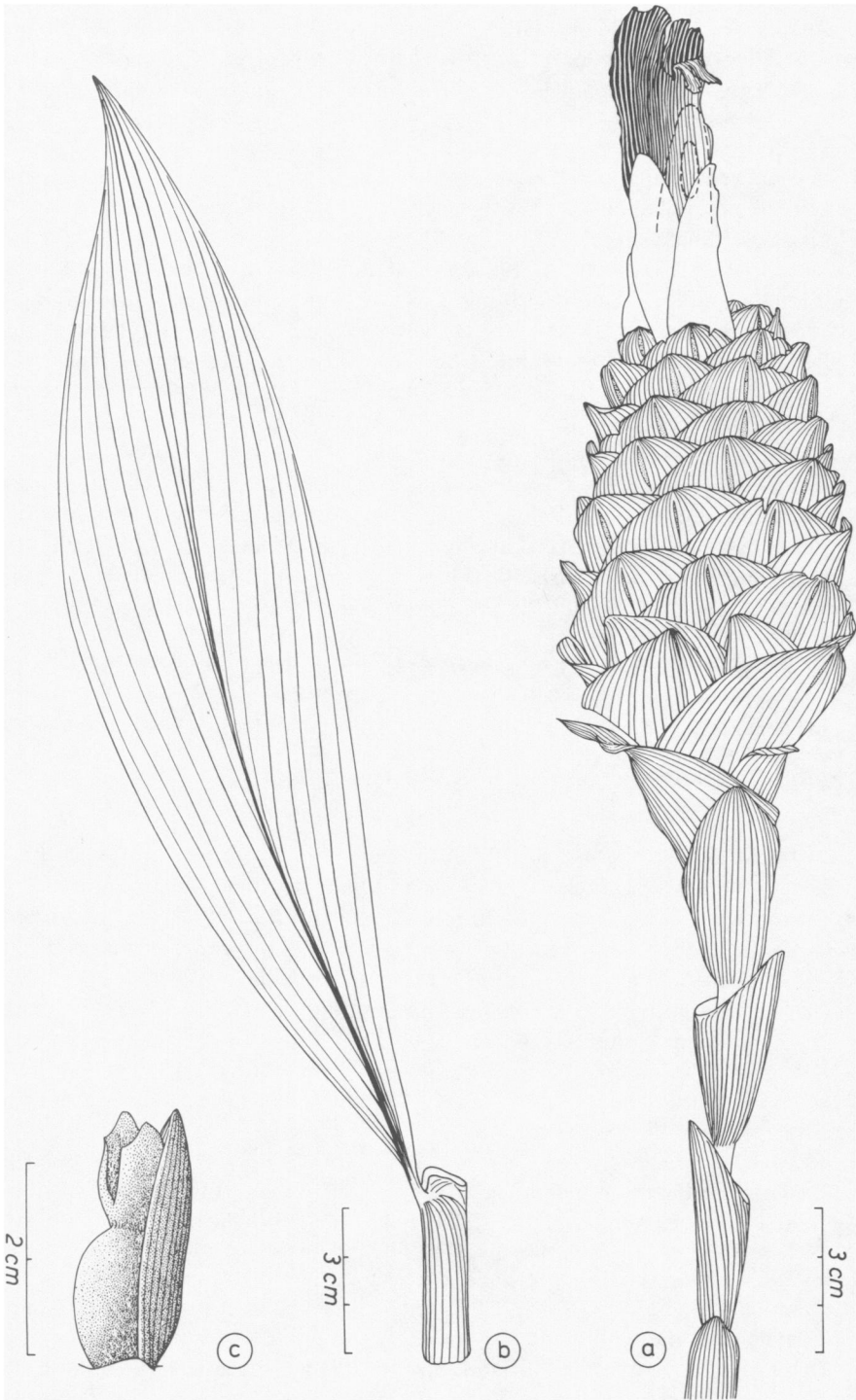


FIG 70. *Costus zamoranus* (a-c, Harling & Andersson 12751). a, flowering shoot; b, leaf; c, bracteole, calyx, and ovary.

After I had published the revision of the Costoideae for Flora Neotropica, I myself collected much additional, well-preserved flowering material of the *C. claviger* group. Soon it became evident that *C. claviger* is a Guianan species, characterized by a separate flowering shoot and a relatively small ligule (5-15 mm). I now divide this group into four different species; the main differences between them are summed up as follows:

	<i>C. claviger</i>	<i>C. erythrophyllus</i>	<i>C. varzearum</i>	<i>C. aff. claviger</i>
Ligule	truncate to slightly two-lobed 5-15 mm	unequally and very deeply two-lobed (5-)10-38 mm	unequally two-lobed 20-30 mm	truncate 2-5 mm
Lamina	10-50 X 3-13 cm	(14-)20-32 X (5-)8-11 cm 6-7-plicate	13-25 X 5-10.5 cm	15-25 X 4-6.5 cm
Appendage of bracts	5-20(-35) X 5-20(-35) mm	25-60 X 20-40 mm	5-15 X 8-16 mm	5-30 X 10-15 mm
Bracts	30-60 X 20-50 mm	20-35 X 20-35 mm	20-25 X 10-18 mm	25-30 X 15-25 mm
Calyx	(10-)12-18 mm	11-16 mm	8-10 mm	12-16 mm
Labellum	50-60 X 50-60 mm	60-65 X 60-65 mm	40-45 X 25-28 mm	40-50 X 35-40 mm
Anther	10-12 mm	9-10 mm	6-7 mm	7-8 mm

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18A. *Costus erythrophyllus* Loesener, Notizbl. Bot. Gart. Berl. 10: 707. 1929. Fig 71

Plants 0.6-2 m tall. Sheaths green, 8-20 mm diam, glabrous. Ligule unequally and very deeply 2-lobed, (5-)10-38 mm long, the lobes narrowly ovate-elliptic to ovate-elliptic, glabrous. Petiole 5-15 mm long, glabrous. Lamina green above, often purplish below, narrowly elliptic, cuneate at the base, acute to acuminate (acumen to 10 mm long) at the apex, (14-)20-32 cm long, (5-)8-11 cm wide, distinctly 6-7-plicate, upper side glabrous, lower side glabrous or costa sparsely puberulous (scape-leaves often hairy). Inflorescence ovoid, 4-8 cm long, 3.5-6 cm wide, borne on a separate shoot ca 60 cm tall covered with only 2-7 well-developed leaves (7-27 cm long and 4-9 cm wide, sparsely to rather densely puberulo-villose on both sides), sheaths obliquely truncate, 3.5-11 cm long, 1-1.5 cm in diameter, glabrous. Bracts dark red, coriaceous, broadly ovate, 2-3.5 cm long and wide, adaxial side glabrous to sparsely puberulous, abaxial side rather densely puberulous, callus 2-4 mm long; appendages foliaceous, green, ascending, triangular-ovate, 2.5-6 cm long, 2-4 cm wide (the four lower ones not measured), rather densely to sparsely puberulo-villose on both sides. Bracteole red, 25-27 mm long, sparsely to rather densely puberulous. Calyx red, 11-16 mm long, 9-12 mm wide, sparsely to rather densely puberulous, the lobes very shallowly triangular, 2-3 mm long. Corolla white, 70-85 mm long, glabrous, tube 15-20 mm long, lobes 55-70 mm long, the dorsal one 22-30 mm wide, the two lateral ones 18-25 mm wide. Labellum sordid-white with a central yellow zone and reddish-striped lateral lobes, broadly obovate when spread out, 60-65 mm long and wide, middle lobe trilobulate, lobules 15-17 mm long and 6-8 mm wide. Stamen pinkish-white, 40-50 mm long, 12-16 mm wide, apex irregularly tridentate, reflexed, anther 9-10 mm long, 4 mm wide. Ovary 5-10 mm long, sparsely to rather densely puberulous. Capsule unknown.

TYPE. *Hort. Bot. Utrecht 72-359* (neotype, U), cultivated from seeds of *Prance, Maas, Kubitzki, Steward, Ramos, Pinheiro & Lima 12064 a*, from Rio Moa, between Igarapé Ipiranga and Aquidabã, Acre, Brazil. The holotype, *Tessmann 4813* from mouth of Río Apaga, Marañon River Region, Loreto, Peru, having been destroyed at Berlin in 1943, a neotype is chosen here.



FIG 71. *Costus erythrophyllus* (a-e, Hort. Bot. Utrecht 72-359). a, habit; b, leaf with ligule; c, inflorescence seen from above; d, flower; e, labellum and stamen.

DISTRIBUTION (Fig 63). Amazonian Colombia, Peru, Ecuador, and Brazil; várzea forest, from sea level to 450 m.

COLOMBIA. META: Acacias, Rio Guamal, *Uribe Uribe 2189* (COL, US). PUTUMAYO: Puerto Porvenir, above Puerto Ospina, *Cuatrecasas 10604* (US); Monclar, Rio Putumayo, between Guepi and Leguizamo, *Gutiérrez V. 2734* (COL). BRAZIL. ACRE: cf type. ECUADOR. NAPO: lower Rio Coca, *Harling 3575* (S).

This species is closely related to *C. claviger* (and in 1972 wrongly put into the synonymy of that species). It is characterized by its strongly plicate leaves and by its unequally 2-lobed, long ligule.

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18B. *Costus varzearum* Maas, Acta Bot. Neerl. 24: 471. 1976.

Fig 72.

Costus claviger sensu Maas in Fl. Neotrop. Monogr. 8: 77. 1972 (pro parte minore).

Low plants, 30-100 cm tall. Sheaths green or tinged with purple-red, 10-15 mm in diameter, densely covered with microscopic trichomes (0.03-0.06 mm long), somewhat scabrid to the touch. Ligule purplish, unequally 2-lobed, 20-30 mm long, the lobes rounded, glabrous or basally densely hairy like the sheaths. Petiole purplish, 5-10 mm long, densely hairy like the sheaths. Lamina often red-purple below, 13-25 cm long, 5-10.5 cm wide, elliptic-obovate, cuneate to obtuse at the base, acute to very shortly acuminate at the apex (acumen 2-4 mm long), ending in a densely hairy, filiform point 1 mm long, upper side glabrous, lower side rather densely puberulous, soft to the touch. Inflorescence terminal, ovoid, 4-9 cm long, 3-4 cm wide, borne on a 3-7 leaved shoot, the leaves strongly congested towards the apex, sheaths very obliquely truncate, 6-9 cm long. Bracts pinkish-red, coriaceous, ovate, 2-2.5 cm long, 1-1.8 cm wide, adaxial side sparsely covered with appressed hairs, abaxial side rather densely to densely so, callus dark green, 1-3 mm long; appendages foliaceous, green, fragile when dry, horizontally spreading in living plant, ascending or reflexed when dry, 0.5-1.5 cm long, 0.8-1.6 cm wide (the four lower ones not measured), broadly triangular-ovate, apex rounded, densely puberulous on both sides. Bracteole pinkish-red, 15-18 mm long, rather densely puberulous. Calyx pinkish-red, 8-10 mm long, ca 6 mm wide, rather densely to densely puberulous, lobes very shallowly triangular, 1-2 mm long. Corolla yellow to pink, 47-55 mm long, glabrous, tube yellow, 10-20 mm long, lobes 35-40 mm long, the dorsal one 15-17 mm wide, the two lateral ones 11-12 mm wide. Labellum creamy-white to pale yellow, narrowly obovate when spread out, 40-45 mm long, 25-28 mm wide, lateral lobes reddish-striped, middle lobe reflexed, irregularly trilobulate, lobules 1-10 mm long and 1-6 mm wide; basal tube formed by labellum and stamen 15 mm long, 6 mm in diam. Stamen creamy white, 35-38 mm long, 7-8 mm wide, gradually narrowed towards the red apex, anther 6-7 mm long. Ovary globose, rather densely puberulous. Capsule ellipsoid, ca 10 mm long, sparsely puberulous, seeds black. Chromosome number $2n = 18$ (*Prance et al 12064 pp*).

TYPE. *Maas, Steward & Ramos, Prance 12860* (holotype, INPA; isotypes, COL, K, NY, U, US, W), Rio Juruá, Igarapé Treize de Maio, Acre, Brazil.

DISTRIBUTION (Fig 63). Brazil, states of Amazonas and Acre, várzea forest.

BRAZIL. ACRE: N bank of Rio Juruá, opposite Cruzeiro do Sul, *Prance et al 2917* (INPA); Rio Moa between Igarapé Ipiranga and Aquidabã, *Prance et al 12064 pp* (DAV, INPA, NY, U). CULTIVATED SPECIMENS. Hort. Bot. Belém, *Huber 6891, 9332* (MG), both originating from Rio Purus, Amazonas, Brazil; *Hort. Bot. Utrecht 71-153* (from *Prance et al 12064 pp*) (E, F, K, MO, U, VEN).

I have named this species *C. varzearum*, as it only inhabits the várzea forests of Brazil.

It is closely related to the Guianan *C. claviger*, differing in its longer ligule (20-30 mm vs 10-15 mm), much smaller leaves (13-25 X 5-10 cm vs 10-50 X 3-13 cm), terminal instead of basal inflorescence, and smaller flowers.



FIG 72. *Costus varzearum* (a-e, Hort. Bot. Utrecht 71-153). a, habit; b, inflorescence seen from above; c, bract; d, flower; e, labellum and stamen.

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18C. *Costus* aff. *C. claviger* R. Benoist

Plants 0.8-2 m tall. Sheaths 5-10 mm diameter, rather densely to densely minutely puberulous. Ligule truncate, 2-5 mm long, densely minutely puberulous. Petiole 2-3 mm long, densely puberulo-sericeous. Lamina narrowly elliptic, cordate at the base, acuminate at the apex (acumen 5-15 mm long), 15-25 cm long, 4-6.5 cm wide, upper side glabrous or sparsely minutely puberulous, lower side densely to sparsely minutely puberulous. Inflorescence terminal, ovoid, 8-9 cm long, 3-5 cm wide. Bracts red, coriaceous, broadly ovate to ovate, 2.5-3 cm long, 1.5-2.5 cm wide, abaxial side densely to rather densely minutely puberulous, adaxial side similar but glabrous to the base, callus absent or obsolete and to 5 mm long; appendages foliaceous, green, reflexed or ascending, ovate-triangular, 0.5-3 cm long, 1-1.5 cm wide (the lowermost not measured), rather densely minutely puberulous on both sides. Bracteole 20-24 mm long, rather densely minutely puberulous, callus 3 mm long. Calyx red, 12-16 mm long, 6-8 mm wide, rather densely minutely puberulous, lobes triangular to deltate, 4-5 mm long. Corolla white (*Prance et al 8867*), ca 70 mm long (*Prance et al 8867*), glabrous. Labellum broadly obovate when spread out, 45-50 mm long, 35-40 mm wide. Stamen ca 40 mm long, anther 7-8 mm long. Ovary 5-10 mm long, densely puberulo-sericeous. Capsule unknown.

DISTRIBUTION (Fig 63). Colombia and Brazil.

COLOMBIA. MAGDALENA: Manaure, 700 m, *Haught 4130* (COL, US). BRAZIL. RONDÔNIA: road to São Lorenço, N bank of Rio Madeira, 10 km above Mutumparaná, *Prance et al 8867* (INPA, NY, U); Forte Príncipe da Beira, caminho de Conceição, *Rodrigues & L. Coelho 4318* (INPA, UO; near Porto Velho, *Black 52-14582* (IAN).

This species is closely related to *C. claviger* and *C. erythrophyllus*. From *C. erythrophyllus* it differs in the smaller ligule and cordate leaf-base.

Killip 34225 (US), from Rio Negro Valley, between Quetamé (1500 m) and Piperál (1200 m), Cundinamarca, Colombia, is closely related to this species.

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***Costus* subgen *Costus* sect *Ornithophilus* Maas, sect nov**

Labellum luteum vel rubrum, lobis lateralibus parvis involutis et tubum efformantibus. Bracteae luteae vel rubrae, raro virides.

TYPE SPECIES. *Costus pulverulentus* Presl.

This section includes species 19-36.

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19a. *Costus lima* K. Schumann var *lima*

Add to the distribution: Honduras.

HONDURAS. *Clewell & Cruz 4115* (EAP).

Sastre & Pinto 1110 (P), San Juan de Arama, Meta, Colombia, *Dudley 10366* (NA), 12 km NE of Hacienda Luisiana and Río Apurimac, 1700 m, prov. Apurimac, Cuzco, Peru, and *Dudley 11872* (NA), 23 km SW of Hacienda Luisiana and Río Apurimac, 1360-1400 m, prov. La Mar, Ayacucho, Peru, are somewhat related to *C. lima*, but diverge in their completely glabrous leaves.

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20b. *Costus comosus* (Jacquin) Roscoe var *bakeri* (K. Schumann) Maas Fig 73c.

As I already suspected in 1972, this variety now has been shown to occur also in southern Central America: *Maas & Dressler 1617* (F, K, MO, U) and *Maas & Dressler 1655* (AAU, COL, MO, U, VEN), both from the Santa Fé region, province of Veraguas, Panama.

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20A. *Costus cupreifolius* Maas, Acta Bot. Neerl. 24: 471. 1976. Fig 74.

Plants ca 1 m tall. Sheaths, ligule, petiole, lower side of leaves, bracts and their appendages, bracteole, calyx, corolla, ovary, and capsule densely covered with white, appressed to erect hairs. Sheaths ca 10 mm diam. Ligule unequally 2-lobed, ca 15 mm long. Lamina narrowly obovate to obovate, cuneate at the base, acuminate at the apex (acumen to 15 mm long), 25-28 cm long, 8-10 cm wide, upper side glabrous except for the puberulous costa, lower side copper-coloured. Inflorescence cylindric, 11 cm long, 4 cm wide, Bracts red (?), coriaceous, broadly ovate, 1-2 cm long and wide, callus obsolete, ca 1 mm long; appendages foliaceous, reflexed, deltate, acute, 0.7-1.5 cm long and wide (the four lower ones not measured). Bracteole 13 mm long. Calyx 10 mm long, 8 mm wide, the lobes depressed-ovate-triangular, 2-3 mm long. Corolla 20 mm long, the tube ca 10 mm long, lobes ca 10 mm long, the dorsal one 8 mm wide, the two lateral ones (in bud) 6 mm wide. Labellum tubular, (in bud), ca 12 mm long and 10 mm wide. Stamen (in bud) ca 11 mm long, 4 mm wide, anther ca 5 mm long. Capsule ellipsoid, ca 5 mm long.

TYPE. *Ewan 16748* (holotype, US; isotype, NY), near San Diego de Colorado, tributary of Río Putumayo, above Puerto Asís, 650 m, Putumayo, Colombia.

DISTRIBUTION (Fig 63). Only known from the type locality.

This new species is named for the colour of the lower side of its leaves, which according to Ewan is "coppery-red, attractive." It cannot be confused with any other species with appendaged bracts because of its indument. It is probably closest to *C. comosus* and *C. productus*, but additional flowering material is required before a definite decision can be made.

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22. *Costus productus* Gleason ex Maas

Rather low plants, 0.3-1.5 m tall. Sheaths membranous, very fragile when dry, puberulous to strigose, 8-15 mm diameter. Ligule unequally 2-lobed, 20-40 mm long, lobes rounded, membranous, very fragile when dry, puberulous to strigose. Petiole 2-5 mm long, densely villose to hirsute. Lamina narrowly elliptic, narrowly obovate, or obovate, rounded at the base, shortly acuminate at the apex, 16-32 cm long, 5.5-9 cm wide, densely strigose to glabrous on both sides, costa densely strigose above. Inflorescence ovoid, 6-11 cm long, 3.5-4(-6) cm wide. Bracts bright red to orange, broadly ovate, characteous to coriaceous, to 2.5 cm long and 3 cm wide, glabrous to sparsely puberulous, callus 6-12 mm long; appendages foliaceous, bright red, usually reflexed when dry, very broadly ovate to deltate, acute to obtuse, 0.5-2 cm long and wide (the lower ones greenish, to 6 cm long and 2.5 cm wide), rather densely puberulo-



FIG 73. *Costus longibracteolatus* (a, Plowman & Davis 4364). a, inflorescence and part of the densely hairy, leafy stem. Photograph by T. Plowman.-*Costus woodsonii* (b, Maas *et al* 1571). b, habit. Photograph by P. J. M. Maas.- *Costus comosus* var *bakeri* (c, Maas & Dressler 1617). c, habit. Photograph by P. J. M. Maas.

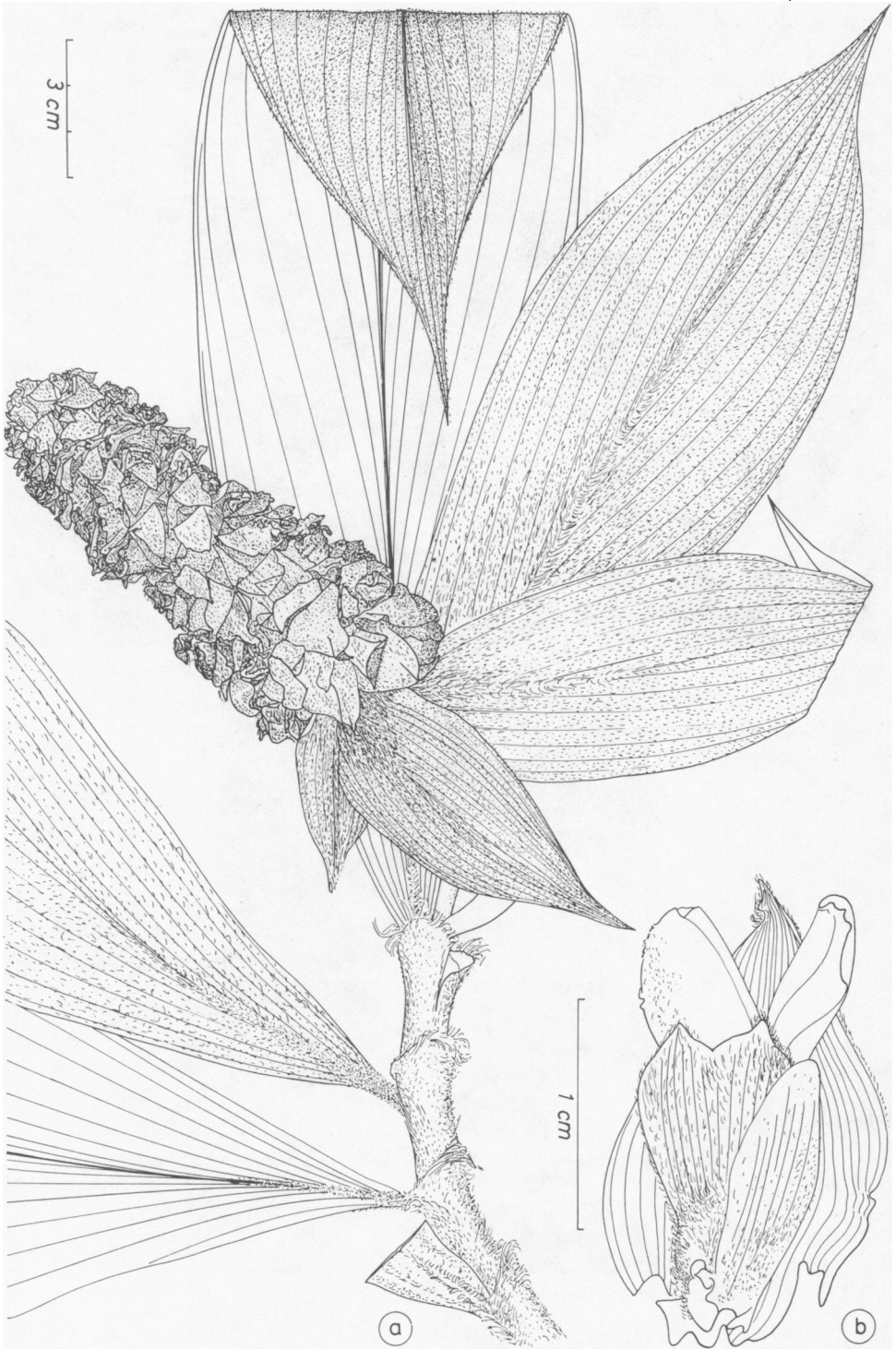


FIG 74. *Costus cupreifolius* (a-b, Ewan 16748). a, habit; b, bract enclosing bracteole, ovary, and calyx.

strigose. Bracteole 17 mm long, sparsely puberulous at the base, callus to 4 mm long. Calyx 10-15 mm long, glabrous to rather densely puberulous, lobes shallowly triangular to deltate, 3-5 mm long, occasionally with a callus 2 mm long. Corolla pale yellow to orange, 35-42 mm long, glabrous, tube 10 mm long, lobes narrowly obovate, 25-32 mm long, 10-12 mm wide. Labellum oblong-obovate when spread out, 25-35 mm long, 8-15 mm wide, lateral lobes involute and forming a tube, upper margin 5-dentate. Stamen narrowly elliptic, 25-30 mm long, 4-8 mm wide, apex rounded or obtuse, anther 6-8 mm long. Ovary 5 mm long, sericeous, especially at the apex. Capsule ellipsoid, 14 mm long, densely yellowish-sericeous, seeds black.

DISTRIBUTION (Fig 63). Colombia and Peru; in forests from sea level to 700 m.

Key to the Varieties of *Costus productus*

- | | |
|--|-----------------------------|
| 1. Leaves glabrous to sparsely puberulous. | 22a. var <i>productus</i> . |
| 1. Leaves rather densely strigose. | 22b. var <i>strigosus</i> . |

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22a. *Costus productus* var *productus*

Costus juruanus var *juruanus* sensu Maas, Fl. Neotrop. Monogr. 8: 90. f. 41. 1972 (excl. type).

Sheaths and ligule sparsely to densely puberulous. Lamina glabrous on both sides or sparsely puberulous towards the margins; costa beneath rather densely villose to hirsute at the base, sparsely puberulo-sericeous towards the apex.

TYPE. *Killip & Smith 25317* (holotype, US; isotype, NY), Perene Bridge, Río Paucartambo Valley, dense forest, 700 m, Junín, Peru.

DISTRIBUTION (Fig 63). Eastern Peru; in forests, to 700 m.

PERU. JUNÍN: Puerto Bermúdez, 375 m, *Killip & Smith 26476* (GH, NY, US). SAN MARTÍN: between Sinchono and Boquerón, *Ferreya 1275* (M, US).

I have excluded *C. juruanus* (see Insufficiently known species), as its exact position can not be determined, all type material having been destroyed. Moreover, the surviving type-photograph does not show any detail of the inflorescence, which is completely covered by one of the upper leaves.

Costus productus is characterized by its red bract-appendages, a very long, fragile ligule, and a relatively long callus of the bracts.

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22b. *Costus productus* var *strigosus* (Maas) Maas, Acta Bot. Neerl. 24: 472. 1976.

Fig 75.

Costus juruanus var *strigosus* Maas, Fl. Neotrop. Monogr. 8: 90. 1972.

Different from var *productus* in its rather densely strigose lamina, ligule, and sheaths.

TYPE. *Cuatrecasas 10684* (holotype, US; isotypes, COL, F), Río Putumayo, Puerto Porvenir, above Puerto Ospina, near La Loma, 230-250 m, Putumayo, Colombia.

DISTRIBUTION (Fig 63). Known only from the type locality; in wet forest.

A sterile collection, *Ll. Williams 1661* (F), from Pébas, Loreto, Peru, probably belongs to this variety, too.



FIG 75. *Costus productus* var *strigosus* (Cuatrecasas 10684). Habit.

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23. *Costus lasius* Loesener

Add to the description (measurements taken from *Maas 1432*): Corolla 35-45 mm long, tube 10 mm long, lobes 25 mm long, the dorsal one 24 mm wide, the two lateral ones ca 20 mm wide. Labellum yellow, tubular, 17-18 mm long, ca 14 mm wide. Stamen yellow, 17 mm long, 8 mm wide, anther 6 mm long, 3 mm wide.

Dressler 2914 (US), from Barro Colorado Island, Canal Zone, is aberrant in its red flowers, cordate leaf-base, and in being glabrous or nearly so.

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24. *Costus scaber* Ruiz & Pavon

On page 84 of the revision of the Costoideae the distribution of *C. scaber* was mapped. Unfortunately all dots on the island of Hispaniola were omitted.

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24A. *Costus wilsonii* Maas, Acta Bot. Neerl. 24: 472. 1976.

Fig 76.

Costus scaber Ruiz & Pavón X *Costus lasius* Loesener ?, Maas, Fl. Neotrop. Monogr. 8: 96. 1972.

Plants 0.5-4 m tall. Sheaths prominently veined when dry, 6-10 mm diameter, glabrous, sometimes puberulous, particularly near the ligule, rarely sparsely hirsute-villose, basal sheaths reddish-brown. Ligule obliquely truncate to slightly 2-lobed, 2-6 mm long, glabrous, sometimes puberulous, rarely sparsely hirsute. Petiole 1-7 mm long, glabrous, sometimes puberulous, rarely sparsely hirsute. Lamina narrowly elliptic, long-acuminate at the apex, (acumen with involute margins, 10-30 mm long, densely covered with long, silky hairs), cuneate (to rounded) at the base, 8-25 cm long, 1.5-7 cm wide, upper side glabrous, rarely sparsely hirsute, lower side glabrous, costa densely whitish-puberulo-sericeous. Inflorescence cylindric to ovoid, 3-10 cm long (to 15 cm in fruit), 1.5-4.5 cm wide. Bracts often yellow, sometimes red or orange to green, coriaceous, broadly ovate, obtuse, often prominently veined when dry, 2-4 cm long and wide, glabrous, callus 2-6 mm long. Bracteole whitish, 12-17 mm long, glabrous, rarely puberulous. Calyx whitish, 5-7 mm long, 6-8 mm wide, glabrous, rarely puberulous, lobes shallowly to very shallowly triangular, 0.5-1.5 mm long. Corolla yellow, 40-47 mm long, glabrous, tube ca 10 mm long, lobes 30-37 mm long, the dorsal one 22-23 mm wide, the two lateral ones 14-17 mm wide. Labellum yellow, oblong-obovate when spread out, 33-35 mm long, 25-28 mm wide, lateral lobes well-developed, often reddish-veined, involute and forming a tube 8-10 mm in diameter, middle lobe reflexed, irregularly 5-lobulate, the lobules triangular to shallowly triangular, 0.5-7 mm long. Stamen yellow, or reddish at apex, 32-33 mm long, 10-12 mm wide, anther 7-9 mm long, 4-4.5 mm wide. Ovary glabrous, sometimes sparsely hairy towards the apex. Capsule ellipsoid, 10-12 mm long, glabrous or sparsely puberulous towards the apex.

TYPE. *Maas & McAlpin 1383* (holotype, U; isotypes, COL, CR, F, K, MO, NY), from Fila Las Cruces, near San Vito de Java, 1400 m, Puntarenas, Costa Rica.

DISTRIBUTION (Fig 63). Panama and Costa Rica; cloud forests, from 1250-1850 m.

COSTA RICA. PUNTARENAS: Las Alturas, 1300-1800 m, *Maas & McAlpin 1471* (CR, DUKE, E, EAP, F, GH, MO, U, US, VEN). PANAMA. CHIRIQUÍ: Quebrado Velo, Finca Lerida, 1630 m, *Allen 4685* (G, GH, U); Boquete, 1260 m, *Davidson 726* (F, GH, MO, US); Cerro Horqueta, 1500 m, *Duke et al 13607* (DUKE); 5.2 mi. NW of El Hato del Volcán, 1830 m, *Luteyn 842* (DUKE); Río Gariché, *Seibert 330* (GH, K, NY); Salta-Cameseta trail, Boquete, Volcan de Chiriqui, 1600 m, *Terry 1366* (F); NE of Cerro Pando, NW of Nueva California, 1500 m, *Wilbur et al 11006* (DUKE); Between Finca Lerida and Boquete, 1700 m, *Woodson et al 1169* (MO); Quebrado Velo, 1800 m, *Woodson & Schery 282* (GH, US).

I have named this species after Robert Wilson, director of Las Cruces Botanical Garden, San Vito de Java, Puntarenas, Costa Rica. In that garden he assembled a very fine collection of Zingiberaceae which was very useful for the present revision; moreover, Robert and Catherine Wilson were so kind as to invite me to their house during my last visit to Costa Rica.

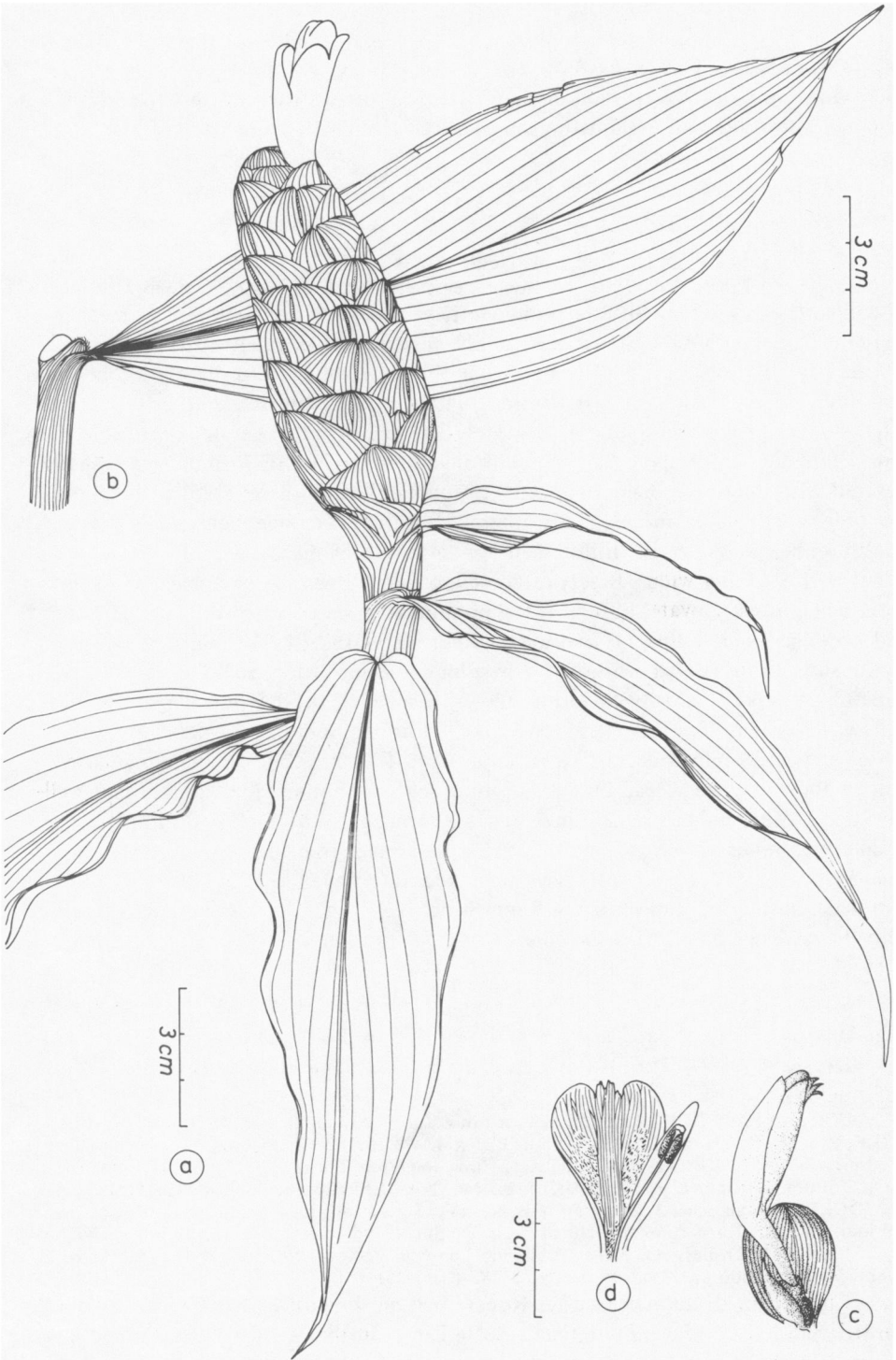


FIG 76. *Costus wilsonii* (a-d, Maas & McAlpin 1471). a, habit; b, leaf; c, bract with flower; d, labelum and stamen.

Costus wilsonii is restricted to the higher borderlands of Costa Rica and Panama. Although it shares some characters with *C. scaber* and *C. lasius*, it is not a hybrid between the two species (as suggested in 1972). It can be distinguished by its leaves that have a very characteristic, long, involute acumen and its labellum with well developed, often reddish-veined lateral lobes.

The colour of the bracts is highly variable as I observed during my visit at San Vito; in *Maas & McAlpin 1471* the colour varied from yellow, orange, reddish to green ! However, generally (according to the label annotations) the colour of the bracts seems to be yellow.

Two collections, *Seibert 330* and *Maas & McAlpin 1471 pp* are slightly aberrant in being sparsely hirsute (like *C. lasius!*) on the upper side of the leaves.

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25. *Costus sprucei* Maas

Fig 77 a-b.

Add to the description: Costa on upper side of lamina densely hirsute-strigose. Inflorescence 1.5-3 cm wide. Bracts red, chartaceous to coriaceous. Bracteole red. Calyx red, 6-10 mm long, to 7 mm wide. Corolla yellow, 30-31 mm long, glabrous to puberulous, tube 6-8 mm long, lobes 22-25 mm long, the dorsal one 11-13 mm wide, the two lateral ones 7-10 mm wide. Labellum yellow, oblong-obovate when spread out, 20-25 mm long, 12-16 mm wide, lateral lobes involute and forming a tube 7-8 mm in diameter, apex irregularly 5-lobulate, lobules 0.5-5 mm long. Stamen yellow, 23-25 mm long, 7-8 mm wide, apex rounded, anther 6 mm long, 3-4 mm wide.

DISTRIBUTION. In addition to the Brazilian states of Pará and Amazonas now also known from Acre and Rondônia.

BRAZIL. ACRE: *Prance et al 12265* (INPA, NY, U). RONDÔNIA: *Prance et al 5218* (INPA, NY, U); *Prance et al 6672* (INPA, NY, U); *Prance et al 8227* (INPA, NY, U), 8866 (U).

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26. *Costus chartaceus* Maas

Add to the description: Calyx 7.5-11 mm long. Bracteole 13-18 mm long.

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26A. *Costus cordatus* Maas, Acta Bot. Neerl. 24: 472. 1976.

Fig 78.

Plants 2 m tall. Sheaths ca 15 mm in diameter, glabrous or somewhat puberulous near the insertion of the petiole. Ligule unequally and deeply 2-lobed, 15-20 mm long, the lobes rounded, sparsely puberulous, the margin densely covered with long hairs. Petiole 5-15 mm long, densely puberulo-sericeous. Lamina narrowly elliptic, cordate at the base, acuminate at the apex (acumen ca 20 mm long), 35-40 cm long, 12.5-13 cm wide, 8-10-plicate, upper side glabrous except for the sericeous costa, lower side rather densely sericeous on costa, veins, and margins. Inflorescence cylindric, ca 10 cm long, 4.5 cm wide. Bracts dark red, coriaceous, broadly ovate-triangular, top-angle ca 90°, 3-4 cm long, 2.5-3 cm wide, abaxial side puberulo-sericeous, the covered part rather densely, exposed part sparsely so, adaxial side sparsely puberulo-sericeous, callus green, 7-9 mm long. Bracteole red, 20-23 mm long, sparsely to rather densely puberulous, 3 mm long. Calyx red, 10-13 mm long, 6-8 mm wide, sparsely puberulous, the lobes shallowly triangular, 3-4 mm long. Corolla pale yellow, 63-75 mm long,

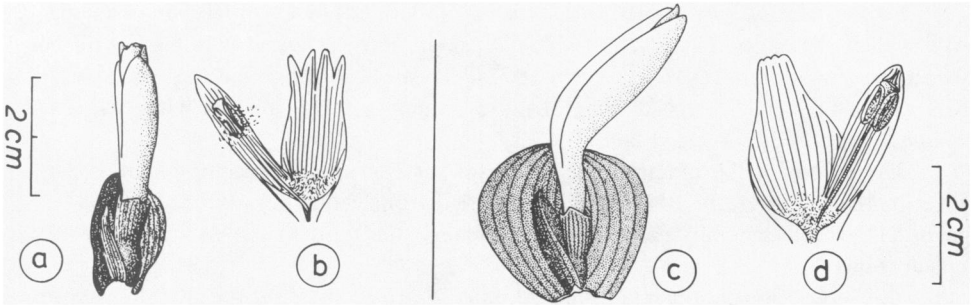


FIG 77. *Costus sprucei* (a-b, Prance et al 12265) and *Costus woodsonii* (c-d, Maas & Mori 1744). a, c, bract with flower; b, d, labellum and stamen.

glabrous, tube 13-20 mm long, lobes 50-55 mm long, the dorsal one 19-21 mm wide, the two lateral ones 14-17 mm wide. Labellum yellow, oblong-obovate when spread out, 40-43 mm long, 25-27 mm wide, lateral lobes involute and forming a tube ca 12 mm diam, upper margin fimbriate, irregularly 7-9-lobulate. Stamen yellow, 35-40 mm long, 11-12 mm wide, apex slightly rounded, anther 10-11 mm long, 4 mm wide. Ovary sparsely puberulous. Capsule ellipsoid, ca 15 mm long, sparsely puberulous.

TYPE. *Maas & Plowman 1965* (holotype, U; isotype, COL), El Boquerón, km 85 of new road Cali-Buenaventura, 150 m, El Valle, Colombia, secondary roadside vegetation.

DISTRIBUTION (Fig 63). Known only from the type locality in El Valle, Colombia.

This species is related to the Colombian *C. chartaceus* and to the Central American *C. plicatus*.

I have studied some Colombian collections which may belong to this species:

1. *Kennedy 147* (U), Andagoya, Chocó. This specimen fits *C. cordatus* in most features, only differing in its obliquely truncate ligule and in the lower side of the lamina being hairy all over (instead of hairy on costa, veins, and margins only); 2. *Idrobo 1762* (COL), mouth of Río Dagua, 45-50 km from Buenaventura, El Valle and *Cuatrecasas 38759* (US, VALLE), Sabaletas, km 29 of old road Cali-Buenaventura, 25 m, El Valle, show similarity to *C. cordatus* and to *C. chartaceus*. Additional flowering material from both localities will help to clarify the systematic position of both specimens.

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28. *Costus woodsonii* Maas

Fig 73b, 77 c-d.

Add to the description: Lamina (narrowly) ovate to (narrowly) obovate, 8-26 cm long, 4-11 cm wide. Bracts pinkish-red in the exposed part, white to greenish-white in the covered part. Bracteole and calyx white to greenish-white, apically red. Corolla red to orange-red, 30-40 mm long, tube 10-15 mm long, lobes 20-25 mm long, the dorsal one 10-13 mm wide, the two lateral ones 7-8 mm wide. Labellum yellow, ovate-oblong when spread out, 26-30 mm long, 18-20 mm wide, the lateral lobes involute and forming a tube 8-10 mm in diameter, apex slightly crenulate. Stamen yellow, 30-32 mm long, 10-12 mm wide, apex obtuse, anther 9 mm long, 4 mm wide. Capsule ellipsoid, 8-15 mm long.



FIG 78. *Costus cordatus* (a-f, Maas & Plowman 1965). a, habit; b, leaf; c, leaf-base; d, bract with flower; e, bracteole with flower; f, labellum and stamen.

DISTRIBUTION. Lowlands of Nicaragua, Costa Rica, Panama, and along the Pacific Coast of Colombia; in lowland thickets near the sea, even growing on sandy beaches!

COLOMBIA. CHOCÓ: Cuevita, *Fernández 201* (COL, US). **EL VALLE:** N shore of Buenaventura Bay, *Killip & Cuatrecasas 38691* (US).

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30a. *Costus spiralis* (Jacquin) Roscoe var *spiralis*

This taxon appears to be quite heterogeneous and may have to be split up. As the taxonomic problems could not all be solved during the present investigation, the results will possibly be given in the future.

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30b. *Costus spiralis* (Jacquin) Roscoe var *villosus* Maas

Add to the distribution: Brazilian states of Amazonas and Amapá.

BRAZIL. AMAPÁ: *B. & C. K. Maguire & Pires 47070* (U. VEN). **AMAZONAS:** *Oliveira 4317, 4768* (IAN, NY).

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30A. *Costus plicatus* Maas, Acta Bot. Neerl. 24: 472. 1976.

Fig 79.

Plants 0.5-2.5 m tall, greenish when dry. Sheaths 6-11 mm diam, glabrous. Ligule very obliquely truncate, 25-60 mm long, glabrous, withering with age. Petiole 15-20 mm long, glabrous. Lamina rather asymmetrical, narrowly elliptic to narrowly obovate, attenuate at the base, long-acuminate at the apex (acumen 15-25 mm long), 25-31 cm long, (7-)8.5-13 cm wide, strongly 6-8-plicate, upper side glabrous, lower side glabrous or very sparsely minutely puberulous, the margins densely covered with long, silky hairs, often becoming glabrous with age. Inflorescence cylindric to ovoid, acute, 5-15 cm long, 3-4.5 cm wide. Bracts pink to red, coriaceous, broadly ovate-deltate, acute (top-angle less than 90°), 2.5-4 cm long, 2-3 cm wide, glabrous, callus yellow to green, 5-11 mm long. Bracteole pink, 17-18 mm long, glabrous. Calyx pink, 7-10 mm long, 7-8 mm wide, glabrous, lobes very shallowly triangular, 0.5-1.5 mm long. Corolla yellow, 45 mm long, glabrous, tube ca 15 mm long, lobes 30 mm long, the dorsal one 15 mm wide, the two lateral ones 11 mm wide. Labellum yellow, oblong-ovate when spread out, 32 mm long, 20 mm wide, the lateral lobes involute and forming a tube 9-10 mm diam, upper margin 5-lobulate, the lobules shallowly triangular to triangular, 2-5 mm long. Stamen yellow, slightly exceeding the labellum, 37 mm long, 12 mm wide, anther 11 mm long, 4 mm wide. Ovary glabrous. Capsule subglobose, 13 mm long, 12 mm wide, glabrous.

TYPE. *Maas & Dressler 1619* (holotype, U), Río Segundo Brazo, 700 m, prov. Veraguas, Panama.

DISTRIBUTION (Fig 63). Costa Rica and Panama; forests, from sea level to 750 m.

COSTA RICA. PUNTARENAS: Esquinas Exp. Station, near Río Esquinas, *P. H. Allen 5598* (EAP); between Golfito and Río Claro, *Maas & McAlpin 1436* (sterile, U); Esquinas forest, *Maas & McAlpin 1451* (sterile, U); Coto 47, *Maas & McAlpin 1463* (sterile, F, U). **PANAMA.** BOCAS DEL TORO: Nievécita, 0-50 m, *Woodson et al 1951* (MO). **CHIRIQUÍ:** Peninsula de Burica, San Bartolomé, 0-50 m, *Woodson & Schery 885* (NY). **VERAGUAS:** Río Primero Brazo, near Santa Fé, 700-750-m, *Croot 25524* (MO, U); Valley of Río Dos Bocas, 11 km from Escuela Agronomica

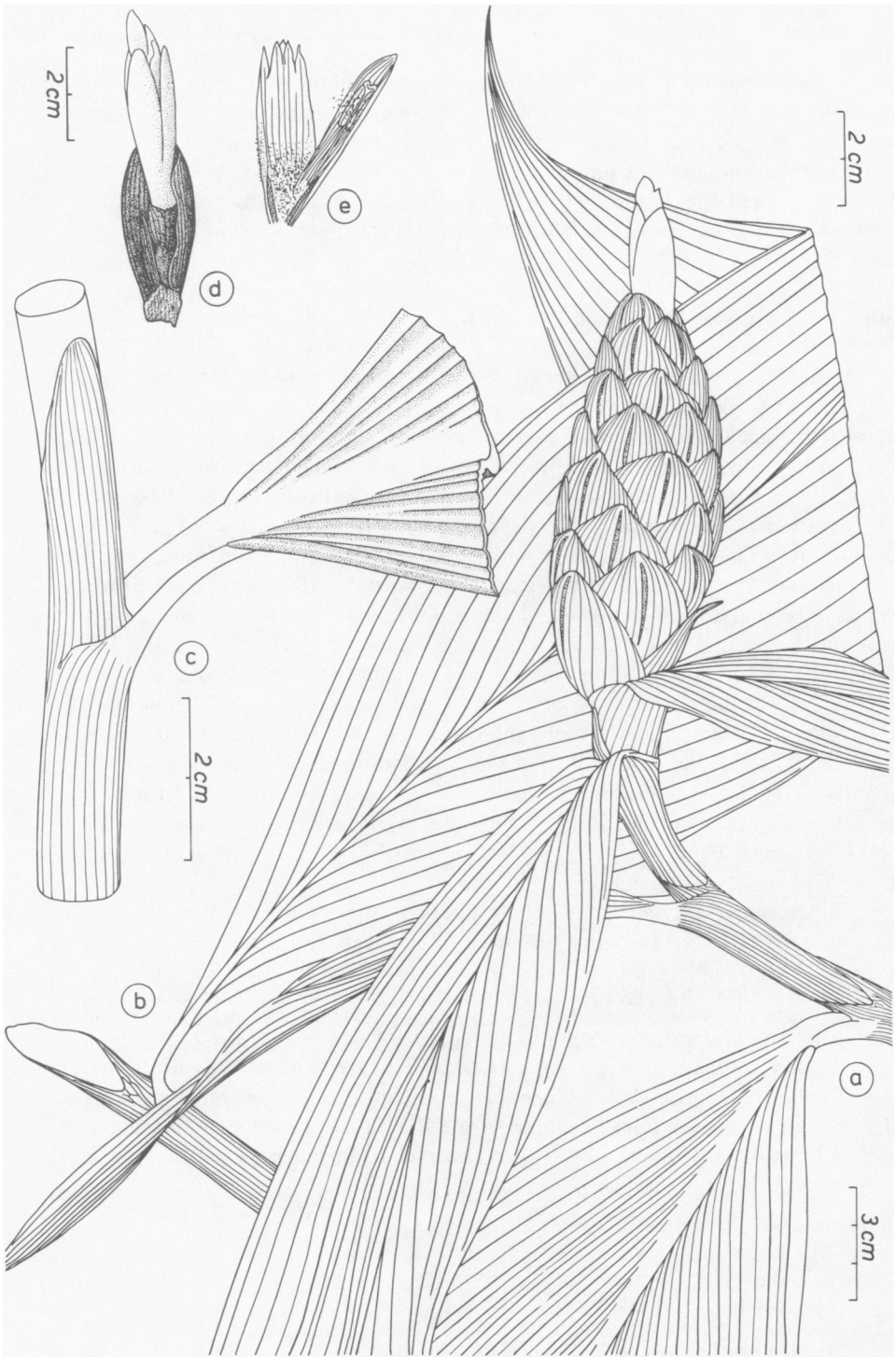


FIG 79. *Costus plicatus* (a-e, Maas 1431). a, habit; b, leaf; c, leaf-base; d, bract with flower; e, labelum and stamen.

Alto Piedra (above Santa Fé), on road to Calovebora, 450 m, *Croat 27535* (MO). CULTIVATED SPECIMENS. Las Cruces Botanical Garden, San Vito de Java, Puntarenas, Costa Rica, *Maas 1431* (U).

Closely related to *C. nitidus*, but in the herbarium as well as in the field readily recognized by its (relatively) much wider, strongly plicate leaves, which, moreover, are more abruptly acuminate.

I am not completely sure of the identity of *Maas, Dressler & Mori 1726* (sterile, U), from El Valle de Antón, 750 m, Coclé, Panama: it is slightly aberrant in having somewhat larger lamina (up to 48 X 19 cm) and sheaths (to 18 mm in diameter).

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30B. *Costus nitidus* Maas, Acta Bot. Neerl. 24: 473. 1976.

Fig 80.

Plants to 4 m tall, pale to dark brown when dry. Sheaths glabrous, shining, 10-20 mm diam. Ligule obliquely truncate to slightly 2-lobed, 20-40 mm long. Petiole 8-15 mm long, glabrous. Lamina narrowly elliptic, cuneate at the base, acute to acuminate at the apex (acumen to 20 mm long), 30-43 cm long, 7-10 cm wide, shining on both sides (in living plant), brownish when dry, glabrous on both sides, margins densely covered with stiff, brownish hairs. Inflorescence pink, ovoid, obtuse, 7-16 cm long, 4-5.5 cm wide. Bracts pink in the exposed part, white in the covered part, coriaceous, broadly ovate, obtuse (top-angle more than 90°), 3-5 cm long and wide, glabrous, callus pale yellow to green, 12-15 mm long. Bracteole white, 18-20 mm long, glabrous. Calyx white, 7-10 mm long, 8 mm wide, glabrous, lobes shallowly to very shallowly triangular, mucronate, 1-3 mm long. Corolla yellow, ca 70 mm long, glabrous, tube 25-30 mm long, lobes 40-45 mm long, the dorsal one 15-22 mm wide, the two lateral ones 13-18 mm wide. Labellum yellow, oblong-obovate when spread out, 30-33 mm long, 17-20 mm wide, the lateral lobes involute and forming a tube 10-12 mm diam, upper margin 5-lobulate, the lobules narrowly triangular, 2-5 mm long, 2-4 mm wide. Stamen yellow, slightly exceeding the labellum, narrowly elliptic, ca 35 mm long, 12-13 mm wide, apex cucullate, slightly recurved, anther 9 mm long, 5 mm wide, tube formed by stamen and labellum ca 10 mm long. Ovary white, narrowly ellipsoid, 5-8 mm long, glabrous. Capsule ellipsoid, 10-15 mm long, glabrous.

TYPE. *Maas & Cramer 1345* (holotype, U), forested hills of Río Reventazón, near grounds of IICA, Turrialba, 600 m, prov. Cartago, Costa Rica.

DISTRIBUTION (Fig 63). Panama and Costa Rica; forests, from 50 m to 900 m.

COSTA RICA. CARTAGO: Tres Equis, Chitaria, *Lankester sn* (CR); Río Atirro, near La Esperanza, 850-900 m, *Maas 1195* (U). LIMÓN: Guayacán, 600-650 m, *Maas 864* (U). PANAMA. BOCAS DEL TORO: Nievécita, 150 m, *Woodson, Allen & Seibert 1951* (MO).

Costus nitidus is closely related to *C. plicatus* (see under that species). During a recent collecting trip to Central America I collected this species, very surprisingly, on the very well-collected forested slopes of the Río Reventazón Valley, a few hundred meters from the guesthouse of the IICA, Turrialba. In the same locality yet another new species, namely *C. glaucus*, was found.

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31. *Costus erythrocoryne* K. Schumann

Add to the distribution: Colombia.

COLOMBIA. AMAZONAS: 2 km downriver from Puerto Nariño, along Río Amazonas, *Plowman et al 2335* (DAV, GH, U).

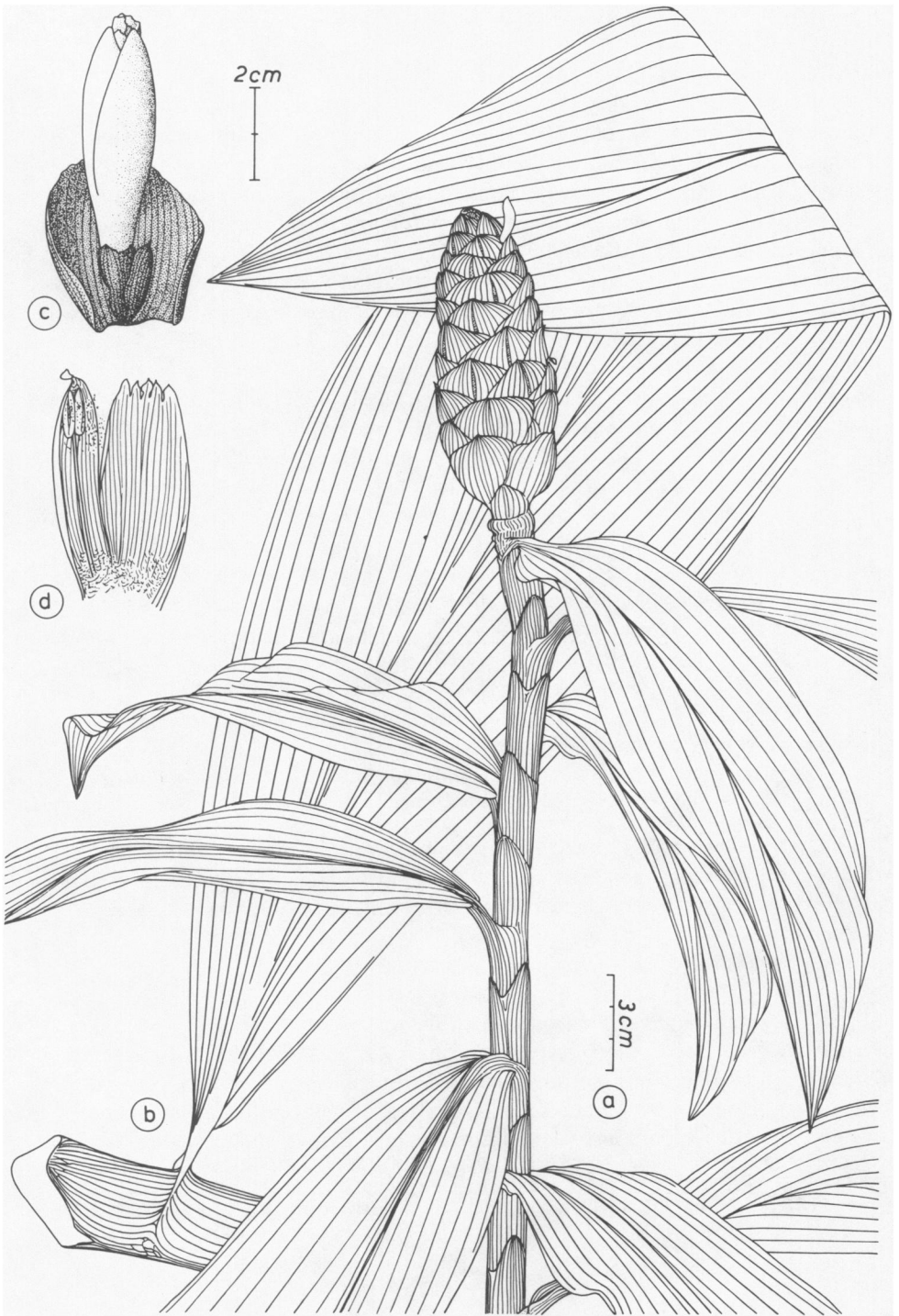


FIG 80. *Costus nitidus* (a-b, *Maas 1195*; c-d, *Maas 864*). a, habit; b, leaf-base; c, bract with flower; d, labellum and stamen.

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31A. *Costus plowmanii* Maas, Acta Bot. Neerl. 24: 470. 1976. Fig 81.

Plants to 3 m tall, rhizomes to 20 mm thick, densely covered with erect and appressed, stiff hairs. Sheaths 10-20 mm diam, rather densely hirsute. Ligule obliquely truncate, 1-10 mm long, rather densely hirsute. Petiole 10-20 mm long, densely hirsute. Lamina narrowly elliptic-obovate to elliptic-obovate, cuneate at the base, acuminate at the apex (acumen 5-20 mm long), 25-47 cm long, 11-18 cm wide, 8-9-plicate, upper side glabrous, lower side densely hirsute-villose. Flowering stems ca 75 cm tall, sheaths purplish-red, obliquely truncate, 6-8 cm long, 2-3 cm wide, sparsely hirsute. Inflorescence ovoid to cylindrical, obtuse, 9-25 cm long, 5.5-8.5 cm wide. Bracts red, coriaceous, broadly obovate, obtuse, 3.5-5 cm long, 2.5-4 cm wide, glabrous to sparsely puberulous on the abaxial side, callus 2-7 mm long, rather inconspicuous. Bracteole 23-29 mm long, very sparsely puberulous. Calyx 10-14 mm long, 8-10 mm wide, very sparsely puberulous, lobes shallowly to very shallowly triangular, 2-4 mm long. Corolla yellow, ca 45 mm long, glabrous, tube 10 mm long, lobes 35 mm long, the dorsal one 17-19 mm wide, the two lateral ones 13-14 mm wide. Labellum yellow, oblong-elliptic when spread out, 30-35 mm long, 17-20 mm wide, strongly grooved on the dorsal side, lateral lobes involute and forming a tube 8-10 mm diam, upper margin 5-dentate, the middle tooth filiform, ca 4 mm long, the rest irregularly dentate-triangular, 2-4 mm long. Stamen yellow, 33-40 mm long, 10-11 mm wide, apex rounded, anther 7-11 mm long. Ovary 4-12 mm long, very sparsely puberulous to glabrous. Capsule ellipsoid, 10-15 mm long.

TYPE. *Maas & Plowman 1900* (holotype, U; isotypes, AAU, COL, E, F, GH, K, MO, NY, P, US, VEN), steep forested slopes near Queremal, Cordillera Occidental, 1350 m, El Valle, Colombia.

DISTRIBUTION (Fig 63). Only known from the type locality in Colombia.

COLOMBIA. EL VALLE: mouth of Río Digua, Río San Juan, below Queremal, between km 52 and 53, 1300-1500 m, *Cuatrecasas 23977* (paratype, F).

Costus plowmanii is named for Dr. Tim Plowman, who contributed substantially to this study by assisting me during field trips in Colombia. Moreover, he made many excellent collections of Zingiberaceae in Ecuador, Peru, and Bolivia.

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32. *Costus stenophyllus* Standley & L. Williams

Add to the description: Leafy stems up to 4 m tall. Petiole 5-10 mm long. Sheaths of flowering stems green, apically red. Bracts red, 2-5 cm long, 2-4 cm wide, callus greenish yellow, to 15 mm long. Calyx red, 15-16 mm long, 8 mm wide. Capsule ellipsoid, 12-13 mm long. Chromosome number $2n = 18$ (*Maas & McAlpin 1444*).

Additional collections: COSTA RICA, *P. H. Allen 5267* (EAP) and *Maas & McAlpin 1444* (COL, CR, F, GH, K, MO, U, VEN), both from the type locality, in secondary forest.

CULTIVATED SPECIMENS. *L. Williams 18935* (EAP), cultivated from seeds of the type.

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35. *Costus barbatus* Suessenguth

Fig 82.

Add to the description: Sheaths 10-17 mm in diameter. Ligule (10-)15-30 mm long. Leaves 13-26 cm long, 4.5-8.5 cm wide. Inflorescence 4-10 cm long, 2.5-4.5

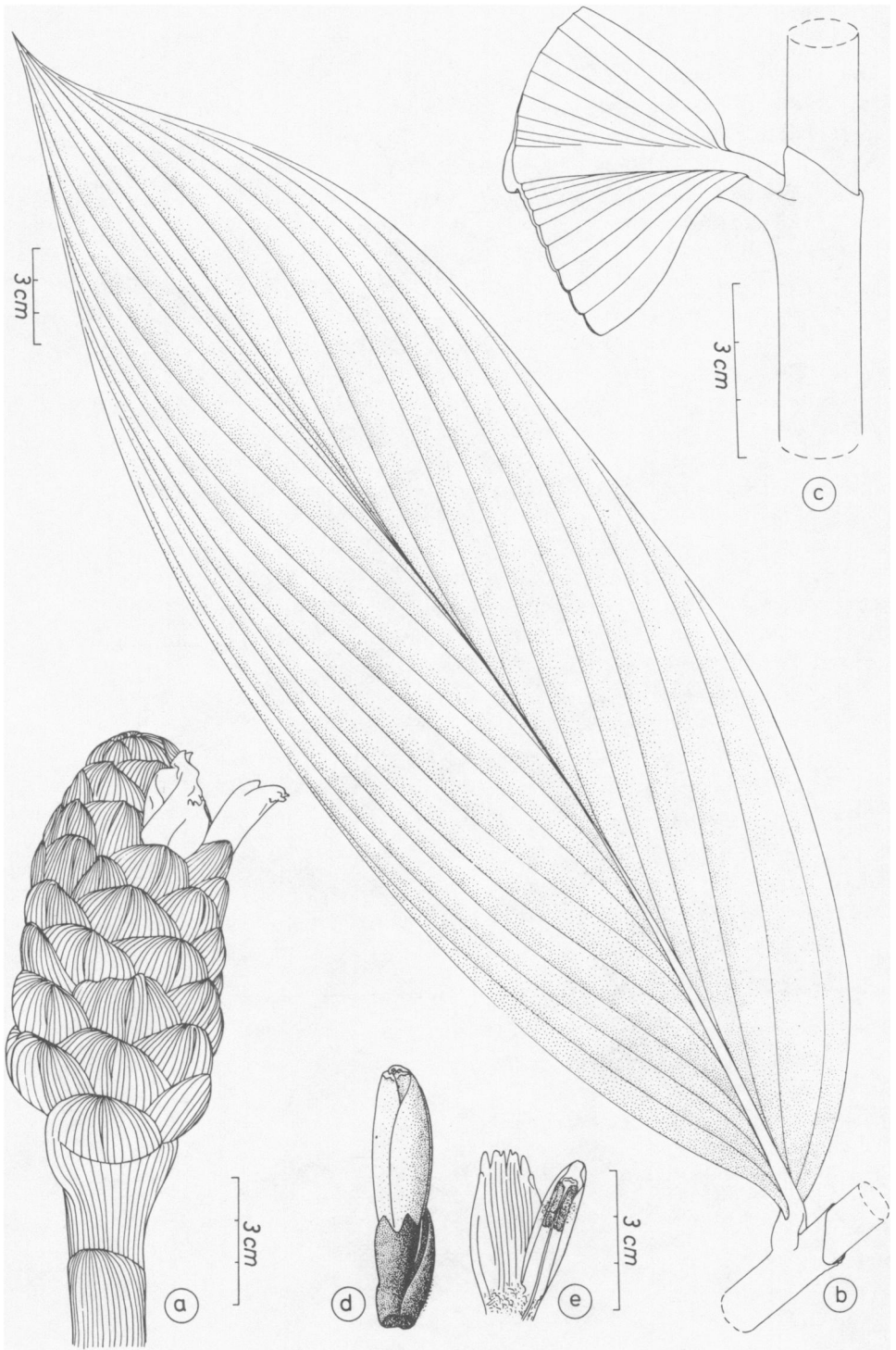


FIG 81. *Costus plowmanii* (a-e, Maas & Plowman 1900). a, inflorescence; b, leaf; c, leaf-base; d, bracteole with flower; e, labellum and stamen.

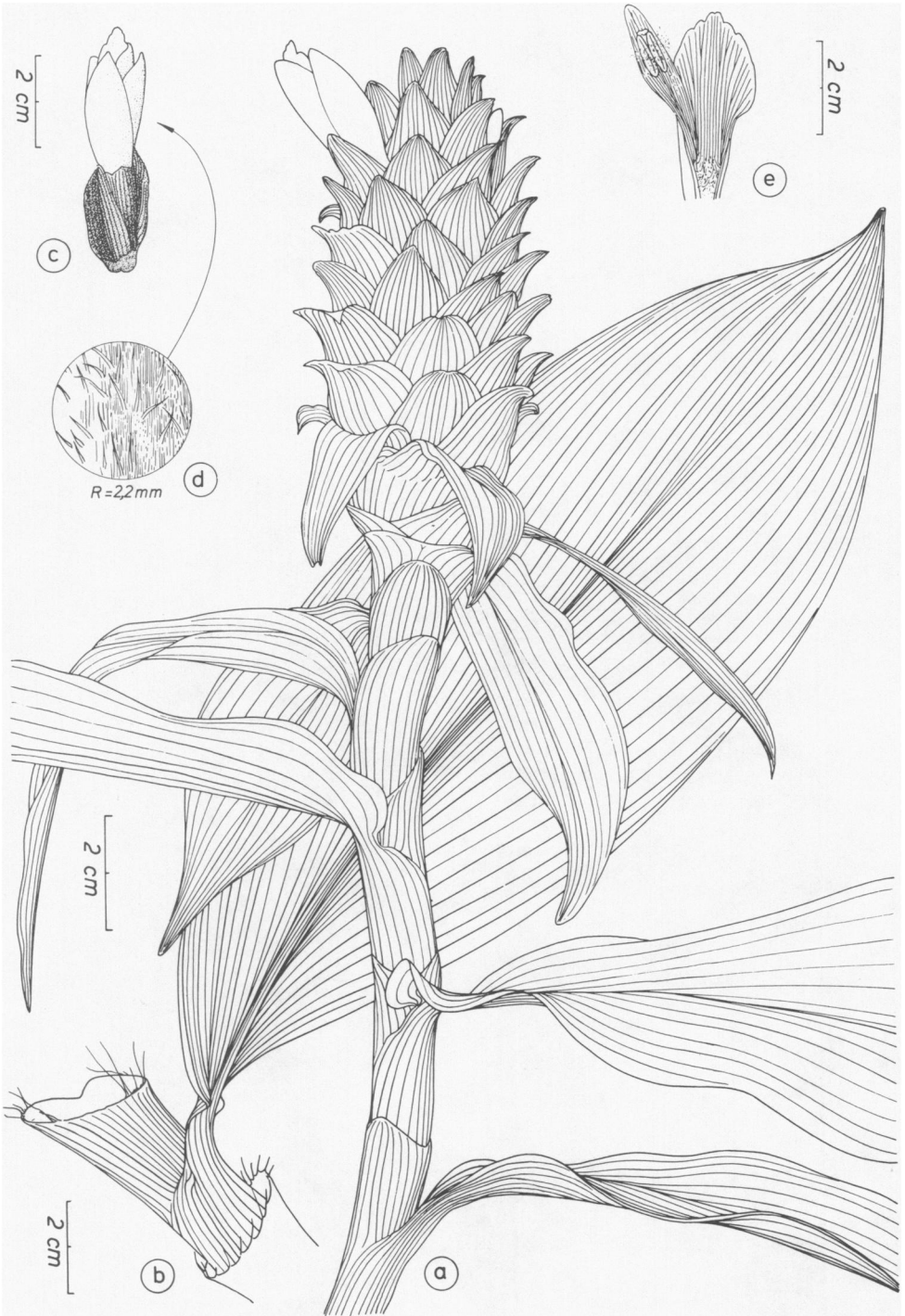


FIG 82. *Costus barbatus* (a-e, Maas & Cramer 1372). a, habit; b, leaf-base; c, bract with flower; d, detail of corolla showing the dense indument; e, labellum and stamen.

cm wide. Bracts 3-4 cm long, 2-4 cm wide; appendages reflexed, 0.2 X 0.5 cm (upper one), 0.5 X 0.8 cm (middle one) to 1.5 X 1.5 cm (lowermost). Corolla yellow, orange at the base, 40 mm long, densely puberulous, tube ca 15 mm long, lobes 25 mm long, the dorsal one 16 mm wide, the two lateral 12-15 mm wide. Labellum yellow, broadly ovate when spread out, 26 mm long, 24 mm wide, lateral lobes involute and forming a tube 8-9 mm diam, upper margin irregularly 5-lobulate, lobules 1-2 mm long, 1-3 mm wide. Stamen yellow, slightly exceeding the labellum, 30 mm long, 10 mm wide, anther 9 mm long, 4 mm wide. Capsule ellipsoid, 12 mm long, 9 mm wide, densely puberulous.

Additional collections: COSTA RICA, *Burger & Gentry 8607* (F, U); *Maas 1241* (U); *Maas & Cramer 1372* (COL, F, K, MO, U).

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35A. *Costus curvibracteatus* Maas, Acta Bot. Neerl. 24: 473. 1976. Fig 83.

Costus scaber auct.: Woodson, Ann. Missouri Bot. Gard. 29: 330. 1942; 32: 72. 1945; non Ruiz & Pavón.

Costus spec A. Maas, Fl. Neotrop. Monogr. 8: 124. 1972.

Plants 1-3 m tall. Rhizomes ca 20 mm thick. Sheaths rather densely hirsute, rarely glabrous, (8-)12-20(-25) mm diam. Ligule obliquely truncate to slightly 2-lobed, 5-10(-15) mm long, lobes rounded, margins reflexed (when dry), hairy like the sheaths. Petiole 5-15 mm long, densely hirsute to strigose. Lamina narrowly elliptic to narrowly obovate, cuneate to rounded at the base, acute to acuminate at the apex (acumen to 20 mm long), (13-)20-35 cm long, (4-)6-10(-12) cm wide, upper side glabrous but costa and margins often strigose, lower side sparsely to densely hirsute-strigose, particularly the costa. Inflorescence ovoid to broadly ovoid, 6-18 cm long, 3-9 cm wide. Bracts orange, red, or yellowish, coriaceous, ovate to ovate-triangular, acute to obtuse, apex (in living plant) slightly curved outwards, often erose in herbarium material, (2.5-)4-5.5 cm long, (1-)2-3.5 cm wide, glabrous to densely strigose, callus absent or subobsolete, yellow. Bracteole red to reddish-orange, 18-28 mm long, sparsely strigulose. Calyx red to reddish-orange, 10-15 mm long, 9-10 mm wide, sparsely strigulose, lobes shallowly triangular to deltate, 2.5-6 mm long, Corolla yellow (to orange), 37-40 mm long, glabrous, tube 10 mm long, lobes 27-30 mm long, the dorsal one 15 mm wide, the two lateral ones 11-12 mm wide. Labellum yellow, tinged with orange, oblong-ovate when spread out, 25-30 mm long, 20-22 mm wide, lateral lobes involute and forming a tube ca 10 mm diam, upper margin 5-lobulate, lobules linear to deltate, 3-6 mm long. Stamen yellow, tinged with orange, 28-35 mm long, 11-12 mm wide, apex cucullate, rounded, anther 9 mm long, 5-6 mm wide. Ovary ellipsoid, 4-8 mm long, glabrous to sparsely strigulose. Capsule ellipsoid, 10-17 mm long, glabrous.

TYPE. *Maas & Cramer 1371* (holotype, U; isotypes, COL, CR, E, F, GH, K, MO), Tapantí, 1200 m, prov. Cartago, Costa Rica.

DISTRIBUTION (Fig 63). Costa Rica and Panama; in forests, 650-1500(-2000) m.

COSTA RICA. HEREDIA: La Virgen del Socorro, 5 km E of Cariblanco, 800 m, *Maas 1264* (U); Cinchona, 5 km S of Cariblanco, 1350 m, *Maas 1331* (F, U). SAN JOSE: La Palma, above Hondura Valley, 1500 m, *Burger & Stolze 5377* (F, U), *Maas & Gómez P. 834* (COL, CR, EAP, F, K, MO, NY, U, US, VEN). PANAMA. CHIRIQUI: vicinity of Bajo Mona and Quebr. Chiquero, 1000-1500 m, *Woodson et al 1000* (GH, MO, US), *Woodson & Schery 544* (MO). COLÓN: El Valle de Antón, 650-800 m, *Croat 25312* (MO), *Dressler 4080* (U), *Dwyer et al 4477* (MO), *Kennedy 430* (U), *Woodson & Schery 202* (GH, US). DARIÉN: Cerro Pirre, 800-1500 m, *Duke & Elias 13805* (MO). PANAMA: above Campana, *Allen 1873* (GH, MO); Cerro Campana, 1000 m, *Allen 2427* (US). VERAGUAS: beyond Rio Tres Brazos, 9 km from Santa Fé, *Croat 25606* (MO); Rio Segundo Brazo, 700-750 m, *Maas & Dressler 1651* (F, MO, NY, P, U, US, VEN).



FIG 83. *Costus curvibracteatus* (a-b, Maas & Dressler 1651; c-d, Maas & Cramer 1371). a, habit; b, leaf; c, bract with flower; d, labellum and stamen.

CULTIVATED SPECIMENS. *Hort. Bot. Utrecht 68-773* (U), originating from Costa Rica.

In the field this species can hardly be confused with any other because of its slightly patent bracts. However, it has some characters in common with *C. barbatus*, but diverges from that species in its bracts, smaller ligule, and glabrous corolla. A characteristic herbarium feature of *C. curvibracteatus* is the apex of the bracts which is often very irregularly incised as if the top has been bitten off by animals (erose).

I am not completely sure of the identity of two Panamanian collections: *Dressler 4190* (U) and *Maas, Dressler & Kennedy 1548* (U), both from Altos de Pacora, 750 m, prov. Panamá, Panama. They are closely related to *C. curvibracteatus* but differ in having a separate flowering shoot, much larger leaves (to 48 X 16 cm), ligule (15-22 mm), bracts (to 7 X 4 cm), and stamen (40 mm). Additional material may show that both specimens represent a distinct variety.

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36. *Costus montanus* Maas

Add to the description: Plants 1-1.5 m tall. Ligule (5-)15-40 mm long. Lamina 13.5-28 cm long, 4-8.5 cm wide. "Flowers" orange to yellowish orange.

INSUFFICIENTLY KNOWN SPECIES

Costus fortalezae K. Schumann, Notizbl. Bot. Gart. Berl. **10**: 708. 1929. Type. *Ule 14b* (holotype, B, destroyed; photographs F, MO, NY, etc.), Fortaleza, lower Rio Juruá, Acre, Brazil.

Costus juruanus K. Schumann in Engler, Pflanzenreich **4**. 46: 389. 1904. Type *Ule 5740 pp* (holotype, B, destroyed; photographs, F, MO, NY, etc.), Middle Rio Juruá, Amazonas, Brazil.

It is very difficult to interpret Schumann's *C. juruanus*, as the original material was destroyed in 1943. The "type-photograph" (from Juruá-Mirim instead of the "mittleren Juruá," as indicated in Schumann's original description) gives good details of ligule and leaves, but the inflorescence is completely invisible, hidden by one of the uppermost leaves. As I already have confused this type-material with the present *C. productus*, I hesitate to interpret it a second time. I, therefore, prefer to put this name in the list of insufficiently known species.

NUMERICAL LIST OF TAXA

- I, 1. *Monocostus uniflorus* (Poepp. ex O. G. Pet.) Maas
- II, 1. *Dimerocostus strobilaceus* O. Kuntze
 a. subsp *strobilaceus*
 b. subsp *gutierrezii* (O. Kuntze) Maas
 c. subsp *appendiculatus* Maas
2. *D. argenteus* (R. & P.) Maas
- III, 1. *Costus subsessilis* (Nees & Mart.) Maas
2. *C. cuspidatus* (Nees & Mart.) Maas
3. *C. curcumoides* Maas
4. *C. fusiformis* Maas
5. *C. fragilis* Maas
6. *C. lanceolatus* O. G. Pet.
 a. subsp *lanceolatus*
 b. subsp *pulcherriflorus* (Ducke) Maas
7. *C. congestiflorus* L. C. Rich. ex Gagnep.
8. *C. villosissimus* Jacq.
- 8A. *C. leucanthus* Maas
9. *C. guanaiensis* Rusby
 a. var *guanaiensis*
 c. var *macrostrobilus* (K. Sch.) Maas
 d. var *tarmicus* (Loes.) Maas
- 9A. *C. asplundii* (Maas) Maas
10. *C. arabicus* L.
11. *C. allenii* Maas
12. *C. laevis* R. & P.
- 12A. *C. glaucus* Maas
- 12B. *C. vinosus* Maas
13. *C. acreanus* (Loes.) Maas
14. *C. amazonicus* (Loes.) Macbr.
 a. subsp *amazonicus*
 b. subsp *krukovii* Maas
- 14bis. *C. zamoranus* Steyerem.
15. *C. longibracteolatus* Maas
16. *C. malortieanus* Wendl.
17. *C. pictus* D. Don
18. *C. claviger* R. Ben.
- 18A. *C. erythrophyllus* Loes.
- 18B. *C. varzeorum* Maas
- 18C. *C. aff claviger* R. Ben.
19. *C. lima* K. Sch.
 a. var *lima*
 b. var *scabremarginatus* Maas
20. *C. comosus* (Jacq.) Roscoe
 a. var *comosus*
 b. var *bakeri* (K. Sch.) Maas
- 20A. *C. cupreifolius* Maas
21. *C. quasi-appendiculatus* Woods. ex Maas
22. *C. productus* Gleason ex Maas
 a. var *productus*
 b. var *strigosus* (Maas) Maas
23. *C. lasius* Loes.
24. *C. scaber* R. & P.
- 24A. *C. wilsonii* Maas
25. *C. sprucei* Maas
26. *C. chartaceus* Maas
- 26A. *C. cordatus* Maas
27. *C. zingiberoides* Macbr.
28. *C. woodsonii* Maas
29. *C. spicatus* (Jacq.) Sw.
30. *C. spiralis* (Jacq.) Roscoe
 a. var *spiralis*
 b. var *villosus* Maas
- 30A. *C. plicatus* Maas
- 30B. *C. nitidus* Maas
31. *C. erythrocoryne* K. Sch.
- 31A. *C. plowmanii* Maas
32. *C. stenophyllus* Standl. & LL Wms.
33. *C. geothyrsus* K. Sch.
34. *C. pulverulentus* Presl
35. *C. barbatus* Suess.
- 35A. *C. curvibracteatus* Maas
36. *C. montanus* Maas
37. *C. lucanusianus* Joh. Braun & K. Sch.
 var *lucanusianus*
38. *C. speciosus* (Koenig) J. E. Smith

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