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Violaceae. Part I: Rinorea and Rinoreocarpus

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1. Aestivation of petals imbricate; dorsal connective scales present or if wanting, not replaced by 2 ventral scales; one kind of seed.
2. Aestivation quincuncial or irregularly imbricate, thecae horizontal; dorsal connective scales wanting; fruits nut-like. Subfamily Leonoideae.
Leonia (to be treated in Part II).
2. Aestivation usually apotact, sometimes quincuncial in *Gloespermum*; thecae slanting or vertical; dorsal connective scales usually present, rarely wanting (as sometimes in *Paypayrola*); fruits usually capsular, sometimes drupe-like. Subfamily: Violoideae.
3. Flowers strictly zygomorphic; anterior petal and dorsal glands of anterior filaments gibbous or calcarate.
Tribe *Violoideae*: *Anchitea*, *Corynostylis*, *Hybanthus*, *Mayanaea*, *Noisettia*, *Orthion*, *Schweiggeria*, *Viola*, etc.
3. Flowers more or less actinomorphic (i.e., varying from all petals equal to only the anterior petal wider than the other ones but never gibbous or calcarate at the base); dorsal glands usually present, variable in shape, but never gibbous or calcarate. Tribe *Rinoreeae*.
4. Petals differentiated into a claw and plate. Subtribe *Paypayrolinae*.
 5. Inflorescences racemoid; filaments and connectives fused to a tube; thecae slantingly oriented on the upper margin of the tube, dorsally scarcely appendaged by a minute connective scale.
Paypayrola (to be treated in Part II).
 5. Inflorescences cymoid; filaments \pm free; thecae vertically oriented, dorsally appendaged by a long-linear connective scale.
Amphirrhox (to be treated in Part II).
4. Petals not differentiated into a claw and plate. Subtribe *Rinoreinae*.
 6. Leaves distichous; inflorescences cymoid (i.e., varying from cymose to mono- or dichasial); petals quincuncial; sometimes apotact; ovules $3 \times (7-22)$; fruits globose, indehiscent, berry-like; seeds mucilaginous, without caruncle and areola.
Gloespermum (to be treated in Part II).
 6. Leaves alternate or opposite, not distichous; inflorescences predominantly thyrsoid to racemose, occasionally cymose; petals predominantly apotact; ovules $3 \times (1-10)$; fruits capsular, dehiscent into 3 valves; seeds coriaceous, with caruncle and areola.
 7. Inflorescence cymose and distinctly pedunculate; connective scales subulate, linear or narrowly deltoid, uncolored, transparent, less than one third as wide as the anthers; ovules $3 \times (6-10)$.
2. *Rinoreocarpus*.
 7. Inflorescence thyrsoid or (pseudo)racemose (cymose and [nearly] epedunculate in *R. uxpanapana*); connective scales laminar, deltoid or ovate, yellowish to brownish, more than two thirds wide as the anthers; ovules $3 \times (1-4)$.
1. *Rinorea*.

Subfamily Violoideae

Tribe Rinoreeae Reiche & Taubert, 1895

Subtribe Rinoreinae Melchior, 1925

1. *Rinorea* Aublet, 1775

INTRODUCTION

Rinorea is a pantropical genus of trees and treelets numbering ca. 160 species, of which 48 occur in the neotropics. They are understory species in tropical forests of lower regions. Their flowers are small and usually whitish colored, arranged in thyrsoid, racemose or cymose inflorescences. Plant collectors have often scented a pleasant odor upon entering forests with flowering *Rinorea*'s. The genus is most abundant in northwestern South America, especially Colombia where 25 species are recognized and over a larger area of Amazonia also with ca. 25 species. Central America and southeastern Brazil are secondary centers, respectively with 14 and five species. The need for a revision of neotropical *Rinorea* has been apparent since the monograph

of S. F. Blake (1924). It was preceded by another large revision of the Violaceae by Eichler (1871a) in Martius' *Flora Brasiliensis*, which was very well illustrated. In this Monograph flowers, fruits and leaves of all 48 species have been illustrated by the author.

HISTORY OF THE TAXON

Four generic names in the neotropical actinomorphic Violaceae were simultaneously published by Aublet (1775): *Rinorea*, *Riana*, *Conohoria* and *Passoura*, each with a single species, respectively *Rinorea guianensis*, *Riana guianensis*, *Conohoria flavescens* and *Passoura guianensis*. These four generic names were first united in Kunth in H.B.K. (1823 [1821]) under *Conohoria* Aublet. ('*Conoria*'), which also included *Piparea* Aublet, 1775 (= *Casearia*, Flacourtiaceae). Kunth (1823) also described a new species in *Conohoria*: *C. ulmifolia*. The use of this generic name was followed by Auguste de Saint Hilaire (1824a, 1824b) who placed three species

under *Conohoria*, of which two are synonyms (one illegitimate) of *Physiphora laevigata* Solander ex de Gingins in A. P. de Candolle (1824, see below), and a third one an illegitimate synonym of *Rinorea guianensis* Aublet (1775, see above). All three of these *Conohoria* species were previously known under *Alsodeia* or *Rinorea*.

All subsequent workers treated *Conohoria* as one of the synonyms of *Alsodeia* or *Rinorea*. Baillon (1873) united Aublet's four names and some later ones (of which only *Physiphora* and *Alsodeia* have been used for neotropical species), under *Rinorea*, by giving a description of this genus and adding a list of generic synonyms in a footnote. This transfer to *Rinorea* was based on page priority in Aublet (1775), and subsequently followed by Kuntze (1891) for the species. Page priority, however, is at present considered as an incorrect interpretation of the rule for simultaneously published generic names. Inasmuch as Kunth in H.B.K. (1823) was the first author to unite the four simultaneously published generic names, under *Conohoria* Aublet, 1775, his choice should be followed under the rules of the present edition of the Code of Botanical Nomenclature.

Hekking (1982), therefore, proposed conservation of the generic name *Rinorea* to avoid at least 160 new combinations. This proposal was accepted at the Berlin Congress, 1987. See *Taxon* 36(1): 273, 1987. Another generic synonym, also often used for neotropical taxa, is *Alsodeia* Petit-Thouars (1804), originally proposed for the African species.

R. Brown (1818) noted the presence of a specimen in Banks' herbarium, collected by Banks (and Solander_m) in SE Brazil and provided with the name *Physiphora* Solander, a nomen nudum. According to Brown this genus differed only slightly from *Alsodeia*, *Conohoria*, *Passoura* ('*Passura*'). *Rinorea* and *Rtana*. It appeared to R. Brown that all these genera, as well as *Piparea* Aublet, 1775 (= *Casearia*, Flacourtiaceae), might be referred to *Alsodeia*. All these generic names, except *Piparea*, are now considered as generic synonyms of *Rinorea*.

De Gingins in A. P. de Candolle (1824) provided *Physiphora* with a genus description for the first time and cited *Ph. laevigata* Solander in Banks' herbarium as the only species. In this monograph I transfer this species to *Rinorea*, as a new combination, *R. laevigata*, although it is commonly known as *Alsodeia physiphora* Martius, 1823–1824 and *R. physiphora* (Martius)

Kuntze, 1891. An illegitimate transfer made by Baillon (1873b) to *Rinorea* based on *A. physiphora* R. Brown in Banks' herbarium and not on *A. physiphora* Martius, 1823–1824, blocked the use of the latter specific epithet.

After the first taxonomic publication on *Rinorea* and its synonyms by Aublet (1775), de Gingins (1823) issued a conspectus of the genera in his "Mémoire sur la famille de Violaceae." This publication may be considered as a precursor to that of Melchior (1925b) on the natural relationships of genera in the Violaceae.

Another detailed study was Baillon's (1873) "Histoire des Plantes," in which his more modern views concerning nomenclature resulted in the transfer of species of *Alsodeia* to *Rinorea* by Kuntze (1891). Radlkofer (1891 [1890]) enumerated some species (including a short diagnosis of a new species, *Alsodeia camptoneura*), and provided short notes on the structure of the leaf epidermis and vascular tissue. Studies of wood anatomy have been continued by Taylor (1938, 1972), Mattos Filho and Rizzini (1968) and Matos Araujo and Mattos Filho (1978, 1979, 1980).

Reiche and Taubert (1895) and Melchior (1925a) provided a taxonomic subdivision of the family Violaceae in both editions of Engler and Prantl's "Die Natürlichen Pflanzenfamilien." Of additional importance is Melchior's (1925b) hypothesis on the natural relationships among the genera and phylogenetic evolution within the Violaceae. The present monograph is essentially based on the generic alignment of Melchior, but differs in major respects because of the discovery of the two new genera *Rinoreocarpus* (described by Ducke in 1925 and treated in Part I) and *Fusispermum* (described by Cuatrecasas in 1950 and to be treated in Part II).

The most important literature on neotropical species of *Rinorea*, serving as a basis for this monograph includes: Aublet (1775), Kunth (1823), Auguste de Saint Hilaire (1824a, 1824b, 1829, 1831), Bentham (1842), Triana and Planchon (1862), Eichler (1871a), Reiche and Taubert (1895), Blake (1924), Melchior (1925a), Sandwith (1929, 1931, 1933, 1955), Baehni and Weibel (1941a, 1941b), Smith and Fernández-P. (1954), Hekking (1979, 1983) and several local studies on Central American Violaceae, e.g., Robinson and Bartlett (1907), Blake in Standley (1923), Standley (1927, 1931, 1940), Standley and Record (1936), Morton in Yunker (1940),

Woodson (1950), Standley and Williams (1961), and A. Robyns (1967a).

MORPHOLOGY

All neotropical species of *Rinorea* are trees or treelets 2–15(–30) m tall and with a stem 2–20 (–50) cm in diameter. The color of the bark varies from grayish to maroon or reddish brown. Freshly cut secondary wood is whitish, yellowish, maroon or reddish colored. The wood anatomy of *Rinorea* in comparison with related genera has already been discussed.

Arrangement of Leaves, Inflorescences, and Branchlets

This arrangement is so complicated in *Rinorea* that it is discussed first, separately. Three different kinds of arrangement occur in neotropical *Rinorea*:

- (a) leaves alternate; all laminar and petiolate; inflorescences 1–5 fasciculate in leaf axils and provided with a distinct central axis; branchlets predominantly monopodial.
- (b) leaves alternate and of two different kinds: apical laminar leaves, and subsessile, scale-like leaves at the base of the branchlets; inflorescences 1–3 fasciculate in the axils of both kinds of leaves; cymules with 1–3 flowers and (nearly) epedunculate branchlets predominantly sympodial, sometimes monopodial.
- (c) leaves apparently opposite, with two different kinds of leaves occurring at the same nodes: petiolate laminar leaves, each pair at an angle of ca. 90°, and sessile scale-like leaves, soon deciduous, each pair also at ca. 90° to each other (see Fig. 2); inflorescences solitary in the axils of scale-like leaves (although apparently inserted in the axils of laminar leaves), and provided with a distinct central axis; branchlets sympodial, either mono- or dichasial.

Arrangement (a) is relatively common in neotropical *Rinorea* and can be found in Supergroup I. Apiculata and Group IIa. *Rinorea*: arrangement (b) is restricted to Group IIb. *Uxpanapana* (one species); arrangement (c) is most common in neotropical *Rinorea* and can be found in Group IIc. *Pubiflora*; the arrangement of the scale-like

leaves can be identified by the presence of scars at the base of the inflorescences: occasionally scale-like leaves are still visible when inflorescences are juvenile.

An additional detailed paper on the arrangement of the leaves, inflorescences and branchlets in *Rinorea* will be published as "Studies of Neotropical Violaceae 2." *Flora* (Jena, GDR) **180**(3–4), 1988.

Branchlets

The branchlets of most neotropical *Rinorea* species are more or less hairy when young, becoming glabrescent with age. *Rinorea flavescens* is one of the few in which the branchlets are nearly always completely glabrous. The indument, or the combination of indument and its color may be characteristic and helpful for the identification of some species. In some species, such as *R. cordata*, *R. brevipes*, *R. riana*, *R. brachythrix*, *R. endotricha*, *R. deflexiflora*, *R. sylvatica* and *R. hymenosepala*, lenticels of branchlets have become callose. Dried specimens of these species can usually be recognized by the purplish branchlets with whitish, or sometimes brownish, callose lenticels.

Terminology of Indument as Used in This Monograph

- (1) Minutely pilosulous (including velutinous): hairs 0–0.1 mm long.
- (2) Pilosulous (often subdivided into puberulous, strigillose, hispidulous, hirtellous and villosulous): hairs 0.1–0.3 mm long.
- (3) Pilose (often subdivided into strigose, hispid, hirsute or villose): hairs 0.3–1 mm long.
- (4) Ciliolate: hairs 0–0.1 mm long.
- (5) Ciliate: hairs 0.1–0.2 mm long or eventually longer.

All kinds of hairs are strictly unicellular and variable in color, which may be whitish, golden, orange-brown, ferruginous, reddish, maroon, or fuscous.

Bud Scales and Stipules

Vegetative buds are both terminal and axillary. Paired stipules (or their scars) can be found at the petiole bases; they are outgrowths from the petioles and therefore can be considered as leaf parts, whereas bud scales can be considered to

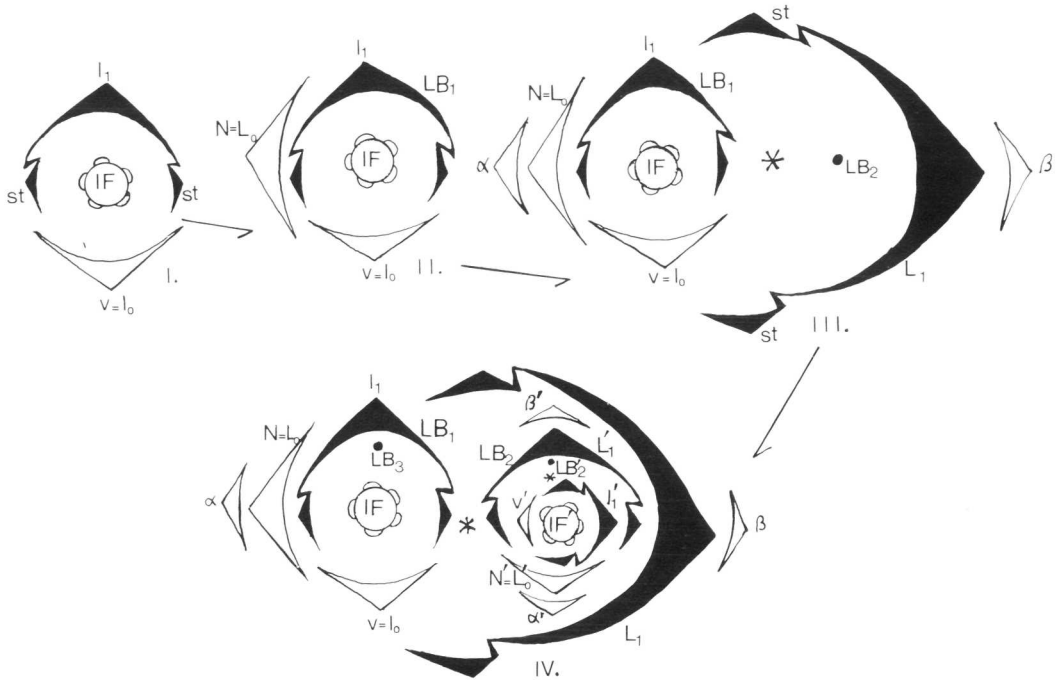


FIG. 2. The development of a monochasial branching system in species with apparently opposite leaves, shown in a series of diagrams (Troll, 1969, fig. 435, modified). Legend: I, II, III, and IV = stages I, II, III, and IV. CA = central axis (CA' = secondary central axis, etc.). * = obliterated or self-eliminating vegetative bud. LB, LB₁, LB₂, etc. = lateral branchlets. IF, IF', etc. = inflorescences. L₀, L'₀, etc., and l₀, l'₀, etc. (open) = originally laminar leaves having become scale-like (respectively N, N', etc., and v, v', etc.). L₁, L'₁, etc., l₁, l'₁ (black) = laminar leaves. st = stipules. α & β = prophylls.

be transformed leaves. Bud scales and stipules are mostly similar in habit and usually share the same features. In some species, however, as in *R. hirsuta* and *R. endotricha*, they are different in shape. Stipules of both these species are subulate, whereas their bud scales are distinctly ovoid to deltoid. Bud scales and stipules may be subcoriaceous, scarious, herbaceous or slightly carnos; their shape varies from orbicular, deltoid or ovoid to linear or subulate; their indument varies like that of the branchlets (see above); the base of bud scales and stipules is symmetric, except in *R. uxpanapana*, where the stipule bases are asymmetric and oblique: the margin may be (sparsely) cili(ol)ate or not; the apex usually varies from obtuse to acute and is mostly black-purplish mucronulate.

Leaves

Leaf shape. — Two different kinds of leaves can be found in neotropical *Rinorea*: (1) conspicuous

petiolate laminar leaves, and (2) inconspicuous, minute scale-like leaves. The latter can be categorized into (2a) scale-like leaves accompanied by two scale-like stipules of similar dimension (both subsistent), found only in *R. uxpanapana*, and (2b) scale-like leaves without accompanying stipules (both soon caducous), found only in Group IIC. Pubiflora. That the scale-like leaves of *R. uxpanapana* can be derived from laminar leaves is proved by the following facts: (1) the presence of stipules; (2) the spiral arrangement along the branchlets just as with the apical laminar leaves; (3) the presence of axillary inflorescences; and (4) the occasional presence of less strongly reduced scale-like leaves with remnants of petioles, laminae, costae and lateral veins.

Caducous scale-like leaves deprived of their accompanying stipules can be found, only by means of careful analysis, in specimens of all those species with apparently opposite leaves which belong to the separate Group IIC. Pubiflora. These scale-like leaves or their leaf scars

occur on the branchlets just below the inflorescences. If still present, they can be easily confused with similarly shaped bud scales and stipules, which are also soon caducous. Bud scales also can be considered as reduced laminar leaves and are probably equivalent to prophylls.

Laminar leaves are usually distinctly petiolate, but subsessile leaves can be found in e.g., *Rinorea maximiliani*, *R. endotricha* and *R. deflexa*. The laminae may be herbaceous, papery or coriaceous and may vary even within one species.

Radlkofer (1891 [1890]) noted hyaline dots, which often occur on the upper side of the laminae of some species, such as *Rinorea camptoneura*. Such hyaline dots can be correlated with mucilaginous epidermis cells, which in *R. riana* are so large that they easily can be observed with a pocket lens. In other species, as in *R. amapsensis* and *R. brevipes*, they are less conspicuous. Such hyaline dots occur also on leaves of species in the closely related genus *Gloeospermum* as well as in *Leonia* (Leonioideae) (cf. Blenk, 1884).

The shape of the lamina varies from elliptic to ovate or obovate, as well as from wide to narrow, sometimes even within one species. In most neotropical *Rinorea* species the lamina is widest near the middle, or either just below or just above. In some species, as *R. brachythrix* and *R. endotricha*, the lamina is widest near the base as well as long tapering to the apex. The laminae of *R. melanodonta* are often also tapering to the base. These three closely related species are characterized by their long tapering leaves and are placed in the same subgroup.

Leaf venation.—The venation pattern in the Violaceae is distinctly pinnate. The number of lateral veins in *Rinorea* varies usually from 8 to 14 pairs (acumen excluded). However, extremely low numbers occur in *R. uxpanapana*, *R. deflexa* and *R. guatemalensis*, respectively with 5–8, 8–9 and 6–11 pairs, whereas extremely high numbers can be found in *R. hymenosepala*, *R. multivenosa*, *R. ulmifolia* and in *R. racemosa*, respectively with 11–18, 15–19, 11–20 and 11–21 pairs.

The lower pairs of lateral veins are congested near the base, where they leave the costa at usually sharper angles than the median and apical ones. According to Hickey and Wolfe (1975) this pattern of basal congestion of lateral veins is characteristic for *Rinorea* and, in our opinion,

also for the genera related to it: *Rinoreocarpus*, *Gloeospermum*, *Amphirrhox*, *Pavpayrola*, *Fusispermum*, *Leonia*, etc. Hickey and Wolfe (1975) presumed that “the primitive tribe of Rinoreidae (=Rinoreae sensu Melchior, 1925a, 1925b) has pinnate leaves with basal secondaries (=lateral veins) originating from the top of the petiole at somewhat lower (=sharper) angle than those above, indicating either common origin from the same incipiently actinodromous trend as occurs in the Flacourtiaceae (e.g., *Berberidopsis*) or from suppression of lateral primaries.” The presence of lateral primaries is inherent to the palmately lobed condition of leaves as propounded in the classification of Hickey and Wolfe (1975). In addition to the arrangement of the basal lateral veins at the top of the petiole, it is striking that the tertiary venation is oriented in a concentric fashion to the leaf base (Hickey & Wolfe, 1975). Such an arrangement has been observed not only in *Rinorea*, but also in *Rinoreocarpus*, *Gloeospermum* and *Fusispermum* and other related genera.

If we follow Hickey and Wolfe’s (1975) venation classification, as illustrated in Figure 3 of their publication, we see that the pattern in neotropical *Rinorea* varies between semi-craspedodromous and camptodromous as well as between their subtypes. In our opinion, a following subdivision of the venation patterns in neotropical *Rinorea* is most likely:

- a. A basic stage of \pm ‘semi-craspedodromous’ venation, characterized by lateral veins (=secondaries) approaching the leaf margin with small and narrow loops. In neotropical *Rinorea* this stage is mostly accompanied by a higher number of lateral veins and tertiary venation \pm scalariform. This type of venation is not common, but can be observed in *R. ulmifolia* and *R. hymenosepala*.
- b. A more derived stage of \pm ‘camptodromous’ venation, which in turn can be subdivided into:
 - bl. A subtype of \pm ‘brochidodromous’ venation, characterized by lateral veins (=secondaries) abruptly curving before approaching the leaf margin and ending with larger rounded loops. In neotropical *Rinorea* this subtype is mostly accompanied by a lower number of lateral veins and tertiary venation reticulate. This stage

is most common and can be observed in *R. macrocarpa*, *R. pubiflora*, *R. camptoneura*, *R. ovalifolia*, *R. guatemalensis*, etc.

- b2. A subtype of \pm 'eu-camptodromous' venation, characterized by lateral veins (=secondaries) gradually curving to the leaf margin and ending with smaller rectangular loops. In neotropical *Rinorea* this subtype is mostly accompanied by a higher number of lateral veins, with tertiary venation \pm scalariform. This type of venation is not common, but occurs in such species as *R. multivenosa*, *R. longistipulata*, *R. villosiflora*, *R. racemosa*, *R. sprucei*, and *R. vaupesana*.

The tertiary venation in neotropical *Rinorea* varies from strictly reticulate to strictly scalariform and seems to be correlated with an increase in the number of lateral veins.

Following Zimmermann (1959, 1965) and Hickey and Wolfe (1975), we also assume that the scalariform venation types may be derived from reticulate ones. If we, on the other hand, accept the hypothesis that a higher number of lateral veins should be more primitive than a lower, this would seem to be contradictory; or else the diversification in leaf venation patterns is more complex than supposed and is probably not evolving at the same rate in all characters in *Rinorea*.

Leaf margin.—Leaf margins in *Rinorea* are mostly (sub)cren(ul)ate or (sub)serr(ul)ate, rarely completely entire. The margin and the apex are provided with usually black-purplish teeth or mucros. Hickey and Wolfe (1975) postulate that a gradual evolution from an entire leaf margin to one distinctly toothed was common for most angiosperms. According to them, a relatively primitive Theoid tooth type is predominant in most of the members of the order Violales, but in *Rinorea* and in some genera of the related family Flacourtiaceae (*Homalium*, *Xylosma*) this tooth type has evolved further to a more advanced Violoid type by fusion of originally free glandular setae with the tooth apex. However, in some *Rinorea* species leaf margins are (sub)entire, which seems to be a contradiction to the hypothesis of Hickey and Wolfe. Since rudimentary Violoid teeth are seen still to be present along the (sub)-entire leaf margins of these species, this

suggests to us derivation from a distinctly toothed condition, from which we presume that these leaf margins have more recently become secondarily (sub)entire. In *R. marginata* the leaf margins have also become thick walled.

Leaf base.—The basal part of the lamina is usually rounded to cuneate, and in some species also shortly decurrent onto the petiole. In *R. melanodonta* the lamina tapers into the petiole. Further, in neotropical species there is a gradual transformation from a symmetric to oblique leaf base. An oblique leaf base can be considered as derived from a symmetric leaf base. The transformation from symmetric to oblique is often accompanied by a transformation from obtuse to cordate or auriculate, although the latter transformation also occurs independently from the former.

A survey of all possible variations and combinations in shape of leaf bases which can be encountered in *Rinorea* is given below:

- a. Leaf base symmetric:
 - a1. Rounded to cuneate, not tapering or decurrent onto the petiole; most common.
 - a2. Shortly decurrent onto the petiole: e.g., *R. haughtii*, *R. laurifolia*, *R. longistipulata*, and *R. lindeniana* var. *fernandeziana*.
 - a3. Tapering onto the petiole: *R. melanodonta*.
 - a4. Obtuse to rounded at the petiole: e.g., *R. multivenosa*, *R. brachythrix*.
 - a5. (Sub)cordate to (sub)auriculate: e.g., *R. maximiliani*, *R. deflexa*.
- b. Leaf base slightly oblique as well as slightly obtuse to subcordate: e.g., *R. camptoneura*, *R. dasyadena*, and *R. lindeniana* var. *lindeniana*.
- c. Leaf base distinctly oblique as well as cordate: e.g., *R. deflexiflora*, *R. neglecta*, *R. sylvatica*, *R. ulmifolia*, and *R. hymenosepala*.

In *R. laevigata* and *R. endotricha* the leaf base may vary from symmetric to oblique; the leaf base of *R. laevigata* is obtuse to rounded at the petiole and that of *R. endotricha* subcordate to subauriculate.

Leaf acumen and apex.—The apical part of the lamina may be cuspidate, acuminate or tapering to the apex. The apex itself varies from acute to obtuse and is usually also black-purplish

mucronulate. This apical tooth is also glandular (Violoid type), just as are the teeth along the leaf margin (Hickey & Wolfe, 1975).

Hairs on laminar leaves.—The costa and the lateral veins are mostly hairy on both sides, especially near the base; the veins are often also glabrescent. The upper side of the costa is usually short-haired, viz., erect pilosulous, puberulous, hirtellous, hispidulous or strigillose, whereas the under side is usually only long-haired, i.e., appressed-pilose or strigose. In some species, as in *Rinorea squamata*, two different kinds of hairs can be found on the underside of the costa, viz., strigose in combination with hispidulous.

In a few species the veinlets (i.e., the tertiary venation) may also be hairy, giving the impression of a densely hairy lamina. In neotropical *Rinorea* the following variations of this indument can be seen:

- a. Veinlets on both sides of the lamina pilose: *R. maximiliani*.
- b. Veinlets of the underside hairy, those of the upperside glabrous:
 - b1. Indument erect pilosulous, hirtellous, hispidulous or hirsute: *R. hirsuta*, *R. marginata* (sometimes also in *R. macrocarpa* and *R. ovalifolia*).
 - b2. Indument appressed pilosulous: *R. racemosa*, *R. sprucei* and *R. vaupesana*, three closely related species.

On the other hand, there are also species in which the costae and veins are completely glabrous on both sides of the lamina: e.g., *R. crenata*, *R. oraria*, *R. flavescens*, and *R. riana*. Sometimes only one side of the costa may be hairy: e.g., the costae of the leaves of *R. amapensis* are completely glabrous above, but may be sparsely hairy underneath. The color of all hair types is variable and may be whitish, yellowish, golden, brownish, orange-brown, ferruginous or maroon.

Domatia.—Domatia are tufts of stiff, erect hairs which can be found in the axils of the costa and some of its lateral veins on the underside of the lamina. In neotropical species their occurrence is restricted to some of the species with apparently opposite leaves; they are wanting in species with alternate leaves. On the other hand, domatia may be present in paleotropical species, which have only alternate leaves (Jacobs, 1965,

1966, 1967; Jacobs & Moore, 1971; Napp-Zinn, 1973; Penzig & Chiabrera, 1903 [1902]; Taton, 1968). Lundstroem (1887) and Penzig and Chiabrera (1903 [1902]) postulated that these tufts of hairs should be inhabited by mites (Acari). Therefore they named these tufts of hairs acaridomatia, or, for short, domatia. They supposed that these domatia give shelter to these mites and that their nectaries provide food to them. In turn these mites apparently protect the leaves by feeding on pathogenic fungi or on other Arthropoda. Similar tufts of hairs or domatia also have been found in species of other plant families.

According to Jacobs (1966) such a mutualism between plants and mites as postulated by Lundstroem and Penzig and Chiabrera have never been confirmed by more recent observations. According to Wilkinson in Metcalfe and Chalk (1979), Tô Ngoc Anh published (1966, 1968) the results of her study on domatial ontogeny in various tropical and temperate species of different plant families. From her work it appears that islands of young cells can be found in vein axils. The development of these is delayed, and in the very young stages these cells cannot be distinguished from other neighboring cells. She emphasized also the constant and remarkable localization of domatia in the axils of the costae and lateral veins belonging to taxa of diverse unrelated plant families in angiosperms as well as in pteridophytes. Subsequently she suggests that this fact is an indication of origination from ancient structures. Finally she thinks that the lack of a secretory epidermis in domatia is no reason to avoid comparison with extrafloral nectaries.

If we consider the presence of domatia as advanced (versus wanting), and if these special structures are indeed very ancient, the evolutionary trend towards the presence of domatia must also be considered as very ancient. This evolution must have been parallel in different taxa, followed by further diversification of these structures in such taxa. Since domatia usually occur in only some of the axils, all axils must be carefully examined for their presence. If present, they will be found in the basal and median part of the costa on the underside of the lamina.

Inflorescences

The arrangement of inflorescences in *Rinorea* is axillary, lateral or apparently terminal. In neo-

tropical species the shape of the inflorescence varies usually from thyrsoid to (pseudo)racemose, rarely from thyrsoid to cymose. Lateral cymules and single flowers are alternately arranged along the central axis (=rachis) in the axils of lower bracts (=‘bracts’ in the taxonomic treatment). Cymoid inflorescences are more common in paleotropical *Rinorea* species than in neotropical ones, but they occur also in *Rinoreocarpus* and *Gloeospermum*, neotropical genera closely related to *Rinorea*. Cymoid inflorescences can be considered as derived from the thyrsoid by acrotonic suppression of the central axis of thyrsoid inflorescences. On the other hand, narrowly thyrsoid inflorescences can be considered as derived from widely thyrsoid ones by reduction of lateral cymules (sometimes even to single flowers at the apex of the central axis). Further reduction of lateral cymules results in pseudoracemose inflorescences, in which most of the cymules are reduced to single flowers with only the basal ones consisting of 1–3 flowers. In racemose inflorescences all flowers have become solitary. In fact, solitary flowers are extremely reduced cymules, since the articulation (and a pair of bracts below it) reveals the separation between peduncle and pedicel. These upper bracts (‘bractlets’ in the taxonomic treatment) sometimes bear reduced or abortive flower buds as relicts of lateral flowers. Since the distinction between (upper) peduncle and pedicel has become obscure because of their habit, they are named respectively as basal and upper parts of ‘pedicels’ in the taxonomic treatment.

Inflorescences may be either determinate (=closed, i.e., having a terminal flower) or indeterminate (=open, i.e., without a terminal flower). Indeterminate inflorescences may be considered as derived from determinate ones by obliteration of the terminal bud. An intermediate condition can be recognized by the presence of only rudimentary, scale-like bracts in tufts at the apex of the central axis (as, e.g., sometimes in *Rinorea brevipes*) (Fig. 3, 6). Thyrsoid, cymose and pseudoracemose inflorescences in *Rinorea*

are always determinate (=closed), whereas racemose ones vary from determinate (=closed) via an intermediate condition to indeterminate (=open). All the different structures seen in inflorescences, varying from thyrsoid to racemose as well as to cymoid, have been depicted in Figure 3 and arranged in Table II according to the two transformation series.

In opposite-leaved species only a reduction of a thyrsoid structure to a racemose can be followed; all inflorescences are mostly solitary. Only thyrsoid inflorescences are found in the following species: *Rinorea hymenosepala*, *R. racemosa*, *R. sprucei*, *R. ulmifolia*, *R. vaupesana* and *R. villosiflora*, versus racemose in most other species. The name of *R. racemosa* is indeed confusing, since its inflorescences are narrowly thyrsoid in reality.

Normally each species has only one type of inflorescence, but there are two species with different types: (1) shortly thyrsoid to (pseudo)racemose in *Rinorea hummelii*, and (2) pseudoracemose to racemose in *R. lindeniana*.

In alternate-leaved species three reduction processes in inflorescences can be followed: (a) from thyrsoid to racemose (Fig. 3 & Table II, numbers 1 & 3–6 in both), (b) from thyrsoid to cymoid (Fig. 3 & Table II, numbers 1–2 & 7 in both), and finally (c) reduction of a bundled arrangement of inflorescences (as depicted in Fig. 4) to a solitary arrangement. Processes (a) and (b) are mutually exclusive, whereas (c) can evolve independently from (a) as well as from (b). The following structures and arrangements of inflorescences in alternate-leaved species can be found: (1) bundles of (1–)2–6 thyrses in, e.g., *Rinorea apiculata*, *R. crenata*, *R. oraria*; (2) bundles of 1–3 pseudoracemes, sometimes accompanied by two additional rudimentary ones in, e.g., *R. multivenosa*, *R. longistipulata*; (3) bundles of (1–)2–6 racemes in, e.g., *R. cordata* (?), *R. haughtii*, *R. laurifolia*; (4) bundles of 1–3 cymules in, e.g., *R. uxpanapana*; (5) thyrsoid inflorescences 1–3-bundled to solitary in, e.g., *R. bahiensis*, *R. bicornuta*, *R. guianensis*, *R. maximiliani*, *R. pa-*

FIG. 3. Transformation series of inflorescences in neotropical *Rinorea* (compare with Table II): E or E₀ = terminal flowers at the apex of the central axis of determinate or closed inflorescences; E₁₋₅ = terminal flowers in lateral cymules of thyrsoid inflorescences; * = obliterated terminal bud in indeterminate or open inflorescences; 1 = widely complex thyrsoid; 2 = less complex thyrsoid; 3 = narrowly thyrsoid; 4 = pseudoracemose; 5a & 5b = racemose (closed); 6 = racemose (open); 7a & 7b = cymules or cymoid inflorescences (all numbers are identical with those of Table II).

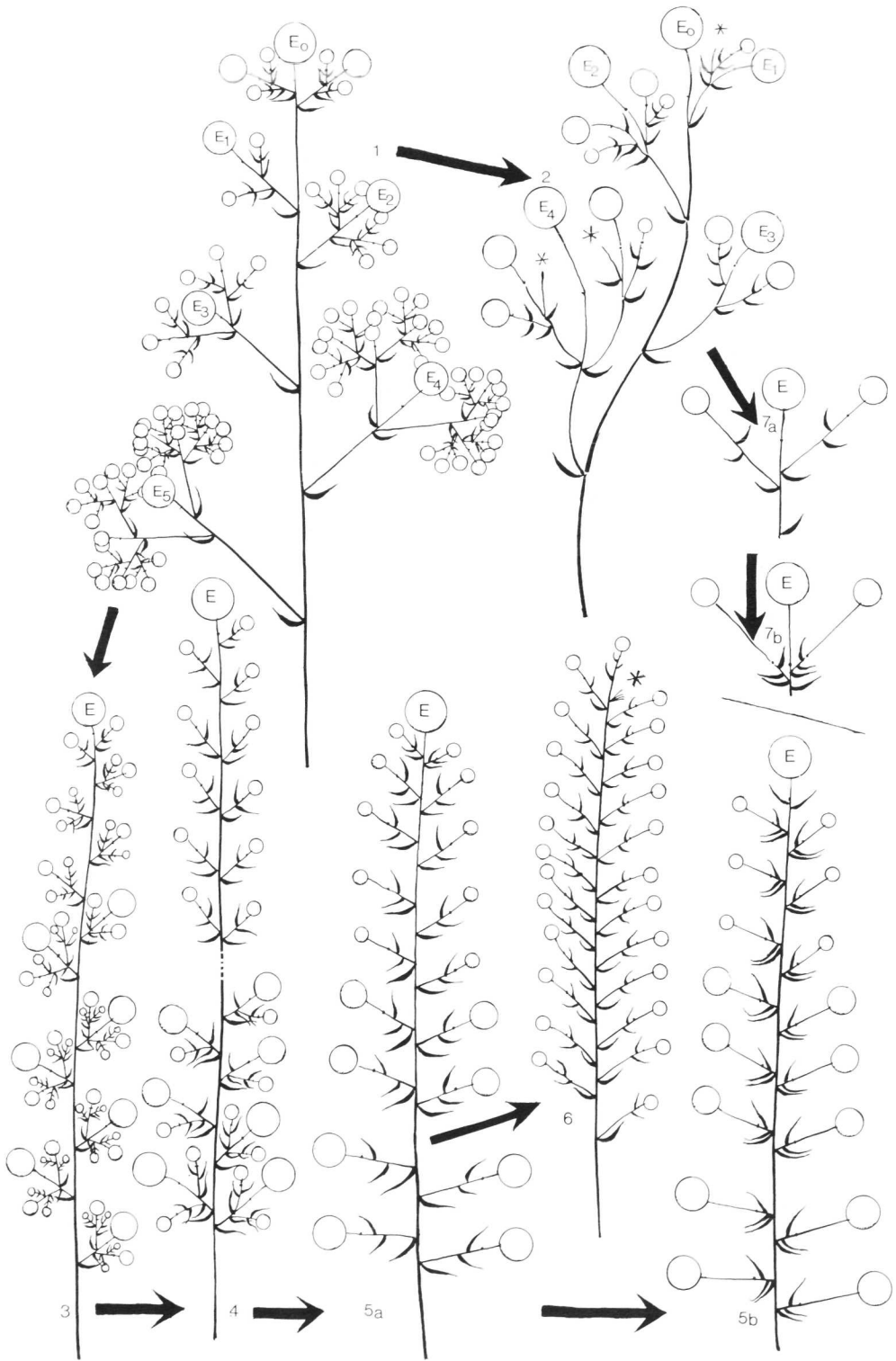


Table II

A correlation between the phylogenetic terminology used in the taxonomic treatment in this monograph and that of Weberling (1981) (fig. 3: 1-7; numbers corresponding with those of this table)

Weberling, 1981	Hekking, 1988
1, 2. <i>Thyrus</i> (distinctly thyrsoïd)	1. <i>Widely complex thyrsoïd</i> : central axis (=rachis) elongated, peduncles elongated, cymules numerous, containing 1-21 flowers: e.g., <i>R. oraria</i> , <i>R. bahiensis</i> , <i>R. guianensis</i> , <i>R. paniculata</i> .
	2. <i>Less complex thyrsoïd</i> : central axis (=rachis) shorter, inflorescence laxiflorous; cymules less numerous, containing 1-7 flowers: e.g., <i>R. ulmifolia</i> , <i>R. hymenosepala</i> .
3. <i>Thyrus</i> (\pm spicoid)	3. <i>Narrowly thyrsoïd</i> : central axis (=rachis) elongated with compact cymules; containing 1-7 flowers: e.g., <i>R. apiculata</i> , <i>R. crenata</i> , <i>R. villosiflora</i> , <i>R. racemosa</i> , <i>R. sprucei</i> , <i>R. vaupesana</i> .
4. Transitional stage between <i>Thyrus</i> (\pm spicoid) and <i>Botryoid</i>	4. <i>Pseudoracemose</i> : inflorescence closed by a terminal flower E; cymules in the basal part of the inflorescences, containing only 1-3 flowers: e.g., <i>R. multivenosa</i> , <i>R. longistipulata</i> , <i>R. lindeniana</i> var. <i>lindeniana</i> .
5. <i>Botryoid</i> (with terminal flower E)	5. <i>Racemose (closed)</i> : flowers solitary, inflorescence apically closed by a terminal flower E: e.g., <i>R. falcata</i> , <i>R. riana</i> , <i>R. guatemalensis</i> (5a), <i>R. viridifolia</i> (5b).
6. <i>Botrys</i> (without terminal flower E)	6. <i>Racemose (open)</i> : idem, open because terminal flower wanting, a lateral flower may secondarily take over the function of the obliterated terminal flower E: e.g., <i>R. laurifolia</i> , <i>R. pubiflora</i> , <i>R. camptoneura</i> , <i>R. flavescens</i> .
7. <i>Cymoid</i>	7. <i>Cymules or cymoid inflorescences</i> containing only 1-3 flowers, peduncles reduced, derived from thyrsoïd inflorescences by reduction of the central axis (=rachis) and lateral cymules: <i>R. uxpanapana</i> .

niculata, and *R. ramiziana*; and finally (6) (pseudo)racemes 2-bundled or solitary in *R. laevigata*. The (1-)2-6-bundled axillary inflorescences of alternate-leaved species seem to be arranged in a dichasial configuration, sometimes also enclosing a lateral branchlet (see diagrams 1-5 of Fig. 4). Such arrangements of inflorescences are described as 'inflorescences fasciculate' in the species descriptions of the Taxonomic Treatment.

In *Rinorea apiculata*, *R. crenata*, *R. oraria*, *R. haughtii* and *R. laurifolia* all adult inflorescences are equally long and completely similar in shape. In *R. multivenosa* and *R. longistipulata*, however, there is a trend to reduction in the fascic-

ulate configuration. In these species, some of the juvenile inflorescences do not become fully developed and remain smaller and distinctly shorter than the other ones, and, moreover, one of the two adult and fully developed inflorescences usually is slightly shorter than the other. In *R. laevigata*, *R. ramiziana*, *R. bahiensis*, *R. guianensis* and *R. paniculata* a single dominating central inflorescence usually is accompanied by one of two smaller lateral ones: these reduced lateral inflorescences are completely free or can be found as adnate lateral branchlets at the base of the central axis; such incorporated basal lateral inflorescences are distinctly longer than the more apical lateral ones. In all of these species the

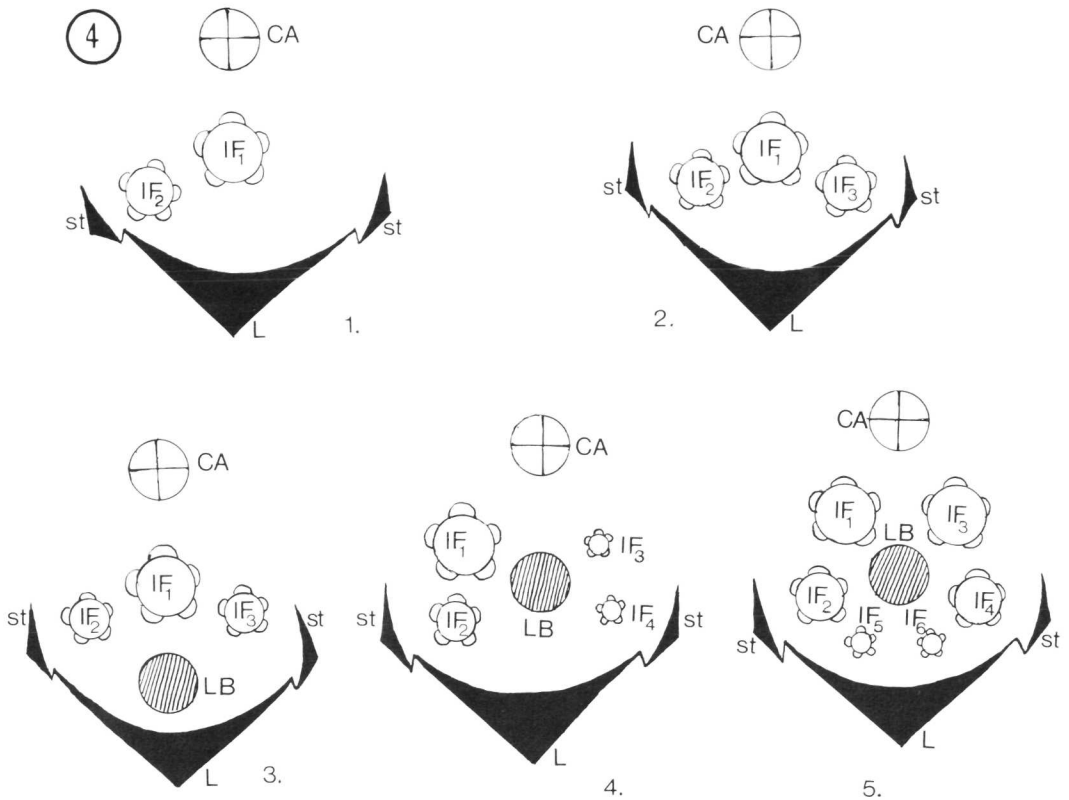


FIG. 4. Fasciculate inflorescences in neotropical *Rinorea* species with alternate leaves. Legend: CA = central axis. IF₁ = inflorescence in the axil of a leaf. IF_{2,3,4,5,6} = accessory or lateral inflorescences. L = leaf, accompanied by two deciduous stipules (=st). LB = lateral branchlets in the axils of the leaves. **1** = two inflorescences fasciculate (e.g., *R. ramiziana* [Brade et al. 18087]). **2** = three inflorescences fasciculate (e.g., *R. guianensis* [Krukoff 1359] and *R. longistipulata* [Prance et al. 7263]). **3** = three inflorescences surrounding a lateral branchlet (e.g., *R. laurifolia* [Haught 1470]). **4** = four inflorescences surrounding a lateral branchlet (e.g., *R. longistipulata* [Prance et al. 7263]). **5** = six inflorescences surrounding a lateral branchlet (e.g., *R. haughtii* [Haught 1908]).

whole transformation series can be followed on herbarium specimens, i.e., from inflorescences 1–3 fasciculate and unequally long to a single inflorescence with one or two basal lateral branchlets distinctly longer than the apical ones.

Flowers

Peduncles, pedicels, bracts, bractlets, sepals, and petals.—Flowers of *Rinorea* are arranged in cymes or appear solitary. As already expounded above, solitary flowers can be considered as extremely reduced cymes, since an articulation and a pair of upper bracts below the articulation are evidence of an original separation between peduncle and pedicel. Peduncles and pedicels are mostly well developed except in a few cases. In

R. uxpanapana and in the four closely related species *R. viridifolia*, *R. antioquiensis*, *R. squamata* and *R. hirsuta*, peduncles are so much reduced that the upper and lower bracts have become clustered together, with the articulation hidden within, so that only a distinct pedicel is visible. In *R. macrocarpa* both peduncles and pedicels are reduced, so that flowers and fruits are subsessile. Since the distinction between (upper) peduncle and pedicel has become obscure by their similar appearance in *Rinorea* and such related taxa as *Rinoreocarpus* and *Gloeospermum*, another terminology has been used in the taxonomic treatment, for practical reasons. Lower bracts have been named bracts and upper bracts bractlets, since they differ in size. In flowers the (upper) peduncles below the articulation are re-

named 'basal part' and pedicels above the articulation 'upper part'; peduncle and pedicel s.str. together are renamed 'pedicel' s.l.

The flowers are usually pendulous, but they are strongly deflexed downward in such species as *Rinorea bicornuta*, *R. ovalifolia*, *R. deflexa*, and *R. deflexiflora*.

Bracts, bractlets and sepals are usually similar in shape and habit. They are ellipsoid, ovate, or deltoid, with an apex varying from rounded to acute. The apex is often black-purplish mucronulate and these mucros are usually glandular, Violoid type (Hickey & Wolfe, 1975, see also under leaf margin). *Rinorea endotricha* and *R. sylvatica* are the only two neotropical species in which bracts, bractlets and sepals are extremely elongated, to about four times as long as wide. Bracts and bractlets of these two species are often equal to, or longer than, the 'pedicels'; their sepals are nearly equal to their reflexed petals.

Bracts, bractlets and sepals are usually herbaceous, sometimes also carnosose along the costa and near the base, as well as scarious near the margin. Their color varies from greenish- to yellowish-white. They are usually more or less hairy outside and occasionally also inside, as in *Rinorea guianensis*, *R. bahiensis*, *R. racemosa* and *R. sprucei*. The indument is variable and may be pilose(ulous), puberulous, strig(ill)ose, hispid(ulous), hirsute or hirtellous. The color of the hairs is whitish, yellowish, golden, orange-brownish, ferruginous, fuscous or maroon and may give an additional touch to the original color of bracts, bractlets and sepals. They are also distinctly costate and/or sometimes also 2-11 veined. In *R. pubiflora*, *R. endotricha*, *R. sylvatica* costa and veins become strongly ribbed when dried. The margins of bracts, bractlets and sepals are usually ciliolate with hairs ca. 0.1 mm long, but in some species, such as *R. maximiliani*, *R. bicornuta*, *R. hirsuta*, *R. ulmifolia*, *R. hymenosepala*, *R. deflexa*, *R. villosiflora* and *R. vaupesana*, sepals are ciliate with hairs ca. 0.2 mm long or longer.

Bractlets are usually distinctly smaller than bracts. Sepals are mostly distinctly larger than bracts and bractlets. They are usually subequal, i.e., with inner sepals slightly larger than the outer ones. In three closely related species (*Rinorea flavescens*, *R. falcata* and *R. camptoneura*) sepals are unequal just as they are in some species of

the related *Gloeospermum*, as well as in species of *Paypayrola* (subtribe Paypayrolinae), although not so strongly unequal as in *Amphirrhox* (subtribe Paypayrolinae) and *Schweiggeria* (tribe Violeae).

The aestivation of sepals in *Rinorea* is quincuncial, whereas that of the petals is predominantly apotact; deviations of petals quincuncial or paratact occur occasionally in flowers of the same specimens.

Flower buds are usually ellipsoid, ovoid, conical or tolpoid, with apices usually varying from rounded via obtuse to acute. Adult flowers are commonly urceolate, since the apices of the petals are more or less reflexed. Petals are equal in nearly all species, except *Rinorea uxpanapana*. The slight tendency to zygomorphy in this species is expressed by the anterior petal being slightly larger than the other, especially posterior, ones. Petals of neotropical species are predominantly herbaceous, but often also carnosose near the base along the costa as well as scarious near the margin. Their outline is diverse and varies from orbicular via (narrowly) elliptic to (narrowly) deltoid or ovate; (narrowly) deltoid or ovate petals are often acuminate or tapering to the apex. The apex in turn varies from rounded to acute and is sometimes provided with a tuft of hairs. Petals are greenish in flower buds, becoming usually whitish, creamy or yellowish in adult flowers. This color may tend to orange in adult flowers of *R. racemosa* and *R. lindeniana* var. *fernandeziana* as well as pinkish or reddish in those of *R. guatemalensis* and occasionally also in those of *R. pubiflora*. Finally, *R. pectino-squamata* is the only species in which the petals are purplish striate along the costa and near the base. Petals of neotropical *Rinorea*'s vary from completely glabrous to distinctly haired. For each species the position of eventually-present indument is different and characteristic.

The following subdivision of the neotropical species of *Rinorea* can be made, based primarily on the presence or absence of indument and secondarily on the position of this indument on the laminae of the petals.

- a. Laminae of petals completely glabrous on both sides: *R. uxpanapana*, *R. macrocarpa*, *R. flavescens*, *R. neglecta*, *R. pectino-squamata*.
- b. Laminae of petals hairy only on the outside:

- b1. near or at the apex: *R. laurifolia*, *R. multivenosa*, *R. longistipulata*, *R. maximiliani*, *R. laevigata*, *R. ramiziana*, *R. hirsuta*, *R. marginata*, *R. brachythrix*;
- b2. scarcely or sparsely hairy along the costa: *R. maximiliani*, *R. viridifolia*, *R. dasyadena*, *R. deflexiflora*, *R. guatemalensis*;
- b3. densely hairy along the costa or along the median part: *R. bicornuta*, *R. amapensis*, *R. pubiflora*, *R. sylvatica*.
- c. Lamina of petals also hairy on the inside:
 - c1. near the base on both sides: *R. cordata*, *R. multivenosa*, *R. longistipulata*;
 - c2. near the apex on both sides, but especially inside: *R. endorricha*;
 - c3. hairy along the median part outside, and near the apical part inside: *R. guianensis*, *R. bahiensis*, *R. sprucei*;
 - c4. hairy along the median part outside, hairy near the base and apex inside: *R. villosiflora*;
 - c5. some petals sparsely hairy outside, more densely hairy inside near the middle: *R. vaupesana*.

Moreover, the species of neotropical *Rinorea* are also characterized by the kinds of indument on the petals. This may be mainly pilose(ulous), puberulous, strig(ill)ose or hispid(ulous). Also important is the color of this indument, which is as variable as that of the sepals: whitish, yellowish, golden, brownish, orange-brown, ferruginous or maroon. The petals vary usually from ciliolate to completely glabrous along the margin. Petals are ciliate in *R. hirsuta* and *R. deflexa* and also in juvenile flowers of *R. vaupesana*. Hair color varies usually from brownish via golden to whitish in these three species.

Androecium (Figs. 5–7).—The androecium of *Rinorea* is composed of five episepalous stamens, each consisting of a filament, a dorsal gland, an anther, a connective and a connective scale. The structure and shape of these staminal elements are highly variable in *Rinorea*; most of these variations are characteristic for (clusters) of species; sometimes some of them also are variable within a single species.

Filaments and dorsal glands. The character state of free filaments and dorsal glands can be considered primitive, as opposed to the ad-

vanced stage of filaments and dorsal glands completely fused with each other. The following stages of hypothesized evolution from the one character state to the other are still visible in recent neotropical species of *Rinorea* (see also Table III).

1. *Filaments and their dorsal glands free* (i.e., neither fused into a tube).
The dorsal glands of the anterior filaments are often more developed than those of the posterior filaments, which may in fact be gradually reduced to even wanting. Such an unequal formation of dorsal glands can be considered as a starting point towards zygomorphy in the androecium (completed in the tribe *Violeae*) (Fig. 6).
 - 1a. dorsal glands free, conical in shape, erect: *R. cordata*, *R. haughtii*, *R. laurifolia*, *R. multivenosa*, *R. longistipulata*, *R. maximiliani*;
 - 1b. dorsal glands free, appressed or adnate to the filaments:
 - 1ba. dorsal glands shorter than the filaments: *R. dasyadena*;
 - 1bb. dorsal glands more or less equal to the filaments: *R. riana*, *R. marginata*, *R. melanodonta*, *R. neglecta*;
 - 1bc. dorsal glands distinctly longer than the filaments: *R. lindeniana*.
 - 1c. dorsal glands free, connate or fused with filaments (and shorter than the filaments): *R. deflexiflora*.
2. *Filaments originally free, but their dorsal glands becoming fused with each other*:
 - 2a. apical parts of the filaments free, basal parts of the filaments included in the glandular tube: *R. apiculata*, *R. crenata*, *R. oraria*, *R. macrocarpa* (Figs. 5 & 7);
 - 2b. filaments of anterior stamens included in their mutually fused dorsal glands; filaments and dorsal glands of posterior stamen(s) free. This dimorphy in the glandular tissue expresses a further tendency to zygomorphy in the androecium: e.g., the three closely related species *R. deflexa*, *R. ovalifolia* and *R. pectino-squamata*;
 - 2c. all the filaments included in their mutually fused dorsal glands; glandular tube carnosous, and brittle between the filaments: *R. hummelii*.

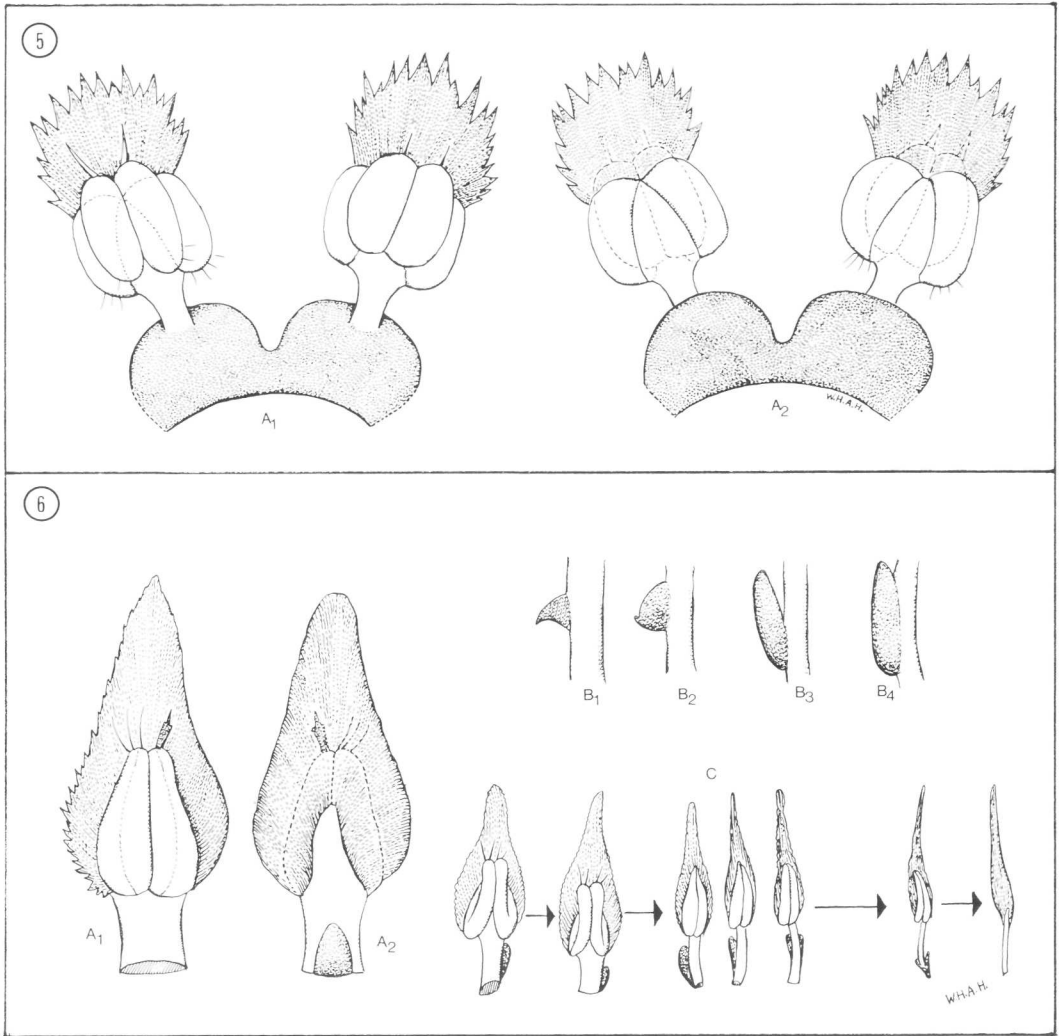
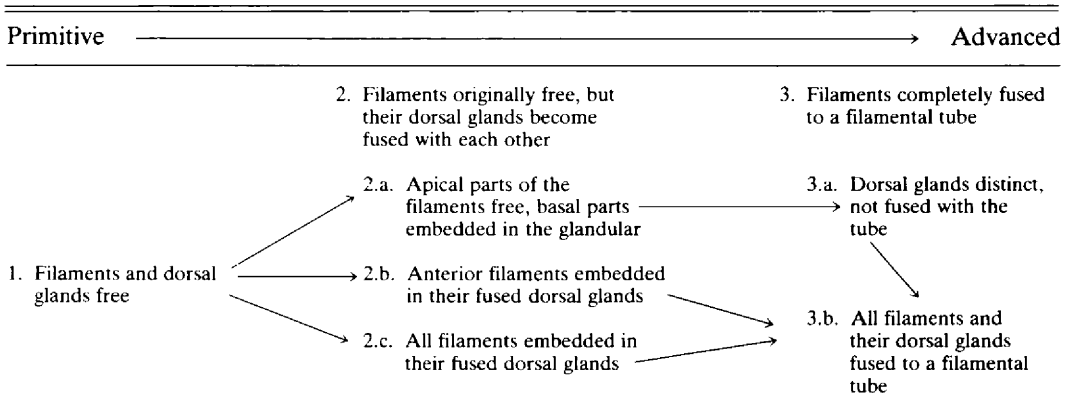


FIG. 5. Some of the variations in shape and structure of the androecium in neotropical *Rinorea* (to be continued). Legend: *R. apiculata* (A_1 = ventral side, A_2 = dorsal side); filaments planted on a lobed glandular tube; anthers sometimes barbate, especially basally, and sometimes ventrally appendaged by cusps and/or hairs; ventral side of connective linear, dorsal side ovate to deltoid and produced into an apical connective scale; connective scales orbicular, orange-brown, fringed.

FIG. 6. Some of the variation in shape and structure of the androecium in neotropical *Rinorea* (continuation and to be continued). Legend: **A.** Kind of stamens as occur in, e.g., *R. viridifolia*, *R. pubiflora*, *R. melanodonta*, *R. dasyadena* (A_1 = ventral side, A_2 = dorsal side); filaments and dorsal glands free; anthers (often) ventrally appendaged by cusps and/or hairs; ventral side of connective linear; dorsal side ovate to deltoid and produced into an apical and lateral connective scale; connective scales orange-brown, ovate or deltoid, acute to obtuse, margin (sub)entire or erose. **B.** Some kinds of free dorsal glands, seen from the lateral side; B_1 and B_2 = erect; B_3 = adnate; B_4 = connate. B_1 = dorsal gland erect, conical, e.g., in *R. cordata*, *R. multivenosa*, *R. longistipulata*, *R. maximiliani*; B_2 = dorsal gland erect, ovoid conical, e.g., in *R. laurifolia*; B_3 = dorsal gland adnate, i.e., appressed basally, but free at the apex, e.g., in *R. viridifolia*, *R. pubiflora*, *R. melanodonta*; B_4 = dorsal glands connate or fused with the filaments, e.g., in *R. deflexiflora*. **C.** Reduction of the androecium in *R. pubiflora* var. *grandifolia*, from completely developed stamens via reduced stamens to completely sterile staminodes.

Table III

Sketch of three possible pathways of evolution in the shape of the androecium of neotropical *Rinorea*



3. *Filaments completely fused to a filamental tube.*

3a. dorsal glands distinct, not fused with each other or only at the very base: *R. bahiensis*, *R. guianensis*, *R. paniculata*;

3b. dorsal glands completely fused with each other and with the filamental tube: *R. ramiziana*, *R. bicornuta*, *R. uxpanapana*, *R. villosiflora*, *R. racemosa*, *R. sprucei*, *R. vaupesana* (Fig. 7).

The features seen in the different stages are usually more or less stable in most of the neotropical species except *Rinorea guatemalensis*. The originally free filaments of this species become included in their dorsal glands, which subsequently fuse with each other to form a glandular tube. The whole series of these stages can be followed in *R. guatemalensis*.

The tropical African species *Rinorea brachypetala* (Turcz.) Kuntze and *R. subintegrifolia* (P. Beauv.) Kuntze also are good examples. In these the whole series from filaments and dorsal glands free to completely fused to different kinds of tubes can be followed within one species (Tennant, 1963).

The dorsal glands and glandular tubes are functioning nectaries, luring small insects to the flowers. Plant collectors have often scented a pleasant odor, upon entering tropical rain forests with an undergrowth of flowering *Rinorea*'s.

Anthers and thecae. The thecae of most of the species are glabrous, but those of the three related species *Rinorea apiculata*, *R. crenata* and *R. ora-*

ria are hairy near the base (Fig. 5). The apices of the thecae are sometimes appendaged by 1–2 cusps and/or 1–5 setae; both kinds of appendages are soon caducous. In the four related species *R. bicornuta*, *R. guianensis*, *R. bahiensis*, and *R. paniculata*, the two cusps are fused with each other to form a dichotomous or fringed cusp.

Connective and connective scales. The connective is ventrally and dorsally differently shaped; the ventral side is usually linear (Figs. 5, 7A) to narrowly deltoid (Fig. 7C₁); the dorsal side is usually wider deltoid or ovoid (Figs. 5, 6, 7). The ventral side of the connective is mostly completely glabrous, but is hairy in some species, as in *Rinorea multivenosa* and *R. villosiflora*. The dorsal side of the connective usually varies from glabrous to appressed pilosulous, rarely also to pilose, as in *R. laurifolia*, *R. multivenosa*, *R. laevigata* and *R. villosiflora*. The connective is dorsally produced into a scarios connective scale, which is exclusively apical in only three closely related species, *R. apiculata*, *R. crenata* and *R. oraria*, which are consequently placed in a separate Supergroup I. Apiculata. The connective scales of all other neotropical species are lateral as well as apical. These connective scales can be considered as secondary emergences from the original sporophyll since vascular tissue is wanting; parts of the original microsporophyll are characterized by the presence of vascular tissue.

Apical connective scales occur not only in the three closely related species of *Rinorea* Supergroup I. Apiculata, but also in species of *Rino-*

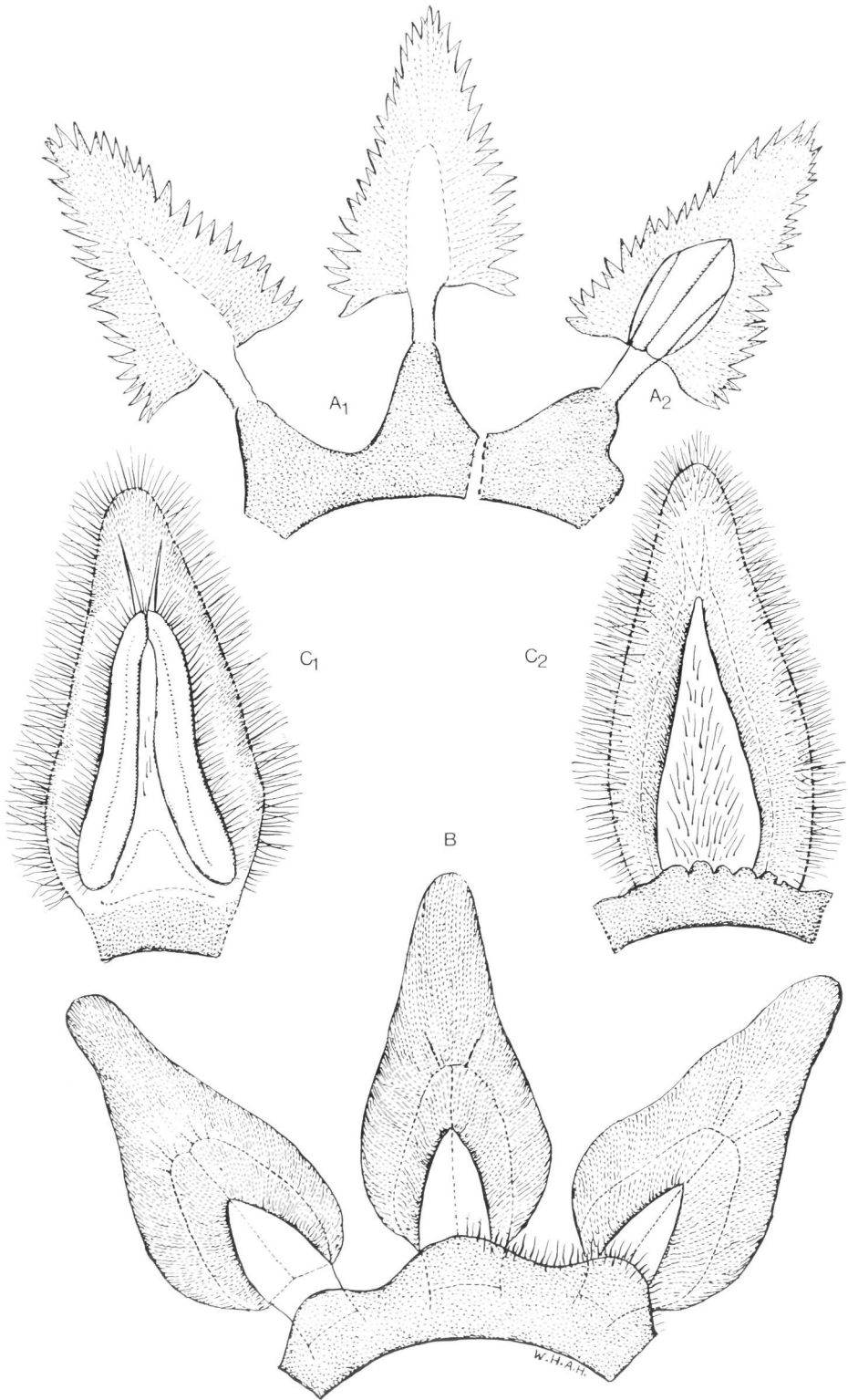
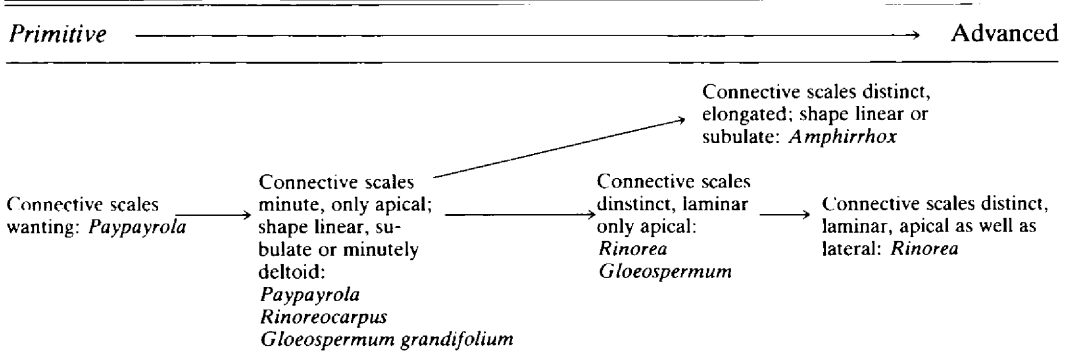


Table IV

Sketch of possible pathways of evolution in the shape of connective scales in the tribe Rinoreeae



reocarpus and *Gloeospermum*, genera with strong affinities to *Rinorea*. The connective scales of nearly all species of *Gloeospermum* are laminar just as in the above three species of *Rinorea*; those of *G. grandifolium* are linear, subulate or minutely deltoid and much shorter than the anthers, just as are those of the monotypic *Rinoreocarpus ulei*. *Rinorea*, *Rinoreocarpus* and *Gloeospermum* belong to the subtribe Rinoreinae. In *Paypayrola* and *Amphirrhox*, in the related subtribe Paypayrolinae, a similar evolution, from connective scales wanting via minute, as in *Paypayrola*, to elongated linear or subulate, as in *Amphirrhox*, can be followed. Both subtribes Rinoreinae and Paypayrolinae belong to the tribe Rinoreeae; finally, a sketch of possible pathways of evolution within the tribe in the shape of connective scales is given in Table IV.

We conclude, finally, that exclusively apical connective scales in *Rinorea* are probably more primitive than connective scales lateral as well as apical. We have already seen that connective scales in *Rinorea* are distinctly laminar. Their

shape is variable and may be orbicular, elliptic, (narrowly) deltoid or (narrowly) ovate. In those that are (narrowly) ovate to deltoid the connective scales are acuminate or tapering to the apex and the apex itself varies from rounded via obtuse to acute. Connective scales are glabrous in most of the species, but in some species they are densely villose outside (*R. maximiliani*, *R. ramiziani* and *R. villosiflora*). The color of the connective scales in most of the species is orange-brown; but a range of diverse colors can be seen in the following species: creamy in *R. ulmifolia*, yellowish in *R. macrocarpa* and *R. hymenosepala*, brown to greyish-brown in *R. laurifolia*, *R. ramiziana*, *R. bicornuta*, *R. deflexiflora*, *R. neglecta*, *R. sylvatica*, *R. villosiflora*, *R. racemosa* and *R. vaupesana*, fuscous in *R. hirsuta* and sometimes in *R. dasyadena*, ferruginous in *R. sprucei* and finally maroon in *R. riana*. In some species connective scales are provided with an uncolored transparent patch near the apex of the anthers. The margin of the connective scales varies, usually, from subentire to erose, but is mar-

FIG. 7. Some of the variation in shape and structure of the androecium in neotropical *Rinorea* (conclusion). Legend. A. Stamens of *R. macrocarpa* (A₁ = dorsal side, A₂ = ventral side): free parts of filaments mounted on a glandular tube; anthers ventrally unappendaged; ventral side of connective linear, dorsal side deltoid, obtuse, and produced into a lateral and apical connective scale; connective scales yellowish or golden-transparent; margin of connective scale fringed. B. Kind of stamens occurring, e.g., in *R. ramiziana*, *R. cornuta*, *R. uxpanapana*, *R. racemosa*: filaments (and often glands) fused into a tube (while free parts of filaments may be present); filamental tube completely glabrous or cili(ol)ate; anthers sometimes ventrally appendaged by cusps and/or hairs; ventral side of connective linear, dorsal side ovate to deltoid and produced into a lateral and apical connective scale; connective scales (sub)entire to (sub)erose, usually brownish. C. Stamens of *R. villosiflora* (C₁ = ventral side, C₂ = dorsal side): filamental tube as in B; anthers ventrally appendaged by elongated cusps; ventral side of connective narrowly deltoid, glabrate to sparsely villose; dorsal side of connective ovate to deltoid, villose; connective scales partly brownish and partly uncolored-transparent, villose and ciliate along the margin.

ginally fringed in *R. apiculata*, *R. crenata*, *R. oraria* and *R. macrocarpa*, and fringed only basally in *R. amapensis*, *R. ulmifolia* and *R. hymenosepala*. The connective scales of *R. pectino-squamata* are basally pectinate.

Abortive stamens and staminodes (Fig. 6c). In *Rinorea pubiflora* var. *grandifolia* completely developed stamens become gradually reduced to staminodes with linear connective scales and with or without rudiments of anthers and dorsal glands. By a complete loss of anthers such flowers have become unisexual, because a functional ovary is still present, which develops later into a capsule with ripened and viable(?) seeds. Curiously, staminate flowers with stamens and a pistillodium have not been found as yet. The SE Asiatic *R. virgata* is dioecious; the pistillate flowers are characterized by having a pistil surrounded by sessile staminodes of which each is provided with a minute dorsal gland. The staminate flowers in turn are characterized by having completely developed stamens, surrounding a pistillodium consisting of a style emerging from a flat sterile receptaculum (Jacobs & Moore, 1971).

Gynoeceum (Fig. 8).—Ovary. The ovary is superior, unilocular and composed of three carpels, united to a single style and stigma; it possesses three parietal placentae, each bearing 1–4 ovules. Each placenta is formed by fusion of the margins of two adjacent carpels. A reduction of the number of ovules per carpel within *Rinorea* from four to one is not spectacular in the evolutionary sense, in which a lower number is considered advanced as opposed to a higher number. Distinctly higher numbers can be found in the related genera *Rinoreocarpus* and *Gloeospermum*, each with respectively 6–10 and 7–22 ovules. Consequently, the numbers 1–4, as in *Rinorea*, can be considered as more advanced.

The shape of the ovary is basically subglobose, but may be also (sub)conical, (ob)pyriform, trapezoid or trilobed. Style and ovary are distinctly separated from each other, except in *Rinorea macrocarpa*. In this species a conical ovary tapers into a style, which itself is also conical. The ovary may be glabrous or hairy. The indument, which is often present, may be pilose(ulous), strig(ill)ose, hispid(ulous), puberulous, villose or villosulous. The ovary of *R. riana* is typified by the 'spiny' hispid hairs. The ovaries vary from greenish to whitish.

Style and stigma. The style is completely glabrous or is pilosulous at the base. The hairs of the ovary and the style are whitish, golden, ferruginous or maroon. The style is filiform and may be erect, curved or sigmoid. The stigma is usually truncate, occasionally capitate, pulvinate or trilobed, and mostly erect, but in some species deflexed. *Rinorea macrocarpa* is the only neotropical species in which the style is conical and apically provided with a pulvinate stigma. When styles and stigmas are curved they are always deflexed towards the anterior petal. Such a condition expresses a trend to zygomorphy in primitively actinomorphic flowers.

A survey of all different kinds of styles and stigmas in neotropical species of *Rinorea* is set forth below. Some of them are illustrated in Figure 8 and the style of *R. uxpanapana* is illustrated in Figure 25.

1. *Shape of style:*

- 1a. Filiform: most common, in all species but the following;
- 1b. (Sub)clavate: *R. laurifolia*, *R. maximiliani*, *R. laevigata*, *R. ramiziana*, *R. lindeniana*, *R. villosiflora*;
- 1c. Conical: *R. macrocarpa*.

2. *Style erect, curved or sigmoid:*

- 2a. Erect to slightly curved: most common, in all species but the following;
- 2b. Distinctly curved: *R. apiculata*, *R. hirsuta*, *R. ulmifolia*;
- 2c. Sigmoid: *R. multivenosa*, *R. paniculata*, *R. lindeniana* var. *lindeniana*.

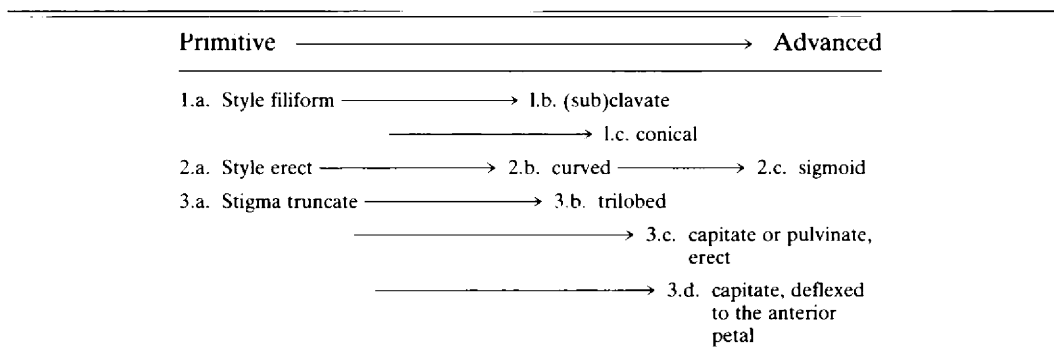
3. *Shape of stigma:*

- 3a. Truncate: most common, in all species but the following;
- 3b. Trilobed, deflexed towards the anterior petal: *R. uxpanapana*;
- 3c. Capitate or pulvinate, erect: *R. macrocarpa*, *R. hirsuta*;
- 3d. Capitate, deflexed towards the anterior petal: *R. sprucei* and sometimes in *R. paniculata*.

If we consider a filiform and erect style as most primitive, as opposed to a conical and curved or sigmoid style, and a truncate stigma as most primitive as opposed to other differentiated shapes, we may infer the possible evolutionary trends in the gynoeceum as expressed in Table V.

Reduced flowers.—Reduced flowers can be

Table V
Shape of styles and stigmas of neotropical *Rinorea*. Sketch of possible evolutionary pathways

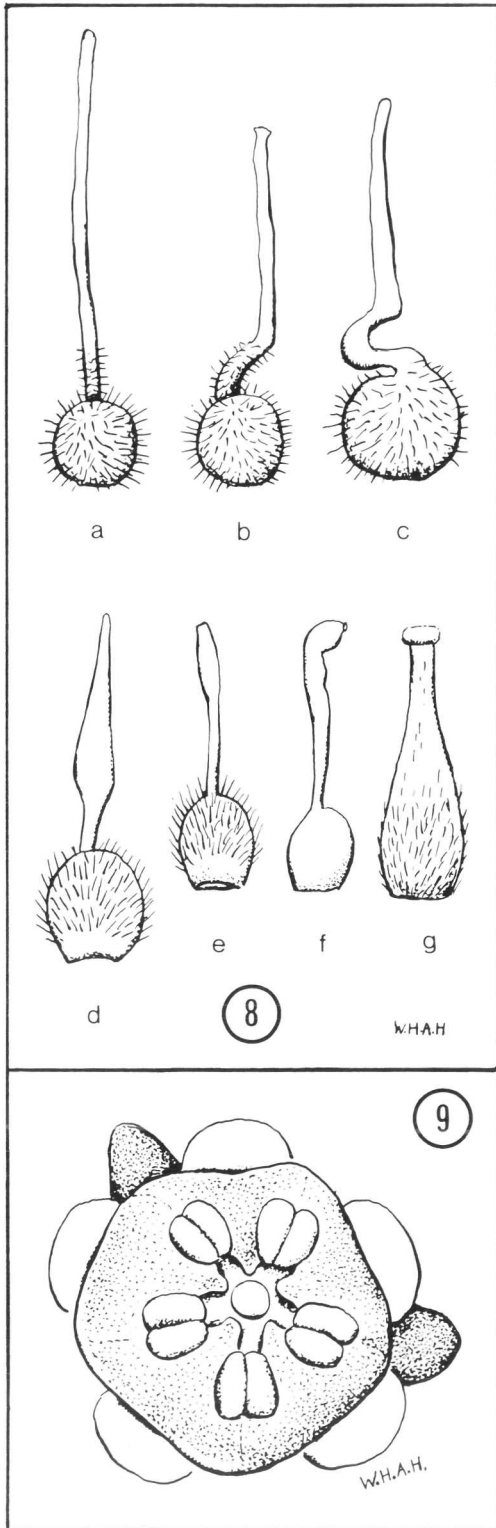


found in the axils of the uppermost bracts (= 'bractlets' in the Taxonomic Treatment) of the lateral cymules of thyrsoid inflorescences (e.g., *Rinorea oraria*, *R. laevigata* and *R. sprucei*). Such flowers (Fig. 9) have reduced sepals and petals, a reduced androecium with minute anthers and a gynoeceum consisting of a minute ovary with a reduced style and stigma. Presumably these minute flowers are cleistogamous, just as in species of *Viola*, *Hybanthus*, etc., in the *Viola*-ceae. A specimen of *R. sprucei* (Ducke 7107) has a cleistogamous flower with a reduced juvenile fruit; adult fruits setting ripened seeds are unknown as yet.

Capsule.—The capsule is unilocular, and loculicidal into three valves. Floral parts, such as sepals, petals, stamens and styles, are usually soon caducous upon fruit set, but in some species floral parts are subpersistent at the base of the ripened capsule, e.g., in *Rinorea apiculata*, *R. crenata*, *R. haughtii*, *R. multivenosa*, *R. laevigata*, *R. ramiziana*, *R. guianensis*, *R. paniculata*, *R. lindeni*, *R. dasyadena*, *R. villosiflora*, *R. sprucei* and *R. vaupesana*. The presence of floral parts at the base of the capsule is very useful in specimens with only fruits, since they can supply the additional floral characters needed for species determination. It is curious that in *R. pubiflora* var. *grandifolia* floral parts (including reduced stamens or staminodes) are subpersistent at the base of ripened capsules, whereas floral parts with completely developed stamens are wanting in fruiting specimens of var. *pubiflora* of the same species. If the style is subpersistent, it will remain undivided at the apex of one of the dehiscing

valves. The capsule of most of the species is more or less symmetric and dehiscent into more or less equal valves. In some species the capsule is predominantly unequal and therefore dehiscent into three unequal valves. That is, usually one valve is distinctly larger than the other two, as in *R. apiculata*, *R. guianensis*, *R. paniculata*, *R. lindeni*, *R. villosiflora*, *R. racemosa*, *R. sprucei* and *R. vaupesana*. The heavy suture lines on the dorsal side of the valves are involved in the mechanism of dehiscence. Dehiscence being loculicidal, the marginal placentae of the original carpels appear in the median parts of the valves. Each valve may contain 1–3(–4) seeds on the (fused marginal = parietal) placenta. Capsules of neotropical species of *Rinorea* are coriaceous or subligneous, mostly more or less distinctly venose and usually hairy. Glabrous capsules are uncommon in neotropical *Rinorea* and are known only from *R. apiculata*, *R. crenata*, *R. haughtii*, *R. flavescens*, *R. racemosa* and *R. sprucei*. The venation is usually obscure, but markedly pronounced in two related species, *R. viridifolia* and *R. squamata*.

According to field data the color of the valves is usually greenish, although sometimes flushed with orange, red or brown, and the veins may be more intensively colored than the valves themselves. Younger, greenish capsules may also turn reddish later on when ripened, as is observed in *R. flavescens*, or to reddish brown and maroon, as in *R. racemosa*. Juvenile capsules of *R. macrocarpa* are also greenish, but this species is probably the only one in the neotropics in which they become yellowish-white when completely ripened. The color of the indument may be whitish,



golden, orange-brown, ferruginous or maroon, which gives an additional touch to the original color of the capsule. The indument, if present, consists mainly of pilose(ulous), puberulous, strig(ill)ose, hispid(ulous), hirsute to hirtellous and villose to villosulous hair types, or is composed of a combination of these types; all the different kinds of indument vary from dense to sparse. A velutinous indument on capsules is rare and as yet has been observed in only three species: *R. bahiensis*, *R. riana*, and *R. villosiflora*. The velutinous indument of the latter two species is in combination with sparsely pilose. A transition between velutinous to pruinose can be found only on the capsules of *R. hirsuta*.

Seeds.—Seeds of *Rinorea* are glabrous or pilosulous, with the indument golden or brownish. The base of the seeds is provided with a caruncle, attractive to ants. On specimens of *R. pubiflora* ants have been observed living in and on fruits with seeds. On the other hand, ants have not been noticed on fruits in which the seeds were damaged or lacking. The apex of the seeds may be provided with a flattened spot, circular or elliptic in outline, the so-called 'areola'. The testa is usually pergamentaceous. The seeds are richly provided with endosperm, in which an erect embryo is embedded (Eichler, 1871; Melchior, 1925a, 1925b). Some plant collectors have observed birds eating fruits and seeds of *R. lindenniana*. Neither is it excluded that fruit- and seed-eating piranhas catch fruits and seeds dropped into the water when the 'habitat' is flooded. Such foraging on fruits by these fish has been recorded for other tree(let)s in flooded areas of Amazonia.

FIG. 8. Some of the variations in shape and structure of the gynoecium in neotropical *Rinorea*. **a.** *R. guatemalensis*: ovary globose, style filiform, erect. **b.** *R. ulmifolia*: ovary globose, style filiform, curved basally. **c.** *R. multivenosa*: ovary subglobose, style filiform, sigmoid curved basally. **d.** *R. laurifolia*: ovary subglobose, style subclavate, erect to slanting. **e.** *R. villosiflora*: ovary subglobose, style subclavate, erect. **f.** *R. sprucei*: ovary subglobose, style subclavate, erect; stigma capitate, directed to the anterior petal. **g.** *R. macrocarpa*: ovary \pm conical, tapering into the style; apical stigma erect, not directed to the anterior petal, pulvinate.

FIG. 9. Reduced flowers of *Rinorea apiculata*: ovary with reduced style and stigma, surrounded by a filamental tube with reduced thecae, petals, and sepals (not visible). Flowers subtended by two bractlets.

CYTOLOGY

Rinorea flavescens is the only species for which chromosome numbers have been counted: where $2n = 24$. The chromosomes are small. This datum has not been given in the literature, but found, rather, on a herbarium label belonging to the specimen *Baldwin 4027* from Belém (Brazil, Pará).

HYBRIDIZATION

Detailed discussion about possible introgressive hybridization between certain taxa of *Rinorea* is presented after the descriptions of the taxa concerned. Introgressive hybridizations are supposed to have occurred:

1. between the species pair *R. guianensis*–*R. bahiensis*;
2. between *R. squamata* and regional races of *R. pubiflora* in Panama;
3. between *R. camptoneura* (belonging to the complex of three closely related species *R. flavescens*, *R. falcata*, and *R. camptoneura*) and regional races of *R. pubiflora* in Amazonia;
4. between *R. ovalifolia* and regional races of *R. pubiflora* in Venezuela;
5. between *R. lindeniana* and *R. riana*(?) in Colombia; and
6. mutually in the complex of the three closely related species *R. flavescens*, *R. falcata* and *R. camptoneura*, resulting in the species pair *R. falcata*–*R. camptoneura*.

In the case of *R. pubiflora* and *R. lindeniana* such hybridizations have probably resulted in the infraspecific taxa known in these species at present. The infraspecific taxa of *R. pubiflora* are probably not homogeneous.

INTERGENERIC RELATIONSHIPS

Rinorea and *Rinoreocarpus* are probably more closely related to each other than either is to *Gloeospermum*, since both genera have dehiscent capsules. Fruits of *Gloeospermum*, on the other hand, are indehiscent, an uncommon feature in the Violaceae. In an evolutionary sense, *Rinorea* seems to be more advanced than *Rinoreocarpus* or *Gloeospermum* in some features. *Rinorea* has a lower number of ovules, 1–4 in each of the

three carpels, versus 6–10 per carpel in *Rinoreocarpus*, and the still higher number, 7–22 per carpel in *Gloeospermum*. Since a lower number of ovules is considered as more advanced than a higher number, *Gloeospermum* seems to be more primitive in this respect than either *Rinorea* or *Rinoreocarpus*, in contrast to that of the indehiscent nature of its fruit.

With respect to androecial characters, in most neotropical *Rinorea* species the filaments are more or less free, as in *Rinoreocarpus*, and three species of *Gloeospermum*. In some subgroups of *Rinorea* and most species of *Gloeospermum*, the filaments are fused into a tube. *Rinoreocarpus* seems to be more primitive than *Rinorea* with respect to the connective scales which are appendages of the thecae. In the former these are subulate, linear, or narrowly deltoid, a character shared only with *Gloeospermum grandifolium*. In *Rinorea*, however, they are distinctly and widely laminar. Exclusively apical connective scales, in *Rinorea*, are postulated to be more primitive than apical plus lateral ones. Apical connective scales occur in three *Rinorea* species, *R. apiculata*, *R. crenata*, and *R. oraria* only, as well as *Rinoreocarpus* and all species of *Gloeospermum*. Apical connective scales of *Gloeospermum* are laminar (except for *G. grandifolium*).

Hypothesizing that more complicated structures have evolved from less complicated ones, we conclude that a possible evolutionary trend in the shape of the connective scales in these three genera proceeded as follows: (1) subulate, linear, or narrowly deltoid apical connective scales (*Rinoreocarpus*, *Gloeospermum grandifolium*); (2) laminar apical connective scales (all other *Gloeospermum* and *Rinorea apiculata*, *R. crenata*, and *R. oraria*); and (3) apical and lateral laminar scales (all other *Rinorea*).

Such common evolutionary trends in the androecia of the three genera support my opinion about their close relationship.

INFRAGENERIC RELATIONSHIPS

Since paleotropical species are excluded from this monograph, I have refrained from proposing a formal subgeneric classification and have confined myself to a provisional subdivision of neotropical *Rinorea* into 'groups.' Two 'super-groups' are distinguished: Supergroup I.

Apiculata, characterized by the presence of exclusively apical connective scales, and Super-group II. *Rinorea*, characterized by the presence of lateral as well as apical connective scales. Super-group II. *Rinorea* has been further subdivided into three Groups, IIa, IIb, and IIc. The species of Group IIa. *Rinorea* have alternate laminar leaves, and inflorescences with a distinct central axis and varying from thyrsoïd to (pseudo)racemose. Leaves of *R. uxpanapana*, the only species in Group IIb. *Uxpanapana*, are dimorphic; minute sessile scale-like leaves occur near the base and larger petiolate laminar leaves occur near the apex of the branchlets; the arrangement is predominantly alternate, but the apical laminar leaves tend secondarily to an apparently sub-opposite position; the inflorescences are subglomerulate and consist of small reduced cymules, 1–3 fasciculate in the axils of both kinds of leaves; the peduncles of the cymules are only 0–0.25 mm long. In the species of Group IIc. *Pubiflora*, petiolate laminar leaves are predominant and have become apparently opposite; the scale-like leaves have become inconspicuous at the base of each inflorescence and are soon deciduous. Finally, all the groups are subdivided into subgroups of more or less closely related species. Descriptions of all such groups are given in the Taxonomic Treatment, before those of the included species.

ECOLOGY

Most of the neotropical species of *Rinorea* occur as trees and treelets in the understorey of tropical rain forests, where they are often locally common. Some also occur in gallery, deciduous, and savanna forests (e.g., *R. laevigata*, *R. ramiziana*, *R. uxpanapana*, *R. ovalifolia*, *R. endotricha*). One species, *R. sprucei*, is known not only from tropical rain forests, but also from scrub. Most of the species are recorded from lowland tropical rain forests, or hilly and (sub)montane regions. Four species occasionally reach the cloud forest zone: *R. crenata*, *R. pubiflora*, *R. lindeniana*, and *R. dasyadena*. In these areas species have been collected on summits, ridges, and slopes of hills and mountains, in gullies and valleys, and along rapids, rivers, streams, and creeks. In lowlands they may occur in uninundated or only periodically inundated areas. In the Andean region, species can be found on both sides of the Cordilleras.

Rinorea species can be found on different soil types, of which the most common are ferro-bauxitic, ferro-lateritic, clayish, loamy, or sandy. Some species are also known from granitic or volcanic outcrops and schistose soils. *Rinorea uxpanapana* grows with *R. hummelii*, *R. guatemalensis*, and *R. deflexiflora* on karst limestone occurring on the Isthmus of Tehuantepec in Mexico (Th. Wendt, 1983, pers. comm.); they are the only species recorded from this soil type.

Rinorea species are usually found between 0 and 700 m, but some species may reach higher altitudes, e.g., *R. dasyadena* (0–1000 m), *R. lindeniana* (0–1200 m), *R. pubiflora* (0–1300 m), *R. hummelii* (0–1800 m), *R. guatemalensis* (0–2000 m), and *R. crenata* (0–2500 m). These extreme altitudes have been recorded from the Caribbean side of tropical Central America. The last four species reach the cloud forest zone.

DISTRIBUTION

General

Rinorea is a pantropical genus with four centers of distribution: (1) Tropical America (48 species); (2) Tropical Africa, including Madagascar (ca. 100 species); (3) India–SE Asia (ca. 12 species); (4) Australian–Pacific area (ca. two species) (Fig. 10).

The neotropical area of distribution, with 48 species, extends from Mexico, via Brazil, to Bolivia and Paraguay. Species can be found on both sides of the Cordilleras. Interestingly enough, the genus does not occur in the West Indies. It can be subdivided, according to phytogeographic criteria, roughly as follows: (a). SE Brazil (E Brazilian Shield) (five species); (b). Amazonia (Central Brazilian Shield, southern part of the Guiana Shield, and the Amazon Basin in between) (22 species); (c). Guianas (northern part of the Guiana Shield) (15 species); (d). Trinidad (continental island) (three species); (e). Andean region (on both sides of the Cordilleras: adjacent regions included) (24 species); (f). Central America (14 species). The total number is greater than 48 because some species overlap into more than one regional area of distribution.

The distribution patterns of all the species are completely correlated with present-day areas of humid forest types in the neotropics (see map—

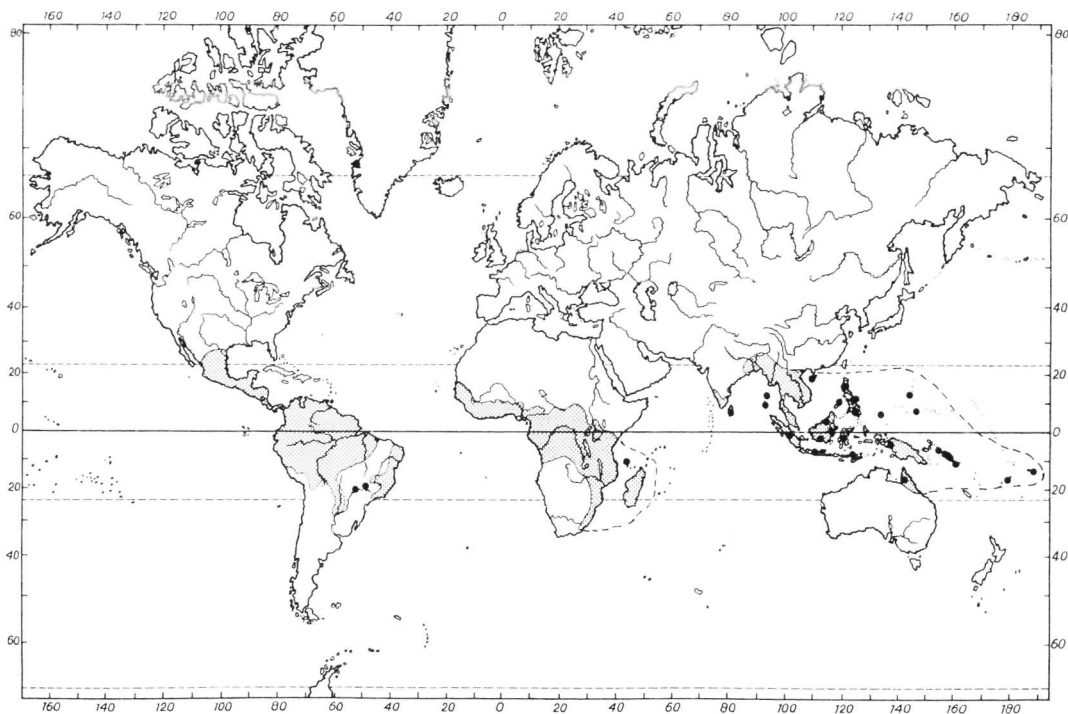


FIG. 10. Distribution of the pantropical genus *Rinorea*.

fig. 1 in Mori et al., 1981), except for the West Indies, where *Rinorea* is wanting, as noted above.

Distribution Patterns

Rinorea species distribution patterns are diverse. They will be discussed here after the survey of the Regional Floras, the Flora Elements, the Disjunctions and more extensively in the Taxonomic Treatment after the descriptions of the taxonomic groups and the taxa to which they belong, taking into account paleogeographic data as well as interpretations of forest refugia. Paleogeographic data are mainly based on Martin in Fittkau (1968), Putzer in Fittkau (1968), Maguire (1970), Raven and Axelrod (1974), van der Hammen (1974), Steyermark (1974, 1979), Krook (1979) and Coney (1982). Interpretations of forest refugia in the Taxonomic Treatment are mainly based on Haffer (1969), Maguire (1970), Langenheim et al. (1973), Prance (1973, 1979a, 1982a, 1982b), Steyermark (1974, 1979, 1982), Brown (1977, 1982) and Krook (1979). For the location of the forest refugia mainly used in the

Taxonomic Treatment we followed the geographical subdivision of Brown, slightly modified more or less according to Prance. First, a survey of the regional floras of *Rinorea* is given, secondly a survey of Flora Elements and finally a survey of Disjunctions. In a summary we shall also deal briefly with migration, speciation, dispersal and distribution in *Rinorea*, based on the discussions in the Taxonomic Treatment after the description of groups, species and varieties concerned.

Survey of the Regional Floras

Ten geographical and/or political regions are listed, and the species found there are catalogued. Cross-references are given where species are found in more than one such region, using the following symbols: A = Amazonian region, AndC = Andean region (outside Venezuela), AndV = Andean region (inside Venezuela), CA = Central America, E = Endemic s.str., F = French Guiana, G = Guyana, O = Orinoco delta, S = Surinam, SE = SE Brazil.

1. Mexico, Central America: total number of 14 species. Four species are in common with Amazonia, seven in common with the Andean region, and four are endemic s.str.

Rinorea brachythrix (CA, E), *R. crenata* (CA, E), *R. dasyadena* (AndC, CA), *R. deflexiflora* (CA), *R. guatemalensis* (CA), *R. hirsuta* (AndC, CA, E), *R. hummelii* (CA), *R. lindeniana* (A, AndC, AndV, CA, G, S), *R. paniculata* (A, AndC, CA), *R. pubiflora* (A, AndC, AndV, CA, F, G, O, S), *R. squamata* (CA), *R. sylvatica* (AndC, CA), *R. uxpanapana* (CA, E), *R. viridifolia* (CA, A, AndC).

2. Colombia: total number of 25 species. Eighteen species occur in the Andean region, of which seven are endemic s.str., and one is in common with the Andean region of Venezuela, the Orinoco delta, and adjacent Guyana. Fourteen species occur in the Amazon region, of which two are endemic s.str. Six species are in common with Central America, of which one is endemic s.str.

Rinorea amapensis (A, F, S), *R. antioquiensis* (AndC, E), *R. camptoneura* (A), *R. cordata* (AndC, E), *R. dasyadena* (AndC, CA), *R. falcata* (A, AndV, F, G, O, S), *R. flavescens* (A, AndC, CA?, F, G, O, S), *R. haughtii* (AndC, E), *R. hirsuta* (AndC, CA, E), *R. hymenosepala* (AndC, E), *R. laurifolia* (AndC, E), *R. lindeniana* (A, AndC, AndV, CA, G, S), *R. macrocarpa* (A, AndC, F, S), *R. marginata* (AndC, E), *R. melanodonta* (AndC, AndV, G, O), *R. multivenosa* (A, E), *R. neglecta* (A, AndC, F, G, S), *R. paniculata* (A, AndC, CA, F), *R. pubiflora* (A, AndC, AndV, CA, F, G, O, S), *R. racemosa* (A), *R. sprucei* (A), *R. sylvatica* (AndC, CA), *R. ulmifolia* (AndC, E), *R. vaupesana* (A, E), *R. viridifolia* (A, AndC, CA).

A twenty-sixth species, *Rinorea ovalifolia*, may be expected, since specimens have been collected on the eastern bank of the upper Río Negro, just over the Venezuelan border.

3. Venezuela: total number of 17 species. Fourteen species occur in the Amazonian region, of which one is endemic. Six species occur in the Andean region of Venezuela, Apure and the Coastal Cordillera included, of which one is endemic, and another occurs also in a restricted area of the Orinoco delta and adjacent Guyana, as well as along the Caribbean coast of Colombia. One species is endemic in the Orinoco delta and adjacent region of Guyana.

Rinorea camptoneura (A), *R. endotricha* (E, G, O), *R. falcata* (A, AndV, F, G, O, S), *R. flavescens* (A, AndC, CA?, F, G, O, S), *R. guianensis* (A, AndV, F, SE), *R. lindeniana* (A, AndC, AndV, CA, G, S), *R. macrocarpa* (A, AndC, F, S), *R. melanodonta* (AndC, AndV, G, O), *R. neglecta* (A, AndC, F, G, S), *R. oraria* (AndV, E), *R. ovalifolia* (A), *R. paniculata* (A, AndC, CA, F), *R. pubiflora* (A, AndC, AndV, CA, F, G, O, S), *R. racemosa* (A), *R. riana* (A, F, G, O, S), *R. sprucei* (A), *R. vaupesana* (A, E).

An eighteenth species, *R. amapensis*, may be expected, since a specimen has been collected on the western bank of the Río Guainía, Colombia, opposite the Venezuelan town of Moroa.

4. Trinidad: total number of species, three, originating from northern Venezuela.

Rinorea lindeniana (A, AndC, AndV, CA, G, S), *R. melanodonta* (AndC, AndV, G, O), *R. riana* (A, F, G, O, S).

5. Guianas: total number of 15 species. Nine species occur in Guyana, nine in Surinam, and 12 in French Guiana, of which one is endemic. Six species are in common with the Orinoco delta, of which one occurs in a more restricted area and another is strictly endemic.

Rinorea amapensis (A, F, S), *R. bahiensis* (F, SE), *R. brevipes* (A, F, G, S), *R. endotricha* (E, G, O), *R. falcata* (A, AndV, F, G, O, S), *R. flavescens* (A, AndC, CA?, F, G, O, S), *R. guianensis* (A, AndV, F, SE), *R. lindeniana* (A, AndC, AndV, CA, G, S), *R. macrocarpa* (A, AndC, F, S), *R. melanodonta* (AndC, AndV, G, O), *R. neglecta* (A, AndC, F, G, S), *R. paniculata* (A, AndC, CA, F), *R. pectino-squamata* (F, E), *R. pubiflora* (A, AndC, AndV, CA, F, G, O, S), *R. riana* (A, F, G, O, S).

6. Ecuador: total number of six species. Five species occur in the Amazonian region, and three in the Andean region, of which one is endemic.

Rinorea apiculata (A, AndC), *R. deflexa* (AndC, E), *R. flavescens* (A, AndC, CA?, F, G, O, S), *R. lindeniana* (A, AndC, AndV, CA, G, S), *R. pubiflora* (A, AndC, AndV, CA, F, G, O, S), *R. viridifolia* (A, AndC, CA).

7. Peru: total number of 12 species. All 12 species occur in the Amazonian region, of which eight are also in the Andean region, with no strictly endemic species. "AndV" means (also) occurring in the Andean region of Venezuela.

Rinorea apiculata (A, AndC), *R. brevipes* (A,

F. G. S). *R. camptoneura* (A), *R. falcata* (A, AndV, F. G. O. S), *R. flavescens* (A, AndC, CA?, F. G. O. S), *R. guianensis* (A, AndV, F. SE), *R. lindeniana* (A, AndC, AndV, CA, G. S), *R. macrocarpa* (A, AndC, F. S), *R. neglecta* (A, AndC, F. G. S), *R. pubiflora* (A, AndC, AndV, CA, F. G. O. S), *R. racemosa* (A), *R. viridifolia* (A, AndC, CA).

8. Brazil: total number of 25 species. Twenty-one species occur in the Amazonian region and five in SE Brazil. There are seven endemic species, s.str.

Rinorea amapensis (A, F, S), *R. bahiensis* (F, SE), *R. bicornuta* (A, E), *R. brevipes* (A, F, G, S), *R. camptoneura* (A), *R. falcata* (A, AndV, F. G. O. S), *R. flavescens* (A, AndC, CA?, F. G. O. S), *R. guianensis* (A, AndV, F. SE), *R. laevigata* (SE), *R. lindeniana* (A, AndC, AndV, CA, G. S), *R. longistipulata* (A, E), *R. macrocarpa* (A, AndC, F, S), *R. maximiliani* (E, SE), *R. multivenosa* (A, E), *R. neglecta* (A, AndC, F. G. S), *R. ovalifolia* (A), *R. paniculata* (A, AndC, CA, F), *R. pubiflora* (A, AndC, AndV, CA, F. G. O. S), *R. racemosa* (A), *R. ramiziana* (E, SE), *R. riana* (A, F. G. O. S), *R. sprucei* (A), *R. vaupesana* (A, E), *R. villosiflora* (A, E), *R. viridifolia* (A, AndC, CA).

9. Bolivia: total number of four species. All four species occur in the Amazonian region, and there are no endemic species.

Rinorea lindeniana (A, AndC, AndV, CA, G. S), *R. ovalifolia* (A), *R. pubiflora* (A, AndC, AndV, CA, F. G. O. S), *R. viridifolia* (A, AndC, CA).

10. Paraguay: total number of one species. It belongs to the SE Brazilian region.

Rinorea laevigata (SE).

A second species, *R. ovalifolia*, belonging to the Amazonian region, also may be expected here, since it has been collected on the Brazilian bank of the Rio Paraguay.

Flora Elements, According to Their Centers of Distribution

1. SE Brazilian element (E Brazilian Shield): *Rinorea maximiliani*, *R. laevigata*, *R. ramiziana*, *R. bahiensis*.
2. Amazonian element s.l. (southern part of the Guiana Shield, Central Brazilian Shield and the Amazon Basin in between):
 - 2a. Amazonian element s.str. (total Amazon Basin): *Rinorea guianensis*, *R. panicu-*

lata, *R. macrocarpa*, *R. pubiflora*, *R. flavescens*, *R. falcata*, *R. neglecta*, *R. ovalifolia*, *R. racemosa*

- 2b. W Amazonian element: *Rinorea camptoneura*, *R. lindeniana*.
- 2c. NW Amazonian element: *Rinorea sprucei*, *R. vaupesana*.
- 2d. SW Amazonian element: *Rinorea multivenosa*, *R. longistipulata*, *R. bicornuta*, *R. viridifolia*.
- 2e. SE Amazonian element: *Rinorea villosiflora*.
3. Guayana element (Guiana Shield): *Rinorea amapensis*, *R. brevipes*, *R. riana*, *R. pectinosquamata*.
4. Venezuela–W Guyana element: *Rinorea melanodonta* (also in Colombia), *R. endotricha*.
5. Coastal Cordillera element: *Rinorea oraria*.
6. SW Andean element:
 - 6a. On both sides of the Cordilleras (Ecuador & Peru): *Rinorea apiculata*.
 - 6b. Only W of the Cordilleras (Ecuador): *Rinorea deflexa*.
7. NW Colombian element (between or W of the Cordilleras): *Rinorea cordata*, *R. haughtii*, *R. laurifolia*, *R. antioquiensis*, *R. marginata*, *R. ulmifolia*, *R. hymenosepala*.
8. NW Colombian–Central American element: *Rinorea hirsuta*, *R. dasyadena*, *R. sylvatica*.
9. Central American element s.l.:
 - 9a. Central American element s.str. (over wider area): *Rinorea crenata*, *R. squamata*, *R. deflexiflora*, *R. guatemalensis*, *R. hummelii*.
 - 9b. Panama: *Rinorea brachythrix*.
 - 9c. Mexico (Vera Cruz): *Rinorea uxpanapana*.

Disjunct Areas

1. SE Brazil–French Guiana: *Rinorea bahiensis*.
2. Amazonia–SE Brazil: *Rinorea guianensis*.
3. Amazonia–S of Cordillera (Apure, Venezuela): *Rinorea falcata*, *R. pubiflora*, *R. lindeniana*.
4. Amazonian–Orinoco area–Coastal Cordillera (Venezuela, Catatumbo included): *Rinorea guianensis*, *R. pubiflora*, *R. lindeniana* (W Amazonia).
5. Orinoco area (and adjacent western Guyana)–Coastal Cordillera (Venezuela)–Caribbean coast of Colombia: *Rinorea melanodonta*.

6. Amazonia—Colombia, E of the Cordilleras (Villavicencio): *Rinorea pubiflora*, *R. lindeniana* (W Amazonia).
7. Amazonia—NW Colombia and adjacent Central America: *Rinorea paniculata*, *R. viridifolia* (W Amazonia), *R. pubiflora*, *R. flavescens* (bordering Central America), *R. lindeniana* (W Amazonia).
8. Amazonia—both sides of Cordilleras in Ecuador and Peru: *Rinorea apiculata*, *R. viridifolia*.

Concluding Remarks

1. *Rinorea* is a pantropical genus with three centers of speciation: a. Tropical America with 48 species; b. Tropical Africa with ± 100 species; c. SE Asiatic—Australian—Oceanic region with 13 species. Each center has its own sets of species and none occurs outside its own center of speciation.

Since ± 100 species occur in tropical Africa and 48 species in tropical America, a differentiation of the genus *Rinorea* on Gondwanaland before its breakup is not excluded. The SE Asiatic—Australian—Oceanic region, with its own species of *Rinorea* as well as its own endemic genera related to *Rinorea*, can be considered as a tertiary center of differentiation with a history of its own, subsequent to migration of genetic material from the African part of Gondwanaland.

2. In tropical America the highest species diversity is found in Amazonia, the second highest in the Andean region and Central America, and the third highest in the Guianas and SE Brazil. The genus is entirely absent from the Caribbean area.

Neotropical speciation centers of *Rinorea* can be found in: (a.) the Central Brazilian Shield; (b.) the Guiana Shield; (c.) the East Brazilian Shield; (d.) the Andean region (since the high uplift of the Cordilleras in the Pliocene); and (e.) in Central America (after closure of the Panama land bridge since the Pliocene) (a, b, and c are rigid, solid Precambrian shields containing stable forest refugia since the early Tertiary).

3. Since nearly all species of *Rinorea* are bound to their natural habitat of tropical rain forests, their history of distribution and speciation is strictly connected with the history of the tropical rain forest (e.g., the occurrence and dimensions of the forest refugia).

4. The disjunct occurrence of species and endemism in southeastern Brazil is explained also by a split-up of an originally continuous area of tropical rain forest, in the totality of tropical South America, into a cluster of Amazonian forests and that of southeastern Brazil. This split-up was caused by a climate change during the Pliocene from a continuous warm humid climate to a dryer and cooler type with oscillating periods (van der Hammen, 1974). Periodical retreats and extensions of tropical rain forests, in Amazonia as well as in southeastern Brazil, were correlated with these climatic oscillations.

5. Isolation, diversification and speciation were stimulated by these repeated retreats and extensions of tropical rain forests over all tropical America.

6. Species endemism in the Andean region and Central America is explained primarily by migration and isolation of populations caused by mountain building and the formation of the Panama land bridge in the late Tertiary and secondarily by repeated retreats and extensions of tropical rain forests.

7. Since the isolated Mexican species *R. uxpanapana* seems to be more closely related to paleotropical than to neotropical species, the origin of this species is probably earlier than the postulated formation of the Panama land bridge, 5.7 my BP. Its ancestral population possibly migrated from South America, where it is now extinct, through the Proto-Greater Antilles Arch to Mexico.

8. The Rio Casiquiare is an important migration route between the Amazon Basin and the Orinoco Basin. The lower Amazon Basin might have been a barrier for north- and southward migrating species.

USES

The leaves of *Rinorea laevigata* ('lobolobo') become mucilaginous when cooked and are eaten by the local population in the environs of the city of Rio de Janeiro with their food. The leaves acquire a more agreeable taste if the shrubs are planted in a good soil under the shade of trees, in order to blanch them (Auguste de Saint Hilaire, quoted by Don, 1831).

The local Surinam names 'Dreeritiki' and 'Drilstokje' for *R. pubiflora* and *R. flavescens* in-

dicates that their branchlets can be used as stirring sticks for mixing drinks. For this purpose branchlets with 3–6 lateral branchlets on a fused nodular structure are taken; these 3–6 lateral branchlets are cut off near their base which results in a 'spider' at the apex of older branchlets.

The local Surinam name 'Maniritiki' for *R. brevipes*, *R. pubiflora*, *R. riana*, *R. falcata* and *R. neglecta* implies that their branchlets and twigs thereof are used for making sieves. For other local names see under the descriptions of the taxa as well as in the Index of Local Names (p. 203).

TAXONOMIC TREATMENT

Subfamily Violaceae.

Tribe Rinoreae Reiche & Taubert, 1895.

Subtribe Rinoreinae Melchior, 1925.

1. Rinorea Aublet, Hist. pl. Guiane **1**: 235. 1775, nom. cons.; Poir. Encycl. **6**: 211. 1804; Schultes cur. post., Syst. veg. ed. 15. **5**: 325. 1819; A. P. de Candolle, Prodr. **1**: 313. mid Jan 1824; G. Don, Gen. hist. **1**: 341. early Aug 1831 ('1831–1838'); Baillon, Hist. pl. **4**: 349. 1873; Kuntze, Revis. gen. pl. **1**: 41. 1891; Reiche & Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. 1. **3(6)**: 329. 1895; Blake in P. C. Standley, Contr. U.S. Natl. Herb. **23(3)**: 838. 1923; Contr. U.S. Natl. Herb. **20(13)**: 491. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 349. 1925; Standley & Record, Publ. 350, Field Mus. Nat. Hist., Bot. Ser. **12**: 265. 27 Jan 1936; L. Williams, Publ. 377, Field Mus. Nat. Hist., Bot. Ser. **15**: 350. 31 Dec 1936; Standley, Publ. 392, Field Mus. Nat. Hist., Bot. Ser. **18**: 715. 1937; Baehni & Weibel, Candollea **8**: 192. May 1941; Baehni & Weibel in Macbride, Publ. Field Mus. Nat. Hist., Bot. Ser. **13(41)**: 58. 30 Jun 1941; Lemée, Fl. Guyane franç. **3**: 58. 1953; Smith & Fernández-Perez, Caldasia **6(28)**: 87. 1954; Standley & L. O. Williams, Fieldiana, Bot. **24(71)**: 77. 1961; A. Robyns in Woodson, Schery & Coll., Ann. Missouri Bot. Gard. **54**: 66. 1967; Aristeguieta, Fam. Gén. Arb. Venez. **794**. 1967; Soukup, Biota **8(62)**: 96. 1970; da Silva & Dames e Silva, Rodriguésia **27(39)**: 193. 1974. Type species. *Rinorea guianensis* Aublet, Hist. pl. Guiane **1**: 235. t. 93. 1775 (Fig. 11, diagram).

Conohoria Aublet, Hist. pl. Guiane **1**: 239. 1775; Schultes cur. post., Syst. veg. ed. 15. **5**: 324. 1819; Kunth in Humboldt, Bonpland & Kunth, Nov. gen. sp. **5(23)**: 301(folio), 306(quarto). 24 Mar 1823 ('1821') ('*Conoria*'); de Gingins ex A. P. de Candolle in A. P. de Candolle, Prodr. **1**: 312. mid Jan 1824; Kunth, Syn. pl. **3**: 305. 28 Feb 1824; A. de Saint Hilaire, Pl. usuel, bras. **4–5**: pl. 10. 12 Jun 1824; Hist. pl. remarq. Brésil. **1**: 319. Jun 1824; Mém. Mus. Hist. Nat. **11**: 493. 1824; Fl. Bras. merid. **2(13)**: 106. 1829 (folio); Fl. Bras. merid. **2(14)**: 148. 8 May 1830 ('1828') (quarto); G. Don, Gen. hist. **1**: 340. early Aug 1831 ('1831–1838') ('*Gonohoria*'); Spach, Hist. nat. vég. Phan. **5**: 523. Jun 1836 ('*Conoria*'); D. Dietrich, Syn. pl. **1**: 831. Jul 1839. Type species. *Conohoria flavescens* Aublet, Hist. pl. Guiane **1**: 239. t. 95. 1775.

Passoura Aublet, Hist. pl. Guiane suppl. **2**: 21. 1775; Poir. Encycl. **5**: 49. 1804. Type species. *Passoura guianensis* Aublet, Hist. pl. Guiane suppl. **2**: 21. t. 380. 1775.

Riana Aublet, Hist. pl. Guiane **1**: 237. 1775; Poir. Encycl. **6**: 196. 1804. Type species. *Riana guianensis* Aublet, Hist. pl. Guiane **1**: 237. t. 94. 1775.

Alsodeia Du Petit-Thouars, Hist. vég. isles austral. Afrique: **55**. 1805; Martius, Nov. gen. sp. pl. **1**: 27. late 1823 or Jan–Feb 1824 ('1823–1832') ('*Alsodea*'); de Gingins in A. P. de Candolle, Prodr. **1**: 313. mid Jan 1824; Sprengel, Syst. veg. ed. 16. **1**: 806. 1825 ('*Alsodea*'); G. Don, Gen. hist. **1**: 341. early Aug 1831 ('1831–1838') ('*Alsodea*'); D. Dietrich, Syn. pl. **1**: 831. Jul 1839 ('*Alsodea*'); Endlicher, Gen. pl. **11**: 911. Nov 1839; Tulasne, Ann. Sci. Nat., Bot. Sér. **3**. **7**: 364. 1847; Walpers, Ann. Bot. Syst. **1**: 71. 6–7 Nov 1848 ('1848–1849'); Bentham in Bentham & Hooker, Gen. pl. **1(1)**: 118. 1862; Turczaninoff, Bull. Soc. Imp. Naturalistes, Moscou **36(1)**: 577. 1863 ('*Alsodeja*'); Oudemans, Arch. Néerl. Sci. Exact. Nat. **2**: 193. 1867; Eichler in Martius, Fl. bras. **13(1)**: 380. 1871; Baillon, Adansonia **10**: 377. 25 Feb 1873 ('Mar 1871–Feb 1873'); W. B. Botting Hemsley, Biol. cent. amer., Bot. **1**: 122. 1873; Triana & Planchon, Ann. Sci. Nat., Bot. Sér. **4**: 126. 1882. Type species. *Alsodeia pauciflora* Du Petit-Thouars, Hist. vég. isles austral. Afrique: **57**. t. 17. fig. 1. 1805.

Physiphora Solander ex R. Brown in Tuckey, Narr. Exped. Congo (App. 5): 440. Mar 1818; de Gingins in A. P. de Candolle, Prodr. **1**: 314. mid Jan 1824. Type species. *Physiphora laevigata* Solander ex de Gingins in A. P. de Candolle, Prodr. **1**: 314. mid Jan 1824.

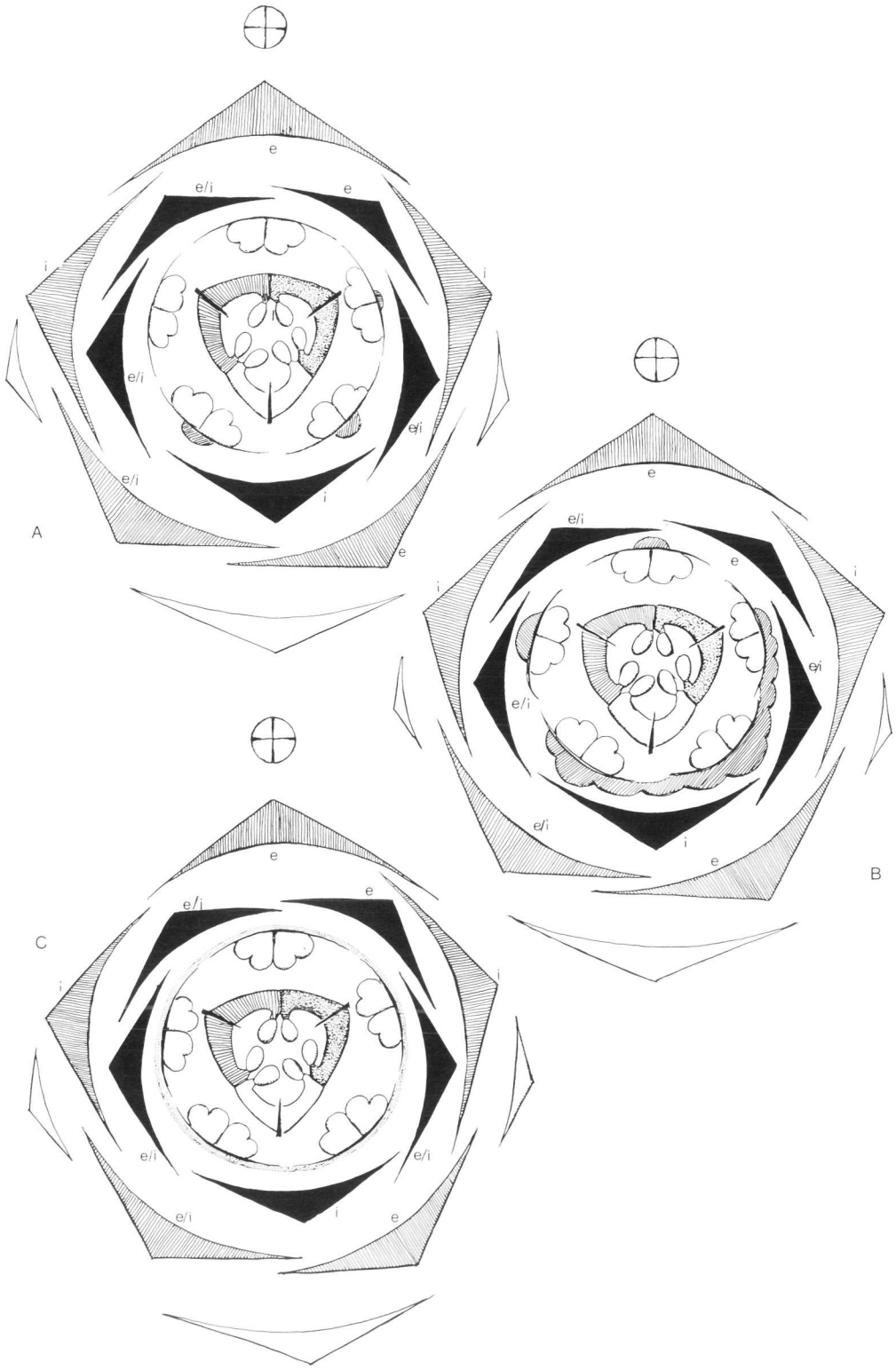
Etymology of generic names:

Alsodeia: ἀλσῶδης = alsodès (Greek), growing in the forest.

Physiphora: φῦση = phusè (Greek), bellow or bladder, referring to the fruits, which seem to be inflated.

φῆρω = phero (Greek), = fero (Latin), to bear.

Conohoria, *Passoura*, *Riana*, and *Rinorea* are



derived from local names in French Guiana (1775); *Rinorea* is also a vernacular name used in Colombia (Caldas).

Trees or treelets. Leaves alternate or apparently opposite; sometimes two different kinds: laminar as well as minute and scale-like; stipules usually herbaceous, deciduous, rarely subpersistent; domatia sometimes present; tertiary venation varying from reticulate to scalariform. *Inflorescences* thyrsoid, pseudoracemose, racemose or cymose, solitary or 1–5 fasciculate in the axils of the leaves, usually dispersed along the branchlets, rarely congested near the apex. *Flowers* solitary or in cymules; 'pedicels' articulate. Sepals five, free, quincuncial. Petals five, free, predominantly apotact. Stamens five; filaments free to completely fused to a filamental tube; dorsal glands free or fused with each other, adnate to or connate with the filaments or the filamental tube. Anthers introrse, dehiscing laterally, sometimes ventrally appendaged by mucros, set(u)lae or cusps. Dorsal connective scales laminar, exclusively apical or apical as well as lateral. Ovary one, subglobose (sub)conical or trapezoid, usually distinct from the style, rarely tapering into the style; placentas three, parietal, each provided with 1–4 ovules. Style one, usually filiform, sometimes claviculate, erect, curved or rarely sigmoid; stigma one, obtuse or subacute, truncate, claviculate, pulvinate or rarely trilobed, usually erect, rarely curved to the anterior petal. *Capsule* one, dehiscing into three valves; each containing one to four seeds; valves subequal or unequal, coriaceous or subligneous. Seeds subglobose to pyriform, with a caruncle at the base and an areola at the apex, with copious endosperm, and provided with an erect embryo.

Type species: *Rinorea guianensis* Aublet. Hist. pl. Guiane 1: 235, t. 93, 1775.

Infrageneric Classification

Genus 1 *Rinorea*.

Supergroup I. 'Apiculata'; species 1–3.

Supergroup II. 'Rinorea'.

Group IIa. 'Rinorea'.

Subgroup IIa.1. 'Haughtii'; species 4–8.

'Haughtii' complex; species 4–6.

'Multivenosa' complex; species 7–8.

Subgroup IIa.2. 'Laevigata'; species 9–11.

Subgroup IIa.3. 'Rinorea'; species 12–15.

Group IIb. 'Uxpanapana'; species 16.

Group IIc. 'Pubiflora'.

Subgroup IIc.1. 'Macrocarpa'; species 17.

Subgroup IIc.2. 'Viridifolia'; species 18–21.

Subgroup IIc.3. 'Pubiflora'; species 22–28.

Subgroup IIc.4. 'Marginata'; species 29.

Subgroup IIc.5. 'Melanodonta'; species 30–32.

Subgroup IIc.6. 'Lindeniana'; species 33–37.

Subgroup IIc.7. 'Ulmifolia'; species 38–39.

Subgroup IIc.8. 'Ovalifolia'; species 40–42.

Subgroup IIc.9. 'Guatemalensis'; species 43–44.

Subgroup IIc.10. 'Racemosa'; species 45–48.

Conspectus of the Taxonomic Groups of Neotropical *Rinorea*

1. Connective scales exclusively apical; leaves alternate; inflorescences thyrsoid to pseudoracemose. Supergroup I. 'Apiculata.'
1. Connective scales apical as well as lateral; leaves alternate or apparently opposite; all kinds of inflorescences. Supergroup II. 'Rinorea.'
2. Inflorescences cymose, without a distinct cen-

FIG. 11. Floral diagrams of neotropical species of *Rinorea*: sepals quincuncial, petals apotact, filaments and dorsal glands free or fused into a tube; dorsal connective scales only laminar; gynoecium trimerous. **A.** Filaments and dorsal glands free; dorsal glands of anterior filaments usually more developed than those of the posterior ones (which may also be wanting). (In most neotropical *Rinorea*.) **B.** Only the dorsal glands of anterior filaments fused with each other (species of Subgroup IIc.8. 'Ovalifolia'). **C.** All filaments and usually also all dorsal glands fused into a tube (e.g., *R. ramiziana* of Subgroup IIa.2. 'Laevigata'; *R. uxpanapana* of Group IIb. 'Uxpanapana'; species of Subgroups Ia.3. 'Rinorea' and IIc.10 'Racemosa'). e = sepal or petal exterior (outer sepal or petal), i = sepal or petal interior (inner sepal or petal), i'e or e'i = one sepal or petal in between, with one margin exterior (=outside), the other one interior (=inside).

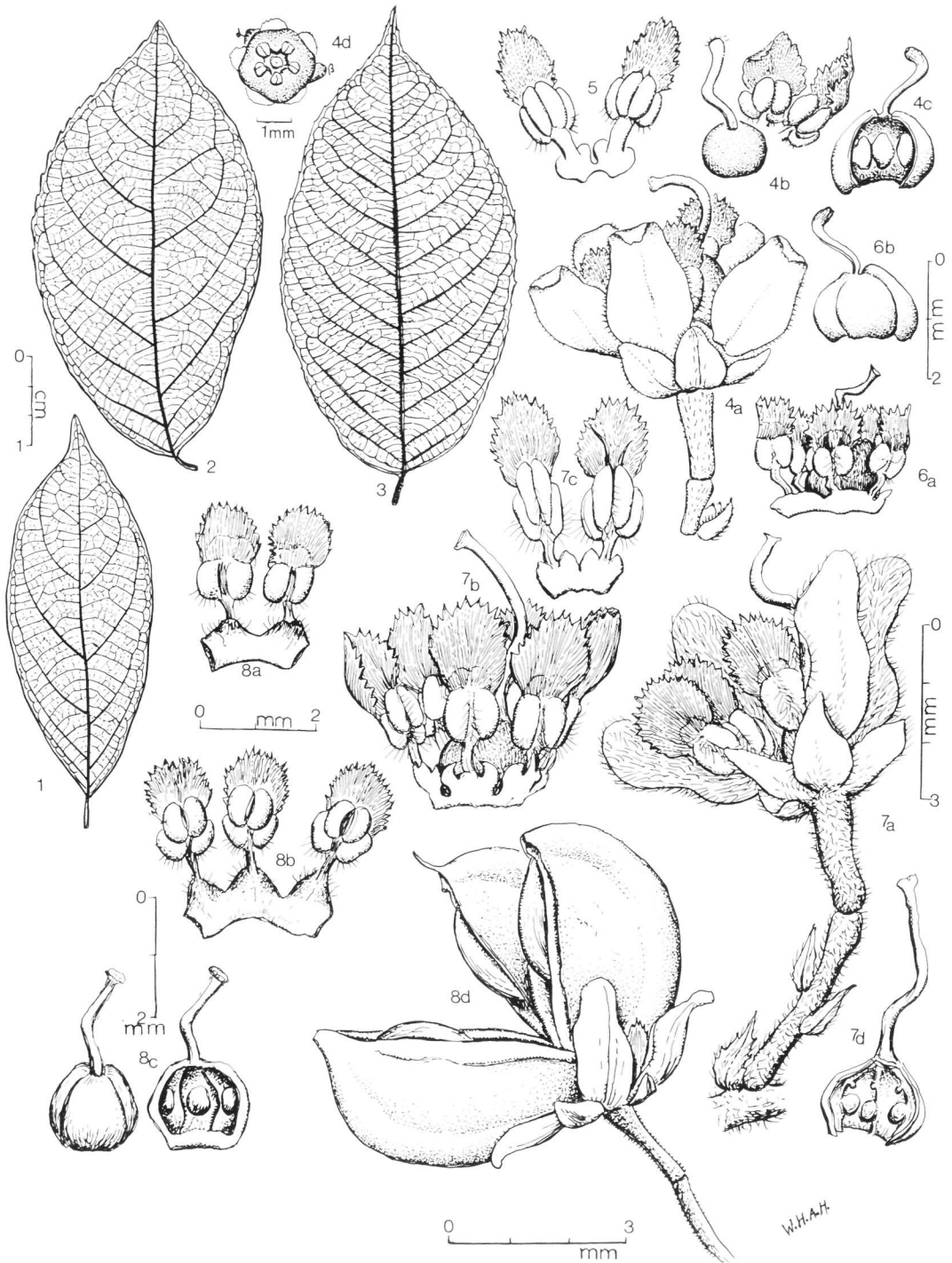


FIG. 12. *Rinorea apiculata* (1, 2, and 4 from Woytkowsky 7356, type; 3 and 8 from Berg 1258; 5 from Harling et al. 14781, paratype; 6 from Croat 21202; 7 from Jaramillo & Coello 2598. 1-3, Leaves. 4a, Flower with glabrous petals. 4b, Same flower, inside, with stamens and pistil. 5, Androecium (ventral), distinctly 5-lobed. 6a, Androecium (dorsal), with filamentous tube 5-sinuate, surrounding the pistil. 6b, Pistil: ovary subglobose to

tral axis, subsessile; two different kinds of leaves; apical leaves laminar and petiolate; basal leaves scale-like, sessile; both kinds of leaves alternate Group IIb. 'Uxpanapana.'

2. Inflorescences thyrsoid, pseudoracemose or racemose, always with a distinct central axis; only one kind of leaves, i.e., laminar leaves (apparently) present.
3. Leaves alternate; only laminar leaves present.

Group IIa. 'Rinorea.'

3. Leaves apparently opposite (in *R. hymenosepala* apical laminar leaves apparently opposite, basal leaves alternate); scale-like leaves obscure, soon deciduous, inserted at the base of each inflorescence.

Group IIc. 'Pubiflora.'

Practical Key to the Taxonomic Groups of Neotropical *Rinorea*

1. Inflorescences cymose, without a distinct central axis, subsessile; two different kinds of leaves; apical leaves laminar and petiolate; basal leaves scale-like, sessile; both kinds of leaves alternate.
Group IIb. 'Uxpanapana'
(Mexico: 16. *R. uxpanapana*).
1. Inflorescences thyrsoid, pseudoracemose or racemose, with a distinct central axis; leaves only laminar and petiolate; alternate or apparently opposite.
2. Leaves apparently opposite (in *R. hymenosepala* apical leaves opposite, basal leaves alternate).
Group IIc. 'Pubiflora.'
2. Leaves alternate.
3. Connective scales exclusively apical.
Supergroup I. 'Apiculata.'
3. Connective scales lateral as well as apical.
Group IIa. 'Rinorea.'

Supergroup I. 'Apiculata'; species 1-3.

Leaves alternate; tertiary venation scalariform; inflorescences axillary, 1-5 fasciculate, thyrsoid; dorsal glands fused with each other to a glandular tube surrounding the basal parts of the filaments; connective scales exclusively apical; ovary (sub)globose, distinct from the style, glabrous; ovules one per carpel.

This supergroup is characterized by having connective scales exclusively apical.

Distribution (Fig. 15). The three species of this subgroup occur scattered in the marginal parts

of the genus area: a) *Rinorea apiculata* on both sides of the Cordilleras in Peru; b) *R. oraria* on the northern slopes of the Coastal Cordillera of Venezuela; c) *R. crenata* restricted to Central America.

This distribution pattern suggests that the areas of these species are relicts of a formerly continuous area of distribution over tropical South America, fragmented by the Cordilleran uplift during the Pliocene (Brown, 1977, 1982; Putzer, 1968; Raven & Axelrod, 1974). A presumed ancestral stock probably became extinct in the center of its area. Subsequent speciation to *Rinorea apiculata* and *R. oraria* followed as a result of isolation. *Rinorea crenata* probably migrated from NW Colombia, where it is extinct now, to Panama after the closing of the land bridge during the Pliocene, ca. 57 my BP (Brown 1977, 1982; Coney, 1982; Raven & Axelrod, 1974).

Key to the Species of Supergroup I. 'Apiculata'

1. Inflorescences richly branched thyrsoid; lateral cymules with up to 9 flowers and with additional undeveloped flowers; connective scales shorter than the anthers; Venezuela. 3. *R. oraria*.
 1. Inflorescences poorly branched thyrsoid to pseudoracemose; lateral cymules up to 5(-7) flowers, but without additional undeveloped flowers; connective scales equaling or longer than the anthers.
 2. Inflorescences thyrsoid; lateral cymules with 1-5(-7) flowers; petioles 1-7 mm long; lamina 2.5-3x as long as wide; connective scales ovate to elliptic, 1.5x as long as wide; Costa Rica, Panama. 2. *R. crenata*.
 2. Inflorescences pseudoracemose; lateral cymules with 1-3 flowers; petioles 7-13 mm long; lamina 2-2.5x as long as wide; connective scales orbicular, equally long as wide; Ecuador, Peru. 1. *R. apiculata*.
1. ***Rinorea apiculata*** Hekking, *Phytologia* 43(5): 469. pl. 2. fig. 7. 1979 ('*apiculatus*'). Type. Perú. Huánuco: Pendencia, 900 m, 18 Sep 1962 (fl. juv fr), *Woytkowski 7356* (holotype, F; isotypes, MO, K). Figs. 12, 13, 15.

←
trilobed, style curved. 7a, Flower with hairy petals. 7b, Androecium (dorsal), with filamental tube 10x -dissected, surrounding pistil. 7c, Androecium, ventral. 7d, Pistil, with longitudinal section of ovary; ovules 3 x 1 (originally 3 x 2?); style curved. 8a, Androecium (dorsal), filamental tube weakly 5-lobed, ciliolate. 8b, Androecium (ventral). 8c, Pistil; habit and l.s., showing ovules distinctly 3 x 1, style curved. 8d, Capsule containing 3 x 1 glabrous seeds, floral parts still present basally.



FIG. 13. Isotype specimen of *Rinorea apiculata* (Woytkowski 7536 [K]).

Treelet 3–30 m tall. Branchlets minutely pilosulous or pruinose. *Leaves* alternate; petioles (3–)7–13 mm long, minutely pilosulous to glabrescent; stipules deciduous, ovate, mucronu-

late, 3–5 × 1–3 mm, herbaceous, glabrescent, ciliolate; lamina elliptic, ovate or obovate, acuminate to cuspidate, (6–)8.5–21 × (2.5–)4–8.5 cm, subcoriaceous, glabrous on both sides; costa

FIG. 14. **A.** *Rinorea crenata* (A₁₋₂ and A₇ from Pittier & Tonduz 9183, type of *R. crenata*; A₃₋₆ and A₈₋₉ from P. H. Allen 4099, type of *R. roureoides* [synonym]). A₁, Leaf. A₂, Flower bud. A₃, Adult flower. A₄, Sepals (e = exterior [=outside], i = interior [=inside], e/i = in between). A₅, Petal. A₆, Androecium (ventral), glandular tube 5-lobed, ovary subglobose to three-lobed, style curved. A₇, Stamen (ventral), with filament planted on the glandular tube. A₈, Pistil and l.s. of ovary, showing ovules 3 × 1. A₉, Capsule with 3 × 1 glabrous seeds, floral parts still present basally. **B.** *R. oraria* (Morillo et al. 3555, type). B₁, Alternate leaves. B₂, Lateral cymule with flower buds, adult and reduced (cleistogamous?) flowers. B₃, Adult flower outside. B₄, Flower, inside, androecium surrounding pistil, style curved. B₅, Sepals subequal (e = exterior [=outside], i = interior [=inside]) and petal. B₆, Androecium (ventral), glandular tube 10-lobed, ovary subglobose to three-lobed. B₇, Stamens (ventral), planted on the glandular tube. B₈, Pistil; habit and with l.s. section of ovary, showing ovules 3 × 1.



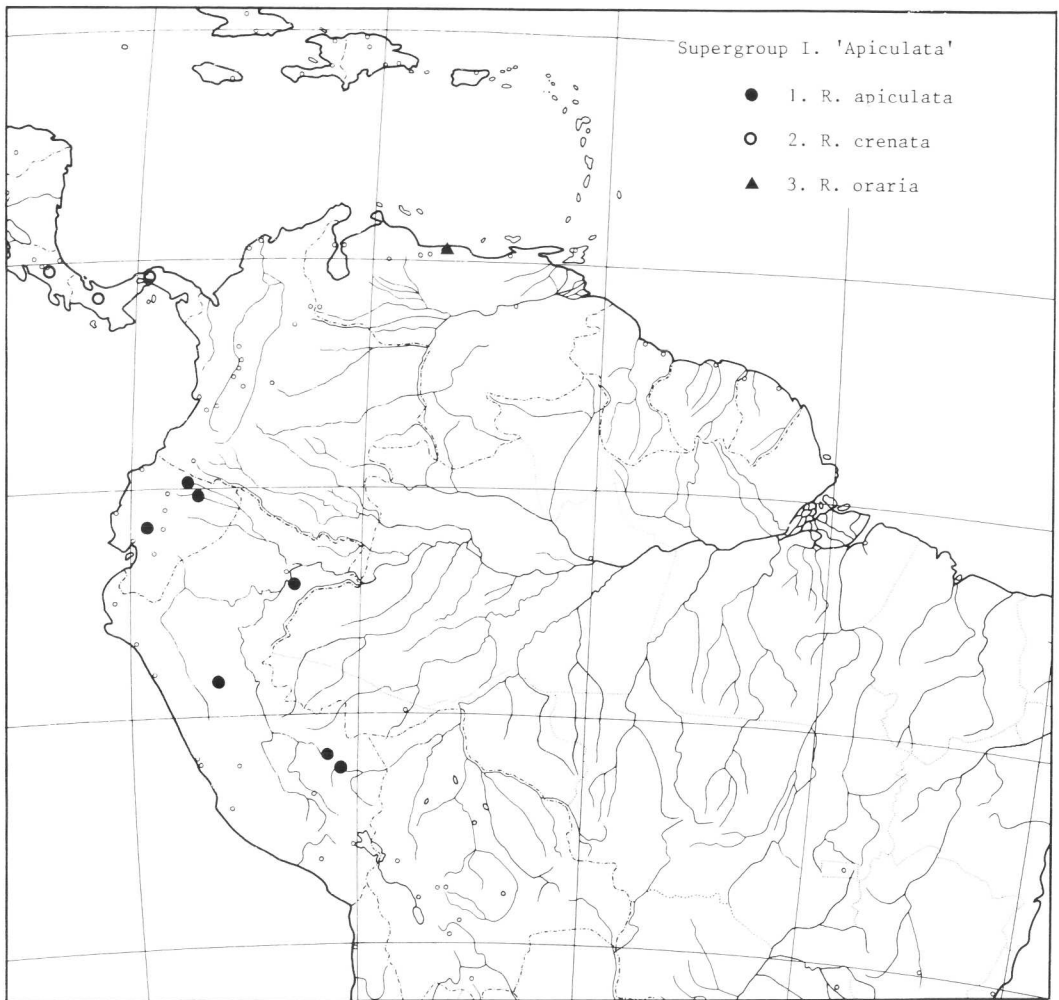


FIG. 15. Distribution of species of *Rinorea* Supergroup I. 'Apiculata.'

and lateral veins glabrous above, densely minutely pilosulous beneath; lateral veins 7–11(–14) pairs (acumen excluded); tertiary venation \pm scalariform; base rounded to obtuse; margin subentire, subcrenate or subserrate, mucronulate; acumen 0.75–4 cm long, apex obtuse, mucronulate. *Inflorescences* axillary, lateral or subterminal, 1–3 fasciculate, narrowly thyrsoid, 4.5–9(–15) \times 1.5–2 cm; central axis pilosulous; cymules 1–3 flowered; common peduncle 2–6(–8) mm long, pilosulous; pedicels 1–2.5(–7.5) mm long, articulate at $\frac{1}{2}$ – $\frac{2}{3}$ from the base, pilosulous; bracts and bractlets, ovate to deltoid, herbaceous, haired to glabrous, margin scarios, ciliolate, apex subacute and mucronulate; bracts

0.75–1 \times 0.4–0.8 mm; bractlets subopposite or alternate, 0.25–0.75 \times 0.25–0.5(–0.75) mm. *Flower* buds orbicular. Flowers drooping or pendulous, greenish, whitish or pale yellow. Sepals subequal, ovate, 1–1.5(–2) \times 0.75–1.25(–1.75) mm, herbaceous, outside completely glabrous, inside usually villose at the base, margin scarios, ciliolate, apex obtuse to rounded. Petals ovate, 2.5–4 \times 1.5–2 mm, herbaceous, glabrous, margin scarios and ciliolate, apex obtuse. Stamens 2–3.25 mm long; apical parts of filaments free, 0.2–0.5 \times 0.1–0.2 mm; filamental tube glandular, 0.3–0.5 mm high, carnos, 5-sinuate to 10-denticulate sparsely pilosulous to glabrescent; anthers ellipsoid, 0.75–1.5 \times 0.5–1 mm,

barbate at the base, apex unappendaged; connective outside, narrowly ovate to linear, 0.5–0.75 × 0.1–0.25 mm. barbate at the base; connective scales exclusively apical, ± orbicular, 0.75–1.5 mm long and wide, usually equaling the anthers, scarious, orange-brown, margin erose to fringed, apex rounded and fringed. Ovary subglobose, 0.75–1.25 mm diameter, glabrous; ovules one per placenta. Style filiform, slightly curved, 1.5–2 mm long, exceeding the stamens by 0.25 mm, completely glabrous; stigma truncate or pulvinate. *Capsule* usually asymmetric, orbicular, acuminate, subtended by subsistent floral parts, coriaceous, glabrous, smooth; three valves, unequal, 6–7 × 2.5–3.5 mm, style often subsistent at the apex of one of the valves. *Seeds* one per valve, globose, ca. 3 mm diam., glabrous, shining.

Distribution (Fig. 15) and ecology. Ecuador and Peru, on both sides of the Cordilleras, mainly in tropical rain forests at 125–900 m, including the following forest refuges: (a) W of the Cordilleras: Chimborazo-West; (b) E of the Cordilleras: Loreto, Napo, Ucayali and Inambari. Soil lateritic.

Phenology. Flowering specimens have been collected in January, February, June, August, September, December; fruiting specimens in October and December. Probably flowering and fruiting throughout the year.

Representative specimens examined: ECUADOR. ESMERALDAS: Nr. Lita, ca. 600 m, 9 Dec 1981 (fl, fr), *Berg 1258* (U). LOS RÍOS: Río Palenque Field Station, halfway between Quevedo and Sto. Domingo de Los Colorados, 200 m, 24 Feb 1974 (bud), *Gentry 10164* (GB, MO, U); NAPO: Rd. Coca (=Puerto Francisco de Orellana) to Armenia Vieja, 15 km S of Coca, ca. 250 m, 22 Jan 1977 (fl), *Harling et al. 14781* (GB, U); vic. Río Aguarico and Sarayacu, 29 Jan 1980 (fl), *Jaramillo & Coello 2598* (AAU).

PERÚ. HUÁNUCO: Trail along Río Monzon nr. Río Huallago at Tingo María, 9°09'S, 76°00'W, 6 Oct 1972 (fl), *Croat 21202* (MO, U). LORETO: Maynas: Río Tamshiyacu nr. Río Maniti, 4°05'S, 72°58'W, 140 m, 1 Aug 1980 (fl), *Gentry et al. 29341* (MO, U). MADRE DE DIOS: Río Manu, Parc Nacional, 350 m, 22 Oct 1979 (fr), *Foster et al. 7166* (F); idem, 400 m, 21 Oct 1979 (fr), *Gentry et al. 27102* (MO, U).

Rinorea apiculata differs from *R. crenata* and *R. oraria* mainly by (1) leaves 2–2.5 × as long as wide (against 2.5–3 ×); (2) inflorescences nearly pseudoracemose with cymules containing 1–3 flowers; and (3) connective scales equaling the

thecae (in *R. crenata* longer and in *R. oraria* shorter than the thecae).

Two deviating specimens have been observed in *Rinorea apiculata*: *Berg 1258* from Ecuador: leaves tending to coriaceous; lateral veins more pronounced and numbering up to 10–14 lateral veins; *Jaramillo & Coello 2598* from Ecuador: flowers and floral parts 1.5–2 × as long as normally seen in other specimens. Its petals are also densely pilosulous inside and sparsely pilosulous along the costa outside; the margin is distinctly ciliolate.

The description of *Rinorea* cf. *roureoides* Woodson in C. H. Dodson and A. H. Gentry (1978) for the Flora of the Río Palenque (Ecuador) does not refer to *R. roureoides*, synonym of *R. crenata*, but to *R. apiculata*. Indeed, *Rinorea crenata* is most closely related to *R. apiculata*. However, the species are geographically separated from each other, since both are wanting in the interjacent Andean region of Colombia. If intermediate specimens should be found in the Colombian area, the possibility of reuniting both species, as varieties or different populations of *R. crenata*, is not excluded.

2. *Rinorea crenata* Blake, Contr. U.S. Natl. Herb. **20(13)**: 500. 1924; P. C. Standley, Publ. 392. Field Mus. Nat. Hist. Bot. Ser. **18(2)**: 715. 1937. Type. Costa Rica. Limón: Shirores, Talamanca, 100 m, Feb 1895 (juv fl), *Pittier & Tonduz 9183* (holotype, US). Figs. 14A, 15.

Rinorea roureoides Woodson, Ann. Missouri Bot. Gard. **37**: 403. 1950; A. Robyns in Woodson, Schery & Coll., Ann. Missouri Bot. Gard. **54(1)**: 68. fig. 1g–i. 1967. Type. Panama. Colón: Río Viejo, vic. Puerto Pilon, 10 m, 2 Feb 1947 (fl, fr), *P. H. Allen 4099* (holotype, MO; isotypes, BM, BR, G).

Tree or treelet 4–15 m tall. Branchlets minutely pilosulous to puberulous; glabrescent. **Leaves** alternate; petioles 3–7 mm long, minutely pilosulous to glabrescent; stipules soon deciduous, usually wanting; lamina usually narrowly elliptic to obovate, acuminate to cuspidate, 7–20.5 × 2–7.5 cm, papery to coriaceous; lamina, costa and lateral veins glabrous on both sides; lateral veins 8–10 pairs (acumen excluded); tertiary venation scalariform; base rounded to cuneate; margin crenate to serrate, mucronulate; acumen 0–2.5 cm long, apex subobtuse, mucronulate. **Inflorescences** axillary, lateral and

subterminal, 1–5 fasciculate, thyrsoïd, 2–7 × 1.5–2 cm; central axis pilosulous, whitish; cymules 1–5(–7) flowered; common peduncle 1.5–7 mm long, pilosulous, whitish; ‘pedicels’ 2–5 mm long, articulate $\frac{1}{2}$ – $\frac{3}{4}$ from the base, pilosulous, whitish; bracts and bractlets, narrowly ovate to deltoid, herbaceous to scarious, whitish pilosulous, margin ciliolate, apex obtuse, mucronulate; bracts 0.5–1 × 0.25–0.5 mm; bractlets subopposite, 0.25–0.75 × 0.2–0.4. *Flower* buds ovoid, obtuse. Flowers white. Sepals subequal, elliptic to ovate, 1–1.5 × 0.75–1 mm, herbaceous, obscurely 1–3 veined, margin cili(ol)ate, apex obtuse to rounded. Petals subelliptic, 2.75–3 × 1.25–2 mm, herbaceous, glabrescent, obscurely 1–3 veined, margin scarious and cili(ol)ate, apex rounded. Stamens (2–)2.5–3(–3.5) mm long; apical part of filaments free, 0.4 × 0.2 mm; filamental tube glandular 0.3–0.6 mm high, carnosé, 5-lobulate; anthers ovoid, 0.75–1 × 0.4–0.5 mm, barbate at the base, apex obtuse, sometimes appendaged by two cusps ca. 0.3 × ca. 0.1 mm; connective outside linear, ca. 0.5 × ca. 0.2 mm, sometimes barbate at the base; connective scales, exclusively apical, ovate to elliptic, 1–1.75 × 0.75–1 mm, usually longer than the anthers, scarious, orange-brown, margin fringed, apex rounded and fringed. Ovary subglobose to 3-lobed, 1 × 0.75–1 mm, glabrous; ovules one per placenta. Style filiform, slightly curved, (1.5–)2–2.25 mm long, exceeding the stamens by 0–0.5 mm, completely glabrous; stigma truncate or pulvinate. *Capsule* more or less symmetric, orbicular to ellipsoid, subtended by subsistent floral parts, coriaceous, glabrous, smooth to obscurely veined; three valves, subequal, 4.25–7 × 2–3 mm, style often subsistent at the apex of one of the valves. *Seeds* one per valve, globose, 2.5–3.5 mm in diam., glabrous, shining.

Distribution (Fig. 15) and ecology. Confined to the forest refugia Chiriquí and Darién, respectively in Costa Rica and Panama. It occurs as undergrowth in lowland rain forest and sometimes as an epiphyte in cloud forests, from 50 to 2500 m.

Phenology. Flowering specimens have been collected in February, fruiting specimens in January and March.

Representative specimens examined: PANAMA, COCLÉ: In mountains nr. the continental divide, 8 km above El Cope, ca. 650 m, 10 Jan 1978 (fr), *Hammel 813* (MO). COLÓN: Vic. Río Indio on rd. from Portobelo

to Nombre de Díos, 50 m, 23 Mar 1976 (fr), *Croat 33626* (MO, U); Santa Rita Ridge, along Río Piedras, ca. 2500 m, 9 Mar 1979 (fr), *Hammel 6352* (MO, U); along Río Escandalosa, 160–180 m, 28 Mar 1982 (fr), *Huft & Knapp 1646* (MO, U); 3–5 km up to Río Guanache, 0°30'N, 79°40'W, 10–20 m, 19 Jan 1973 (fr), *Kennedy & Foster 2129* (MO, U). DARIÉN: S.L., 24 May 1966 (fr), *Duke 8326* (MO). SAN BLÁS: Comarca de San Blás El Llano–Cartí Rd., 19 km from Interamerican Hwy., 9°19'N, 78°55'W, 130–350 m, 4 Sep 1984 (juv fr), *de Nevers & Herman 3839* (MO).

Rinorea crenata differs from *R. apiculata* and *R. oraria* mainly by its connective scales being longer than the anthers.

3. *Rinorea oraria* Steyermark & Fernández-P., *Brittonia* **30**(1): 43, fig. 3, 1978. Type, Venezuela. Distrito Federal: Cordillera costanera, N-slope, 1–6 km E of Los Tanques de la Electricidad de Caracas, S of Camuri Grande, 700–800 m, 17 Jul 1973 (fl), *G. & B. Morrillo & Manara 3355* (holotype, COL; isotypes, U, VEN). Figs. 14B, 15.

Treelet 5–6 m tall. Branchlets sparsely pilosulous to pruinose, glabrescent. *Leaves* alternate; petioles 4–10 mm long, minutely pilosulous; stipules soon deciduous, usually wanting; lamina usually narrowly obovate, acuminate to cuspidate, 8–13 × 2–5 cm, coriaceous; lamina, costa and lateral veins glabrous on both sides; lateral veins (8–)10–12 pairs (acumen excluded); tertiary venation scalariform; base rounded to cuneate; margin subserrate, subcrenate or subentire, mucronulate; acumen 0.75–1.25 cm long, apex (sub)obtuse, mucronulate. *Inflorescences* axillary, lateral and terminal, 1–3 fasciculate, widely thyrsoïd, 4–15 × 0.5–2 cm; central axis minutely pilosulous; cymules with 1–9 flowers and sometimes accompanied by undeveloped flowers; common peduncle 3–9 mm long, minutely pilosulous; ‘pedicels’ 1–6 mm long, articulate at $\frac{1}{2}$ – $\frac{3}{4}$ from the base, minutely pilosulous; bracts and bractlets (narrowly) ovate, herbaceous to scarious, minutely pilosulous to glabrate; margin ciliolate, apex (sub)obtuse; bracts ca. 1.5 × ca. 0.75 mm; bractlets ca. 0.75 × ca. 0.25 mm. *Flower* buds ellipsoid to ovoid. Sepals subequal, elliptic to ovate, 1–1.25 mm long and wide, herbaceous to scarious, glabrous, obscurely 3-veined, margin ciliolate, apex obtuse. Petals elliptic to ovate, 3–3.25 × 1.5–1.75 mm, herbaceous to scarious, glabrous, margin ciliate near the base, apex rounded and ciliolate. Stamens (1.5–)1.75–

2.25 mm long; apical part of filaments free, ca. $0.25 \times$ ca. 0.1 mm; filamental tube glandular, 0.2–0.5 mm high, carinose, 10-lobulate, sparsely pilosulous to glabrescent; anthers ellipsoid to ovoid, $0.75\text{--}1 \times 0.5\text{--}0.75$ mm, sparsely barbate at the base, apex rounded to obtuse, unappendaged; connective outside, linear to narrowly deltoid, ca. $0.5 \times 0.1\text{--}0.3$ mm, glabrescent; connective scales exclusively apical, ovate to elliptic, $0.5\text{--}0.75 \times 0.5$ mm, shorter than the anthers, scarious, orange-brown, margin erose to fringed, apex rounded. Ovary subglobose to 3-lobed, $1\text{--}1.25 \times$ ca. 1 mm, glabrous; ovules one per placenta. Style filiform, sigmoid to curved at the base, ca. 1.5 mm long, exceeding the stamens by $0.5\text{--}0.75$ mm, completely glabrous; stigma truncate or pulvinate. *Fruits* unknown.

Distribution (Fig. 15) and ecology. Known only from the type collection on the northern slopes of the Coastal Cordillera in Venezuela, from 700 to 800 m.

Rinorea oraria differs from *R. apiculata* and *R. crenata* by (1) the wider thyrsoid inflorescences containing cymules with 1–9 flowers (in *R. crenata* narrowly thyrsoid, cymules with 1–5 flowers; in *R. apiculata* nearly pseudoracemose, cymules with 1–3 flowers); and (2) connective scales shorter than the anthers.

Supergroup II. 'Rinorea.'

Leaves alternate or apparently opposite; tertiary venation varying from reticulate to scalariform; *inflorescences* axillary, 1–5 fasciculate to solitary, varying from thyrsoid to (pseudo)racemes or rarely to cymose; filaments and dorsal glands free or fused to a tube; connective scales apical as well as lateral; ovary usually (sub)globose, distinct from the style, rarely conical and tapering into a conical style, hairy or glabrous; ovules one to four per carpel.

This supergroup is characterized by having connective scales lateral as well as apical.

Group IIa. 'Rinorea.'

Leaves alternate; tertiary venation varying from reticulate to scalariform; *inflorescences* 1–5 fasciculate to solitary, varying from thyrsoid to (pseudo)racemose, filaments and dorsal glands free or fused to a tube; connective scales apical as well as lateral; ovary usually (sub)globose, distinct from the style, usually hairy, rarely glabrous; ovules usually one, rarely two, per carpel.

This group is characterized by having leaves alternate in combination with a distinct central axis within the inflorescences.

Key to the Species of Group IIa. 'Rinorea'

1. Inflorescences thyrsoid; lateral cymules with 1–15 flowers (sometimes accompanied by 1–10 flower buds or undeveloped flowers); filaments fused into a tube.
2. Leaves and inflorescences congested near the apex of the branchlets; lateral cymules with 1–3 flowers (usually accompanied by 1–5 flower buds or undeveloped flowers); connective scales villose outside; capsule sparsely pilose: SE Brazil. 11. *R. ramiziana*.
2. Leaves and inflorescences remotely dispersed along the branchlets; lateral cymules with 1–11 flowers (sometimes accompanied by 1–10 flower buds or undeveloped flowers); connective scales glabrous; outside, capsule densely puberulous to strigillose (fruits of *R. bicornuta* unknown).
3. Petals shorter than 3.5 mm, $1\text{--}1.5 \times$ as long as the sepals; stamens 1.5–3 mm long; style 1–2.5 mm long.
4. Inflorescences widely thyrsoid; lateral cymules with 1–11(–15) flowers (sometimes accompanied by 2–6 flower buds or undeveloped flowers); flowers pendulous; flower buds ellipsoid; petals, elliptic 2–3 mm long; stamens 1.5–2 mm long; connective scales 1–2 mm long, $1.5\text{--}2.5 \times$ as long as the anthers; style 1–1.5 mm long; Panama, Colombia, Venezuela, French Guiana, N Brazil. 15. *R. paniculata*.
4. Inflorescences narrowly thyrsoid; lateral cymules with 1–5(–7) flowers; flowers deflexed; flower buds conical; petals ovate to deltoid, 3–3.5 mm long; stamens 2–3 mm long; connective scales 2–2.5 mm long, $2.5\text{--}3 \times$ as long as the anthers; style 2–2.5 mm long; NW Brazil. 12. *R. bicornuta*.
3. Petals 3.5 mm long or more, $1.5\text{--}2.5 \times$ as long as the sepals; stamens 3–5 mm long; style 2.5–3.5 mm long.
5. Petals $2\text{--}2.5 \times$ as long as wide; anthers $1\text{--}1.5 \times$ as long as wide; connective scales more than 1 mm wide, $2\text{--}3 \times$ as long as wide; lateral veins 8–10 pairs (acumen excluded); acumen 0–0.5 cm long; French Guiana, SE Brazil. 14. *R. bahiensis*.
5. Petals $2.5\text{--}3 \times$ as long as wide; anthers $1.5\text{--}2 \times$ as long as wide; connective scales less than 1

mm wide, 3–4 × as long as wide; lateral veins (8–)9–13(–16) pairs (acumen excluded); acumen 0.5–3 cm long; Venezuela, French Guiana, Peru, Brazil.

13. *R. guianensis*.

1. Inflorescences (pseudo)racemose; filaments not or slightly connate at the base.
6. Leaves and inflorescences congested near the apex of the branchlets; leaf lamina narrowly elliptic to (ob)ovate, 3–4 × as long as wide; tertiary venation reticulate; SE Brazil.
7. Leaves petiolate; petioles 1–7 mm long; leaf lamina glabrous on both sides; petals 4.5–5 mm long; connective whitish villose outside, especially near the apex; connective scales glabrous outside; SE Brazil.
10. *R. laevigata*.
7. Leaves subsessile; petioles 1–2 mm long; leaf lamina pilose on both sides; petals 5–5.5 mm long; connective glabrous outside; connective scales whitish villose outside, just above the connective; SE Brazil.
9. *R. maximiliani*.
6. Leaves and inflorescences remotely dispersed along the branchlets; leaf lamina elliptic or (ob)ovate, 2–3 × as long as wide; tertiary venation more or less scalariform; Colombia, W Brazil.
8. Connective scales 3–4 mm long, 3–4 × as long as wide; Amazonian region of Colombia and W Brazil.
9. Lateral veins 15–19 pairs (acumen excluded); leaf base obtuse at the petiole; bracts 0.75–1 mm long; sepals 1–2 × 0.5–1 mm; petals 1–1.5 mm wide, 3–4 × as long as wide; connective whitish villose outside; ovules 3 × 1; SE Colombia, W Brazil.
7. *R. multivenosa*.
9. Lateral veins 11–15 pairs (acumen excluded); leaf base slightly decurrent into the petiole; bracts 1.25–1.75 mm long; sepals 2–2.5 mm long; petals 2–2.5 mm wide, 2–3 × as long as wide; connective glabrous outside; ovules 3 × 2; W Brazil.
8. *R. longistipulata*.
8. Connective scales 1.5–3 mm long, 1.5–3 × as long as wide; Andean region of Colombia.
10. Pedicels 4.5–6.5 mm long; petals 2.5–3 mm long, 1–2 × as long as wide; all petals deeply cordate at the base; ovary pilosulous; Colombia.
4. *R. cordata*.
10. Pedicels 1.5–3.5 mm long; petals 3–6 mm long, 2–4 × as long as wide; outer petals obtuse, rounded to subcordate at the base; ovary glabrous or hairy.
11. Sepals 1.5–2 mm long; petals 4–6 mm long; connective scales 2.5–3 mm long; ovary glabrous or nearly so; style 2.5–3.5 mm long; Colombia.
5. *R. haughtii*.
11. Sepals 0.5–1.5 mm long; petals 3–4 mm long; connective scales 2–2.5 mm long; ovary densely pilosulous; style 2–2.5 mm long; Colombia.
6. *R. laurifolia*.

Subgroup IIa.1. 'Haughtii'; species 4–8.

Leaves and inflorescences remotely dispersed along the branchlets; tertiary venation ± scalariform; *inflorescences* 1–5 fasciculate, (pseudo)racemose; filaments and dorsal glands (nearly) free, conical, sometimes wanting on posterior filaments; ovary usually hairy; ovules one, rarely two, per carpel.

This subgroup can be subdivided into two complexes, 'Haughtii' and 'Multivenosa.' The former is probably endemic in the Andean region of Colombia and the latter in the Amazonian area of W Brazil, separated from each other by the Cordilleras de los Andes.

'Haughtii' complex; species 4–6.

Inflorescences strictly racemose; all petals (sub)cordate at the base; floral parts not elongated, connective scales ovate or deltoid; ovary usually hairy, glabrous in *R. haughtii*; ovules one per carpel.

Distribution (Fig. 19). The species of this complex, restricted to NW Colombia, became separated from the main genus area in Amazonia through the Pliocene Cordilleran uplift.

4. *Rinorea cordata* Smith & Fernández-P., *Caldasia* **6(28)**: 90. t. 1. 1954. Type, Colombia, Santander: Valley of Magdalena, Margarita Creek, vic. Barrancabermeja, between the rivers Sogamosa and Colorado, 100–500 m, 10 Oct 1934 (fl. juv fr), *Haught 1388* (holotype, US; isotype, COL (fragment, n.v.)).

Figs. 16A, 19.

Tree. Branchlets glabrous or glabrescent, reddish purple and with whitish callose lenticels when dried. *Leaves* alternate; petioles 7–20 mm long, minutely hirtellous when young to glabrescent when older; stipules deciduous, unknown; lamina (narrowly) elliptic, acuminate, 5–20 × 2–10 cm, coriaceous; lamina, costa and lateral veins glabrous on both sides; lateral veins 8–10 pairs (acumen excluded); tertiary venation ± scalariform; base rounded to cuneate; margin crenate, mucronulate; acumen ca. 2.25 cm long; apex sub-obtuse, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary or 1(–5?) fasciculate, racemose, ca. 6.5 × 1.5 cm; central axis hispidulous; 'pedicels' 4.5–6.5 mm long, artic-

ulate near the middle or just above, hispidulous; bracts and bractlets herbaceous, pilosulous, ciliolate, bracts narrowly elliptic to ovate, 1.25 × 0.4–0.6 mm, subobtuse; bractlets subopposite close to the bracts, ovate, 1 × 0.4–0.6 mm, subobtuse. Flower sepals subequal, ovate, 1–2 × 0.75–1 mm, herbaceous, pilosulous, ciliolate, apex obtuse. Petals elliptic to ovate, 2.5–3 × 1.75–2 mm, herbaceous; base cordate, ± pilosulous outside, densely pilosulous inside; not hairy along the margin; acumen ca. 0.5 mm long; apex obtuse (?), strongly reflexed. Stamens (1.75–)2–2.5 mm long; filaments free, ca. 0.5 × ca. 0.25 mm; dorsal glands free, erect, conical, ca. 0.25 × 0.1–0.2 mm, carnos, glabrous; anthers narrowly ovoid, 1.25 × 0.75 mm, glabrous; anthers narrowly ovoid, 1.25 × 0.75 mm, glabrous, apex obtuse and unappendaged; connective outside narrowly deltoid, subobtuse, 1.25 × ca. 0.25 mm, glabrous; connective scales apical as well as lateral, ovate, 1.5–2(?) × 1 mm, scarious, orange-brown, margin erose (?), apex unknown. Juvenile fruit globose, 2 × 1.5 mm, golden pilosulous; juvenile seeds one per placenta. Style filiform, slightly curved at the base, 2.25–2.5 mm long, sparsely pilosulous at the base; stigma truncate. Adult fruits unknown.

Distribution (Fig. 19) and ecology. Known only from the type collection in the northern part of the valley of Río Magdalena, Santander, NW Colombia, in a tropical forest along a creek.

Rinorea cordata can be distinguished from all other neotropical species of *Rinorea* by its petals distinctly basally cordate. The type specimen of *R. cordata* has glomerules in the axils of the leaves on which only one racemose inflorescence is arranged instead of more (as in *R. haughtii* and *R. laurifolia*); additional inflorescences are probably broken off during collecting and drying of this specimen.

5. *Rinorea haughtii* Smith & Fernández-P., *Caldasia* 6(28): 92. t. 3. 1954. Type. Colombia. Santander: Valley of Magdalena, Campo Zarzal, vic. Barrancabermeja, between the rivers Sogamosa and Colorado, 100–500 m. 15 Dec 1934 (fl). *Haught 1470* (holotype. COL: isotypes. F, HH, K, US). Figs. 16B, 19.

Treelet, ca. 5 m tall. Branchlets sparsely ferruginous pilosulous when young, glabrescent when older. Leaves alternate; petioles 3–8 mm

long, minutely pilosulous when young, glabrescent when older; stipules deciduous, narrowly ovate to deltoid, acuminate, 4 × 1 mm, herbaceous, glabrous, veined, golden-brownish ciliolate, subobtuse; lamina (narrowly) elliptic, ovate or obovate, acuminate, 5–17 × 2.5–6.5 cm, coriaceous to papery; lamina, costa and lateral veins glabrous on both sides; lateral veins 9–15 pairs (acumen excluded); tertiary venation ± scalariform; base rounded to cuneate, slightly decurrent into the petiole; margin subserrate to subcrenate, mucronulate; acumen 0.5–1.75 mm long, apex subacute, mucronulate. *Inflorescences* axillary, lateral, and subterminal, 1–5 fasciculate, racemose, 2.25–5 × 1–1.75 cm; central axis golden-brown pilosulous, sometimes also sparsely pilose; 'pedicels' 1.75–2.5 mm long, articulate at 1/2–1/3 from the base, golden brownish pilosulous; bracts and bractlets ovate, herbaceous, whitish to golden hispidulous, margin ciliolate, apex subacute, sometimes mucronulate; bracts 0.75–1.25 × ca. 0.75 mm; bractlets subopposite, close to the bracts, 0.75–1 × 0.5–0.75 mm. *Flower buds* ovoid to conical. Flowers creamy to yellow. Sepals subequal, ovate to deltoid, 1.5–2 × 0.75–1.25 mm, herbaceous, golden pilose along the costa and near the apex, sometimes obscurely 2-veined, margin ciliolate, apex obtuse. Petals (narrowly) ovate, 4–6 × 2.25 mm, herbaceous, sparsely pilose outside, base subcordate, sparsely pilosulous to villose inside, margin ciliolate, apex subobtuse. Stamens 3–3.5 mm long; filaments (nearly) completely free, 0.4 × 0.2–0.4 mm, dorsally hirsute, ventrally glabrous; dorsal glands free, erect, conical, 0.25 × 0.05–0.2 mm, carnos, glabrous; anthers ovoid, ca. 1.25 × 0.75 mm, glabrous, apex obtuse, unappendaged; connective outside, narrowly deltoid, subobtuse, 1 × 0.25 mm, glabrous, subobtuse; connective scales apical as lateral, ovate, 2.75–3 × 1–1.25 mm, scarious, orange-brown, erose near the base, apex subentire, obtuse to rounded. Ovary ovoid to conical, 0.75–1 mm long and wide, glabrous, sometimes with 1–2 pilose hairs; ovules one per placenta. Style filiform, erect or curved at the base, 2.5–3.25 mm long, exceeding the stamens by 0.25–0.75 mm, completely glabrous; stigma truncate. *Capsule* more or less symmetric, elliptic, acuminate, subtended by subpersistent floral parts, coriaceous, glabrous, obscurely veined; valves three, subequal, 5–7.5 × 2.5–3 mm, sometimes with the style subpersistent at the apex



of one of the valves. *Seeds* one per valve, globose, ca. 4 mm in diam., glabrous.

Distribution (Fig. 19) and ecology. Probably endemic in NW Colombia, in the tropical rain forest refuges of Nechí and of the valley of the Río Magdalena. Occurring as small trees, from 0 to 100 m.

Phenology. Flowering specimens have been collected in January, May, September and December; fruiting specimens in May and September.

Representative specimens examined: COLOMBIA, BOYACÁ: Puerto Boyacá, 26 Sep 1952 (fl. fr). *Romero-Castañeda & Jaramillo-Mejía 3392* (COL). CHOCCÓ: Mun. of Juradó, between Río Curiche and Alto Curiche, 10–100 m, 31 Jan 1967 (fl). *Duke 9579* (U); idem, NW of Alto Curiche, 300 m, 20 May 1967 (fl). *Duke 11255 (3)* (COL); between Boca Curiche and Alto Curiche, 3–125 m, 20 May 1967 (fl. fr). *Duke 11287 (2)* (U).

Rinorea haughtii differs from *R. cordata* and *R. laurifolia* by: (1) lateral veins numbering up to 15 pairs (versus up to 11 pairs); (2) longer petals (4–6 mm long, versus shorter than 4 mm); (3) longer connective scales and style, both longer than 2.5 mm; and (4) the ovary glabrous (versus hairy).

Rinorea haughtii is the only species in Group IIa. *Rinorea* with an ovary glabrous (or nearly so); in all others the ovary is distinctly hairy.

6. *Rinorea laurifolia* Smith & Fernández-P., *Caldasia* **6(28)**: 90, t. 2, 1954. Type, Colombia, Santander: Vic. Puerto Berrio, between the rivers Carare and Magdalena, 100–700 m, Jul 1936 (fl), *Haught 1908* (holotype, COL; isotype, US). Figs. 16C, 19.

Tree; branchlets sparsely pilosulous. *Leaves* alternate; petioles 5–16 mm long, glabrous; stipules deciduous, narrowly ovate to deltoid, acuminate, 2.5–3 × ca. 1 mm, herbaceous, ciliate, subacute; lamina (narrowly) ovate, acuminate,

8–16 cm × 4.5–7.5 mm, coriaceous; lamina, costa and lateral veins glabrous on both sides; lateral veins 9–11 pairs (acumen excluded), tertiary venation ± scalariform; base rounded, slightly decurrent into the petiole; margin subserrate to subentire; acumen 0.75–1.75 mm long, apex subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, 1–4 fasciculate, 3–3.75 × 0.75–1 cm; central axis puberulous; pedicels 1.75–3.5 mm long, articulate at $\frac{1}{2}$ – $\frac{2}{3}$ from the base, puberulous; bracts and bractlets herbaceous, pilose(ulous), ciliate; bracts ca. 1 × ca. 0.75 mm, elliptic, obtuse; bractlets close to the bracts, ca. 0.75 × ca. 0.5 mm, ovate, subobtuse. *Flower buds* ovoid to tolpoid. Sepals subequal, ovate to elliptic, 0.75–1.25 × 0.75–1 mm, herbaceous, pilosulous, ciliate. Petals ovate, 3–3.5 × ca. 1 mm, herbaceous; base subcordate, pilosulous outside; margin completely glabrous; apex (sub)obtuse, pilosulous outside. Stamens 2.25–3 mm long; filaments (nearly) completely free, 0.3–0.5 × 0.2 mm, pilose to glabrous; dorsal glands free, erect, ovoid to conical, 0.1–0.2 mm long and wide, sometimes fused with the filaments or apparently wanting; anthers deltoid to ovoid, 0.9 × 0.3–0.4 mm, glabrous, apex obtuse to apiculate, unappendaged; connective outside, deltoid, 0.75 × 0.25 mm, pilose to glabrous; connective scales lateral as well as apical, ovate, 2–2.25 × 0.75–1 mm, scarious, brown, margin suberose, apex rounded to obtuse. Ovary subglobose to obscurely 3-lobed, 0.75–1 mm in diam., pilosulous along the ribs and near the apex; ovules one per placenta. Style subclavate, erect, 2–2.5 mm long, exceeding the stamens by 0.2–0.5 mm; stigma truncate. *Fruits* unknown.

Distribution (Fig. 19). Known only from the type collection in the valley of Río Magdalena, Santander, N Colombia, between 100 and 700 m.

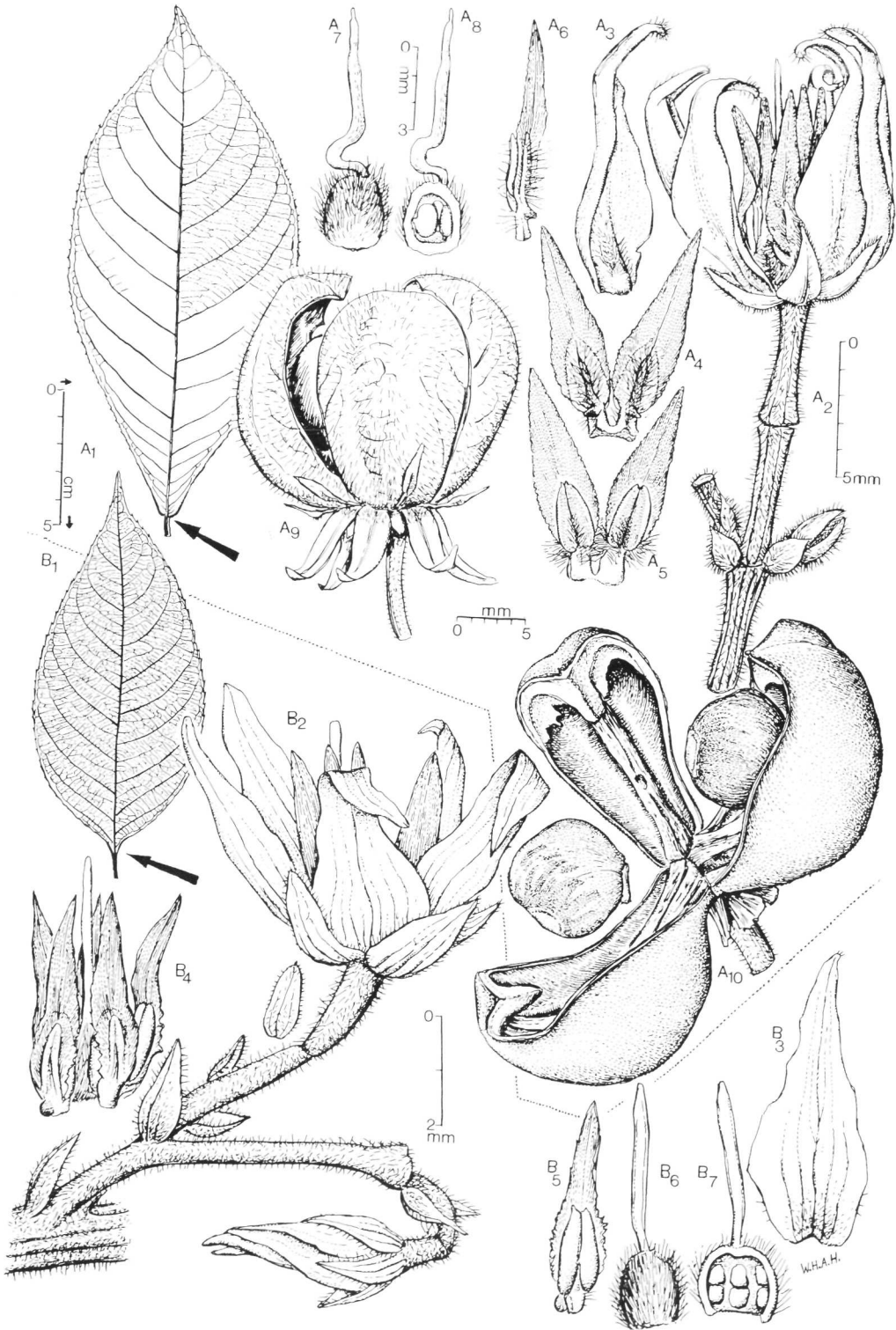
Rinorea laurifolia differs from *R. cordata* and *R. haughtii* mainly by its relatively small anthers, only ca. 1 mm long and less than 0.5 mm wide.

FIG. 16. **A.** *Rinorea cordata* (*Haught 1388*, type). **A₁**, Leaf. **A_{2,3}**, Older flowers with a juvenile fruit and curved style. **A₄**, Petal cordate basally (ventral), distinctly hairy basally. **A₅**, Idem (dorsal), weakly hairy basally. **A₆**, Stamens. **B.** *R. haughtii* (**B₁** from *Haught 1470*, type; **B_{2,3}** and **B_{4,5}** from *Duke 11287(2)*; **B₆** from *Duke 9579*). **B₁**, Leaves. **B₂**, Flower. **B₃**, Sepals (e = exterior [=outside], i = interior [=inside]). **B₄**, Petal, basally subcordate. **B₅**, Androecium (dorsal), with erect ovoid-conical dorsal glands, surrounding pistil. **B₆**, Stamen (ventral). **B₇**, Pistil. **B₈**, Capsule with 3 × 1 seeds, floral parts basally and style still present apically. **B₉**, Seed, glabrous. **C.** *R. laurifolia* (*Haught 1908*, type). **C₁**, Leaf. **C₂**, Flower bud. **C₃**, Adult flower. **C₄**, Sepals (e = exterior [=outside], i = interior [=inside]). **C₅**, Androecium and pistil: dorsal glands erect, ovoid conical. **C₆**, Pistil: l.s. of ovary, showing ovules 3 × 1; style subclavate.



FIG. 17. Holotype specimen of *Rinorea multivenosa* (Traill 22 [30.IX.1874], K).

FIG. 18. **A.** *Rinorea multivenosa* (**A**₁₋₈ from Traill s.n. [1875]; **A**₉ from Prance et al. 23902; **A**₁₀ from Traill 23 [1875], paratype). **A**₁, Leaf, obtuse at the very base. **A**₂, Lateral cymule at the base of the central axis, containing one adult flower, a reduced flower and another one dehiscent. **A**₃, Petal (ventral), hairy near the base. **A**₄, Stamens (dorsal), with erect conical dorsal glands and connective densely hairy. **A**₅, Stamens (ventral), thecae, connective, and filaments barbate. **A**₆, Stamen (lateral). **A**₇, Pistil, with style sigmoid curved at the base. **A**₈, Pistil with l.s. of the ovary showing ovules 3 × 1. **A**₉, Juvenile capsule, hairy, and with floral parts still present basally. **A**₁₀, Older capsule, becoming glabrous, with 3 × 1 glabrous seeds. **B.** *R. longistipulata* (Prance et al. 7529, paratype). **B**₁, Leaf, decurrent into the petiole. **B**₂, Lateral cymule at the base of the central axis, containing one flower bud and one adult flower. **B**₃, Petal (inside), subcordate and hairy basally. **B**₄, Androecium (dorsal), surrounding pistil, some stamens provided with an erect ovoid-conical dorsal gland. **B**₅, Stamen (ventral), provided with an ovoid-conical dorsal gland. **B**₆, Habit of pistil; style erect to slightly curved basally. **B**₇, Pistil, with l.s. of ovary, showing ovule 3 × 2.



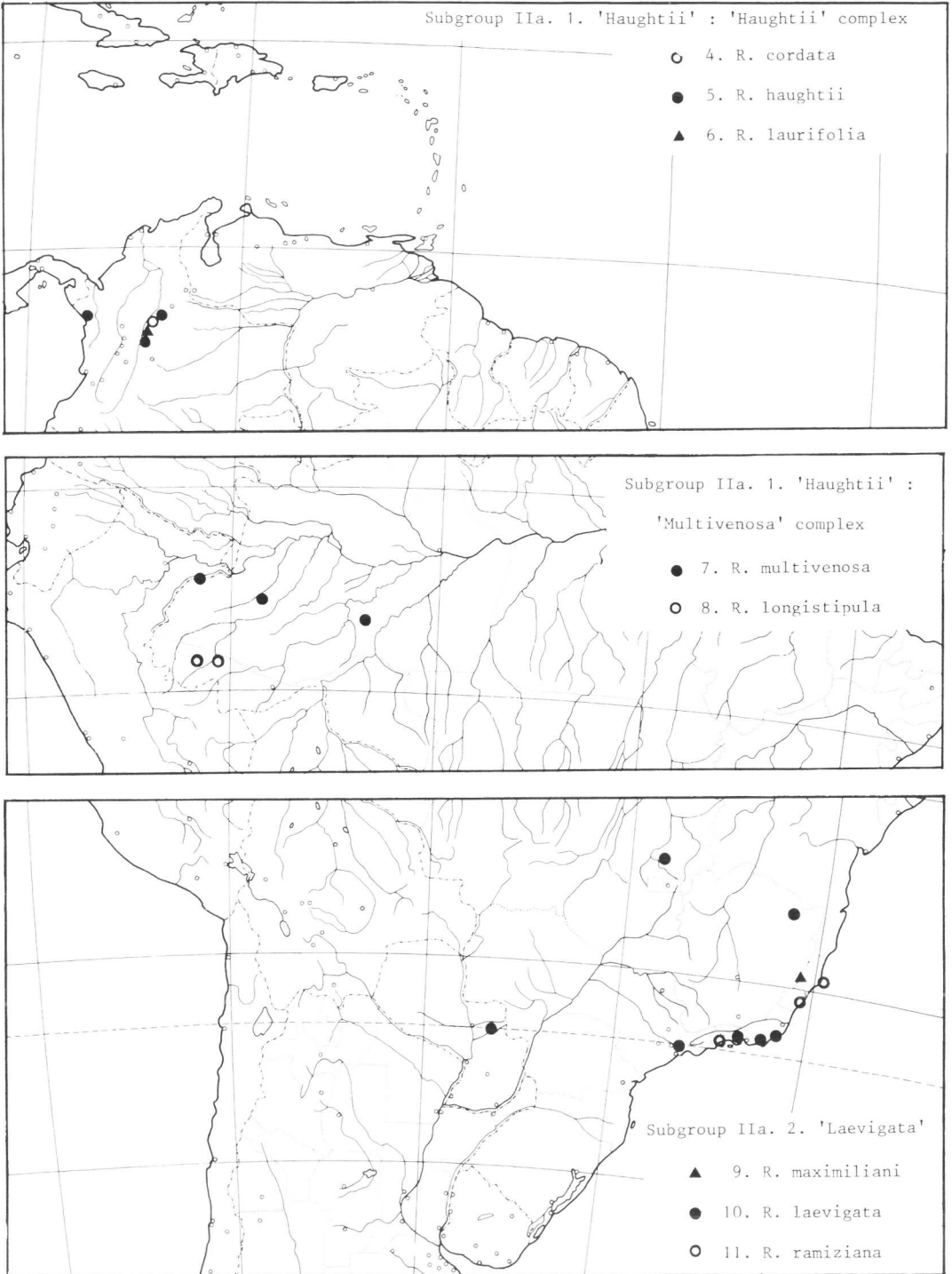


FIG. 19. Distribution of species of *Rinorea* Subgroup IIa.1. 'Haughtii' (subdivided into a 'Haughtii' and a 'Multivenosa' complex) and Subgroup IIa.2. 'Laevigata.'

'Multivenosa' complex; species 7, 8.

Inflorescences pseudoracemose; only outer petals subcordate; floral parts elongated, connective scales narrowly ovate or deltoid; ovary hairy; ovules one per carpel in *Rinorea multivenosa* and two in *R. longistipulata*.

Distribution (Fig. 19). The species of the complex occur, probably endemically, in forest refuge of SW Amazonia.

7. *Rinorea multivenosa* Hekking, *Phytologia* **43**(5): 472, pl. 2, fig. 9. 1979. Type, Brazil. Amazonas: Várzea at Sepatini, Rio Purus, Upper Amazon and tributaries, 30 Sep 1874 (fl), *Traill* 22 (holotype, K; isotype, P).

Figs. 17, 18, 19.

Tree 2–3 m tall. Branchlets sparsely and minutely pilosulous when young, glabrescent when older. *Leaves* alternate; petioles 5–9 mm long, sparsely pilosulous when young, glabrescent when older; stipules deciduous, narrowly ovate to deltoid, subacute, 4–5 × 0.25–1.75 mm, herbaceous, sparsely pilosulous, richly veined, ciliate; lamina elliptic to ovate, acuminate, 8–20.5 × 4.5–10.5 cm, papery to herbaceous, glabrous on both sides; lateral veins 15–19 pairs (acumen excluded); tertiary venation ± scalariform; base cuneate to rounded, obtuse at the petiole; margin (sub)serrate, mucronulate; acumen 0.5–1.5 cm long, apex subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, 1–2 fasciculate, pseudoracemose, 5–13 × 1–2 cm, laxiflorous near the base; central axis hirtellous; cymules 1–3 (–5?) flowered; common peduncle 1–2.5 mm long, hirtellous; 'pedicels' 2.5–2.75 mm long, articulate near the middle, hirtellous; bracts and bractlets ovate to deltoid, acuminate, herbaceous, hirtellous, costate, ciliate, subacute; bracts 0.75–1 × 0.5–0.6 mm; bractlets subopposite to alternate, 0.5–0.75 × 0.3–0.6 mm. *Flower buds* ovoid, conical, (sub)obtusate. *Flowers* white. *Sepals* subequal, ovate to deltoid, 1.25–2 × 0.5–1 mm, herbaceous, hirtellous, costate or 3–5 veined, ciliate, (sub)acute. *Petals* narrowly ovate, acuminate, 5–5.25 × 1.25–1.5 mm, herbaceous, outer petals subcordate at the base, base of outer and inner petals carnosate, minutely pilosulous outside, densely villose inside, glabrous along the margin, apex subobtusate, pilosulous. *Stamens* ca. 4 mm long; filaments (nearly) completely free, 0.25–0.75 × 0.2–0.4 mm, vil-

lose near the anthers; basal part fused to a minute tube, 0.1 mm high; dorsal glands free, erect, conical 0.2–0.4 mm long and wide, callose, pilosulous to glabrescent; anthers ovoid, 1.25–1.5 × ca. 0.75 mm, apex subacute, unappendaged; connective outside narrowly ovate to deltoid, (sub)acute, 1–1.25 × ca. 0.25 mm, whitish villose; connective inside, linear, 1–1.25 × ca. 0.1 mm, sometimes pilose near the base; connective scales apical as well as lateral, narrowly ovate to deltoid, acuminate, ca. 3.5 × ca. 1 mm, scarious, orange-brown, margin suberose near the base, apex subacute and subentire. *Ovary* subglobose 1.25–1.5 × 1–1.25 mm, greenish-white when fresh, golden villose; ovules one per placenta. *Style* filiform, sigmoid at the base, 3–3.25 mm long, whitish when fresh, glabrous or sparsely appressed pilosulous, exceeding the stamens by ca. 0.6 mm; stigma apiculate, subacute. *Cap-sule* ± symmetric, orbicular to ovoid, acuminate, subtended by subsistent floral parts, coriaceous to subligneous, greenish when fresh, sparsely pilose to glabrescent, apex subobtusate to subacute; valves three, subequal, 8.5–9.5 × 3–4 mm. *Seeds* one per valve, globose, ca. 4.5 mm in diam., glabrous.

Distribution (Fig. 19) and ecology. SW Amazonia of Brazil and SE Colombia between the rivers Amazonas and Madeira near Tefé and Olivença; occurring in periodically inundated areas. An additional specimen recorded from Rio de Janeiro (*Traill s.n. in herb. Glaziou*) was probably cultivated there.

Phenology. Flowering specimens have been collected in September and October and the only fruiting specimen in January.

Representative specimens examined: COLOMBIA. AMAZONAS: Quebrada Arara, 2 hr N of Leticia nr. Amazon River, 27 Jan 1969 (fr), *Croat* 7541 (MO, U). BRAZIL. AMAZONAS: Rio Javari, Tambaqui, 18 Oct 1976 (fl, fr), *Prance et al.* 23902 (INPA, MO, NY, U) & 23903 (INPA, NY, U); Inambu Kisawa, Rio Jutahi (=Jutai), 5°12' S, upper Amazon and tributaries, 29 Jan 1875 (fr), *Traill* 23 (K, P); Upper Amazon and tributaries, 1875 (fr), *Traill s.n.* (P); RIO DE JANEIRO & GUANABARA (Cult?): Quinta de Christovão, Rio de Janeiro, 16 Oct 1874 (fl), *Traill s.n.* (P, herb. Glaziou).

Sepals, petals, stamens and style, subsistent at the base of (juvenile) fruits, give additional flower characters to fruiting specimens. Fruits of *Rinorea multivenosa* are sparsely pilose to glabrescent (versus juvenile fruits of *R. longistipulata* densely pilose).

8. *Rinorea longistipulata* Hekking, *Phytologia* 43(5): 471. pl. 2, fig. 8. 1979. Type. Brazil. Acre: Forest on terra firme, vic. Tarauca, 14 Sep 1968 (fl. juv fr), *Prance et al. 7263* (holotype, U; isotypes, C, COL, F, G, HH, INPA, K, MG, MICH, MO, NY, P, R, S, U, VEN). Figs. 18B, 19.

Treelet 6–8 m tall. Branchlets pilosulous when young, glabrescent when older. *Leaves* alternate; petioles 5–12 mm long, glabrous; stipules deciduous, narrowly deltoid, subacute, 6–9 × 1–2 mm, herbaceous, pilosulous near the base, richly veined, ciliolate; lamina elliptic to ovate, acuminate, 6–14.5 × 3–7 cm, papery to subcoriaceous; lamina, costa and lateral veins glabrous on both sides; lateral veins 11–15 pairs (acumen excluded); tertiary venation ± scalariform; base rounded to cuneate, slightly decurrent into the petiole; margin subcrenate, mucronulate; acumen 0.5–2 cm long, apex subacute to subobtuse, mucronulate. *Inflorescences* axillary, lateral and subterminal, 1–3 fasciculate, pseudoracemose, 3–10 × 1–2.5 cm; central axis pilosulous; cymes 1–3 flowered, sometimes also provided with 1–2 rudimentary flower buds; common peduncles if present, 3–4 mm long, pilosulous; ‘pedicels’ 2–6 mm long, articulate near the middle, pilosulous; bracts and bractlets deltoid, ovate or elliptic, herbaceous, pilosulous, costate to 2–5 veined, ciliolate, apex subobtuse to subacute, sometimes mucronulate; bracts 1.25–1.75 × 0.6–0.8 mm, 3–5 veined; bractlets 0.75–1 × ca. 0.6 mm, 1–3 veined. *Flower* buds ovoid, conical, subobtuse to subacute. Flowers white. Sepals subequal, elliptic, ovate to deltoid, 2–2.5 × 1.25–1.75 mm, herbaceous, 3–5 veined, ciliolate, apex obtuse to subacute, sometimes mucronulate. Petals ovate, acuminate, 5–6.25 × 2–2.5 mm, herbaceous, outer petals subcordate at the base, base of outer and inner petals carnosely minutely pilosulous outside, densely pilosulous inside; margin scarios, glabrescent; apex subobtuse to subacute, sparsely pilosulous. Stamens subsessile, 3.25–4.5 mm long; filaments free, 0.3–0.4 × 0.3–0.5 mm, sparsely pilose inside; dorsal glands free, erect, conical, 0.2–0.3 × 0.1–0.3 mm, callose, glabrous; anthers ovoid, 1.5–1.75 × ca. 0.75 mm, glabrous, apex subobtuse to subacute, unappendaged; connective outside narrowly deltoid, subacute, 1.25 × 0.3–0.4 mm, glabrous; connective inside, linear ca. 1.25 × ca. 0.1 mm,

glabrous; connective scales lateral as well as apical, narrowly ovate, acuminate, 3–4 × 0.75–1.25 mm, scarios, orange-brown, erose to lacerate near the base, apex subobtuse to subacute, subentire. Ovary subglobose to slightly 3-lobed, ca. 1.25 × ca. 1 mm, golden pilose; ovules two per placenta. Style filiform, erect, sometimes slightly curved at the base, 3–3.5 mm long, completely glabrous, exceeding the stamens by ca. 0.5 mm; stigma truncate. Young *fruits* green, pilose.

Distribution (Fig. 19) and ecology. Known only from the type locality in Acre, SW Amazonia of Brazil, in unindated forest.

Phenology. Two flowering records in September; juvenile fruits have also been collected in September; the species probably also fruits in October.

Additional specimen examined: BRAZIL. ACRE: 1–3 km E of Rio Tarauca, 21 Sep 1968 (fl. juv fr), *Prance et al. 7529* (C, COL, F, G, HH, INPA, K, MG, MICH, MO, NY, P, R, S, U, VEN).

Sepals, petals, stamens and style are subsistent on (juvenile) fruits. *Rinorea longistipulata* is the only neotropical species in *Rinorea* in which the leaves are alternate in combination with ovules two per placenta. It has longer stipules, bracts, sepals and petals than *R. multivenosa*; the stipules of *R. longistipulata* are 6–9 mm long; longer, in fact, than in any other neotropical species of *Rinorea*.

Subgroup IIa.2. ‘*Laevigata*’; species 9–11.

Leaves and inflorescences congested at the apex of the branchlets; tertiary venation reticulate; *inflorescences* solitary or accompanied by 1–2 smaller lateral ones, thyrsoid or racemose, rarely pseudoracemose; filaments and dorsal glands (nearly) completely free or fused with each other to a tube; ovary hairy; ovules one per placenta.

This subgroup is characterized especially by leaves and inflorescences congested at the apex of the branchlets.

The three species belonging to this subgroup, *Rinorea maximiliani*, *R. laevigata* and *R. ramiziana* occupy an intermediate position between the preceding and the next subgroup, because of (1) the racemose inflorescences of *R. maximiliani* and *R. laevigata* (which is occasionally pseudoracemose) and their filaments and dorsal glands (nearly) completely free just as in the species of Subgroup IIa. 1. ‘*Haughtii*’; and (2) the



FIG. 20. Isotype specimen of *Rinorea maximiliani* (Maximilian Prinz zu Wied-Neuwied s.n. [BR, herb. Martius]). Parts of these specimens were used for the illustration in Eichler in Martius (1871).



inflorescences of *R. ramiziana* being poorly branched thyrsoid and its filaments and dorsal glands completely fused with each other to a tube, just as in *R. bicornuta* in Subgroup IIa. 3. 'Rinorea'.

Distribution (Fig. 19). The three species are restricted to SE Brazil, but *Rinorea laevigata* is also found more interiorly.

9. *Rinorea maximiliani* (Eichler in Martius) Kuntze, Revis. gen. pl. 1: 42. 1891; Reiche & Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. 1. 3(6): 329. 1895 ('*Maximilianii*'); Blake, Contr. U.S. Natl. Herb. 20(13): 500. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352. 1925. Figs. 19, 20, 21A.

Alsodeia maximiliani Eichler in Martius, Fl. bras. 13(1): 381. t. 77. fig. 1. 1871. Type. Brazil. Espírito Santo (?); S.l., March 1817 (fl.), *Maximilian Prinz zu Wied-Neuwied s.n.* (lectotypus novus. BR [herb. Martius]; isotype, BR [herb. Martius]).

Treelet 2–3 m tall; branchlets erect pilose when young, glabrescent when older. *Leaves* alternate, subsessile, congested near the apex of the branchlets; petioles 1.5–2 mm long, pilose; stipules subpersistent, narrowly ovate to deltoid, subacute, mucronulate, 4–5 × 1–1.5 mm, herbaceous, pilose, costate, densely ciliate; lamina narrowly elliptic to obovate, acuminate, sometimes emarginate, 5.5–14 × 1.5–4.5 cm, coriaceous, pilose on both sides; lateral veins (11–)12–13(–15) pairs; tertiary venation reticulate; base symmetric, rounded to subcordate; margin slightly thickened, (sub)serrate to (sub)crenate, mucronulate, subentire near the base; acumen hardly differentiated, apex subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, congested near the apex of the branchlets, racemose, laxiflorous, 6–8.5 × ca. 1.5 cm; central

axis puberulous to pilose; 'pedicels' 4–7 mm long, articulate at $\frac{1}{3}$ – $\frac{1}{4}$ from the base, puberulous; bracts and bractlets, ovate to deltoid, herbaceous, pilosulous, ciliate, apex subacute; bracts ca. 1.5 × ca. 1 mm; bractlets subopposite, ca. 1 × ca. 0.75 mm. *Flower* buds ovoid to conical, subacute. Flowers dirty white. Sepals (sub)equal, (narrowly) ovate, ca. 2 × 0.75–1 mm, herbaceous, pilose, costate and 2–3 veined, ciliate, apex (sub)obtuse. Petals narrowly ovate, 5–5.5 × ca. 1.75 mm, herbaceous, sparsely pilose outside, margin ciliate, apex obtuse, pilosulous. Stamens subsessile, 4–4.25 mm long; filaments (nearly) completely free, 0.3–0.4 mm long and wide, glabrous; dorsal glands free, erect, conical, ca. 0.25 mm long, carose to callose, glabrous; anthers narrowly ovate, acuminate, 2.25 × 0.5–0.75 mm, glabrous, thecae sometimes mucronulate at the apex; connective outside ca. 0.75 × ca. 0.25 mm, ovate, subobtuse, glabrous; connective scales lateral as well as apical, narrowly ovate, 3.75 × 0.75 mm, scarious, golden-brown, dorsally densely whitish villose just above the connective, erose near the base, apex obtuse, subentire. Ovary subglobose to ovoid, up to 3 × 1.75 mm, whitish pilose to strigose; ovules one per placenta, each inserted near the middle of the placenta. Style filiform to slightly subclavate to the apex, slightly sigmoid to curved at the base, 3–3.5 mm long, exceeding the stamens by 2–2.5 mm, glabrous; stigma truncate. *Fruits* unknown.

Distribution (Fig. 19) and ecology. Known only from the type collection from tropical forest along the coastal region of Espírito Santo (forest refuge: Bahía-South).

Rinorea maximiliani differs from *R. laevigata* and *R. ramiziana* by: (1) its leaves subsessile and pilose on both sides (versus petiolate and glabrous on both sides); (2) its stipules longer than 4 mm (versus distinctly shorter); and (3) its dor-

FIG. 21. A. *Rinorea maximiliani* (*Wied-Neuwied s.n.*, type). A₁, Leaf. A₂, Flower. A₃, Bractlets. A₄, Sepals (e = exterior [=outside], i = interior [=inside], e.i = in between). A₅, Petal. A₆, Androecium (dorsal), surrounding pistil. A₇, Stamen (ventral), appendaged by two scales. A₈, Stamen (dorsal), filament with erect conical dorsal gland, dorsal connective scale densely villose. A₉, Pistil. A₁₀, Idem, with l.s. of ovary, showing ovule 3 × 1. B. *R. laevigata* (B₁ from *Widgren s.n.*; B₂ from *Pohl 117*; B₃ and B₅₋₁₀ from *Schüch s.n.*; B₄ from *Anpeuz s.n.*; B₁₁ from *Riedel 4*). B_{1,2}, Leaves. B₃, Flower. B₄, Reduced (cleistogamous?) flower. B₅, Sepal. B₆, Petal. B₇, Stamen (dorsal), with connective villose and connective scale predominantly glabrous. B₈, Stamen (ventral), thecae at the apex appendaged by two scales. B₉, Pistil. B₁₀, Idem, with l.s. of ovary, showing ovules 3 × 1. B₁₁, Capsule, with one glabrous seed in each valve, floral parts present basally. C. *R. ramiziana* (*Glaziou 12425*, type). C₁, Leaf. C₂, Flower. C₃, Androecium (dorsal), with connective glabrous and connective scale densely villose. C₄, Capsule, dehiscing into three valves, floral parts basally and style apically still present. C₅, Valve (inside), showing one undeveloped seed. C₆, Completely developed glabrous seeds.

sal glands conical, erect on the dorsal side of the filaments.

10. Rinorea laevigata (Solander ex Gingins)
Hekking, comb. nov. Figs. 19, 21B.

Physiphora laevigata Solander ex Gingins in A. P. de Candolle, Prodr. 1: 314, mid-Jan 1824. Type. Brazil. 'Rio de Janeiro,' 1768 (juv fr, *Banks herb. s.n.* (= *Banks & Solander s.n.*) (holotype, BM).

Rinorea physiphora Baillon, Hist. pl. 4: 346, figs. 358–362, 1873, nom. illeg., because based on *Alsodeia physiphora* Brown in *Banks herb. s.n.*, nom. invalid.: *Traité bot. méd. phan.* 2: 836, Mar 1884 ('1883–1884').

Rinorea physiphora (Martius) Kuntze, Revis. gen. pl. 1: 42, 1891, nom. illeg., according to Code Art. 55.1a; Reiche & Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. 1. 3(6): 329, 1895; Blake, Contr. U.S. Natl. Herb. 20(13): 501, 1924, cited as '(Martius) Baillon'; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352, 1925; da Silva & Dames e Silva, *Rodriguesia* 27(39): 197, 1974, cited as '(Martius) Baillon.'

Alsodeia physiphora Martius, Nov. Gen. sp. pl. 1(2): 28, t. 19, late 1823 or Jan–Feb 1824 ('1823–1832') ('*Alsodea*'); Sprengel, Syst. veg. ed. 16. 1: 807, late 1824 (t.p. 1825) ('1825'); Syst. veg. ed. 16. 4(2): 99, Jan–Jun 1827 ('*Alsodea*'); D. Dietrich, Syn. pl. 1: 831, Jul 1839 ('*Alsodea*'); Eichler in Martius, Fl. bras. 13(1): 382, pl. 77, fig. 2, 1871 (exclusive *Glaziou 12425*, lectotype of *R. ramiziana* Glaziou ex Hekking); Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 184, 1891 ('1890'); Glaziou, Bull. Soc. Bot. France 52. Sér. 4. 5. Mém. 3a: 22, 1905. Type. Brazil. Guanabara: Rio de Janeiro, nr. Cadete (=Catete?), nr. Sebastiãoopolis? (cf. Martius, 1823–1824 ['1823–1832']), s.d. (fr), *Martius 185* (?) = (134, written on a small label attached to the specimen, lectotypus novus, M; isotype, *Martius 185* (?) (M, (135)).

Conohoria lobolobo Aug. de Saint Hilaire nom. illeg., according to Code Art. 63(1), Pl. usuel. bras. 10(1–2): pl. 10, 12 Jun 1824; Hist. pl. remarq. Brésil 1: 320, Jun 1824 (= *Alsodeia physiphora* Martius, which is cited as a synonym); Mém. Mus. Hist. Nat. 11: 494, 1825 ('1824'); Fl. Bras. merid. 2(13): 107, 1829 (folio); Fl. Bras. merid. 2(14): 149, 8 May 1830 ('1828') (quarto); G. Don, Gen. hist. 1: 341, early Aug 1831 ('1831–1838') ('*Gonohoria loboloba*'); Spach, Hist. nat. vég. Phan. 5: 523, Jun 1836 ('*Conohoria*'). Type. Brazil. Rio de Janeiro: Babylonia nr. Rio de Janeiro, 1816 (fl), *Aug. de Saint Hilaire Catal. A 1. No 137* (lectotypus novus, P [to which a manuscript of Aug. de Saint Hilaire has been added], isotypes, P).

Conohoria castaneaefolia Aug. de Saint Hilaire, Pl. usuel. bras. 10(2–3), 12 Jun 1824 ('*castaneaefolia*'); Hist. pl. remarq. Brésil 1: 321, Jun 1824; Mém. Mus. Hist. Nat. 11: 495, 1825 ('1824'); Fl. Bras. merid. 2(13): 108, 1829 (folio); Fl. Bras. merid. 2(14): 149, 8 May 1830 ('1828') (quarto); G. Don, Gen. hist. 1: 341, early Aug 1831 ('1831–1838') ('*Gonohoria*');

Spach, Hist. nat. vég. Phan. 5: 524, Jun 1836 ('*Conohoria*'); W. J. Hooker, Icon. pl. 1: t. 63, 1837 ('*castaneaefolia*') p.p. (the description and illustration refer to a mixture of this taxon and *Alsodeia brevipes* Benthham, 1842 (= *A. laxiflora* Benthham, 1842)). Dietrich, Syn. pl. 1: 832, Jul 1839. Type. Brazil. Rio de Janeiro: São Christovo nr. Sebastiãoopolis, 1816 (fl), *Aug. de Saint Hilaire, Cat. A 1: 439* (lectotypus novus, P; isotypes, P).

Alsodeia castaneaefolia (Aug. de Saint Hilaire) Sprengel, Syst. veg. ed. 16. 4(2): 99, Jan–Jun 1827 ('*Alsodea*').

Alsodeia castaneaefolia Sprengel sensu Eichler in Martius, Fl. bras. 13(1): 382, t. 77, fig. 3, 1871 p.p. (two of the cited synonyms *Conohoria rinorea* Aug. de Saint Hilaire and *Alsodeia floribunda* Moricand, the species description, the illustrated fruit and most of the specimens belong to *Rinorea guianensis* Aublet; the cited specimens of Aug. de Saint Hilaire may belong to both species).

Rinorea castaneaefolia (Aug. de Saint Hilaire) Baillon, *Traité Bot. Méd. Phan.* 2: 836, Mar 1834 ('1833–1834'); Kuntze, Revis. gen. pl. 1: 42, 1891 cited as '(Aug. de Saint Hilaire) Kuntze'; Reiche & Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. 1. 3(6): 329, 1895, cited as '*castaneaefolia* (Sprengel) Kuntze'; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352, 1925, cited as '(Aug. de Saint Hilaire) Baillon' and '(Sprengel) Kuntze.'

Tree or treelet, 3–15 m tall. Branchlets sparsely puberulous when young, glabrescent when older. *Leaves* alternate, congested near the apex of the branchlets; petioles (0.5–)1.5–5(–7) mm long, puberulous to glabrescent above, glabrous beneath; stipules deciduous, deltoid to ovate, (0.5–)1.25–1.75 × (0.5–)1 mm, herbaceous, strigillose along the costa, 5–7 veined, ciliolate, apex subacute, occasionally mucronulate; lamina narrowly elliptic to obovate, acuminate, 2–15 × 0.5–5 cm, herbaceous to papery, glabrous on both sides; costa puberulous above, glabrescent beneath; lateral veins (11–)13–16(–20) pairs; tertiary venation reticulate; base rounded to cuneate, symmetric to oblique, slightly obtuse to rounded at the petiole; margin (sub)serrate to (sub)crenate, mucronulate; acumen hardly differentiated, apex subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, usually solitary, sometimes accompanied by a lateral one, congested near the apex of the branchlets, usually racemose, occasionally pseudoracemose, laxiflorous, (1–)2–12.5 × 0.75–1.25 cm; central axis puberulous; flowers solitary; cymules, if present, 1–3 flowered; 'pedicels' 3.5–9 mm long, usually articulate below the middle, pilosulous; bracts and bractlets ovate to deltoid, herbaceous, sometimes sparsely strigillose along the apical

part of the costa, ciliolate, apex acute, mucronulate; bracts 1–1.25 × 0.75–1 mm; bractlets subopposite to alternate, 0.5–1 × 0.5–0.75 mm. *Flower* buds ovoid to conical, subobtusate. Flowers creamy- to yellowish-white. Sepals subequal, ovate, 1–1.75 × 1–1.25 mm, herbaceous, glabrous or sparsely ferruginous pilose near the apex, 1–3(–5) veined, margin scarios, cili(ol)ate, apex subacute, mucronulate. Petals (narrowly) ovate, acuminate, 4.75–5 × (1.25–)1.5–2 mm, herbaceous, glabrous or appressed pilosulous at the apex, margin sometimes sparsely ciliolate, apex (sub)obtusate. Stamens subsessile, 3.5–4.25 mm long; filaments free or slightly connate at the base, 0.2–0.4 × 0.3 mm, glabrous or slightly pilosulous; dorsal glands free or more or less fused to a tube, 0.25–0.75 mm long (or high), 0.25 mm wide (if free), carnos, slightly pilosulous to glabrous; anthers narrowly ovoid, 1.25–2 × 0.5–0.75 mm, apex obtuse to subacute, often appendaged by two free or connate cusps, ca. 0.4 × ca. 0.05 mm; connective outside deltoid, obtuse, ca. 0.75 × ca. 0.25 mm, whitish villose especially near the apex; connective scales lateral as well as apical, narrowly ovate 3–3.75 × 1–1.25 mm, scarios, golden-brown, glabrous, margin erose near the base, apex obtuse and subentire. Ovary subglobose 0.75–1.75 × 0.5–1.25 mm, pilose near the apex; ovules one per placenta, each inserted near the middle of the placenta. Style filiform to subclavate, slightly sigmoid at the base when young, erect when older, 3–3.5 × 0.25–0.75 mm, exceeding the stamens by 0.25–0.75 mm; stigma truncate. *Capsule* sometimes asymmetric, (sub)orbicular, acuminate, subacute, usually subtended by subsistent floral parts, coriaceous, sparsely pilose to glabrescent, obscurely veined, shining; valves three, subequal to unequal, 5–9.5 × 2–4 mm, with the style subsistent at the apex of one of the valves. *Seeds* one per valve, subglobose, 2–5.5 mm in diam., glabrous, shining.

Distribution (Fig. 19) and ecology. It is widely spread over SE Brazil and along the Río Paraguay, including the following forest refugia: (a) Bahía-South; (b) Rio de Janeiro; (c) Araguaia; (d) Río Paraguay. Along the Río Paraguay *Rinorea laevigata* occurs together with *R. ovalifolia*, which has a wide Amazonian distribution. It is usually found in the understory of local tropical rain forests of the coastal region but, more interiorly, also in deciduous forests, as well as in gallery forests along rivers.

Phenology. Flowering specimens collected May–July as well as in September–December, fruiting specimens in January–March and May–December.

Representative specimens examined: BRAZIL, GOIAS: Between Goyaz and Levalcaute, s.d. (bud), *Burchell* 7527 (K). MINAS GERAIS: Arassuaí (=Arassuaí). Nov 1915 or 1918 (fl, juv fr), *Vincent* s.n. (L 950.176–400). RIO DE JANEIRO & GUANABARA: Rio de Janeiro?, 29 Jun 1836 (fl), *Anpœur* s.n. (LE); Rio de Janeiro, 1846 (fl), *Barboza* s.n. (BR, herb. Martius); idem, May 1823 (?) (fl), *Beyrich* 5/23 (?) (LE); aqueduct, Rio de Janeiro, 24 Dec 1825 (fl, fr), *Burchell* 1203 (K); vic. Rio de Janeiro, s.d. (fl, fr), *Burchell* 1334 (K); Rio de Janeiro?, s.d. (bud), *Caminhão* (W); Rio de Janeiro, s.d. (fl, fr), *Casaretto* 563 (G); Corcovado, Andaluz, Sep–Oct 1862 (fl), herb. E. Drake (del Castillo) s.n. (P); Corcovado, Sep 1869 (fl), herb. E. Drake (del Castillo) s.n. (P); aqueduct, Rio de Janeiro, s.d. (fl, fr), herb. Fischer (LE); Rio de Janeiro?, s.d. (fl), *Freyreys* s.n. (S); Rio de Janeiro?, s.d. (fl), *Frölich* s.n. (S); Rio de Janeiro and vic., Aug & Nov 1836 (fl, fr), *Gardner* 7 p.p. (BM, HH, MO, NY); Rio de Janeiro, 1836 (fl), *Gardner* 7 p.p. (K [herb. Hookerianum]), P [herb. E. Drake (del Castillo)]; idem, 1837 (fl, fr), *Gardner* 7 p.p. (K [herb. Benthalianum], OXF); idem (?), Jan 1838 (fl), *Gardner* 7 p.p. (CGE, W 00157); idem, s.d. (fl), *Gardner* 7 p.p. (P, Catal 1866 no 18); Rio de Janeiro, Mt. Organo, s.d. (fl), *Gardner* 7 p.p. (G, herb. Moricand); Rio de Janeiro, wooded hills, Jan (?) 1841 (fr), *Gardner* (?) s.n. (BM); Rio de Janeiro, Marro de Inglez, Corcovado, 27 Jun 1863 (fl, fr), *Glaziou* 347 (BR [herb. Martius], P [herb. Glaziou], R 4715); Rio de Janeiro, s.d. (fl, fr), *Glaziou* 2962 (BR, C, K, P [herb. Glaziou]); Rio de Janeiro Larangueiras, 2 May 1869 (fl), *Glaziou* 3676 (BR, HH, C, P [herb. Glaziou]); Rio de Janeiro, Mt. Nov 1872 (fl), *Glaziou* 6069 (C, K, P [herb. Glaziou]); Praia Brava, Cabo Frio, 28 Sep 1960 (fl), *Gomes & Burk Marx* 1187 (RB); Rio de Janeiro, s.d. (fl), *Graham* s.n. (K); idem, 1839 (fl, fr), *Guillemin ex Riedel* Cat 1027 (F, G, P); Morro de P. João, Rio de Janeiro, Oct 1914 (fl, fr), *Hoehne* 277 (SP); Rio de Janeiro?, s.d. (fr), herb. *Jacquin* (W); Corcovado, s.d. (fr), *Langsdorff* s.n. (LE); Rio de Janeiro (?), 1832 (fl), *Lhotsky* s.n. (G, [herb. de Candolle]); Rio de Janeiro (?), s.d. (fl, fr), *Lund* 585 (BR [herb. Martius], C); Rio de Janeiro, s.d. (fl, fr), *Luschnath* s.n. (OXF); Rio de Janeiro?, s.d. (fl), *Martius* s.n. (M 147), S); Rio de Janeiro, July 1878 (fl), *Miers* 3070 (CGE, G, K); aqueduct, Rio de Janeiro, Oct 18.. (fr), *Mikan* 35 (W); Rio de Janeiro?, s.d. (fr), *Mikan* 446 (W); Catumbi, Rio de Janeiro, s.d. (fl, fr), *Mosen* 2776 (S); Rio de Janeiro?, 1862 (bud, fr), *Nadeaud* s.n. (P, herb. E. Drake [del Castillo]); Rio de Janeiro, nr. Praia Grande, 1863 (bud), *Netto* s.n. (HH); Corcovado, s.d. (fr), *Netto* s.n. (R 79835); Sta. Tereza, 22 Oct 1879 (fl), *Netto* s.n. (R 78853); Rio Sacopan, 22 Oct 1942 (fl), *Edm. Pereira* 117 (HB 6382, RB 46589); Rio de Janeiro?, s.d. (fl), *Pohl* 111 (G [herb. de Candolle]); Rio de Janeiro, aqueduct, s.d. (fl), *Pohl* 117 (M); Rio de Janeiro?, s.d. (fl, fr), *Pohl* 4356 (F, HH, W); idem, s.d. (fl), *Raben* 316 (BR, C, F); idem, s.d. (fl), *Raddi* s.n. (FI); Rio de Janeiro, s.d. (fl), herb. *Richard* s.n. (P (herb. E. Drake [del Castillo]); vic. Rio

de Janeiro, Oct 1829 (fl. fr). *Riedel 4* (LE); idem, 1832 (fl. fr). 75 (K, LE) & 75a (LE); idem, Dec 18.. (fl). 141 (G, P); idem, 1832 (fl. fr). *s.n.* (BM, BO, BR, C, FI, G, K, L, LE, MO, NY, P, S, US, W); Babylonia Mountain, nr. Rio de Janeiro, 1816–1821 (fl). *Saint Hilaire A-1 137* (P); vic. Rio de Janeiro, 1822 ('1816–1821') (fl). *Saint Hilaire C-2 58* (P); Rio de Janeiro, 1827 (?) (fl). *Saint Hilaire s.n. ex herb. Nees von Esenbeck* (R 79815); Sebastianopolis, s.d. (fl). *Schüch s.n.* (M 116); Sebastianopolis? s.d. (fl). *Schüch s.n.* (F, W); Sta. Tereza, Oct 1879 (bud). *herb. Schwacke 2076 ex herb. Damasio s.n.* (RB); Rio de Janeiro?, s.d. (fl). *Sello 987* (M); idem, 1815–1817, *Sello s.n.* (BM); Morro da Gambão, Cabo Frio, 11–9–1967 (fl). *Sucré 1537* (RB, U); Rio de Janeiro?, 1848 (bud). *Tweedie 1248* (K [herb. Benthamianum, herb. Hookerianum]); idem, 1837, 1249 (K); idem, s.d. (fl). 1324 (K); Morro da Nova Cinta, Rio de Janeiro, Sep 1893 (fl). *Ule 3258* (HBG, R 79801); Isle of Cabo Frio, 11 Oct 1899 (fl). *Ule s.n.* (HBG); Rio de Janeiro? s.d. (fl, fr). *Widgren 1024* (S). 1205 (BR). *s.n.* (C, LE, R 79845, S). SÃO PAULO: S.L., s.d. (bud, fr). *Burchell 4960* (K).

PARAGUAY. CONCEPCIÓN: San Luis, between the Ríos Apa and Aquidaban, 1908–1909 (bud). *Fiebrig 4159* (HBG).

Local name: Brazil: Lobo-lobo (Guanabara, Rio de Janeiro).

Uses: The leaves become mucilaginous when cooked, and are eaten by the local Negro population of Rio de Janeiro. The leaves acquire a more agreeable taste if the shrubs are planted in good soil under the shade of trees in order to blanch them (St. Hilaire, 1824a, 1824b; Don, 1831).

Rinorea laevigata differs from *R. maximiliani* and *R. ramiziana* by its connectives being whitish villose outside, while the connective scales are glabrous. In *R. maximiliani* and *R. ramiziana* the situation is just reversed; their connectives are glabrous outside, while the connective scales are whitish villose. In some specimens of this species, e.g., *Anpeuz s.n.*, reduced flowers have been found together with normally developed flowers. These flowers are probably cleistogamous.

Specimens cited in Malme (1901) and Glaziou (1905) as *Alsodeia castaneaefolia* (Saint Hilaire) Sprengel do not belong to *R. laevigata* but to *R. guianensis* Aublet.

11. *Rinorea ramiziana* Glaziou ex Hekking. *Phytologia* 53(4): 255, pl. 1, fig. 4, 1983.

Figs. 19, 21C.

Alsodeia ramiziana Glaziou, Bull. Soc. Bot. France 52, Sér. 4, 5, Mém. 3a: 22, 1905, nom. nud.; Blake,

Contr. U.S. Natl. Herb. 20(13): 157, 1924 (species dubia ob nomine nudo et ab auctore (=Blake) non observata). Type, Brazil, Rio de Janeiro: Campos nr. Itaca, Apr–May 1881 (fl). *Glaziou 12425* (holotype, P [herb. Glaziou]); isotypes, C [herb. Warming], K [herb. Benthamianum], LE, P).

Treelet 3–5 m tall. Branchlets glabrous, porphyreous when dried. *Leaves* alternate, congested near the apex of the branchlets; petioles 1.5–5 mm long, minutely pilosulous above, glabrous beneath; stipules deciduous, deltoid, ca. 2 × ca. 1 mm, herbaceous, hispid(ulous) along the costa, margin glabrescent, apex subacute; lamina narrowly elliptic to obovate, 5–13 × 2–5.5 cm, papery to coriaceous; lamina, costa and lateral veins glabrous on both sides; lateral veins (8–)11–16 pairs; tertiary venation reticulate; base rounded to cuneate, sometimes slightly oblique and rounded at the petiole; margin subentire, slightly thickened, mucronulate; acumen hardly differentiated, apex obtuse to (sub)acute, mucronulate. *Inflorescences*, axillary, lateral and subterminal, solitary or 2-fasciculate, congested near the apex of the branchlets, thyrsoid, laxiflorous 5–10 × 1–2 cm; central axis sparsely pilosulous to glabrescent; cymules 1–3 flowered, sometimes accompanied by 1–5 juvenile flower buds or undeveloped flowers; common peduncles 1.25–3 mm long, sparsely pilosulous; 'pedicels' 1.25–2 mm long, usually articulate at 1/3 from the base, sparsely pilosulous; bracts and bractlets subequal, ovate to deltoid, 0.75–1 × 0.5–0.75 mm, herbaceous, margin scarious, ciliolate, apex subacute, mucronulate. *Flower buds* ovoid to conical, subacute. Sepals subequal, deltoid to ovate, ca. 1.75 × 1.25–1.5 mm, herbaceous, margin scarious and ciliolate, apex subobtusate to acute, mucronulate. Petals narrowly ovate, acuminate, 4.75–5.25 × 1.5–1.75 mm, herbaceous, pilosulous at the apex, margin not ciliolate, apex subobtusate to subacute. Stamens subsessile, ca. 3.25 mm long; filaments and dorsal glands fused to a tube; filamental tube 0.1–0.2 mm high, glabrous; anthers narrowly elliptic to ovate, ca. 2 × ca. 0.75 mm, thecae mucronate; connective outside, narrowly deltoid, subacute, ca. 0.75 × 0.1–0.2 mm, glabrous, sometimes whitish villose along the apical margin; connective scales lateral as well as apical, ovate, ca. 3 × ca. 1 mm, scarious, brownish, densely whitish villose outside, margin erose, apex obtuse and suberose. Ovary ovoid, ca. 1.25 × ca. 0.75 mm, whitish pilose to villose;

ovules one per placenta, each inserted at the base of the placenta. Style filiform, subclavate near the apex, erect, ca. 2.5 mm long, exceeding the stamens by ca. 0.5 mm, glabrous, pilosulous near the base; stigma truncate. *Capsule* slightly asymmetric elliptic to orbicular, acuminate, subtended by subsistent floral parts, coriaceous, sparsely pilose, veined; valves three, unequal to subequal, ca. 10 × 4.5–7 mm, with the style often subsistent at the apex of one of the valves. *Seeds* one per valve, subglobose, 4 × 5 mm, glabrous.

Distribution (Fig. 19) and **ecology**. Known only from the Atlantic coastal region of SE Brazil, including the following forest refugia: (a) Rio de Janeiro-North and (b) Alegre, in tropical rain as well as savanna forests.

Phenology. Flowering specimens have been collected in April and May, fruiting specimens only in May.

Additional specimens examined: BRAZIL. ESPÍRITO SANTO: Vitória, 6 May 1946 (fl. fr), *Brade et al.* 18087 (RB 56709); Lagão do Durão, Linhares, Rio Doce, 15 Apr 1934 (bud), *Kuhlmann 215* (RB 34384). RIO DE JANEIRO: Campos, Itaóca, Apr 1880 (fl), *Ramiz Galvão 422* (P. herb. Glaziou).

Rinorea ramiziana differs from *R. maximiliani* and *R. laevigata* by: (1) thyrsoid inflorescences versus (pseudo)racemose in the latter two; (2) the 'pedicels' and the style shorter than 3 mm.

Subgroup IIa.3. 'Rinorea'; species 12–15.

Leaves and inflorescences remotely dispersed along the branchlets; tertiary venation reticulate to scalariform; *inflorescences* solitary or accompanied by 1–2 smaller lateral ones, thyrsoid; filaments and dorsal glands fused to a tube; ovary hairy; ovules one per placenta.

This subgroup is characterized by having thyrsoid inflorescences in combination with leaves and inflorescences remotely dispersed along the branchlets.

Inflorescences of *Rinorea bicornuta* are poorly branched and provided with only 1–5(–7?) lateral cymules, much resembling those of *R. ramiziana* in Subgroup IIa. 2. 'Laevigata,' and in contrast to those of the other three species of this subgroup. Inflorescences of *R. guianensis*, *R. bahiensis* and *R. paniculata* are richly branched and provided with lateral cymules consisting of 1–11(–21) flowers. The filaments are fused into a tube, just

as in *R. ramiziana* of Subgroup IIa. 2. 'Laevigata,' *R. uxpanapana* of Group IIb. 'Uxpanapana' and the species of Subgroup IIc. 10. 'Racemosa.'

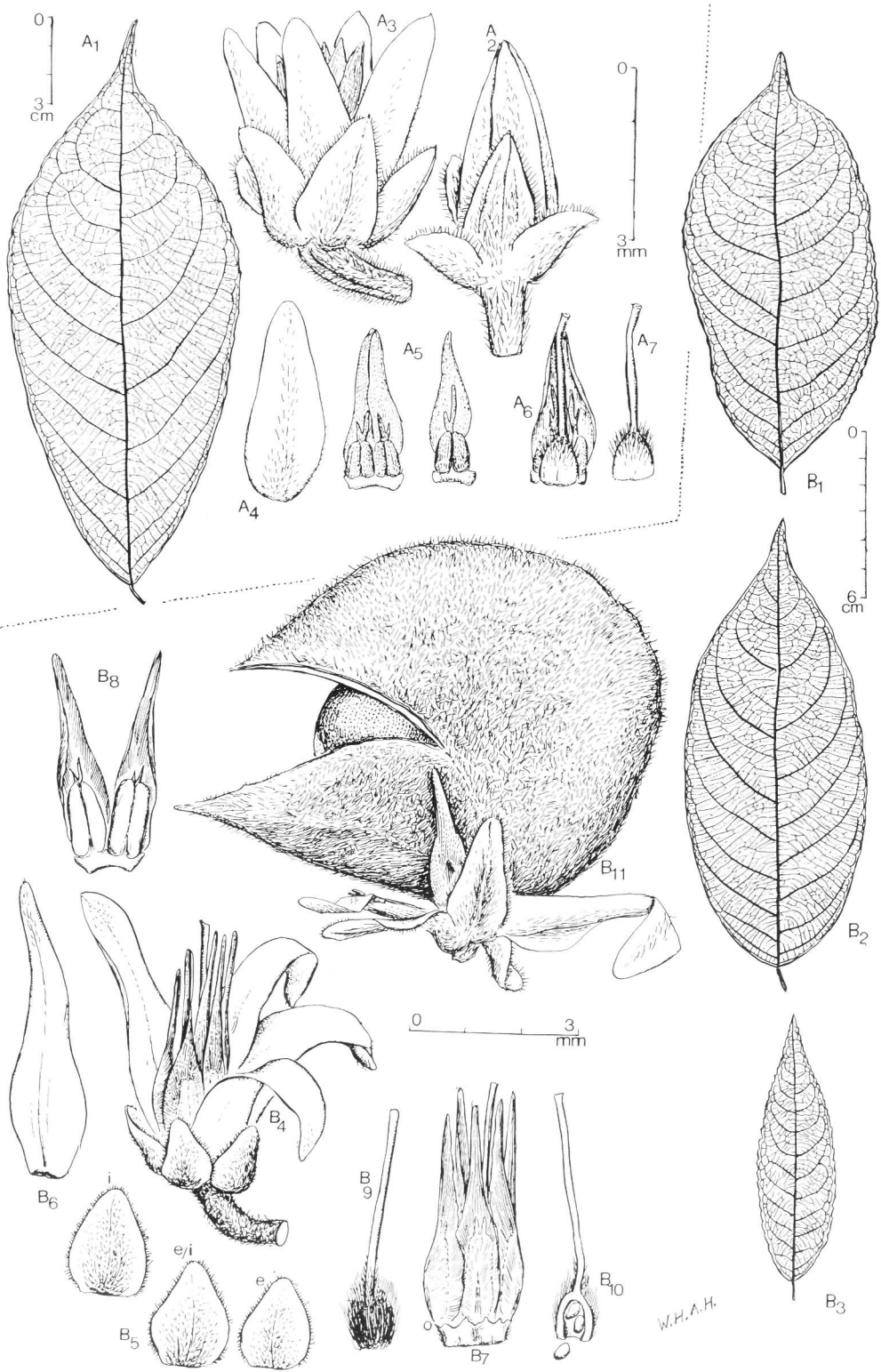
The dorsal glands are usually distinct and adnate to the tube in *Rinorea guianensis*, *R. bahiensis* and *R. paniculata*, but they are completely fused with the tube in *R. bicornuta*. This feature of *R. bicornuta* is shared with *R. ramiziana*, *R. uxpanapana* and the species of Subgroup IIc. 10. 'Racemosa.'

Distribution (Fig. 24). The distribution patterns of the four species of this subgroup, taken together, correspond with present-day areas of moist forest in the neotropics (see map in Mori et al., 1981, fig. 1) except for the West Indies, where *Rinorea* is wanting. This suggests also the existence of a previously coherent area for a common ancestral stock extending from SE Brazil to the Guianas, northern Venezuela and W Colombia. The Cordilleran uplift resulted in isolation of *R. paniculata* in W Colombia and *R. guianensis* on the Coastal Cordillera of Venezuela. The occurrence of *R. paniculata* in Central America is due to migration from W Colombia.

12. *Rinorea bicornuta* Hekking, *Phytologia* **43**(5): 474. pl. 2, fig. 10. 1979. Type. Brazil. Amazonas: Tonantíns, R. Solimões, 9 Nov 1927 (fl), *Ducke s.n.* (holotype RB 21.353).

Figs. 22A, 24.

Tree. Branchlets densely strigillose. *Leaves* alternate; petioles 3–11 mm long, pilose; stipules deciduous, narrowly deltoid, acuminate, 4–5 × 1–1.5 mm, herbaceous, veined, costa pilose, margin ciliate; lamina obovate, acuminate, 10–20 × 4–8.5 cm, papery, glabrous on both sides; costa sparsely pilose(ulous) on both sides; lateral veins 10–13 pairs (acumen excluded); tertiary venation ± scalariform; base rounded to cuneate; margin subentire to subcrenate; acumen 0.5–2.25 cm long, apex subobtusate to obscurely mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, thyrsoid, ca. 9 × 1–1.5 cm; central axis hirsute; cymules 1–5(–7?) flowered; common peduncles 1.25–2.5 mm long, hirsute; 'pedicels' 1–3 mm long, articulate at 1/3 from the base, hirsute; bracts and bractlets ovate to deltoid, (sub)acute, mucronulate, herbaceous, pilosulous, pilose along the median part, ciliate; bracts ca. 1.25 × ca. 0.75 mm; bractlets subop-



posite, 0.75–1 × ca. 0.5 mm. Flower buds conical, subacute. Flowers strongly deflexed, whitish. Sepals subequal, ovate to deltoid 2–2.5 × 1.5–1.75 mm, herbaceous, carnosose and pilose near the base and along the costa, 1–3 veined, margin ciliate, apex subobtusate, mucronulate. Petals ovate to deltoid, ca. 3.25 × ca. 1.5 mm, herbaceous, carnosose and pilose(ulous) near the base and along the costa, sparsely ciliolate, apex obtuse. Stamens ca. 2.5 mm long; filaments and dorsal glands fused to a tube; filamental tube ca. 0.2 mm high, carnosose, glabrous; anthers ellipsoid to ovoid, 0.8 × 0.4 mm; apex of thecae rounded, appendaged by a common bicornous cusp, 0.4–0.8 × 0.3 mm, sometimes fringed; connective outside (narrowly) deltoid, subacute to subobtusate, 0.2–0.6 × 0.2 mm, glabrous; connective scales lateral as well as apical, ovate, acuminate, 2–2.25 × ca. 0.75 mm, scarious, brownish, margin suberose, apex subacute to subobtusate. Ovary subconical to ovoid, 0.8 × 0.4 mm, pilose near the apex; ovules one per placenta. Style filiform, erect or slightly curved near the apex, 2–2.5 mm long, exceeding the stamens by ca. 0.5 mm, completely glabrous; stigma truncate to obscurely pulvinate. Fruits unknown.

Distribution (Fig. 24) and ecology. Known only from the type collection near Tefé in Western Amazonia of Brazil, in a tropical rain forest on a river bank.

Rinorea bicornuta is named after its two long, connate, and fringed cusps appendaged on the ventral side of the anthers. It differs from *R. guianensis*, *R. bahiensis* and *R. paniculata* by its: (1) narrowly thyrsoid inflorescences containing lateral cymules with usually 3–5 flowers versus widely thyrsoid and lateral cymules with 1–15 (–21) flowers; (2) pedicels only 1–3 mm long versus 1.5–5.5 (–7.5) mm long; (3) older flower buds and flowers strongly deflexed; and (4) flower buds conical (in *R. bahiensis* between conical and tolpoid, in *R. guianensis* tolpoid and in *R. paniculata* ellipsoid to ovoid).

13. *Rinorea guianensis* Aublet, Hist. pl. Guiane **1**: 235, t. 93. ('*Guyannensis*'). 1775; J. A. Schultes, Syst. veg. **5**: 325 late 1819 early 1820 ('1819'); de Gingins in A. P. de Candolle, Prodr. **1**: 313, mid Jan 1824; G. Don, Gen. hist. **1**: 341, fig. 65, early Aug 1831 ('1831–1838'); Reiche & Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. **1**. **3(6)**: 329, 1895 ('*guyanensis*'); Blake, Contr. U.S. Natl. Herb. **20(13)**: 499, 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. **2**. **21**: 352, 1925; Lanjouw & Uittien, Recept. Trav. Bot. Néerl. **37**: 156, (no. 77), 1940; Lemée, Fl. Guiane franç. **3**: 59, 1953; da Silva and Dames e Silva, Rodriguesia **27(39)**: 195, 1974; Howard, J. Arnold Arbor. **64**: 282, 1983. Type. French Guiana: s.l., s.d. (fl), *Aublet s.n.* (holotype, P (herb. Rousseau-Denaiffe 5: 169, illustrated in reverse in Aublet, 1775, t. 93); isotype, BM (type locality Caux (=Kaw) (fide Blake, 1924))). Figs. 22B, 24.

Conohoria rinorea (A. de Saint Hilaire nom. illeg. (Code Art. 63.1), p.p. (synonym *Alsodeia paniculata* excluded). Hist. pl. remarq. Brésil **1**: 321, Jun 1824; Mém. Mus. Hist. Nat. **11**: 495, 1825 ('1824'); Fl. Bras. merid. **2(13)**: 108, 1829 (folio); Fl. Bras. merid. **2(14)**: 150, 8 May 1830 ('1828') (quarto); D. Dietrich, Syn. pl. **1**: 831, Jul 1839. Type. Brazil. Rio de Janeiro: Trapiceiro nr. Sebastianopolis, 1816–1821 (fl in Sep), *Auguste de Saint Hilaire s.n.* (holotype, P (herbarium Florae Brasiliae meridionalis, Museo Parasisiensis dedit Aug. de St. Hilaire); isotypes (?), P (without name of collector, no 57 added); P (without name of collector, added 'Ceulli(?) près de Rio Janeiro)').

Alsodeia rinorea Sprengel nom. illeg., Syst. veg. ed. **16**: **1**: 807, 1824 ('1825') ('*Alsodea*'); Syst. veg. ed. **16**: **4(2)**: 99, 1827, p.p. (synonym *A. paniculata* Martius excluded).

Alsodeia floribunda Moricand, Fl. nouv. Amér. **70**: t. 47, 1839 ('1833–1846'); Walpers, Ann. Bot. Syst. **1**: 71, 6–7 Nov 1848 ('1848–1849'). Type. Brazil. Bahia: 1834 (fl), *Blanchet 1626* (holotype, F (illustrated in Moricand, 1839, t. 47); isotypes, G, NY, P).

Alsodeia castaneaefolia Sprengel sensu Eichler in Martius, Fl. bras. **13(1)**: 382, pl. 77, fig. 3, 1871 p.p. (two synonyms *Conohoria rinorea* St. Hilaire and *Alsodeia floribunda* Moricand, the species description,

FIG. 22. A. *Rinorea bicornuta* (Ducke s.n., RB 21.353, type). A₁, Leaf. A₂, Flower bud. A₃, Adult flower. A₄, Petal, dorsally pilosulous. A₅, Stamens (ventral). A₆, Pistil, surrounded by two stamens. A₇, Pistil. B. *R. guianensis* (B₁ from Krukoff 1319; B₂ from Krukoff 7257; B₃ from Djalma et al. s.n., RB 80179; B₄₋₁₀ from Miranda Bastos 190; B₁₁ from Riedel 1003). B₁₋₃, Different kinds of leaves. B₄, Flower. B₅, Sepals (e = exterior [=outside], i = interior [=inside], e/i = in between). B₆, Petal (dorsal), slightly pilosulous at the apex. B₇, Androecium (dorsal), surrounding pistil. B₈, Two stamens (ventral). B₉, Pistil. B₁₀, Idem, with l.s. of ovary, showing ovules 3 × 1. B₁₁, Capsule, dehiscing into three unequal valves, glabrous seeds, floral parts still present basally.

the illustration of the fruit and most of the cited specimens refer to *R. guianensis* Aublet; the two other synonyms *Alsodeia castaneaefolia* Sprengel and *Conohoria castaneaefolia* St. Hilaire refer to *R. laevigata* (Solander ex Gingins) Hekking; the specimens cited as *St. Hilaire s.n.* belong to *R. laevigata* or to *R. guianensis*.

Tree or treelet 2–20 m tall. Branchlets appressed puberulous to strigillose when young, glabrescent when older. *Leaves* alternate; petioles 3–15 mm long, sparsely pilosulous when young, glabrescent when older; stipules deciduous, narrowly ovate to deltoid, acuminate, 2–13 × 1 mm, striate, pilosulous along the costa, margin ciliate; lamina (narrowly) elliptic to obovate, acuminate to cuspidate, (3.5–)4.5–19 × (1–)2.5–9.25 cm; coriaceous to papery, glabrous on both sides; both sides of costa completely glabrous to strigillose near the base; lateral veins (8–)9–13(–16) pairs (acumen excluded); tertiary venation reticulate, sometimes varying to ± scalariform; base rounded to cuneate; margin (sub)serr(ul)ate, (sub)cren(ul)ate or subentire, mucronulate; acumen 0.5–1.5(–2.75) cm long, apex subobtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary or often accompanied by one or two distinctly smaller inflorescences, thyrsoid, (3–)4–15.5 × 1.5–8 cm; central axis golden puberulous to hirtellous; cymules (1–)3–9 flowered, sometimes accompanied by 2–12 juvenile or undeveloped flowers; common peduncles 2–12.5 mm long, puberulous to hirtellous; 'pedicels' 1.5–7.5 mm long, articulate below the middle, puberulous to hirtellous; bracts and bractlets deciduous, ovate to deltoid, subobtuse to subacute, puberulous along the median part, ciliate; bracts 0.5–1.5 × 0.5–1 mm; bractlets subopposite, 0.25–1.25 × 0.25–1 mm. *Flower buds* narrowly tolpoid, (sub)acute. Flowers drooping, creamy or yellowish-white, fragrant. *Sepals* subequal, ovate, (1–)1.5–2.75 × 1–1.75 mm, herbaceous, carnosose near the base, appressed yellowish pilosulous along the median part outside and sometimes also inside, 1–5 veined, ciliate, obtuse, mucronulate. *Petals* narrowly ovate, 3.5–5.5 × 1.25–1.75 mm, herbaceous, appressed yellowish pilosulous to glabrescent outside, appressed yellowish pilosulous near the apex inside, margin sometimes sparsely ciliate, apex obtuse. *Stamens* 3–4.5(–5) mm long; filaments and dorsal glands fused to a tube, rarely one posterior filament free; filamental tube

0.2–0.75 mm high, carnosose, appressed pilosulous to glabrous; dorsal glands sometimes differentiated, adnate to the filamental tube, deltoid, carnosose, glabrous; anthers narrowly ovoid, 1–1.75 × 0.6–1 mm, apex obtuse, appendaged by 1–2 cusps, 0.1–1 × 0.1–0.2 mm; connective outside narrowly deltoid to ovate, acute to subobtuse, 0.75–1.75 × 0.25–0.75 mm, usually glabrous, rarely with 1–4 pilose hairs; connective scales lateral as well as apical, narrowly ovate to deltoid, 2.5–3.5(–4) × 0.75–1 mm, scarious, orange-brown, margin subentire near the base, apex subobtuse and suberose. *Ovary* subglobose, subconical or trapezoid, 0.75–2 × 0.5–1 mm, yellowish puberulous to strigillose; ovules one per placenta. *Style* filiform, erect or slightly sigmoid at the base, 2.5–3.5 mm long, exceeding the stamens by 0–0.5(–0.75) mm, pilosulous near the base; stigma truncate, obtuse. *Capsule* asymmetric, slightly oblique, ellipsoid, acuminate, subtended by subpersistent floral parts, coriaceous to subligneous, greenish when fresh, densely yellowish puberulous to strigillose; valves three, unequal, the larger one 7–10 × 4–5 mm, the two smaller ones 4–5 × 1.5–3 mm. *Seeds* one per valve, globose, ca. 2 mm in diam., glabrous, shining.

Distribution (Fig. 24) and *ecology*. Its main area of distribution is Amazonia (Brazil, Peru) and adjacent French Guiana, but it is found also in two disjunct areas: (a) SE Brazil with the forest refugia Pernambuco, Bahia, Rio de Janeiro and the area between Rio de Janeiro and Brasilia-Araguaia; and (b) the Coastal Cordillera of Venezuela including the forest refuge Rancho Grande. The disjunction in SE Brazil, isolated from its main center of distribution, was probably caused by a climatic change from a warmer humid climate to a cooler and dryer type since the early Tertiary (van der Hammen, 1974), by which process a formerly coherent area of tropical rain forest became fragmented. Human influences also caused the areas of the SE Brazilian rain forests to become still more limited. The next disjunction, mainly on the northern slopes of the Coastal Cordillera in Venezuela, is probably due to the same climatic change over the whole continent, combined with the gradual uplift of this Cordillera since the Pliocene. This resulted in an additional rain shadow S of this Cordillera. In the meantime *Rinorea guianensis* could survive on the northern slopes of the rising Cordillera, which was catching still more rain, so that the humid

tropical rain forest habitat was maintained. This species occurs as undergrowth in primary, secondary and disturbed rain forests, from 0 to 425 m; it inhabits uninundated as well as periodically inundated areas. It is often collected along rivers and creeks, in sandy to clayish soil.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: VENEZUELA. MIRANDA: Sta. Teresa, 1956 (juv fr), *Bernardi* 5682 (VEN 39880).

PERÚ. LORETO: Maynas, Río Nanay, just below Mishana, 120 m, 11 Jan 1976 (fl, fr), *Gentry et al.* 15845 (MO, U).

BRAZIL. AMAPÁ: s.l., 1956 (fl), *Miranda Bastos* 190 (COL, RB, U, UB). AMAPÁ-PARÁ: Rio Jarú, Monte Dourado, 30 Jan 1968 (bud), *Oliveira* 4049 (NY). AMAZONAS: Manaus, 14 Nov 1955 (fl), *Coelho INP*: 2894 (COL); Rio Madeira, Borba, 16 Jan 1930 (fl), *Ducke s.n.* (RB 25070); Parintins, Lago José Assú, 28 Dec 1935 (fl), *Ducke s.n.* (RB 35731); Manaus, 2 Nov 1935 (fl), *Ducke s.n.* (RB 35733); Rio Negro, Tapurucoara, 7 Apr 1947 (fl), *Froes* 22099 (P, U, US); Basin of Rio Madeira, mun. Humayta between Monte Cristo and Santa Victoria on Rio Ipixuna, 15–17 Nov 1934 (fl), *Krukoff* 7257 (BM, BR, F, G, HH, K, LE, MICH, MO, NY, S, U, US); Basin of Rio Solimões, municipality São Paulo de Olivença, 26 Oct–11 Dec 1936 (fl), *Krukoff* 8644 (B, BM, BR, G, HH, K, LE, NY, P, S, U, US); Santo Antonio de Abonari, Manaus–Caracari, km 220, 25 Dec 1976 (fl), *Prance et al.* 24275 (C, COL, F, G, HH, K, INPA, M, MG, MICH, MO, NY, P, R, S, U, VEN, UFMG, U, US); Manaus, 22 Jan 1964 (fr), *Rodrigues & Osmarino* 5693 (INPA, 14,405, U); idem, 29 Dec 1965 (fl, juv fr), 7375 (INPA 16,768, U); Rio Bía, tributary of Rio Jutai, 5 Nov 1975 (bud), *N. A. Rosa* 516 (NY); rd. from Camacan to Itabuna, 29 Jul 1965 (fr), *Belém* 1414 (COL). BAHIA: Centro de Pesquisas do Cacau (CEPEC), Ilhéus, 24 May 1965 (fl), *Belém & Magalhães* 1116 (COL) & 1118 (COL, U, UB); Monte Pascual, 3 Oct 1966 (fl), *Belém & Pinheiro* 2700 (U, UB); Coraci, 28 Nov 1978 (fl), *Belém & Pinheiro* 2937 (COL, U, UB); s.l. 1834 (?) (fl), *Blanchet s.n.* (BM, K, LE, OXF, P, W); s.l., s.d. (fr), *Bondar* 2208 (F, SP) & 2283 (F); Ilhéus, 12–20 km SE of Buerarema, 100 m, 27 Oct 1979 (fl), *Mori & Benton* 12875 (CEPEC, U); Mun. of Santa Cruz de Cabralia, 12 km NW of Porto Seguro, 28 Nov 1979 (fl), *Mori et al.* 13047 (CEPEC, U); Mun. of Prado, rd. BA 284 from Prado to Itamaraju, 65 km NW of Prado, s.d. (fl), *Mori et al.* 10639 (CEPEC, U); Mun. of Una, 29 Aug 1978 (fl), *Mori & Thompson* 11030 (CEPEC, U); Mun. of Uruçuca, 4 Nov 1978 (fl), *Mori et al.* 11047 (CEPEC, U); rd. from Uruçuca to Taboquinhas, 20 Apr 1971 (fl), *Pinheiro* 1203 (CEPEC, U); rd. from Uruçuca to Lagão Encantado, 4 Jun 1971 (fr), *Pinheiro* 1281 (CEPEC, U); rd. from Uruçuca to Posto S. Antonio da BR 101, 14 Sep 1971 (fl), *Pinheiro* 1632 (CEPEC, U); Plantation of S. Rafael, Una, 14 Dec 1968, *T. S. Santos* 314 (CEPEC, U); Itaibó, 28 Oct 1970 (fl), *T. S. Santos*

1213 (CEPEC, U). MATO GROSSO: Rd. BR 80, Plantation of Cachimbo, 18 Nov 1956 (fl), *Cordeiro* 1057 (INPA, U); Upper Machado region, nr. Tabaiçro, Nov–Dec 1931 (fl), *Krukoff* 1319 (BM, HH, K, MICH, NY, P, U, UC), 1359 (BM, F, G, HH, K, MICH, MO, NY, P, S, U, UC, US) & 1508 (BM, G, HH, K, MICH, NY, P, S, U); Aripuanã, 11 Jan 1979 (fl, fr), *M. G. Silva & A. Pinheiro* 4228 (F, INPA, U). MINAS GERAIS: s.l., 1844 (bud), *Claussen & Weddel s.n.* (P). PARÁ: Mun. of Faro, S. Jorge, 11 Nov 1950 (fl), *Black & Ledoux* 50-10675 (COL); region of Tapajós, locality of Bão Vista, 18 Aug 1932 (fl), *Capucho* 389 (F); idem, 10 Nov 1932 (fl), 484 (F); Rio Itapacurá, tributary of Tapajós, 24 Jan 1933 (fl), *Ducke s.n.* (RB 25064); Rio Perí, tributary of Xingu, 30 Nov 1955 (fl), *Froes* 32497 (COL); region of Rio Moju, 6 Apr 1957 (fl), *Froes* 33159 (COL); Upper Rio Capim, E of Tocantins, 26 Mar 1949 (fr), *Froes & Murça Pires* 24144 (S 6) (INPA 6641, R 103982); Fordlandia, region of Rio Tapajós, Sep 1931 (fl), *Krukoff* 1020 (=Uw 19308) (BM, F, G, HH, K, MICH, MO, NY, P, S, U, UC, US); s.l., 15 Feb 1947 (fl), (*Murça*) *Pires et al.* 1327 (P, US); Serra de Cachimbo, 425 m, 12 Dec 1956 (fl), (*Murça*) *Pires et al.* 6152 (COL, NY); idem, 17 Dec 1956 (fl), 6402 (NY); Rios Pacaja and Muirapiranga, km 7–8.5 line SW of Ihla de Breu, ±2°45'N, ±50°45'W, 27 Sep 1965 (bud), *Prance et al.* 1476 (F, K, NY, U); 1 km N of Rio Muirapiranga, 11 Nov 1965 (fl), *Prance et al.* 1606 (K, NY, U, Z); Cuiabá–Santarém Hwy, BR 163, km 1230, vic. Igarapé Kazuo, 19 Nov 1977 (fl), *Prance et al.* P-25583 (INPA, NY, U); idem, km 1305, vic. Igarapé José Petro, 22 Nov 1977 (fl), *Prance et al.* P-25661 (INPA, NY, U); idem, 23 Nov 1977 (juv fr), P-25675 (INPA, NY, U). PERNAMBUCO: Gurjaú, 5 Dec 1951 (fl), *Ducke & Lima* 68 (R 76.151). RIO DE JANEIRO (incl. GUANABARA): Guanabara, Rio de Janeiro, Corcovado, 11 Nov 1883 (fl), *Anonymous s.n.* (R 79843); idem, 5 Nov 1946 (fl), *Apparicio et al.* 405 (RB 58205, U); Guanabara, Rio de Janeiro, s.d. (fl), *Belangera s.n.* (P); idem, Serra de Carioca, 7 Nov 1931 (fl), *Brade* 11209 (HH, R 79.584); idem, s.l., s.d. (fl), *Casaretto* 564 (G) & 1705 (G); idem, Salão de Vista Chinezca, 4 Oct 1940 (fl), *Djalma et al.* 31 (RB 80.179, U); idem, Sumaré, perto da Lagoinha, 2.1.1938 (fl), *Ducke & Kuhlmann s.n.* (RB 137.598, U); idem, Tijuca, Dec 1913 (fl), *Dusên s.n.* (S); idem, s.l., s.d. (fl), *Gardner* 203 (BM, CGE, K, W); Corcovado s.d. (fl, fr), *Glaziou* 747 (BR, C, P, R), 4071 (C, F, GO, K, P) & 7519 (C, K, LE, P); idem, Eré, s.d. (fl), *Graham* 3 (K); idem, Corcovado, Sep 1915 (fl, juv fr), *Hoehne* 61 (SP); idem, s.l., Oct 1953 (fl), *Luschnath* 471 (BR); idem, M. Lucae, 1836 (fl), *Luschnath s.n.* (P); idem, s.l. (1838), *Luschnath s.n.* (= *Martius* 471!) (LE); idem, s.l., s.d. (juv fl), *Luschnath s.n.* (OXF); idem, Sumaré, 2 Nov 1988 (sic!) (fl), *Markgraf* 3129 (RB); idem, s.l., s.d. (fl), *herb. Martius* 471 (= *Luschnath* 471) (K, LE, NY); idem, Corcovado, 1878 (?) (fl), *Miers* 3126 (K) & 3975 (K); idem, Corcovado, bequeathed 1879 (fl), *Miers s.n.* (BM); idem, Corcovado, 30 Sep 1874 (fl), *Mosén* 2740 (S); idem, Santa Teresa, 19 Jan 1880 (fr), *Netto s.n.* (R 79.808, R 79.810); idem, Jacarepaguá, 14 Jan 1962 (fr), *Pabst* 6798 (= *Perreira* 6948) (K); idem, s.l., 26 Dec. 1953 (fl), *Pedersen* 2566 (BR, C); idem, Jacarepaguá, 14 Jan 1962 (fr),

Pereira 6948 (= *Pabst* 6798) (K); idem, Morro de Corcovado (fl). *Pereira & Aparicio* 405 (HB 6385); idem, Corcovado, Sep (fl), *Riedel* 163 (G, P); idem, Corcovado, Oct 1832 (fl, juv fr), *Riedel* 1003 (G, K, LE); idem, s.l., s.d. (bud, fl, fr), *Riedel s.n.* (BM, BO, C, FI, G, HH, NY, P, S, US, W); idem, rd. of Lagoinha, 20 Nov 1933 (fl), *P. Rosa* 31 (RB 80.180); idem, s.l., s.d. (bud), *St. Hilaire* (?) 57 (?) (P); idem, Trapiceiro, 1816–1821 (bud, fl), *St. Hilaire A.*, 410 (P); idem, s.l., s.d. (bud, fl), *St. Hilaire s.n.* (P); idem, Corcovado, s.d., s.d. (bud, fl), *St. Hilaire s.n.* (P); idem, Corcovado, s.d. (fl), *Saldanha da Gama* 4273 (GOET, RB, U) & 5665 (RB); idem, Corcovado, 11 Nov 1883 (bud), 4754 (RB, U); idem, Corcovado, s.d. (fl), 5665 (=4273) (RB); idem, Corcovado, 11 Mar (?) 1883 (fl), *s.n.* (R 79.691); idem, Corcovado, 7 Dec 1886 (fl), *Schenker* 1396 (C); idem, Corcovado, 1879 (bud), *herb. Schwacke* 1560 (GOET); idem, Corcovado, s.d. (fl), *herb. Schwacke* 4754 (= *Saldanha da Gama* 4754) (RB 91.413, U); idem, Corcovado, 11 Nov 1883 (fl), *herb. Schwacke s.n.* (R 79.851); idem, rd. of Vista Chinês 25 Nov 1940 (fl), *F. G. da Silva* 47 (?) (RB 82.092, U); idem, s.l. 11 Apr 1940 (fl), *A. & F. Tatto* 726, *ser no* 40.080 (A, S); idem, Tijuca, s.d. (fl), *Ule XV* (R 79.837) & *Ule* 3617 (HBG, R); idem, s.l., 1844 (fl), *Widgren* 635 (S) & *s.n.* (S). RONDÔNIA: Basin of Rio Madeira, ± 3 km E of Matuparaná, 24 Nov 1968 (fr), *Prance et al.* 8829 (INPA, NY, U); Porto o Velho, 17 Nov 1949 (fl), *N. T. Silva* 344 (COL); border of Rio das Garças, 27 Sep 1949 (fl), *N. T. Silva* 380 (COL).

S.L.: s.d. (fl). *Smith ex herb. Linnaei f. s.n.* (LINN).

Specimens of *Rinorea guianensis* showing possible introgressive hybridization with the closely related species *R. bahiensis*: BRAZIL, BAHIA: Ilhéus, 22 Apr 1971 (bud), *Pinheiro* 1230 (CEPEC, U); Gandu along rd. to Algadão, 14°45'S, 39°30'W, 23 Oct 1970 (fl), *T. S. Santos* 1185 (CEPEC, U); rd. from Camacau to Pimenta-Mascote, ± 15°35'S, ± 39°20'W, 22 Apr 1972 (fl), *T. S. Santos* 2284 (CEPEC, U).

Local names: French Guiana: Rinoré (Caraim language, Aublet [1775]). Brazil: Ajará (Pará); Amarelinho (Amazonas); Aquariquara(na) (Amazonas, Pará); Can(n)elha de Jacamin (Pará); Cinzeiro (Bahia); Imbiribatana (Pernambuco); Pau de Gamba (Guanabara, Rio de Janeiro).

Rinorea guianensis is closely related to *R. bahiensis* and *R. paniculata*, less so to *R. bicornuta*. For remarks differentiating between the two lat-

ter species, see under those species. *Rinorea guianensis* differs from *R. bahiensis* mainly by: (1) sepals only 1–1.75 mm wide, versus 1.75–2 mm wide; (2) petals 2.5–3× as long as wide, versus only 2–2.5×; (3) anthers 1.5–2× as long as wide, versus only 1–1.5×; and (4) connective scales 3–4× as long as wide, versus ca. 2.5×.

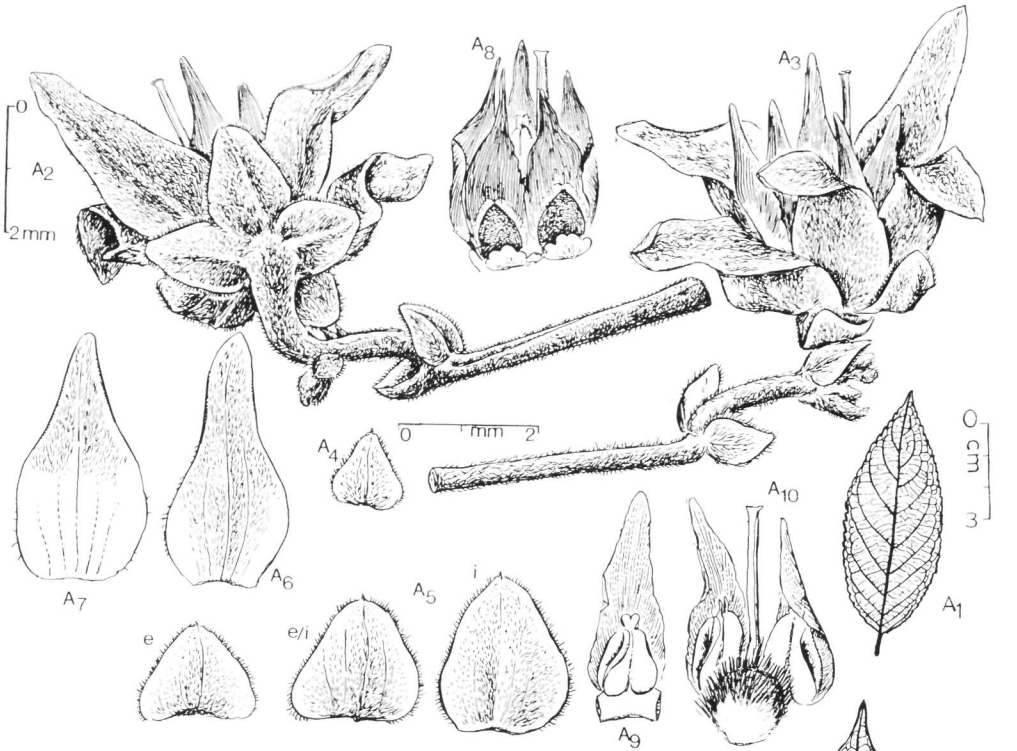
In general, floral parts of *Rinorea guianensis* are narrower and relatively longer than those of *R. bahiensis*. Floral parts such as peduncles, pedicels, bracts, bractlets, sepals and petals, are golden-whitish velutinous in *R. bahiensis* but in *R. guianensis* are less densely pilosulous to glabrescent. Inflorescences of *R. bahiensis* are more compact than those of *R. guianensis*. Leaves of *R. bahiensis* are usually more elliptic than those of *R. guianensis* and often also smaller.

Typical specimens of *Rinorea guianensis* can be easily distinguished by these differentia, but in SE Brazil there occur specimens of *R. guianensis* with flowers tending to those of *R. bahiensis* and in turn there occur specimens of *R. bahiensis* in French Guiana with leaf characters of *R. guianensis* and *R. paniculata*. In such specimens introgressive hybridization is not excluded.

Even within *Rinorea guianensis* itself there occur three different kinds of local races: (1) specimens with (sub)entire leaves and tertiary venation ± scalariform just as in *R. paniculata*, occurring in Amazonia (a) and in the Coastal Cordillera of Venezuela (c); (2) specimens with subserrate to subcrenate, rarely subentire leaves and tertiary venation reticulate; predominantly in Amazonia and adjacent French Guiana (a); and (3) specimens with distinctly crenulate or serrulate leaves and tertiary venation densely reticulate; predominantly in SE Brazil (b).

14. *Rinorea bahiensis* (Moricand) Kuntze, Revis. gen. pl. 1: 42. 1891; Blake, Contr. U.S. Natl. Herb. 20(13): 498. 1924; Melchior in En-

FIG. 23. A. *Rinorea bahiensis* (A₁ from *Pinheiro* 459 & *T. S. Santos* 122; A₂₋₁₁ from *Kuhlmann* 06592). A₁, Leaf. A₂₋₃, Flowers. A₄, Bractlets. A₅, Sepals (e = exterior [=outside], i = interior [=inside], e/i = in between). A₆, Petal, dorsally appressed-velutinous. A₇, Petal (ventral), appressed-velutinous near the apex. A₈, Androecium (dorsal), with dorsal glands, surrounding pistil. A₉, Stamen (ventral). A₁₀, Pistil, equaling the stamens. B. *R. paniculata* (B₁, B₂ from *Martius s.n.* (109), type; B₃₋₈ from *J. M. Pires* 51880). B₁, Leaf. B₂, Flower. B₃, Sepals (e = exterior [=outside], i = interior [=inside], e/i = in between). B₄, Petal. B₅, Two stamens (ventral). B₆, Stamens (dorsal), with dorsal gland. B₇, Pistil. B₈, Idem, with l.s. of the ovary, showing ovules 3 × 1. B₉, Capsule, dehiscing into three unequal valves, each with one glabrous seed; floral parts still present basally and a remnant of the style apically.



gler & Prantl, Nat. Pflanzenfam. ed. 2, 21: 352. 1925. Figs. 23A, 24.

Alsodeia bahiensis Moricand, Pl. nouv. Amér.: 68, pl. 46. 1839 ('1833-1846'); Walpers, Ann. Bot. Syst. 1: 71. 6-7 Nov 1848 ('1848-1849'); Eichler in Martius, Fl. bras. 13(1): 383. 1871. Type, Brazil, Bahia: Vic. Salvador (Bahia), 1834 (fl. juv fr). *Blanchet 1476* (lectotypus novus, G (herb. Moricand, specimen illustrated in Moricand, 1839; pl. 46; this specimen is characterized by having larger leaves than the specimen, which has been used for the type description); isotypes, F. G (herb. Moricand, herb. de Candolle)).

Tree or treelet, (2-)8-25 m tall. Branchlets sparsely pilosulous when young, glabrescent when older. *Leaves* alternate; petioles 3-7 mm long, appressed pilosulous when young, glabrescent when older; stipules deciduous, narrowly deltoid, 1-1.25 × 0.25-0.5 mm, herbaceous, strigillose along the costa, veined, ciliolate; lamina obovate to elliptic, acuminate to cuspidate, 3-10 × 1.5-5.5 cm, papery to coriaceous, glabrous on both sides with the costa sparsely strigillose near the base to completely glabrous; lateral veins 8-10 pairs (acumen excluded), glabrous on both sides; tertiary venation reticulate to scalariform; base rounded to cuneate, sometimes slightly decurrent into the petiole; margin (sub)entire, sometimes mucronulate; acumen 0-0.5 cm long, apex (sub)obtuse, sometimes mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, often accompanied by 1-2 distinctly smaller lateral inflorescences, thyrsoid, 3-9.5 × 1.5-6 cm; central axis yellowish puberulous; cymules 3-9 flowered, sometimes accompanied by 2-6 juvenile or undeveloped flowers; common peduncle 2-5 mm long, densely whitish to golden puberulous; 'pedicels' 2-5.5 mm long, articulate below the middle, densely yellowish puberulous; bracts and bractlets widely ovate to deltoid, herbaceous to carnose, yellowish velutinous, yellowish ciliolate, apex subacute to subobtuse; bracts 1-1.25 × 0.75-1.25 mm; bractlets 0.25-1.25 mm long and wide. *Flower* buds tolpoid to conical. Flowers drooping, white. Sepals subequal, ovate, 2-2.75 × 1.75-2 mm, herbaceous, carnose near the base, densely appressed yellowish velutinous on both sides (glabrous at the base inside), yellowish ciliolate, apex obtuse, mucronulate. Petals (narrowly) ovate, 4-4.25 × ca. 2 mm, herbaceous, appressed yellowish velutinous on both sides (glabrous at the base inside), sparsely ciliolate or glabrous along the margin, apex obtuse. Stamens 3.5-4 mm long; filaments and dorsal

glands fused to a tube; filamental tube dorsally (0.1-)0.25-0.75 mm high, lobed along the apical margin, ventrally ca. 0.4 mm high, carnose, sparsely pilosulous to glabrescent; anthers ovoid, ca. 1.25 × ca. 1 mm, apex obtuse, appendaged by one or two cusps, the two free or partly to completely fused with each other, 0.2-0.4(-1) × 0.2-0.3 mm; connective outside ovate to deltoid, acute to obtuse, 0.75-1 × 0.6-0.7 mm, glabrous; connective scales lateral as well as apical, (narrowly) ovate to deltoid, ca. 3.25 × ca. 1.25 mm, scarious, orange-brown, subentire near the base, apex (sub)obtuse and suberose. Ovary subglobose to trapezoid, 1-1.25 × ca. 0.75 mm, yellowish hispidulous; ovules one per placenta. Style filiform, erect, slightly curved at the base, 2.5-2.75 mm long, exceeding the stamens by 0-0.25 mm, at the base yellowish strigillose; stigma obtuse to truncate. Juvenile *fruits* globose, densely yellowish strigillose.

Distribution (Fig. 24) and ecology. Mainly found in the coastal region of Bahia and Espírito Santo (SE Brazil), it also occurs disjunct in French Guiana. These areas of distribution include the following forest refugia: (a) SE Brazil: Bahia; (b) French Guiana: Oyapock. Its characteristic SE Brazil-French Guiana disjunction is probably due to the same historical climatic factors as in the closely related species *Rinorea guianensis*. It is locally common in primary and disturbed rain forests, where it is often collected along creeks. In SE Brazil it prefers 'latossolo.'

Phenology. Flowering period from August until January; fruiting specimens have been collected in June and December.

Representative specimens examined: FRENCH GUIANA: Compté River, ca. 65 km S of Cayenne, 6 Jan 1977 (fl). *Mori 8878* (NY, U); Village Molinier, 3 km from mouth of River Cascades, 7 Jan 1966 (fl). *Oldeman B-813* (AAU, CAY).

BRAZIL, BAHIA: Mun. of Prado, 17°12'S, 39°24'W, 31 Aug 1979 (fl). *Matos Silva & Britto 700* (CEPEC, U); Potiragua, 13°56'S, 39°53'W, 17 Nov 1967 (bud). *Pinheiro 459 & T. S. Santos 122* (CEPEC, U); Mun. of Una, 5 Nov 1969 (bud). *T. S. dos Santos 470* (CEPEC, U); Ba. Itabepi, 19 Aug 1971 (fl). *T. S. dos Santos 1860* (CEPEC, U). ESPÍRITO SANTO: Chapado, Pancas, Colatino Rio, 2 Dec 1943 (fl). *Kuhlmann 06592* (BR 114854); Reserva F. Linhares, 29 Nov 1977 (fl). *Prada (=Spada) 026/77* (RBR, U); Linhares, nr. valley of Rio Doce, 1 Oct 1971 (fl). *T. S. dos Santos 2030* (CEPEC, U).

Local names. Brazil: Cinzeiro (Bahia); Quiro bravo (Bahia); Tambor (Bahia, Espírito Santo).

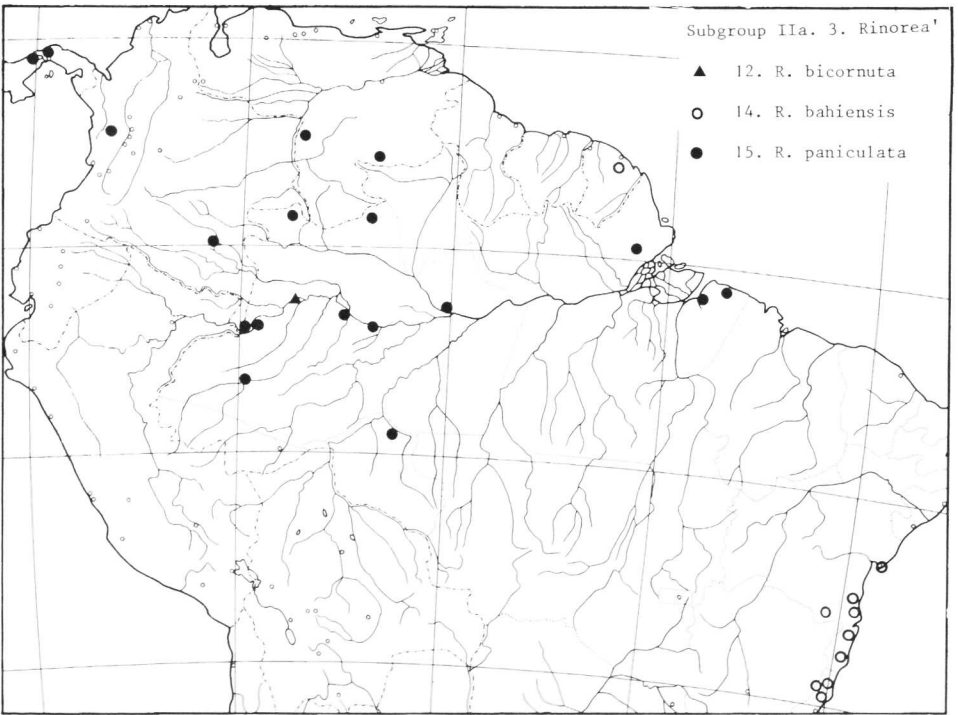
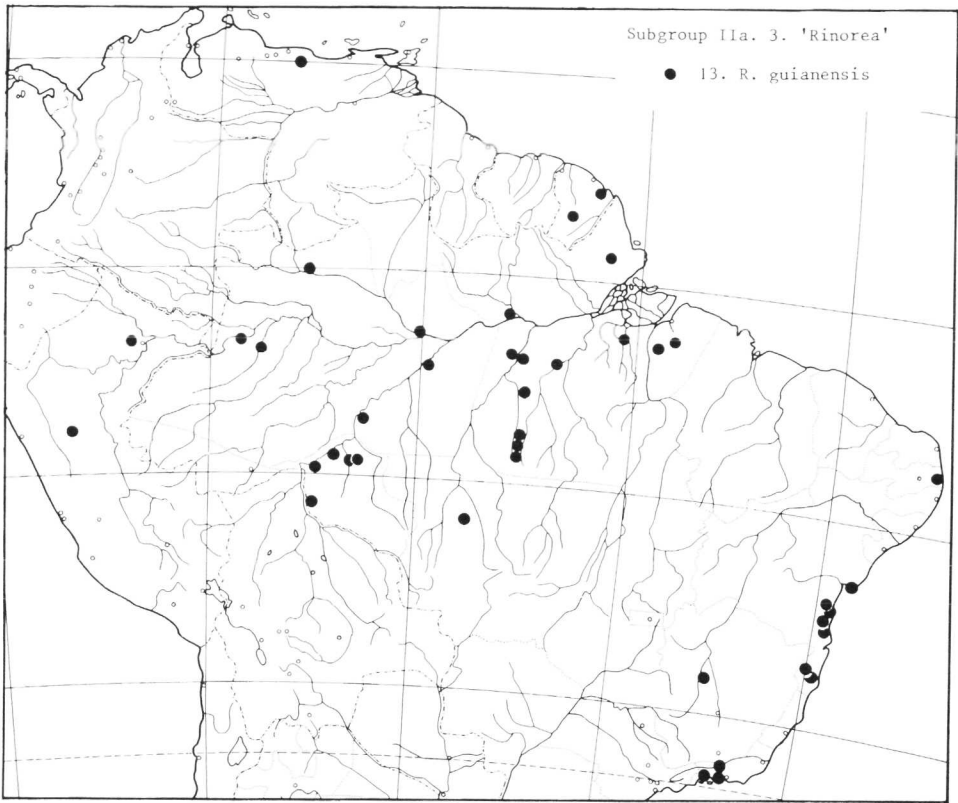


FIG. 24. Distribution of species of *Rinorea* of Subgroup IIa.3. 'Rinorea.'

For remarks differentiating *Rinorea bicornuta*, *R. guianensis* and *R. paniculata*, see under those species.

Two specimens of *Rinorea bahiensis* collected in French Guiana (*Mori 8878* and *Oldeman B-813*) have inflorescences and flowers with features distinctly referable to *R. bahiensis*, but their habit (e.g., their leaves) show similarities to *R. guianensis*, also not common there (its type specimen is the only known specimen). Introgressive hybridization of *R. bahiensis* with *R. guianensis* is presumed.

15. *Rinorea paniculata* (Martius) Kuntze, Revis. gen. pl. **1**: 42. 1891; Blake, Contr. U.S. Natl. Herb. **20**(13): 498. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925, cited as '(Martius) Melchior'; Lemée, Fl. Guyane Franç. **3**: 59. 1953, cited as 'OK' (=Kuntze); Smith & Fernández-P., *Caldasia* **6**(28): 94. 1954. Figs. 23B, 24.

Alsodeia paniculata Martius, Nov. gen. sp. pl. **1**(2): 30. t. 21. late 1823–Jan–Feb 1824 ('1823–1824'); D. Dietrich, Syn. pl. **1**: 831, Jul 1839 ('*Alsodea*'); Eichler in Martius, Fl. bras. **13**(1): 383. 1871 p.p. (synonyms *Rinorea guianensis* Aublet and *Alsodeia rinorea* Sprengel [=synonym of *R. guianensis* Aublet] excluded); Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München **20**: 185. 1891 ('1890'). Type, Brazil, Amazonas: Area of Telê and Coari, s.d. (flowering Nov–Dec) (fl, fr), *Martius s.n.* (holotype, M (109) (illustrated in reverse in Martius, Nov. Gen. sp. pl. **1**(2): t. 21. 1823–1824); isotypes, G(?), M (110, 111, 112, 113, these numbers written on small labels attached to the specimens)).

Tree or *treelet*, 1.5–25 m tall. Branchlets yellowish to whitish pilosulous or puberulous. *Leaves* alternate; petioles 0.25–2.75 cm long, sparsely yellowish pilosulous when young, glabrescent when older; stipules deciduous, narrowly deltoid, subacute, (1–)9–11 × 1–1.75 mm, herbaceous, sparsely pilosulous along the costa to glabrescent, veined, sometimes sparsely ciliolate; lamina (narrowly) elliptic to (ob)ovate, acuminate, (4–)6.5–23 × (1.5–)2–10 cm, coriaceous, occasionally papery, glabrous on both sides; costa on both sides slightly pilosulous to glabrescent; lateral veins, (7–)8–10(–13) pairs (acumen excluded); tertiary venation ± scalariform; base rounded to cuneate; margin subentire to (sub)crenate or (sub)serrate, slightly thickened, mucronulate; acumen 0.5–3.5 mm long, apex obtuse to acute, mucronulate. *Inflorescences* axil-

lary, lateral and subterminal, thyrsoid, solitary or often accompanied by one or two distinctly smaller lateral inflorescences. 5–20 × (1.5–)2.5–6 cm; central axis yellowish to whitish puberulous; cymules (1–)3–11(–15) flowered, often accompanied by 2–6 juvenile or undeveloped flowers; common peduncle 2–15(–35) mm long, yellowish puberulous; 'pedicels' 2.5–5 mm long, usually articulate below the middle, yellowish puberulous or strigillose; bracts and bractlets deltoid to ovate, herbaceous to carnose, sparsely strigillose along the costa, ciliolate, apex subacute, mucronulate; bracts (0.5–)0.75–1.75 mm long and wide; bractlets 0.5–1 mm long and wide. *Flower* buds ellipsoid to ovoid, obtuse. Flowers drooping, greenish- or yellowish-white, fragrant. Sepals subequal, ovate, 1.25–2.5 × 1–1.5 mm, herbaceous, carnose near the base, minutely yellowish-whitish strigillose, ciliolate, apex obtuse, occasionally mucronulate. Petals elliptic to ovate, (1.75–)2–3 × (1–)1.25–1.5 mm, herbaceous, sometimes sparsely yellowish pilosulous along the costa, sometimes ciliolate, apex rounded to obtuse. Stamens 1.5–2 mm long; filaments and dorsal glands fused to a tube; free parts of filaments 0–0.1 mm long; filamental tube sometimes strongly lobed, usually 0.2–0.3 mm high, glandular tissue of the tube on the dorsal side of the stamens up to 0.75(–1) mm high; anthers ellipsoid, 0.75 × 0.6 mm, apex rounded, appended by 1–2 cusps free or connate, ca. 0.2 mm × 0.1–0.2 mm; connective outside deltoid to ovate, subobtuse, 0.4–0.8 × 0.4–0.6 mm, glabrous. Connective scales lateral as well as apical, ovate to deltoid, 1.25–1.75 × ca. 0.75 mm, scarious, slightly orange-brown, margin erose, apex obtuse. Ovary ovoid-conical to trapezoid, 0.6–1 × 0.6–0.7 mm, pilose(ulous) along the ribs and near the apex; ovules one per placenta. Style filiform, sometimes subclavate near the apex, strongly sigmoid at the base to slightly curved, 1–1.25 mm long, ± equaling the thecae; stigma truncate to capitulate, often deflexed towards the anterior petal. *Capsule* asymmetric, slightly oblique, ellipsoid, acuminate, subtended by subsistent floral parts, coriaceous to subligneous, smooth, olive-brown colored when fresh by a dense golden to brownish puberulous to strigillose indument; valves three, unequal; the larger one 9–11 × 4–6 mm; the two smaller ones 6–8 × 2–4 mm. *Seeds* one per valve, globose, ca. 3 mm in diam., olive-brown when fresh, glabrous, shining.

Distribution (Fig. 24) and ecology. The main area of distribution is in the basins of Amazonas and the upper Orinoco. *Rinorea paniculata* occurs also disjunct in NW Colombia in the forest refuge of Chocó and in adjacent Panama in the forest refuge of Darién. The species is wanting in SE Brazil. These disjunct populations probably became isolated from the main population in Amazonia by the Pliocene Cordilleran uplift (Brown, 1977, 1982; Putzer, 1968; Raven & Axelrod, 1974), which dissected a previous coherent area of tropical rain forests. From the isolated area in Chocó a successful migration to Central America followed, probably after the formation of the Panama land bridge, also during the Pliocene, ca. 5.7. my BP (Brown, 1977, 1982; Coney, 1982; Raven & Axelrod, 1974).

The species is confined to tropical rain forests on hill slopes, along rivers and creeks, in undisturbed as well as periodically inundated areas, from 50 to 500 m. It usually prefers sandy to clayish soil.

Phenology. Probably flowering throughout the year; fruiting specimens have been collected in January, February, May and December.

Representative specimens examined: PANAMA. COCLÉ: Coclé del Norte, 50–100 m, 23 Aug 1978 (fl), *Hammel 460* (MO). COLÓN: Santa Rita Ridge logging Road, 19 km from Transisthmian Hwy., Jan 1968 (bud), *Dwyer & Gentry 8556* (MO, U); idem, 6 km from Transisthmian Hwy., 11 Dec 1973 (fr), *Gentry et al. 8830* (MO, U). SAN BLÁS: Comarca de San Blás, S of confluence of Río Cangandí with Río Titamibe, 9°24'N, 79°8'W, 50–150 m, 27 Jan 1985 (fl), *de Nevers et al. 4666* (MO).

COLOMBIA. AMAZONAS–VAUPÉS: Río Apaporis, between the Ríos Kanari & Paoa, 250 m, 1–15 Dec 1951 (fl), *García-Barriga 14049* (COL). CHOCÓ: Rd. from Yuto to Lloro, 2 km E of Yuto, 50 m, 18 Jun 1979 (bud), *Gentry et al. 24386* (F, MO, U). VAUPÉS: Banks of Río Inírida, 70°30'W, 200 m, 17–18 Feb 1953 (fl), *A. Fernández 2281* (COL).

VENEZUELA. AMAZONAS: Atures, between Puerto Ayacucho and Golivan, ±5°35'N, 67°15'W, 60 m, 9 May 1980 (bud), *Steyermark et al. 122118* (MO, U, VEN); Atures, along Río Cataniapo, ±45 km SE of Puerto Ayacucho, ±5°35'N, 67°15'W, 9 May 1980 (fl), *Steyermark et al. 122183* (MO, U, VEN); Atures, N side of Río Cataniapo, 45 km SE of Puerto Ayacucho, 5°35'N, 67°15'W, 200–300 m, 11 May 1980 (bud), *Steyermark et al. 122277* (MO, U, VEN). BOLÍVAR: Canaracuni, Jan 1942 (juv fr), *F. Cardona 392* (VEN 8713).

FRENCH GUIANA: Falls of Magasin. Creek Mataronny, Lower Approuague, 24 Jan 1970 (fl), *Oldeman B-2859* (CAY).

BRAZIL. AMAPÁ: Upper Rio Maracá, Mazagão, s.d.

(fl). *Anonymous s.n.* (RB 21.354). AMAZONAS: Manaus, former hwy. BR 17, km 40, 11 Nov 1955 (fl), *D(ionisio) F. Coelho s.n.* (INPA 2887, NY, U); Rio Icana, Carch Tanuly, 5 May 1947 (fl, fr), *R. L. Drews 22284* (COL, U); Rio Solimões, Igarapé Belém, 10 Dec 1947 (fl), *R. L. Froes 23697* (IAN, U); Itacoutiara, vic. Manaus, 23 Jan 1961 (fl), *Fromm 1418* (=E. *Santos 1140*) (=Sacco 1675) (=Z. *Trinta 344*) (HB, R, U); Basin of Rio Solimões, mun. São Paulo de Olivença, nr. Palmares, 11 Sep–26 Oct 1936 (bud), *Krukoff 8572* (BM, BR, G, K, L, LE, MO, NY, U, US); Rio Juruá, 1 km from the city of Euruncpê, 23 Oct 1975 (fl), *Pena 599* (IPEAN, NY); Uaupés, Apr 1947 (bud), *J. M(urça) Pires 539* (IAN, NY); Basin of Rio Demeni, vic. Tototobi, 2 Mar 1969 (fr), *Prance et al. 10396* (INPA, NY, U); Manaus, Forest Reserve Ducke, 29 Nov 1963 (fl), *W. Rodrigues 5548* (INPA 14.221, U); Hwy. Manaus–Itacoatiara km 67, 14 Nov 1962 (fl), *W. Rodrigues & Chagas 4800* (=Xil-no X-1623) (INPA 13.327, U); Manaus, Rio Preto km 67, 27 Nov 1966 (fl), *W. Rodrigues et al. 4832* (INPA 13.365, U). MATO GROSSO: Nr. Tabajara, upper Machado Region, Nov–Dec 1931 (fl), *Krukoff 1363* (BM, F, G, HH, K, MICH, MO, NY, P, S, U, UC). PARÁ: Belém, 20 Oct 1957 (fl), *E. Pereira 3318* (HB, RB, U); railway station Bragança, km 25, 23 Feb 1951 (fl), *J. M(urça) Pires 3102* (IAN, US); vic. Belém, Sep–Oct 1961 (juv fl), *J. M(urça) Pires 51880* (K, NY, P, U, US); Belém, IPEAN, Reserve APEG Q 206-12-S/N, 8.9.1967 (fl), *J. M(urça) Pires & N. T. Silva 11.145* (IPEAN, P).

Local name. Brazil: Acariquarana (Pará).

Rinorea paniculata differs from *R. guianensis* and *R. bahiensis* by: (1) flower buds elliptic to obtuse-ovoid versus tolpoid in *R. guianensis* and tolpoid to conical in *R. bahiensis*; (2) petals shorter than 3.5 mm; (3) anthers shorter than 1 mm; and (4) connective scales shorter than 2 mm, only 1.5–2× as long as the anthers (in the two other species usually longer than 2 mm and 2–3× as long as the anthers).

Thus the flowers of *Rinorea paniculata* are usually distinctly smaller than those of *R. guianensis* and *R. bahiensis*. In the specimen *Gentry & Renteria A. 24386* (U) from Chocó in Colombia, connective scales are strongly fringed. The inflorescences of this specimen are smaller than commonly in this species.

Group IIb. 'Uxpanapana'; species 16.

Leaves alternate, apical ones tending to be subopposite; apical leaves petiolate and laminar; basal leaves sessile and scale-like; tertiary venation reticulate; *inflorescences* 1–3 fasciculate in the axils of both kinds of leaves, cymose, subsessile; common peduncles reduced to apparently wanting; filaments and dorsal glands com-

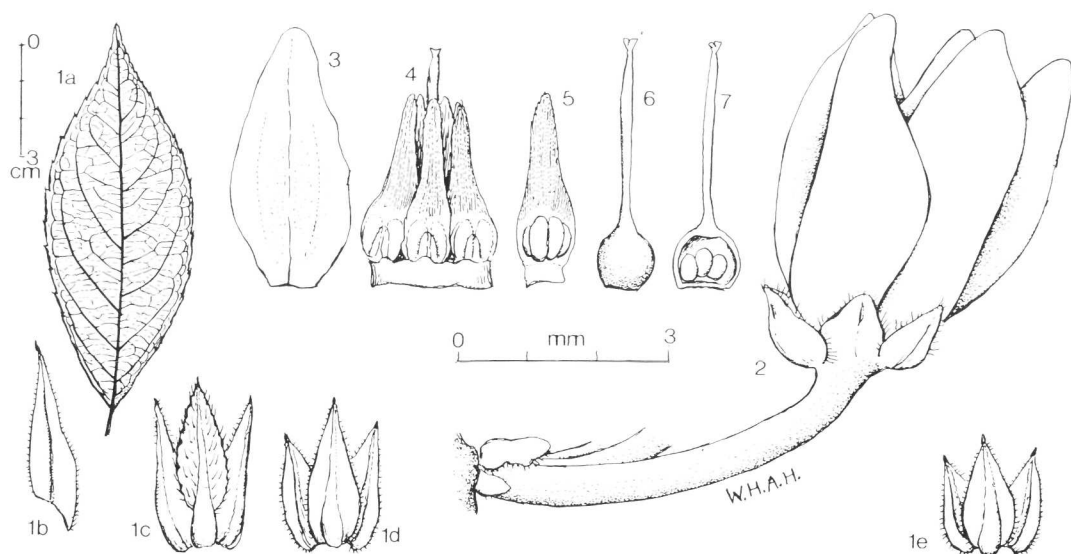


FIG. 25. *Rinorea uxpanapana* (Wendt et al. 3907, type). **1a–e**, Two different kinds of leaves and stipules. **1a**, Laminar leaf. **1b**, Stipule of laminar leaf, oblique at the base (1b–e, enlarged, same scale as that of the flower). **1c**, Transitional stage of laminar leaf to scale-like leaf, accompanied by two stipules. **1d, e**, Scale-like leaves, accompanied by two stipules, slightly oblique at the base. **2**, Cymule with bract and bractlets (scale-like leaf and two stipules omitted); cymule (sub)sessile, with three pedicels; one flower illustrated. **3**, Petal. **4**, Androecium, surrounding pistil. **5**, Stamen (ventral). **6**, Pistil. **7**, Pistil, with l.s. of ovary, showing ovules 3×1 .

pletely fused to a tube; ovary (sub)globose, distinct from the style, glabrous; ovules one per placenta.

This group is characterized by possession of two different kinds of leaves, spirally arranged along the branchlets, and bearing 1–3 subsessile cymose inflorescences in their axils.

- 16. *Rinorea uxpanapana*** Wendt, Bol. Soc. Bot. México **45**: 134, fig. 1. 1984. Type. Mexico. Veracruz: Mun. Minatitlán, 13.7 km E of La Laguna, terrace of Uxpanapa, $17^{\circ}20'N$, $94^{\circ}23'E$, 130 m, 28 Apr 1982 (fl), *Wendt et al.* 3907 (holotype, MEXU; isotype, U; isotypes not seen: BM, CAS, CHAPA, COL, CSAT, ENCB, F, HH, INIF, MO, NY, TEX, US, XAL). Figs. 25, 26.

Treelet 4 m tall. Branchlets glabrous, possessing two kinds of leaves: laminar leaves, alternate to subopposite in the apical part of the branchlets, and scale-like leaves in the basal part of the branchlets. *Laminar leaves* petiolate, more or less soon deciduous; petioles articulate at the base, 2–6 mm long, glabrous beneath, puberulous above; stipules subsistent, narrowly ovate, oblique at the base, $1.5\text{--}2.5 \times 0.5\text{--}1$ mm, scarious, costate, glabrous, margin ciliate at the base,

apex (sub)obtusate, mucronulate; lamina, narrowly elliptic, acuminate, $4.5\text{--}15 \times 1.5\text{--}5.5$ cm, papery; lamina, costa and lateral veins glabrous on both sides; domatia wanting; lateral veins 5–7(–8) pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate; margin subcrenate, mucronulate; acumen 1–1.5 cm long, apex (sub)obtusate to (sub)acute, mucronulate. *Scale-like leaves* subsessile, distinctly more costate than its two subsistent stipules; stipules as those of laminar leaves; lamina of scale-like leaves minute, ovate, acuminate, $1.5\text{--}2 \times 0.5\text{--}1$ (–1.25) mm, scarious, sparsely pilose to glabrescent, distinctly costate, margin entire, irregularly ciliate, apex subobtusate mucronulate. *Inflorescences* axillary, lateral or subterminal, 1–3 fasciculate, cymose; cymules contracted, subsessile, containing 1–3 flowers; common peduncle 0–0.25 mm long, glabrous; ‘pedicels’ 4–7 mm long, articulate at the base, glabrous; bracts and bractlets close together at the base, widely ovate, (sub)obtusate, mucronulate, scarious, costate, margin fimbriate and ciliate; bracts ca. $1 \times 1\text{--}1.25$ mm; bractlets ca. 0.5×0.6 mm. *Flower* buds conical, obtuse. Flowers creamy to pale yellow. Sepals subequal, deltoid to ovate, $1\text{--}1.5 \times 0.6\text{--}1.2$ mm, herbaceous, glabrous, costate, mar-

gin scarios, fimbriate and cili(ol)ate, apex acute to obtuse, obscurely mucronulate. Petals elliptic to ovate, $2.75\text{--}3.75 \times 1.25\text{--}2$ mm, herbaceous, carnos along the median part, glabrous, margin scarios, not ciliolate, apex obtuse to rounded. Stamens ca. 2.5 mm long; filaments $0.2 \times 0.3\text{--}0.4$ mm, fused to a sinuate tube $0.2\text{--}0.3$ mm high; dorsal glands ca. 0.3 mm long, carnos, glabrous, fused with the tube; anthers ellipsoid, ca. 0.75×0.25 mm, glabrous, apex rounded, unappendaged; connective outside, ovate, subobtuse, $0.2\text{--}0.4$ mm long, glabrous; connective scales lateral as well as apical, ovate, $2\text{--}2.25 \times 0.6\text{--}0.75$ mm, scarios, orange-brown, at the base uncolored and transparent, margin subentire, apex suberose and obtuse. Ovary subglobose, ca. 0.75 mm in diam.; ovules one per placenta. Style filiform, erect to slightly curved near the apex, exceeding the stamens by $0.25\text{--}0.75$ mm, completely glabrous; stigma 3-lobulate, erect to slightly deflexed to the anterior petal. *Fruits* unknown.

Distribution (Fig. 26) and ecology. Known only from the type collection in Zona Uxpanapa, Los Tuxtlas (forest refuge) in southern Vera Cruz on the Isthmus of Tehuantepec, SE Mexico. Altitude ca. 125 m. The type specimen has been collected in a medium high deciduous forest, characterized by an occurrence of *Bursera simaruba*, *Spondias radlkoferi*, etc.

Annual rainfall in this area is ca. 4000 mm, but there is also a pronounced dry season of ca. 2 months; climatic drought in the area is further enhanced by the karstic limestone habitats on which *Rinorea uxpanapana* grows. Nevertheless, these relatively dry conditions are apparently not unfavorable, since such species as *R. deflexiflora*, *R. guatemalensis* and *R. hummelii* grow together with this species (Wendt, 1984).

Rinorea uxpanapana differs from all other neotropical species of *Rinorea* by the combination of the following characters: (1) the occurrence of two different kinds of leaves: (a) laminar leaves with distinct petioles and laminae and (b) subsistent, scale-like leaves; (2) stipules also subsistent, scarios and oblique at the base, in habit similar to the scale-like leaves; (3) petioles of laminar leaves articulate at the base; (4) minute cymose inflorescences 1–3 fasciculate and subglomerulate in the axils of both kinds of leaves; cymules (nearly) without peduncle and provided with only 1–3 flowers; (5) basal parts of 'pedicels' reduced (as in Subgroup IIC.2. *Viridifolia*),

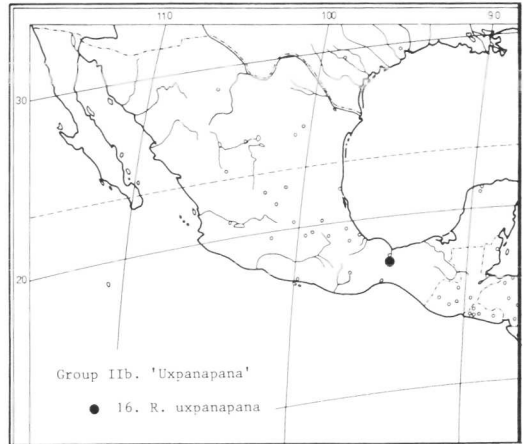


FIG. 26. Distribution of *Rinorea uxpanapana* of Group IIB. 'Uxpanapana.'

whereas the apical parts are elongated; (6) petals subequal, tending slightly to zygomorphy by anterior petals being slightly larger than the posterior ones; (7) filaments and dorsal glands fused to a filamental tube (as in *R. ramiziana* and in the Subgroups IIA.3. *Rinorea* and IIC.10. *Racemosa*); (8) ovary glabrous with ovules one per placenta (as in Supergroup I. *Apiculata*); and (9) stigma trilobed, which is exceptional in *Rinorea*.

The slight zygomorphy of the flowers of *Rinorea uxpanapana* suggests a close relationship to some *Rinorea* species of the Old World as well as to *Hybanthus mexicanus* (syn.: *Alsodeia* (= *Rinorea*) *parvifolia* Watson), belonging to the tribe *Violeae*; there also exists a remote relationship to the genus *Orthion* which also belongs to the *Violeae*; all these taxa mentioned are restricted to Central America. The occurrence of the slightly zygomorphic flower character in both tribes, *Rinoreae* as well as *Violeae*, the distinction between them has been become less sharp than presumed before. *Rinorea uxpanapana* is the only neotropical species with minute cymose inflorescences, in contrast to the paleotropical situation, where more species occur with cymose inflorescences. A reduced sessile cymose inflorescence, as in *R. uxpanapana* and in other, paleotropical, species, can be considered as the stage most derived from the thyrsoid, which has been postulated as the basic inflorescence structure in *Rinorea*. The reduction to this short-peduncled cymose inflorescence can be explained by an acrotonic suppression of the central axis

of a previously existing thyrsoid inflorescence (see Morphology). Since the Mexican *R. uxpanapana* seems to be more related to paleotropical than to neotropical species, a common origin during the late Cretaceous and the Paleogene, when exchange of genetic material between Africa and tropical South America was still possible, is most likely. During the Pliocene, however, both continents became so far separated from each other, that the distance between them more and more became a limiting factor for genetic exchange. Therefore, the isolated population of *R. uxpanapana* in southern Mexico may be considered as a relict, probably originating from a common African-South American stock, from which ancestors of related species of *Hybanthus* and *Orthion* probably also originated. From tropical South America it possibly migrated via the Colombian area to Central America, synchronously with extinction on the South American mainland. Such a migration must have started before the high uplift of the Cordilleras during the Pliocene. For this presumed migration to Central America, two geological periods can be considered: a) a more recent period in the Pliocene, during the creation of the Panama land bridge, ± 5.7 my B.P. or b) much earlier during the late Cretaceous and Paleogene via the Proto Greater Antilles Arch, which was situated far SW of the present position, i.e., before it was swept through the widening gap between North and South America (Coney, 1982). Because of the isolated taxonomic position of *R. uxpanapana*

as well as by its presumed closer relationship with some paleotropical species, the period of late Cretaceous and Paleogene is most likely. Closely related species of *Orthion* and *Hybanthus*, with slightly zygomorphic flowers, and also predominantly occurring in Central America, probably originated from the same common or closely related ancestral stock as did *Rinorea uxpanapana*. It is striking that the flowers of *R. uxpanapana* are also similar to those of the subgroups 'Rinorea' and 'Racemosa.' However, it is not excluded that *Rinorea uxpanapana* must be transferred to *Hybanthus* Jacq. subgenus *Hybanthus* (= *Euhybanthus* sensu G. K. Schulze, 1936) after a future revision of neotropical *Hybanthus* and after collection of additional, especially fruiting, material of *Rinorea uxpanapana*.

Group IIc. 'Pubiflora.'

Leaves apparently opposite; tertiary venation varying from reticulate to scalariform; *inflorescences* axillary, solitary, varying from thyrsoid to (pseudo)racemose; filaments and dorsal glands free or fused with each other sometimes to a tube; ovary usually (sub)globose, distinctly separated from the style, occasionally conical and tapering into a conical style, usually hairy, sometimes glabrous; ovules one to four per placenta.

This group is characterized by having leaves apparently opposite, in combination with a distinct central axis within the inflorescences.

Key to the Species of Group IIc. 'Pubiflora.'

1. Inflorescence thyrsoid; lateral cymules with 1-9 flowers.
2. Leaf base asymmetric and oblique, (sub)cordate to (sub)auriculate at the petiole; Andean region of Colombia.
 3. All leaves apparently opposite; inflorescences 2-5 cm wide; sepals and connective scales 1-1.5 mm wide, both 2-3 \times as long as wide; dorsal glands (if present) 0-0.5 mm long, shorter than filaments; apex of thecae unappendaged or appendaged by cusps 0.1-0.2 mm long; Andean region of Colombia. 38. *R. ulmifolia*.
 3. Apical leaves apparently opposite, basal leaves alternate; inflorescences 1-2 cm wide; sepals and connective scales 0.5-1 mm wide; both 3-4 \times as long as wide; dorsal glands 0.5-1 mm long, slightly longer than filaments; apex of thecae appendaged by cusps 0.4-0.8 mm long; Andean region of Colombia. 39. *R. hymenosepala*.
2. Leaf base symmetric, not (sub)cordate or (sub)auriculate at the petiole; Central America, Amazon Basin or E. Brazil.
 4. Leaf lamina glabrous on both sides.
 5. Tertiary venation reticulate; connective and connective scales glabrous outside; ovules 3 \times (2-3); seeds pilosulous; Mexico, Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica, Panama. 44. *R. hummelii* (p.p.).
 5. Tertiary venation scalariform; connective and connective scales villose outside; ovules 3 \times 1; seeds glabrous; E. Brazil. 45. *R. villosiflora*.

4. Leaf lamina appressed pilosulous beneath.
6. Ovary and capsule distinctly hairy; sepals narrowly ovate, 2–2.5 mm long. SE Colombia, S Venezuela. NW Brazil. 48. *R. vaupesana*.
6. Ovary and capsule glabrous; sepals ovate, 1–2 mm long.
7. Petals 1.5–2.5 mm long. 1–1.5 × as long as the sepals; connective scales 1–1.5 mm long, 2–3 × as long as the anthers; style 0.5–1 mm long; seeds 3.5–4.5 mm long and wide; leaf acumen 0.25–2.5 cm long. SE Colombia, S Venezuela, NE Peru, N Brazil. 46. *R. racemosa*.
7. Petals 3–3.5 mm long, 2–3 × as long as the sepals; connective scales 2–2.5 mm long, 3–4 × as long as the anthers; style 2–3.5 mm long; seeds ca. 3 mm long and wide; leaf acumen 1–6 cm long; E Colombia, S Venezuela, NW Brazil. 47. *R. sprucei*.
1. Inflorescences (pseudo)racemose; all flowers solitary or 1–3 in small lateral cymules at the base of the inflorescences.
 8. 'Pedicels' articulate at the base; bracts and bractlets inserted together at the base.
 9. Flowers and fruits subsessile; 'pedicels' 0.5–1 mm long; free parts of filaments surmounting a glandular tube; connective scales fringed, yellow, transparent; ovary conical tapering into a conical style; ovules 3 × (2–3); capsule 3–6 cm long; Colombia, Venezuela, Surinam, French Guiana, Peru, Brazil (Amazonia). 17. *R. macrocarpa*.
 9. Flowers and fruits distinctly pedicellate; 'pedicels' 1–6 mm long; filaments and dorsal glands completely free; connective scales suberose to subentire, brown; ovary subglobose; style filiform; ovules 3 × 1; capsule 1–2.5 cm long (fruits of *R. antioquiensis* unknown).
 10. Leaf lamina hirsute to hirtellous beneath; anthers 2–3 × as long as the filaments; connective scales fuscous-brown; capsule velutinous to pruinose; Panama, Colombia. 21. *R. hirsuta*.
 10. Leaf lamina glabrous beneath, costa and lateral veins more or less hairy on both sides; anthers 0.5–2 × as long as the filaments; connective scales orange-brown; capsule loosely pilose to pilosulous (fruits of *R. antioquiensis* unknown).
 11. Anthers 0.5–1 mm long, 0.5–1 × as long as the filaments; connective outside 0.5–0.75 mm long; connective scales 2–3 × as long as the anthers; style exceeding the stamens by 1–1.5 mm; racemes probably not longer than 3.5 cm; Colombia (Andean region). 19. *R. antioquiensis*.
 11. Anthers 1–2 mm long, 1–2 × as long as the filaments; connective outside 0.75–1 mm long; connective scales 1–2 × as long as the anthers; style exceeding the stamens by 0.25–1 mm; racemes (2–)3.5–11 cm long.
 12. 'Pedicels' usually 2.5–4 mm long; connective scales 2.25–3 mm long; lateral veins usually 8–11 pairs (acumen excluded); costa usually golden brownish strigose beneath; Panama, Colombia, Ecuador, Peru, Brazil, Bolivia. 18. *R. viridifolia*.
 12. 'Pedicels' usually 1–2.5 mm long; connective scales 1.5–2.25 mm long; lateral veins usually 11–14 pairs (acumen excluded); costa usually ferruginous strigose beneath, often in combination with ferruginous hispidulous; Nicaragua, Costa Rica, Panama. 20. *R. squamata*.
 8. 'Pedicels' articulate above the base; bracts and bractlets separately inserted from each other.
 13. Leaf base obtuse, (sub)cordate or (sub)auriculate at the petiole.
 14. Petals 1–1.5 × as long as the sepals; bracts, bractlets and sepals (narrowly) deltoid and gradually acuminate; bracts more than 2 × as long as wide and 0.5–1.2 × as long as the pedicels.
 15. Petals whitish puberulous especially near the apex inside; petals outside glabrous (or sparsely whitish puberulous at the apex); leaves subsessile with petioles 0.1–3 mm long; lamina gradually tapering to the apex; tertiary venation reticulate; capsule 1.5–2.5 cm long; ovules and seeds 3 × 2; seeds glabrous; E Venezuela, SW Guiana. 32. *R. endotricha*.
 15. Petals glabrous inside; petals outside golden strigose along the costa (sometimes also along adjacent veins); leaves petiolate with petioles 1–10 mm long; lamina cuspidate to acuminate; tertiary venation ± scalariform; capsule 2.5–3.5 cm long; ovules and seeds 3 × 3; seeds pilosulous; Costa Rica, Panama, Colombia. 37. *R. sylvatica*.
 14. Petals 2–4 × as long as the sepals; bracts, bractlets and sepals usually deltoid to ovate and shortly acuminate to cuspidate; bracts less than 2 × as long as wide and 0.2–0.5 × as long as the pedicels.
 16. Flowering material.
 17. Dorsal glands of anterior filaments fused with each other; only the posterior filament(s) free.
 18. 'Pedicels' (2–)4–6 mm long; sepals 1–2 mm wide, ciliolate; petals 2–3 × as long as wide, margin glabrous or sparsely ciliolate; connective scales 5–8 × as long as the filaments; ovules 3 × 2; Venezuela, Brazil, N Bolivia, N Paraguay. 40. *R. ovalifolia* (p.p.).

18. 'Pedicels' 2–2.4 mm long; sepals 0.75–1 mm wide, ciliate; petals 4–5 × as long as wide, ciliate; connective scales 3–5 × as long as the filaments; ovules 3 × 1; Ecuador (W of Andes). 41. *R. deflexa* (p.p.).
17. All filaments free; free dorsal glands adnate to the filaments.
19. Lamina widest at 1/3 from the base, from there gradually tapering to the apex; connective scales 3–3.5 mm long, 6–7 × as long as the filaments; Panama. 31. *R. brachythrix* (p.p.).
19. Lamina widest near the middle, acuminate to cuspidate; connective scales 1–3 mm long, 1.5–4 × as long as the filaments.
20. Style 1–2 mm long.
21. Petals 2–3.25 mm long; stamens 1.5–2.5 mm long; dorsal glands 1–1.5 × as long as the filaments, glabrous; ovules 3 × 1 (rarely 3 × 2); style sigmoid or curved at the base; Panama, Colombia, Venezuela, Trinidad, Guyana, Surinam, Ecuador, Peru, W Brazil, NW Bolivia. 33a. *R. lindeniana* var. *lindeniana* (p.p.).
21. Petals 3.25–4 mm long; stamens 2.5–3 mm long; dorsal glands 0.5–0.75 × as long as the filaments, pilosulous; ovules 3 × 2 (rarely 3 × 1); style erect to slightly curved; Costa Rica, Panama, W Colombia. 34. *R. dasyadena* (p.p.).
20. Style 2–3.5 mm long.
22. Filaments 1.25–1.5 mm long; connective scales 1.5–2.25 mm long, 1–1.5 × as long as the filaments; anthers shorter than the filaments; Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, Panama. 35. *R. deflexiflora*.
22. Filaments 0.5–1 mm long; connective scales 2–3 mm long, 2.5–4 × as long as the filaments; anthers longer than the filaments; tropical South America.
23. Leaf base distinctly oblique, distinctly subcordate to subauriculate at the petiole; young branchlets, petioles and inflorescence axis densely ferruginous hispid to hispidulous; petals 3–4 mm long; ovules 3 × 1. Colombia, Venezuela, Guianas, Peru, Brazil. 36. *R. neglecta*.
23. Leaf base obscurely oblique, obscurely subcordate to subauriculate at the petiole; young branchlets, petioles and inflorescence axis sparsely golden pilosulous; petals 4–5 mm long; ovules 3 × 2.
24. Domatia present; sepals with 3–5 veins; ovary usually villose; SE Colombia, SE Venezuela, Peru, N Brazil. 28. *R. camptoneura* (p.p.).
24. Domatia wanting; sepals with 5–11 veins; ovary usually strigose; Colombia, Guianas, Peru, Brazil (Amazonia). 27. *R. falcata* (p.p.).
16. Fruiting material.
25. Ovules and seeds 3 × 1 (ovules in *R. lindeniana* rarely 3 × 2).
26. Lateral veins 8–9 pairs (acumen excluded); acumen 0–0.3 cm long; leaf base symmetric, rounded-obtuse to subcordate or subauriculate at the petiole; Ecuador (W of Andes). 41. *R. deflexa* (p.p.).
26. Lateral veins 9–15 pairs (acumen excluded); acumen 0.3–4 cm long; leaf base asymmetric, obscurely to distinctly obtuse, subcordate or subauriculate at the petiole.
27. Seeds glabrous; leaf base distinctly oblique and distinctly subcordate to subauriculate at the petiole; costa ferruginous strigose beneath; petioles, branchlets and inflorescence axis ferruginous hispid and hispidulous; Colombia, Venezuela, Guianas, Peru, Brazil. 36. *R. neglecta* (p.p.).
27. Seeds hirtellous; leaf base obscurely oblique and obscurely obtuse, subcordate or subauriculate at the petiole; costa sparsely whitish to golden pilosulous or glabrescent beneath; petioles, branchlets and inflorescence axis golden brownish pilosulous; Panama, Colombia, Venezuela, Trinidad, Guyana, Surinam, Ecuador, Peru, W Brazil, NW Bolivia. 33a. *R. lindeniana* var. *lindeniana* (p.p.).
25. Ovules and seeds 3 × 2 (ovules and seeds rarely 3 × 1 in *R. dasyadena*, sometimes 3 × 3 in *R. deflexiflora*).

28. Lamina widest at $\frac{1}{3}$ from the base, from there gradually tapering to the apex: (juvenile fruits densely ferruginous hispidulous); Panama. 31. *R. brachythrix* (p.p.).
28. Lamina widest near the middle, acuminate to cuspidate.
29. Seeds hirtellous; Central America, adjacent NW Colombia.
30. Capsule 2–3 cm long; seeds 6–8 mm diam.; leaf base obscurely oblique, subcordate or subauriculate at the petiole; Panama, W Colombia. 34. *R. dasyadena* (p.p.).
30. Capsule 1–2 cm long; seeds 2–5 mm diam.; leaf base distinctly oblique, subcordate or subauriculate at the petiole; Mexico, Guatemala, Belize, Honduras?, Nicaragua, Costa Rica, Panama. 35. *R. deflexiflora*.
29. Seeds glabrous; Amazonia s.l. (sometimes just S of the Cordilleras in Venezuela; *R. falcata*).
31. Branchlets and capsule ferruginous hispid and hispidulous; leaf margin whitish pilosulous and whitish cili(ol)ate; Venezuela, Brazil, N Bolivia, N Paraguay. 40. *R. ovalifolia* (p.p.).
31. Branchlets and capsules sparsely golden pilosulous to glabrescent; leaf margin glabrous.
32. Domatia present; seeds usually 7–8 mm diam.; SE Colombia, SE Venezuela, Peru, N Brazil. 28. *R. camptoneura* (p.p.).
32. Domatia wanting; seeds usually 4–5 mm diam.; Colombia, Venezuela, Surinam, French Guiana, Peru, Brazil. 27. *R. falcata* (p.p.).
13. Leaf base not obtuse, neither (sub)cordate nor (sub)auriculate at the petiole; sometimes slightly decurrent into the petiole.
33. Lamina underneath erect pilosulous.
34. Leaf margin thick walled; racemes probably 1–4 cm long; 'pedicels' 1.5–3 mm long; bracts 0.5–1 mm long; all filaments and dorsal glands free; ovules and seeds 3 × (3–4); capsule 3–3.5 cm long; seeds pilosulous; Colombia. 29. *R. marginata*.
34. Leaf margin thin walled; racemes usually 4–12 cm long; 'pedicels' usually 3–6 mm long; bracts 1.5–2 mm long; dorsal glands of anterior filaments fused with each other; only the posterior filament(s) free; ovules and seeds 3 × 2; capsule 1–2.5 cm long; seeds glabrous; Venezuela, Brazil, N Bolivia, N Paraguay. 40. *R. ovalifolia* (p.p.).
33. Lamina glabrous beneath (only costa and lateral veins may be hairy).
35. Branchlets with numerous callose lenticels (branchlets purplish, but with white lenticels when dried).
36. Domatia present; anthers 1–1.5 mm long; style exceeding the stamens by 0.5–1.5 mm; indument whitish to golden; seeds glabrous; Guianas, N Peru, NE Brazil. 23. *R. brevipes*.
36. Domatia wanting; anthers 1.5–2 mm long; style exceeding the stamens by 0–0.5 mm; indument golden, ferruginous or maroon; seeds of *R. riana* pilosulous (seeds of *R. brachythrix* unknown).
37. Racemes usually 5–15 cm long; 'pedicels' 3–15 mm long; connective scales 2–3 mm long, 3–5 × as long as the filaments; ovary 'spiny' hispid; style 1.5–2.5 mm long; capsule velutinous and sparsely pilose; indument predominantly maroon; Venezuela, Trinidad, Guianas, Brazil. 25. *R. riana*.
37. Racemes usually 4–5 cm long; 'pedicels' 2–3 mm long; connective scales 3–4 mm long, 6–8 × as long as the filaments; ovary strigillose; style 2.5–3 mm long; capsule strigillose; indument golden to ferruginous; Panama. 31. *R. brachythrix* (p.p.).
35. Branchlets without numerous callose lenticels (branchlets usually brownish, sometimes purplish or violet when dried).
38. Flowering material.
39. Petals hairy outside along the costa.
40. Leaf costa glabrous above; domatia wanting; sepals whitish pilosulous, scarcely ribbed when dried; petals brownish pilose(ulous); stamens 2–3 mm long; ovules 3 × (1–2); SE Colombia, SW Venezuela, Surinam, French Guiana, Brazil (Amazonia). 22. *R. amapensis*.
40. Leaf costa puberulous above; domatia present; sepals ferruginous hispid and hispidulous, strongly ribbed when dried; petals ferruginous strigose; stamens 3–4 mm long; ovules 3 × (2–4); Costa Rica, Panama, Colombia, Venezuela, Guianas, Ecuador, Peru, Brazil, Bolivia. 24. *R. pubiflora*.
41. Anthers completely developed, 1–2 mm long, 0.75–1 mm wide, 0.5–

- 0.75 × as long as the connective scales; connective scales ovate. 0.75–1.25 mm wide; Costa Rica ?, Panama, Colombia, Venezuela, Guianas, Ecuador, Peru, Brazil, Bolivia. 24a. var. *pubiflora*.
41. Anthers reduced or wanting. 0–1.5 mm long. 0–0.75 mm wide. 0–0.5 × as long as the connective scales; connective scales narrowly ovate to linear, 0.25–0.75 mm wide; Costa Rica, Panama, Colombia, Venezuela, Guianas, Peru, W Brazil. 24b. var. *grandifolia*.
39. Petals glabrous (sometimes with some scattered hairs).
42. Ovary glabrous (sometimes with some scattered hairs); Colombia, Venezuela, Guianas, Ecuador, Peru, Brazil (Amazonia). 26. *R. flavescens*.
42. Ovary distinctly hairy.
43. Dorsal glands all fused with each other, or only those of the anterior filaments.
44. Dorsal glands all fused with each other; Central America.
45. Ovules 3 × 1; domatia usually present in Central American specimens, often wanting in Mexican specimens; lateral veins usually 6–9 pairs (acumen excluded); S Mexico, Guatemala, Belize, Honduras. 43. *R. guatemalensis*.
45. Ovules 3 × (2–3); domatia wanting; lateral veins usually 8–13 pairs (acumen excluded); S Mexico, Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica, Panama. 44. *R. hummelii*.
44. Dorsal glands of anterior filaments only fused with each other; the posterior filament(s) free; Tropical S America.
46. 'Pedicels' 1 mm long; sepals 0.5–1 mm long; petals 2–2.5 mm long, 1.5–2 × as long as wide; stamens 2 mm long; style 1.5 mm long, 1.5 × as long as the ovary; French Guiana. 42. *R. pectino-squamata*.
46. 'Pedicels' 2–6 mm long; sepals 1.5–3 mm long; petals 3–4.5 mm long, 2–5 × as long as wide; stamens 2.5–3.5 mm long; style 2–2.5 mm long, 2–3 × as long as the ovary. 18. (40. *R. ovalifolia* & 41. *R. deflexa*).
43. All filaments free; all dorsal glands free, adnate to the filaments.
47. Style 1–2 mm long.
48. Petals 3.25–4 mm long; stamens 2.5–3 mm long; dorsal glands 0.5–0.75 × as long as the filaments, pilosulous; ovules 3 × 2 (rarely 3 × 1); Costa Rica, Panama, W Colombia. 34. *R. dasyadena* (p.p.).
48. Petals 2–3.25 mm long; stamens 1.5–2.5 mm long; dorsal glands 1–1.5 × as long as the filaments, glabrous; ovules 3 × 1 (rarely 3 × 2); Panama; Colombia, Venezuela, Trinidad, Guyana, Surinam, Ecuador, Peru, W Brazil, NW Bolivia. 33. *R. lindeniana* (p.p.).
49. Leaf base slightly oblique, obtuse; Panama, Colombia, Venezuela, Trinidad, Guyana, Surinam, Ecuador, Peru, W Brazil, NW Bolivia. 33a. var. *lindeniana*.
49. Leaf base symmetric, usually decurrent into the petiole; Costa Rica, Panama, Colombia. 33b. var. *fernandeziana*.
47. Style 2–4.5 mm long.
50. Lamina gradually tapering to the apex.
51. 'Pedicels' 2–3 mm long; filaments ca. 0.5 mm long; anthers 3 × as long as the filaments; connective scales 6–7 × as long as the filaments; lamina at widest $\frac{1}{3}$ from the base, rounded to cuneate near the base, obtuse to rounded at the petiole; branchlets purplish with whitish callose lenticels when dried; Panama. 31. *R. brachythrix* (p.p.).
51. 'Pedicels' 4–8 mm long; filaments ca. 1 mm long; anthers 2 × as long as the filaments; connective scales 3–5 × as long as the filaments; lamina usually at widest $\frac{1}{2}$ from the base, usually also tapering to the base; branchlets without such lenticels; NE Colombia, Venezuela, Trinidad, Guiana. 30. *R. melanodonta*.

50. Lamina not tapering to the apex.
52. Petals 2.5–4 × as long as the sepals; Central America. 45.
52. Petals 1.5–2.5 × as long as the sepals, South America. 24.
38. Fruiting material.
53. Ovules and seeds 3 × 1 (ovules in *R. lindeniana* extremely rarely 3 × 2).
54. Lateral veins 6–9(–11) pairs (acumen excluded); seeds glabrous (seeds of *R. deflexa* unknown).
55. Petioles 2–6 mm long; leaf base rounded to subcordate or subauriculate at the petiole; acumen 0–0.3 cm long; Ecuador. 41. *R. deflexa* (p.p.).
55. Petioles 2–12 mm long; leaf base cuneate, sometimes decurrent into the petiole; acumen 0.3–2 cm long; S Mexico. Guatemala, Belize, Honduras. 43. *R. guatemalensis*.
54. Lateral veins (7–)9–15 pairs (acumen excluded); seeds pilosulous.
56. Capsule usually symmetric, distinctly brownish pilosulous; valves (sub)equal; seeds usually maculate when dried; branchlets erect pilosulous in combination with sparsely pilose, often drying to violet; SE Colombia, SW Venezuela, Surinam, French Guiana, Brazil. 22. *R. amapensis*.
56. Capsule usually asymmetric, obscurely whitish hispidulous to glabrescent; valves usually unequal; seeds usually not maculate when dried; branchlets pilosulous when young, glabrescent when older, usually drying to brownish; Panama, Colombia, Venezuela, Trinidad, Guyana, Surinam, Ecuador, Peru, W Brazil, NW Bolivia. 33. *R. lindeniana* (p.p.).
57. Leaf base slightly oblique and obtuse at the petiole; Panama, Colombia, Venezuela, Trinidad, Guyana, Surinam, Ecuador, Peru, W Brazil, NW Bolivia. 33a. var. *lindeniana*.
57. Leaf base symmetric, often decurrent into the petiole; Costa Rica, Panama, Colombia. 33b. var. *fernandeziana*.
53. Ovules and seeds 3 × (2–4), seeds sometimes abortive or undeveloped (in *R. flavescens*, *R. dasyadena* and *R. hummelii* extremely rarely also 3 × 1).
58. Lamina gradually tapering to the apex.
59. Lamina widest at 1/3 from the base, rounded to cuneate near the base, obtuse to rounded at the petiole; lateral veins 11–14 pairs (acumen excluded); 'pedicels' 2–3 mm long; seeds unknown; branchlets purplish with whitish callose lenticels when dried; Panama. 31. *R. brachytrix* (p.p.).
59. Lamina usually widest at 1/2 from the base, usually also tapering to the base; lateral veins 9–12 pairs (acumen excluded); 'pedicels' 4–8 mm long; seeds pilose; branchlets without such lenticels; NE Colombia, Venezuela, Trinidad, Guiana. 30. *R. melanodonta*.
58. Lamina cuspidate to acuminate (42. *R. pectino-squamata* is further indeterminate with this key, since fruits and seeds are wanting; it is a species without domatia; it is endemic in French Guiana).
60. Seeds glabrous.
61. Branchlets ferruginous hispid and hispidulous.
62. Floral parts (including reduced stamens or staminodes [see 41]) subsistent at the base of the capsule; domatia always present; leaf margin not ciliolate; Panama, Colombia, Venezuela, Guianas, Peru, Brazil (W. Amazonia). 24ba. *R. pubiflora* var. *grandifolia* fo. *grandifolia*.
62. Floral parts wanting at the base of the capsule; domatia present or wanting; leaf margin ciliolate; Venezuela, Brazil, N Bolivia, N Paraguay. 40. *R. ovalifolia* (p.p.).
61. Branchlets golden hirtellous, glabrescent or glabrous.
63. Domatia present; seeds usually 7–8 mm long and wide; SE Colombia, SE Venezuela, Peru, N Brazil. 28. *R. camptoneura* (p.p.).
63. Domatia wanting; seeds usually 4–6 mm long and wide.
64. Capsule sparsely appressed pilosulous; leaf costa pilo-

- sulous to glabrescent above, sparsely golden strigose to glabrescent beneath; petioles golden hirtellous above; Colombia, Venezuela, Surinam, French Guiana, Peru, Brazil (Amazonia). 27. *R. falcata* (p.p.).
64. Capsule glabrescent to glabrous; leaf costa glabrous on both sides; petioles glabrescent; Colombia, Venezuela, Guianas, Ecuador, Peru, Brazil (Amazonia). 26. *R. flavescens*.
60. Seeds pilosulous.
65. Domatia present.
66. Inflorescences and infructescences sparsely pilosulous; bracts 0.5–1 mm long, scarcely ribbed when dried; pedicels up to 3 mm long, sparsely pilosulous; capsule pilosulous; seeds 3×2 , extremely rarely 3×1 ; Costa Rica, Panama, Colombia. 34. *R. dasyadena* (p.p.).
66. Inflorescences and infructescences densely puberulous to hispidulous; bracts 1–2 mm long, strongly ribbed when dried; pedicels up to 6 mm long, densely puberulous or hispidulous; capsule puberulous and sparsely pilose; seeds $3 \times (2-4)$; Costa Rica, Panama, Colombia, Venezuela, Guianas, Ecuador, Peru, Brazil, Bolivia. 24. *R. pubiflora*.
67. Floral parts (including reduced stamens or staminodes [see 37]) subpersistent at the base of the capsule; Costa Rica, Colombia, Venezuela, Guianas, Brazil. 24bb. var. *grandifolia* fo. *andersonii*.
67. Floral parts wanting at the base of the capsule; Panama, Colombia, Venezuela, Guianas, Ecuador, Peru, Brazil, Bolivia. 24a. var. *pubiflora*.
65. Domatia wanting.
68. Inflorescences and infructescences up to 23 cm long; bracts 0.5–1 mm long; 'pedicels' 1–3 mm long; Costa Rica, Panama, W Colombia. 34. *R. dasyadena* (p.p.).
68. Inflorescences and infructescences up to 8.5 cm long; bracts 1–2 mm long; 'pedicels' 2.5–6 mm long.
69. Branchlets erect pilosulous in combination with sparsely pilose, usually violet when dried; seeds $3 \times 1(-2)$, usually maculate when dried; SE Columbia, SW Venezuela, Surinam, Fr Guiana, Brazil (Amazonia). 22. *R. amapensis* (p.p.).
69. Branchlets hirtellous to glabrescent, usually pale brownish when dried; seeds $3 \times 2(-3)$, never maculate when dried; S Mexico, Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica, Panama. 44. *R. hummelii*.

Subgroup IIc.1. 'Macrocarpa': species 17.

Leaf base symmetric; tertiary venation reticulate; *inflorescences* racemose; *flowers* and *fruits* subsessile; 'pedicels' articulate at the base; bracts and bractlets inserted together at the base of the 'pedicels'; filaments and dorsal glands fused to a tube with free parts of filaments surmounted on the tube; ovary conical and tapering into a conical style, hairy; ovules two to three per placenta.

Rinorea macrocarpa is the only species known in this subgroup, which is characterized by flowers and fruits subsessile and by the typical shapes of the androecium and gynoecium, unique in neotropical *Rinorea*. The feature of 'pedicels' articulate at the base is shared with *R. uxpanana*

of Group IIb. 'Uxpanapana' and with the species of Subgroup IIc. 2. 'Viridifolia.' In these species, however, flowers and fruits are distinctly pedicellate, in contrast with those of *R. macrocarpa*.

17. *Rinorea macrocarpa* (Martius ex Eichler in Martius) Kuntze, Revis. gen. pl. 1: 42. 1891; Reiche & Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. 1. **3(6)**: 329, figs. 149, 152. 1895; Blake, Contr. U.S. Natl. Herb. **20(13)**: 514. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925; Baehni & Weibel, Candollea **8**: 195. May 1941; in Macbride, Publ. Field Mus. Nat. Hist., Bot. Ser. **13(4(1))**: 60. 30 Jun 1941; Smith & Fernández-

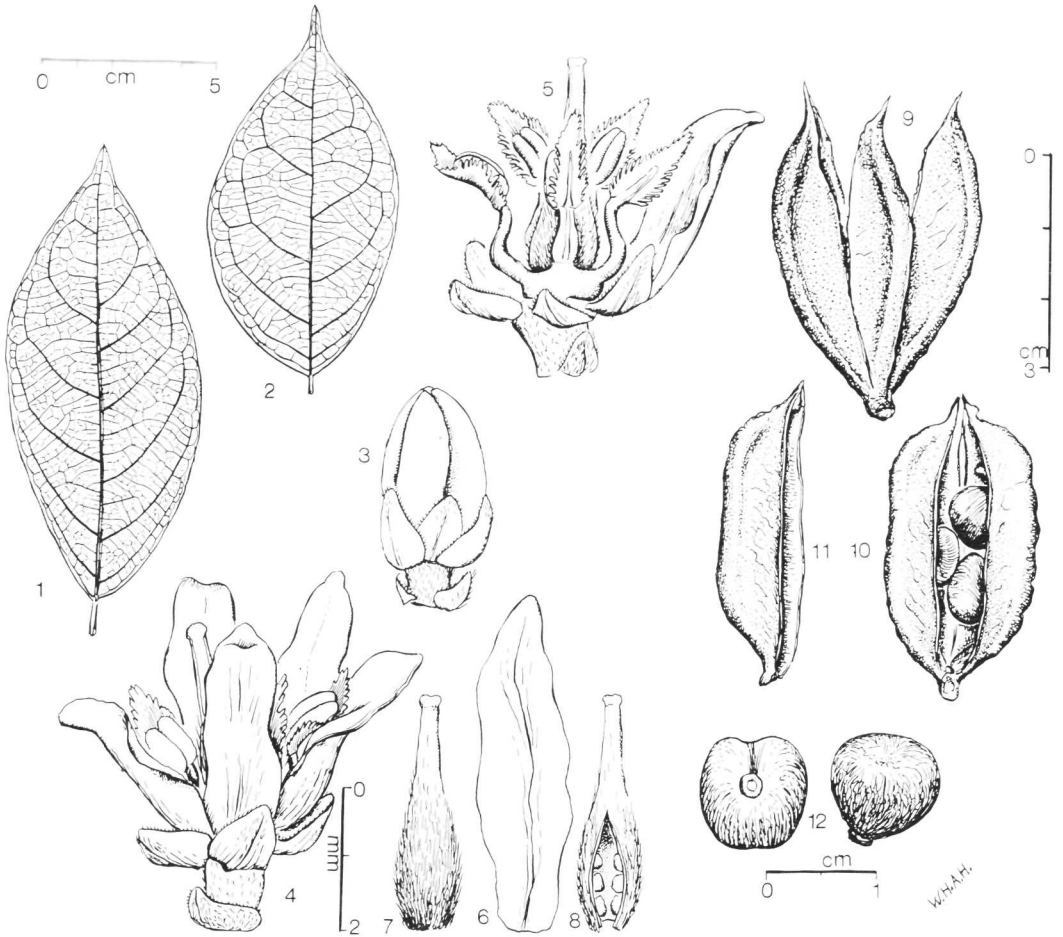


FIG. 27. *Rinorea macrocarpa* (1 from Prance et al. 13531; 2 from Maguire 24150; 3-8 from F. Cardona 1666; 9 from Martius s.n. (105), type; 10-11 from Krukoff 1527; 12 from W. Rodrigues 873). 1, 2, Leaves. 3, Flower bud. 4, Adult flower. 5, Flower (inside); androecium (dorsal), with filaments mounted on a glandular tube; stamens surrounding the pistil. 6, Petal. 7, Pistil with an ovary tapering into the style. 8, Idem, with the ovary opened, showing ovules 3 × 3. 9-11, Capsule dehiscing into three subequal valves. 12, Seeds, glabrous.

P., *Caldasia* 6(28): 104. 15 Aug 1954.

Figs. 27, 28.

Alsodeia macrocarpa Martius ex Eichler in Martius, Fl. bras. 13(1): 385, t. 78, fig. 1. 1871; Radlkofer, Sitzungsber. Math-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 185. 1891 ('1890'); Glaziou, Bull. Soc. Bot. France 52. Sér. 4. 5. Mém 3a: 22. 1905. Type, Brazil. Amazonas: s.d. (fr), Martius s.n. (lectotypus novus, M (105); isotypes M (106, 107, these numbers are written on small labels attached to the specimens).

Tree or treelet, 1.5-10 m tall. Branchlets ferruginous pilose(ulous) or strig(ill)ose when young, glabrescent when older. Leaves apparently op-

posite, occasionally ternate; petioles 2-13 mm long, ferruginous hispid(ulous) above, ferruginous strig(ill)ose beneath; stipules deciduous, narrowly deltoid, 2.5-3 × 0.5-1 mm, herbaceous, ferruginous strig(ill)ose along the costa, ciliate; lamina (narrowly) elliptic to (ob)ovate, acuminate to cuspidate, 5.5-21.5 × 2-9.25 cm, usually papery, glabrous on both sides; costa and lateral veins sparsely pilosulous to glabrescent above, ferruginous pilose(ulous) or strig(ill)ose to glabrescent beneath; domatia sometimes present; lateral veins 6-10(-12) pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate; margin subentire to (sub)crenate

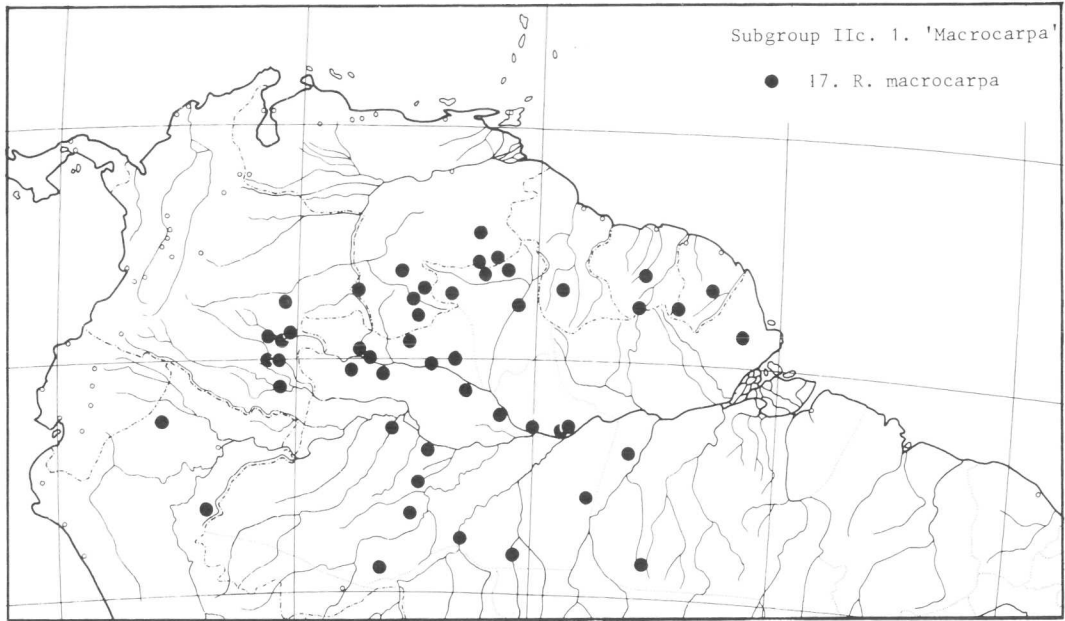


FIG. 28. Distribution of *Rinorea macrocarpa* (Subgroup I1c.1. 'Macrocarpa').

or (sub)serrate, mucronulate; acumen 0.5–2.75 cm long, apex subobtusate to acute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 2–8.5 cm long, densiflorous; central axis greenish when fresh, golden to ferruginous puberulous or strigillose; flowers and fruits subsessile; 'pedicels' 0.5–1 × 0.25–0.75 mm, articulate at the base, sparsely appressed puberulous or strigillose; bracts and bractlets together at the base below the articulation, ovate to deltoid, herbaceous, glabrous or pilosulous to the apex, ciliolate, apex subobtusate to subacute, mucronulate; bracts 0.75–1(–1.5) × 0.5–1 mm; bractlets 0.5–0.75 mm long and wide. *Flower* buds ovoid, obtuse. Flowers yellowish-white. *Sepals* subequal, ovate to deltoid, 0.75–1.5 × 0.5–1 mm, herbaceous, glabrous or pilosulous at the apex, ciliolate, apex subobtusate. *Petals* narrowly ovate, acuminate, 3–4.5 × 1–1.5 mm, herbaceous, usually completely glabrous also along the margin, apex obtuse. *Stamens* 2–3 mm long; free parts of the filaments curved to outside, 0.5–1 × 0.23–0.5 mm, glabrous; filamental tube glandular, 0.1–0.3 mm high, carnosate, glabrous; anthers ellipsoid to ovoid, 0.75–1 × 0.3–0.6 mm, apex obtuse, unappendaged; connective outside, narrowly ovate or deltoid to linear, (sub)obtusate, (0.6–)0.75–1.25 × (0.1–)0.25–0.5 mm, glabrous;

connective scales lateral as well as apical, ovate to deltoid, (1–)1.25–1.75 × 0.75–1 mm, scarious, transparent, yellow, margin and apex fringed, apex obtuse. *Ovary* conical, tapering into the style, 1–1.25 × ca. 0.75 mm, appressed ferruginous pilosulous; ovules two to three per placenta. *Style* conical near the base, stipitate near the apex, 2–3 mm long, ± equaling the stamens; stigma pulvinate. *Capsule* symmetric, ovoid to ellipsoid, acuminate, coriaceous to subligneous, greenish- to yellowish-white when fresh, often reddish to whitish punctate when dried, sparsely ferruginous hispidulous, obscurely veined; valves three, equal, (3–)3.25–5.75 × 0.6–1.25 cm. *Seeds* two to three per valve, globose, 4–10 mm in diam., usually glabrous, sometimes minutely pilosulous.

Distribution (Fig. 28) and *ecology*. Widely spread over Amazonia s.l. (SE Colombia, S Venezuela, Brazil, N Peru), Roraima area, the upper basin of the Orinoco and the eastern part of the Guianas; expected in the western part of the Guianas. The species has reached the Andean region of Upper Amazonia. There are no records from the other side of the Cordilleras. It seems that the species did not succeed in passing the Cordilleras before the Pliocene uplift. It occurs in the understory of tropical rain forests of low-

lands and submountainous regions from 0 to 600 m; some specimens have been collected on banks of rivers and creeks. Soil sandy to clayish, often mixed with humus.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: COLOMBIA. AMAZONAS: Río Caquetá. La Pedrera. Cerro de Cupatí. 240–580 m. 30 Sep 1952 (fl. juv fr). *Garcia-Barriga 14564* (COL. US); idem. Quebrada Tonemia. 5 Oct 1952 (fr). *Schultes & Cabrera 11730* (COL. US). AMAZONAS–VAUPÉS: Río Apaporis. Jino-Gojé between the rivers Piraparaná and Popeyaká. 250 m. 3–11 Sep 1952 (juv fr). *Garcia-Barriga 14461* (COL. US); Río Apaporis. between Río Pacoa and Río Kananarí. Soratama. 250 m. 16 Aug 1951 (bud). *Schultes & Cabrera 13572* (COL. HH. US); idem. 20 Aug 1951. *13693* (COL); idem. 28 Sep 1951 (fl). *14169* (HH. K. NY. UC. US). VAUPÉS–GUAINIA: Riverside of Río Inirida. vic. Morichal nr. the mouth of Río Papanuána. 70°30'W. 200 m. 14 Feb 1953 (fr). *Fernández 2263* (COL. US); idem. 17–18 Feb 1953 (fl. fr). *2283* (COL. US) & *2285* (COL. US); idem. 20 Feb 1953 (bud. juv fr). *2308* (COL. US). VAUPÉS: Bank of Río Vaupés. between Mitu and the confluence with Río Kibiyurí. 200 m. 23–24 Mar 1970 (fl. fr). *Fernández & Soejarto 2375* (COL); Río Vaupés. Alto Vaupés. vic. Miraflores. 300 m. 3 Jan 1944 (fr). *Gutierrez & Schultes 498* (HH); Inambú (=Enambú). 18 Nov 1952 (fr). *Romero-Castañeda 3624* (COL); (W)Jacaricuara. trail from Río Paca to Papurí. 7 Dec 1952 (fr). *Romero-Castañeda 3906* (COL); Cerro de Mitú. 22 Dec 1952 (fr). *Romero-Castañeda 3944* (COL); Río Vaupés. Falls of Yuruparí. 13 Apr 1952 (fr). *Schultes & Cabrera 19020* (COL); Tapucuara. Río Negro. 11 Sep 1947 (fl). *Schultes & Lopéz 8957* (NY. US).

VENEZUELA. AMAZONAS: Along Río Castanho. tributary of Padañiri. tributary of Río Negro. 100–140 m. 16–24 Feb 1946 (bud. fr). *F. Cardona 1371* (US. VEN); Occamo. Aug 1972 (fl. fr). *Lizot 1972-11* (U. VEN); Cerro Yapacana. 3°45'N. 66°45'W. 3 May 1970 (fr). *Steyermark & Bunting 103015* (U. VEN). BOLÍVAR: Yumariba. Río Ikaburú. 430 m. 1 Oct 1946 (fl). *F. Cardona 1666* (US. VEN).

SURINAM. Kwatta. Coppename River. 22 Jul 1944 (bud). *Maguire 24150* (F. HH. K. NY. U. US); Sipaliwini savanna area on Brazilian frontier. Jan 1970 (fr). *Oldenburger et al. 1187* (U).

FRENCH GUIANA: Tumaç Humac. along Brazilian border. 1 km N of Mitaraka-Nord. 350 m. 6 Aug 1972 (juv fr). *Granville 1169* (CAY. P); Upper Approuague. valley of a tributary creek Parépou. 2°30'N. 53°30'W. 25 Sep 1968 (bud). *Oldeman T-177* (CAY. P. U).

PERU. LORETO: Alto Amazonas. between Andoas and Capahuari-South. 76°28'W. 2°90'S. 210 m. 13 Sep 1979 (fr). *Diaz & Jaramillo 1360* (MO. U); Leticia. Jun 1902 (fl). *Ule 6192* (G. HBG. K. L).

BRAZIL. AMAPÁ: Río Amapari. vic. Porto Terezinha. 70–300 m. 11 Nov 1954 (fr). *Cowan 38266* (F. K. NY); idem. 13 Nov 1954 (fl. fr). *38302* (NY. RB. US).

AMAZONAS: Sumauma. Río Domeni. 10 Sep 1962 (bud). *Appa 143* (=Duarte 7138) (HB. INPA. RB. U); Transamazonian Hwy. 03°06'1976 (fl). *Bahia 80* (NY); Mirapinima. 5 Feb 1944 (tr). *Baldwin 55: 4* (US); Caman aus. Río Negro. 12 Feb 1959 (fr). *Cavalcante 593* (INPA. MG); Manaus. BR 17. km 26. 27 Jun 1956 (fl). *D. F. Coelho 3943* (COL. MG); Manaus. Forest Reserve Ducke. Picada. 17 Jun 1958 (fl). *L. Coelho 12* (COL. INPA. U); Sumauma. Río Domeni. 10 Sep 1962 (bud). *Duarte 7138* (=Appa 143) (HB. INPA 6532. RB. U); Barcellos. Río Negro. 9–6–1955 (fl). *Ducke 7094* (RB); Serra do São Gabriel. Río Negro. 8 Oct 1945 (bud). *Froes 21124* (COL. IAN. NY. US); Padauriy. Castanha. 9 Oct 1947 (bud). *Froes 22585* (COL. IAN. US); Fóz de Uaupés. Upper Uaupés. 7 Apr 1952 (bud). *Froes 28200* (COL. IAN); Eachveia. Uby. Río Purús. 21 Jun 1903 (fl). *Goeldi 3905* (P. RB. US); Río Caubury between mouths of Río Iá and Río Maturaca. 3–7 Nov 1930 (fr). *E. G. Holt & E. R. Blake 453* (HH. NY. US); Jatuarana River. Machado River (=Jiparana River) region. ±7°35'S. ±60°40'W. Dec 1931 (fr). *Krukoff 1527* (G. HH. U); Mun. Humayta nr. Livramento. on Rio Livramento. 12 Oct–6 Nov 1934 (fr). *Krukoff 6864* (U); Río Uaupés. 15 Oct 1947 (fl). *Murça Pires 672* (NY); Serra do Curicuari. Río Negro. 24 Oct 1978 (fr). *Nascimento 724* (INPA. NY. U); São Gabriel. Río Negro. 20 Apr 1975 (fr). *Nascimento et al. 172* (IPEAN. NY); Río Curuquêta. São Paulo. 30 km above mouth Río Coti. Río Purús. Río Italuxi. 19 Jul 1971 (fl). *Prance et al. 14414* (C. COL. F. G. HH. INPA. K. M. MG. MICH. MO. NY. P. R. U. US. VEN); Tapuruquara in basin of Río Negro. 16 Oct 1971 (fr). *Prance et al. 15319* (C. F. G. HH. INPA. K. M. MG. MICH. MO. NY. P. R. S. U. US. VEN); idem. 21 Oct 1971 (bud. juv fr). *15736* (C. COL. F. G. HH. INPA. K. M. MICH. MO. NY. P. R. S. U. US. VEN); Basin of Río Purús. Río Cunhuá at Canaça. 6°34'S. 66°27'W. 27 Nov 1971 (fr). *Prance et al. 16394* (C. COL. F. G. HH. INPA. K. M. MG. MICH. MO. NY. P. R. U. US. VEN); São Antonio de Abonauri. Manaus–Caracarai km 220. 24 Nov 1976. *Prance et al. 24263* (C. COL. F. G. HH. INPA. K. MG. MICH. MO. P. R. U. UFMG. US. VEN); vic. Borba. s.d. (fl). *Riedel 1341* (G. LE); idem. s.d. (bud). *s.n.* (G); Camanaus. Upper Río Negro nr. Uaupés. 12 Feb 1959 (fr). *J. S. Rodrigues 67* (COL. INPA); Río Uatumã. Cachoeira Morena. 25 Nov 1956 (fr). *W. Rodrigues 248* (INPA. U); Camanaus. Upper Río Negro nr. Uaupés. 12 Feb 1959 (fr). *W. Rodrigues 873* (INPA. U); Manaus. km 60 BR-17. 17 May 1961 (bud. juv fl). *W. Rodrigues 2616* (INPA. U); Tefê. 17 Nov 1959 (fr). *W. Rodrigues & L. Coelho 1410* (INPA. MG. U); Hwy. Manaus–Itacaotiara km 90. Río Preto. 20 Aug 1961 (bud). *W. Rodrigues & J. Lima 3005* (INPA. U); Hwy. Manaus–Itacaotiara km 78. Río Preto. 11 Jan 1966 (fr). *W. Rodrigues & Osmarino 7394* (INPA. U); Río Negro. Río Jauapari. 13 Feb 1977 (fr). *M. R. Santos 25* (INPA. NY); Manaus. Dec–Mar 1850–1851 (fr). *Spruce 1320* [K]herb. Benthamianum. herb. Hookerianum]. P); idem. Jun 1851 (fl). *1603* (BM. CGE. G. K. LE. M. OXF. P. W); idem. 13 Aug 1874 (fl). *Traill 19a* (K); Upper Amazon & tributaries. Guaré. 22 Oct 1874 (fr). *Traill 19b* (P) & *s.n.* (K). PARÁ: Vic. Igarapé Kazus. km 1230. 19 Nov 1977 (fr). *Prance et*

al. P 25579 (NY, U): Itaituba, km 85 hwy. Itaituba-Jacarearanga, Parque Nacional de Tapajós. (L.B.D.F.), 14 Nov 1978 (juv fr). *M. G. Silva & C. Rosario* 3725 (INPA, NY, U). RORAIMA: Upper Rio Pacú, 6 Apr 1948 (bud). *Froes* 23183 (IAN, SP); Indian trail from Surucucu (2°53'N, 63°36'W) to Uaicá (3°33'N, 63°11'W), between Surucucu and Maloca Maiyobtedi, 7 Feb 1971 (fr). *Prance et al.* 13531 (INPA, NY, U); idem, between Maiyobtedi & Botamatedi, about 3°N, *Prance et al.* 13548 (INPA, NY, U); Manaus-Caracarái km 346, Igarapé Jundia, 1°56'N, 62°25'W, 26 Nov 1976 (fr). *Prance et al.* 24315 (C. F. G. HH, INPA, K. M. MG, MICH, MO, NY, P. R. S. U, UFMG, VEN).

Some specimens have a more hairy habit, differing from the other specimens by their leaves hirtellous beneath and by fruits and seeds distinctly hirtellous to hispidulous. Representative specimens: VENEZUELA, AMAZONAS: Yavita, 128 m, 24 Jan 1942 (fr). *Ll. Williams* 13955 (G. US, VEN 8741); BOLÍVAR: Río Apacará, region of Urimán (=Urimón), 400–500 m, 17 Aug 1954 (fr). *Bernardi* 1492 (FI, NY, VEN).

BRAZIL, RORAIMA: Porto Mucajai, Rio Mucajai, 14 Mar 1971 (fr). *Prance et al.* 10981 (INPA, NY, U, US).

Local names. Venezuela: Akay-mota-yek (Bolívar, Arekuna language); Bayoinia (=Bayoarina) kohi (Amazonas). Surinam (Arawak): Baririkuti. Brazil: Canella de Jacomín (Amazonas).

Rinorea macrocarpa can not be confused with any other species of neotropical *Rinorea* because of the combination of the following characters: (1) flowers and fruits subsessile; (2) free parts of filaments surmounted on a glandular tube; (3) connective scales transparent, yellowish and fringed along the whole margin; (4) ovary conical and tapering into a conical style; and (5) capsule elongated and acuminate, often reddish punctate.

Subgroup IIc.2. 'Viridifolia'; species 18–21.

Leaf base symmetric; tertiary venation reticulate; inflorescences racemose; flowers and fruits distinctly pedicellate; 'pedicels' articulate at the base; bracts and bractlets inserted together at the base of the 'pedicels'; filaments and dorsal glands not fused with each other; ovary (sub)globose, distinct from the style, hairy; ovules one per placenta.

This subgroup is characterized by having inflorescences racemose, in combination with 'pedicels' distinct, articulate at the base and with filaments and dorsal glands free.

The three species *Rinorea viridifolia*, *R. antioquiensis* and *R. squamata* are most closely related to each other. The capsules of *R. viridifolia* and *R. squamata* are distinctly veined and hirtellous to hirsute (that of *R. antioquiensis* is unknown), whereas that of *R. hirsuta* is obscurely veined and velutinous to pruinose. *Rinorea hirsuta* differs, furthermore, from the three other species by the leaves hirsute beneath (versus glabrous). Because of these differences, *R. hirsuta* is in a position by itself within this subgroup.

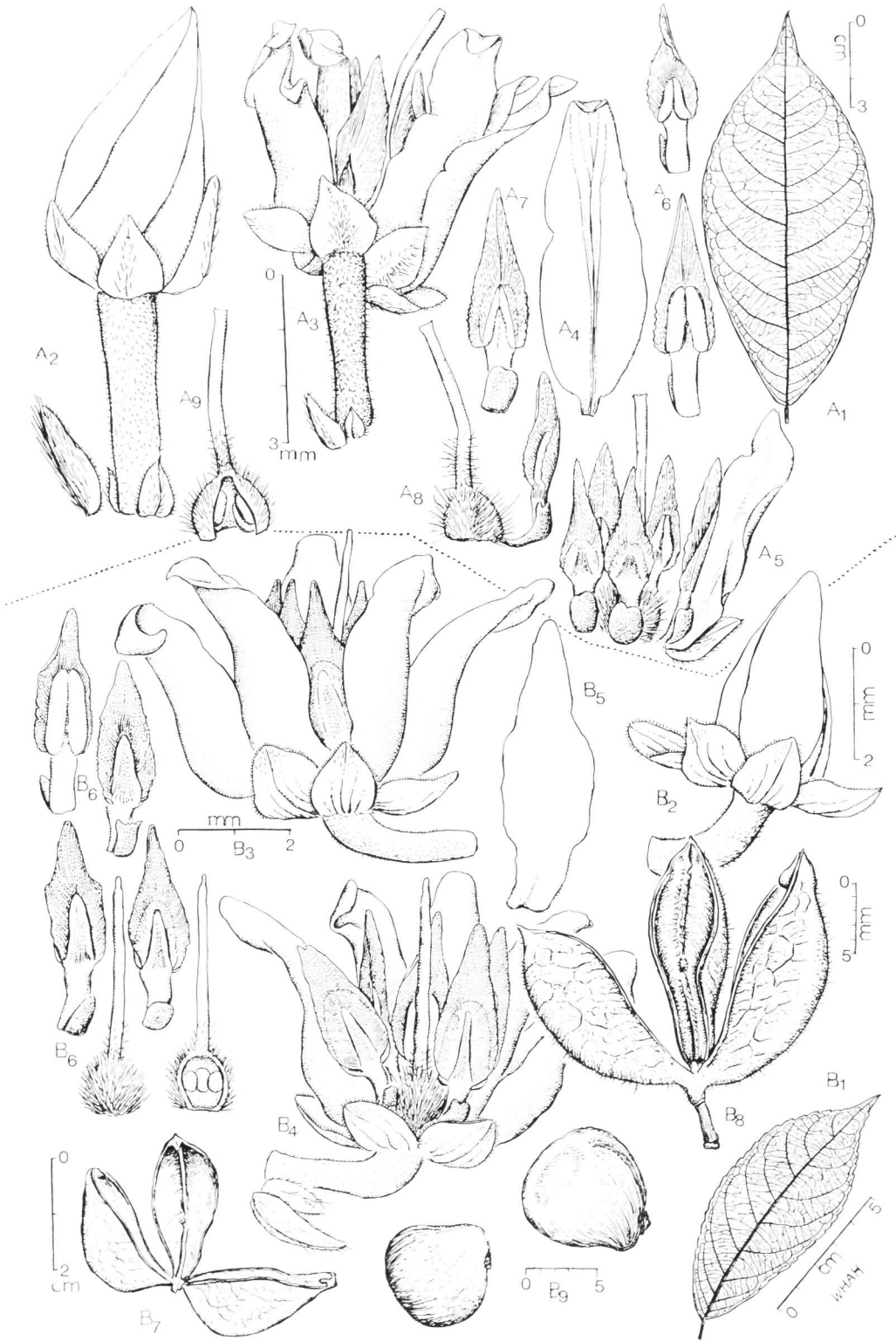
Distribution (Fig. 31). The four species of this subgroup together occupy an area ranging from W Amazonia to Nicaragua. If the areas of distribution of all four species are taken together, the most likely conclusion is that all four probably originated from a common ancestral population with a coherent area in S America, that this coherent area became fragmented by orogenesis during the Pliocene, and that finally subsequent migration took place to Central America after the creation of the Panama land bridge, ±5.7 my BP. These processes caused isolation of different populations and induced speciation, into the four species over the presently known area.

18. *Rinorea viridifolia* Rusby. Mem. Torrey Bot. Club 6(1): 5. 1896; Blake. Contr. U.S. Natl. Herb. 20(13): 514. 1924; Melchior in Engler & Prantl. Nat. Pflanzenfam. ed. 2. 21: 352. 1925; Baehni & Weibel, Candollea 8: 197. May 1941; in Macbride, Publ. Field Mus. Nat. Hist., Bot. Ser. 13(4(1)): 62. 30 Jun 1941. Type. Bolivia. Guanai-Tipuni: Apr–Jun 1892 (fl). *Bang* 1337 (lectotypus novus, NY: isotypes, BM, F. HH, K, M, MICH, MO, NY, US, W).

Figs. 29B, 31.

Rinorea juruana Ule in Pilger. Verh. Bot. Vereins Brandenburg 47: 158. 1906 ('1905'); Blake. Contr.

FIG. 29. A, *Rinorea antioquiensis* (Haught 4566, type). A₁, Leaf. A₂, Flower bud with bracts and bractlets, pedicels articulate at the base. A₃, Adult flower with bracts and bractlets. A₄, Petal. A₅, Sepals, petals, and androecium (dorsal), surrounding pistil. A₆, Two separate stamens (ventral). A₇, Stamen (dorsal). A₈, Pistil. A₉, Idem, with l.s. showing ovules 3 × 1. B, *R. viridifolia* (B, from *Bang* 1337, type; B₂₋₄, from *Killip & A. C. Smith* 28898; B₁, from *Krukoff* 10939; B₅₋₈, from *Krukoff* 5022). B₁, Leaf. B₂, Flower bud. B₃, Adult flower. B₄, Flower (inside), with an androecium surrounding the pistil. B₅, Petal. B₆, Stamens (dorsal and ventral), habit of pistil, and l.s. of ovary, showing ovules 3 × 1. B₇₋₈, Capsule dehiscing into three valves, showing 3 × 1 arrangement of seeds. B₉, Seeds, glabrous.



U.S. Natl. Herb. **20(13)**: 514. 1924; Melchior *in* Engler & Prantl, *Nat. Pflanzenfam.* ed. 2. **21**: 352. 1925; Baehni & Weibel, *Candollea* **8**: 194. May 1941; *in* Macbride, *Publ. Field Mus. Nat. Hist., Bot. Ser.* **13(4(1))**: 59. 30 Jun 1941; Soukup, *Biota* **5(37)**: 40. 1964. Type. Brazil. Amazonas: Upper Rio Juruá. Jul 1902 (fl. fr). *Ule 5633* (holotype, B (destroyed in World War II); lectotypus novus, G; isotypes, HBG, K, MG, L, F).

Rinorea gracilis Rusby, *Bull. New York Bot. Gard.* **8**: 106. 1912; Blake, *Contr. U.S. Natl. Herb.* **20(13)**: 517. 1924 ('species of uncertain position'); Melchior *in* Engler & Prantl, *Nat. Pflanzenfam.* ed. 2. **21**: 352. 1925. Type. Bolivia. Santa Buena Ventura. \approx 500 m. 24 Nov 1901 (bud, fr). *R. S. Williams 611* (holotype, NY; isotypes, BM, K, US).

Tree or treelet 1.5–15 m tall. Branchlets golden-brownish hirtellous, sometimes in combination with golden-brownish strigose, glabrescent when older. *Leaves* apparently opposite, occasionally ternate; petioles (1–)2–12 mm long, golden to ferruginous puberulous above, golden to ferruginous strig(ill)ose beneath; stipules deciduous, narrowly deltoid, 2–3.25 \times 0.75–1 mm, herbaceous, golden-brownish strigose, veined, ciliolate; lamina (narrowly) elliptic to obovate, acuminate to cuspidate, 2.5–15.5 \times (1–)1.5–7 cm, papery, glabrous on both sides; costa golden-brownish puberulous above, golden-brownish strigose beneath; domatia usually present, golden-brown; lateral veins (7–)8–11(–12) pairs (acumen excluded), golden-brownish puberulous to glabrescent above, golden-brownish strigose to glabrescent beneath; tertiary venation reticulate; base cuneate to rounded, sometimes slightly decurrent into the petiole; margin (sub)crenate to (sub)serrate, mucronulate; acumen 0.25–2.5 cm long, apex (sub)obtusate, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, (2.25–)4.5–9 cm long; central axis golden-brownish puberulous to hispidulous; 'pedicels' (2–) 2.5–4 mm long, articulate at the base, golden-brownish hirtellous to glabrescent; bracts and bractlets together at the base below the articulation, ovate to deltoid, herbaceous, golden-brownish strigillose along the costa and near the apex, ciliolate, apex subacute, mucronulate; bracts 0.75–1.75 \times 0.75–1 mm; bractlets 0.5–1.25 \times 0.5–0.75 mm. *Flower buds* ovoid, conical, obtuse. *Flowers* pendulous, greenish when young, creamy to yellow when adult, fragrant. *Sepals* subequal, ovate to deltoid, acuminate, 1–1.75 \times 0.75–1.75 mm, herbaceous, golden strigillose near the apex or near the costa,

sometimes glabrescent, 1(–5) veined, margin golden ciliolate near the base; apex obtuse to acute. *Petals* ovate to deltoid, acuminate, 3.75–5.25 \times 1–2 mm, herbaceous, usually sparsely strigillose along the costa and near the apex, cili(ol)ate near the base, apex (sub)obtusate. *Stamens* 3–4 mm long; filaments free 0.75–1 \times 0.3–0.6 mm, glabrous, mostly 0.6–0.75 \times as long as the anthers; dorsal glands free, adnate to the filaments, (narrowly) ovoid, (0.5–)0.75–1 \times 0.25–0.75 mm, carnosate, glabrous, occasionally golden pilosulous near the base, apex free, obtuse, truncate or emarginate; anthers, ovate 1–1.75 \times 0.5–1 mm, usually 1.25–1.75 \times as long as the filaments, glabrous, apex obtuse, sometimes apiculate, unappendaged; connective outside narrowly deltoid, subobtusate, 0.75–1.25 \times 0.25–0.5 mm, glabrous; connective scales lateral as well as apical, 2.25–3 \times ca. 1 mm, 1.75–2 \times as long as the anthers, scarious, orange-brown, sometimes erose near the base, apex obtuse. *Ovary* (sub)globose, 1–1.25 \times 0.75–1 mm, golden pilose; ovules one per placenta. *Style* filiform, erect or slightly curved, especially near the apex, (2–) 2.25–3.25 mm long, exceeding the stamens by 0.25–0.5 mm, usually slanting pilosulous near the base; stigma truncate. *Capsule* symmetric, elliptic to ovate, acuminate, coriaceous to subligneous, (pale) green when fresh, sparsely golden-brownish hirtellous, distinctly veined; valves three, (sub)equal, (1–)1.5–2 \times 0.5–0.75 cm, style sometimes subsistent at the apex of one of the valves. *Seeds* one per valve, globose, 4–8 mm in diam., glabrous.

Distribution (Fig. 31) and *ecology*. Widely spread over West and Upper Amazonia (Ecuador, Perú, Brazil and NW Bolivia). Its center of distribution probably was SW Amazonia, from whence the species penetrated southward into the Andean regions of Peru and Bolivia. Isolated areas can be found in the Andean regions of Colombia and Ecuador as well as in Panama; they can be related to the following forest refugia: (a) Colombia (E of the Cordilleras): Villavicencio; (b) Colombia (W of the eastern Cordilleras): Río Magdalena; (c) Ecuador (W of the Cordilleras): Chimborazo-West; and (d) Panama: Darién.

The disjunct population in Villavicencio probably became isolated from the main area in Amazonia by the change from a previously tropical rain forest to a dryer vegetation of savannas and grass lands in the intervening area of the Llanos.

This change was due to the rain shadow caused by the Pliocene uplift of the Coastal Cordillera in addition to a general change of the climate from warm humid to cooler dry during that time (Steyermark, 1974, 1979, 1982; van der Hammen, 1974).

Another population became isolated in W Ecuador and NW Colombia by a similar process of orogenesis during the Pliocene. Subsequent migration from Colombia to Panama was possible after the creation of the land bridge, ± 5.7 my BP (Coney, 1982; Raven & Axelrod, 1974), where *Rinorea viridifolia* occurs together with the closely related *R. squamata*.

Rinorea viridifolia occurs as an undergrowth in the understory of tropical rain forests and deciduous forests in lowlands as well as in (sub)mountainous regions, from 0 to 1800 m. In lowlands it occupies undated as well as periodically inundated areas, in lateritic, clayish or sandy soils.

Phenology. Flowering and fruiting throughout the year.

Representative specimens examined: PANAMA. COLÓN: Base of Cerro Bruja, along Río Escandalosa above Mina Boquerón, 19 km from Transisthmian Hwy. on rd. to Salamanca. $9^{\circ}50'N$, $79^{\circ}32'W$, 10–200 m, 18 Mar 1982 (fl). *Knapp & Kress 4317* (MO, U). DARIÉN: S of El Real, base of Cerro Pirra, ca. $8^{\circ}00'N$, $77^{\circ}45'W$, ca. 50 m, 27 Mar 1985 (f). *McPherson 6986* (MO, U); idem, 31 Mar 1985 (fl). *7083* (MO, U).

COLOMBIA. AMAZONAS: Loretoyacu River, ± 100 m, Oct 1945 (fr). *Schultes 6753-A* (US). AMAZONAS-VAUPÉS: Río Apaporis, Jinogojé, at mouth of Río Piriparaná. $0^{\circ}15'S$, $70^{\circ}30'W$, ± 225 m, Mar 1952 (fr). *Schultes & Cabrera 19827* (US). ANTIOQUÍA: Between Arteaga and Chigoradó, El Tigre, 100 m, 1 Oct 1961 (fr). *Cuatrecasas & Willard 26138* (COL). ANTIOQUÍA-BOLÍVAR: Cimaterra River, ± 38 km W of Barrancabermeja, $6^{\circ}55'N$, $74^{\circ}15'W$, 13 Feb 1967 (fr). *J. de Bruijn 1481* (MER, U, WAG). BOLÍVAR: Cimaterra, Quebrada Chontarales, 300 m, 1 Sep 1953 (fl; fr). *Romero-Castañeda 4356* (AAU, COL). META: Puerto López, 240 m, 31 Jul 1944 (fr). *E. L. & R. R. Little 8359* (COL, P, UC, US). PUTUMAYO: 40 km NW of Puerto Asís, ± 300 m, 31 Jul 1965 (fl). *King & Guevara 6126* (F).

ECUADOR. GUAYAS: Halfway up Hacuendo Trail 12 km from Guayaquil, 18 Feb 1962 (fr). *Gilmartin 590* (US). NAPO: S.L., Sep 1931 (fl). *Benoist s.n.* (P); San Pablo de las Secoyas, 2.5 km W. $0^{\circ}15'S$, $77^{\circ}21'W$, 300 m, 5 Aug 1980 (fl). *Brandbyge et al. 32496* (AAU); idem, Río Wai si Aya, N tributary to Río Aguatico, 7 Aug 1980 (fl). *Brandbyge et al. 32605* (AAU); idem, 10 Aug 1980 (fl). *Brandbyge & Asanza 32748* (AAU); San Pablo de las Secoyas, 300 m, 11 Aug 1980 (fl). *Brandbyge et al. 32800* (AAU); idem, 8 Aug 1981 (bud), *33325* (AAU); idem, 11 Aug 1981 (bud), *33333* (AAU);

Río Cuyabeno, ± 2 km upstream from Puerto Bolívar, $0^{\circ}6'S$, $76^{\circ}10'W$, 300 m, 18 Aug 1981 (fl). *Brandbyge et al. 33660* (AAU); idem, ± 2 –6 km upstream from Puerto Bolívar, 300 m, 18 Aug 1981 (fl). *Brandbyge et al. 33719* (AAU); idem, 3 km upstream from Puerto Bolívar, 19 Aug 1981 (fl). *Brandbyge et al. 33776* (AAU); Río Xasuni, 60 km upriver from Nueva Rocafuerte, 13 Sep 1977 (fr). *Foster 3624* (F); idem, 80 km upriver, 225 m, 16 Sep 1977 (fr). *Foster 3683* (AAU, F, MO, U); Cerro Antisana, 5 km SE of Tena, $0^{\circ}30'W$, $78^{\circ}0'W$, 650 m, 28 Jun 1960 (bud). *Grubb et al. 1434* (K, NY); idem, 28 Aug 1960 (bud), *1493* (K, NY); SE of Nueva Rocafuerte, vic. Río Braga, 200–230 m, 1, 2 Mar 1981 (fr). *Jaramillo & F. Coelho 4479 & 4645* (AAU, QCA). MORENO-SANTIAGO (ZAMORRA): Tayuza, 500 m, 7.2.1962 (fr). *Cazelet & Pennington 7712* (K, NY, UC, US). PASTAZA: Río Cararay nr. Tzapino, 400–500 m, 15 Aug 1980 (fl). *Jaramillo & F. Coelho 3561* (AAU, QCA).

PERU. CUZCO: Paucartambo, confluence of Río Carbon with Río Alto Madre de Dios, 6–7 Aug 1974 (fr). *Foster et al. 3052* (F). HUÁNUCO: Leoncio Prado, across Río Huallaga from Tingo María, 650 m, 17 Jan 1976 (fr). *Gentry et al. 15917* (MO, U); vic. Tingo María, 24 Jun 1961 (fr). *Mathias et al. 5398* (F). JUNÍN: Río Paucartambo Valley, nr. Perene Bridge, 700 m, 19 Jun 1929 (fr). *Killip & A. C. Smith 25347* (US); Río Negro at Satipo, 800 m, 16 Aug 1960 (fl). *Woytkowski 5810* (G, HH, US). LORETO: Coronel Portillo, trail between Caserio de J. C. Mariategui and Mejico, vic. Abujao and Río Abujao, $8^{\circ}15'S$, $73^{\circ}45'W$, 300 m, 10 Dec 1978 (fr). *C. Diaz et al. 765* (MO, U); Bartra, $2^{\circ}30'S$, 200 m, 15 Sep 1979 (fr). *C. Diaz et al. 1443* (MO, U); Upper Amazonas, Andoas, Río Pastaza nr. Ecuador border, 230 m, 16 Nov 1979 (fr). *Gentry et al. 28141* (MO, U); Maynas, Yanamono, on Río Amazonas between Indiana and mouth of Río Napo, $2^{\circ}38'S$, $72^{\circ}48'W$, 120 m, 25 Jul 1980 (fr). *Gentry et al. 28992* (MO, U); Casería Alianza, Río Tamshiyacu, trail toward Río Maniti, $4^{\circ}05'S$, $72^{\circ}58'W$, 140 m, 1 Aug 1978 (fl). *Gentry et al. 29296* (MO, U); Explorama, on Río Amazonas, between Indiana and mouth of Río Napo, $3^{\circ}28'S$, $72^{\circ}48'W$, 130 m, 18 Feb 1981 (fl). *Gentry et al. 31148* (MO, U); Lower Río Huallaga, below Yurimaguas, Puerto Arturo, 135 m, 24–25 Aug 1929 (fr). *Killip & A. C. Smith 27727 & 27785* (F, US); idem, Sta. Rosa, 135 m, 1–5 Sep 1929 (fl, fr). *Killip & A. C. Smith 28898* (F, NY, US); San Antonio, on Río Itaya, ± 110 m, 10 Sep 1929 (fl). *Killip & A. C. Smith 29417* (F, NY, US); Maynas, vic. of Yurimaguas, S of Río Marañón, s.d. (bud). *Poeppig 2137 c* (G); Basin of Río Ucayali from $10^{\circ}S$ until mouth, Middle Ucayali, vic. Lago Yarina-cocha, 1923 (fl). *Tessmann 3199* (F, G, NY, S); Basin of Río Marañón, from Iquitos upstream to mouth of Río Santiago nr. Pongo de Manseriche, $\pm 77^{\circ}30'W$, 1924 (fl). *Tessmann 5281 a* (G, S); Soledad, on Río Itaya, ± 110 m, Jul 1925 (juv fl). *Tessmann 5281 b* (G, NY, S); Lower Río Huallaga, Río Yurimaguas, 155–210 m, 10 Oct 1929 (fr). *Ll. Williams 4127* (F); idem, Zapote Jacu, Sta. Rosa, 155–210 m, 9 Nov 1929 (fr). *Ll. Williams 4865* (F); Previsto, 250 m, 11 Oct 1962 (fl). *Woytkowski 7619* (HH, US). MADRE DE DIOS: Tambopota, 30 km SSW of Puerto Maldonado at affluence

of Río La Torre (Río d'Orbigny). SE Bank of Río Tambopota Reserve, 12°49'S, 69°17'W, 260 m, 19 Apr 1980 (fr). *Barbour 4867* (F. MO. US); idem, 29 Apr 1980 (bud, fr), 5043 & 5046 (MO. U); idem, 6 May 1980 (fr), 5167 (MO. U); idem, 2 Jun 1980 (fl), 5482 (MO. U); idem, 27 Jun 1980 (fl), 5782 (MO. U); Río Manu, nr Cocha Sashu station, 14 Aug 1973 (fr), *Foster 2567* (F); idem, 17 Feb 1977 (fl), *Foster & Janson 6111* (F); Parque Nacional del Manu, 23 Sep 1976 (fl), *Foster & Terborgh 5072* (F); idem, Río Manu, 380 m, 17 Oct 1979 (fr), *Gentry et al. 26805* (MO. U); idem, across river from Cocha Cashu camp, 380–420 m, 23 Oct 1979 (fr), 27189 (MO. U); Tambopota Reserve, Río Tambopota at mouth of Río d'Orbigny, 12°05'S, 69°17'W, 250 m, 1 Mar 1981 (st), *Gentry et al. 31808* (MO. U). SAN MARTÍN: Lamas, N of San Antonio, Río Cumbasa, 2 Oct–4 Nov 1937 (fr), *Belshaw 3560* (F); Mariscal Cáceres, 20 km N of Tocache Nuevo, nr Tinanta, 500 m, 14 Mar 1979 (fr), *Gentry et al. 25749* (MO. U); s.l., Sep 1924 (fl, juv fr), *Klug 3802* (BM, F, HH, K, MO, NY, S, US); Río Huallaga, mouth of Río Mishollo, 8°01'S, 76°39'W, 350–380 m, 25 Jul 1973 (fr), *Schunke-Vigo 6412* (U); Mariscal Cáceres, Río Huallaga, Tocache Nuevo, Puerto Piza, 10 Jun 1974 (fl), *Schunke-Vigo 6922* (MO. U); Cañatilla, NE of rd, 28 km to Tocache Nuevo, 525 m, 6 Jul 1974 (fr), *Schunke-Vigo 7185* (MO. U); Mariscal Cáceres, Tocache Nuevo, Quebrada de Sta. Rosa, 500–700 m, 19 Jul 1974 (fr), *Schunke-Vigo 7584* (MO. U); Mariscal Cáceres, Tocache Nuevo, 500–700 m, 14 Oct 1980 (fr), *Schunke-Vigo 12361* (MO. U); Tarapoto, s.d. (fl), *Spruce s.n.* (BM, W).

BRAZIL. ACRE: 25–30 km NW of Río Branco on rd, to Serra Madureira, 28 Feb 1978 (fr), *W. R. Anderson 12129* (NY, U); Highway Abuña–Río Branco km 242–246, vic. Campinas, *Forero et al. 6341* (C, COL, F, G, HH, INPA, K, M, MICH, MO, NY, P, R, U, US, VEN); Road Boca do Acre–Río Branco, 141 km from Río Branco, 27 Sep 1980 (bud), *Lowrie et al. 229* (INPA, NY, U); Cruzeiro do Sul, Rios Juruá & Moa, Río Juruá between Mundurucus and Tatajuba, 13 May 1971 (fr), *Maas et al. P-12901* (U); Seringal São Francisco, nr Río São Francisco, vic. the town Río Branco, May 1911 (fl), *Ule 9618* (G, K, L, S); Cobija, Río Acre nr. Bolivian border, 12 Jan 1912 (fl), *Ule 9619* (G [herb. Delessert], K). **AMAZONAS:** Upper Purús, Ponto Alegre, 10 Apr 1904 (bud, fr), *J. Huber 4376* (MG, RB, U, US); nr. mouth of Río Embira, tributary of Río Tarauaca, 7°30'S, 70°15'W, 26 Jun 1933 (fr), *Krukoff 5022* (BM, F, G, HH, K, LE, M, MICH, NY, S, SP, U, UC, US); Coari, s.d. (bud), *Poeppig s.n.* (P).

BOLIVIA. BENI: Rurrenabaque, 300 m, 23 Nov 1923 (fr), *Cardenaz 1761* (HH, K, MICH, NY); idem, Oct–Dec 1930 (fl), *Fleischmann 473* (S); idem, 12 Oct 1921 (fl, fr), *O. E. White 1474* (fl, fr). **LA PAZ:** Prov. of Larecaja, Tuirí, nr. Mapiří, Río Mapiří, 12–30 Sep 1939 (fr), *Krukoff 10939* (CU, F, G, HH, K, LIL, MICH, MO, NY, S, U, US); Tumpasa, 500–600 m, 21 Jan 1901 (fr), *R. S. Williams 565* (BM, K, NY, US).

Local names: Colombia: Huesito (Bolívar, Santander); Peru: Cafecilla (Loreto); Canela/illa de Vieja (San Martín); Takit (Amazonas, Huambisa language); Virola quiro (Loreto).

Rinorea viridifolia differs from *R. squamata* by the following combination of characters: (1) its indument predominantly golden (in *R. squamata* predominantly ferruginous); (2) the number of lateral veins 8–11 pairs (versus 11–14 pairs); (3) costa usually only sparsely strigose beneath (in *R. squamata* densely strigose in combination with hispidulous); (4) 'pedicels' of adult flowers 2.25–4 mm long (versus 1.25–3 mm long); and (5) connective scales 2.25–3 mm long (versus 1.75–2.25 mm long).

For remarks differentiating it from *Rinorea antioquiensis* see under that species. In the specimens *Schunke-Vigo 6922* (Peru) and *Brandbyge et al. 33776* (Ecuador) the indument of the costa underneath is more or less similar to that of *R. squamata*. All other characters, however, distinctly point to *R. viridifolia*. A specimen, *Killip & Smith 29417*, collected in Peru and cited by Baehni and Weibel (1941a, 1941b) as *R. falcata*, appears to belong to *R. viridifolia*.

19. *Rinorea antioquiensis* Smith & Fernández-P., *Caldasia* 6(28): 105. t. 6. 1954. Type. Colombia. Antioquia: Forest SE of Chigorodó, 40 km S of Turbo, 50 m, 15 Apr 1945 (fl), *Haught 4566* (holotype, US; isotypes, COL, K, NY). Figs. 29A, 31.

Treelet 4 m tall. Branchlets ferruginous hirsute in combination with sparsely ferruginous hirtellous. *Leaves* apparently opposite, ternate; petioles 2–6 mm long, ferruginous pilose above, sparsely ferruginous pilose to glabrescent beneath; stipules deciduous, narrowly deltoid to linear, mucronulate, 3.25–5.5 × 1–3 mm, herbaceous, ferruginous strigose, densely veined, ciliolate; lamina (ob)ovate to elliptic, acuminate to cuspidate, 4–16.5 × 1.5–7 cm, papery, glabrous on both sides; costa densely ferruginous pilose(ulous) above, ferruginous strigose beneath; domatia scarcely present or wanting; lateral veins (8–)10–14 pairs (acumen excluded), ferruginous pilosulous to glabrescent above, ferruginous strigose to glabrescent beneath; tertiary venation reticulate; base rounded to cuneate; margin subentire to subcrenate, mucronulate; acumen 0.25–1 cm long, apex subobtusate to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, ca. 3.5 cm long; central axis ferruginous hispidulous to puberulous; 'pedicels' 3.75–4 mm long, articulate at the base, ferruginous hirtellous; bracts and

bractlets together at the base below the articulation, ovate to deltoid, herbaceous, ferruginous strig(ill)ose along the costa, ciliolate, apex subacute, mucronulate; bracts 1–2 × ca. 0.75 mm; bractlets 0.5–1 × ca. 0.5 mm. *Flower buds* tolpoid, subobtusate. *Flowers* pendulous, yellow, fragrant. *Sepals* subequal, ovate to deltoid, acuminate, 1–2.25 × 1–1.5 mm, herbaceous, ferruginous strigose along the costa, slightly costate, obscurely 3–5 veined, margin scariosus and ciliolate; apex subacute. *Petals* narrowly ovate, acuminate, 5 × 1.75 mm, herbaceous, completely glabrous also along the margin, apex subobtusate. *Stamens* ca. 3 mm long; *filaments* free, ca. 1 × 0.3–0.5 mm, ca. 1.25 × as long as the anthers, glabrous; dorsal glands free, adnate to the filaments, ellipsoid to (ob)ovoid, ca. 0.75 × ca. 0.5 mm, 0.6–0.75 × as long as the filaments, carnose, glabrous, apex free, truncate or emarginate; anthers ovoid, ca. 0.75 × ca. 0.5 mm, ca. 0.75 × as long as the filaments, apex obtuse, unappendaged; connective outside deltoid, subacute to obtuse, 0.4–0.7 × 0.4–0.5 mm, glabrous; connective scales lateral as well as apical, ovate, acuminate, ca. 2 × ca. 1 mm, ca. 2.5 × as long as the anthers, scariosus, orange-brown, suberose, apex subacute. *Ovary* globose, ca. 1 mm in diam., golden to ferruginous pilose; *ovules* one per placenta. *Style* filiform, erect to slightly curved, ca. 3 mm long, exceeding the stamens by 1–1.25 mm, golden to ferruginous pilosulous near the base; stigma truncate. *Fruits* unknown.

Distribution (Fig. 31). Known only from the type collection in the forest refuge Nechí in NW Colombia (Antioquia). It was recorded as rather common in the tropical rain forest at ca. 50 m.

Leaves of *Rinorea antioquiensis* and *R. squamata* usually have 10–14 pairs of lateral veins versus usually 8–11 pairs in *R. viridifolia*. The indument of the underside of the costa of the leaves of *R. antioquiensis* and *R. squamata* is ferruginous, versus golden-brown in *R. viridifolia*. The density and kind of indument in *R. antioquiensis*, however, is equal to that of *R. viridifolia* i.e., only sparsely strigose versus densely strigose (and sometimes also hispidulous) in *R. squamata*.

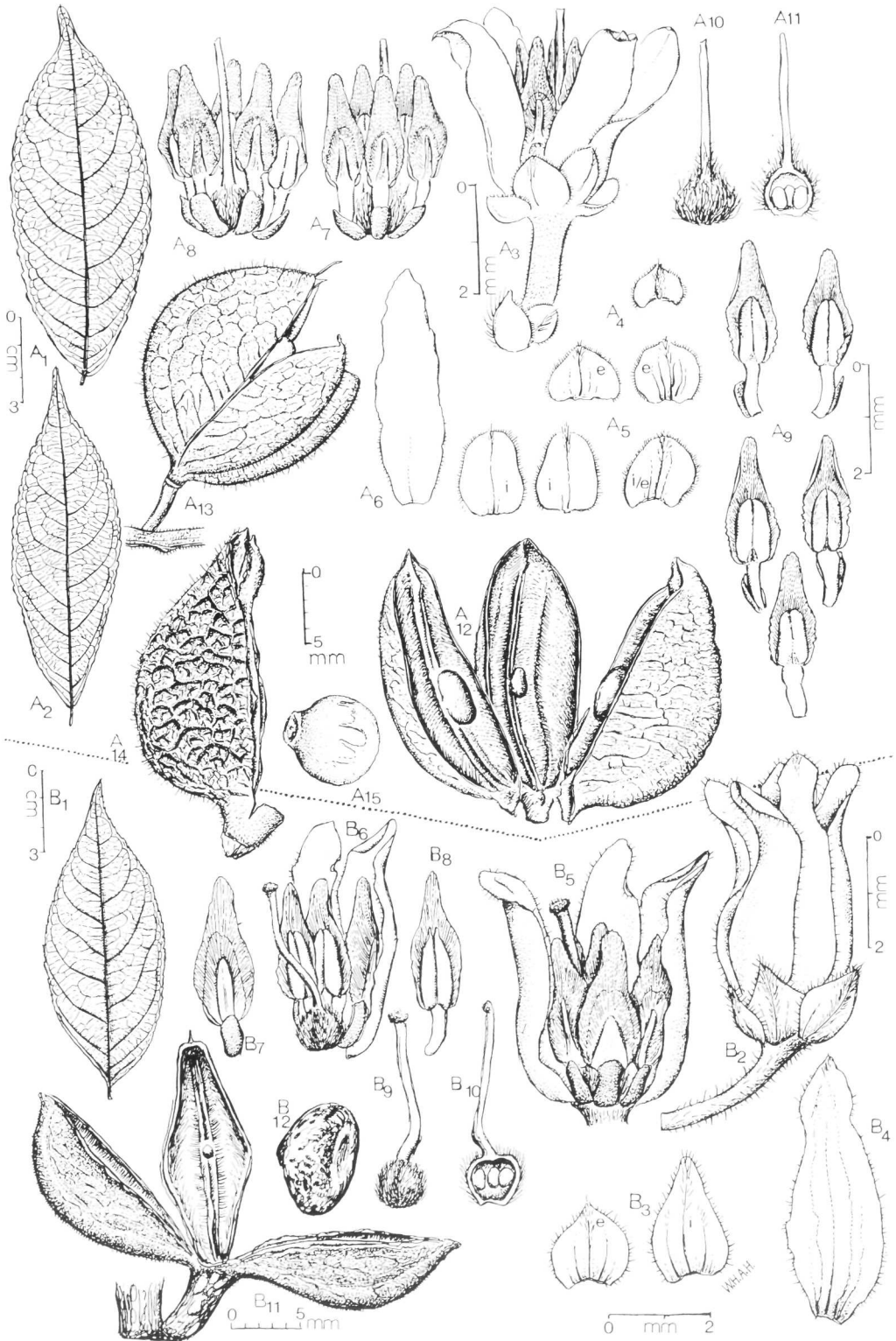
Pedicels of *Rinorea antioquiensis* are 3.75–4 mm long and those of *R. viridifolia* usually 2.5–4 mm long, versus 1.25–2.5 mm in *R. squamata*. *Rinorea antioquiensis* differs further from *R. viridifolia* and *R. squamata* by: (1) anthers ca. 0.75 mm long and distinctly shorter than the filaments

(versus 1–1.5 mm long and distinctly longer than the filaments); (2) connective scales ca. 2.5 × as long as the anthers (versus 1.5–2 ×); and (3) style exceeding the stamens by 1–1.25 mm (versus 0.25–0.5 mm).

20. *Rinorea squamata* Blake. Contr. U.S. Natl. Herb. **20(13)**: 516. 1924; Standley, Smithsonian Misc. Collect. **78(8)**: 24. 1927; Publ. 392. Field Mus. Nat. Hist., Bot. Ser. **18(2)**: 715. 1937; Robyns in Woodson, Schery & Coll. Ann. Missouri Bot. Gard. **54(1)**: 68. fig. 1a–f. 1967. Type. Panama. Canal zone: Nr. Gatún, 0–700 m, 10 Feb. 1911 (fl), *Goldman 1864* (holotype, US). Figs. 30A, 31.

Rinorea pubipes Blake. Contr. U.S. Natl. Herb. **20(13)**: 515. 1924; Standley, Publ. 392. Field Mus. Nat. Hist., Bot. Ser. **18(2)**: 715. 1937. Type. Costa Rica. Limón: Zent farms, ca. 30 km W of Puerto Limón. s.d. (fl. fr), *Pittier s.n.* (holotype, US 578517; isotype, F 1709848).

Treelet 1.5–12 m tall. Branchlets ferruginous pilose and pilosulous when young, glabrescent when older. *Leaves* apparently opposite; petioles 2–10 mm long, ferruginous strig(ill)ose above, ferruginous strigose in combination with hispidulous beneath; stipules deciduous, narrowly deltoid to linear, 3.5–4.25 × 1–1.25 mm, herbaceous, ferruginous strig(ill)ose near the costa, ciliolate; lamina (narrowly) elliptic to (ob)ovate, acuminate to cuspidate, 3.5–13.5 × 1–6 cm, papery, glabrous on both sides; costa above ferruginous to golden puberulous or hirtellous; ferruginous strigose and sometimes also ferruginous hispidulous beneath; domatia present, ferruginous; lateral veins (9–)11–14 (acumen excluded), less-densely hairy than the costa to glabrescent; tertiary venation reticulate; base rounded to cuneate; margin (sub)cren(ul)ate or (sub)serr(ul)ate, mucronulate; acumen 0.25–2.5 cm long, apex (sub)acute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 3.5–11 cm long; central axis, ferruginous pilosulous; 'pedicels' 1.25–2.5(–3) × 0.75–1 mm, articulate at the base, (sparsely) ferruginous pilosulous; bracts and bractlets together at the base below the articulation, ovate to deltoid, herbaceous, ferruginous strig(ill)ose, ciliolate, apex obtuse to subacute, sometimes mucronulate; bracts 0.5–1.25 × 0.5–1 mm; bractlets 0.5–0.75 mm long and wide. *Flower buds* (narrowly) ovoid, tolpoid or conical, subobtusate. *Flowers* pendulous, whitish, creamy, pale yellow or pale orange. *Sepals*



subequal, elliptic to (ob)ovate. 1–2.25 × 1–1.5 mm, herbaceous, ferruginous to golden strigillose near the apex and near the costa, obscurely 1–3 veined, margin scarious, golden to ferruginous ciliolate, apex obtuse to subacute, mucronulate. Petals narrowly (ob)ovate, 3.5–4.25 × 1–1.5 mm, herbaceous, glabrous or nearly so, slightly ciliolate near the base, apex (sub)obtuse. Stamens 2.5–3.25 mm long; filaments free, 0.75–1 × 0.25–0.5 mm, ca. 0.75 × as long as the anthers, glabrous; dorsal glands free, adnate to the filaments, (ob)ovoid, 0.25–1.25 mm long, usually shorter than the filaments, sometimes equaling or slightly longer, carnose, glabrous, apex free, truncate, obtuse or (sub)acute; anthers ovoid, 1–1.5 × 0.5–0.75 mm, 1.5–1.75 × as long as the filaments, glabrous, apex obtuse, unappendaged; connective outside (narrowly) deltoid, subacute to subobtuse, 0.75–1 × 0.25–0.5 mm, glabrous; connective scales lateral as well as apical, ovate, acuminate, 1.75–2.25 × 0.5–1 mm, ca. 1.5 × as long as the anthers, scarious, orange-brown, margin suberose, apex obtuse. Ovary globose, ca. 1 mm in diam., golden to whitish strigillose; ovules one per placenta. Style filiform, more or less erect, 2.25–3 mm long, exceeding the stamens by 0.25–0.75 mm, at the base mostly golden pilosulous to strigillose; stigma truncate or obtuse. *Capsule* symmetric, elliptic to ovoid, acuminate, coriaceous to subligneous, green to yellowish-brown when fresh, sparsely golden-brownish hirtellous to hirsute, distinctly veined; valves three, subequal, 1.5–2(–2.5) × 0.5–0.75 cm. *Seeds* one per valve, globose, 4–8 mm in diam., glabrous.

Distribution (Fig. 31) and ecology. Confined to Central America, where *R. squamata* occurs from Nicaragua to Panama. Its area of distribution is correlated with the following forest refuges: Chiriquí, Darién and dispersed localities in

SE Nicaragua. Fairly frequent in the understory of primary or disturbed tropical rain forests in lowlands as well as in (sub)mountainous regions from 0 to 700 m. Sometimes collected from marginal zonations between forests and pastures. Also inhabiting river banks. Soil preference unknown.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: NICARAGUA. ALTO: Río Sicciucas, along Río Grande, 0–15 m, 27 Apr 1949 (galls on branchlets), *Molina 2475* (BM, EAP). BLUEFIELDS: SE base of Cerro S. Isidro, Ríos Kama & Escondido, ±12°10'N, 84°35'W, 65 m, 24 Mar 1966 (fl), *Proctor et al. 27227* (F). PUERTO CABEZA: Braggmans Bluff, 4/11/1928 (fl), *Englesing 206* (F, NY, US). ZELAYA: Drainage of Río Alemán, Mts. of Esquipelas and Alemán, 27–29 Nov 1951 (fr), *Shank & Molina 4759* (A, EAP, F); drainages of the Ríos Punta Gorda, Alemán and Zapote, 30 m, 5 Dec 1951 (fr), *Shank & Molina 4979* (EAP, F, HH); vic. El Recreo on Río Mico, 30 m, 23 Apr–14 May 1949 (fl), *Standley 19921* (F).

COSTA RICA. ALAJUELA: S of Canalete nr. Río Zapote and along the new rd. to Upala, 10°46'–47'N, 85°02'–03'W, 100–200 m, 12 Nov 1975 (fr), *Burger & Baker 9996* (AAU). LIMÓN: 3 km E of El Carmén, 10 m, 29 Mar 1972 (fr), *Lent 2428* (F); drainage of the Ríos Parismina and Reventazón, 3 Oct 1951 (fr), *Shank & Molina 4150* (EAP, F, US); drainage of the Río Valle Estrella, Mta. Andromeda, 26–28 Oct 1951 (fr), *Shank & Molina 4542* (EAP, F, HH); Mte. Verde, 9 km from sea coast, 25 Apr 1928 (fr), *Stork 1689* (F, MICH, UC); 9 km upstream from mouth of Estrella River, 21 Apr 1952 (fl), *Stork 4605* (MICH, UC). PUNTARENAS: Cantón de Osa, vic. Palma Norte de Osa nr. Río Terreba, 30 m, 1 Apr 1950 (fl), *P. H. Allen 5524* (EAP, F, MO, NY, UC, US); ±5 km W of Rincón de Osa, Osa Peninsula, 8°42'N, 81°31'W, 24–30 Mar 1973 (bud), *Burger & Gentry 8934* (F, GB, U).

PANAMA. BOCAS DEL TORO: Changuinola Valley, 16 Mar 1924 (bud), *Dunlap 564* (F, US); Almirante, 100 m, 29 Nov 1971 (fr), *Lao & Gentry 444* (F); Filo Almirante, 100–200 m, 3 Jan 1975 (bud), *Nee & Hansen 14110* (MO); Region of Almirante, Jan–Mar 1928 (fl, fr), *Proctor Cooper 400* (F, FHO, K, MO, NY, US); vic. Chiriquí Lagoon, Fish Creek, 14 Apr 1941 (bud,

FIG. 30. **A.** *Rinorea squamata* (A₁ and A_{14,15} from *Standley 26150*; A₂ from *Standley 28037*; A_{3,11} from *Brother Paul 442*; A₁₂ from *Stork 1689*; A₁₃ from *Shank & Molina 4150*). A_{1,2}, Leaves. A₃, Flower, with bracts and bractlets at the base of the pedicel. A₄, Bractlet. A₅, Sepals (e = exterior [=outside], i = interior [=inside], e i = in between). A₆, Petal. A₇, Androecium (dorsal), surrounding the pistil. A₈, Idem, but showing the pistil. A₉, Two stamens (dorsal), and three ventral stamens. A₁₀, Pistil. A₁₁, Idem, with l.s. of ovary, showing ovules 3 × 1. A_{12–14}, Capsule dehiscing into three valves, showing different habit and seeds 3 × 1. A₁₅, Seeds, glabrous. **B.** *R. hirsuta* (B₁ and B_{10,12} from *Gentry 15173*, paratype; B_{2,9} from *Hartman 12230*, type). B₁, Leaf. B₂, Flower. B₃, Sepals (e = exterior [=outside], i = interior [=inside]). B₄, Petal. B₅, Flower (inside); androecium (dorsal); style exceeding the stamens. B₆, Pistil, accompanied by three stamens and two petals. B₇, Stamen (dorsal). B₈, Stamen (ventral). B₉, Pistil. B₁₀, Idem, with l.s. of ovary, showing placentation 3 × 1. B₁₁, Capsule, dehiscing into three valves, showing 3 × 1 arrangement of seeds (seed undeveloped). B₁₂, Seed, glabrous.

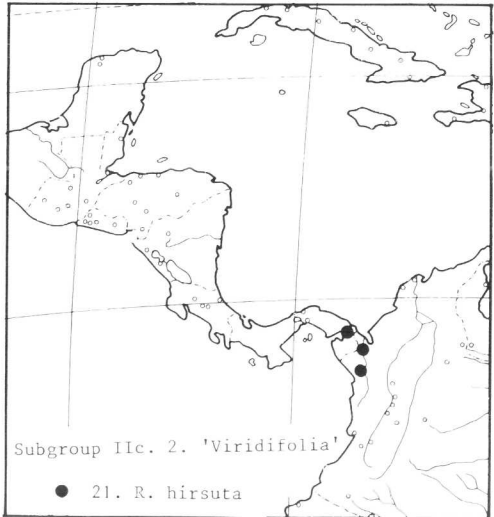
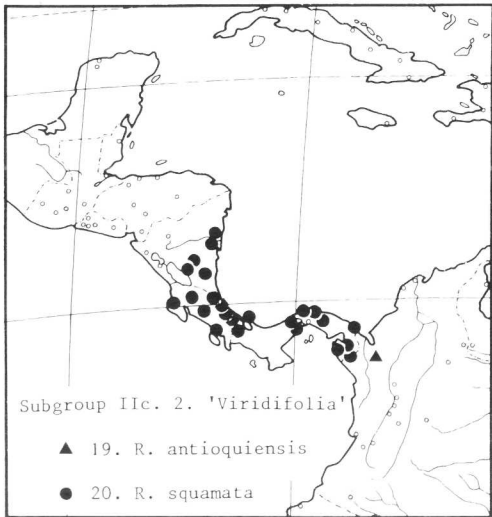
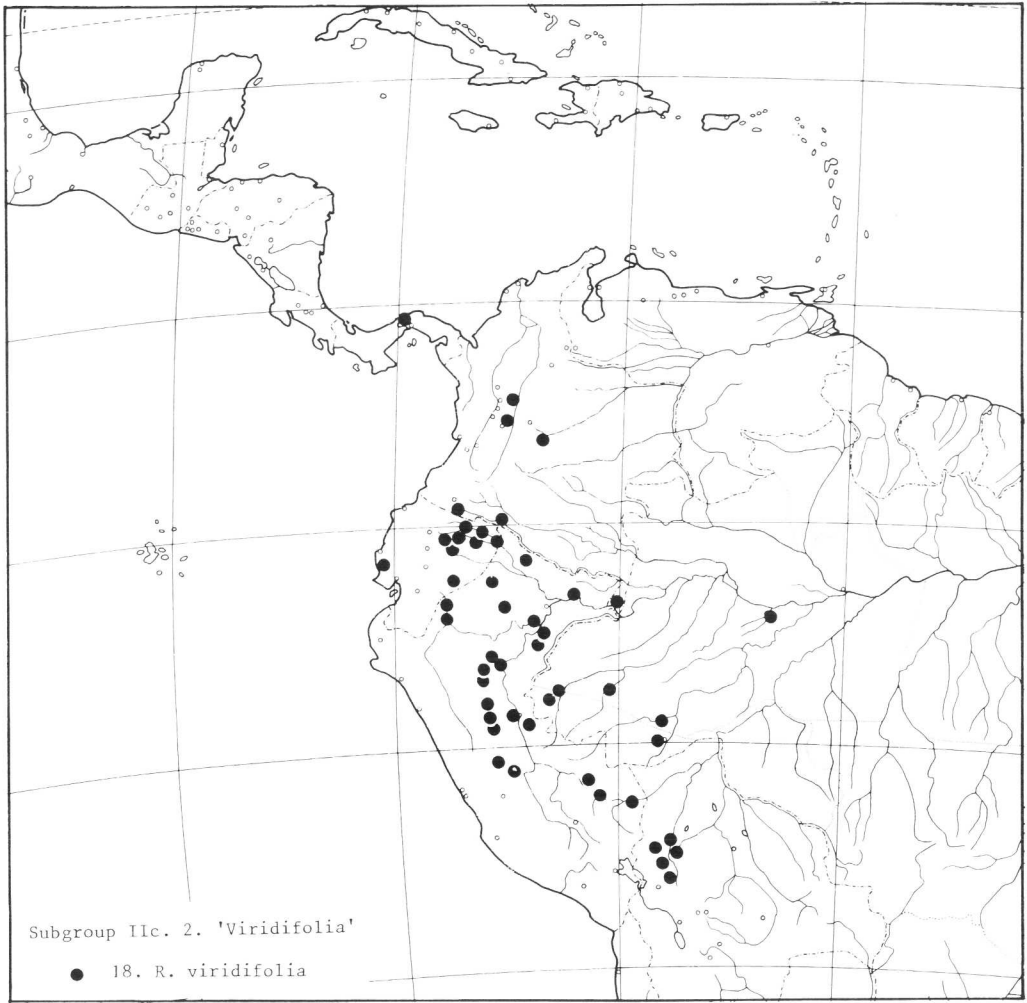


FIG. 31. Distribution of species of *Rinorea* Subgroup IIc.2. 'Viridifolia.'

fr). *von Wedel 2221* (HH, MO, NY, US); idem, 22 Apr 1941 (fl, fr), 2298 (MO, NY, US); idem, 24 Apr 1941 (fl, fr), 2322 (HH, NY, US). CANAL ZONE: Barro Colorado Island, 3 Jun 1969 (fr), *Foster 91*. (f), along Río Mendosa, on upstream side of Pipeline Rd. Ridge, 12 km NW of Gamboa, 26 Aug 1975 (fr), *Mori 7942* (MO, U); idem, 8 km NW of Gamboa, 26 Oct 1973 (fr), *Nee 7603* (AAU); Chagres, ± 5 km from mouth, s.d. (fr), *Stevens 1296* (US); along Río Boquerón, 70 m, 30 Dec 1934 (fl), *Steyermark & P. H. Allen 17225* (BM, BR, FI, G, K, MICH, MO, P, S, U, UC); Pipeline Rd., $9^{\circ}13'N$, $79^{\circ}43'W$, 100–200 m, 27 Oct 1980 (fr), *Sytsma 1955* (MO, U). COCLÉ: Along rd. between la Pintada and Coclecito, 8 km N of stream of Llano Grande, Atlantic slope, 513 m, 7 Dec 1979 (fr), *Croat 49242* (MO, U); 29 km N of Penonome on rd. to Coclesito (9 km N of turnoff to Llano Grande), 175 m, 22 Feb 1978 (fl), *Hammel 1724* (MO, U); Continental Divide, 7 km N of Llano Grande, rd. to Coclesito, 500–700 m, 19 Apr 1978 (fl), *Hammel 2517* (MO, U). COLÓN: Río Guanache, 0–100 m, 19 Jan 1980 (bud), *Antonio 3355* (MO, U); Riverbanks of Río Boquerón, ± 3 km from La Pelona, 21 Sep 1973 (fr), *Carrasquilla et al. 370* (MO); vic. Río Iguanita, $9^{\circ}30'N$, $79^{\circ}42'W$, 390 m, 7 Apr 1977 (fr), *D'Arcy 11251* (MO, U); 2–4 km up to Río Guanache from the Portobelo Highway, $9^{\circ}30'N$, $79^{\circ}40'W$, 0–50 m, 3 Oct 1981 (fr), *Knapp 1124* (MO); idem, 24 Mar 1975 (fl), *Mori & Kallunki 5196* (MO, U); along Río Guanache, 6 km S of Portobelo, 0–10 m, 10 Dec 1973 (fr), *Nee & Gentry 8695* (MO, U); Upper Río Piedras headwaters, 11 km SW of Cerro Braja, $9^{\circ}25'N$, $79^{\circ}35'W$, 600–700 m, 4 May 1981 (fr), *Sytsma et al. 4311* (MO, U). DARIÉN: Trail between Pingona and Yavisa, ± 15 m, 17 Mar 1937 (fr), *P. H. Allen 247* (F, HH, MO, NY, US); N Punta Guyabo Grande, 75–200 m, 27 Apr 1980 (fl, juv fr), *Antonio & Halm 4335* (MO, U); 10 km NE of Jaqué, slopes of Río Tabuelitas above Birogueria, on Río Jaqué, 10–50 m, 29 Jan 1981 (fl, fr), *D'Arcy & Sytsma 14480 & 14489* (MO, U); ± 5 km SE of El Real de Santa Maria, 18 Jun 1962 (fr), *Duke 4857* (BM, MO); Río Tucuti above Tucuti, 25 Jul 1962 (juv fr), *Duke 5269* (MO); Río Chucunaque, between Ríos Membrillo and Subeuti, 22 Aug 1966 (fr), *Duke 8590* (U); Cocalito, 13 Aug 1963 (fr), *Dwyer 4334* (BM); Enseñada del Guayabo, 16–19 km SE of Jaqué, 29 Apr 1980 (fl), *Garwood 990* (MO, U); 3–5 km SE of Rijibisal on Río Paraseneco, ± 15 km S of El Real, 18 Dec 1980 (fr), *Hartman 12030* (MO, U); Río Jaqué Valley, along Quebrada Luka, $7^{\circ}27'N$, $78^{\circ}05'W$, 100–200 m, 26 Jan 1982 (fl, fr), *Knapp & Mallet 3185* (MO, U); Río Tuquesa, 250 m, 8 Jul 1975 (fr), *Mori 7039* (MO); Shores of Enseñada del Guabo between Puntas Grande and Chiquita, 25 Jun 1975 (fr), *Stern & Chambers 183* (Yw 51674) (US); above Río Paca, 26 Jun 1959 (fr), *Stern et al. 586* (HH, MO, US); Río Tiura, vic. El Real de Sta. Maria, 1 Jul 1959 (fr), *Stern et al. 781* (HH, LE, & R.); Distr. Chepijana, 700 m, 9 Mar 1940 (fr), *M. E. & R. A. Terry 1430* (F, HH, MO). PANAMÁ: To El Real de Sta. Maria, 20 May 1971 (fl, fr), *D'Arcy 5528* (MO); El Llano–Carti Rd., 10 Sep 1976 (fr), *D'Arcy 10597* (MO, U); Headwaters of Río Tabuelita and ridge to Río Pavarandó, ca. 10 km of Jaqué, 150–500 m, 2 Feb 1981 (fr), *D'Arcy &*

Sytsma 14601 (MO, U); Empira, 20 Mar 1861 (fl), *Stutton Hayes 16* (BM); Río Grande, 20 Mar 1861 (fl), *Stutton Hayes s.n.* (K); 8 km N of El Llano–Carti Rd., E of Río Teable, $9^{\circ}15'N$, $78^{\circ}50'W$, 450 m, 19 Aug 1981 (fr), *Knapp 966* (MO); El Llano–Carti–Tupile Rd., 200–500 m, 26–27 Mar 1973 (fl), *Liesner 1148* (AAU); El Llano–Carti Rd., 9.6 km from Inter American Hwy., 350 m, 26 May 1975 (fl), *Mori & Kallunki 6400* (MO, U); idem, 12 km N of Pan Am. Hwy., El Llano, 400 m, 11 Mar 1974 (fl), *Nee 10453* (MO, U); N of Panama City, 1932 (fl), *Br/other Paul 442* (F, MICH, NY, US); Río Tapa, 7 Dec 1923–11 Jan 1924 (bud, fr), *Standley 26141* (US), 26150 (HH, US) & 28037 (K, US). SAN BLAS: El Llano to Carti Rd., 16.5 km N of Panamerican Hwy., border of Panamá, 13 Apr 1977 (fr), *Folsom 2611* (MO, U); from Puerto Obaldía to La Bonga, tributary of the Río Armilia, $8^{\circ}40'N$, $77^{\circ}25'W$, 0–50 m, 17 Apr 1982 (fl), *Knapp & Mallet 4662* (MO, U). S.L.: Vic. Marragantí, 3–60 m, 3–9 Apr 1908 (fr), *R. S. Williams 1031* (NY).

Local names. Panamá: Guayacillo (Almirante, Bocas del Toro); Molenillo (Bocas del Toro, Panamá); Pata de Galluna (Darién).

For differences with *Rinorea antioquiensis* and *R. viridifolia* see under those species. The specimens *Cufodonti 135 & 175*, collected in Costa Rica and incorrectly cited as *R. squamata* by Cufodonti (1935), belong to *R. deflexiflora*.

21. *Rinorea hirsuta* Hekking, Phytologia 53(4): 250. pl. 1, fig. 1. pl. 2, fig. 1. 1983. Type. Panama. Darién: Río Balso between Manene and Río Coasi riverside, 29 Dec 1980 (fl), *Hartman 12230* (holotype, U; isotype, MO (n.v.)).

Figs. 30B, 31.

Treelet 1–4 m tall. Branchlets brownish hispidulous, glabrescent, possessing whitish lentils (when dried); bud scales deltoid, 3 mm long and wide, herbaceous, golden strigillose, ciliate, apex subacute and mucronulate. *Leaves* apparently opposite; petioles 0.3–1.5 mm long, densely brownish hispid(ulous) above, densely brownish hispid beneath; stipules deciduous, subulate, 2–9 \times 0.5 mm, brownish hispidulous, mucronulate; lamina (narrowly) ovate to elliptic, acuminate, 8–20 \times 3–9 cm, papery, densely orange-brownish to ferruginous hirsute beneath; costa and lateral veins ferruginous hirtellous above; lateral veins 9–14 (acumen excluded); tertiary venation reticulate; base rounded to cuneate, sometimes (sub)obtusate at the petiole, margin serrate or crenate, ciliate, mucronulate; acumen 0–3.5 cm long, apex (sub)obtusate to subacute, mu-

cronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 5.25–10 × 1 cm; central axis brownish hispidulous; 'pedicels' 2–6 mm long, articulate at the base, brownish hispidulous; bracts and bractlets together at the base below the articulation, deltoid, herbaceous, densely brownish strigillose, ciliate, soon deciduous; bracts and bractlets ca. 1.5 mm long and wide. *Flower* buds conical, acutish, nodding. Sepals subequal, ovate to deltoid, acuminate, 1.25–2 × 1.25–1.5 mm, herbaceous, appressed brownish pilosulous near the costa and near the apex obscurely 1–3 veined, ciliate, apex (sub)acute. Petals ovate to deltoid, acuminate, 4.25 × 1.75 mm, herbaceous, glabrous, ciliate, apex obtuse to (sub)acute, pilosulous. Stamens 3–3.25 mm long; filaments free, ca. 0.75 × ca. 0.25 mm, ca. 0.5 × as long as the anthers, glabrous; dorsal glands free, adnate to the filaments, (narrowly) ellipsoid, 0.5–0.8 × ca. 0.25 mm, shorter than or equaling the filaments, carnose, glabrous, apex free, obtuse; anthers ovoid, acuminate, ca. 1.5 × 0.5–0.75 mm, 2–2.5 × as long as the filaments, glabrous, apex of thecae obtuse, apiculate or mucronate; connective outside, narrowly ovate to linear, obtuse, 1–1.25 × ca. 0.25 mm, glabrous; connective scales lateral as well as apical, ovate, acuminate, 2.25–2.5 × 0.8–1.1 mm, ca. 1.5 × as long as the anthers, scarious, fuscous, suberose at the base, subtentire near the apex, apex obtuse. Ovary globose, ca. 0.75 mm in diam., densely golden pilosulous; ovules one per placenta. Style filiform, curved at the base, ca. 2.5 mm long, exceeding the stamens by ca. 0.25 mm, completely glabrous; stigma ca. 0.25 mm long and wide, pulvinate, papillose. *Capsule* symmetric, ovoid, acuminate, subligneous, brownish velutinous to pruinose, obscurely veined; valves three, subequal, ca. 1.5 × ca. 0.5 cm. *Seeds* one per valve, subglobose to pyriform, 6–8 mm in diam., glabrous.

Distribution (Fig. 31) and ecology. Probably endemic in NW Colombia (Chocó) and adjacent Panama, including the following forest refugia: Nechí and Darién. Occurs as undergrowth in tropical rain forests. Collected from river sides and slopes of hills and mountains, from 200 to 300 m.

Phenology. A flowering specimen has been collected in May and two fruiting specimens in December.

Additional specimens examined: COLOMBIA, Chocó: Vic. Salto del Río Truandó, 2 Jul 1954 (fr. *Romero-Castañeda 4671* (COL); trail from Unguía toward base of Cerro Tacarcuna, nr. Río Tigre, 200–300 m. 15 Jul 1975 (fr. *Gentry 15173* (MO, U).

Rinorea hirsuta is named for its hirsute indument on the underside of the leaves. Smith and Fernández-P. (1954) identified the Colombian specimen *Romero-Castañeda 4671* as *R. riana* because of the shape of its leaves and the fuscous velutinous indument of the capsule. *Rinorea hirsuta*, however, differs completely from *R. riana* by the densely fuscous indument on the underside of the leaves and the 'pedicels' articulate at the base. By this latter character *R. hirsuta* belongs to the complex of *R. viridifolia*, *R. antioquiensis* and *R. squamata*, but differs from them by the combination of the following characters: (1) leaf lamina up to 20 × 9 cm; (2) lamina, costa, lateral veins and veinlets densely fusco-hirsute beneath; (3) anthers 2–2.5 × as long as the filaments (versus 0.75–1.75 ×); (4) connective scales fuscous (versus orange-brown); and (5) capsule fusco-velutinous to -pruinose (versus loosely hirsute to hirtellous; fruits of *R. antioquiensis* unknown).

Subgroup IIc.3. 'Pubiflora'; species 22–28.

Leaf base symmetric, tending to slightly asymmetric in two species; lamina always glabrous beneath, although costa and lateral veins may be hairy; lamina (usually) not tapering to the apex; margin thin walled; tertiary venation reticulate; *inflorescence* racemose; *flowers* and *fruits* distinctly pedicellate; 'pedicels' articulate above the base; bractlets separately inserted from the bracts; filaments and dorsal glands not fused with each other, posterior glands sometimes reduced or wanting; ovary usually (sub)globose, distinct from the style, usually hairy, but in *Rinorea flavescens* glabrous; ovules usually one to two per placenta, but in *R. pubiflora* two to four per placenta.

This subgroup is characterized by having a combination of the following features: *inflorescences* racemose, 'pedicels' articulate above the base and finally filaments and dorsal glands. These characters are shared with the species of Subgroups IIc.4. 'Marginata' and IIc.5. 'Melanodonta.' The species of this subgroup differ from

Subgroup IIc.4. 'Marginata' species by the lamina glabrous beneath and the margin thin walled (versus hirtellous and margin thick walled); they differ from those of Subgroup IIc.5 'Melanodonta' by leaves (usually) not tapering to the apex (versus always tapering to the apex); for more differences see under those subgroups.

Distribution (Figs. 35 & 38). The species of this subgroup are mainly distributed over tropical South America with Amazonia and the Guianas as the center of speciation. *Rinorea pubiflora*, *R. flavescens* and *R. falcata* are most widely spread; *R. camptoneura* is restricted to W Amazonia. A common origin of these species in Amazonia is postulated. The areas of the three remaining species, *R. amapensis*, *R. brevipes* and *R. riana*, are concentrated in the Guianas, from whence they radiated to adjacent regions. A common origin of the last three species on the Guiana Shield is postulated. All species are wanting in SE Brazil. *Rinorea pubiflora* and probably also *R. flavescens* are the only species that succeeded in migrating to Central America after the closing of the Panama land bridge during the Pliocene, ± 5.7 my BP.

22. *Rinorea amapensis* Hekking, *Phytologia* **43(5)**: 476. pl. 3, fig. 11. 1979. Type. Brazil. Amapá: Serro do Navio, Rio Amapari, frequent on Fritz Akerman Ore Body on heavily forested hills, 70–300 m, 4 Nov 1954 (fl, fr), Cowan 38121 (fl, fr), (holotype, NY; isotypes, HH, MICH, MO, NY, S, U, UC, W).

Figs. 32, 33A, 35.

Tree or treelet, 1–15 m tall. Branchlets violet colored when dried, erect pilosulous and less densely pilose. *Leaves* apparently opposite; petioles 2–7 mm long, erect pilosulous above, appressed pilose(ulous) beneath; stipules deciduous, deltoid, 1–4 × 1–2 mm, herbaceous, appressed brownish pilosulous, ciliolate, mucronulate; lamina elliptic to obovate, acuminate to cuspidate, (2.5–)5–14 × 2–5 cm, papery, glabrous on both sides; costa glabrous above, sparsely hairy to glabrescent beneath, domatia wanting; lateral veins (7–)9–11(–13) pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate; margin subentire, subserrate to subcrenate, mucronulate; acumen 0.25–1.75 mm long, apex subacute, mucronulate. *Inflores-*

ences axillary, lateral and subterminal, solitary, racemose, 5–8.5 cm long; central axis erect brownish to whitish pilosulous; 'pedicels' 4–5 mm long, articulate at $\frac{1}{5}$ – $\frac{2}{3}$ from the base, brownish to whitish pilosulous; bracts and bractlets ovate to deltoid, herbaceous, whitish to brownish pilosulous along the median part, 1–3 veined, margin ciliolate, apex subobtusate, mucronulate; bracts ca. 1.25 × 1–1.25 mm; bractlets ca. 1 mm long and wide. *Flower* buds ovoid to tolpoid. Flowers drooping, whitish to yellowish. Sepals subequal, ovate to orbicular, 1.25–2.25 × 1.25–1.75 mm, herbaceous, whitish pilosulous, 3–5 veined, margin whitish ciliolate, apex obtuse to rounded. Petals narrowly ovate, 3–4.25 × 1.25–1.75 mm, herbaceous, carnosate at the base, scarious along the margin, appressed brownish pilose(ulous) along the median part; apex obtuse and ciliolate. Stamens 2.5–3 mm long; filaments free, 0.5–0.75 × 0.25–0.5 mm, glabrous; dorsal glands nearly always free, extremely rarely two fused with each other, adnate to the filaments, rarely fused with the filaments, usually ellipsoid, 0.25–0.8 × 0.2–0.4 mm, carnosate, glabrous, apex obtuse to subacute; anthers ovoid to ellipsoid, 1.2–1.4 × (0.4–)0.6–0.8 mm, glabrous, apex of the thecae obtuse, sometimes apiculate or appendaged by 1–7 set(ul)ae; connective outside, narrowly elliptic or deltoid, 0.75 × 0.25 mm, slightly pilosulous or glabrescent, apex subobtusate to subacute; connective scales apical as well as lateral, ovate to deltoid, ca. 2.25 × ca. 0.75 mm, scarious, orange-brown, margin (sub)erose, fringed at the base, apex (sub)obtusate. Ovary subglobose, 0.75–1.25 × 0.6–0.9 mm, brownish pilose; ovules one to two per placenta. Style filiform, erect, 2–2.5 × ca. 0.2 mm, exceeding the stamens usually by 0.25–0.5 mm, slightly pilosulous near the base; stigma truncate. Capsule symmetric, ovoid to ellipsoid, slightly acuminate, coriaceous to subligneous, green with a flush of pink when fresh, brownish pilosulous, veined; valves three, (sub)equal, occasionally unequal 0.75–3.25 × 0.25–1 cm. Seeds one, sometimes two per valve, subglobose, 5–7 mm in diam., stained, erect brownish pilosulous, often purplish spotted when dried.

Distribution (Fig. 35) and ecology. French Guiana, Surinam, N Brazil and S Venezuela; to be expected in Guyana. Occurs in the understory of tropical rain forests of low lands and hilly



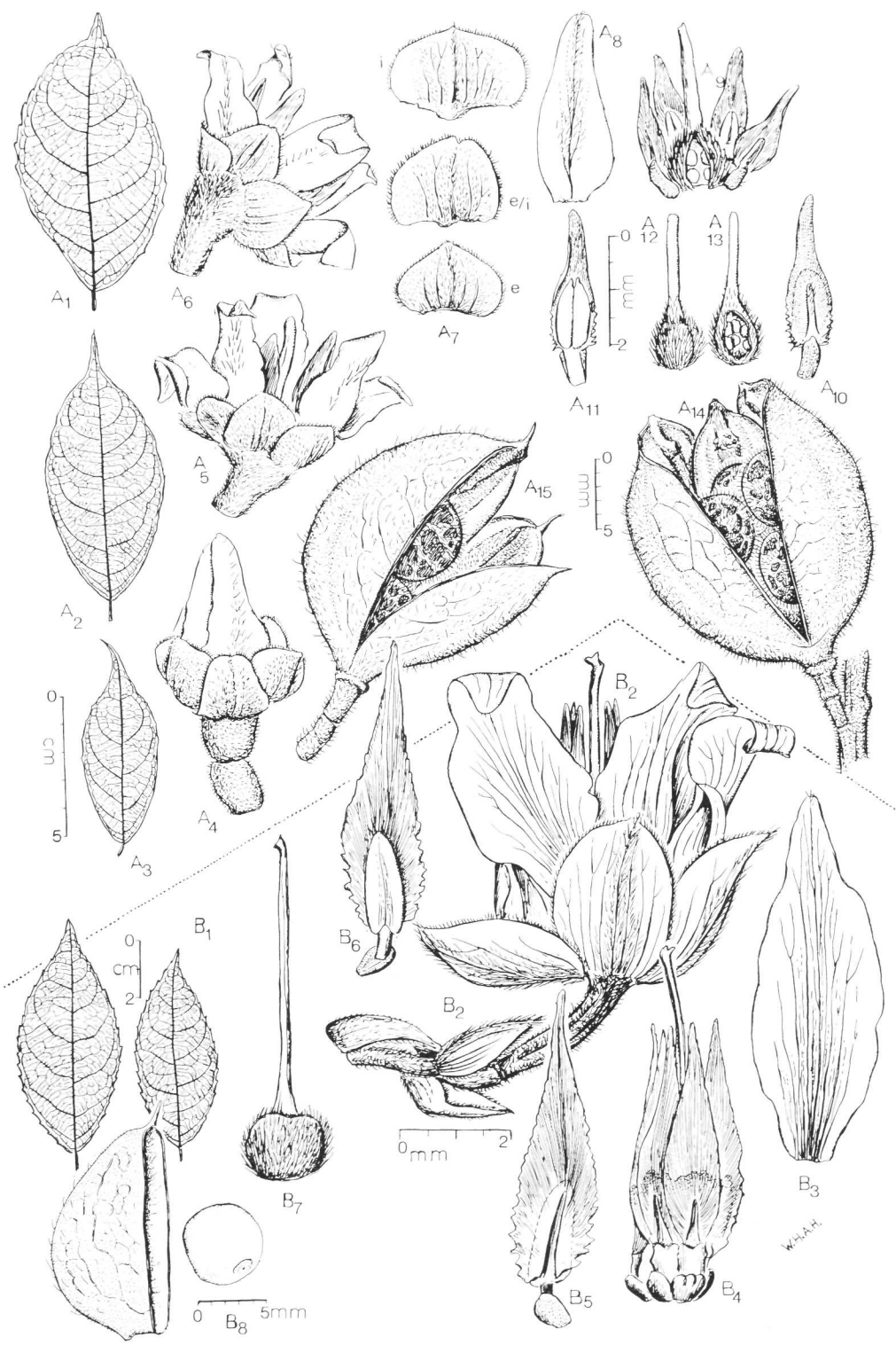
FIG. 32. Isotype specimen of *Rinorea amapensis* (Cowan 38121, W ex NY).

areas, from 70 to 550 m. Frequent in forests on Frits Akerman Ore Body. Specimens have been collected on slopes of hills and along rivers and creeks, on granitic, ferrolateritic or clayish soil.

Phenology. Probably flowering throughout the year.

Representative specimens examined: COLOMBIA. VAUPÉS: Río Guainía. Puerto Colombia, opposite Ven-

FIG. 33. **A.** *Rinorea amapensis* (A₁ from Mello 1998; A_{2,3} from de Granville 679; A₄₋₁₃ from Cowan 38121, type; A_{14,15} from Cowan 38735). A₁₋₃, Leaves. A₄, Flower bud. A_{5,6}, Flowers. A₇, Sepals. A₈, Petal. A₉, Androecium, surrounding pistil. A₁₀, Stamen (dorsal). A₁₁, Stamen (ventral). A₁₂, Pistil. A₁₃, Pistil, with l.s. of ovary, showing ovule 3 × 2. A₁₄, Capsule, dehiscing into three (sub)equal valves, containing pilosulous seeds. A₁₅, Idem, valves unequal. **B.** *R. brevipes* (B₁ from A. C. Smith 2323; B₂₋₇ from FBG 5730; B₈ from A. C. Smith 3080). B₁, Leaves. B₂, Flower. B₃, Petal. B₄, Androecium dorsally surrounding pistil. B₅, Stamen (dorsal). B₆, Stamen (ventral). B₇, Pistil. B₈, Valve of a capsule, with glabrous seed.



ezuelan town of Moroa, 2°40'N, 67°30'W, 200–275 m, 31 Oct–2 Nov 1952 (bud), *Schultes et al. 17933* (HH, US).

SURINAM: Nassau Mountains, W of Marowijne River, 400–500 m, 31 Dec 1954 (fr), *Cowan & Lindeman 39034* (NY, U); Rapids of Blanche Marie, 19 Jun 1965 (bud), *Maas & Tawjoeran LBB 10899* (Xyl. no. U/11680) (BBS, U).

FRENCH GUIANA: Montagne de Kaw (=Caux), 275 m, 11 Dec 1954 (bud, fr), *Cowan 38735* (NY, P, U); S of Montagne des Trois Pitons, NW of St. Georges de l'Oyapock, 21 Jan 1981 (fr), *Cremers 6983* (CAY, U); above Creek Armontabo, W Lower Oyapock, 22 Feb 1981 (fr), *Cremers 7056* (CAY, U); Grégoire, coastal area, 28 Jan 1972 (fr), *Deward 149* (CAY, U); Ilets St. Régis, Cayenne, 7 Oct 1970 (bud, fr), *de Granville 679* (CAY, P); Rivière Comté, Chantier Desmont, 9 Feb 1965 (fr), *Hallé 1066* (P); 13 km SW of Sinnamary, 5°18'N, 52°57'W, *Leeuwenberg 11650* (CAY, U, WAG); Rte. de St. Elie, 12 Oct 1977 (fr), *Lescure 725* (CAY, U); Comté river, 50 km S of Cayenne, 1 Jan 1977 (fr), *Mori 8859* (NY, U); Mont la Fumée, Säul, 3°37'N, 53°12'W, 200–400 m, 20 Aug 1982 (fl), *Mori & Boom 14748* (NY, U); Comté River, 52 km S of Cayenne, 5 Dec 1976, *Mori et al. 8686* (NY, U); Chantier Desmont, 40 km S of Cayenne, 9 Feb 1965 (fr), *Oldeman 1100* (CAY); Rd. Prévert, ca. 45 km S of Cayenne, 5 Oct 1965 (fl), *Oldeman 1580* (CAY); Ilets Yacareshin, Oyapock, 10 Dec 1965 (fl), *Oldeman 1727* (CAY); Rd. of Maripa, Oyapock, 30 Nov 1965 (fr), *Oldeman 1807* (CAY); Creek Grégoire, Sinnemary River, 3 May 1976 (fl), *Oldeman 2136* (CAY); Creek Ipoucun de l'Approuage, 1 Mar 1969 (fr), *Oldeman B-2282* (CAY); Säul, Montagne la Fumée, 19 Aug 1971 (bud), *Oldeman B-4040* (CAY); Rd. Maripa, river Oyapock, 8 Jun 1970 (fl), *Oldeman T-854* (CAY); Bank of River Camopi, tributary of Oyapock, 17 Feb 1968 (fr), *Oldeman & Sastre 294* (P); Rd. of St. Elie, km 16, 28 Sep 1978 (bud), *Prevost 327* (CAY, U); Rd. of St. Elie, km 15, 12 Jul 1982 (fl), *Riera 232a* (CAY, U); Rd. of St. Elie, 18 Feb 1981 (fr), *Sabatier 43* (CAY, U); Montagne Alikéné, Camopi, tributary of Oyapock, 17 Feb 1968 (bud, fr), *Sastre 294* (CAY); Rd. of St. Elie, Sinnamary, 17 Dec 1978 (bud), *Sastre 6141* (P, U); Pompidou-Papaichton, river Maroni, May 1975 (bud, fr), *Sastre & Moretti 4038* (CAY, P, U); Rd. of St. Elie, 19 km, Sinnamary, 14 May 1975 (fl), *Sastre & Moretti 4194* (P, U).

BRAZIL. AMAPÁ: Serro do Navio, Rio Amapari, 300 m, 4 Sep 1954 (fl, fr), *Cowan 38121* (HH, MICH, MO, NY, S, U, UC, W); idem, 70–300 m, 11 Nov 1954 (fl, fr), *Cowan 38254* (HH, K, NY, P, RB); idem, 70–300 m, 12 Nov 1954 (fl, juv fr), *Cowan 38276* (B, COL, NY); idem, 70–300 m, 16 Nov 1954 (fl), *Cowan 38337* (LIL, M, NY). **AMAZONAS:** Vic. Manaus, 29 Jun 1955 (fl), *Chagas 1279* (COL); Rd. Manaus–Caracarai (BR-174) 63 km, 8 Aug 1979 (fl, fr), *Cid et al. 25* (INPA, NY, U); Rd. Manaus–Caracarai (BR-174) 97 km, 3 Sep 1979 (fr), *Cid et al. 983* (INPA, NY, U); Manaus, Igarapé do Passarinho, 3 Aug 1956 (fl), *Donisio s.n.* (INPA 4.043, U); Igarapé do Binda, 21 Sep 1955 (fl), *Mello 1998* (COL, INPA, MG, U); Rd. Manaus–Igarapé Leão, 5 km from Manaus–Caracarai rd., 21 Jan

1971 (fr), *Prance et al. 11417* (NY, U); Rd. Manaus–Itacoatiara km 69, 5.10.1960 (juv fr), *W. Rodrigues 1810, Xil. no. X 779* (INPA, U); idem, km 45, s.d. (fl), *W. Rodrigues & Chagas 1825* (INPA, U); Manaus, Reserva Florestal Ducke, 29 Jul 1966 (fl), *W. Rodrigues & Osmarino 8206* (INPA, U). **PARÁ:** Rio Capim, Igarapé Putiritá, 20 Feb 1882 (bud), *herb. Schwacke 3489* (RB).

Local names. Surinam: Lèlè tiki (local Creole language). French Guiana: Bois lèlè, Lèlè tiki (local Creole language), Boumbi-kid'ia (Aucan language, Maroni), Kuuku ariut (Palikur language), Tâyu (Wayâpi language), Wayau (Oyampi language).

Rinorea amapensis differs from *R. pubiflora* and *R. brevipes* by: (1) branchlets drying to violet (without callose lenticels); (2) costa glabrous above (versus puberulous); (3) domatia wanting; (4) petals brownish pilose(ulous) along the median part (in *R. pubiflora* ferruginous strigose along the costa and in *R. brevipes* glabrous or nearly so); (5) stamens 2.5–3 mm long (versus (2.75–)3–6 mm long); and (6) seeds pilosulous as mostly in *R. pubiflora* (but glabrous in *R. brevipes* and *R. pubiflora* var. & fo. *grandifolia*).

Seeds of *Rinorea amapensis* are usually stained. Its indument varies from whitish via golden to brownish as in *R. brevipes*, whereas the indument of *R. pubiflora* is predominantly ferruginous.

Rinorea amapensis has been described from material which had been identified incorrectly as *R. martini* (Turczaninoff) Blake, 1924. The type specimen of *Alsodeia martini* Turczaninoff appeared not to belong to a separate species, but to *R. pubiflora*.

23. *Rinorea brevipes* (Bentham) Blake, Contr. U.S. Natl. Herb. 20(13): 512. 1924.

Figs. 33B, 35.

Alsodeia brevipes Bentham, J. Bot. (Hooker) 4: 106. 1842; Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 185. 1890 (1891). Type. Guyana: Banks of Rio Quitaro, 1838 (bud, juv fl), *Schomburgk, (Robert Hermann) 574* (holotype, K [herb. Benthamianum]; isotypes, K [herb. Hookerianum], BM, CGE, F, HH, L, OXF, P, U.S. W).

Conohoria brevipes (Bentham) Miquel, Linnaea 22: 556. 1849.

Alsodeia guianensis (Aublet, 'Passoura guianensis') Eichler var. *brevipes* (Bentham) Eichler in Martius, Fl. bras. 13(1): 387. 1871.

Rinorea laxiflora (Bentham) Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352. 1925.

Conohoria laxiflora (Benth) Miquel, *Linnaea* 22: 556. 1849.

Alsodeia guianensis (Aublet, '*Passoura guianensis*') Eichler var. *laxiflora* (Benth) Eichler in Martius, *Fl. bras.* 13(1): 387. 1871.

Alsodeia laxiflora Benth, *J. Bot. (Hooker)* 4: 107. 1842. Type. Guyana: Banks of Rupununi, 1836(1837) (fl). *Schomburgk, (Robert Hermann) 125* (holotype, K [herb. Benthamianum]; isotypes, K [herb. Hooke-rianum], BM, CGE, G. L., OXF, P, U.S., W).

Tree or treelet, 1–13 m tall. Branchlets purplish with numerous small whitish callose lenticels when dried, golden-brownish pilosulous when young, glabrescent when older. *Leaves* apparently opposite, occasionally ternate; petioles 2–11 mm long, golden to whitish puberulous above, golden to whitish strigose when young beneath, glabrescent when older; stipules deciduous, narrowly deltoid, 3–5 × ca. 0.25 mm, herbaceous, golden to whitish pilose(ulous), veined, ciliolate; lamina elliptic to obovate, cuspidate, (2–)2.5–13 × (0.5–)1–4.5 cm, papery to subcoriaceous, glabrous on both sides; costa erect whitish to golden puberulous above, especially near the base, whitish to golden pilose beneath; domatia present, golden to whitish; lateral veins (7–)10–12(–14) pairs (acumen excluded), more or less hairy to glabrescent; tertiary venation reticulate; base rounded to cuneate; margin serr(ul)ate to cren(ul)ate, mucronulate; acumen 0–1.75 cm long, apex obtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 2.5–7.5 cm long; central axis densely golden to whitish puberulous; pedicels 3–7 mm long, 1(–2) × articulate near the middle or just below, golden to whitish puberulous; bracts and bractlets ovate to deltoid, herbaceous, appressed golden whitish pilosulous or glabrescent, 5–9 veined, 5–9 ribbed when dried, whitish ciliolate, apex subacute, mucronulate; bracts 1.75–2.25 × 1.25–2.25 mm; bractlets 1.5–2 mm long and wide. *Flower buds*, tolpoid to ovoid, acuminate, subobtusate to subacute. Flowers drooping, whitish, creamy or yellowish, fragrant. Sepals subequal, ovate, deltoid or elliptic, 1.75–3 × 1.25–2 mm, herbaceous, golden to whitish strigillose along the median part, 5–(7–9) veined, 5–(7–9) ribbed when dried, margin whitish ciliolate, apex obtuse to subacute, mucronulate. Petals (narrowly) ovate to elliptic, 4–6.5 × ca. 2 mm, herbaceous, glabrous or sometimes provided with 1–5 pilose hairs, not ciliolate along the margin, apex obtuse,

sometimes pilosulous. Stamens (2.75–)3–6 mm long; filaments free, 0.5–1.25 × ca. 0.25 mm, glabrous; dorsal glands free, adnate to the filaments, ellipsoid to obovoid, 0.5–0.75 × 0.3–0.4 mm, 0.3–0.5 × as long as the filaments, carnosous, glabrous or pilosulous, apex free, obtuse, truncate or emarginate; anthers (narrowly) ellipsoid or ovoid, 1.25–1.5 × 0.6–0.8 mm, apex (sub)obtusate to subacute, sometimes appendaged by 1–4 setae; connective outside, (narrowly) ovate, 0.75–1.5 × 0.2–0.6 mm, glabrous, apex subobtusate to subacute; connective scales lateral as well as apical, (narrowly) ovate, 2.25–5 × 0.75–1.5 mm, scarious, orange-brown, margin suberose, apex subobtusate to subacute. Ovary subglobose, 0.75–1.5 mm long and wide, golden to whitish pilosulous; ovules one to two per placenta. Style filiform, subconical at the base, erect, 3–5 × ca. 0.2 mm, exceeding the stamens usually by 0.75–1.25 mm, completely glabrous; stigma truncate. *Capsule* usually symmetric, ovoid to ellipsoid, slightly acuminate, coriaceous to subligneous, golden to whitish pilosulous, in combination with sparsely pilose, veined; valves three, usually (sub)equal, 1.5–2 × 0.4–0.7 cm, sometimes a rudiment of the style present at the apex of one of the valves. Seeds usually one per valve, globose, 6 mm in diam., glabrous.

Distribution (Fig. 35) and *ecology*. Widely spread over the Guianas and adjacent Amazonia of Brazil. Occurs as undergrowth in tropical rain forests mainly of submontane areas from 150 to 175 m. Specimens have been collected along rivers and creeks, in rocky, ferrobauixitic or clayish soil, often slightly mixed with humus.

Phenology. Flowering specimens have been collected in January, February, March, June, October and November, fruiting specimens in January, March, October and November.

Representative specimens examined: GUYANA: Takutu River, 7 Oct 1931 (fl). *Forest Dept. BG, Field No 221, Record No 2212* (FHO, K); Wabuwak Kanuku Mountains, Oct 1948 (fl). *Forest Dept. BG, Field No W/B 269, Record No 5730* (K, NY); Tawatawan head, Kanukus, 1 Feb 1952 (fr). *Forest Dept. BG, Field No G 180, Record No 6810* (K, NY); s.l., 1843 (st), *M. R. Schomburgk 1249* (M); s.l., 1843 (fl), 1282 (K, L, M); s.l., 1841 (fl). *R. H. Schomburgk 937* (CGE, G, K, P, W); s.l., 1841 (fl). *s.n.* (FI); s.l., s.d. (fl). *Schomburgk s.n.* (LE); Basin of Rupununi River nr. mouth Charwair Creek, ca. 2°35'N, 1–4 Nov 1932 (fl). *A. C. Smith 2322* (F, G, HH, K, MO, NY, P, S, U, US); W extremity of Kanuku Mt., drainage of Takutu River, 150 m, 4–22

Mar 1938 (fl. fr). *A. C. Smith 3080* (B, F, G, HH, K, LE, LIL, NY, S, US, W).

SURINAM: Lely mountains, SW-plateau covered by ferro-bauxite, 550–710 m, 1 Oct 1975 (fl), *Lindeman, Stoffers et al. 629* (U); Rapids of Blanche Marie, 19 Jun 1965 (juv fl), *Maas & Tawroejan LBB 10899* (BBS, U); idem, 15 Feb 1971 (fl. fr), *Reeder LBB 13457* (U).

FRENCH GUIANA: S Kourou, Montagne de Singes nr. Cayenne, 23 Nov 1981 (fl. juv fr), *Cremers 7661* (CAY, U).

PERU. LORETO: Vic. Tarapoto, 1855–1856 (fl), *Spruce (s.n.)* (BR).

BRAZIL. AMAZONAS: Paraná-mirí dos Ramos, s.d. (juv fr), *Spruce 1107* (2) (K). PARÁ: Porto Alegre, Rio Acary, 23 Mar 1908 (fr), *Froes 23107* (COL, US). RORAIMA: Bormida, foothills of Serra da Lua, 13 Jan 1963 (fr), *Prance et al. 9621* (NY, U); Serra de Caráuma, Nov 1908 (fl), *Ule 7732* (G, K, L, NY, US).

Local names. Guyana: Isay-it-roh (Amerindian language); Mamusaré (Arawak language); Shero (Wapishiana language); Shipiye (Macusi language). Surinam: Lèle, Lèle-tiki, Manari-tiki.

Rinorea brevipes differs from *R. amapensis* and *R. pubiflora* by: (1) its branchlets provided with numerous small callose lenticels (dried branchlets are purplish with whitish lenticels); (2) its petals glabrous or nearly so; (3) its style exceeding the stamens by 0.75–1.25 mm (versus 0–0.5 mm); and (4) its seeds glabrous (versus hairy in *R. amapensis* and *R. pubiflora* (except fo. *grandifolia*)).

Dried branchlets of *Rinorea riana* are also usually purplish with whitish lenticels, but the lenticels are larger and less numerous than in *R. brevipes*. The indument of *R. brevipes* and *R. amapensis* is predominantly golden to whitish (in *R. amapensis* also brownish), whereas that of *R. pubiflora* is predominantly ferruginous and that of *R. riana* predominantly maroon.

In *Rinorea brevipes*, *R. pubiflora* and *R. campstoneura* domatia are present on the underside of the leaves, but wanting in the other species of this subgroup.

Eichler (1871a) cited '*Conohoria castaneaefolia* Hook. Ic. t. 63 !, nec St. Hil.' as a synonym of *Alsodeia guianensis* (Aublet) Eichler var γ *laxiflora* based on *Alsodeia laxiflora* Benth (=*Rinorea brevipes* (Benth) Blake). W. J. Hooker (Icon. pl. 1, pl. 63, 1837) enumerated *Conohoria castaneaefolia* Aug. de St. Hilaire (as '*castaneaefolia*'), which is a synonym of *R. laevigata* (Solander ex Gingins) Hekking; the added description and illustration, however, refer to a mixture of *R. laevigata* and *R. brevipes*. The

exsiccatae belong to both species and moreover to *R. pubiflora*. The illustration shows a plant with the habit of *R. brevipes*, but with leaves alternate, which character belongs to *R. laevigata* and not to *R. brevipes*. The illustrated flower shows anthers completely glabrous outside, which refers rather to *R. brevipes* than to *R. laevigata*.

24. *Rinorea pubiflora* (Benth) Sprague & Sandwith in Sandwith, Bull. Misc. Inform. **1931(4)**: 171. 1931; Lemée, Fl. Guiane franç. **3**: 60. 1953; Smith & Fernández-P., *Caldasia* **6(28)**: 107. 1954.

Tree or treelet, 0.25–20 m tall. Branchlets ferruginous hispid in combination with ferruginous puberulous, older ones glabrescent. *Leaves* apparently opposite, sometimes ternate or quaternate; petioles (2–)4–15(–20) mm long, puberulous above, sparsely ferruginous strigose beneath, older ones glabrescent; stipules deciduous, narrowly deltoid, 2–4 × 0.75–1.2 mm, herbaceous, ferruginous strigillose along the median part, margin ciliolate; lamina elliptic, ovate or obovate, acuminate to cuspidate, (3.5–)5–20 × 1.5–8 cm, papery to subcoriaceous, glabrous on both sides; costa erect puberulous near the base above, sparsely ferruginous strigose beneath; domatia present, brownish; lateral veins glabrous or nearly so, (6–)8–11(–13) pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate; margin subserrate, subcrenate or subentire; acumen 0.5–3.5 cm long, apex subobtusate to subacute, mucronulate. *Inflorescences* axillary, lateral or subterminal, solitary, racemose, (1–)2–7.5(–11.5) cm long; central axis, puberulous or hispidulous; 'pedicels' 2–6 mm long, 1(–2) × articulate near the middle, greenish when fresh, indument ferruginous puberulous or hispidulous; bract and bractlets (widely) deltoid or ovate, herbaceous, 3–5 striate, strongly 3–5 ribbed when dried, greenish when fresh, ferruginous strigillose or hispidulous, ciliolate, apex subacute, sometimes mucronulate; bracts 1.25–2 × 1–1.75 mm; bractlets subopposite, 1.25–1.75 × 1–1.25 mm. *Flower buds* ovoid, (sub)obtusate; flowers drooping, usually greenish, whitish or creamy, sometimes yellow or pinkish-white, fragrant. *Sepals* subequal, widely deltoid, ovate or orbicular, 1.5–2.25 × 1.75–3 mm, herbaceous, greenish when fresh, ferruginous hispid to hispidulous, 7–11 striate, becoming strongly ribbed when dried, margin orange-brown cili(ol)ate, apex subobtusate

to subacute, mucronulate. Petals (narrowly) elliptic to ovate, 3.25–5.5(–6.5) × (1.25–)1.5–2(–2.75) mm, herbaceous, ferruginous strigose along the costa, sometimes partly ciliolate, apex subobtusate. Stamens 2.75–4 mm long; filaments free 0.5–1.5 × 0.1–0.5 mm, glabrous, dorsal glands not fused with each other, equaling or slightly longer than the filaments, adnate, free near the apex, conical, ellipsoid or (ob)ovoid, 0–1.25 × 0–0.6 mm, carnosic, apex (sub)obtusate; anthers, if present, ovoid, 0–1.75 × 0–1 mm; glabrous, obtuse, sometimes appendaged by set(ul)ae or cusps; connective outside narrowly deltoid, 0–1.2 × 0–0.3 mm, usually golden-brownish to ferruginous, pilosulous; connective scales lateral as well as apical, ovate, 1.75–2.25(–3.25) × 0.25–1.25 mm, scarious, orange-brown, subtentate to erose, obtuse. Ovary subglobose, 0.5–1.25 mm long and wide, ferruginous strigose; ovules usually two to three, occasionally one or four per placenta. Style filiform, erect, 2–3.25 × ca. 0.2 mm, equaling or slightly exceeding the stamens, glabrous, rarely pilosulous near the base; stigma truncate. *Capsule* symmetric, (narrowly) ovoid to ellipsoid, coriaceous to subligneous, green when fresh, puberulous in combination with sparsely erect pilose, indument brownish to ferruginous; valves three, subequal, 1.5–3.5 × 0.5–1 cm. *Seeds* usually two to three, occasionally one or four, per valve, globose, 4–8 mm in diam., brownish puberulous to pilosulous, sometimes completely glabrous.

Distribution (Fig. 35) and ecology. *Rinorea pubiflora* is the most common and widely spread neotropical species of *Rinorea*. Its main area of distribution is over Amazonia (E Colombia, SE Venezuela, Peru, Brazil and N Bolivia) and the Guianas, which includes many forest refugia (see under the varieties and formae). This species also occurs disjunctly in forest refuges of the Andean region on both sides of the Cordilleras and in adjacent Central America, from 0 to 1300 m, but is wanting in SE Brazil.

The ecological amplitude is wide. It is a common undergrowth tree(let) in primary, secondary and disturbed tropical forests, and in SE Venezuela it is also recorded from mesophytic forests. It occurs on lateritic, clayish or sandy soil; sometimes also on granitic, schistic or sandstone rocks.

Phenology. Flowering and fruiting throughout the year.

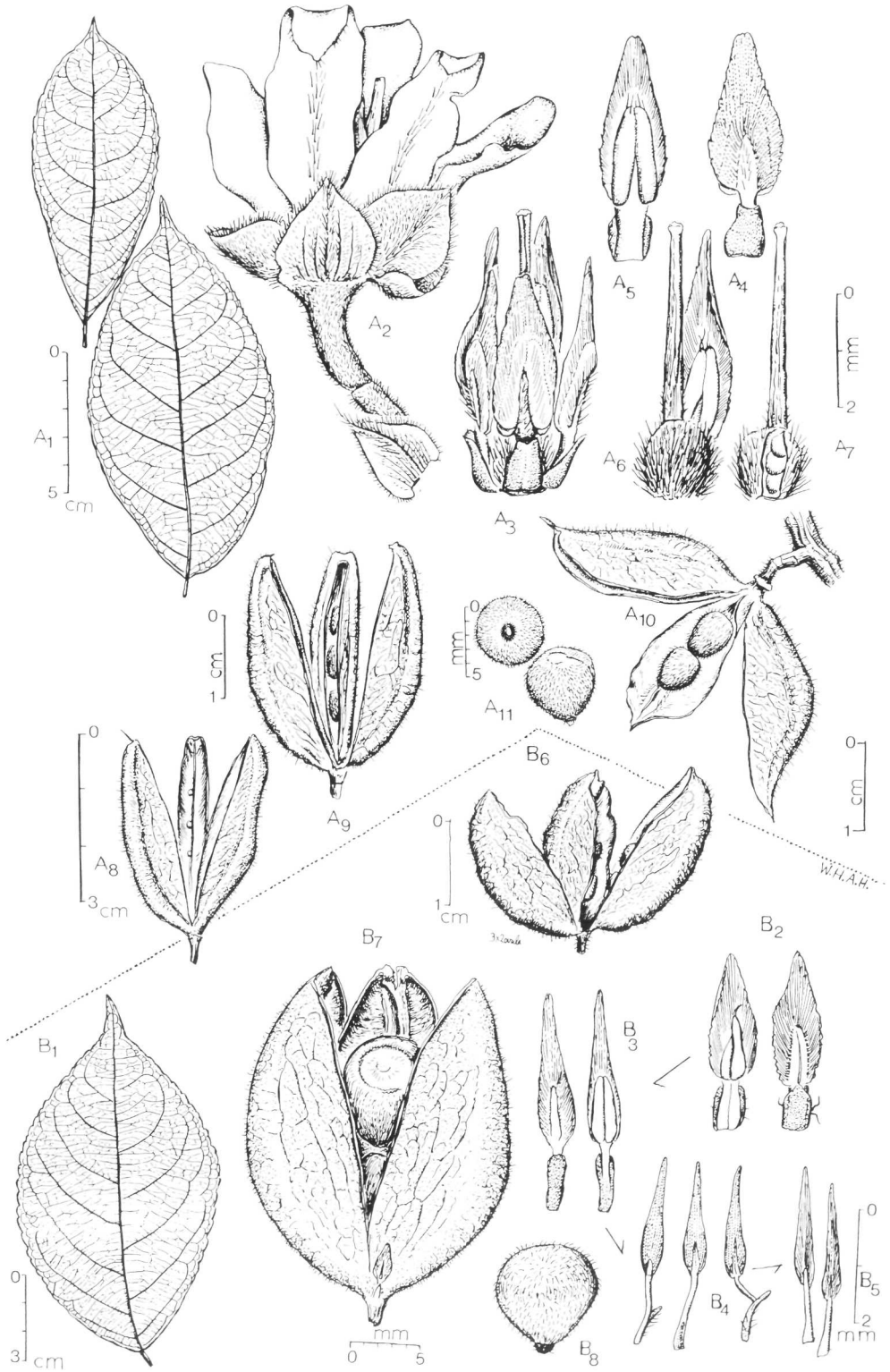
Local names. Venezuela: Molinillo (Zulia), Pata-grulla (Amazonas, Bolivar), Pata-pauji (Bo-

livar). Guyana: Baridi-kutchi & Barudi-kutchi (=kutshi) (=Chicken Hawks foot, Arawak language). Mamusaré (Arawak language). Shipiye (Macusi language), Shero (Wapisiana language); Surinam: Boem(ki)kidia (Aucan language), Dreeritiki (local Creole language), Drilstokje (Surinam Dutch), Kiki (Aucan language), Lèlè, Lèlè-tiki, Maniritiki (local Creole language). French Guiana: Boumbiki(ki)dia (Aucan language), Passoura/Passoure (Caraiù language [Aublet, 1775]), Tàyù (Wayápi language); Perú: Lluichovaran-dilla (Loreto), Canella de Jacamin (Loreto), Jurac barilla (Loreto). Brazil: Burangica (Maranhão), Canel(h)a de Jacamin (Amazonas, Mato Grosso, Pará, Rondônia).

Uses: The Surinam names "Dreeritiki" and "Drilstokje" indicate the use of branchlets for stirring drinks. Lateral branchlets clustered at the apex of a central branchlet are cut off resulting in a "spider-head." The local Creole name in Surinam "Manari-tiki" indicates that branchlets and twigs can be used for making sieves (information from J. C. Lindeman).

Rinorea pubiflora differs from other members of this subgroup by the combination of the following characters: (1) branchlets densely ferruginous hispidulous and less densely hispid (callose lenticels are usually wanting); (2) the upperside of the costa erect puberulous (as in *R. brevipes*); (3) the underside of the costa strigose (as in *R. brevipes*); (4) domatia present beneath (as in *R. brevipes* and *R. camptoneura*); (5) its sepals multivenose, becoming strongly ribbed when dried (as in *R. brevipes*, but less strongly ribbed when dried); (6) its petals densely ferruginous strigose along the costa (in *R. amapensis* golden to brownish pilosulous along the median part); (7) the number of ovules two to four (versus one to two in the other species); and (8) its seeds usually hairy (as in *R. amapensis* and *R. riana*, versus glabrous in all other species and in its own forma *grandifolia*). For differences in the colors of the indument, see under *R. brevipes*.

Rinorea pubiflora is a very variable species with many local races. In the western part of its area—Venezuela, Colombia and W Brazil—it has smaller and more ovate to orbicular fruits. In the eastern parts of its area the fruits are more narrowly elliptic to narrowly ovate. In Venezuela and Colombia most of the specimens have more rigid and more crenate leaves than elsewhere. In southern Amazonian populations the indument of the leaves is scarcely developed. Such speci-



mens can be recognized by characteristic features of branchlets, inflorescences, pedicels, bract(let)s, flowers and fruits. In *Florschütz & Maas 2483*, collected in Surinam, the inflorescences are pseudoracemose with lateral cymules containing three flowers arranged at the base of the central axis just as in *R. lindemiana*. Such a floral arrangement is exceptional in *R. pubiflora*.

Key to the Varieties and Formae of
R. pubiflora (Benth) Sprague & Sandwith

1. Anthers completely developed, 1–1.75 × 0.75–1 mm, $\frac{2}{3}$ × as long as the connective scales; connective scales ovate, 0.75–1.25 mm wide; floral parts wanting at the base of the capsule; seeds pilosulous; Panama, Colombia, Venezuela, Guianas, Peru, Brazil, Bolivia.
 - 24a. var. *pubiflora*.
1. Anthers reduced to completely wanting, 0–1.5 × 0–0.75 mm, 0–0.5 × as long as the connective scales; connective scales narrowly ovate to linear, 0.25–0.75 mm wide; floral parts subpersistent at the base of the capsule; seeds pilosulous or glabrous; Costa Rica, Panama, Colombia, Venezuela, Guianas, Peru, Brazil.
 2. Seeds glabrous; Panama, Colombia, Venezuela, Peru, Brazil (W Amazonia).
 - 24ba. fo. *grandifolia*.
 2. Seeds pilosulous; Costa Rica, Panama?, Colombia, Venezuela, Guianas, Brazil.
 - 24bb. fo. *andersonii*.

24a. *Rinorea pubiflora* (Benth) Sprague & Sandwith var. *pubiflora*. Figs. 34A, 35.

Alsodeia pubiflora Benth. J. Bot. (Hooker) 4: 106. 1842. Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 184. 1891 ('1890'). Type. Guyana, 1838 (fl), *Schomburgk (Robert Hermann) 573* (holotype, K [herb. Benthamianum]); isotypes, BM [herb. Shuttleworth], G, HH, NY, OXF, P.

Passoura guianensis Aublet. Hist. pl. Guiane 2 Suppl.: 21. t. 380. ('*Guyannensis*') 1775; Lamarck, Tabl. en-

cycl. 1(1(2)): pl. 135. fig. 2e, g–l. 13 Feb 1792 ('1791'); Tabl. encycl. 2(4(2)): 107. (nr 2735). 6 Nov 1797 ('1793') ('*Conoria*') p.p. (only the cited synonym *Passoura*), Poirct in Lamarck, Encycl. 5: 49. 9 Jan. 1804 ('*Passoura*') p.p. (synonym *Conohoria flavescens* Aublet excluded); Howard, J. Arnold Arbor. 64: 288. 1983. Type. French Guiana: Timoutou. May (before 1775) (fr), *Aublet s.n.* (lectotype indicated here, since status of a holotype is uncertain, P [herb. Jussieu 12797+B, specimen found in a mixture without name]; the specimen illustrated in Aublet, 1775, t. 380 also belongs unmistakably to *Passoura guianensis* Aublet = *Rinorea passoura* (A. P. de Candolle ex Gingins in A. P. de Candolle) Kuntze = *Rinorea pubiflora* (Benth) Sprague & Sandwith because it has three seeds in each of the valves).

Alsodeia guianensis (Aublet) Eichler in Martius, Fl. bras. 13(1): 387. t. 78, fig. 2. 1871 (based on *Passoura guianensis* Aublet) p.p. (varieties excluded); Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 184. 1891 ('1890').

Conohoria passoura A. P. de Candolle ex Gingins in A. P. de Candolle, Prodr. 1: 312. mid Jan 1824, nom. illeg. according to Code Art. 63.1. p.p. (synonym *Conohoria flavescens* Aublet excluded); G. Don, Gen. hist. 1: 340. early Aug 831 ('1831–1838') ('*Gonohoria*') p.p. (synonym *C. flavescens* Aublet ('*Gonohoria*') excluded); D. Dietrich, Syn. pl. 1: 831. Jul 1839 (synonym *C. flavescens* Aublet excluded). Type as *Passoura guianensis* Aublet.

Rinorea passoura (A. P. de Candolle ex Gingins in A. P. de Candolle) Kuntze, Revis. gen. pl. 1: 42. 1891 ('*passura*') nom. illeg. according to Code Art. 63.1; Blake, Contr. U.S. Natl. Herb. 20(13): 507. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2, 21: 352. 1925; Baehni & Weibel, Candollea 8: 195. May 1941.

Rinorea passoura Kuntze, Revis. gen. pl. 1: 42. 1891 ('*passura*'); Baehni & Weibel in Macbride, Publ. Field Mus. Nat. Hist., Bot. Ser. 14(4(1)): 61. 30 Jun 1941; Soukup, Biota 5(37): 40. 1964.

Rinorea panura Durand & Jackson, Ind. kew. Suppl. 1: 465. 1901. nom. invalid. because of orthographical error.

Alsodeia martini Turczaninoff, Bull. Soc. Imp. Naturalistes, Moscou 36(1): 557. 1863 ('*Alsodeja*'). Type. French Guiana: Cayenne s.d.(fl), *Martin s.n.* (holotype, KW (n.v.); isotype, KW).

Rinorea martini (Turczaninoff) Blake, Contr. U.S. Natl. Herb. 20(13): 506. 1924; Lemée, Fl. Guian. franç. 3: 59. 1953.

FIG. 34. A. *Rinorea pubiflora* var. *pubiflora* (A₁ from *Rombouts 818*; A₂₋₈ from A. C. Smith 2738; A₉ from Cowan 38963; A_{10,11} from *Lanjouw & Lindeman 1874*). A₁, Leaves. A₂, Flower. A₃, Androecium (dorsal), surrounding pistil. A₄, Stamen (dorsal). A₅, Stamen (ventral). A₆, Pistil, accompanied by a stamen. A₇, Pistil, with ovary opened, showing three ovules on one placenta. A₈₋₁₀, Capsule, dehiscing into three subequal valves. A₁₁, Seeds puberulous. B. Var. *grandifolia* (B₁ from *Velez 2337*; B₂ from *H. Allen 3324*; B₃ and B₄ from *Duque Jaramillo 2015*; B₅₋₈ from *de la Cruz 2991*; B₉ from *de la Cruz 1437*). B₁, Leaf. B₂₋₅, Stamens, with reduced thecae gradually changing to sterile staminodes. B₆, Capsule with hairy seeds. B₇, Capsule with glabrous seeds (forma *grandifolia*). B₈, Seeds pilosulous (forma *andersonii*).

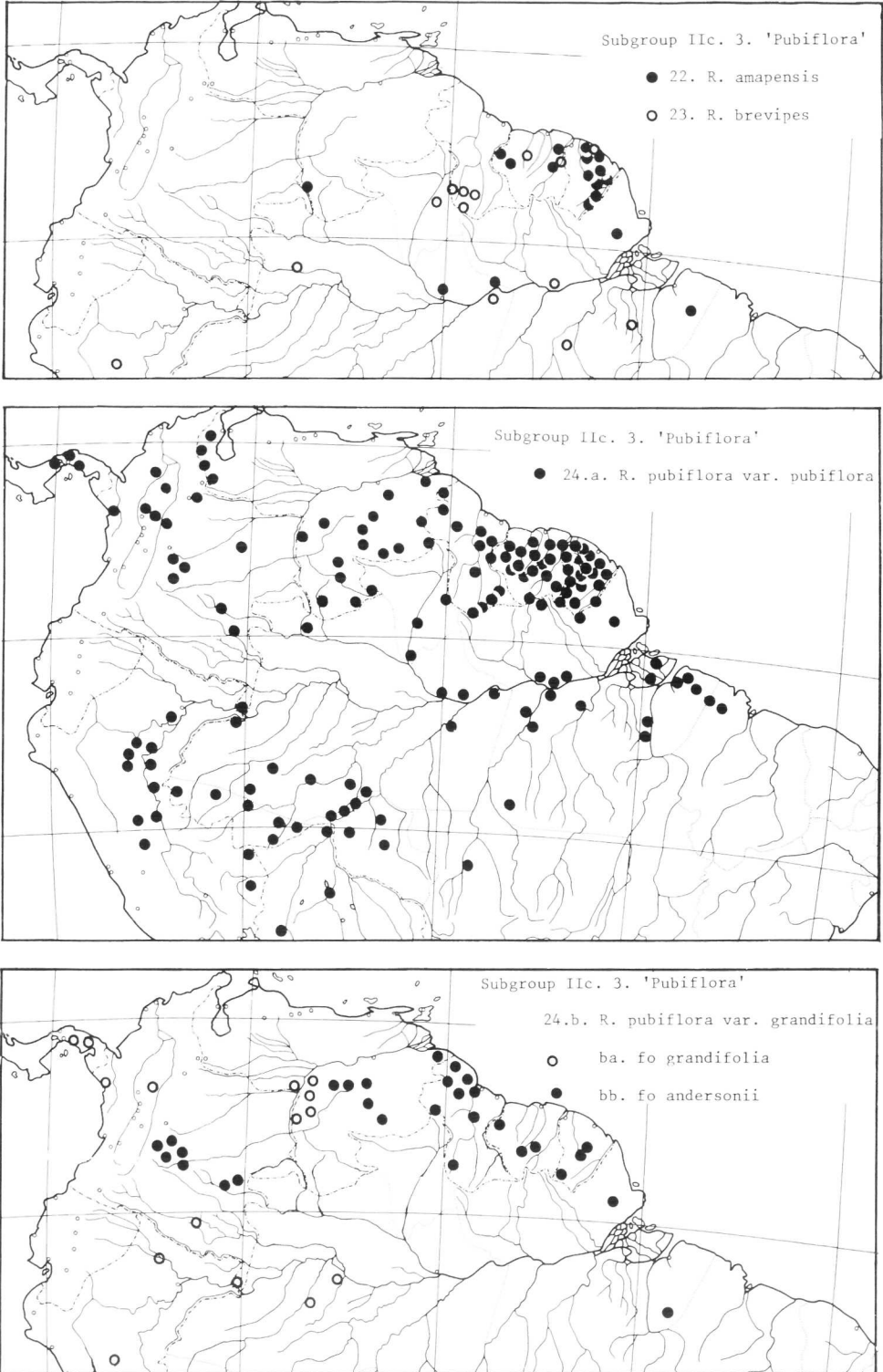


FIG. 35. Distribution of species of *Rinorea* Subgroup IIC.3. 'Pubiflora' (to be continued).

Tree or treelet 0.25–20 m tall. *Leaves* with lamina (3.5–)5–16.5 × (1.5–)2–8 cm, tending to a more papery habit than in var. *grandifolia*; acumen 0.5–2.5 cm long. *Stamens* completely developed, 3–4 mm long; filaments 0.5–1 × 0.25–0.5 mm (wider than in var. *grandifolia*); dorsal glands equaling or slightly longer than the filaments, free near the apex, ellipsoid or (ob)ovoid, 0.25–1.25 × 0.2–0.6 mm; anthers ovoid, 1–1.75 × 0.75–1 mm, wider and larger than those of var. *grandifolia* (if present in the latter variety); connective scales ovate, obtuse, 1.75–3.25 × 0.75–1.25 mm, scarious, orange-brown. *Ovary* 0.5–1.25 × 0.5 mm; ovules two to four per placenta. *Style* (often shorter than in var. *grandifolia*) 2–2.75 mm long, usually completely glabrous. *Capsule* usually longer and more narrowly ellipsoid to ovoid than in var. *grandifolia* and never subtended by floral parts; valves three, (1.75–)2–3 × 0.5–1 cm. *Seeds* two to three, rarely four, per valve, 4–4.5 mm in diam., always brownish puberulous to pilosulous.

Distribution (Fig. 35) and *ecology*. *Rinorea pubiflora* var. *pubiflora* is the most common and widely spread neotropical taxon of *Rinorea*. Its main area of distribution extends over Amazonia (E Colombia, SE Venezuela, Ecuador, Perú, Brazil and N Bolivia) and the Guianas. The Lower Amazon basin and probably also the adjacent Guianas belong to the area of origin; from Amazonia it penetrated southwestward to Peru, Ecuador, and Bolivia (Yungas-North). This taxon also occurs disjunctly in forest refugia on both sides of the Cordilleras and in adjacent Panama: (a) Colombia and Venezuela. E and S of the Cordilleras: Apure, Villavicencio; (b) Venezuela. N of the Cordilleras near Lago de Maracaibo: Catatumbo; (c) Colombia. W of the eastern Cordilleras: Río Magdalena, Nechí; and (d) Panama: Darién.

The two disjunct populations of the forest refugia Apure and Villavicencio became isolated from the main area through the change of previously interjacent tropical rain forests into savannas or grass lands, probably due the rain shadow from the Pliocene Cordilleran uplift plus a general climatic change from warm and humid to cooler and dryer during the same period (Steyermark, 1974, 1979, 1982; van der Hammen, 1974). This orogenesis also isolated other populations in Catatumbo, the Río Magdalena valley and in Nechí. From Nechí it migrated to Darién

after the closing of the Panama land bridge during the Pliocene (± 5.7 my BP). *Rinorea pubiflora* is not recorded from SE Brazil.

The distribution pattern of *Rinorea pubiflora* var. *pubiflora* is strikingly correlated with the present-day areas of humid forests in the neotropics (see map in Mori et al., 1981, fig. 1), except for SE Brazil and the West Indies, where this taxon is wanting.

The ecological amplitude is also wide; var. *pubiflora* is common as undergrowth in primary, secondary or disturbed tropical rain forest, from 0 to 1300 m. The primary forests in turn can be subdivided into seasonal swamp forests, dryer low forests, Mora forest and (sub)mountainous forests. In SE Venezuela it is also recorded from mesophytic forests. It occurs on lateritic, clayish and sandy soil. In French Guiana the species is also found on different geological formations such as granites, schists or sandstones.

Phenology. Flowering and fruiting throughout the year.

Representative specimens examined: PANAMA. COLÓN: Sta. Rita Ridge, $\pm 9^{\circ}25'N$, $79^{\circ}35'W$, 500 m, 4 Mar 1979 (fl, juv fr), Hammel & D'Arcy 6312 (MO, U). PANAMÁ: El Llano-Cartí Rd., 9 km from Inter-American Hwy., 350–375 m, 7 May 1976 (fl), Croat 34788 (MO); Cerro Jefé, nr. Río Indio, 700 m, 15 Feb 1968, Duke 15223/4 (U); 10 km from Panamerican Hwy. on the El Llano-Cartí Rd., $9^{\circ}14'N$, $79^{\circ}00'W$, 350 m, 21 Apr 1982 (fl), Knapp et al. 4729 (MO, U). SAN BLÁS: Comarca de San Blás, El Llano-Cartí Rd., km 26.5, $9^{\circ}19'N$, $78^{\circ}55'W$, 175 m, 9 Mar, 1985 (fl, fr), de Nevers 5075 (MO, U), (aberrant because of its abundant hispidulous indument, especially on the underside of the leaves, with the laminae, costa, veins and veinlets densely ferruginous hispidulous).

COLOMBIA. AMAZONAS: Río Loretoyacu, below Barracón Cauchero, 12 Dec 1945 (fr), Dugue-Jaramillo 2342 (COL). ANTIOQUIA & BOLÍVAR: Border between both Depts., confluences of the rivers Ité and Tamar into river Cimitarra, ± 38 km W of Barranca Bermeja, $\pm 6^{\circ}55'N$, $74^{\circ}15'W$, 27 Feb 1967 (fl, fr), de Bruijn 1522, 1532 (COL, MER, U, VEN, WAG), CHOCÓ: Between Río Curiche and Alto Curiche, 13 Jan 1967 (fl), Duke 9583 (U). CÓRDOBA: Ayapel, Monte Libano, 22 May 1949 (fr), Romero-Castañeda 1728 (COL, US). META: Sierra de la Macarena, mouth of Río Sansa into Río El Cúejar, 490 m, 5 Mar 1956 (fl, fr), Idrobo 2161 (COL); Llanos Orientales, mun. of Puerto López, SE of Cabuyaro, vic. Laguna de Yurimena, $4^{\circ}16'N$, $72^{\circ}41'W$, 175–200 m, 16 Sep 1958 (bud), Jaramillo-Mejía et al. 1240 (COL). NORTE DE SANTANDER: La Motilonia, frontier of Colombia and Venezuela, valley of Río de Oro, $\pm 9^{\circ}05'N$, $72^{\circ}50'W$, 40–50 m, 15–20 Feb 1965 (fr), Garcia-Barriga & Lozano-C 18347 (COL); idem, valley of Río Catatumbo between Puerto

Barco and Caño Brandy, 50–70 m, 24–30 May 1965 (fr). *Garcia-Barriga & Lozano-C 18407* (COL). SANTANDER: Magdalena valley, Campo Capote, 30 km E of Carare, 300 m, 29 Sep 1977 (fr), *Gentry et al. 20023* (MO, U); Río Carare, 300 m, 28 Sep 1945 (fr). *Hodge 6503* (HH): ± 15 km SE of Barranca Bermeja, 8 km from Río Opón, 200 m, 27 Aug 1954 (fl, fr). *Romero-Castañeda 4737* (AAU, COL) & *4738* (COL). VAUPÉS: Alto Caribe, 70°35'W, 220 m, 23 Jan 1955 (bud, fr), *Fernández 1918* (COL, F, US). VICHADA: Llanos, Mt. Arrojo, 100 m, 19 Jan 1944 (fl), *Hermann 10984* (COL, HH, US).

VENEZUELA. AMAZONAS: Río Siapa and Sierra Parima, frontier with Brazil, 550 m, 11 Mar 1946 (fl), *F. Cardona 1326* (US, VEN); Mavaca, Upper Orinoco, s.d. (fl, fr), *Lizot 111* (VEN 80.022); Atabapo, rd. between Culebra and la Falda del Extremo, N of Cerro Duida, 3°40'N, 65°45'W, 180–300 m, 9 Feb 1982 (fr), *Steyermark et al. 126280* (U, VEN); ± 25 km S of Puerto Ayacucho, 5°30'N, 67°35'W, 3 Aug 1967 (fl, fr), *Wessels Boer 1955* (U); Upper Orinoco, Caño Pavo above Tamatama, 121 km, 8 May 1942 (fr), *Ll. Williams 15.265* (VEN 8747). BOLÍVAR: Upper Cuyuni, 30 km S of El Dorado, 6 Apr 1955 (fr), *Bernardi 2120* (NY); Pica Caicara del Orinoco, San Juan de Manipare, Río Saupare, 20.2 km S of Caicara, ± 7°N, 67°W, 100–200 m, Mar 1975 (fr), *Delascio & Lopez Reyes 2754* (U, VEN); Caño Pablo, tributary of Río Caura, 6 km ESE of Las Pavas (Salto Para), 6°14'N, 64°24'W, 240 m, 8 May 1981 (fr), *Liesner & Morillo 13945* (MO, U, VEN); Raudales del Maiha along Río Paragua, 4°25'N, 63°7'W, ± 500 m, 1 Jan 1962 (fr), *Steyermark 90480* (VEN); Medio Caura, Salto del Para, Medio Caura, 250 m, 9 Mar 1939 (fl, fr), *Ll. Williams 11439* (F, MICH, UC, US, VEN). TACHIRA: Parcelamiento Guarumito, 4 km W of La Fría, 8°14'N, 72°17'W, 120 m, 14 Nov 1979 (fr), *Steyermark et al. 120394* (MO). ZULIA: Road to Tukukos, Berijá, Feb 1954 (fl), *Aristeguieta & Montoya 2096* (F); rd. Machique-Colón, nr. Río Catatumbo, 85 km NW of Sta. Barbara, San Carlos del Zulia, 9 Nov 1967 (bud), *de Bruijn 1465* (MER, U, WAG); Colón, hacienda El Rosario, 18 km E of rd. Mochiques-La Fría, 12 km N of Río Catatumbo, 10–50 m, 22 Jun 1978 (fl), *Alfonso-G 6466* (HERZU, U); Río Lora, 13 Dec 1922 (fr), *Pittier 10932* (A, NY, US, VEN); Aricuiza, 7-11-1972 (fr), *Veillon 117* (U, VEN).

GUYANA: Upper Oronoque River, 15 Sep 1937 (fl), *Baddington 16* (K); Wanatobo, Corantyne River, 25 Oct 1951 (fl), *Forest Dept. BG CAP 113* (=6764) (K, MICH, NY, U); Berbice, Canje River, 16 Dec 1914 (fl), *Hohenkerk 638A* (=G12) (K); Bartica Grove, Nov 1886 (fl), *Jenman 2370* (BM, K); Kartubu, Cuyuni River, 5 Aug 1933 (fl), *C. D. & R. C. Mell 209* (NY, US); Mataruki River, Upper Essequibo, 4 Dec 1935 (fl), *Myers 5823* (K); Essequibo, Broid Aripay, 1836–1837 (fl, fr), *Schomburgk (R. II.) 119* (BM, G [herb. de Candolle], G [herb. Delessert ex herb. Graham], K [herb. Benthamianum], K [herb. Hookerianum], OXF, P, US, W); Berbice, 1837–1838 (fl, fr), *Schomburgk (R. H.) 336* (BM, CGE [herb. Leman], F, G [herb. de Boissier & Barbey-Boissier], G [herb. de Candolle], G, HH, K [herb. Benthamianum, herb. Hookerianum], L, NY, OXF, P, W); Roraima, 1842–1843 (fl), *Schomburgk*

(*R. H.* with *M. R. ?*) 774 p.p. (CGE [herb. Leman], F, G, K, P); Haiowa Falls, basin of Essequibo River, 5°0'N, 27 Sep 1937 (fl, fr), *A. C. Smith 2128* (F, G, HH, K, MO, NY, P, S, U, US); Basin of Essequibo River nr. mouth of Onoro Creek, 1°35'N, 15–24 Dec 1937 (fl, fr), *A. C. Smith 2738* (F, G, HH, K, MO, NY, P, S, U, US); Basin of Shodikar Creek, tributary of Essequibo River, 8–22 Jan 1938 (fl, fr), *A. C. Smith 2877* (F, G, HH, K, MO, NY, S, U, US).

SURINAM: Goudkreek, Corantijn, 17 Oct 1916 (fl), *BW 3521* (=Stahel & Gonggrijp, *Tree nr 169*) (U); Lawa, Tapanahony, 31 Oct 1918 (fl, fr), *BW 4165* (=Gonggrijp) (U); Coppename, Raleigh Falls, 17 Aug 1928 (juv fl), *BW 6344* (=Gonggrijp & Stahel 87) (U); Moengo on Cottica River, 26 Dec 1954 (fl, fr), *Cowan 38963* (NY, RB, U); Dam on Sarakreek, 11 Nov 1951 (fl, fr), *Florschütz 191* (U); Bakhuis-Gebergte between Rivers Kabalebo and Coppename, 12 Dec 1965 (bud, fr), *Florschütz & Maas 2316* (U); Mapane-kreek area, 18 Dec 1961 (fl, fr), *Hekking 1215 & 1215 bis* (BBS, U); Para, Aug 1842 (fl), *Hostmann (& Kappler) 1130 & 1130a* (C, CGE, F, FI, G, K [herb. Benthamianum], K [herb. Hookerianum], L, LE, M, MO, P, S, W); Wilhelmina Gebergte, Frederik Top, ± 3°40'N, 56°30'W, 325 m, 7 Aug 1963 (juv fr), *Irwin et al. 54571* (B, F, K, U, Z); Lower slopes of Kayser Gebergte, 40 km above confluence with Lucie Rivier, ± 500 m, 25 Sep 1973 (fr), *Irwin et al. 55790* (COL, K); Beekhuizen nr. Casseporekreek, Aug 1837 (fl), *Kegel 645* (GOET); Kwatta, Aug 1837 (fr), *Kegel 1245* (GOET, U); Jarikabakreek between Uitkijk and Groningen, Lower Saramacca River, 25 Nov 1960 (fr), *Kramer & Hekking 2171* (U); Base of Voltzerg, 21 Sep 1933 (fl, fr), *Lanjouw 928* (U); Suriname River below Kabel, 10 Nov 1933 (juv fl), *Lanjouw 1224* (U); Kabokreek, tributary of Tibiti River, 17 Jan 1949 (bud, fr), *Lanjouw & Lindeman 1874* (Uw 1575) (U); Mapane-Kreek area, Aug 1961 (fl), *LBB* (=Boerboom) 8799 (BBS, U); vic. Kabalebo, S of Utrecht, Corantyne, 21 Oct 1973 (fr), *LBB* (=Teunissen) 14488 (BBS, U); Suhoza, 19 Sep 1953 (fl, fr), *Lindeman 4640* (U); Saramacca River, 15 Jul 1944 (fl), *Maguire 24122 p.p.* (BR, F, HH, K, MO, NY, P, U, US, VEN); Lower slopes of Frederik top, 325 m, ± 15 Jul 1963, *Maguire et al. 54571* (Uw 17390) (U); Doksie-kreek, tributary of Coppename River, 9 Oct 1954 (fl), *A. M. W. Mennega 259* (U); Kayser Gebergte, 8 Nov 1976 (fr), *Mori & Bolten 8629* (NY, U); Sipalawini savanna area, N of Vier Gebroeders, 29 Nov 1968 (fl), *Oldenburger et al. 567* (U); Upper Litanie Rivier, Knopioamer, SE border of Surinam, 12 Aug 1937 (fl), *Rombouts 818*: Jodensavanne, Mapane-kreek area, 11 Sep 1955 (fl), *Schulz 7318* (U); Wilhelmina-gebergte, Juliana-top, 500 m, 4 Aug 1963 (fl), *Schulz 10322* (BBS, U); Para Distr., Reeberg, 18 Aug 1975 (fr), *Teunissen LBB 15470–15471* (BBS, U); Lower Corantyne, 21 Oct 1975 (bud), *Teunissen LBB 15472* (BBS, U); Upper Nickery River, Stondosi Falls, 8 Dec 1962 (fr), *Wessels Boer 321* (U); Tapanahoni River, 13 Apr 1962 (fl, fr), *Wessels Boer 1272* (U); 20 km from Coppename River, W of Emma Ketten, vic. Hendrik Top, 18 May 1963 (fl), *Wessels Boer 1398* (U); Upper Surinam river, Placer, Victoria, s.s. (fr), *Wüllschlägel 1357 p.p.* (BR, W).

FRENCH GUIANA: s.l., s.d. (bud. fl). *Aublet s.n. in herb. Duncan* (G. [herb. Boissier]); St. Jean. 7 & 17 Apr 1914 (fl). *Benoist 1082 & 1103* (P); Creek Gabrielle. 28 Aug 1916 (fl). *Cremers 3823* (CAY, U). Creek Alice. Upper Tamoc. 4 Apr 1977 (fl). *Cremers 4618* (CAY); Creek Sai, tributary of Grand Inini. 26 Aug 1970 (fr). *de Granville 640* (CAY, P, U); Summit of Mt. Atachi Bacca. 525 m. 8 Mar 1971 (fr). *de Granville 839* (CAY, P); Saül, Roche Bateau. 22 Jul 1979 (fl). *de Granville 3144* (CAY, U); 50 km S of Saül, summit of Tabulaire. 500 m. 24 Aug 1980 (fl). *de Granville 3598* (CAY, U); Upper Oyapock. Trois Sauts. 28 Dec 1974 (fr). *Grenand 603* (CAY, P, U); Riverside Mana nr. Saut Fracas. 24 Aug 1962 (fl). *Hallé 670* (P); between Saül and Crique Nouvelle France. 3°37'N, 53°12'W, 200 m. 4 Feb 1978 (fr). *Leeuwenberg 11723* (CAY, U, WAG); s.l., 1838 (fr), 1840 (fr), 1850 (fl). *Leprieur s.n.* (P); Forestier de la Mirande, vic. Cayenne. 100–150 m. 3 Nov 1974 (fl, fr). *P. J. M. & H. Maas et al. 2193* (U); Saül, Crique Limonade. 200–300 m. 3 Nov 1974 (fr). *P. J. M. & H. Maas et al. 2240* (U); Cayenne. s.d. (bud. fl). *Martin s.n.* (BM, K [herb. Hookerianum]). K. KW, L, P); riverside of Maroni. 1861 (fl, fr). *Mélinon 197 p.p.* (BM, BO, F, NY, P, US); Saül, Limonade trail. 3°37'N, 53°12'W, 200–400 m. 7 Sep 1982 (fr). *Mori et al. 14864* (NY, U); Boeuf Mort trail, Mt. La Fumée. 3°37'N, 53°12'W, 200–400 m. 2 Oct 1982 (fr). *Mori & Boom 15034* (NY, U); Comté. ±75 km S of Cayenne. 12 Jun 1965 (fr). *Oldeman 1377* (CAY); Riverside Iracoubo, vic. river Mana. 11 Aug 1966 (fl). *Oldeman 2183* (CAY); Riverside Camopi, tributary of Oyapock. 8 Dec 1967 (fl). *Oldeman 2606* (CAY); Creek Grégoire, river Sinnamary. 28 Apr 1968 (fl). *Oldeman B-1605* (CAY); Grand Inini nr. Saut Equerre. SE of Maripa Soula. 18 Aug 1970 (bud, fr). *Oldeman B-3505* (CAY); Crique Sable. Upper Approuage. 25 Oct 1968 (fl, fr). *Oldeman T-248* (P); River Ara-ta-ye, falls of Pararé, River Approuage. 25 Oct 1978 (fl). *Poncy 175* (P); Mt. des Carapas, nr. Kourou. 17 Nov 1978 (fr). *Prévost 391* (CAY, U); Zidockville, upper Oyapock nr. Brazilian border. 30 Jul 1980 (bud). *Prévost & Grenand P-893* (CAY, U); Acarouany (Karouany). 18 Sep 1854 (fl, fr). *Sagot 33 p.p.* (P, S, W); Massif du Miteraka. border with Suriname & Brazil. 500 m. 13 Aug 1972 (bud). *Sastre 1676* (P, U); Maroni, Godebert, Oct 1919 (fl, fr). *Wachenheim 13* (BM, F, K, P, US).

ECUADOR. NAPO: Añangu, mouth of Río Añangu into Río Napo. Parque Nacional Yasuní. 76°24'W, 0°31'S. ca. 250 m. 30 Jun–9 Jul 1982 (fl). *SEF 10410* (NU, QCA, U).

PERU. HUÁNUCO: Pachitea. Puerto Inca. 2 km E of town. 9°18'S, 74°57'W, 250–300 m. 11 Sep 1982 (fl). *Foster et al. 8694* (AMAZ, MO, U, USM). JUNÍN: Along Río Perene. 600 m. 16–18 Jun 1929 (fr). *E. P. Killip & A. C. Smith 25154* (F, US); Puerto Bermudez. 375 m. 14–17 Jun 1929 (bud). *E. P. Killip & A. C. Smith 26507* (FI, NY, RB, US). LORETO: Río Aguyita, vic. Aguyita. 3 Oct 1965 (fl). *Croat 20965* (MO, U); Fortaleza nr. Yurimaguas. Dec 1932 (fl, fr). *Klug 2787* (BM, F, G, HH, K, MO, NY, S, US); Bosque Nacional A. von Humboldt. Pucallpa–Tingo María, km 86. 8 Sep 1980 (bud). *Maas et al. 4520* (Uw 26235) (U); trail

to San Ramón, vic. Yurimaguas. 180 m. 25 Oct 1931 (fr). *Mexia 6082* (BM, F, G, HH, K, LIL, MICH, MO, NY, PENN. S. U, UC, US); Maynas. Yurimaguas. Dec 1830 (fl). *Poeppig 213, b* (G, LL, P, W); Basin of Ucuyali from 10°S to mouth. Dec 1923 (fl, fr). *Tessmann 3136* (S), *3162* (G) & *3441* (F, G, NY, S); Upper Río Itaya. 8 Oct 1929 (fr). *Ll. Williams 3475* (F). MADRE DE DIOS: Tambopata. 30 km. SSW of Puerto Maldonada at confluence of Río La Torre (Río d'Orbigny) and Río Tambopata. 12°49'S, 69°17'W, ±260 m. 19 Apr 1980 (fl). *Barbour 4846* (MO, U); idem. 280 m. 5–6 Nov 1979 (fl, fr). *Hartshorn 2407 & 2411* (U). PASCO: Oxampampa, Pichis Valley. 10 km down river from Puerto Bermudéz. 10°15'S, 74°55'W, 300 m. Dec 1980 (fr). *Foster 8132* (F); Oxapampa, idem. 24 Sep 1982 (fl). *Foster 8899* (MO, SMF, U, USM); Oxapampa, Palcazu Valley: Iscozacín, trail to Villa Americana. 10°12'S, 75°15'W, 400 m. 12 Jan 1984 (fl). *Foster et al. 7919* (MO, U); Oxapampa, Pichis Valley. 10 km down river from Puerto Bermudéz, Reserva Mumuqui. Dec 1980 (fr). *Foster & Wright 8047* (F). SAN MARTÍN: Chazuta. Río Huallaga. 260 m. Apr 1935 (fl). *Klug 4081* (BM, F, HH, K, NY, UC, US).

BRAZIL. ACRE: Río Branco–Porto Velho Hwy., km 22. Quinoá. 30 Mar 1979 (fr). *Albuquerque et al. 1291* (INPA, NY, U); Mun. of Río Branco, Río Iquiri. 7 Sep 1951 (fl). *Bockermann 151* (SP); Hwy. Abuña to Río Branco. km 242–246, vic. Campinas. 17 Jul 1968 (fl). *Forero et al. 6323* (C, COL, F, G, HH, K, M, MG, MICH, MO, NY, P, R, S, U, VEN); 13 km from Brasileia–Assis rd., 2 Nov 1980 (fr). *Lowrie et al. 685* (INPA, NY, U); vic. Porangaba, Río Juruá–Mirim & Río Moa. Cruziero do Sul. 17 May 1971 (bud). *Maas et al. P 13075* (INPA, NY, U); vic. Sena Madureira. 9°05'S, 68°40'W, 27 Sep 1980 (fl). *B. W. Nelson et al. 488* (INPA, NY, U); E of Rio Tarucá, 15 km below Tarucá. 21 Sep 1968 (fr). *Prance et al. 7428* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, S, U, US, VEN); Río Juruá, Juruá–Mirim. Sep 1901 (fl). *Ule 5797* (G, HBG, K, L, MG, NY, S). AMAPÁ: Bank of Río Amapari, vic. Porto Terizinha. 1954 (bud, fr). *Cowan 38608* (NY, RB); Tumac-Humac. S slope of the Toukochipann. 480 m. 19 Aug 1972 (bud, fr). *de Granville 1293* (CAY); Río Taue. 0.5 km E of confluence with Oiapoque. 2°53'N, 52°22'W, 24 Aug 1960 (bud). *Irwin et al. 47790* (F, MICH, NY, U, UB, US, VEN). AMAZONAS: Río Siapa. Sierra Parima. Brazilian–Venezuelan border. 550 m. 11 Mar 1946 (fl). *F. Cardona 1326* (US, VEN); Río Uatumã, mun. of Itapiranga. Igarapé Sta. Luzia. 16 Aug 1979 (bud). *Cid et al. 414* (INPA, NY, U); Manaus. Igarapé de Mariane. 16 Dec 1955 (fr). *D. Coelho 3126* (INPA, U); Upper Solimões, Benjamin Constant. 10 Sep 1962 (bud). *Duarte 7137* (HB 27658, INPA, RB, U); Cachoeira Caranguejo, Río Cauabury. 24 Oct 1930 (fl, fr). *E. G. Holt & E. R. Blake 418* (F, HH, RB, US); Basin of Río Madeira, Mun. of Borba nr. Bella Vista. 4–6 Sep 1934 (bud, juv fr). *Krukoff 5980* (BM, BR, F, G, HH, K, LE, MO, NY, S, US); Río Purús, Río Ituxi, vic. Lábrea. 28 Oct 1968 (fr). *Prance et al. 7988* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, U, US, VEN); Basin of Río Demeni, vic. Tototobi. 27 Feb 1969 (fl). *Prance et al. 10294* (INPA, NY, U); Na-

morado, Novo, watershed between Rios Curuquê and Madeira at Abuña, 30 Jul 1971 (fl), *Prance et al. 14688* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, U, S, U, S, VEN); Rio Preto, 1 Jun 1964 (fl), *W. Rodrigues & D. Coêlho 5870* (INPA, U); Hwy. Manaus-Itacoatira km 60, 8 Dec 1961 (juv fr), *W. Rodrigues & J. Lima 3554* (INPA, 10.104, U); vic. Serra Aracá, 26 Feb 1977 (fr), *N. A. Rosa & Cordeiro 1682* (INPA, NY); Parana-miri das Ramas, Oct 1850 (fr), *Spruce 1107-c* (P). MARANHÃO: S of Fazenda Guarany, km 113 of BR 316, 2°46'S, 45°43'W, 1980 (bud), *Daly et al. D-168* (INPA, NY, U); Fazenda São Francisco, 11 km N of km 337 of BR 316, 4°0'S, 44°56'W, 25 Sep 1980 (bud), *Daly et al. D-262* (INPA, NY, U); Maracassumé River Region, 16 Sep 1932 (fl), *R. Froes 1908* (F, G, HH, K, MICH, MO, NY, P, S, U, S, U, S). MATO GROSSO: Rio Juruana, 15 Jun 1977 (fl), *N. A. Rosa & M. R. Santos 2136* (INPA, NY). PARÁ: Nr. EMBRAPA Station, Altamira-Itaituba 23 km, 30 Oct 1977 (fr), *C. C. Berg et al. BG 759* (NY, U); Tapajós, Bõa Vista, 13 Sep 1932 (fl), *Capucho 441* (F); ca. 30 km SW of Tucuruí, dam project, 3°65'S, 49°49'W, 4 Nov 1981 (fr), *Daly et al. 1201* (INPA, NY, U); 13 km N of Bragança, 0°59'S, 46°15'W, 20 m, 8 Apr 1980 (fr), *Davidse et al. 18083* (INPA, MG, NY, U); Obidos, Rio Branco, Cacasalinho, 9 Feb 1919 (fl), *Ducke s.n.* (RB 5350, U); Rio Tocantins, Jacundá, 14 May 1951 (fl), *R. L. Froes 27082* (COL, INPA); Currupirú, Gato, Planalto de Santarém, 22 Aug 1954 (bud), *R. L. Froes 31059* (COL, INPA); Mun. of Monte Alegre, region of Assaizal, Oct 1954 (fl), *R. L. Froes 31449* (COL, INPA); Teperinha nr. Santarém, 11 Sep 1925 (fl), *Ginzberger 895* (W); Lower Cupary River, plateau between Xingu and Tapajós rivers, Sep 1931 (fl), *Krukoff 1058* (G, HH, K, MICH, MO, NY, P, S); Cassipa, Tapajós river region, Sep 1931 (bud, fr), *Krukoff 1245* (F, G, HH, K, MICH, MO, NY, P, S, U); vic. Belém, 25 Aug 1945 (fl), *J. Murça (Pires) & Black 167* (P, RB 55.524, U, US); Belém-Brasília km 63, 24 Sep 1959 (fr), *Oliveira 155* (COL); Belém, Reserve of IAN, 20 Oct 1957 (fl, fr), *E. Pereira 3328* (HB 5418, RB 101.700, U); Rd. BR 22 from Capanema to Maranhão km 107, 20 km W of Rio Gurupi, 26 Oct 1965 (fr), *Prance et al. 1671* (F, K, NY, U, Z); Rd. BR 22 km 98, vic. Cachoeira, 3 km beyond Rio Piria, 21 Aug 1964 (fl), *Prance et al. 58782* (COL, F, K, NY, U, Z); Gleba Bacaja, mouth of Rio Bacaja, 3°22'20"S, 50°47'50"W, 22 Nov 1980 (fl), *Prance et al. P-26391* (INPA, MG, NY, U); Tumac-Humac, Rio Arepecurú, 1 Oct 1958 (fl, juv fr), *de Sampaio 5146 R 18.729*; Copanima, Rio Peizebois, Sep 1906 (bud), *J. S. dos Santos 7305* (MG); Acará, Jacarequera, Tapera, 20 Feb 1966 (fr), *M. Silva 506* (MG); Santarém-Palhão km 35, vic. Igarapé Curupira, 2 Nov 1969 (bud), *M. Silva & R. Souza 2470* (MG, NY, U); Igarapé-assú, nr. railway station of Bragança, 6 Feb 1903 (fl, fr), *Siquiera 3339* (MG, RB 21.363, NY); Ourem, Rio Guamá, São José, 9 Dec 1903 (fl), *Siquiera 4058* (MG, RB 21.361); airstrip on W Bank of Rio Maicuru, ca. 23 km upstream from Lageira, 0°55'S, 54°26'W, ca. 250 m, 18 Jul 1981 (bud), *Strudwick et al. 3145* (INPA, MG, NY, U); idem, 28 Jul 1981 (bud), *3646* (INPA, MG, NY, U); idem, 29 Jul 1981 (bud), *3687* (INPA, MG, NY, U); airstrip on Rio

Curua, 0°59'S, 54°92'W, 7 Aug 1981 (fl); Taperinha nr. Santarém, 7 Sep 1927 (fl), *Zerny 896* (F). RORAIMA: Rio Cantá, Serro do Cantá, Oct 1951 (fl), *G. A. Black 51-13894 & 51-13904* (COL, IAN); Jarú, Dec 1913 (bud, fr), *Kuhlmann 83* (RB 21.351); mouth of the Rio Branco, 8 Jan 1924 (fr), *Kuhlmann 1106 p.p.* (RB); Foot of Serra da Lua, 21 Jan 1969 (bud), *Prance et al. 9366* (COL, F, G, HH, INPA, K, M, MICH, MO, NY, P, R, S, U, S, U, S, VEN); Porto Mucajá, Rio Mucajá, 25 Mar 1971 (bud), *Prance et al. 11227* (INPA, NY, U). RONDÔNIA: Rio Jarú, BR 29, 21 Sep 1962 (fl), *Appa 76 & Duarte 7136* (B, HB 27.653, INPA 14.765, RB); 1 km NE of Ariquemias, 13 Aug 1968 (bud), *Forero & Wrigley 7021* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, P, R, S, U, S, U, S, VEN); Rio Jaciparaná, 9–12 km above Jaciparaná, 9°15'S, 64°33'W, 30 Jun 1968 (bud), *Prance et al. 5378* (C, COL, F, G, HH, INPA, K, M, MICH, MO, P, R, S, U, S, U, S, VEN); W bank of Rio Madeira, 2 km below mouth of Rio Abuña, 15 Jul 1968 (bud), *Prance et al. 6033* (C, COL, F, G, HH, INPA, K, M, MICH, MO, P, R, S, U, S, U, S, VEN); Rd. Manaus-Canacari km 329, N of Waimari-Atoari, 16 Nov 1977 (fr), *W. C. Steward et al. 17* (INPA, NY, U); S.L., s.d. (fr), *Martius s.n.* (BR).

BOLIVIA. LA PAZ: Larecacha, 27.8 km to Guanay, 865 m, 28 Nov 1980 (fl), *Beck 3770* (U, UMSA). PANDO: W bank of Rio Madeira, 2 km above Riberão, 26 Aug 1968 (fl), *Prance et al. 6489* (NY, U); SW of Cobija on the Rio Nauraueda, 1 km W of river, ca. 250 m, 31 Jul 1982 (fl), *Sperling & King 6423* (INPA, MG, NY, U).

26b. *Rinorea pubiflora* (Bentham) Sprague & Sandwith var. *grandifolia* (Eichler in Martius) Hekking. Figs. 34B, 35.

Tree or treelet 1–20 m tall. *Leaves* with a lamina (3.5–)7.5–20.5 × (1.5–)4–8.5 cm, more coriaceous than in var. *pubiflora*; acumen (0.5–)1–3.5 cm long (the maximal length is longer than in var. *pubiflora*). *Reduced stamens* or staminodes, 2.75–4 mm long; filaments 0.5–1.5 × 0.1–0.4 mm (more slender than in var. *pubiflora*); dorsal glands reduced or wanting, 0–0.5 × 0–0.3 mm; anthers 0–1.5 × 0–0.75 mm, smaller than in var. *pubiflora* or completely wanting; connective scales gradually reduced from (narrowly) ovate or deltoid to linear, 2–2.5 × 0.25–0.75 mm, scarious, orange-brown. *Ovary* 1–1.25 mm long and wide; ovules one to two, occasionally three per placenta. *Style* (often longer than in var. *pubiflora*) 2–3.25 mm long, always hispidulous near the base (in contrast with var. *pubiflora* in which the style is usually completely glabrous). *Capsule* usually shorter and more ellipsoid or ovoid than in var. *pubiflora* and always subtended by subsistent floral parts, consisting

of sepals, petals, reduced stamens or staminodes (in contrast with var. *pubiflora* in which such floral parts are always wanting), valves (1.5–)2–2.75 × 0.4–0.8(–1.3) cm. Seeds usually two per valve, rarely one or three, (3–)4–8 mm long and wide (usually larger than in var. *pubiflora*), glabrous or pilosulous (dependent on which forma).

Distribution (Fig. 35) and ecology. The area of distribution of var. *grandifolia* is included in that of var. *pubiflora*. It comprises Amazonia s.l., the Guianas, some isolated localities in NW Colombia and finally also eastern Panama. The ecological amplitude is similar to that of var. *pubiflora*. It is found from 0 to 600 m, probably not reaching the maximum altitude of var. *pubiflora*.

Phenology. Presumably flowering and fruiting throughout the year.

Representative specimens examined: COLOMBIA. META: 5 km above mouth of Caño Cabra into Río Guayabero, 22 Feb 1969 (bud, juv fr), *Pinto & Sastre 945* (COL); Llano de San Martín, Villavicencio, Paraiso, Firamena, Jan 1836 (fl), *Triana s.n.* ('5047') (COL). VAUPÉS: Bacuraba Cachoeira, 200 m, 4 Nov 1944 (fl), *H. Allen 3324* (MO, US); Río Unilla, Calamar Matorrales, 30 Oct 1939 (fl, juv fr), *Cuatrecasas 7331* (F, US).

VENEZUELA. APURE: Río Parguaza, 12 Apr 1946 (fl), *Vélez 2337* (VEN). BOLÍVAR: Reserva Forestal La Paragua, Feb 1979 (bud, fr), *Blanco 679* (VEN); Cerca de Boca Caropa, 5 Sep 1943 (fl), *F. Cardona 878* (F, NY, US, VEN 8731); La Paragua, along Río Paragua, 6 Apr 1943 (fl), *Killip 37271* (F, HH, K, NY, S, US, VEN 8722); Río Paragua, Isla El Casabe, 265 m, 9 Apr 1943 (fl), *Killip 37305* (US, VEN 8723); La Prisión, Medio Caura, 100 m, 18 Mar 1939 (bud, juv fr), *Ll. Williams 11546* (US, VEN). DELTA AMACURO: Tucupita, 5–14 km ESE of Los Castillos de Guayana, 8°28–31'N, 50–200 m, 28 Mar–2 Apr 1979 (fl), *Davidse & Gonzalez 16424* (MO, U).

GUYANA. River margin of Essequibo, 5 Mar 1931 (fl, juv fr), *Martijn 280* (K); Roraima, 1842–1843 (fl), *Schomburgk (Rob. H.? with M. Rich.?) 774 p.p.* (CGE, G, K).

SURINAM. Corantijn, Matappi, 15 Jun 1918 (juv fr), *B. W.* (=Gonggrijp) 2088 (U); Lucie Rivier, Oost Rivier, 225 m, 8 Sep 1963 (fl), *Irwin et al. 55497* (COL, F, NY, U); Gran Río, 20 Sep 1905 (bud), *Tresling 463* (MG, U).

FRENCH GUIANA. Tumac-Humac, frontier with Brazil, 2 km NW of Toukouchipann, 520 m, 29 Aug 1972 (fr), *de Granville B-4494* (CAY, P).

BRAZIL. RORAIMA: Boa Vista–Caracarai Rd. (BR 174), 58 km S of Boa Vista, 31 Jan 1969 (juv fr), *Prance et al. 9519* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, S, U, US, VEN).

Representative specimens examined that show possible hybridization with *Rinorea ovalifolia* (Britton

Blake, VENEZUELA. AMAZONAS: Atures, ca. 11 km N of Puerto Ayacucho, 5°44'N, 67°30'W, 90 m, 26 Jan 1978 (bud), *O. Huber & Cerda 1450* (B, VFN); Atures, vic. El Burro, 5°43'N, 67°30'W, 80–130 m, 29 Jan 1975 (bud), *O. Huber & Cerda 1502 & 1503* (VEN).

Var. *grandifolia*'s habit is quite similar to that of var. *pubiflora*, but its leaves tend to be more coriaceous and the indument less dense. This variety is characterized by a gradual reduction of its androecium from nearly normally developed stamens with reduced anthers to staminodes without anthers.

In var. *grandifolia*, there exists only a reduction to ♀ flowers, but not a reduction to ♂ flowers. *Rinorea virgata*, of tropical Asia, is probably the only species which is dioecious and has completely developed ♂ and ♀ flowers. Var. *grandifolia* can be subdivided into two formae, when seeds are present: a) fo. *grandifolia* with glabrous seeds and b) fo. *andersonii* with pilosulous seeds. Specimens without seeds have been identified only to var. *grandifolia*.

24ba. Rinorea pubiflora (Benth) Sprague & Sandwith var. *grandifolia* (Eichler in Martius) Hekking comb. nov. fo. *grandifolia*.

Figs. 34B, 35.

Alsodeia falcata Martius ex Eichler in Martius, var. *grandifolia* Eichler in Martius, Fl. bras. **13(1)**: 386, 1871. Type. Brazil. Amazonas: Tefé (formerly Egas), s.d. (bud, fr), *Martius s.n.* (lectotypus novus, M (123), isotypes, M (124, 125, 126, 127, collection numbers written on small labels attached to the specimens).

Rinorea scandens Ule, Verh. Bot. Vereins Prov. Brandenburg **47**: 157, 1906 ('1905'); Blake, Contr. U.S. Natl. Herb. **20(13)**: 515, 1924. Type. Brazil. Amazonas: Itanga (Marary), Oct 1900 (fl, fr), *Ule 5018* (holotype, B, destroyed in World War II); lectotypus novus, HBG: isotypes, F (photograph & fragment), G, L (seeds wanting; seeds glabrous according to the type description by Ule, 1906 ('1905')).

Rinorea passoura (A. P. de Candolle ex Gingins in A. P. de Candolle) Kuntze var. *grandifolia* (Eichler in Martius) Hekking fo. *grandifolia*, Phytologia **53(4)**: 257, 1983, nom. illeg. according to Code Art. 63.1.

Rinorea passoura (A. P. de Candolle ex Gingins in A. P. de Candolle) Kuntze var. *andersonii* Sandwith ex Hekking fo. *leiosperma* Hekking, Phytologia **43(5)**: 480, 1979, nom. illeg. according to Code Art. 63.1.

Racemose inflorescences 2–7 cm long, just as long as in var. *pubiflora*. Flowers yellow or white. Petals 3.25–5 mm long, slightly narrower than is usual in var. *pubiflora*. Seeds 5–8 mm diam., glabrous.

Distribution (Fig. 35) and ecology. The main area of distribution is in West and Upper Amazonia (SE Colombia, S Venezuela, N Peru and NW Brazil), including the forest refugia Ventuari, Tefé, Loreto, and Ucayali. This forma also occurs disjunctly in some forest refugia of the Andean region and adjacent Panama: (a) NW Colombia, W of the eastern Cordilleras: Nechí, Río Magdalena (?); and (b) Panama: Darién.

The ecological amplitude is similar to that of var. *pubiflora*, but it is also recorded from igneous outcrops in Venezuela, from 0 to 600 m.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: PANAMA, COLÓN: Sta. Rita Ridge Rd., 21 km from Transisthmian Hwy., 9°25'N, 79°37'W, 400–500 m, 22 May 1982 (fr), Knapp & Schmalz 5244 (MO, U). PANAMÁ: El Llano—Cartí Rd., 9 km from Interamerican Hwy., 350 m, 20 Mar 1975 (fr), Mori & Kallunki 5115 (MO, U); idem, 22 Mar 1975 (fr), 5154 (MO, U); El Llano—Cartí Rd., 12.7 km from Interamerican Hwy., 15 Feb 1975 (bud, fr), Mori et al. 4694 (MO, U); SAN BLÁS: El Llano—Cartí Rd., ca. 10 km N of Interamerican Hwy., 9°15'N, 79°00'W, ca. 550 m, 14 Mar 1985 (fl, fr), McPherson 6851 (MO, U).

COLOMBIA, AMAZONAS: Trapecio Amazónico, Río Loretoyacu, between the rivers Loretoyacu and Hamayuca, N of Loretoyacu, Nov 1945 (fr), Duque-Jaramillo 2015 (COL); idem, above Barracón Cauchero, 10 Dec 1945 (fr), Duque-Jaramillo 3203 (COL); idem, Río Loretoyacu, 100 m, Nov 1945 (fr), Schultes 6918 (COL). CAQUETÁ: Riverbank of Río Gaguán, S of Cartagena, 24 Apr 1953 (bud, fl, fr), Romero-Castañeda 4085 & 4087 (COL); CHOCÓ: Mun. Juradó, Upper Curiche, E of mouth Curiche, 3–10 m, 20 May 1967 (fr), Duke 11286 (2) (U).

VENEZUELA, AMAZONAS: 3.5 km S of Puerto Ayacucho, 4 May 1977 (fr), Steyermark & O. Huber 113844 (VEN). APURE: Puerto Paéz, 22 Apr 1948 (fr), Vélez 2438 (VEN); Pargusoa, 22 Apr 1948 (fr), Vélez 2448 (VEN).

PERU, LORETO: Maynas, Río Napo, 300 m, from mouth of Paco Caño into la Cocha de Urcumiraño, 12 Oct 1979 (fr), Diaz & Jaramillo 1548 (MO, U). SAN MARTÍN: Mariscal Cáceres, Tocache Nuevo, nr. Yacu Sisa, 500–600 m, 7 Mar 1981 (fr), Schunke-Vigo 12513 (F, U).

BOLIVIA, PANDO: SW of Cobija on the Río Naraüeda, 11°08'S, 69°08'W, ca. 250 m, 2 Aug 1982 (fr), Sperling & King 6469 (INPA, MG, NY, U).

Local names. Venezuela: Amé (Apure); Salao (Bolívar).

Fo. *grandifolia* differs from var. *pubiflora* as well as from fo. *andersonii* by its glabrous seeds (versus seeds puberulous to pilosulous). Fo.

grandifolia is more heterogeneous than fo. *andersonii* and seems to be composed of regional populations: (1) Amazonia: Specimens with leaves relatively larger and longer acuminate than is usual for var. *pubiflora*; they resemble those of the regional populations of fo. *andersonii*; capsules and seeds of Amazonian specimens of fo. *grandifolia* much resemble those of *R. camptoneura*; (2) Venezuela: Specimens with leaves as large as in specimens belonging to the regional populations of var. *pubiflora*; the subcoriaceous leaves and the capsules much resemble those of the regional population of *R. ovalifolia*; and (3) Central America: Specimens with leaves relatively smaller and more serrate and crenate than usual for var. *pubiflora*, and therefore resembling those of *R. squamata*; also the indument of the capsule and the glabrous seeds much resemble those of *R. squamata*.

Capsules of fo. *grandifolia* can be distinguished from those of the similar species by the presence of subpersistent floral parts, such as sepals, petals, reduced stamens or staminodes versus them wanting. The inflorescences of specimens of fo. *grandifolia* collected in Venezuela, Colombia and Central America are usually more densiflorous than those collected in Amazonia. Concerning the Venezuelan specimens, it is not surprising that some of them can be easily confused with those of *R. ovalifolia*, which occurs along the Río Orinoco. Outside this region both taxa can be more clearly distinguished from each other. Introggressive hybridization with *R. ovalifolia* is supposed.

24bb. *Rinorea pubiflora* (Benth) Sprague & Sandwith var. ***grandifolia*** (Eichler in Martius) Hekking fo. ***andersonii*** (Sandwith ex Hekking) Hekking comb. nov. Figs. 34, 35.

Rinorea passoura (A. P. de Candolle ex Gingins in A. P. de Candolle) Kuntze var. *andersonii* Sandwith ex Hekking fo. *andersonii*, Phytologia 43(5): 479, pl. 3, fig. 13, 1979, nom. illeg. according to Code Art. 63. 1. Type. Guyana: Barima, opposite Anabisi Creek, 8 Apr 1945 (fl. juv fr), Fanshawe F 2463 (=FDG 5199 (holotype, K; isotypes, NY, P. U. US).

Rinorea passoura (A. P. de Candolle ex Gingins in A. P. de Candolle) Kuntze var. *grandifolia* (Eichler) Hekking fo. *andersonii* (Sandwith ex Hekking) Hekking, Phytologia 53(4): 258, 1983, nom. illeg. according to Code Art. 63.1.

Rinorea pulleana Melchior in Engler & Prantl. Nat.

Pflanzenfam. ed. 2: 21: 352. 1925. nom. nud.; Lemée. Fl. Guiane franç. 3: 60. 1953.

Racemose inflorescences (4.5–)10–11.5 cm long (usually longer and more laxiflorous than in var. *pubiflora*). Flowers white, creamy or yellow. Petals (4–)5–6.5 × 1.5–2 mm, usually longer than those of var. *pubiflora* and fo. *grandifolia*, 3–3.5 × as long as wide (versus 2.5 × in var. *pubiflora*). Seeds (3–)4–7 mm in diam., brownish pilosulous (versus glabrous in fo. *grandifolia*).

Distribution (Fig. 35) and ecology. The main area of distribution of fo. *andersonii* is predominantly more eastern than that of fo. *grandifolia*: Lower Amazonia of Brazil (Pará, Amapá), the Guianas and SE Venezuela (Bolívar), including the forest refugia: (a) Roraima-North, Guianas, Oyapock, Belém, and Imerí. Two disjunct populations occur in a far western area, amidst the area of fo. *grandifolia*, but still E of the Cordilleras: (b) Colombia, along the Vaupés, which is a western part of the forest refuge Imerí; (c) Colombia, forest refuge Villavicencio, situated between the Eastern Cordilleras and the Llanos.

The ecological amplitude is similar to that of var. *pubiflora*. It occurs from 0 to 500 m.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: COSTA RICA. SAN JOSÉ: Río Sucio, station Carillo, Parque Nacional Braulio Carillo, 25 Apr 1984 (bud. fl), *Sánchez et al.* 489 (CR, U).

COLOMBIA. META: Sierra de la Macarena. Río Sansa nr. junction with Río Guéjar, 22 Feb 1956 (fl, fr), *Idrobo & Jaramillo-M* 2059 (COL); Llano de San Martín, Río Meta, s.d. (fl, fr), *Karsten s.n.* (LE, W); ± 20 km SE of Villavicencio, 500 m, 17 Mar 1939 (fr), *Killip* 34268 (COL); Basin of Río Meta, 1851–1857 (bud, juv fr, *Triana s.n.* (G, K, NY, W), VAUPÉS: Riverbank of Río Inirida, vic. the village Sta. Rosa, 70°50'W, 220 m, 25 Jan 1953 (fr), *Fernández* 1975 (COL, US).

VENEZUELA. BOLÍVAR: Río Karún, tributary of Río Paragua, Apr 1943 (fl, juv fr), *F. Cardona* 483 (US, VEN 8730); Río Paragua between Guaiquinima and Río Torono, Aurukima nr. Río Lapo, 13 Apr 1943 (fr), *Killip* 37436 (LIL, NY, US, VEN 8724); above Salto de Para, 6°12'N, 64°15'W, ± 250 m, 22 May 1978 (fr), *Steyermark et al.* 117201 (U, VEN); Salto de Para, 170 m, 11 Mar 1939 (fl, fr), *Ll. Williams* 11498 (F, G, MICH, US, VEN 8728).

GUYANA: County W.W.D., Barama river, (Dec 1910) (fl, fr), *C. W. Anderson* 617 (K); Upper Rupununi River nr. Dadanawa, 2°45'N, 31 May 1922 (bud, fr), *de la Cruz* 1437 (F, HH, MO, NY, PENN); Pomeroon District, Pomeroon River, 14–20 Jan 1923 (fl, fr), *de la Cruz* 2991 (F, HH, MO, NY, PENN, UC, US); idem, 17–24 Dec 1924 (fl, juv fr), 3176 (F, HH, MO, NY,

PENN, UC, US); Pomeroon District, Kabakabari, 10–15 Feb 1923 (fr), *de la Cruz* 3297 (F, MO, NY, PENN, UC, US); Barima River opposite Anabisi Creek, 8 Apr 1945 (fl, fr), *Forest Dept. BG 2199* (= *Fanshawe* 12463) (K, NY, P, U, US); Essequibo River, opposite Kamuparu, 30 Oct 1937 (fr), *Forest Dept. BG 2548* (= *Fanshawe* F 14); Anapiakoro Creek, Pomeroon River, 24 Jan 1939 (fr), *Forest Dept. BG JB 2893* (FHO, K); Groete Creek, Essequibo River, 24 Apr 1944 (fl, fr), *Maguire & Fanshawe* 22942 (F, MO, NY, P, U, US, VEN).

SURINAM: Saramacca River, 15 Jul 1944 (bud, fr), *Maguire* 24122 p.p. (BR, K, NY).

FRENCH GUIANA: Nr. the river Arataya, tributary of the river Gouaigue, nr. the fall Saut Pararé, 4 Feb 1969 (fr), *de Granville* 22 (CAY, P); idem, 29 Oct 1978 (fl), *Sastre* 6253 (P, U); Camopi, Mt. Belvédère, 29 Nov 1984 (fr), *de Granville* 7069 (CAY, U).

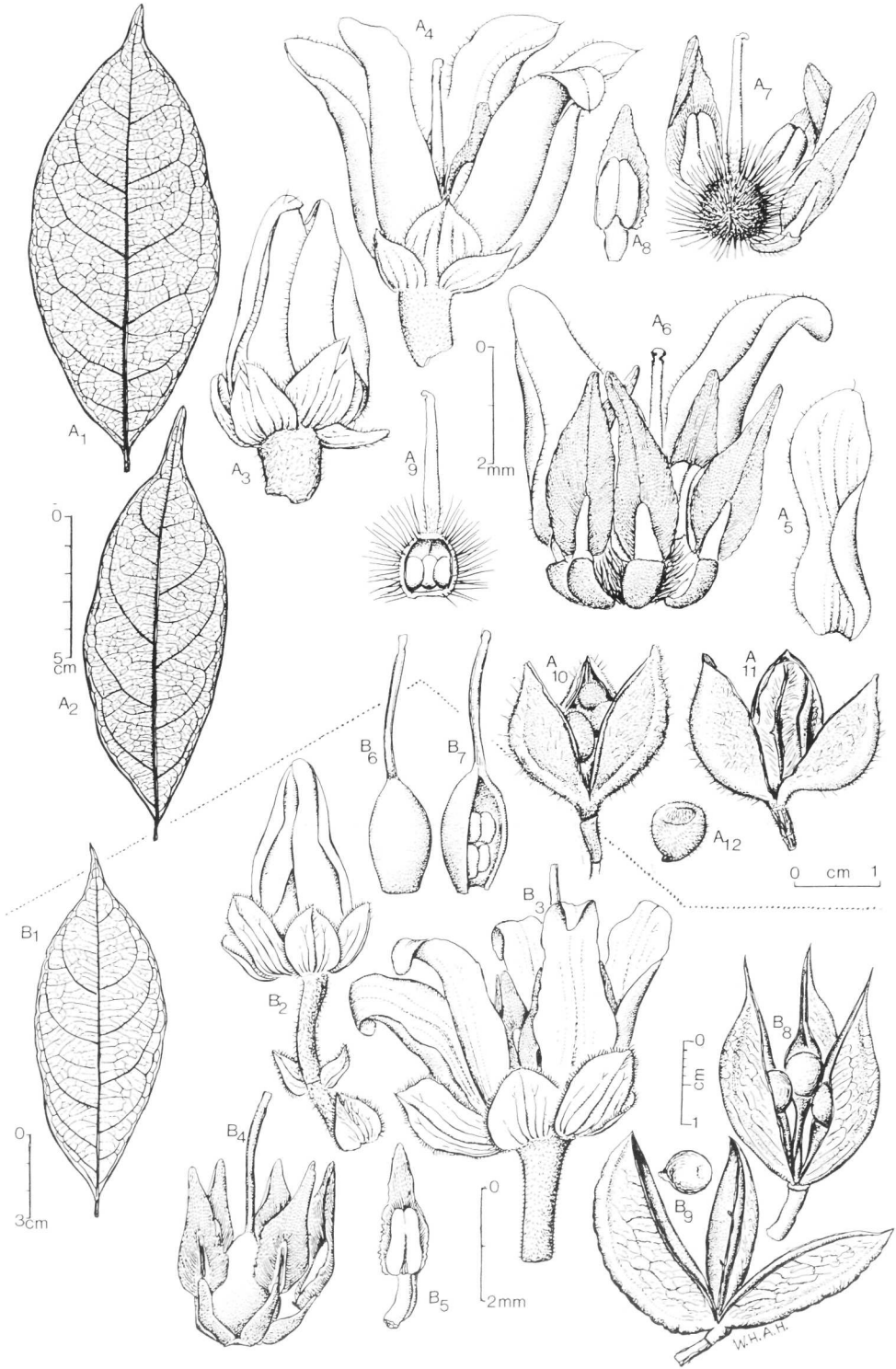
BRAZIL. AMAPÁ: Serro de Navio, Rio Amapari, 70–300 m, 31 Nov 1954 (juv fr), *Cowan* 38525 (NY, W); Rio Araguari, 2 Oct 1961 (fr), *Pires et al.* 51473 (NY). PARÁ: Rio Guamá, above Curém, Tembê, Jul 1953 (fl, juv fr), *J. M. Pires & N. T. Silva* 4617 (IAN, US).

Local names. Venezuela: Pata grulla (Bolívar); Pate de Paují (Bolívar); Guyana: Mamusaré.

Fo. *andersonii* differs from fo. *grandifolia* by having pilosulous seeds (versus seeds glabrous). Fo. *andersonii* much resembles var. *pubiflora* e.g., by its hairy seeds, but can be distinguished from the latter by the occurrence of floral parts, such as sepals, petals, reduced stamens or staminodes, subsistent at the base of the capsule (versus floral parts wanting in var. *pubiflora*).

Not only the petals, but also other floral parts in specimens of fo. *andersonii* tend to be larger than those of var. *pubiflora*. Leaves of fo. *andersonii* tend to be larger and longer tapering into the apex than those of var. *pubiflora*. The indument of fo. *andersonii* is less dense than in var. *pubiflora*. By these characters and by the smaller shape of the fruits, fo. *grandifolia* much resembles *R. falcata*. An introgressive hybridization of *R. pubiflora* with the complex of the three closely related species, *R. flavescens*, *R. falcata* and *R. camptoneura*, is supposed.

Triana and Planchon (1862) cited a specimen of *Alsodeia flavescens*, which originated from the Río Meta basin in E Colombia (however, without any indication of a collector). Under the citation of *A. flavescens*, a synonym, *Conohoria passoura* A. P. de Candolle (= *R. pubiflora*), has been added. The seeds have been described as pilosulous, whereas those of *R. flavescens* are glabrous. The cited specimen probably does not belong to *R. flavescens*, but to *R. pubiflora*. Because of the



note that the stamens did not produce pollen, we presume that this specimen belongs to var. *grandifolia*. Since its seeds have been described as pilosulous, we also conclude that it belongs to fo. *andersonii*. Identification of the specimen *Karsten s.n.*, collected on the same locality before 1862, also resulted in fo. *andersonii*.

The epitheton infra-specificum *andersonii* has been derived from *Rinorea andersonii* Sandwith, described in an unpublished handwritten manuscript of Sandwith joined to the specimen *Fanshawe F 2463 (=FDG 5199)* in the Kew Herbarium (K). Sandwith added a note to his handwritten description: 'Apparently a var. of *pubiflora*. Leaves longer acuminate, more strongly + intricately reticulate underneath. Sepals + Petals more glabrescent.'

Two different sizes of pollen grains in fo. *andersonii* were discovered by Dr. W. Punt during his analysis in 1974 (personal reference): (a) relatively small pollen in *P. H. Allen 3324*; the pollen grains have the same size as those of *Florschütz 191*, belonging to var. *pubiflora*; and (b) relatively large pollen in *Fanshawe F 2463*.

- 25. *Rinorea riana* Kuntze.** Revis. gen. pl. **1**: 42. 1891, 'Kunze,' according to Code Art. 72.1); Lemée. Fl. Guyane franç. **3**: 59. 1953; Smith & Fernández-P., *Caldasia* **6(28)**: 108. 1954. Type as *Riana guianensis* Aublet, 1775. Figs. 36A, 38.

Rinorea riana (A. P. de Candolle ex Gingins in A. P. de Candolle) Kuntze. Revis. gen. pl. **1**: 42. 1891. nom. illeg. according to Code Art. 63.1: Blake. Contr. U.S. Natl. Herb. **20(13)**: 503. 1924 p.p. (mixture of *R. riana* and *R. lindeniana* (Tulasne) Kuntze); Melchior in Engler & Prantl. Nat. Pflanzenfam. ed. 2. **21**: 352. 1925; Sandwith. Bull. Misc. Inform. **1929(2)**: 77. 1929.

Conohoria riana A. P. de Candolle ex Gingins in A. P. de Candolle. Prodr. **1**: 312. mid Jan 1824. nom. illeg. according to Code Art. 63.1: G. Don. Gen. hist.

1: 340. early Aug 1831 ('1831-1838') ('*Gonohoria*'). D. Dietrich. Syn. pl. **1**: 831. Jul 1839.

Conohoria riana (Aublet) Oldeman in Hallé. Oldeman & Tomlinson. Tropical Trees: 173. 1978. nom. illeg. according to Code Art. 63.1.

Alsodeia riana (A. P. de Candolle ex Gingins in A. P. de Candolle) Turczaninoff. Bull. Soc. Imp. Naturalistes Moscou **36(1)**: 557. 1863 ('*Alsodeja*'). nom. illeg. according to Code Art. 63.1.

Riana guianensis Aublet. Hist. pl. Guiane **1**: 237. t. 94. ('*Guyannensis*') 1775; Lamarck. Tabl. encycl. **1(1(2))**: pl. 135. fig. 1 a-i. 13 Feb 1792 ('1791'); Tabl. encycl. **2(4(2))**: 106 (nr 2734). 6 Nov 1797 ('1793'); Tabl. encycl. **2(4(2))**: 107 (nr 2735). 6 Nov 1797 ('1793') '*Conohoria*' p.p., only the cited synonym *Riana*; Poirét in Lamarck. Encycl. **6**: 196. 2 Oct 1804; Lanjou & Uittien. Recueil Trav. Bot. Néerl. **37**: 156 (no 76). 1940; Howard. J. Arnold Arbor. **64**: 282. 1983. Type. French Guiana: Aroura. s.d. (bud). *Aublet s.n.* (holotype. P [herb. Rousseau Denaiffe 5: 173, illustrated in Aublet. 1775: t. 94]; isotypes. BM [photograph BM 2312 A & B]).

Alsodeia prunifolia Sprengel. Syst. veg. ed. 16. **1**: 807. 1824 ('1825') ('*Alsodea*') nom. illeg. according to Code Art. 63.1); Eichler in Martius. Fl. bras. **13(1)**: 388. 1871 (as 'species dubia et excludenda'). Type as *Riana guianensis* Aublet, 1775.

Treelet 1-8 m tall. Branchlets purplish with large (usually) whitish callose lenticels, sparsely puberulous to glabrescent. *Leaves* apparently opposite; petioles (1-)2.5-10(-15) mm long, ferruginous or maroon pilosulous or puberulous when young, glabrescent when older; stipules deciduous, narrowly ovate, subobtuse to subacute, 3-3.5 × 0.75-1.5 mm, herbaceous to scarious, ferruginous strig(ill)ose, veined, ciliolate; lamina (narrowly) ovate to elliptic, cuspidate to acuminate, (4.5-)8-24.5 × (1.25-)3-8.75 cm, usually widest near 1/2 from the base, sometimes widest at 1/3 from the base; coriaceous; lamina, costa and lateral veins glabrous on both sides; lateral veins 8-13 pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate; margin subentire to subserrate or subcrenate, obscurely mucronulate; acumen (0.5-)1-3.5(-4) cm

FIG. 36. *Rinorea riana* (A₁ from Wullschlägel 1356; A₂ from Zaandam 6638. A_{1,2} from Gleason 9 (=391); A_{1,2} from Florschütz & Maas 2548; A_{1,2} from Maguire 40802). A_{1,2}, Leaves. A₃, Flower bud. A₄, Adult flower. A₅, Petal. A₆, Flower (inside), showing dorsal side of androecium, surrounding pistil. A₇, Pistil, with ovary "spiny" strigose, accompanied by three stamens. A₈, Stamen (ventral). A₉, Pistil, with l.s. of ovary, showing 3 × 1 placentation. A_{10,11}, Capsule, velutinous and sparsely pilose, dehiscing into three valves, showing seeds 3 × 1. A₁₂, Seed, pilosulous. B. *R. flavescens* (B₁ from Wullschlägel 830; B₂₋₄ from F. Cardona 2492; B₅ from F. Cardona 2783; B_{6,7} from Splitgerber 739). B₁, Leaf. B₂, Flower bud. B₃, Adult flower. B₄, Androecium (dorsal), surrounding pistil. B₅, Stamen (ventral). B₆, Pistil, completely glabrous. B₇, Idem, with l.s. of ovary, showing ovules 3 × 2. B_{8,9}, Capsule completely glabrous, with seeds glabrous.

long, apex subobtuse to subacute, obscurely mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, extremely rarely 2–4 fasciculate, racemose, (1.25–)5–14.5 cm long, laxiflorous; central axis sparsely ferruginous pilosulous; 'pedicels' (1.75–)3–4.5 mm long, articulate at $\frac{1}{2}$ – $\frac{3}{4}$ (– $\frac{1}{4}$) from the base, ferruginous pilosulous to puberulous; bracts and bractlets, deltoid, ovate or elliptic, herbaceous, ferruginous to golden pilose along the costa, veined, ferruginous to golden ciliolate, apex (sub)acute; bracts 1.5–1.75 \times , 0.75–1 mm; bractlets subopposite, 0.75–1.75 \times , 0.5–1 mm. *Flower buds* tolpoid. Flowers drooping, dirty yellowish-white when fresh, fragrant, drying to chocolate-brown. Sepals subequal, ovate, 1–2 \times 0.5–1.5(–1.75) mm, herbaceous, usually (sparsely) ferruginous to golden pilose(ulous) along the costa, 5–7(–9) veined, 5–7(–9) striate when dried, margin scarious and golden ciliolate, apex subacute. Petals narrowly ovate to deltoid, 3–5 \times 1.25–2 mm, herbaceous, costa sometimes sparsely ferruginous to golden pilose, margin sometimes sparsely golden ciliolate, apex (sub)obtuse. Stamens 2.75–3.75 mm long; filaments free, 0.5–0.75 \times 0.25–0.75 mm, glabrous; dorsal glands free, extremely rarely some of them fused with each other, adnate to the filaments, equaling or slightly longer or shorter than the filaments, (narrowly) ellipsoid to ovoid, (0.25–)0.5–1.5 \times 0.25–1 mm, carnos, slightly pilosulous to completely glabrous, apex free, obtuse, truncate or emarginate; anthers ovoid, 1.5–2 \times 0.5–1 mm, apex (sub)obtuse, unappendaged; connective outside (narrowly) deltoid to elliptic, (sub)obtuse, 0.75–1 \times ca. 0.25 mm, glabrous; connective scales lateral as well as apical, ovate, 2.25–2.75 \times 1–1.25 mm, scarious, maroon colored, margin (sub)erose, apex obtuse, suberose to subentire. Ovary subglobose, (0.5–)0.75–1.5 mm long and wide, 'spiny' hispid in combination with densely hispidulous, indument golden when young, maroon when older; ovules one to two per placenta. Style filiform, erect or slightly curved near the base, (1.25–)1.75–2.5 \times ca. 0.2 mm, exceeding the stamens usually by 0.25–0.5 mm, predominantly glabrous, pilosulous near the base; stigma truncate. *Capsule* symmetric, (ob)ovate to orbicular, acuminate, coriaceous to subligneous, pale green to maroon colored when fresh, velutinous in combination with sparsely pilose, indument maroon when

dried, venation orange to reddish-brown when fresh; valves three, equal, 1.5–2.75 \times 0.5–1 cm. *Seeds* one to two per valve, globose, 4–10 mm long, ferruginous hirtellous.

Distribution (Fig. 38) and ecology. *Rinorea riana* is widespread in the Guianas, Lower Amazonia (Brazil, Pará), Lower Basin of the Orinoco (Venezuela) and Trinidad. It is a fairly common undergrowth in primary rain forests in lowlands as well as in hilly or submountainous areas from 0 to 800 m, and also recorded from forests growing on C 2 Ore Body. Specimens in hilly areas have been collected on summits, rocky gullies and slopes. Also occurs along rivers, streams and creeks. In lowlands it inhabits uninundated areas such as river dunes and ridges as well as periodically inundated areas, in granitic, schistic, ferrobauxitic, clayish or sandy soils.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: VENEZUELA. BOLÍVAR: Estación Magdalena, 15 km NE of the Río Grande, tributary of the Orinoco, 290 m, 18 Feb 1959 (fr), *Bernardi 7120* (G, MER); Reserva Forestal la Paragua, Feb 1970 (bud), *Blanco 748* (VEN); 20–23 km SW of Monteco on rd. to San Pedro de las Dos Bocas, 7°10'N, 62°55'W, \pm 200 m, 1–3 Aug 1978 (juv fr), *Liesner & A. C. González 5882* (MO, U); Represa Curi, 1–5 km S of Dam, islands and W side river, 7°45'N, 63°00'W, 220–240 m, 1 Apr 1981 (fr), *Liesner & A. C. González 11113* (MO, U); 30 km S of El Manteco, N of Ríos Hacha & Supamo, SE of Los Patos, 9 Aug 1960 (fr), *Steyermark 87029* (NY, VEN 62805); Sierra Itamaca, Río Toro (Río Grande), between Río La Reforma and Puerto Rico, N of El Palmar, 200–250 m, 11 Dec 1960 (fr), *Steyermark 87883* (NY, VEN 61552); Altiplanicie de Nuria, E of Miami, Hato de Nuria, 500–600 m, 16 Jan 1961 (fr), *Steyermark 88575* (NY, VEN 61549); Rd. El Dorado–Sta. Helena de Ibairen km 38, Pica de Penetración, 230 m, 30 Aug 1957 (fr), *Trujillo 3640* (MY); Guyapo, Baja Caura, 200 m, 14 Apr 1939 (fr), *Ll. Williams 11816* (MICH, US, VEN). BOLÍVAR–DELTA AMACURO: Río Grande (Río Toro), 8°4'N, 61°44'W, 320 m, 10 & 14 Apr 1964 (fl, fr), *Breteler 3762 & 3806* (MER, U, VEN). DELTA AMACURO: ESE of Los Castillos de Guayana, \pm 8°30'N, 62°20'W, 50–200 m, 28 Mar–2 Apr 1979 (fl, fr), *Davidse & A. C. González 16.425* (MO, U); E of Río Grande, ENE of El Palmar, nr. border of Bolívar State, 23 Jan 1965 (fr), *Marcano Berti 633* (F, NY, US, VEN); Río Guyubuni, Cerro La Paloma, Sierra Imatata, 100–200 m, 16 Nov 1960 (fr), *Steyermark 87551* (HH, NY, UC, VEN 61536) & 87562 (MO, NY, VEN 61534). LOWER ORINOCO: Eleanora Creek, May 1886 (1885) (fr), *Rushy & Squires 129* (BM, F, G, HH, K, M, MICH, MO, NY, PENN, UC, US, VEN, Z).

TRINIDAD: Teteron Bay, 11 Mar 1920 (fr), *Britton*

496 (HH, NY, US); Arima. 16 Feb 1846 (fr). *Crueger* 5903 & s.n. (K).

GUIYANA: F of Itany + 50 km S of Mackenzie. 15 Jan 1955 (fr). *Cowan* 39233 (K, NY, US); Rupununi River, Simuri Creek. 7 Aug 1931 (fl. fr). *Forest Dept. BG 2118* (=D 127) (K); Corantyne, s.d. (fl). *herb. A. F. M. Glaziou* 125 (P); Tumatumari. 18 Jun–8 Jul 1921 (fl. fr). *Gleason* 9 (=391) (HH, K, NY, US); Corantyne River, Epira. Nov 1879 (fl. fr). *Jenman* 125 & 126 (K); Essequibo River, Groete Creek, Kanuni Creek. 27 Mar 1944 (fr). *Maguire & Fanshawe* s.n. (NY, US); Kartabu Point, 5 Aug 1933 (bud, juv fr). *C. R. & R. C. Mell* 210 (US); N.W. District, 8 km S of Matthews Ridge, White Creek, 30 Aug 1976 (juv fr). *Mori et al.* 8244 (NY, U); Essequibo River, Moraballi Creek, nr. Bartica, ±5 m, 6 Sep 1929 (fl. fr). *Sandwith* 180 (K, MY, U); Cuyuni River, below the Akaiio falls, 20 Nov 1929 (fl). *Sandwith* 633 (K); Essequibo River, Labbakabra Creek, Tiger Creek. 23 Aug 1937 (bud). *Sandwith* 1182 (K, NY, U); W extremity of Kanuka Mt. in drainage of Takutu River. 650 m. 4–22 Mar 1938 (fr). *A. C. Smith* 3196 (B, F, G, HH, K, LE, LIL, MO, NY, P, U, US); NW Portion of Kanuku Mt., Mt. Iramaikpang, 650 m. 22–23 Apr 1938 (juv fr). *A. C. Smith* 3675 (B, F, G, HH, K, LE, LIL, P, S, U, US, W); Cuyuni River, Camaria Falls, 30 Jul 1933 (fl). *Tutin* 432 (BM, K, U, US).

SURINAM: Between Gansé and Kabel, 14 Apr 1915 (fl. fr). *BW* 384 (=Stahel) (U); Brownsberg, 400 m, 12 Jun 1915 (fl). *BW* 588 (=Stahel & Gonggrijp) (U); Marowijne distr., Nassau Mts., 400–550 m, 31 Dec 1954 (fr). *Cowan & Lindeman* 39030 (G, NY); idem, 1 Jan 1955 (fr). 39087 (MO, NY, W); between Brokopondo and Berg en Dal, 10 Aug 1966 (fl). *van Donselaar* 3520 (U); Avannavero falls, David falls, Kabalebo, tributary of Corantyne River, 20 Apr 1951 (fl). *Florschütz* 2215 (U); Bakhuis gebergte, between Kabalebo and Coppename, 12 Dec 1964 (bud, juv fr). *Florschütz & Maas* 2313 (U); Upper Coppename, Raleigh Falls, 6 Sep 1961 (fl. fr). *Hekking* 978 (U); s.l., s.d. (fl). *Hostmann & Kappler* 243 (BM, C, CGE, F, G, HH, K [herb. Benthamianum & Hookerianum], LE, M, P, W); s.l., 1843_m (fl). *Hostmann* 1026 (G); s.l., 1842_m (fl). *Hostmann & Kappler* 1126 (F, G, K [herb. Benthamianum & Hookerianum], LE, MO, P, W); Wilhelmina Gebergte, 3 km S of Juliana-top, 12 km N of Lucie Rivier, 275 m, 30 Jul 1963 (fl). *Irwin et al.* 54491 (COL, F, K, U, Z); Emmaketen, Toekoemoetoe Creek, 25 Jul 1959 (bud). *Jonker & Daniels* 748 (U); Rikanau, Moengo, 16 Mar 1961 (bud. fr). *Kramer & Hekking* 3126 (U); Railroad Paramaribo–Dam, vic. Sect. O, Nov 1941 (fl, juv fr). *Krukoff* 12333 (HH, LIL, NY); Upper Coppename, Raleigh Falls, 11 Sep 1933 (fl). *Lanjouw* 774 (U); Nassau gebergte, 11 Mar 1949 (bud). *Lanjouw & Lindeman* 2583 (NY, U); Lely mountains, SW plateau, 550–710 m. 20, 22 Sep–1, 2, 3 Oct 1975 (fl. fr). *Lindeman, Stoffers et al.* 108, 171, 635, 679 & 731 (U); Railroad nr. Kabel, 21–26 Jul 1950 (bud). *LBB* 3023 = 3029 (=Doeve) (U); 2 km N of Blanche Marie Falls, Upper Nickerie, 19 Jun 1965 (fl. fr). *LBB* 10897 (=Maas & Tawjoeran) (U); Marowijne, Nassau Mts., 400–550 m, 12 & 14 Mar 1955 (fr). *Maguire* 40797 (NY, S) & 40802 (F, NY, P, RB, U); Rikanau Hill, Moengo, 17 Mar

1955 (fr). *Maguire* 40814 (MICH, NY, UC); Distr. Saramacca, Coppename River upstream Kaaimanston, 26 Jun 1954 (bud). 4 *M. W. Mennega* 150 (U); Brownsberg, Mazaroni Plateau, 90 km S of Paramaribo, 24 Sep 1976 (juv fr). *Mori & Bolten* 8398 (NY, U); Lely Mts., 175 km SSE of Paramaribo, 500–700 m, 16 Oct 1976 (fr). *Mori & Bolten* 8510 (NY, U); Upper Saramacca River, Summit of Stofbroeckoe Mt., 500 m, Aug 1957 (fl). *Schulz* 8046 (U); Blauweberg, May 1838 (fl). *Splitgerber* 878 (L); Upper Nickerie River, Blanche Marie Falls, 18–19 Sep 1900, *Tulleken* 330 & 334 (L); idem, Falla Watra, 11 Sep 1900, *Tulleken* 467 (L); idem, Stondosi Falls, 8 Dec 1962 (fl, juv fr). *Wessels Boer* 316 (U); Para, Topibo, s.d. (fl). *Wullschlägel* 1356 (BR, W); Upper Suriname River, Pl. Victoria, s.d. (fr). *Wullschlägel* 1357 p.p. (BR, W); Brownsberg, 18 Sep 1924 (fl, juv fr). *Zaandam BW* 6638 (U).

FRENCH GUIYANA: Confluence of Creek Marouina with Sinnamary River nr. Petit Saut, 14 Feb 1979 (fr). *Cremers* 5422 (CAY, U); Grégoire, coastal region between St. Laurent and Cayenne, 28 Jan 1972 (fr). *Deward* 148 (CAY, P, U); Oyapock, riverbank of Yaroupi, S of Sautes Couéki, 10 Apr 1970 (fr). *de Granville* 308 (CAY, P); Tumac-Humac, Mitaraka S, ±1 km SW of Summit, 600 m, 17 Aug 1971 (juv fr). *de Granville* 1283 (CAY, P); N of Pic Matecho, 30 km NE of Saül, 550 m, 22 Jan 1980 (fr). *de Granville* 3372 (CAY, U); Summit of Tabulaire, 50 km S of Saül, 450 m, 24 Aug 1980 (juv fr). *de Granville* 3599 (CAY, U); Region of Haute Armontabe (Lower Oyapock), Summit of Piton Central, 22 Feb 1981 (fr). *de Granville* 4364 (CAY, U); Summit of NE part of Mts. de la Trinité, 6 Aug 1981 (fr). *de Granville* 4788 (CAY, U); Tumac-Humac, Brazilian border, Upper Maroni, 400 m, 26 Aug 1972 (fl). *de Granville* B-4476 (CAY, P, U); Upper Oyapock, Trois Sauts, 29 Jul 1975 (fl). *Grenand* 1088 (CAY, U); Upper Maroni, Creek Petit Tamouri, 26 Mar 1974 (fr). *Lescure* 216 (CAY); Rd. St. Elie, SW of Sinnamary, Mar 1980 (fr). *Lescure* 889 (CAY, U); Karouany (Cacarouany) (Acarouany), 1854 (fl, juv fr). *Mélinon* 41 (K [herb. Hookerianum 1867], NY, P, S); Riverbanks of the Maroni, 1861 (fl, fr). *Mélinon* 197 p.p. (BM, P); Comté, between Roche Fendée and Bélizon, 21 Jul 1965 (fr). *Oldeman* 1453 (CAY); River Icoube, E of River Mana, 11 Aug 1966 (fl). *Oldeman* 2195 (CAY); River Arataye, tributary of Approuague, 3 Feb 1969 (fr). *Oldeman* 2923 (CAY); River Comté, Creek Galibi, 22 Jul 1967 (fl). *Oldeman* B-1121 (CAY); River Sinnamary, Courcibo, 7 Aug 1967 (fl). *Oldeman* B-1171 (CAY); River Kourou, 12 Sep 1967 (fl, juv fr). *Oldeman* B-1307 (CAY, P); Upper Oyapock, Yaroupi River, Saut Tainoua, 17 Apr 1970 (fr). *Oldeman* B-3013 (CAY); River Grand Inini nr. Saut Equerre, 18 Aug 1970 (fr). *Oldeman* B-3152 (CAY); First fall of River Eureupoucigne, tributary of Upper Oyapock, 22 May 1970 (fl). *Oldeman* T-797 (CAY); Sauts Pararé, river Arataye, tributary of Approuague, 25 Nov 1978 (fr). *Poncy* 172 (P); Saül, circuit Belvédère, 30 Jun 1978 (fr). *Prévost* 269 (CAY, U); Acarouany (=Karouany), 7 May 1855, 1857 (fl). *Sagot* 33 (P [herb. Sagot]); Antecum Pata, River Itani, 17 Jul 1972 (juv fr). *Sastre* 1396 (P); Tumac-Humac, Layon Point de Trijonction

Mitarka, 400 m, Aug 1972 (bud), *Sastre 1608* (CAY, P); Upper Maroni, Itany, Antecum Pata, 23 Apr 1975 (fr), *Sastre & Moretti 3906* (P, U); Creek Margot, E of St. Laurent, 26 May 1955 (fr), *Service Forestière BAF-OG 7052* (P).

BRAZIL-FRENCH GUIANA: Placier de Caserven, 1898 (bud), *Geay s.n.* (P).

BRAZIL, AMAPÁ: Serro do Navio, Rio Amapari, 70–300 m, 16 Nov 1954 (fr), *Cowan 38338* (BM, G, NY); riverbank of Rio Villa Nova, 8 Nov 1976 (juv fr), *Ribeiro 1649* (INPA, NY, U). PARÁ: Pargominas-Belém 10 km, 2°51'S, 47°34'W, 140 m, 10 Jan 1976 (fr), *Bamps 5112* (BR, U); Ruropolis Presidente Medici, 4°00'S, 55°04'W, 25 Jan 1976 (fr), *Bamps 5238* (BR, U); Santarém-Ruropolis km 103, 3°15'S, 55°00'W, 200 m, 27 Jan 1976 (fr), *Bamps 5256* (BR, U); Tumuc Umaque, Rio Parú de Oeste, Missão Tiriyo, 2°20'N, 55°45'W, 20 Feb 1970 (fr), *Cavalcante 2439* (MG, NY, U); Bão Vista on Rio Tapajós, May–Jun 1929 (fl, juv fr), *Dahlgren & Sella 85* (F, US); ± 55 km from Tukurui, 4°03'S, 49°54'W, 11 Dec 1981 (juv fr), *Daly et al. 1302* (INPA, NY, U); Serra de Carajós "Azul," vic. Serra Norte, 5°59'S, 50°28'W, 8–12 Dec 1981 (fr), *Daly et al. 1929* (INPA, NY, U); Almirim, 9 Apr 1903 (fr), *Ducke 3449* (MG, RB); Mapuera, above Castanhal, 7 Dec 1907 (juv fr), *Ducke 9065* (MG); Rio Cumunã, Castanhal, Lago Salgado, 24 Nov 1970 (juv fr), Rio Tocantins, Jatobá, 17 May 1951 (bud), *Froes 27112* (COL, IAN); Region of Amapú, Rio Pracupí, Portel, 1 Jun 1956 (fl), *Froes 32799* (COL, IAN); Rio Itacayuni, 14 Jun 1949 (bud), *Froes & Black 24486* (COL, IAN); Rio Capim, 16 Mar 1949 (fr), *Froes & Murça Pires 24112* (COL, IAN); Tapajós River Region, Fordlandia, Sep 1931 (fr), *Krukoff 1025* (BM, G, HH, K, MICH, MO, NY, P, S, U); Hwy. Belém-Brasília, 17 Aug 1959 (fl, fr), *Kuhlmann & Jimbo 28* (SP); Rios Pacaja and Muirapiranga, SW of Irla de Breu, 2°33'–50'S, 50°38'–40'W, 23 Sep 1965 (fr), *Prance et al. 1456* (COL, NY); idem, 3 Oct 1965 (juv fr), *1525* (F, K, NY, U); Belém-Brasília Hwy. km 93, 5 Aug 1963 (fr), *Maguire et al. 56010* (NY, U); Transamazonian Hwy. BR 230, 90 km NE of Itaituba, 29 Nov 1977 (fr), *Prance et al. P-25850* (INPA, NY, U). RORAIMA: Posto Macajá, Rio Macajá, 16 Mar 1971 (juv fr), *Prance et al. 11023* (INPA, NY, U).

S.L.: s.d. (fl). *Anonymous s.n. in herb. J. E. Smith ex herb. Linnaei filii s.n.* (LINN).

Local names. Venezuela: Caspadillo (=Gaspadillo) (marrón) (Amacuro, Amazonas, Bolívar), Molinillo (Bolívar), Pata grillo/grullo (Bolívar), Pata paují (Bolívar); Guyana: Mamusaré (Arawak language), Shero (Wapisiana language), Shipiye (Macusi language); Suriname: Boembi kiridia (Aucan language), Lèlè(-tiki) and Manari(e)-tiki(e) (local Creole names); French Guiana: Boumbikidia (Aucane language), Ouagnon (Oyampi language), Pacumleima, Riana = Riane (Carai language in Aublet, 1775). Brazil (Maranhão): Pywa'y-hu.

Uses: The local Creole name in Surinam "Manari-tiki" means that branchlets and twigs can be used for making sieves.

Rinorea riana is characterized by combination of the following characters: (1) its predominantly maroon indument (when dried); (2) branchlets with large callose lenticels, which are larger and less numerous than in *R. brevipes* (dried branchlets of both species are usually purplish with whitish lenticels); (3) leaves, costa and lateral veins glabrous on both sides, just as in *R. flavescens*; domatia are wanting; (4) ovaries and juvenile fruits erect 'spiny' hispid in combination with densely hispidulous (its indument is initially straw-yellow, but soon turns to maroon [when dried]); and (5) its capsule velutinous in combination with scarcely pilose (its indument is maroon [when dried]).

Dried flowers turn chocolate-brown, whereas those of most of the other species in this subgroup turn orange.

In two specimens, *Jonker & Daniels 772a* from Surinam and *Froes 32799* from Brazil, some of the dorsal glands adnate to the filaments are fused with each other, which is exceptional in this species.

Rinorea riana has often been confused with *R. lindeniana*, although the species are quite different (cf. Melchior, 1929). Some striking errors in preceding studies are given below: (1) both species were described separately by Blake (1924). The description and material studied of *R. lindeniana* are correct. The description of *R. riana* is a mixture of both species, the type specimen belongs to *R. riana* and the additional specimens to *R. lindeniana* var. *lindeniana*; (2) specimens from Venezuela identified and cited by Knuth (1928) as *R. riana*, appear to belong to *R. lindeniana* var. *lindeniana*; and (3) specimens from Colombia cited by Smith and Fernández-P. (1954) as *R. riana* belong to both varieties of *R. lindeniana* and to *R. viridifolia*. The description of *R. riana* given by the two latter authors refers also to a mixture of *R. riana* and *R. lindeniana*, just as in Blake (1924).

26. *Rinorea flavescens* (Aublet) Kuntze, Revis. gen. pl. 1: 42. 1891; Reiche & Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. 1. 3(6): 329. 1895; Blake, Contr. U.S. Natl. Herb. 20(13): 507. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352. 1925; Sand-

with, Bull. Misc. Inform. **1931(4)**: 172. 1931; Baehni & Weibel, *Candollea* **8**: 193. May 1941; in Machride, Publ. Field Mus. Nat. Hist. Bot. Ser. **13(4(1))**: 59. 30 Jun 1941; Lemée, Fl. Guyane franç. **3**: 60. 1953; Smith & Fernández-P., *Caldasia* **6(28)**: 107. 1954.

Figs. 36B, 38.

Conohoria flavescens Aublet, Hist. pl. Guiane **1**: 239. t. 95. 1775; Lamarck, Encycl. **2(1)**: 96. 16 Oct 1786; Tabl. encycl. **1(1(2))**: pl. 135, fig. 2a–d. 13 Feb 1792 ('1791'); Tabl. encycl. **2(4(2))**: 107. (nr 2735). 6 Nov 1797 ('1793') '*Conohoria*' Aublet p.p. (*Passoura* Aublet & *Riana* Aublet excluded); Poirlet in Lamarck, Encycl. **5**: 47. 9 Jan 1804 p.p. (*Passoura* Aublet excluded); Schultes in Roemer & Schultes, Syst. veg. ed. 15. **5**: 234. 1819 p.p. ('*Passura*' excluded); Languet & Uittien, Receuil Trav. Bot. Néerl. **37**: 150. (no 18). 1940 ('*Conorea*'); Hallé, Oldeman & Tomlinson, Trop. trees forests: 173. 1978; Howard, J. Arnold Arbor. **64**: 266. 1983. Type. French Guiana: 'In forests of Sinnamary ('Sinémari'), ca. 60 km S. of the Atlantic coast,' s.d. (fl Sep), Aublet s.n. (holotype, P [herb. Rousseau-Denaiffe **5**: 172, also illustrated in reverse in Aublet, 1775: t. 95]; isotype, BM [photo BM 2313], MO).

Alsodeia flavescens (Aublet) Sprengel, Syst. veg. ed. 16. **1**: 806. late 1824 ('1825') '*Alsodea*' p.p. (synonym *Passoura guianensis* Aublet excluded); Bentham, J. Bot. (Hooker) **4**: 106. 1842 p.p. (synonym *Conohoria passoura* A. P. de Candolle ex Gingins excluded); Triana & Planchon, Ann. Sci. Nat. Bot. Sér. **4**. **17**: 126. 1862 p.p. (*Conohoria passoura* A. P. de Candolle ex Gingins and *Passoura* Aublet excluded); the description refers to *R. pubiflora* (Benth.) Sprague & Sandwith and the cited specimens under the observation to *R. pubiflora* var. *grandifolia* fo. *andersonii*; Eichler in Martius, Fl. bras. **13(1)**: 386. 1871 p.p. (*Conohoria passoura* A. P. de Candolle ex Gingins excluded); Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München **20**: 185. 1891 ('1890').

Tree or *treelet* 1–20 m tall. Branchlets often purplish when dried, sparsely golden puberulous to appressed pilose when young, glabrescent to completely glabrous when older. *Leaves* apparently opposite, occasionally ternate; petioles 3–14 mm long, golden hirtellous when young, glabrescent to completely glabrous when older; stipules deciduous, narrowly deltoid, subobtuse to subacute, 0.25–2.25 × 0.5–1.5 mm, herbaceous, golden pilosulous, golden ciliolate; lamina ovate, acuminate to cuspidate, 5–20 × (1.25–)2–2.75 cm, papery; lamina, costa and lateral veins glabrous on both sides; domatia wanting; lateral veins (7–)8–11(–12) pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate; margin subentire to (sub)crenate or

(sub)serrate, obscurely mucronulate; acumen 0.5–2.5(–3) cm long, apex subacute to subobtusely mucronulate. *Inflorences* axillary, lateral and subterminal, solitary, racemose, (3–)5–13 cm long; central axis often purplish and shining when dried, golden hirtellous to glabrescent; 'pedicels' 2–6 mm long, articulate near the middle, golden hirtellous, glabrescent; bracts and bractlets ovate to deltoid, herbaceous, often golden strigillose near the apex of the costa, glabrescent, golden ciliolate, apex obtuse to (sub)acute; bracts 1–1.5 × 0.75–1.25 mm; bractlets subopposite 0.5–1 × 0.5–0.75 mm. *Flower* buds ovoid, obtuse. Flowers pendulous, creamy or yellow, fragrant. Sepals unequal, herbaceous, mostly glabrous, occasionally minutely golden pilosulous, 5–7 veined, margin scarious and golden ciliolate; outer sepals ovate to deltoid, 1–1.5 mm long and wide, apex obtuse; inner sepals (ob)ovate to orbicular, 1.5–3.5 × 1–2 mm, apex rounded. Petals (narrowly) ovate, 3.25–5 × 1–2 mm, herbaceous, glabrous, sometimes golden ciliolate near the apex, apex obtuse. Stamens 2.75–4 mm long; filaments free, 0.75–1 × ca. 0.3 mm, glabrous; dorsal glands free, adnate to the filaments, sometimes wanting on some of the filaments, narrowly ellipsoid to obovoid, 0–1 × 0–0.3 mm, carnosely glabrous, apex free, (sub)obtuse, sometimes emarginate; anthers ovoid to ellipsoid, 1–1.75 × 0.5–1.25 mm, glabrous, apex of the thecae obtuse, unappendaged; connective outside narrowly deltoid, subobtuse, 0.75–1 × ca. 0.25 mm, glabrous; connective scales lateral as well as apical, ovate, 2–3 × 0.75–1.75 mm, scarious, orange-brown, margin suberose to subentire, apex obtuse. Ovary globose to conical, 1–1.5 × 0.5–1.25 mm, usually glabrous, rarely with some scattered golden pilosulous hairs; ovules two per placenta. Style filiform, erect 2–3 × ca. 0.25 mm, exceeding the stamens by 0.2–0.3(–0.5) mm; stigma truncate. *Capsule* more or less symmetric, ovoid to ellipsoid, acuminate, coriaceous to subligneous, green and flushed brown when young, becoming reddish when older, usually reddish-brown to purplish when dried, usually glabrous, occasionally sparsely golden pilosulous, veined; valves three, subequal, 1.5–2.5(–3) × 0.4–0.8 cm. *Seeds* two per valve, extremely rarely one, globose, 5–6 mm in diam., glabrous.

Distribution (Fig 38) and *ecology*. Mainly spread over Amazonia (Brazil, Venezuela, Colombia, Ecuador, Peru), adjacent Upper Orinoco

area and the Guianas. A disjunct population occurs in NW Colombia, N and W of the eastern Cordilleras, including the forest refugia: Chocó, Nechí, and Santa Marta.

It is common in the understory of primary and secondary tropical rain forests from sea level up to submountainous areas, from 0 to 700 m. Specimens have been collected on hill slopes, in gullies and along rivers, streams and creeks. Along rivers in lowlands it inhabits uninundated areas as river dunes and ridges as well as periodically flooded areas. It grows in quartzitic, bauxitic, ferro-lateritic, clayish or sandy soils, mostly deficient in such nutrients as P, Ca, K, Mg, Cu, B, Mn, Zn, but with a high percentage of Al (*Monsalve* 278, Colombia, Valle del Cauca).

Phenology. Flowering and fruiting throughout the year.

Representative specimens examined: COLOMBIA. AMAZONAS: Río Miriti-paraná, Caño Guacayá, 0°30'S, 70°40'W, 200 m, 2–8 Mar 1952 (fl. fr), *Schultes* 15774 (HH, US); AMAZONAS-VAUPÉS: Río Apaporis between el Río Pacoa and Río Kananari, 250 m, 17 Jun 1951 (fl), *Schultes* 12627 (US). CHOCÓ: Río Ciego, 17 Jun 1967 (fr), *J. A. Duke* 13298 (4) (U). VALLE: Río Cajibambra, Pacific Coastal area, 5–80 m, 24 Apr 1944 (fl), *Cuatrecasas* 17060 (COL, F); idem, 5–15 May 1944 (fr), 17486 (F, G); Bajo Calima, Concesión Buena-ventura, 3°55'N, 77°W, 100 m, 30 Aug 1984 (fl), *Monsalve-B* 278 (MO, U). VAUPÉS: Mitú, 280 m, 22–30 Jun 1958 (fr), *García Barriga et al.* 16092 (COL); between Wacaricuara and el Varador along Río Yi, 9–12 Dec 1952 (fl), *Romero-Castañeda* 3920 (COL).

VENEZUELA. AMAZONAS: Río Sipapo between Sipapo and Raudal del Danto, May 1971 (fr), *Blanco* 1284 (VEN). APURES: 23 km NE of Puerto Ayacucho, 5°51'N, 67°25'W, ca. 90 m, 20 Apr 1978 (fl. juv fr), *Davidse & O. Huber* 15.374 (MO, U); Atabapo, Río Cunucunuma between Culebra and Huachamacari, vic. Cerro Duida, 3°40'N, 65°45'E, 180–200 m, 28 Jan–26 Feb 1982 (fl), *Steyermark et al.* 125693 (U, VEN). BOLÍVAR: Vic. Río Icabaru and Río Hacha, 30 Oct 1955 (fr), *Bernardi s.n.* (NY); Río Caroni, nr. mouth of Tiriká, 400 m, May 1945 (fl), *F. Cardona* 1167 (NY, US, VEN); Río Icabarú, tributary of Río Caroni, 500 m, 6 Aug 1947 (bud), 2148 (VEN); idem, 6 Aug 1947 (bud), 2151 (VEN); Río Curuta, Alto Barague, 550 m, Apr 1958 (fl. fr), 2492 (VEN); Río Chicanán, Alto Guyuni, 170 m, Feb 1949 (fr), 2783 (VEN).

GUYANA: Demerara River, 27 Feb 1910 (fr), *C. W. Anderson* 562 (K); Makauria Creek, Essequibo River, 8 km N of Bartica, 23 Jul 1950 (fr), *Fanshawe in Forest Dept.* F 520 = 3256 (K, NY); Upper Mazurini district, Fillipui, 24 Jul 1957 (fr), *Forest Dept.* RB 59 = 7883 (K, NY); Canja River in county Berbice, 16 Dec 1914 (fr), *Hohenkerk* 638 (=G 10) (K); Upper Demerara River, Sep 1887 (fl), *Jenman* 4251 (K); Demerara River, Nov 1888 (fl), *Jenman* 4935 (K); idem, Jun 1889 (fl), 5034 (BM, K); Kurupung, Upper Ma-

zuruni River, 29 Nov 1922 (fr), *Leng (& Persaud)* 262 (F, NY); Hope, Jun 1924 (fr), *Persaud* 9 (F, K, MO, NY); Makreba Falls, Kurupung, Upper Mazuruni River, 24 Feb 1939 (fr), *Pinkus* 262 (F, NY); Moraballi Creek nr. Bartica, Essequibo River, 14 Sep 1929 (fl. fr), *Sandwith* 225 (K, NY, U); s.l. 1837 (fl), *R. H. Schomburgk* 119a (US); s.l., s.d. (fl), *R. H. Schomburgk* 336a (BR, CGE, F, G, HH, K, US, W).

SURINAM: Marowijne, Upper Cottica, Patamarca River, 21 Nov 1967, *Boerboom* 69 (= LBB 12254), (U); Zanderij I, 9 Jul 1917 (fl), *Tree number* 194-Z-I, *BW* 2984 (U); Saramacca, Watramiri, vic. Zanderij, 30 Oct 1919 (bud), *Tree number* W'm 1510, *BW* 4437 (U); Zanderij I, 26 Nov 1919 (juv fr), *Tree number* 194-Z-I, *BW* 4458 (U); Rikanau Hill, 26 Dec 1954 (fl. fr), *Cowan* 38968 (F, NY, US); vic. Moengo, Cottica River, 26 Dec 1954 (fr), *Cowan* 38984 (F, NY, U, US); 20 km SW of Avanavero, Kabalebo, 13 Nov 1976 (fl), *Heyde & Lindeman* 55 (U); s.l., 1842 (fl), *Hostmann & Kappler* 1144 p.p. (LE, S); Upper Maratukka River, 25 May 1965 (fl), *Maas & Tawjoeran* LBB 10869 (BBS, U); Tafelberg Creek, 5 Oct 1944 (fr), *Maguire* 24894 (BR, F, G, MO, NY, P, RB, U, UC, US, VEN); vic. Moengo, Cottica River, 19 Mar 1955 (fr), *Maguire* 40817 (BM, K, NY, RB); Blauweberg, 12 Mar 1838 (fr), *Splitgerber* 739 (L); Kwakoegron, Saramacca, Jan 1945 (fr), *Stahel* 244a (B, HH); Paramaribo, s.d. (bud), *Weigelt s.n.* (W); Upper Nickerie, 8 Dec 1962 (fl), *Wessels Boer* 319 (U); Upper Surinam, 1851 (fl), *Wullschlägel* 830 (?) (BR); Berlijn, s.d. (fr), *Wullschlägel* 1693 (U).

FRENCH GUIANA: S.d. (fl. fr), *Aublet s.n. in herb.* A. L. de Jussieu 12.797 + A (P); St. Laurent du Maroni, s.d. (fr), *BAFOG Service Forestière* 7104 (U); s.l., s.d. (fr), *BAFOG (?)* 7244 (U); s.l., 1871 (?) (fr), *herb. Barbier* (P); Charvein, 5 Jan 1913–1914 (fr), *Benoist* 486 (P); idem, 20 Jan 1914 (fl), 682 (P); idem, 20 Jan 1924 (fr), 683 (P); Road Cayenne–St. Laurent PK 185, 8 Oct 1979 (fl), *Cremers* 5940 (CAY, U); Cayenne, s.d. (bud, fr), *Desfont s.n.* (C); Grégoire, 16 May 1972 (juv fr), *Deward* 209 (CAY); SE of St. Laurent, Rd. of Paul Isnard, 7–8 km after side rd. of Apatou, 7.11.1982 (fr), *Fournet* 294 (CAY); Maroni, 1891, *Gandoger s.n.* (P); vic. St. Georges de l'Oyapock, 30 Mar 1981 (bud), *Grenand* 1976 (CAY, U); Cabaret Creek, St. Georges de l'Oyapock, 19 Dec 1978 (fr), *Lescure* 78 (CAY 779, U); Cayenne, s.d. (fl. fr), *Martin s.n.* (BM, P); Cayenne, s.d. (fr), *herb. Martius* (BR); Banks of Maroni, 1861 (?) (fr), *Mélinon* 230 (K); Koisoa Idemacousiá, 1842 (?), (bud), *Mélinon* 279 (P); River Approuague, Maripa, 1 Feb 1967 (fr), *Oldeman* 2416 (CAY, U); River Approuague nr. first rapid of Creek Matarony, 21 Mar 1967 (fl), *Oldeman* B-1000 (P); River Oyapock, Creek Armentabo 2 km upstream from mouth, 4 Jul 1969 (fl), *Oldeman* B-2434 (CAY); St. Laurent, Creek Balotie, 30 Nov 1948 (fr), *Service des Eaux et Forêts* 4344 (P, U); vic. Mana, 19 Dec 1965 (fr), *Service Forestière* 7104 (P).

ECUADOR. PASTAZA: Curaray (Jesús Pitisha), ca. 200 m, 20 Mar 1980 (fl), *Harling & Andersson* 17554 (GB, U).

PERU. AMAZONAS: Caterpiza, 200 m, 3 Sep 1979 (fl), *Huashik* 335 (MO, U); Río Santiago, 2–3 km from Caterpiza, 65 km N of Pinglo, 3°30'S, 77°40'W,

17 Nov 1979 (fl), *Huashikat 1317* (MO, U); idem. 28 Nov 1979 (fl), *1412* (MO, U); idem. 19 Feb 1980 (fr), *2122* (MO, U); idem. 23 Nov 1979 (fr), *Tunqui 132* (MO, U); idem. 4 Jan 1980 (fr), *558* (MO, U). LORETO: Vic. Llago Llanchuma nr. Río Nanay, 2°27'S, 73°51'W, 2 Aug 1972 (fr), *Croat P-18699* (MO, U); Maynas, Río Nanay, Mishana, 30 km SW of Iquitos, 17 Aug 1980 (fr), *Foster 4367* (MO, U); Maynas, Río Momón, vic. Iquitos, 120 m, 12 May 1978 (bud), *Gentry et al. 21.725* (MO, U); Mishuyaca nr. Iquitos, 100 m, 24-28 Sep 1929 (fl), *Killip & A. C. Smith 29981* (F, RB 3919); Yurimaguas, Mar 1831 (?) (bud), *Poeppig 2324-B* (W); Maynas, Río Nanay, Lupuna, 17 Dec 1976 (fr), *Revilla 2063* (MO, U).

BRAZIL. AMAPÁ: S.L., 12 Sep 1955 (fl, juv fr), *Miranda Bastos 55* (COL, INPA, RB, U). AMAZONAS: Manaus, 14 Nov 1955 (fl, fr), *L. F. Coelho INPA 2896* (COL, INPA, MG); Manaus, 1877-1878 (fl), *Jobert 448* (P); Manaus-Humaita Rd., km 672, 19 Sep 1980 (fl), *Lowrie et al. 123* (INPA, NY, U); Río Tiquié, basin of Uaupés, 8.5.1945 (fr), *Nunes Pereira s.n.* (MG 30287); Tefé, s.d. (fl), *Poeppig 2137 p.p.* (G, LE, P, W); Manaus, Igarapé da Cachocira Alta do Tarumá, 8 Nov 1962 (fl), *W. Rodrigues & Chagas 4739* (INPA 13.265, U); idem. 10 Oct 1965 (fr), *5681* (= *Xil. no. X-2095*) (INPA 14393, U); Manaus, Estrada Torquado-Tapajós, km 106, 16 Jan 1962 (fl), *W. Rodrigues & Loureiro 7160* (INPA 15.822, U); Serra Acará, 24 Feb 1977 (fl), *N. A. Rosa & Cordeiro 1636* (INPA, NY); Manaus, 1877 (fl), *Schwacke 448* (R 79.802). PARÁ: Jungle nr. I.A.N., Belém, 30 May 1944 (fl), *Baldwin 4027* (US); San José de Laranjeira, s.d. (fl), *Burchell 9864* (BR, HH, K, LE, P); Belém, forest Rodrigues Alves, 24 May 1949 (fl), *T. Guedes 160* (R 103.967); Rd. Belém-Brasília, km 92, 26 Aug 1959 (fl), *Kuhlmann & Jimbo 127* (SP); Rd. Belém-Brasília, 27 Nov 1959 (fl), *Oliveira 166* (COL, INPA); E. F. B. Sta. Isabel, 5 Feb 1909 (fr), *Pessoal do Museo Goeldi MG 10168* (MG); Mun. Benevides, ca. 30 km N of Belém, 24 Jan 1980 (fr), *Plowman et al. 8061* (NY, U); vic. Cachoeira km 96, rd. BR 22 from Belém to Gurupí, 30 Oct 1965 (bud, fr), *Prance & Pennington 1842* (COL, F, K, NY, U); Rd. BR 22 from Capanema to Maranhão, 5 Nov 1965 (fr), *Prance & Pennington 1979* (COL, F, K, NY, U); Rd. BR 22, km 98, vic. Cachoeira, 22 Aug 1964 (fr), *Prance & N. T. Silva 58809* (F, K, NY, U, UB); Rd. from Belém to Bosqueiro, 13 Mar 1968 (fr), *Sastre 131* (P); Rio Captim, Putiritá, 20 Feb 1882 (fl, fr), *Schwacke III-156 p.p.* (GOET, R 79.804); On lands of I.A.N., Belém, 31 Jan 1944 (fl, juv fr), *A. Silva 69* (F, K, US); Paragominas, Rio Uraim, rd. Belém-Brasília, 19 Jan 1966 (fl, fr), *M. Silva 458* (MG 31.483); Jari, rd. of Munguba, km 14, 9°04'S, 36°11'W, 16 Jun 1969 (fl), *N. T. Silva 2205* (INPA, NY, U); Peixeboi, Bragança, 15 Jul 1907 (fl), *Siquiera 8297* (MG, RB 21.371); 12 Oct 1961 (fl), *W. Rodrigues & Lima 3431* (INPA 122, U). RIO DE JANEIRO (cult): 28 Dec 1878 (fl), *Glaziou 10086* (= 1086) (C, K, P, R 7414).

S.L.: s.d. (fl), *Rudge s.n.* (BM); s.d. (fl), *Smith ex herb. Linnaei f. s.n.* (LINN).

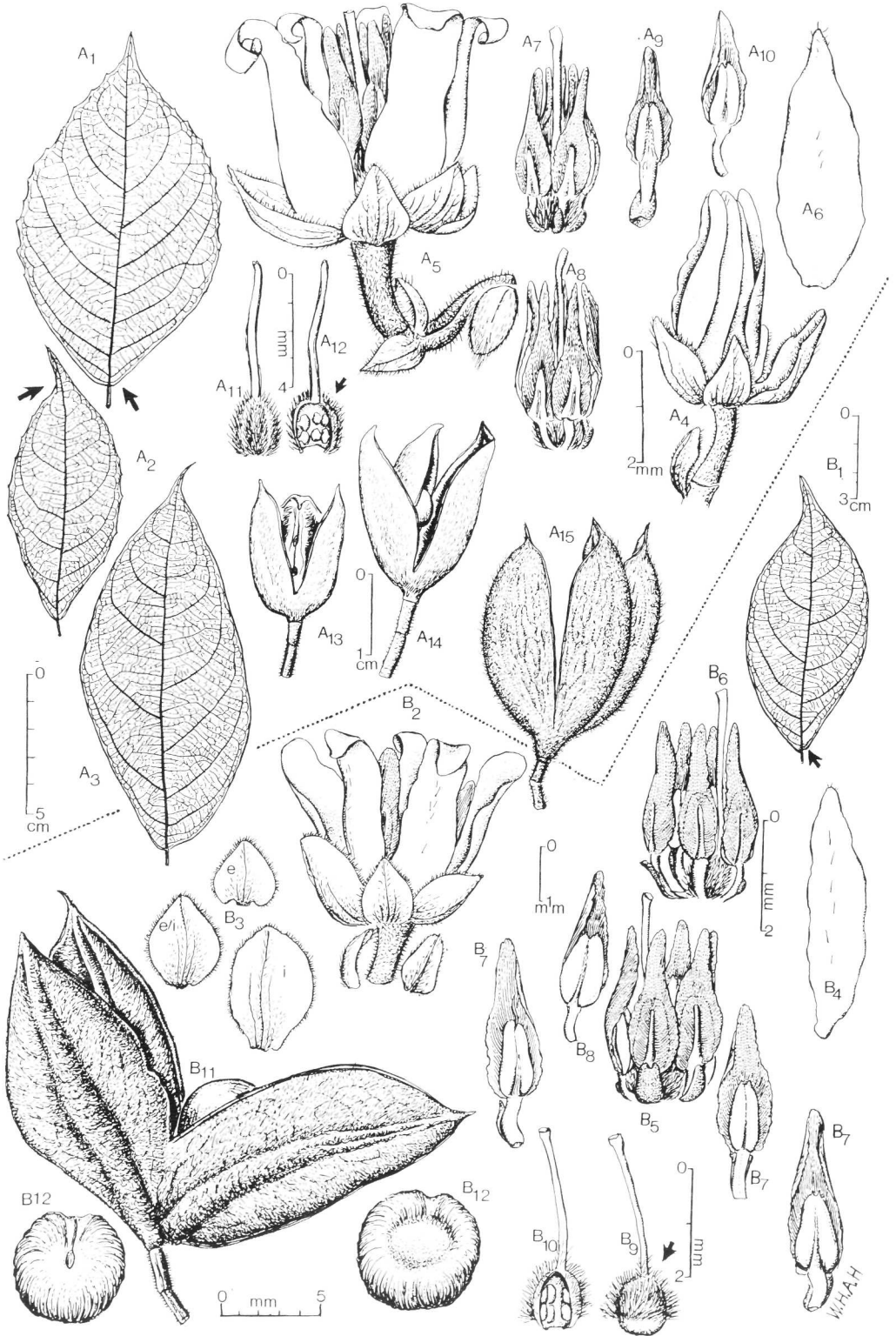
Local names. Colombia: Oo-má-hé-o (Amazonas, Tanimuku language), Palo duro (Vaupés),

Doi-Yo-ki (Vaupés, Kubeo language); Venezuela: Kurumota and Kurun-mota-yek (Bolívar, Arakuna language near Río Caroni); Guyana: Baridi (=Barudi) kut(ch)i (=Chicken hawks foot, Arawak language), Ifa-kut(ch)i (=Duck's foot, Arawak language), Mamusaré (Arawak language), Sheró (Wapisiana language), Shipiyé (Macusi language); Surinam: Akami(e) Koerraré (Caraib language), Akarnie eknoerarsi (Caraib language), Bar(r)ikoet(j)i, Baririkoti and Baririkuti (=Chicken hawks foot, Arawak language), Dreeritiki, Drilitiki, Driritiki (local Creole language), Drilstokje (Surinam Dutch), Gankikisè (Saramacca language), Koerraré (Caraib language), Lèlè and Lèlè-tiki (local Creole language), Mamoeoemmi(e), Mamoeoemni, Namoeoemmi and Namuduni (Saramacca language); French Guiana: áyú (Wayápi language), Barririkoti, Bois lèlè (local Creole language), Boubikidia (Aucan and Paramaka language), Conohorie and Conori (Caraib language, Aublet (1775)), Lèlè-tiki (local Creole language), Pareban Kamwi, Pare Banwi (Oyapock river); Brazil: Canela de Garça (Amapá); Jacamin renepeá (Pará); Perú: Takit (Amazonas, Huambisa language), Tsachira kumpari (Amazonas and Loreto, Huambisa language), Yutabanco (Loreto).

Uses: The Surinam names Dreeritiki, Drilstokje, Drilitiki and Driritiki indicate that branchlets are used for stirring drinks (see under *R. pubiflora*).

This species belongs to a complex of three closely related species, *Rinorea flavescens*, *R. falcata* and *R. camptoneura*. In *R. flavescens* the ovary is glabrous (or nearly so), whereas those of the other two species are densely hairy. Only *R. camptoneura* has domatia on the under side of the leaves. Their differences are discussed in more detail under *R. falcata*.

Rinorea flavescens has often been confused with *R. pubiflora* by various 19th century authors, because they did not know the differences between the species. This confusion results from the fact that Aublet (1775) described *Conohoria flavescens* only from flowering specimens and *Passoura guianensis* (= *R. pubiflora*) only from fruiting specimens. Therefore most of these authors united both taxa under the name of one or the other of the two species. Bentham (1842) tried to unravel this confusion by describing a new species *A. pubiflora* based on specimens of *R. H. Schomburgk 573* and by enumerating the



other one as *A. flavescens* with the two collections *R. H. Schomburgk 119 & 336*, of which both, however, consisted of a mixture of *R. flavescens* and *R. pubiflora* (sic!). The description and illustration of *A. flavescens* in Oudemans (1867a, 1867b) and probably also the cited specimen *Martin s.n.* refer rather to *R. pubiflora* than to *R. flavescens*. Further confusion was caused by Grisebach (1861) ('1864') citing *A. flavescens* as occurring in Trinidad, based on the specimen *Crueger s.n.* (=5903?), which actually belongs to *R. riana*.

27. *Rinorea falcata* (Martius ex Eichler in Martius) Kuntze, Revis. gen. pl. 1: 42. 1891; Blake, Contr. U.S. Natl. Herb. 20(13): 511. 1924; Sandwith, Kew Bull. 1955(3): 372. 1955.

Figs. 37A, 38.

Alsodeia falcata Martius ex Eichler in Martius, Fl. bras. 13(1): 386. 1871 p.p. (var. *grandifolia* Eichler excluded); Radlkofer Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 185. 187. 1891 ('1890'). Type. Brazil. Amazonas: Rio Japurá, s.d. (fr), *Martius s.n.* (lectotypus novus, M [97]; isotypes, M [98, 99, 101] these numbers are written on small labels attached to the specimens).

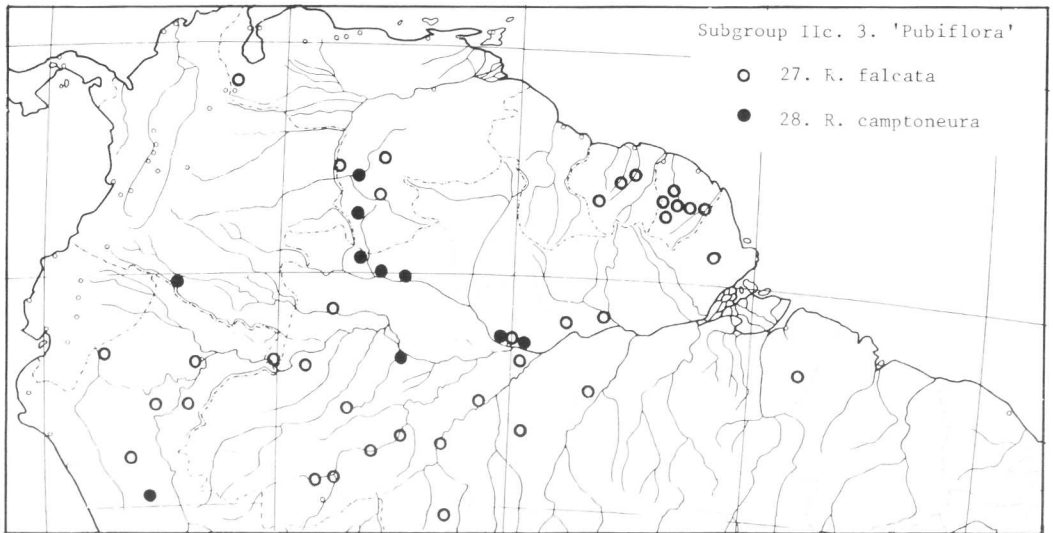
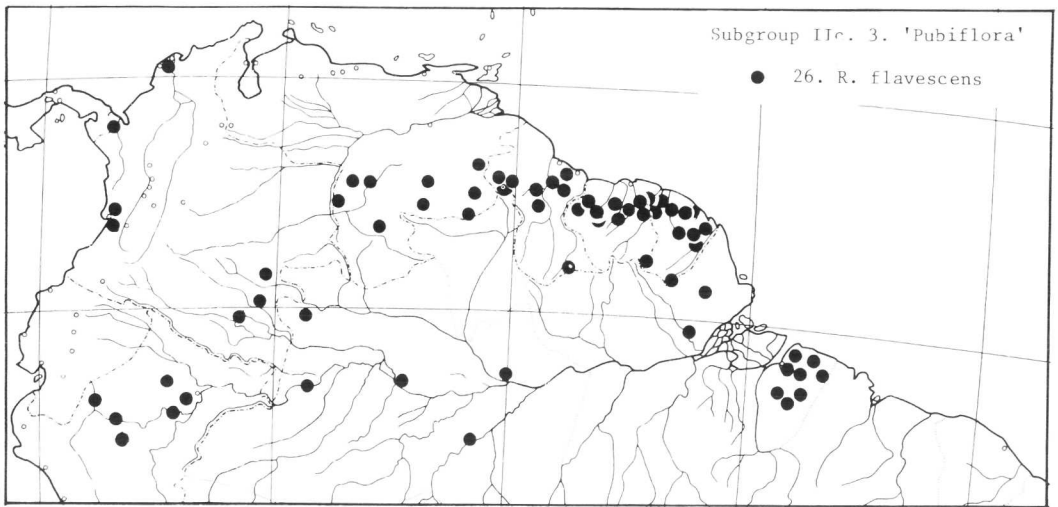
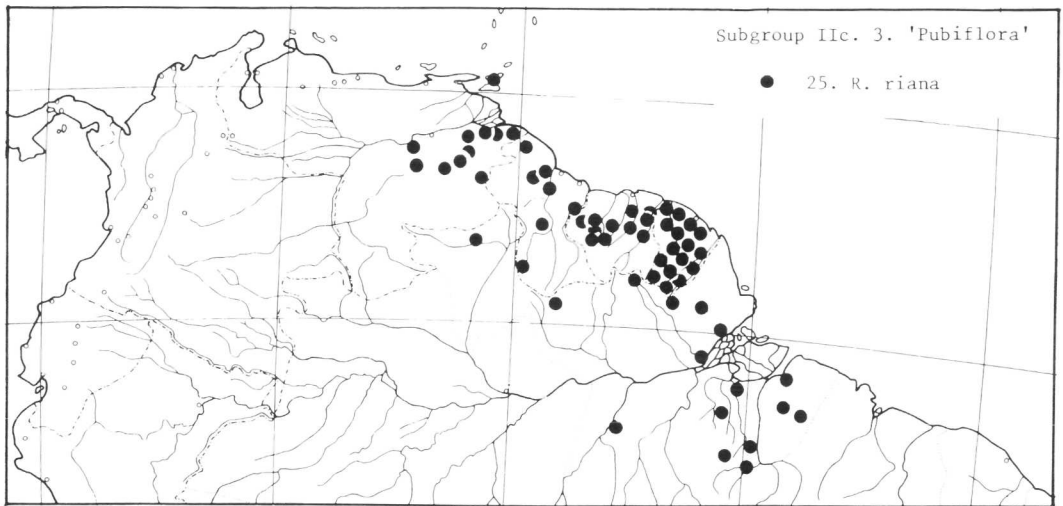
Alsodeia guianensis (Aublet, 'Passoura guianensis') Eichler var. *parviflora* Eichler in Martius, Fl. bras. 13(1): 387. 1871. Type: Suriname: Nr. river Lava (Lawa), s.d. (fl), *Kappler 2111* (lectotypus novus, L; isotypes, GOET, L, P, W).

Rinorea surinamensis Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352. 1925, nom. nud.; Notizbl. Bot. Gart. Berlin-Dahlem: 10(96): 546. 1929. Typus ineditus in herb. *Kappler 2111* (GOET, L, P, W).

Tree or treelet, 1.5–10 mm tall. Branchlets golden hirtellous when young, glabrescent when older. Leaves apparently opposite, occasionally ternate; petioles 4–10 mm long, golden hirtellous

above, glabrescent beneath; stipules deciduous, narrowly deltoid, subacute, 1–1.25 × ca. 1 mm, herbaceous, golden strigillose, golden ciliolate; lamina (narrowly) elliptic to (ob)ovate, acuminate to cuspidate, 4.5–18.5 × 1.5–8 cm, papery, glabrous on both sides; costa golden pilosulous above when young, glabrescent when older, sparsely golden strigose to glabrescent beneath; domatia wanting; lateral veins 9–11 pairs (acumen excluded), glabrous on both sides; tertiary venation reticulate; base rounded to cuneate, often slightly asymmetric and oblique as well as slightly obtuse to subcordate at the petiole; margin subcrenate to subentire; obscurely mucronulate; acumen 1.5–2 cm long, erect to falcate, apex subobtuse to subacute, mucronulate. Inflorescences axillary, lateral and subterminal, solitary, racemose, 8–12.5 cm long; central axis golden hispidulous; pedicels 3–4 mm long, articulate near the middle, golden pilosulous; bracts and bractlets ovate, herbaceous, golden strigillose, ciliolate, subobtuse; bracts 1–1.25 × ca. 1 mm; bractlets subopposite, 0.75–1 × ca. 0.75 mm. Flower buds ovoid to tolpoid, obtuse. Flowers pendulous, greenish, yellow or yellowish-white. Sepals unequal, ovate 1.25–2.5 × 1–1.5 mm, herbaceous, appressed golden pilosulous along the median part, with 5–9(–11) veins, margin scarious and golden ciliolate, apex obtuse. Petals narrowly ovate, 4–5 × 1.75–2.25 mm, herbaceous, glabrous or nearly so, margin sometimes golden ciliolate, apex obtuse. Stamens 2.75–3.5 mm long; filaments free, 0.75–1 × ca. 0.25 mm, glabrous or nearly so; dorsal glands free, adnate to the filaments, sometimes one of them wanting, (narrowly) ovoid to ellipsoid, 0.5–0.75 × 0.3–0.4 mm, glabrous, apex free, (sub)obtuse; anthers ovoid, (0.6–)1–1.5 × 0.4–0.8 mm, glabrous, apex

FIG. 37. A. *Rinorea falcata* (A₁ from *Martius s.n.* (101); A₂ from *Martius s.n.* (97), lectotype; A₃ from *Martius s.n.* (99), isotype; A_{4–12} from *Farinas et al.* 603; A_{13–14} from *Martius s.n.* (98), isotype; A₁₅ from *Rudge 14* (?)). A_{1–3}, Leaves. Leaf obtuse at the very base, apex falcate. A₄, Flower bud. A₅, Adult flower, with bract and bractlets. A₆, Petal, slightly pilosulous. A₇, Androecium (dorsal), surrounding pistil, filaments provided with dorsal glands. A₈, Idem, two filaments without dorsal glands. A₉, Stamen, provided with dorsal gland (ventral). A₁₀, Stamen without dorsal gland (ventral). A₁₁, Pistil with a strigillose ovary. A₁₂, Idem, with l.s. of ovary, showing ovules 3 × 2. A_{13,14}, Younger capsules with appressed pilosulous indument, glabrous seeds 3 × 2. A₁₅, Older capsule, dehiscing into three valves. B. *R. camptoneura* (B₁ from *Spruce 1069*; B_{2–11} from *Ll. Williams 14992*; B₁₂ from *Spruce s.n.*). B₁, Leaf. B₂, Adult flower. B₃, Sepals unequal (e = exterior [=outside], i = interior [=inside], e/i = in between). B₄, Petal, sparsely pilosulous. B₅, Androecium (dorsal), surrounding pistil: three filaments with distinct dorsal glands, one with a reduced dorsal gland. B₆, Idem, one filament with and one without a reduced dorsal gland. B₇, Stamens with dorsal glands (ventral). B₈, Stamen without dorsal gland (ventral). B₉, Pistil: ovary villose. B₁₀, Idem, with l.s. ovary, showing ovules 3 × 2. B₁₁, Capsule, dehiscing into three subequal valves. B₁₂, Glabrous seeds.



of thecae obtuse, sometimes appendaged by 1–2 set(ul)ae or 1–2 cusps, up to $1 \times 0.1\text{--}0.2$ mm; connective outside narrowly ovate-obtuse, ca. $0.75 \times 0.25\text{--}0.5$ mm, glabrous; connective scales lateral as well as apical, ovate, $2\text{--}2.5 \times 0.6\text{--}0.9$ mm, scarious, orange-brown, margin (sub)erose, apex obtuse. Ovary subglobose, ca. $1 \times$ ca. 0.75 mm, yellowish-white, golden or ferruginous strigose; ovules two per placenta. Style filiform, erect, $2.25\text{--}2.75 \times$ ca. 0.2 mm, exceeding the stamens by $(0\text{--})0.25\text{--}0.5$ mm, completely glabrous, rarely sparsely pilosulous near the base; stigma truncate or subclavate. *Capsule* more or less symmetric, ovoid, acuminate, coriaceous to subligneous, greenish-yellow when young, appressed olive to golden pilosulous, usually orange-brown to purplish when dried, veined; valves three, subequal, $1.5\text{--}2 \times 0.4\text{--}0.8$ cm. *Seeds* two per valve, globose, 4–5 mm in diam., glabrous.

Distribution (Fig. 38) and ecology. *Rinorea falcata* is widespread over Amazonia (Brazil, N Peru), Upper Orinoco area and the Guianas (except Guyana, although to be expected there). The species is also disjunct in the forest refuge Apure just on the southern slopes of the Cordilleras of W Venezuela. It is common in the understory of primary and secondary tropical rain forests, where it has been collected on slopes of hills and mountains, from 75 to 475 m, in gullies and along rapids, creeks, streams and rivers. Along rivers in lowlands the species inhabits uninundated as well as periodically inundated areas, on granitic, rocky or clayish soils.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: COLOMBIA, AMAZONAS: Leticia, 13 Oct 1946 (fl). *Black 46-193* (COL).

VENEZUELA, AMAZONAS: Atures, Siquita, E Bank of the Río Orinoco, $4^{\circ}13'N$, $67^{\circ}47'W$, 90 m, 28 Apr 1979 (fr). *Davidse et al. 16.816* (MO, MYF, U); Upper Orinoco, La Esmeralda, $3^{\circ}25'N$, $65^{\circ}40'W$, Jan–Feb 1969 (fl). *Farinas et al. 603* (VEN 77.882); Upper Orinoco, between Esmeralda-savanna and SE base of Cerro Duida, 200 m, 22 Aug 1944 (fr). *Steyermark 57790* (F, NY). TACHIRA: Sierra El Casadero between Las Dantas and Las Adjuntas, $7^{\circ}45'N$, $72^{\circ}25'W$, 12 Nov 1979 (fl, fr). *Steyermark et al. 120155* (MO, U).

SURINAM: 4 km SW of Juliana-top in the Wilhelmina Gebergte, 10 km N of Lucie River, 325 m, 31

Aug 1963 (fr). *Irwin et al. 55175* (U); s.l., 1862 (fl). *Kappler 145* (L); idem, 1842 or 1844? (fl). *1144 p.p.* (F, G, L, P, W); Armina, Sep 18 (fl). *Kappler 2110* (L, P, W); vic. River Lawa, Nov 18. (fl). *Kappler 2111* (L, P, W); Brokopondo, Natural Park Brownsberg, 470 m, 12 Apr 1981 (bud). *Tjon Lim Sang & Ketner U1S 16487* (BBS, U).

FRENCH GUIANA: River Mana, 26 Aug 1981 (bud). *Cremers 7331* (CAY, U); Upper Maroni, 1877 (bud, fr). *Crévaux s.n.* (P); Riverbank of Inini just before Bicade, 20 Aug 1970 (bud), de *Granville 579* (P); Saul, 20 Dec 1975 (juv fr), de *Granville 2746* (CAY, U); Riverbank Arataye, Rapid of Pararé, River Approuague, 15 Aug 1977 (fl). *Sastre 5671* (P); Maroni, s.d. (bud). *Wachenheim 24* (HH, P).

PERU. AMAZONAS: Valle del Río Santiago, 65 km N of Pinglo, Quebrada Caterpiza, 200 m, 12 Dec 1979 (fr). *Huashikat 1517* (MO, U) & 4 Feb. 1980 (fr). *1950* (MO, U); AMAZONAS-LORETO: Mouth of Río Santagio, s.d. (fl). *Tessmann 4163* (NY, US); LORETO: Maynas, vic. mouth of Río Momon, 130 m, 3 Feb 1978 (fr). *Diaz & Jaramillo 66* (F, MO, U); Road to Nauta-Iquitos, 3 km from Nauta, $4^{\circ}30'S$, $73^{\circ}32'W$, 140 m, 27 Jun 1979 (fr). *Diaz & Jaramillo 1226* (MO, U); Maynas, upper Río Nanay above Sta. María de Nanay, ca. 150 m, 25 Mar 1979 (fr). *Gentry et al. 26269* (MO, U); Fundo Balcon, Río Momon, vic. Iquitos, 7 Jul 1961 (fr). *Mathias & Taylor 5441* (F, UC); Fundo Palencia, N of Requena, 19 Jul 1961 (bud). *Mathias & Taylor 5601* (F); Coronel Portillo, Aguaytía, 245 m, 18 Oct 1972 (fl). *Schunke Vigo 5415* (NY, U); Margarita, Requena, 233 m, 17 Apr 1964 (fr). *Schunke Vigo 6410* (F); La Victoria on the Amazon River, Aug–Sep 1929 (fl). *Ll. Williams 2712* (F), *2961* (F). LORETO–SAN MARTÍN: Vic. Aguaytía, 1 Jul 1960 (fl, fr), *Mathias & Taylor 5091* (F).

BRAZIL. AMAPÁ: Rio Araguari, $1^{\circ}11'N$, $52^{\circ}8'W$, 28 Sep 1961 (juv fr). *Pires et al. 51283* (NY). AMAZONAS: Itaituba–Humaita km 7, $7^{\circ}37'S$, $60^{\circ}38'W$, 13 Feb 1976 (fr). *Bamps 5412* (BR); BR 174 Manaus–Caracarái km 56, 8 Aug 1979 (fl). *Cid et al. 19* (INPA, NY, U); basin of Rio Solimões, São Paulo de Olivença, nr. Palmares, 11 Sep–26 Oct 1936 (fl). *Krukoff 4908* (F, NY), *8067* (G, HH, K, LE, MICH, MO, NY, P, S, U, US) & *8219* (BM, G, HH, K, LE, MICH, MO, P, S, U, US); Manaus–Humaita Rd. km 500, 17 Sep 1980 (fl). *Lowrie et al. 59* (INPA, NY); s.d. (fl). *Martius s.n.* (M 104); Basin of Rio Purus, 2 km S of Lábrea, 1 Nov 1968 (fr). *Prance et al. 8161* (INPA, NY, U); Rio Purus, Rio Ituxi, vic. Boca do Curuquete, 9 Jul 1971 (fr). *Prance et al. 14053* (*Uw 19062*) (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, S, U, US, VEN); idem, 19 Jul 1971 (fr). *14415* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, S, U, US, VEN); Rio Cunhuá at Deni Indian village, $6^{\circ}43'S$, $66^{\circ}47'W$, 28 Nov 1971 (fr). *Prance et al. 16436* (INPA, NY, P, U); Manaus, 6 Nov 1959 (fr). *W. Rodrigues & D. Coelho 1363* (INPA, U); Tefé, 17 Nov 1959 (fl). *W. Rodrigues & L. F. Coelho 1141*; Maués, Rio Paranari, Alucujá,

FIG. 38. Distribution of species of *Rinorea* Subgroup IIc.3. 'Pubiflora' (conclusion).

7 Dec 1961 (fr), *W. Rodrigues & L. F. Coêlho* 3928 (INPA 40.493, U); Rio Negro, Tapuruquara, 22 Jan 1978 (fr), *Steward et al.* 468 (INPA, NY, U); Rio Purus, Barreiras de Maniwa, 29 Sep 1874 (fl), *Traill* 20 (F, P); idem, 29 Sep 1874 (fl), *s.n.* (K); Rio Purus Icobal, 10 Oct 1874 (fl), *Traill s.n.* (K); Upper Amazon and tributaries, March 1875 (fl), *Traill s.n.* (HH). PARÁ: Itaituba-Humaita km 210, 13 Feb 1976 (fr), *Bamps* 5372 (BR); Mun. Oriximiná, Rio Paeu de Oeste, 4 Sep 1980 (fl), *Cid et al.* 2036 (INPA, NY, U); Upper Rio Purus, Porto Alegre, 8 Apr 1904 (fr), *J. Huber* 4389 (MG); Rio Trombetas, Serra de Onça, 70 m, 7 Jul 1980 (bud), *Martinelli* 7298 (INPA, NY, RB 20425, U); São Domingo do Capim, 4°10'S, 48°10'W, 18 Jun 1978 (fl), *N. A. Rosa* 2414 (INPA, NY). RONDÔNIA: Rd. to Belmonte, Igipare Agua Bão, 05.09.2975 (fr), *Cordeiro* 742 (NY).

Local names: Surinam: Manari-tiki; Peru: Canilla de Vieja (Loreto); Takit (Amazonas, Huambisa language).

Uses: The local Creole name in Surinam means that branchlets and twigs can be used for making a sieve.

This species belongs to the complex of three closely related species, *Rinorea flavescens*, *R. falcata* and *R. camptoneura*. The sepals are more unequal than in any other species of neotropical *Rinorea*; their seeds are glabrous, a character shared with *R. brevipes* and *R. pubiflora* var. and fo. *grandifolia*. Their habit, their inflorescences and their flowers are so similar that these species can easily be confused with each other. In *R. flavescens* the branchlets, petioles, leaves, petals, stamens, ovary, style, capsules and seeds are completely glabrous (or nearly so), whereas *R. camptoneura* is more hairy in its habit. *Rinorea falcata* is intermediate in this respect. The differences between these species can be circumscribed as follows: (1) domatia present only in *R. camptoneura*; (2) leaf base symmetric in *R. flavescens* and slightly oblique in *R. camptoneura*; in *R. falcata* just in between; (3) sepals of *R. flavescens* and *R. camptoneura* more unequal than in *R. falcata*; (4) sepals of *R. flavescens* scarious and those of *R. camptoneura* herbaceous; sepals of *R. falcata* are herbaceous with the margin scarious; (5) sepals of *R. flavescens* glabrous or nearly so, but in *R. camptoneura* and *R. falcata* appressed pilosulous; (6) sepals of *R. falcata* and *R. flavescens* have respectively 5–9 and 5–7 veins, whereas those of *R. camptoneura* have only 3–5; (7) petals of *R. flavescens* are glabrous, those of *R. camptoneura* sparsely pilose(ulous); petals of *R. falcata* are just in between; (8) ovary in *R.*

flavescens glabrous or nearly so, versus densely strigose in *R. falcata* and densely villose in *R. camptoneura*; (9) style completely glabrous in *R. flavescens* versus pilosulous at the base in *R. camptoneura*; *R. falcata* is just in between; and, finally, (10) capsule of *R. flavescens* glabrous or nearly so; in *R. falcata* and *R. camptoneura* sparsely but distinctly hairy.

Rinorea falcata seems to be intermediate between *R. flavescens* and *R. camptoneura* except for the number of the veins in the sepals. By the differences in the latter feature it is not certain whether to consider *R. falcata* as a hybrid between the two other ones or not. Dried leaves of *R. flavescens* and *R. falcata* are more shining than those of *R. camptoneura*, which are distinctly dull. The indument in these species is predominantly golden, sometimes different. The ovary of *R. falcata* is often ferruginous strigose, that of *R. camptoneura* usually whitish, sometimes also golden or ferruginous.

Rinorea falcata has been listed in the two editions of a revision of Peruvian Violaceae by Baehni and Weibel (1941a, 1941b), based on the single specimen *Killip & Smith* 29147, which is taxonomically not *R. falcata*, but *R. viridifolia*. The poor description does not provide a sharp distinction between the two species and may, therefore, refer to both species. *Rinorea falcata* has also been collected recently from Peru. For *Alsodeia* (= *Rinorea*) *falcata* var. *grandifolia* see under *R. pubiflora* var. *grandifolia* fo. *grandifolia*.

A specimen, *Glaziou* 6069, cited by Glaziou as *Alsodeia* (= *Rinorea*) *falcata* and collected in SE Brazil (Corcovado, Rio de Janeiro), does not belong to that species, but to *R. laevigata*.

Alsodeia guianensis (Aublet) Eichler var. *parviflora* Eichler in Martius, 1871a, does not belong to the same taxon as *Rinorea parviflora* Blake ex Pittier, Man. pl. usual. Venez. 445, 1926. The former is a synonym of *R. falcata*, the latter a synonym of *R. lindeniana*.

28. *Rinorea camptoneura* (Radlkofer) Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352, 1925; Sandwith, Kew Bull. 1955(3): 372, 20 Dec 1955. Figs. 37B, 38.

Alsodeia camptoneura Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 186, 1891 ('1890'); Blake, Contr. U.S. Natl. Herb.

20(13): 517, 1924 ('doubtful species'). Type, Brazil, Amazonas: Rio Negro, between Manaus and Barcelos, Dec 1851 (fl), *Spruce 1964* (lectotypus nov., M: isotypes, K [herb. Benthamianum; herb. Hookerianum], P [herb. E. Drake del Castillo]).

Tree or treelet, 3.5–14 m tall. Branchlets golden hirtellous when young, glabrescent when older. *Leaves* apparently opposite, occasionally ternate; petioles 3–10 mm long, golden hispidulous above, golden strigillose to glabrescent beneath; stipules deciduous, narrowly deltoid, subacute, 1–2.5 × 0.4–0.8 mm, herbaceous, golden strigillose, ciliolate; lamina elliptic to obovate, acuminate, 3.5–15 × 1.25–6.75 cm, papery, glabrous on both sides; costa above sparsely golden puberulous near the base, sparsely golden strigose beneath; domatia present, golden pilose(ulous); lateral veins 8–13 pairs (acumen excluded) glabrescent on both sides; tertiary venation reticulate; base rounded to cuneate, slightly asymmetric and oblique as well as slightly obtuse to subauriculate at the petiole; margin subcrenate or subserrate to subentire, mucronulate; acumen 1.5–2.5 cm long, apex obtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 4.5–12.5 cm long; central axis, creamy or whitish colored when fresh, sparsely golden pilosulous; 'pedicels' 2.5–7.5 mm long, articulate at $\frac{1}{3}$ from the base, golden strigillose; bracts and bractlets ovate to deltoid, herbaceous, golden strig(ill)ose along the costa, ciliolate, apex obtuse; bracts 1–1.5 × 0.75–1.25 mm; bractlets 0.75–1(–1.5) × 0.75–1(–1.25) mm. *Flower* buds ovoid to obovoid, obtuse. Flowers pendulous, creamy white. Sepals unequal, (ob)ovate to elliptic, 1.25–3 × 1.25–1.75 mm, herbaceous, golden strig(ill)ose along the costa and/or near the apex, 3–5 veined, margin golden ciliolate, apex (sub)obtuse. Petals narrowly ovate, 4.25–4.5 × ca. 1.5 mm, herbaceous, golden pilosulous along the costa or glabrescent, margin sometimes golden ciliolate especially near the apex, apex obtuse. Stamens 3–3.5 mm long; filaments free, (0.5–)0.75–1 × 0.2–0.4 mm, glabrous; dorsal glands free, adnate to the filaments, sometimes one or more of them wanting, (narrowly) ovoid to ellipsoid, (0–)0.75–1 × (0–)0.3–0.4 mm, carnos, glabrous, apex free, acute to obtuse or truncate to emarginate; anthers narrowly ovoid to ellipsoid, 1–1.25 × 0.4–0.5 mm, apex of thecae obtuse, sometimes appendaged by 2–5 set(ul)ae and/or 1–2 cusps, 0.2–

0.4 × 0.1–0.2 mm; connective outside narrowly deltoid to linear, subobtusate to acute, 0.75–1 × 0.1–0.25 mm, glabrous; connective scales lateral as well as apical, ovate, 2.25–2.5 × ca. 1 mm, scarious, orange-brown, margin suberose, apex obtuse. Ovary subglobose, ca. 1 mm in diam, usually whitish, sometimes golden or ferruginous villose; ovules two per placenta. Style filiform, erect, 2.25–2.75 × ca. 0.2 mm, exceeding the stamens by ca. 0.25 mm, slightly pilosulous at the base; stigma truncate. *Capsule* more or less symmetric, ovoid, acuminate, coriaceous to subligneous, golden to ferruginous pilose(ulous), veined; valves three, (sub)equal, ca. 1.75 × ca. 0.75 cm. *Seeds* two per valve, globose, 7–8 mm in diam., glabrous, extremely rarely sparsely pilose, often reddish stained when dried.

Distribution (Fig. 38) and *ecology*. *Rinorea camptoneura* is widespread over (the northern part of) W Amazonia, from where the species migrated to Upper Amazonia in Colombia (Putumayo) and Peru (Huanuco) as well as along the Rio Negro and the Casiquiare to the Upper Orinoco area of Venezuela (Amazonas).

It occurs as an undergrowth in the understory of primary rain forests, where it has been collected on slopes and along rapids, from 125 to 250 m, creeks, streams and rivers. Soil not indicated.

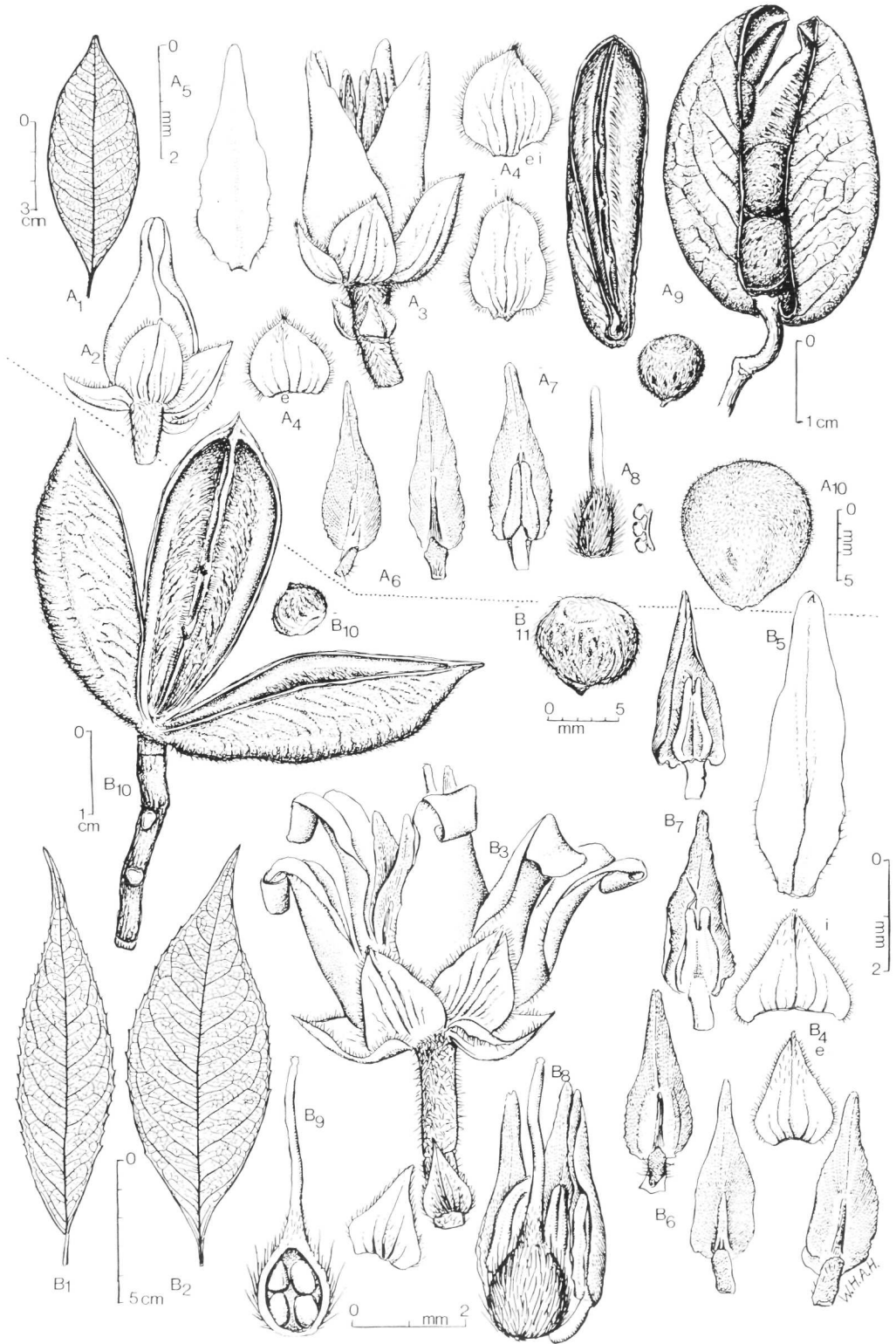
Phenology. Flowering records from the period October–April, fruiting specimens have been collected in February, April and May, probably flowering and fruiting throughout the year.

Representative specimens examined: COLOMBIA, PUTUMAYO: Rio Putumayo, along banks of the tributary Piñuña Negro, 20 Nov 1940 (fl), *Cuatrecasas 10703* (COL).

VENEZUELA, AMAZONAS: Rapids of Trachipote, Delta of Ventuari, 21 Apr 1942 (fl, fr), *Ll. Williams 14992* (F. G. RB, US, VEN, W).

PERU, HUÁNUCO: Huánuco, vic. Tingo María, valley of the river Huallaga, 24 Sep 1954 (fl), *Ferreya 10299* (US).

BRAZIL, AMAZONAS: Rio Negro, Igarapé do Guedes, 23 Dec 1923 (fl), *Kuhlmann 1002* (RB 21.352); vic. Manaus, s.d. (fl), *Riedel 1581* (K, LE); idem, Dec 1850–Mar 1851 (fr), *Spruce 1049 & 1390* (NY), 1069 (M, OXF); Rocky shore of Rio Negro, 4 Feb 1851 (fl), *Spruce 1379* (K [herb. Benthamianum], P [herb. Drake del Castillo]); vic. Manaus, Dec 1850–Mar 1851 (fl, fr), *Spruce 1390* (K [herb. Benthamianum & Hookerianum], P [herb. Drake del Castillo]) & *Spruce s.n.* (BM [herb. H. F. Hence], C, G [herb. De Candolle], HH, LE, M, OXF, P); Ihla da Silva, Basin of Rio Negro, 16 Jan 1978 (fl), *Steward et al. 372* (INPA, NY U).



S.L.: s.d. (fl). *Fielding s.n.* (G); s.d. (fl), *Riedel s.n.* (G. OXF).

This species belongs to the complex of three related species *Rinorea flavescens*, *R. falcata* and *R. camptoneura*. It differs from *R. flavescens* and *R. falcata* by having domatia on the underside of the leaves, versus wanting in the two other species. The ovaries of *R. falcata* and *R. camptoneura* are densely hairy, versus glabrous (or nearly so) in *R. flavescens*. The style of *R. camptoneura* is pilosulous at the base, versus completely glabrous in *R. flavescens*. In *R. falcata* the style is completely glabrous or slightly pilosulous at the base. For detailed differences see under *R. falcata*.

Subgroup IIc.4. 'Marginata'; species 29.

Features as in Subgroup IIc.3. 'Pubiflora' except lamina hirtellous beneath, leaf margin thick walled and number of ovules three to four per placenta. This subgroup consists of only the one species *Rinorea marginata* which has close affinities to species of Subgroup IIc.3. 'Pubiflora' and to those of Subgroup IIc.5. 'Melanodonta.' The stamens, with relatively short filaments and relatively long connective scales, which are in turn narrowly deltoid or ovate, resemble those of the species of Subgroup IIc.5. 'Melanodonta.'

29. *Rinorea marginata* (Triana & Planchon)

Rusby ex Johnston, Proc. Boston Soc. Nat. Hist. **34**: 238. 1909 (p.p.) (the additional specimens belong to *R. melanodonta* Blake); Blake, Contr. U.S. Natl. Herb. **20(13)**: 510. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925 p.p. (the type locality refers to *R. marginata*, the other localities refer to *R. melanodonta* Blake); Smith & Fernán-dez-P., *Caldasia* **6(28)**: 102. pl. 5. 1954.

Figs. 39, 42.

Alsodeia marginata Triana & Planchon, Ann. Sci. Nat. Bot. Sér. 4. **17**: 127. 1862. Type. Colombia. Tolimá: Paso de Opia along the Río Magdalena, between Bogota and Maraquita, 500 m, 1854 ('1851-1857') (fl. fr). *Triana s.n.* (lectotypus novus, probably original holotype. P: isotypes. BM. COL. F. FI. G. K. MEXU [600 m], NY. W).

Treelet. Branchlets whitish pilosulous. *Leaves* apparently opposite; petioles 2-7 mm long, whitish pilosulous; stipules deciduous, ovate to deltoid, 2-2.5 × ca. 1.5 mm, coriaceous, strigose along the costa, ciliolate, apex (sub)obtuse; lamina (narrowly) elliptic, acuminate to cuspidate, 4-11.5 × 1.5-4.5 mm, coriaceous, glabrous above, whitish to yellowish hirtellous beneath; costa above slanting whitish pilosulous to glabrescent; lateral veins 6-12 pairs (acumen excluded); tertiary venation densely reticulate, more prominent beneath than above; base rounded, slightly decurrent into the petiole; margin entire, thick walled especially beneath, yellowish or whitish colored, rudimentarily mucronulate; acumen 0.3-1 cm long, apex subobtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, (1-)2-3.5 cm long, central axis golden hispidulous; 'pedicels' 1.75-3 mm long, articulate at $\frac{1}{3}$ - $\frac{2}{3}$ from the base, golden to brownish hispidulous; bracts and bractlets ovate to deltoid, herbaceous, strigose along the costa, margin ciliolate, apex subacute, sometimes mucronulate; bracts 0.75-1 × ca. 0.75 mm; bractlets 0.6-0.8 × ca. 0.6 mm. *Flower buds* ovoid to conical, obtuse. Flowers pendulous, color unknown. *Sepals* subequal to unequal, outer sepals ovate to deltoid, inner ones ovate to orbicular, 1.25-2 × 1.25-1.75 mm, herbaceous, golden to whitish strigillose along the costa especially near the apex, 7-9 veined, 7-9 ribbed when dried, margin golden to whitish ciliolate, apex subobtuse to subacute, sometimes mucronulate. *Petals* ovate, 3.75-4.75 × 1.25-1.5 mm, herbaceous, predominantly glabrous,

FIG. 39. A. *Rinorea marginata* (*Triana s.n.*, type). A₁, Leaf, with entire, thick-walled margin. A₂, Flower bud. A₃, Adult flower, with bractlets. A₄, Sepals (e = exterior [=outside], i = interior [=inside], e/i = in between). A₅, Petal. A₆, Stamens, provided with dorsal glands (dorsal). A₇, Idem. ventral. A₈, Pistil, ovary and a placenta containing three ovules. A₉, Capsule with hairy seeds, one valve showing a placenta for three seeds. A₁₀, Seeds detailed. B. *R. melanodonta* (B, from *Steyermark 88640*; B₂₋₉, from *H. H. Smith 1756*, type; B_{10,11}, from *Broadway 489*). B_{1,2}, Leaves tapering basally and apically. B₃, Adult flower with pedicel and bractlets. B₄, Sepals (e = exterior [=outside], i = interior [=inside]). B₅, Petal. B₆, Stamens (dorsal). B₇, Stamen (ventral). B₈, Pistil, surrounded by three stamens. B₉, Pistil, with l.s. of ovary, showing ovules 3 × 2. B₁₀, Capsule, dehiscing into three valves, showing 3 × 2 arrangement of seeds, seeds pilose. B₁₁, Seed detailed; indument pilose.

margin whitish ciliolate near the base, apex obtuse and slightly pilosulous. Stamens 3.25–3.75 mm long; filaments free, ca. 0.5×0.25 mm, glabrous; dorsal glands free, adnate to the filaments, obovate to subclavate, ca. 0.5×0.2 – 0.4 mm, carnosely, sparsely pilosulous, apex free, subobtuse; anthers ovoid, 1.4 – 1.8×0.75 mm, apex of thecae obtuse, usually appendaged by (1–)2 cusps, ca. 0.2×0.05 – 0.1 mm; connective outside narrowly deltoid, obtuse, 1 – 1.25×0.25 mm, sparsely pilosulous to glabrescent; connective scales lateral as well as apical, ovate, 2.75 – 3.25×1 mm, scarious, orange-brown, margin suberose near the base, apex obtuse. Ovary pyriform to subconical, 1 – 1.25×0.3 – 0.4 mm, golden-brownish strigose; ovules three to four per placenta. Style filiform, erect, 2.25 – 2.5 mm long, equaling the stamens, slanting pilosulous at the base; stigma truncate, subobtuse or subacute. *Capsule* more or less symmetric, ovoid, acuminate, coriaceous to subligneous, slightly pilosulous to glabrescent, veined; valves three, (sub)equal 3.25 – 3.5×0.75 – 1 cm. *Seeds* two to three per valve, 7.5 – 10×7.5 mm, golden-brownish pilosulous.

Distribution (Fig. 42). Known only from the type collection on the river banks of the southern Río Magdalena valley in Colombia (Tolimá), at 500 m.

Rinorea marginata is characterized by the combination of the following characters: (1) an erect pilosulous indument on the underside of the leaves; (2) a thick walled and entire leaf margin; and (3) the number of ovules three, occasionally four per carpel.

Subgroup IIc.5. 'Melanodonta': species 30–32.

Features in common with Subgroups IIc.3. 'Pubiflora' and IIc.4. 'Marginata' except: leaves long-tapering to apex, not thick-walled and entire, not hirtellous beneath; ovules strictly two per placenta.

The species of this subgroup are most closely related to *Rinorea marginata*, the only species of Subgroup IIc.4. 'Marginata,' since their stamens have relatively short filaments and relatively long connective scales in contrast with those of Subgroup IIc.3. 'Pubiflora.'

The leaf bases of *Rinorea melanodonta* and *R. brachythrix* are symmetric, those of *R. endotricha* vary from symmetric to asymmetric and oblique.

Distribution (Fig. 42). The three species of this subgroup are scattered and separated from each other in Central America and in northern tropical South America: (a) *Rinorea endotricha* occupies a coherent area in Itamaca of E Venezuela and adjacent W Guiana; (b) *R. melanodonta* occurs disjunct in three isolated localities along the Caribbean coast, on Trinidad and further inland in Itamaca, where it can be found together with *R. endotricha*; and (c) *R. brachythrix* is restricted to Panama.

The distribution areas of the species of this subgroup are probably relicts of a formerly coherent one, over the northern part of tropical South America, for a common ancestral stock. This coherent area possibly became fragmented through the Pliocene Cordilleran uplift (Brown, 1977, 1982; Putzer, 1968; Raven & Axelrod, 1974). Following the isolation of local populations, speciation to the three current species ensued. One of these species, *R. brachythrix*, might have originated from a population migrating to Panama during or after the closing of this land bridge during the Pliocene, ca. 5.7 my BP (Brown, 1977, 1982; Coney, 1982; Raven & Axelrod, 1974).

30. *Rinorea melanodonta* Blake, Contr. U.S. Natl. Herb. **20(13)**: 511, pl. 35, 1924; Smith & Fernández-P., *Caldasia* **6(28)**: 104, 1954; Steyermark, *Fieldiana Bot.* **28(4)**: 989, 1957. Type, Colombia, Santa Marta: Vic. Santa Marta, Masinga Vieja, 245 m, 3 Feb 1898–1899 (fl. fr), *H. H. Smith 1756* (holotype, US 533722; isotypes, BM, BR, G. HH, K, L, LL, MICH, MO, NY, P, PENN, S, U, UC).

Figs. 39, 40, 42.

Treelet 1–8 m tall. Branchlets golden to ferruginous strigose and pilosulous when young, glabrescent when older. Leaves apparently opposite; petioles 3–10 mm long, golden to ferruginous puberulous when young, glabrescent when older; stipules deciduous, narrowly ovate to deltoid, 4 – 6×1 – 1.25 mm, herbaceous, ferruginous strigose especially near the apex of the costa, veined, ciliolate, apex acute; lamina elliptic to ovate, tapering to the apex, usually also to the base, (2.5) – 6.5 – $17 \times (0.75)$ – 1.75 – 5.25 cm, coriaceous to papery, glabrous on both sides; costa puberulous above near the base, sparsely ferruginous strigillose beneath near the base or glabrescent; domatia wanting; lateral veins 9–12

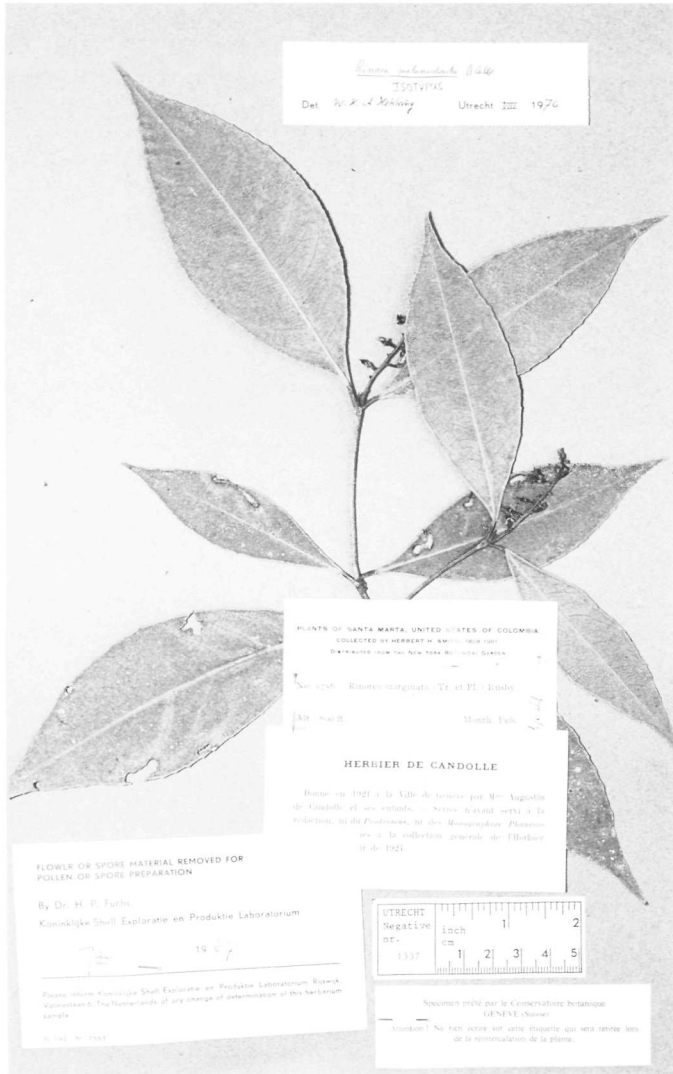


FIG. 40. Isotype specimen of *Rinorea melanodonta* (H. H. Smith 1756, G [herb. de Candolle]).

pairs (acumen excluded); tertiary venation reticulate; base cuneate to tapering into the petiole; margin subcrenate to subserrate, thin walled, mucronulate; acumen 0.7–2.5 cm long, apex subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 2–5.5 cm long; central axis golden to ferruginous puberulous; ‘pedicels’ 4–8 mm long, articulate at 1/2–1/3 from the base, ferruginous puberulous; bracts and bractlets ovate to deltoid, herbaceous, golden to ferruginous strigillose, margin ciliolate, apex subacute, sometimes mucronulate; bracts 1.75–2.25 × 1.25–2 mm; bractlets subopposite

just below the articulation, 1.5–1.75 × 1.25–1.5 mm. *Flower buds* tolpoid to conical, subobtusate. Flowers drooping, white, with odor of slippery elms. Sepals subequal, ovate to deltoid acuminate, 2–3 × 1.5–2.25 mm, herbaceous to scarious, golden to ferruginous puberulous near the apex, 5–9 veined, becoming striate when dried, margin ciliolate, apex (sub)acute. Petals narrowly ovate, 5–5.75 × 1.5–2.25 mm, herbaceous, margin sparsely ciliolate, apex obtuse. Stamens 4–4.5 mm long; filaments free, 0.75–1 × 0.6–0.8 mm, glabrous; dorsal glands free, adnate to the filaments, narrowly deltoid to (ob)ovate, ca. 1 ×

(0.3–)0.6–0.8 mm, equaling or slightly longer than the filaments, carnosely, slightly pilosulous to glabrescent, apex rounded, truncate or obtuse; anthers (narrowly) ovoid, 1.5–2 × (0.3–)0.5–0.75 mm, apex of thecae obtuse or apiculate, sometimes appendaged by a cusp, 0.2–0.5 × ca. 0.1 mm; connective outside narrowly deltoid, subacute, 1.25–1.75 × 0.25–0.5 mm, sparsely golden to ferruginous pilosulous or glabrescent; connective scales lateral as well as apical, ovate, 3.25–3.5 × ca. 1.5 mm, scarious, orange-brown, margin suberose, sometimes fringed at the base, apex subacute and suberose. Ovary subglobose, (sub)conical or (ob)pyriform, 1.5–2 × (0.75–)1.25–1.5 mm, golden to ferruginous strigose; ovules two per placenta. Style filiform, erect or slightly curved, 2.5–3 × ca. 0.25 mm, exceeding the stamens by 0.25–0.5 mm, strigillose near the base; stigma truncate, obtuse or pulvinate. *Cap-sule* more or less symmetric, (ob)ovoid, acuminate, coriaceous to subligneous, golden to ferruginous pilosulous, veined; valves three, (sub)equal, (1.5–)2–3.75 × 0.5–1 cm. *Seeds* two per valve, globose, 5–6 mm in diam., ferruginous pilose.

Distribution (Fig. 42) and ecology. Mainly in Venezuela and W Guiana, also in an isolated spot in northern Colombia. Its areas of distribution include the following forest refugia: (a) Venezuela, W Guiana (S of the lower Orinoco): Itamaca; (b) isolated localities along the Caribbean coast of Colombia and Venezuela: Santa Marta, Rancho Grande, Sucre; and (c) Trinidad.

The species occurs as a small tree in evergreen tropical rain forests in lowlands and submountainous areas from 100 to 900 m. Specimens have been collected on calcareous slopes, in gullies and along rivers and creeks.

Phenology. Flowering specimens have been collected in February and during the period May–August; fruiting specimens during the periods December–February and May–August.

Representative specimens examined: COLOMBIA. MAGDALENA: Sta. Marta, ravine nr. Jiracasaca (Juacasaca), 800 m, 13 Jan 1898–1901 (fl), *H. H. Smith 900a* (NY); Sta. Marta, 9 km NE of Masinga, 700 m, 1 Jun 1898–1901 (fl. fr), *H. H. Smith 900b* (B. F. G. HH, L. MICH. MO. PENN. S. U. UC. US); Sta. Marta, 5 km E of Masinga, 200 m, Aug 1898–1901 (fr), *H. H. Smith 900c* (NY).

VENEZUELA. BOLIVAR: 18 E km of La Paragua-Ciudad Piar Road to San Pedro, ca. 300 m, 7 Jul 1975 (fl. fr), *Gentry & Berry 15030* (MO. U); Rio Asa, above Raudal Cotua, S of La Paragua, 290 m, 1 Aug 1960

(juv fr), *Steyermark 86754* (VEN 58.686); Quebrada Caballape, W of Hato de Nuria, E of Miamo, Altoplano of Nuria, 230–350 m, 21 Jan 1961 (fr), *Steyermark 88640* (NY, S, VEN). FALCÓN: Cerro de Agua (San Antonio), Piritu, 200 m, 14 Jun 1979 (bud, fr), *Anonymous (Flora Falcón, HW, B1) 745* (MO, U, VEN); Sierra de San Luis, 800–900 m, 20 Aug 1967 (juv fr), *Steyermark 99292* (U, VEN). LARA: Barquisimeto, s.d. (fr), *Karsten s.n.* (W). NUEVA ESPARTA: Isles of Margarita, 28 Aug 1903 (fl. fr), *Johnston 120* (C. F. HH, NY, US, W); idem, 27 Jul 1903 (fl. juv fr), *Miller & Johnston 225* (BM, F. HH, K, NY, P, US). SUCRE: Forest of Aricagua, vic. Cristobal Colón, 5 Jan–22 Feb 1923 (fr), *Broadway 489* (NY, US); S slopes of Cerro Imposible, between Cedeño and Boca del Tatarical, along Quebrada Imposible, 140–220 m, 21 May 1945 (fr), *Steyermark 62834* (F, NY); Cerro Imposible between Bedeño and Boca del Tatarical, 21 May 1945 (juv fr), *Steyermark 62839* (VEN 36325). YARACUY: Distr. San Felipe, Mun. of Veroes, 5 km S of Bella Vista, 10°23'N, 68°24'W, 200–450 m, *Agostini et al. 1788* (U, VEN).

TRINIDAD: Tunarony valley (=Ticcarony valley?), 4 Dec 1903 (fr), *Othmer s.n. (1365 ?)* (M).

GUYANA: DISTRICT OF RUPUNUNI: ca. 9 km from Karasabai along Yuroca River, 4°00'N, 59°21'W, savanna and riparian forest, ca. 300 m, 3 Jan 1982 (fr), *Knapp & Mallet 2789* (MO, U).

The three closely related species in this subgroup are characterized by their leaves tapering to the apex. *Rinorea melanodonta* differs from *R. brachythrix* and *R. endotricha* by: (1) leaf bases usually also tapering to the base; (2) pedicels 4–8 mm long (versus 1–3 mm long); (3) filaments 0.75–1 mm long (versus 0.25–0.75 mm long); (4) anthers ca. 2 × as long as the filaments (versus ca. 3 × or more); and (5) connective scales 3–5 × as long as the filaments (versus 5–8 ×).

Dried branchlets of *Rinorea brachythrix* and *R. endotricha* are usually reddish to purplish with whitish to brownish callose lenticels; such lenticels are wanting in *R. melanodonta*.

Holo- and isotype specimens of *Rinorea melanodonta* (*H. H. Smith 1756*) have been previously distributed as *Alsodeia* (= *Rinorea*) *marginata*, which resulted in many errors of citation by various authors.

Melchior (1925b) mentioned Venezuela, Isles of Margarita and Trinidad incorrectly as localities of occurrence for *Rinorea marginata* instead of that of *R. melanodonta*. This error has been perpetuated by H. Pittier et al. in their Catalogue of the Flora of Venezuela (1947).

31. *Rinorea brachythrix* Blake, Contr. U.S. Natl. Herb. 20(13): 510, pl. 34, 1924; A. Robyns in Woodson, Schery & Coll., Ann. Missouri Bot.

Gard. **54(1)**: 70. 1967a. Type. Panama. Darién: S. Darién, vic. La Palma, 0–50 m. 26 Apr. 1914 (fl. juv fr), *Pittier 6601* (holotype US 716664; isotypes, G. Z). Figs. 41A, 42.

Treelet 1–4 m tall. Branchlets purplish with whitish callose lenticels (when dried), sparsely strigillose, indument golden to ferruginous. *Leaves* apparently opposite; petioles 5–17.5 mm long, golden to ferruginous strigillose on both sides; stipules deciduous, narrowly ovate to deltoid, ca. 6 × ca. 1.25 mm, herbaceous, veined and golden-brownish strigose, margin ciliolate, apex subacute, mucronulate; lamina narrowly ovate, widest at 1/3 from the base, long tapering to the apex, acuminate to cuspidate, 11.5–17 × 4–5.5 cm, coriaceous, glabrous on both sides; costa sparsely strigillose above near the base, sparsely ferruginous strigose beneath; domatia wanting; lateral veins 11–14 pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate, symmetric, obtuse to rounded at the petiole; margin serrate, mucronulate; acumen 2–2.5 cm long, apex (sub)obtuse, mucronulate. *Inflorescences* axillary, lateral or subterminal, solitary, racemose, 4–4.5 cm long; central axis sparsely strigillose or hispidulous, indument golden to ferruginous; 'pedicels' 2–3 mm long, articulate at 1/2–1/4 from the base, sparsely golden to ferruginous hispidulous to strigillose; bracts and bractlets deciduous, narrowly ovate, herbaceous, pilosulous, ciliolate; bracts 1.5–1.75 × 0.75–1 mm; bractlets 1.25 × 0.5 mm. *Flower buds* ovoid, obtuse. *Flowers* dropping, yellow. *Sepals* (sub)equal ovate to deltoid, acuminate, 2–2.5 × 1.5–2 mm, herbaceous, golden to ferruginous strigillose, especially near the apex, 5–7 veined, margin ciliolate, apex subacute. *Petals* (narrowly) ovate, acuminate, ca. 5 × 1.75–2.25 mm, herbaceous, pilosulous near the apex, margin ciliolate near the base, apex subacute. *Stamens* 3.75–4 mm long; filaments free, ca. 0.5 × ca. 0.25 mm, glabrous; dorsal glands free, adnate to the filaments, ovate, 0.2–0.5 × ca. 0.2 mm, 0.5–1 × as long as the filaments, carnos, glabrous, apex obtuse; anthers narrowly deltoid, 1.5–1.75 × 0.4–0.8 mm, apex obtuse, usually appendaged by two cusps, 0.3–0.4 × 0.1 mm; connective outside narrowly deltoid, obtuse, ca. 1.5 × ca. 0.25 mm, glabrous; connective scales lateral as well as apical, ovate, 3.25–3.75 × ca. 1.25 mm, scarious, orange-brown, margin suberose, apex obtuse. *Ovary* subglobose, ca. 1.25 ×

1 mm, ferruginous strigillose; ovules two per placenta. *Style* filiform, erect, 2.75–3 × 0.2–0.4 mm, exceeding the stamens by 0.25–0.5 mm strigillose near the base; stigma truncate. *Juvenile fruits* green when fresh, indument ferruginous strigillose.

Distribution (Fig. 42) and *ecology*. *Rinorea brachythrix* is known only from two localities in Panama (Darién and San Blás), both belonging to the forest refuge Darién. It is a small tree in evergreen seasonal and tropical rain forests mainly in lowlands from 0 to 100 m (or more?). The specimen *Sugden 355* occurred in a forest rich in palms, containing ca. 200 woody species. Specimens have been collected on steep slopes of hilly areas and along rivers.

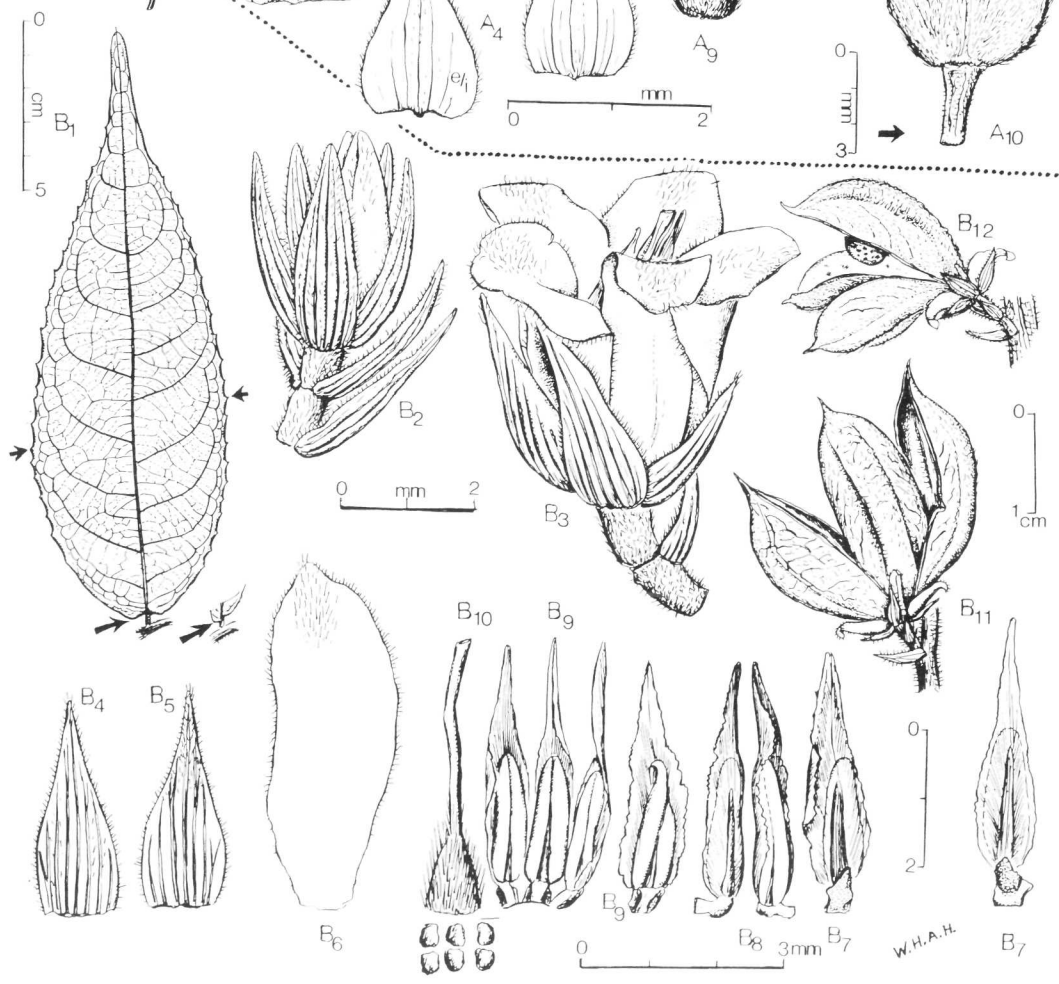
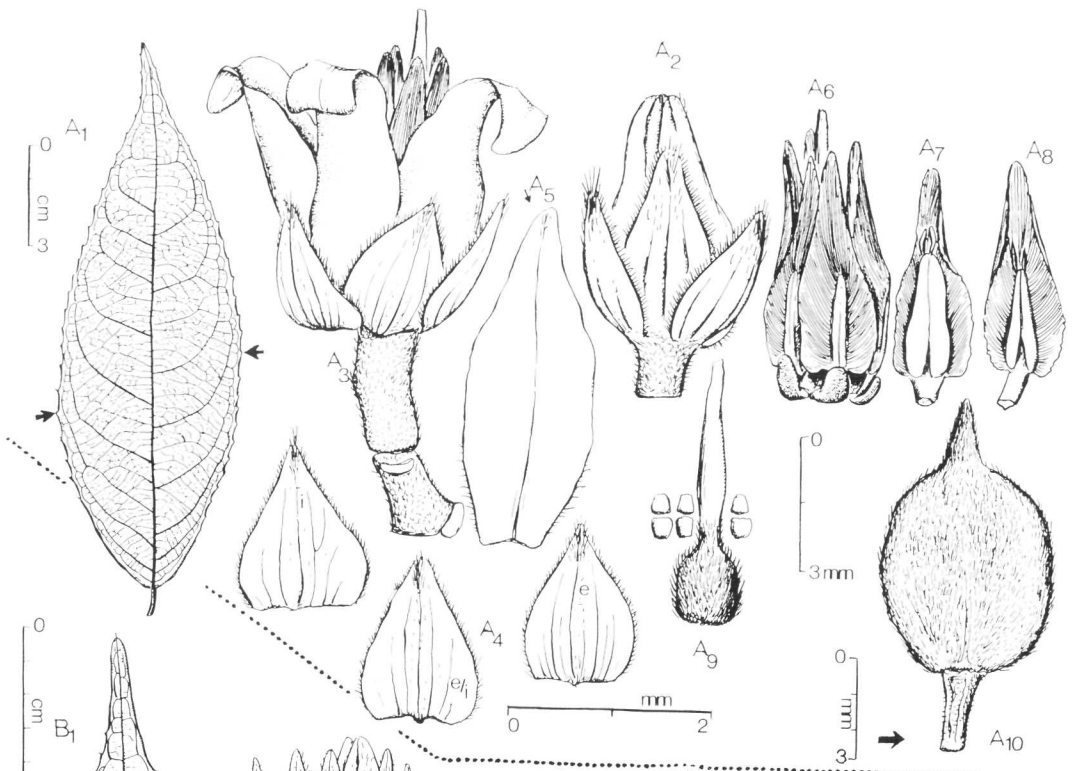
Phenology. One specimen flowered in April and two specimens were fruiting in January and in April.

Specimen examined: PANAMA, SAN BLÁS: Río Acla, 8°48'30"N, 77°40'30"W, 25–100 m, 16 Jan 1979 (fr), *Sugden 355* (MO).

Rinorea brachythrix most resembles *R. endotricha*, but differs from it by: (1) its distinctly longer petioles, 5–17.5 mm long (versus 0–3 mm long); (2) its petioles hairy (versus glabrous); and (3) its petals 2–2.5 × as long as the sepals (versus ca. 1.5 ×). For more differences with *R. endotricha* see under that species.

32. *Rinorea endotricha* Sandwith, Bull. Misc. Inform. **1933(6)**: 324. 16 Aug 1933. Type. Guyana, Essequibo district: Rupununi River, Simuni Creek, ±100 m, Aug 1931 (fl. juv fr), *Davis D 136* (=Forest Dept. 2127) (holotype, K; isotype, FHO). Figs. 41B, 42.

Treelet, 1.5–2 m tall. Branchlets reddish-brown when dried, provided with brownish lenticels, indument ferruginous hispidulous, glabrescent; bud scales, narrowly deltoid, subobtuse, mucronulate, 3.5–5 × 0.5 mm, herbaceous, ferruginous strigillose, ciliolate, richly veined. *Leaves* apparently opposite, subsessile, petioles 0.1–3 mm long, glabrous; stipules subsistent, later deciduous, subulate, mucronulate, 1–5 × 0.1 mm, ferruginous strigillose; lamina narrowly ovate to elliptic, widest at 1/3 from the base, long tapering to the apex, acuminate, 8–20 cm long, 2–8 cm wide, coriaceous; lamina, costa and lateral veins glabrous on both sides; domatia wanting; lateral veins 11–15 (acumen excluded); tertiary vena-



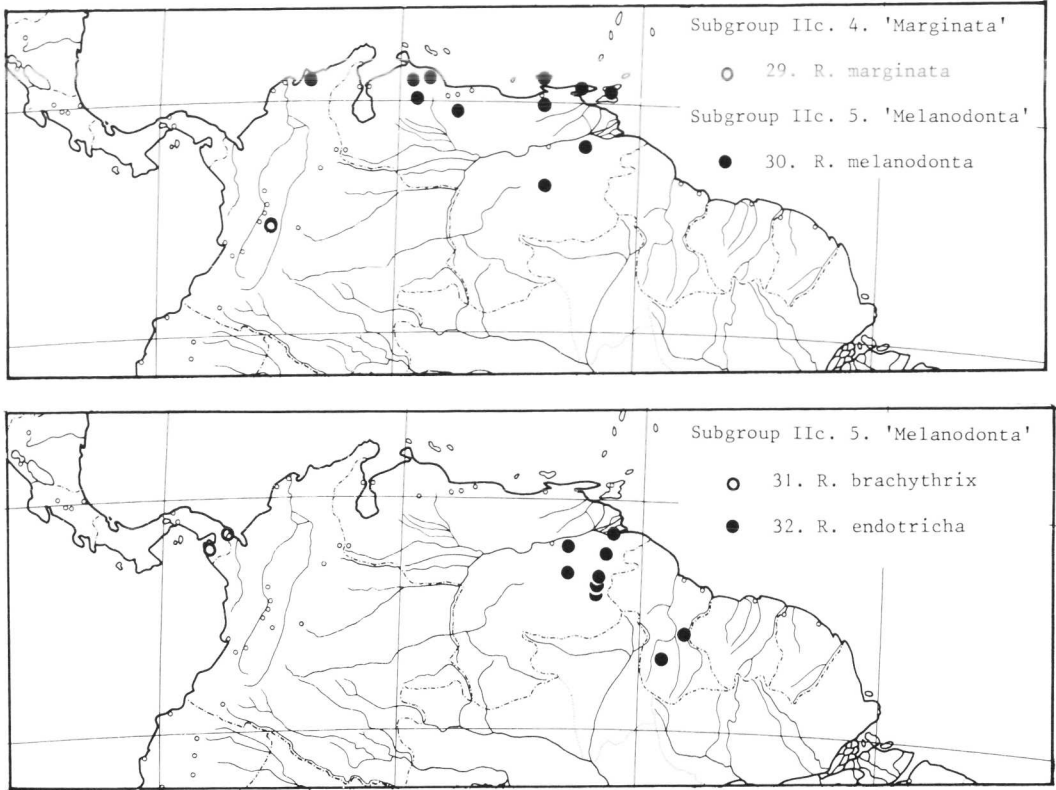


FIG. 42. Distribution of species of *Rinorea* Subgroups IIc.4. 'Marginata' and IIc.5. 'Melanodonta.'

tion reticulate; base rounded to cuneate, symmetric or asymmetric, (sometimes obliquely) subcordate or subauriculate at the petiole; margin (sub)serrate, mucronulate; acumen 1.5–3.5 cm long, apex obtuse to acute, mucronulate. *In-florescences* axillary, lateral and subterminal, solitary, occasionally two fasciculate, racemose, 2–5.5 cm long; central axis brownish strigillose; 'pedicels' 1–3 mm long, articulate near the middle, greenish to whitish when fresh, brownish strigillose; bracts and bractlets subpersistent,

(narrowly) ovate to deltoid, acuminate, coriaceous, brownish strig(ill)ose along the costa, distinctly 5-veined, strongly 5-ribbed when dried, ciliolate, apex subacute, mucronulate; bracts 1–3 × 0.5–1 mm; bractlets subopposite just below the articulation, 1.25–2 × 0.6–1 mm. *Flower* buds ovoid to conical, obtusish. Young flowers greenish-white, adult flowers pure white. Sepals (sub)equal, narrowly deltoid to ovate, gradually acuminate, 3.25–4 × 1.25–1.5 mm, nearly equaling the reflexed petals, coriaceous, brown-

FIG. 41. A. *Rinorea brachythrix* (Pittier 6601, type). A₁, Leaf, widest below the middle and obtuse at the petiole. A₂, Flower bud. A₃, Flower. A₄, Sepals (e = exterior [=outside], i = interior [=inside], e/i = in between). A₅, Petal. A₆, Androecium (dorsal), surrounding pistil. A_{7,8}, Stamens (ventral). A₉, Pistil, with ovary containing 3 × 2 ovules. A₁₀, Juvenile fruit. B. *R. endotricha* (B₁ and B₁₁ from Steyermark 88074; B₁ [only leaf base] from Maas et al. 5902; B_{2–10} from Trujillo 2397; B₁₂ from Steyermark 88652). B₁, Leaf, widest below the middle and subauriculate at the very base. B₂, Flower bud. B₃, Adult flower, showing the petals apically hairy inside. B₄, Sepal (dorsal). B₅, Sepal (ventral), distinctly hairy near the apex. B₆, Petal (ventral), hairy near the apex. B₇, Stamens (dorsal), with dorsal glands. B₈, Stamens (lateral). B₉, Stamens (ventral). B₁₀, Pistil and ovary, with 3 × 2 ovules. B₁₁, Capsule, dehiscing into three equal valves; floral parts still present basally. B₁₂, Idem, with subequal valves containing punctate seeds.

ish strigillose or puberulous on both sides, distinctly 5–7 veined, strongly 5–7 ribbed when dried, ciliolate, apex subacute, mucronulate. Petals narrowly elliptic to obovate, 5–5.25 × 2 mm, herbaceous, white when fresh, drying to chocolate-brown, whitish puberulous near the apex, especially on the inner side of the petals, ciliolate along the margin, apex obtuse. Stamens subsessile, 3.5–4 mm long; filaments free, 0.3–0.7 × 0.2–0.4 mm, glabrous; dorsal glands free, adnate to the filaments, deltoid, (ob)ovate or elliptic, 0.4–0.8 × 0.3–0.4 mm, slightly longer than the filaments, carnos, glabrous, apex subacute, obtuse, rounded or truncate; anthers narrowly ovoid to deltoid, acuminate, 1.75–2 × 0.5–0.7 mm, apex obtuse, unappendaged; connective outside, narrowly deltoid, subacute, 1.75 × 0.25 mm, glabrous; connective scales lateral as well as apical, narrowly ovate, acuminate, 3–3.5 × 0.25–0.5 mm, scarios, orange-brown, margin suberose, apex subobtuse to subacute. Ovary ovoid to subconical, 1–1.25 × 0.75–1 mm, golden strigose; ovules two per placenta. Style filiform, erect or slightly curved, 2.75–3.25 × 0.2–0.4 mm, exceeding the stamens by 0–1 mm, strigose near the base; stigma truncate or (sub)obtuse. *Capsule* symmetric to asymmetric, ellipsoid to ovoid, acuminate, subligneous to coriaceous, reddish punctate when dried, sparsely brown strigillose, veined; valves three, subequal to unequal, 1.75–2.25 × 0.4–0.8 cm. *Seeds* two per valve, globose, 3.25–3.5 mm in diam., purplish spotted when dried, glabrous.

Distribution (Fig. 42) and **ecology**. *Rinorea endotricha* is confined to the forest refuge Itamaca in the lower basin of the Orinoco (Venezuela) and in adjacent regions of Guyana. It is an undergrowth tree in primary rain forests from 0 to 250 m. Soil unknown.

Representative specimens examined: VENEZUELA. BOLÍVAR: Mazivaca, ±17 km S of los Castillos, vic. mouth of Río Orinoco, 6 Dec 1959 (juv fl, fr), *Bernardi* 7891 (VEN); Piar. Calceta Larga, Vía San Pedro de las Bocas, NE of El Manteco, 260–290 m, Jul 1978 (fr), *Delascio & Liesner* 7218 (MO, VEN); Cerro la Reforma, above junction of Río Reforma with Río Toro (=Río Grande), N of El Palmar, 200–250 m, 15 Dec 1960 (fl, fr), *Steyermark* 88074 (F, NY, VEN); 18.5 km S of El Dorado, 215 m, 23 Jul 1960 (bud), *Steyermark* 88604 (VEN 58685); idem, 25 Jul 1960 (fr), 88652 (VEN 58689); vic. El Dorado, 25 Aug 1954 (fl), *Trujillo* 2397 (G, MY, NY, VEN). DELTA AMACURO: Tucipita, Los Castillos de Guayana, ±8°30'N, 62°20'W, 50–200 m, 28 Mar–2 Apr 1979 (fl), *Davidse & A. C.*

González 16.355 (MO), S.L.: s.d. (fr), *Bernardi* 7167 & 7167a (VEN 81429 & 81430).

GUYANA: Mabura Hill forest, 5°19'N, 58°38'W, 100–200 m, 28 Oct 1981 (fl, fr), *Maas et al.* 5902 (U).

Local names. Guiana: Mamusaré (Arawak language); Shero (Wapisiana language); Shipiye (Macusi language).

Rinorea endotricha differs from *R. brachytrix* and *R. melanodonta* by: (1) leaves subsessile with petioles only 0–3 mm long (versus distinctly petiolate, 3–17.5 mm long); (2) leaf bases subauriculate at the petiole (in *R. brachytrix* obtuse to rounded at the petiole; leaves of *R. melanodonta* usually tapering into the base); (3) bracts, bractlets and sepals narrowly deltoid and acuminate, more than 2× as long as wide, strongly ribbed when dried; (4) sepals nearly equaling reflexed petals; and (5) petals hairy inside.

Bracts, bractlets and sepals of *Rinorea endotricha* are similar to those of *R. sylvatica* of Subgroup IIc.6. Lindeniana. Leaves of *R. sylvatica* are not tapering to the apex, but shortly acuminate or cuspidate. The number of ovules in *R. endotricha* is two per placenta versus three in *R. sylvatica*. Seeds of *R. endotricha* are glabrous and purplish spotted (when dried), while those of *R. sylvatica* are brownish pilosulous and not spotted. And dried flowers of *R. endotricha* are chocolate-brown, those of *R. sylvatica* mostly orange.

Subgroup IIc.6. 'Lindeniana': species 33–37.

Leaf base (usually) slightly to distinctly asymmetric, obtuse, (sub)cordate or (sub)auriculate; tertiary venation varying from ± reticulate to ± scalariform; inflorescences (pseudo)racemose; flowers and fruits distinctly pedicellate; 'pedicels' articulate above the base; bractlets separately inserted from the bracts; filaments and dorsal glands not fused with each other; ovary (sub)globose, distinct from the style, hairy; ovules one to three per placenta.

This subgroup is characterized by having more or less asymmetric leaf bases in combination with the occurrence of (pseudo)racemose inflorescences. It is a more or less heterogeneous subgroup, in which the following morphological tendencies and possible (inter)relationships can be observed: (1) Leaf bases of *Rinorea lindeniana* var. *lindeniana* and *R. dasyadena* are only slight-

ly asymmetric, just as are those of *R. falcata* and *R. camptoneura*, both belonging to Subgroup IIc.3. Pubiflora *Rinorea lindeniana* var. *fernandeziana* is the only taxon within this subgroup in which the leaf bases are symmetric and cuneate, sometimes even decurrent into the petiole. (2) Leaf bases of *R. deflexiflora*, *R. neglecta* and *R. sylvatica* are distinctly asymmetric and (sub)cordate and (sub)auriculate just as those of the two species of Subgroup IIc.7. Ulmifolia. (3) *Rinorea lindeniana*, *R. dasyadena* and *R. deflexiflora* are closely related to each other by similar morphological features; the numbers of their ovules vary gradually, being respectively: one, occasionally two; two, occasionally one; and two to three per placenta. (4) The two remaining species, *R. neglecta* and *R. sylvatica*, resemble each other also by their similar indument; they differ from each other by differences in the number of ovules: respectively one and three per placenta. The sepals, bracts and bractlets of *R. sylvatica* are narrowly deltoid to ovate and gradually acuminate, in contrast to those of *R. neglecta*.

Distribution (Fig. 47) and ecology. *Rinorea neglecta* is widespread over Amazonia and in adjacent regions of Venezuela and the Guianas. The area of distribution of *R. lindeniana* is remarkable for its hemi-elliptic shape around the Amazon Basin. Further north, this species occurs in isolated areas in Venezuela and Colombia, as well as in adjacent Central America. Two other species, *R. dasyadena* and *R. sylvatica*, are confined to NW Colombia and Central America, while *R. deflexiflora* is the only species restricted to Central America. All areas of the species taken together correspond exactly with the present-day areas of the humid forests in the neotropics (see Mori et al., 1981, fig. 1) except for the West Indies and SE Brazil, where representatives of this subgroup are wanting. The distribution patterns in this subgroup also indicate a center of speciation in Amazonia, from whence populations migrated to the marginal areas of the mainland of South America. In these marginal areas populations became isolated by the Pliocene Cordilleran uplift. From one of these isolated areas, situated in NW Colombia, subsequent migration of populations took place to Central America after the closing of the Panama land bridge, 5.7 my BP. NW Colombia and adjacent Central America can be considered as a secondary center of diversification.

33. *Rinorea lindeniana* (Tulasne) Kuntze, Revis. gen. pl. 1: 42. 1891.

Tree or treelet 1.5–15 m tall. Branchlets golden-brownish pilosulous, when young, glabrescent when older. *Leaves* apparently opposite; petioles 2–10 mm long, golden-brownish to ferruginous puberulous; stipules deciduous, narrowly ovate, 1.25–2 × 0.5–1.5 mm, herbaceous, golden-brownish pilosulous, veined, striate when dried, ciliolate, mucronulate; lamina narrowly elliptic to (ob)ovate, cuspidate, (3–)4.5–22.5 × 1–10 cm, papery, glabrous on both sides; costa sparsely whitish to golden pilosulous above near the base, sparsely whitish to golden hirtellous to glabrescent beneath; domatia wanting; lateral veins 10–15 pairs (acumen excluded); tertiary venation ± reticulate; base rounded to cuneate, symmetric to slightly oblique and subauriculate at the petiole; margin (sub)cren(ul)ate to (sub)entire, mucronulate; acumen (0.25–)0.5–3.5(–4) cm long, apex obtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, (pseudo)racemose, 2.5–22.5 × 0.4–0.75 cm; central axis pale green, sparsely hirtellous, indument whitish via golden to ferruginous; basal flowers arranged in 1–3(–7) flowered cymes; apical flowers solitary; ‘common peduncle’ of lateral cymes ca. 2.5 mm long, as hairy as the pedicels; ‘pedicels’ 1–2(–3) mm long, usually articulate near the middle, whitish to golden-brownish pilosulous; bracts and bractlets ovate, acute, mucronulate, sparsely golden-brownish pilosulous to glabrescent, veined, ciliolate; bracts 0.75–1 × 0.5–0.75 mm, with 3–5 veins; bractlets 0.6–0.75 × 0.25–0.35 mm, with 1–3 veins. *Flower buds* ovoid, subobtusate. *Flowers* drooping, whitish, creamy, orange or reddish. *Sepals* (sub)equal, (widely) ovate, 0.75–1.25(–2) × 1.25–1.5(–2) mm, herbaceous, green, golden-brownish pilosulous to glabrescent, with 5–7 veins, costa prominent, margin ciliolate, apex golden-brownish pilose, obtuse, mucronulate. *Petals* ovate, 2–3(–3.5) × 1.25–1.5(–2) mm, herbaceous to carnosate, glabrous or slightly golden-brownish pilose along the costa, margin ciliolate, apex obtuse. *Stamens* (1.5–)2–5 mm long; filaments free, 0.3–0.5 × 0.1–0.3 mm, glabrous; dorsal glands free, adnate to the filaments, narrowly ellipsoid to deltoid, 0.5–1 × 0.2–0.25 mm, 1.5 × as long as the filaments, carnosate, glabrous, apex free, subacute, subobtusate or

truncate; anthers ovoid, 0.75–1 × 0.25–0.5 mm, glabrous, apex obtuse and unappendaged; connective outside (narrowly) deltoid, (sub)acute, 0.5–0.75 × 0.1–0.25 mm, glabrous; connective scales lateral as well as apical, ovate, 1.25–1.75 × 0.5–0.75 mm, scarious, golden-brown, erose, obtuse. Ovary, subglobose, sometimes trapezoid or conical, 0.75–1 mm long and wide, golden-brownish hirsute; ovules usually one, extremely rarely two per placenta. Style stipitiform to subclavate, sigmoid or curved at the base, (1.25–) 1.5(–2) mm long, exceeding the stamens by 0–0.3 mm, often slightly pilosulous at the base; stigma obtuse to apiculate. *Capsule* usually asymmetric, ellipsoid or ovoid, coriaceous to subligneous, green when fresh, sparsely golden-brownish to whitish hispidulous to glabrescent, veined, style sometimes subsistent at the apex of one of the valves; valves three, usually unequal, with one usually larger than the other two, 1–1.75 × 0.4–0.8 cm. *Seeds* one per valve, globose, (3–)6–7.25 × 4–6 mm, golden-brownish pilosulous.

Distribution (Fig. 47) and ecology. The distribution of *Rinorea lindeniana* consists of a large hemi-elliptic area surrounding the lower Amazon Basin and many smaller disjunct areas all around. The main area occupies the Guiana Shield as well as the Central Brazilian Shield and the Andean region, just E of the Cordilleras, in between. Disjunct areas can be found in Venezuela, Colombia and Central America. Occurs in inundated or uninundated forests from 0 to 1200 m, on metamorphic, ferrolateritic, clayish or sandy soils.

Phenology. Flowering and fruiting throughout the year.

Rinorea lindeniana differs from *R. dasyadena* and *R. deflexiflora* by: (1) petals only 2–3.25 mm long (versus 3.25–4.25 mm long); (2) stamens only 1.5–2.5 mm long (versus 2.5–3.5 mm long);

(3) dorsal glands exceeding the filaments (versus shorter); (4) the number of ovules one per placenta (versus two, occasionally three); and (5) the style 1.25–2 mm long, just as in *R. dasyadena* (versus ca. 2.5 mm in *R. deflexiflora*).

Key to the Varieties of *Rinorea lindeniana*

1. Leaf base asymmetric, slightly oblique and slightly subauriculate at the petiole; inflorescences racemose to pseudoracemose; sepals 0.75–1.5 mm long and wide; Panama, Colombia, Venezuela, Trinidad, Guyana, Surinam, Ecuador, Peru, W. Brazil, NW Bolivia. 33a. var. *lindeniana*.
1. Leaf base symmetric, often slightly decurrent into the petiole; inflorescences strictly racemose; sepals 1.5–2 mm long and wide; Costa Rica, Panama, Colombia. 33b. var. *fernandeziana*.

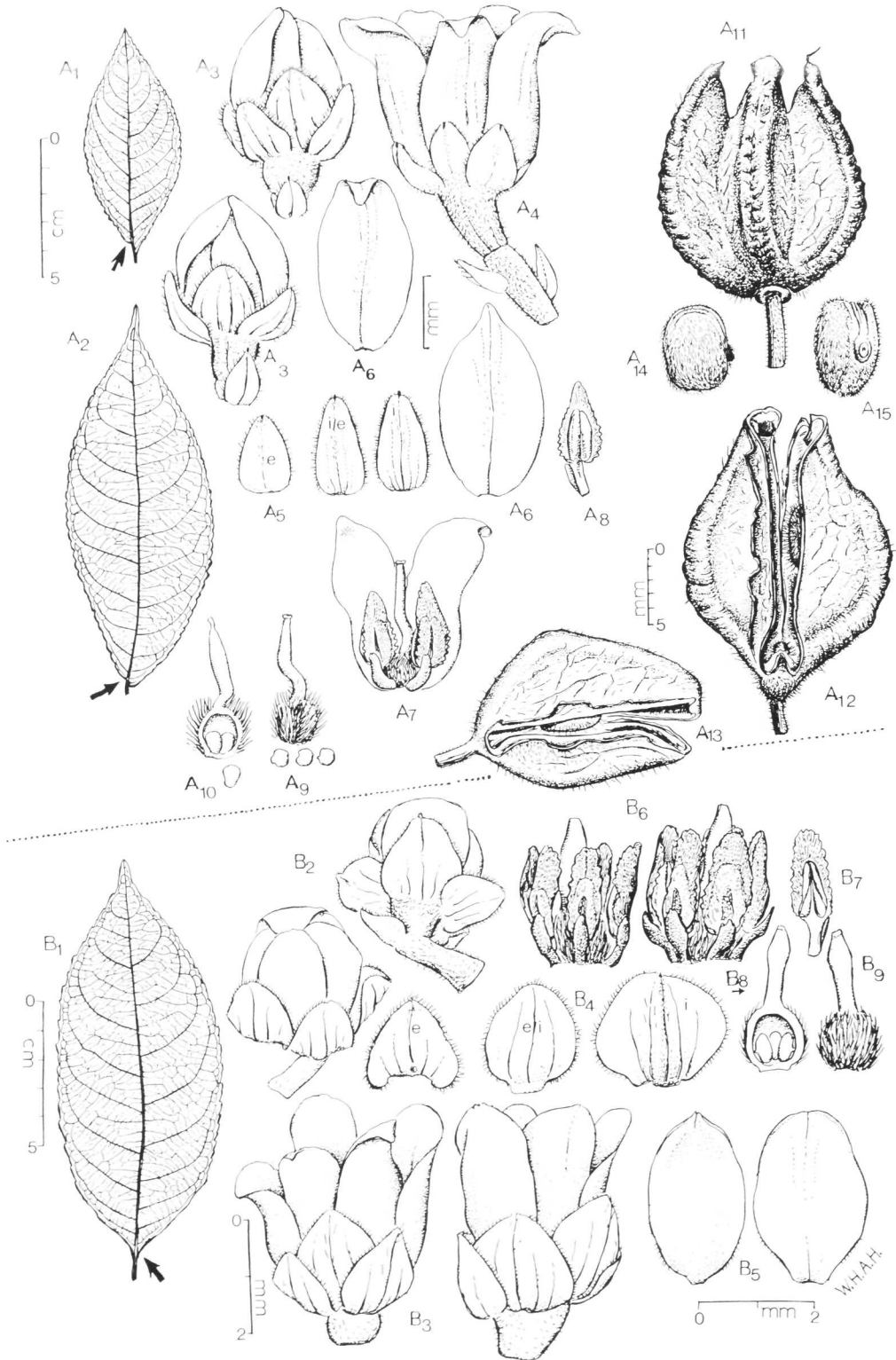
33a. *Rinorea lindeniana* (Tulasne) Kuntze var. *lindeniana*. Blake, Contr. U.S. Natl. Herb. **20(13)**: 503. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925; Notizbl. **10(96)**: 546. 30 Mar 1929; Sandwith, Bull. Misc. Inform. **1929(2)**: 77. 12 Mar 1929; Bull. Misc. Inform. **1933(6)**: 325. 16 Aug 1933; Baehni & Weibel, Candollea **8**: 194. May 1941; in Macbride, Publ. Field Mus. Nat. Hist., Bot. Ser. **13(4(1))**: 60. 30 Jun 1941; Smith & Fernández-P., Caldasia **6(28)**: 97. 1954.

Figs. 43A, 47.

Alsodeia lindeniana Tulasne, Ann. Sci. Nat. Bot., Sér. 3. **7**: 364. 1847; Walpers, Ann. Bot. Syst. **1**: 71. 6–7 Nov 1848 ('1848–1849'); Triana & Planchon, Ann. Sci. Nat. Bot., Sér. 4. **17**: 126. 1862; Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München **20**: 185. 1891 ('1890'). Type. Venezuela. Mérida-Trujillo: Cordillera de los Andes, 1000–3000 ft (=330 m, fide Melchior [1929]), 8 Apr 1982 (fl). *Linden* 247 (holotype, P; isotypes (?) (with different or without localities) BM, F, G, K, OXF, P, W).

Alsodeia guianensis (Aublet, 'Passoura guianensis') Eichler var. *lindeniana* (Tulasne) Eichler in Martius, Fl. bras **13(1)**: 387. 1871.

FIG. 43. A. *Rinorea lindeniana* var. *lindeniana* (A₁ from Cuatrecasas 7390; A₂ from Badillo 1450; A₃ from Breteler 3926; A_{4–10} from Ijjasz-Madriz 336; A_{11–13} from Montaldo 3851; A_{14,15} from A. C. Smith 3441). A_{1,2}, Leaves, oblique at the petiole. A₃, Flower buds. A₄, Adult flower. A₅, Sepals, subequal (e = exterior [=outside], i = interior [=inside], e:i in between). A₆, Petals. A₇, Androecium (dorsal), with pistil and two petals. A₈, Stamen (ventral). A_{9,10}, Pistil: ovary with ovules 3 × 1; style sigmoid curved at base. A_{11–13}, Capsule, dehiscing into subto unequal valves. A_{14,15}, Seeds, pilosulous. B. Var. *fernandeziana* (Fernández 365, type). B₁, Leaf, base symmetric and decurrent into the petiole. B₂, Flower buds. B₃, Adult flowers. B₄, Sepals subequal to unequal (e = exterior [=outside], i = interior [=inside], e:i = in between). B₅, Petals. B₆, Androecium (dorsal), surrounding pistil. B₇, Stamen (ventral). B₈, Pistil, with l.s. of ovary, showing ovules 3 × 1. B₉, Habit of pistil, style slightly curved at base.



Rinorea micrantha Ule in Pilger, Verh. Bot. Vereins Brandenburg 47: 157. 1906 ('1905'); Blake, Contr. U.S. Natl. Herb. 20(13): 504. 1924. Type, Brazil, Acre: Upper Juruá, mouth of Tejo, May 1901 (fl), Ule 5477 (holotype, B (destroyed in World War II); lectotypus novus, HBG; isotypes, G. K. L).

Rinorea parviflora Blake ex Pittier, Man. pl. usual, Venez.: 445. 1926, nom. nud.; Knuth, Repert. Spec. Nov. Regni Veg. Beih. 43: 488. 15 Nov 1927 ('1928'), cited as a synonym of *R. riana* (A. P. de Candolle) Kuntze; Melchior, Notizbl. Bot. Gart. Berlin-Dahlem 10(96): 546. 30 Mar 1929, cited as a synonym of *R. lindeniana* (Tulasne) Kuntze. Type specimen not indicated; the specimens Pittier 8908 (G. HH, NY, US, VEN 8726) & 8915 (HH, NY, US, VEN 8710) both from Venezuela (Carabobo-Yaracuy), provided with the notation *R. parviflora* S. F. Blake nov. sp. (ined.), belong to *R. lindeniana* (Tulasne) Kuntze var. *lindeniana*.

Tree or treelet 1.5–15 m tall. Leaf bases slightly oblique and subauriculate at the petiole. Inflorescences racemose or pseudoracemose. (4–)7.5–22.5 × ca. 0.5 cm. Pedicels, bracts and bractlets and floral parts usually smaller than in var. *fernandeziana*. Flowers whitish, creamy or yellowish. Sepals of adult flowers 0.75–1.5 × 0.5–1 mm. Petals ovate, 2–3 × 1–1.5(–2) mm. Style stipitiform, usually strongly sigmoid at the base. Capsule usually asymmetrically shaped, hispidulous to glabrescent, similar as in var. *fernandeziana*, 1–1.75 × 0.4–0.8 cm. Seeds subglobose, golden brownish pilosulous, similar as in var. *fernandeziana*, (3–)6–7.25 × 4–6 mm.

Distribution (Fig. 47) and ecology. The main area of distribution of var. *lindeniana* consists of a large hemi-elliptic main area from the Guiana Shield via the Upper Amazonian–Andean region (just E of the Cordilleras) to the Central Brazilian Shield. The species is notably wanting in the lower Amazon Basin, possibly because of the Atlantic transgression during the Pleistocene (Krook, 1979) and/or because of unknown ecological conditions. Two disjunct areas just S and E of the Cordilleras correspond to two forest refugia: (a) Colombia: Villavicencio; and (b) Venezuela: Apure.

Both populations became separated from the main population N of the Amazon Basin by transformation of previously interjacent tropical rain forests into savannas and grasslands. The origin of this dryer vegetation in the Llanos is due to the Cordilleran uplift causing a rain shadow as well as to a general climatic change from warm and humid to a cooler and dryer type. Both

processes started in the early Pliocene (Steyermark, 1974, 1979, 1982).

A second, probably coherent, series of disjunct areas occurs along the Caribbean Coast of Venezuela, which are correlated with the following forest refugia: (c) Catatumbo; (d) Rancho Grande; and (e) Sucre-Trinidad.

Finally, a third, probably also coherent, series of disjunct areas occurs in N Colombia and adjacent Panama, corresponding with the following forest refugia: (f) Colombia, W of the eastern Cordilleras: Río Magdalena; (g) Colombia, W of the Western Cordilleras: Nechí; and (h) Panama: Darién.

In this last series *Rinorea lindeniana* var. *lindeniana* is accompanied by another var., *fernandeziana*. The populations of the last two series became isolated by the already mentioned Cordilleran uplift and migrated subsequently to Central America after the closing of the Panama land bridge during the same period.

Rinorea lindeniana var. *lindeniana* occurs as a tree or treelet in the understory of primary tropical rain forests in both lowland and hilly to (sub)mountainous regions, from 0 to 1200 m. In the lowlands it is recorded from such uninundated areas as river dunes and ridges as well as from periodically inundated areas. Soil ferro-lateritic, clayish or sandy. Also found between metamorphic rocks, e.g., schists or gneisses.

Phenology. Flowering and fruiting throughout the year.

Representative specimens examined: PANAMA, DARIÉN: E slope of Cerro Sapo, 800 m, 3 Feb 1978 (bud), Hammel 1318 (MO, U); Río Tuquesa, Charco Chiva, 8°23'N, 77°47'W, 100 m, 5 Jul 1975 (fr), Mori 6690 (MO); Río Tuquesa, Charco Peje, 250 m, 8 Jul 1975 (fl), Mori 7049 (MO, U); N slopes of Cerro Pirre, 300–700 m, 8 Apr 1975 (fr), Mori & Kallunki 5506 (MO, U); 10 km NE of Jaqué, slopes of Río Tabuelitas above Brioguerá, along Río Jaqué below mouth of Río Pavarandó, ±125 m, 29 Jan 1981 (fr), Sysma & D'Arcy 3268 (MO, U). SAN BLÁS: Mainland opposite Playon Chico, 0–5 km from Caribbean Coast, 0–200 m, 4 Oct 1972 (fr), Gentry 6405 (MO); Comarca de San Blas, Aila Tiwar, Río Acla, 8°48'30"N, 77°40'30"W, 25–100 m, 16 Mar 1979 (fl), Sugden 5748 (MO).

COLOMBIA, AMAZONAS: Mouth of Río Loretoyacu above Barracón Cauchero, 300 m, 18 Nov 1945 (juv fr), Duque-Jaramillo 1107 (COL); Colombian–Brazilian Border nr. Rios Caquetá and Apaporis, opposite villa Bittencourt, 250 m, 5–6 Oct 1952 (juv fr), Garcia-Barriga 14752 (US); Río Amaca-Yacu, 20 km above mouth into the Río Amazonas, 3 Feb 1969 (fr), Sastre & Echeverry 584 (COL, P); Río Loretoyacu, 100 m, 20

km NE of Loreto (Perú). Oct 1946 (fl. fr). *Schultes & Black 8421* (K. US). CAQUETA: El Gaguán, vic. Johnson S of Cartagena. 27 Apr 1953 (fr). *Romero-Castañeda 4112* (COL); Remolino, mouth of Río Caqueta, 2 May 1953 (fr). *Romero-Castañeda 4183* (COL); CHOCÓ: Mun. of Riosucio, Parque Nacional de Katios, 28 Sep 1979 (fr). *Barbosa 1.188* (AUU). CÓRDOBA: Sahagun. 8°57'N, 75°27'W, 150–200 m, 27 Jan 1918 (fl). *Pennell 4079* (NY, US); Río Sino, 100–200 m, 7–10 Mar 1918 (fl). *Pennell 4634* (HH, MO, NY, US). CUNDINAMARCA: Mun. of Medina, vic. Boquerón de Santa Inés, 550 m, 28 Mar 1971, *Pinto & Bernal 1612* (COL). META: Savannas of San Juan de Aram, left border of Río Güejar, vic. Los Micos, 5–20 Dec 1950 (fr). *Idrobo & Schultes 706* (US); Sierra de la Macarena Northern Plateau, 1000 m, 3 Feb 1953 (fl). *Phillipson 2350* (BM); Villavicencio, 525 m, Mar 1948 (fl). *Sandeman 5817* (K. OXF); Basin of Río Meta, 1851–1857 (bud). *Triana s.n. p.p.* (!) (BM, FI); Río Zanza, N of Sierra Macarena, 2 Mar 1956 (fr). *Vogel 278* (MJG). PUTUMAYO: Umbría, 0°54'N, 76°10'W, 325 m, Jan–Feb 1931 (fl. fr). *Klug 1949* (F, HH, K, MICH, MO, NY, S. US); La Taqua, Río Caquetá, 5 May 1953 (fr). *Romero-Castañeda 4209* (COL). SANTANDÉR: Magdalena valley, Campo Capote, 30 km E of Carare, 6°47'N, 74°06'W, 300 m, 29 Sep 1977 (fl). *Gentry & Renteria 20022* (MO, U); ±3 km NE of Cimatarra, 200 m, 19 Aug 1953 (fl. fr), *Romero-Castañeda 4315* (COL). VAUPÉS: Cerro de Mitú, 380 m, 17 Sep 1968 (fl). *Cuatrecasas 6888* (COL, F, US); San José de Guaviare, 240 m, 4 Nov 1939 (fr). *Cuatrecasas 7390* (COL, F, US); Borders of Río Inirida (70°30'W), vic. Morichal nr. the border of Guainia, close to the mouth of Río Rapunáuna, 200 m, 17–18 Feb 1953 (fl. fr), *Fernández 2284* (COL, US).

VENEZUELA. ANZOÁTEGUI: Along Río León nr. Quebrada Danta, tributary of Río Neverí, NE of Bergatín, 500 m, 20 Feb 1945 (fr). *Steyermark 61014* (F, NY, US) & *61015* (VEN 35983). APURE: Left bank of Río Nula, about 20 km from Nulita, 420 m, 28 Apr 1964 (fl. fr). *Ijjasz-Madriz 336* (VEN); Reserva Forestal San Camililo, vic. Chiricoa, ±10 km E of San Camililo (El Nula), 200 m, 1 Apr 1968 (fr). *Steyermark et al. 81135* (VEN). ARAGUA: Parque Nacional, Dos Ríos, Caribbean coastal area, 600 m, 19–20 May 1943 (fl). *Killip & A. C. Smith 37738* (NY, US, VEN); Guamites, La Mesa, 700–1100 m, 17 Oct 1963 (fr). *Montaldo 3851* (NY); Parque Nacional Aragua, from Guamites to La Mesa, 1400 m, July 1947 (fl. fr). *Pittier & Nakichenovich 15486* (US, VEN); between Quebrada Río Hondo, S of Tremaria and Choroní, Río Grande del Medio, 200–300 m, 30 Apr–1 May 1972 (fl). *Steyermark & Carreño Espinoza 105876* (U, VEN); Rd. Maracay–Chorani, 1500 m, 6 Jun 1959 (fl). *Trujillo 4164* (MY); above Guamitas P.N., 780 m, 7 Oct 1938 (fr). *Ll. Williams 10450* (F, US, VEN 8725). BARINAS: Pedraza, nr. the border of Bolívar State, Feb 1953 (fl. fr). *Aristeguieta 1645* (NY, US, VEN 33919); Madre del Monte, Río Curbatuco, 300–400 m, 10 Dec 1954 (fl). *Bernardi 1716* (FI, K, MER 47758); 77 km from Barinas along rd. to San Cristobal, 350 m, 6 May 1964 (fl). *Breteler 3926* (MER, U, WAG). BOLÍVAR: Fall of Chalimeno in the Río Paramichi, 18 km N of the Ven-

ezuelan–Brazilian border, 4°2'N, 62°58'W, 625 m, 8 Jan 1962 (fr). *Steyermark 90712* (NY, U, VEN). CARABOBO: Río San Estebán (Las Quiegas), 450 m, 11 Sep 1964 (fr). *Dositeo 22* (VEN); Cassipanero, 700 m, Apr–May 1846 (fl. fr). *Funck & Schlimm 526* (BM, BR, CGE, F, G, P, US); ±15 km S of Puerto Cabello, ±6 km S of San Estebán, 10°24'N, 68°04'W, 150 m, 14 Apr 1982 (fl). *Liesner & Medina 13633* (MO, U, VEN). CAROBOBO–YARACUY: Guaremales, from Pto. Cabello to San Felipe, 19 Jun 1920 (fl). *Pittier 8908* (HH, NY, US, VEN 8726); Hills of La Forteleza (=Hills of Guaremales, 350 m [teste Blake, 1924]), 2 Jul 1920 (fl). *Pittier 8915* (HH, NY, US, VEN 8716). DISTR. FEDERAL: Capaya, s.d. (fl). *Karsten s.n.* (LE, W); El Limón, Puerto La Cruz, 700 m, 27 Aug 1918 (fl. juv fr), *Pittier 8056* (HH, US, VEN 8719); Depto. Libertador, between La Peña and Chichiriviche, along Río Chichiriviche, 10°31'N, 67°14'30"W, 500 m, 9 Oct 1976 (fl. fr), *Steyermark & Espinoza 11276* (U, VEN). GUARICO–MIRANDA: Road from Sta. Teresa to Altagracia de Orituco, Jun 1953 (bud). *Aristeguieta 1773* (VEN). LARA: Along the Aroa River, ±5 m, 26–28 Jun 1913 (fl). *Pittier 6378* (G, NY, US, VEN). MÉRIDA: Tovar, 1856–57 (fr). *Fendler 1981* (HH, K); 0.5–2.0 km above dam site on Río Guaimaral, 7°45'N, 71°29'W, 200–400 m, 15 Mar 1981 (fl. fr), *Liesner & González 10609* (MO, U) & *10632* (MO, U). MIRANDA: Parque Nacional de Guatopo, Sep 1966 (juv fr), *Aristeguieta & Agostini 6376* (VEN); Distr. Páez, drainage of Río Guapo, Cerro Riberón between Ríos Guapo and Chiquito, 44.5 km SE of Caucagua, 10°05'N, 66°01'W, 200–400 m, 8–10 Jun 1977 (fr), *Davidse & González 13754* (MO, U); Depto. Páez, Fila La Tigre, Quebrada San Juan, 18 km SE of Cúpira, 10°04'–05'N, 65°45'–47'W, 2–7 Sep 1977 (fr), *González & Ortega 1318* (MO, U). PARQUE NACIONAL de Siquire, 4 Apr 1917 (fr), *Pittier 7086a* (HH, US, VEN 8714); Parque Nacional de Guatopo, trail to Morro de Aguamaral passing Ríos Taquasito and San Lorenzo, 800 m, 25 Nov 1961 (fr). *Steyermark 90046* (VEN); Cerros del Bachiller, S of Sta. Cruz, 10 km W of Cúpira, 10°9'N, 65°48'W, 16–17 Mar 1978 (fr), *Steyermark & Davidse 116314* (MO, U). PORTUGUESA: Along Río Tucupido, 30 km E of Guanare, 9°2'N, 70°1'W, 11 Mar 1982 (fl. fr), *Liesner et al. 12491* (U, VEN). SUCRE: Paria Peninsula Cariaquita, 10–13 Mar 1911 (fl), *Bond et al. 258* (HH, NY, PENN, US); El Guayabito along Río Guayabito at its junction with the Río Zumbador, 10°10'N, 64°17'W, 230–250 m, 20–22 Nov 1981 (fr), *Davidse & González 19205* (MO, U); S slopes of Cerro Imposible, between Cedeño and Boca del Totaricual, along Quebrada Imposible, 140–120 m, 21 May 1945 (fl. fr), *Steyermark 62835* (F, NY, VEN 29789); Cerro Patao, N of Puerto de Hierro, NE of Güira, 100–300 m, 23 Jul 1962 (fl), *Steyermark & Agostini 91164* (K, US, VEN) & *91263* (K, US, VEN). TÁCHIRA: 10 km E of La Fundación, around Represa Dorada, 600–1000 m, 10–13 Mar 1981 (fr), *Liesner & González 10309* (MO, U); La Rochela, between Quebrada La Donata and Río Cuíte, S of La Espuma, SW of Santo Domingo, 7°31'N, 72°3'W, 350 m, 8 Nov 1979 (fr), *Steyermark & Liesner 119.553* (MO, U). YARACUY: Yumare, 100 m, 7 Feb 1929 (fr), *Bernardi 6929* (VEN); Chivaroa, 500 m, 30 Mar 1953 (fr), *Gines*

4328 (US); Sierra de Aroa, Cerro Tigre, 10 km E of Aroa, Río Carabobo, 800–1200 m, 10°26'N, 68°49'W, 31 Mar 1980 (fr), *Liesner & González 9771* (MO, U); Los Quaremales, 3 Feb 1919 (fr), *Pittier 8402* (US); Distr. Bruzual, Montaña de María Lionza, along Río Yaracuy, vic. la Quebrada Quibayo, 10°7'N, 68°55'W, 250 m, 12 Mar 1981 (fl), *Steyermark et al. 124903* (U, VEN); Mun. Chivaese, 30 Jun 1957 (fl), *Trujillo 3449* (MY).

TRINIDAD: Maracas, 1900 (fl, fr), *Dannouse 6421* (K, NY); Carapichaima, 4 Mar 1903 (fr), *Dannouse s.n.* (NY); Chaguanas, Caroni, 7 May 1868 (fl), *J. H. Hart 2786* (G); Arima, 16 Feb 1904 (NY) or 16 Jul 1904 (K) (fr), *McLean s.n.* (K, NY).

GUYANA: Rupununi River, above mouth of Marparri Creek, 14 Sep 1931 (fl), *Forest Department BG D-718 (=2169)* (K); NW slopes Kanunuku Mountains of Moku-moku Creek, tributary of Takutu, 150–400 m, 31 Mar–16 Apr 1938 (fl, fr), *A. C. Smith 3441* (B, F, HH, K, LE, LIL, NY, P, S, U, S, W).

SURINAM: S.L., s.d. (fl), *Kappler 243-B* (S, edidit R. F. Hohenkerk, 1845).

ECUADOR. NAPO: Vic. S. Pablo de Secoyas, 0°15'S, 77°21'W, 300 m, 5 Aug 1980 (fl, fr), *Brandbyge et al. 32458* (AAU); Lagunas de Cuyabeno, 0°1'S, 76°11'W, 300 m, 25 Aug 1981 (fl), *Brandbyge et al. 36128* (AAU); Río Yasuni, 80 km upriver from Nueva Rocafuerte, 225 m, 15 Sep 1977 (fr), *Foster 3659* (F); idem, 17 Sep 1977 (fl), *3710* (AAU). PASTAZA: Puerto Sarayacu, 3 Oct 1974 (fl), *Holguer Lugo 3908* (GB, U); Custillo Urco, 8 km N of Puerto Sarayacu, 6 Oct 1974 (fl, fr), *Holguer Lugo 3926* (GB, U); Tzapino, community of Waorani (Aucas), Río Curaray, 400–500 m, 16 Aug 1980, *Jaramillo & Coello 3599* (AAU); idem, Río Tzapino, 400–500 m, 17 Aug 1980 (fl), *Jaramillo & Coello 3651* (AAU).

PERU. AMAZONAS: S of Aintami Creek, E of Río Cenepa, 4°35'N, 78°12'W, 225 m, 15 Jan 1974 (fr), *Berlin 1584* (MO, U); Río Santiago, 2 km from Caterpiza, E bank of Caterpiza, 180 m, 13 Oct 1979 (fr), *Huashikot 905* (MO, U). AMAZONAS–LORETO: Basin of Río Marañón from Iquitos to mouth Río Santiago into Pongo de Manseriche, ca. 77°30'W, 1924 (fl), *Tessmann 4630* (G, NY, S). CUZCO: La Convención, 4 km NE of Hacienda Luisiana and Apurímac River, vic. Cordillera Vilcabamba (12°30'S, 74°30'W), 670 m, 31 Jul 1968 (fr), *Dudley 11463* (F). HUÁNUCO: Puerto Lira, along Río Pachitea, 300 m, 23 Jul 1929 (fl), *Killip & A. C. Smith 26832* (F, NY, US). JUNÍN: Cahuapanas, on Río Pichis, 340 m, 20–21 Jul 1929 (fr), *Killip & A. C. Smith 26714* (US) & *26716* (US); Mazamari, 1000 m, 7 Sep 1960 (fl, fr), *Woytkowsky 5968* (G, HH, UC, US). LORETO: Varadero de Mazán from Río Amazonas to Río Napo, 22 Aug 1972 (fr), *Croat 19459* (MO, U); Maynas, nr. Brilla Nueva, Borro, Indian village on upper Río Yaguasyacu, tributary of Río Ampiacu, 3°19'S, 71°51'W, 8 Nov 1977 (fl, fr), *Gentry et al. 20392* (MO, U); Andoaz, Río Pastaza, nr. border of Ecuador, 2°48'S, 76°28'W, 210 m, 15 Aug 1980 (fl), *Gentry et al. 29711* (MO, U); San Antonio, on Río Itaya, 110 m, 18 Sep 1929 (fl, fr), *Killip & A. C. Smith 29298* (F, US), *29342* (F, NY, US), *29459* (F, US) & *29630* (F, HH, US); Florida, Río Putumayo, at mouth of Río

Zubinetá, 180 m, May–Jul 1931 (fl), *Klug 2173* (BM, F, G, HH, K, MO, NY, S, US); above Pongo de Manseriche, left bank of Río Marañon, 26 Dec 1931 (fl), *Mexia 6346* (BM, F, G, HH, K, LIL, MICH, MO, NY, PENN, S, U, UC, US, Z); Río Javari, 2 hours above Río Javarizinho, 24 Oct 1976 (juv fr), *Prance et al. 24083* (INPA, NY, U); rd. to Nauta, vic. Iquitos, 30 Nov 1976 (fr), *Revilla 2044* (MO, U); Gamitanococha, Río Mazán, 100–125 m, 31 Jan 1935 (fl, fr?), *J. M. Schunke 148* (F, HH, LIL, MICH, NY, S, UC, US); Pucallpa, 8°23'S, 74°32'W, 16 Jul 1980 (fl), *Sousa 056* (MO, U); Maynas, Yanomono, 75 km NE of Iquitos, 3°30'S, 72°50'W, 106 m, 17 Oct 1980 (fl), *Vasquez & Jaramillo 521* (AMAZ, MO, U, USM); Lower Río Hullaga, 155–210 m, Oct–Nov 1929 (fr), *Ll. Williams 4881* (F, US). MADRE DE DIOS: Tambopata, 30 km SSW of Puerto Maldonado, at affluence of Río La Torre (Río d'Orbigny) and Río Tambopata (SE Bank), 12°49'S, 69°17'W, 260 m, 6 May 1980 (fl), *Barbour 5200* (MO, U); Parque Nacional del Manu, at junction of Río Panagua with Río Manu, 8 Aug 1975 (fl), *Foster 2516* (F). SAN MARTÍN: Mariscal Cáceres, Quebrada de Huaquisha, on the right side of Río Huallaga, 7°50'S, 76°40'W, 400–450 m, 30 Jun 1974 (fr), *J. Schunke-Vigo 7066* (MO, U); nr. Tarapoto, 1855–1856 (?) (fl), *Spruce s.n.* (K, W).

BRAZIL. ACRE: Mun. of Río Branco, rd. Río Branco–Porto Acre 20–30 km, 11 Oct 1980 (fr), *Cid & Nelson 2860* (INPA, NY, U); Basin of Río Purus, nr. mouth of Río Macaahan, tributary of Río Yaco, 9°20'S, 69°W, 9 Aug 1933 (fl, juv fr), *Krukoff 5391* (Xyl U/W 19330) (F, G, HH, K, LE, M, MICH, MO, NY, S, SP, U, UC, US, W); Río Branco, 24 Sep 1980 (fr), *Lowrie et al. 175* (INPA, NY, U); Rios Jurua–Mirim & Moa, vic. Porangaba, 17 May 1971 (fl), *Maas et al. 13070* (INPA, NY, U); rd. Río Branco–Quixada km 11, 10°0'S, 67°50'W, 18 Oct 1980 (fl, fr), *Br. Nelson 573* (INPA, NY, U); Porto de Río Acre, 11 Jul 1965 (fl), *Pires 10076* (COL, UB); Mun. of Sena Madureira, 10 km E of Río Iaco above Sena Madureira, 4 Oct 1968 (fr), *Prance et al. 7820* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, P, R, S, U, US, VEN); Río Acre, Sobazon, Jan 1912 (fl, fr), *Ule 9621* (G, K, L, NY, S). AMAZONAS: Río Demeni (Dimini), posto indígena Genipapo, 15 Oct 1952 (fl), *Froes 28940* (COL); Basin of Río Jurua nr. mouth of Río Embira, tributary of Río Tarauaca, 7°30'S, 70°15'W, 3 Jun 1933 (juv fr), *Krukoff 4636* (F, G, K, LE, M, MICH, MO, NY, RB, S, U, UC, US, W); idem, 4 Jul 1933 (fl), *5154* (F, G, HH, K, LE, M, MICH, NY, S, U, UC, US); Basin of Río Demeni, vic. Río Totobí, 25 Feb 1969 (fr), *Prance et al. 10211* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, S, U, US, VEN). PARÁ: Alto Purus, Porte Alegre, 7 Apr 1904 (fl, fr), *J. Huber 4377* (MG, RB, US); Río Purus, Bom Lugar, 29 Apr 1904 (fl), *J. Huber 4665* (INPA 159448, MG 4665, P, RB 21356). RONDÔNIA: Presidente Penna e Jarú, Jul 1918 (fl), *Kuhlmann 2175* (RB 14261); Basin of Río Madeira, 8 km NE of Porto Velho, 7 Nov 1958 (fr), *Prance et al. 8243* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, S, U, US, VEN); RORAIMA: Roraima, 10 km SE of Serra da Lua, 2°25'–29'N, 60°11'–14'W, 17 Jan 1969 (fr), *Prance et al. 9317* (C, COL, F, G, HH, INPA, K, M, MG,

MICH. MO. NY. P. R. S. US. VEN): Roraima. Par-amiteri Indian village (3°25'N, 63°23–30'W) 20 Feb 1973 (fr). *Prappo et al.* 10636 (INPA NY 15) S.L., s.d. (fr). *Martius s.n.* (M 102, 103).

BOLIVIA. LA PAZ: Santa Buena Ventura, 375 m, 27 Nov 1901 (fr). *R. S. Williams* 630 (BM, K, NY, US).

Local names. Colombia: Jasmín (Córdoba), Monilillo (Meta), Montée and Moonté (Amazonas, Ticuna language), Sangregallo (Chocó); Venezuela: Duara (Barinas), Gaspadilla, Gaspalilla (Anzoátegui); Luvara (Aragua); Pate grulla (Aragua); Rabo de Cachicamo (Carabobo), Tabaquito (Miranda, El Guapo language); Guyana: Mamusaré (Arawak language), Shero (Wapisiana language), Shipiye (Macusi language); Peru: Canel(l)a/Canil(l)a de Vieja (San Martín), Gopeña-go-ey (Loreto, Huitoto language), Limo(n)sacha, Limonsache, Pantui (Loreto).

The var. *lindeniana* differs from var. *fernandeziana* mainly by the asymmetric and subauriculate shape of the leaf bases and by inflorescences usually longer and narrower than in var. *fernandeziana*. The style of *Rinorea lindeniana* var. *lindeniana* is usually strongly to sigmoid curved, just as in *R. paniculata* of Subgroup IIa.3. 'Rinorea.' *Rinorea lindeniana* var. *lindeniana* has been often confused with *R. riana*, although the taxa are quite different. Some striking errors by various authors have been given under *R. riana*. Some specimens of var. *lindeniana* are aberrant in some features, e.g.: (1) *Brandbyge et al.* 36128 (Ecuador, Napo) has leaves provided with an extremely long acumen, up to 4 cm long; (2) *Mori* 7049 (Panama, Darién) has inflorescences thyrsoid at the base, i.e., with lateral cymules with three flowers or more; and (3) *Hammel* 1318 (Panama, Darién) has the number of ovules two instead of one per placenta.

Alsodeia guianensis (Aublet) Eichler var. *parviflora* Eichler in *Martius*, Fl. bras. 13(1): 387, 1871 does not belong to the same taxon as *Rinorea parviflora* Blake ex Pittier. The former is a synonym of *R. falcata*, but the latter is a synonym of *R. lindeniana* var. *lindeniana*.

33b. *Rinorea lindeniana* (Tulasne) Kuntze var. *fernandeziana* Hekking, *Phytologia* 43(5): 482, pl. 3, fig. 14, 1979. Type. Colombia, Chocó: Corédo, along the Pacific Coast, 16 Jun 1950 (bud, juv fl). *Fernández* 365 (holotype, COL; isotype, US). Figs. 43B, 44, 47.

Tree or *treelet* 3–10 m tall. *Leaf* bases symmetric, sometimes slightly decurrent into the petiole. *Inflorescences* strictly racemose, usually shorter than in var. *lindeniana*, 2.5–5 × ca. 0.75 cm. Pedicels, bracts, bractlets and floral parts usually larger than in var. *lindeniana*. *Flowers* whitish, creamy, yellowish, orange, sometimes also pink at the base. Sepals of juvenile flowers 1.5–2 mm long and wide. Petals of juvenile flowers ellipsoid, 3–3.5 × 1.75–2 mm. Style subclavate, not sigmoid as in var. *lindeniana*, slightly curved at the base. *Capsule* and *seeds* as in var. *lindeniana*. Fresh fruits are green, sometimes reddish stained.

Distribution (Fig. 47) and *ecology*. Variety *fernandeziana* occurs in the forest refugia Nechí in NW Colombia and Darién in adjacent Panama. It occurs as a treelet or tree in the understorey of primary tropical rain forests from 100 to 750 m. Its ecological amplitude is the same as that of var. *lindeniana*, which also occurs in this area.

Phenology. Probably flowering and fruiting throughout the year.

Representative specimens examined: COSTA RICA. PUNTARENAS: Hills above Palmar Norte, 100–200 m, 20 May 1976 (fl). *Croat* 35130 (MO).

PANAMA. CANAL ZONE: 1 Dec 1972 (fl), *Kennedy & Andrews* 1886 (MO, U); along Río Mendosa, 8 km NW of Gamboa, 100 m, 1 Nov 1973 (fl), *Nee* 7734 (MO, U); idem, 90 m, 9 Feb 1974 (fr), 9570 (MO, U). DARIÉN: Cerro Pirre, 300–650 m, 13 Dec 1976 (fr), *Duke* 6552 (MO); W slope of Cerro Pirre, 1000 m, 14 Dec 1962 (fr), *Duke* 6592 (MO); half way up slope of Cerro Pirre from Piji Vazal, 12 Nov 1977 (fl, fr), *Folsom* 6238 (MO, U); Cerro Sapo, 800 m, 1 Feb 1978 (fr), *Hammel* 1192 (MO, U); S of El Real on trail up Cerro Pirre, 8°00'N, 77°45'W, 550–1030 m, 29 Mar 1985 (fl), *McPherson* 7050 (MO, U); 10 km NE of Jaqué, slopes of Río Tabuelitas above Biroguería, on Río Jaqué below mouth of Río Pavarando, 125 m, 30 Jan 1981 (fr), *Sytsma & D'Arcy* 3330 (MO, U). SAN BLÁS: W of Puerto Obaldia, vic. La Bonga, 8°40'N, 77°25'W, 50–140 m, 24 Mar 1985 (fr), *McPherson* 6966 (MO).

COLOMBIA. CHOCÓ: N of Alto Curiche, 300 m, 19 May 1967 (fl), *Duke* 11216 (3) (MO, U); Río Salaquí, upstream from Río Sucio, 200 m, 23 May 1967 (fl), *Duke* 11374 (3) (unknown).

The variety *fernandeziana* differs from var. *lindeniana* mainly by the symmetric shape of the leaf bases and by inflorescences usually shorter and wider than in var. *lindeniana*. It is often confused with *Rinorea riana* because its habit, at first glance, resembles that of the latter. Most of the detailed characters, however, point rather

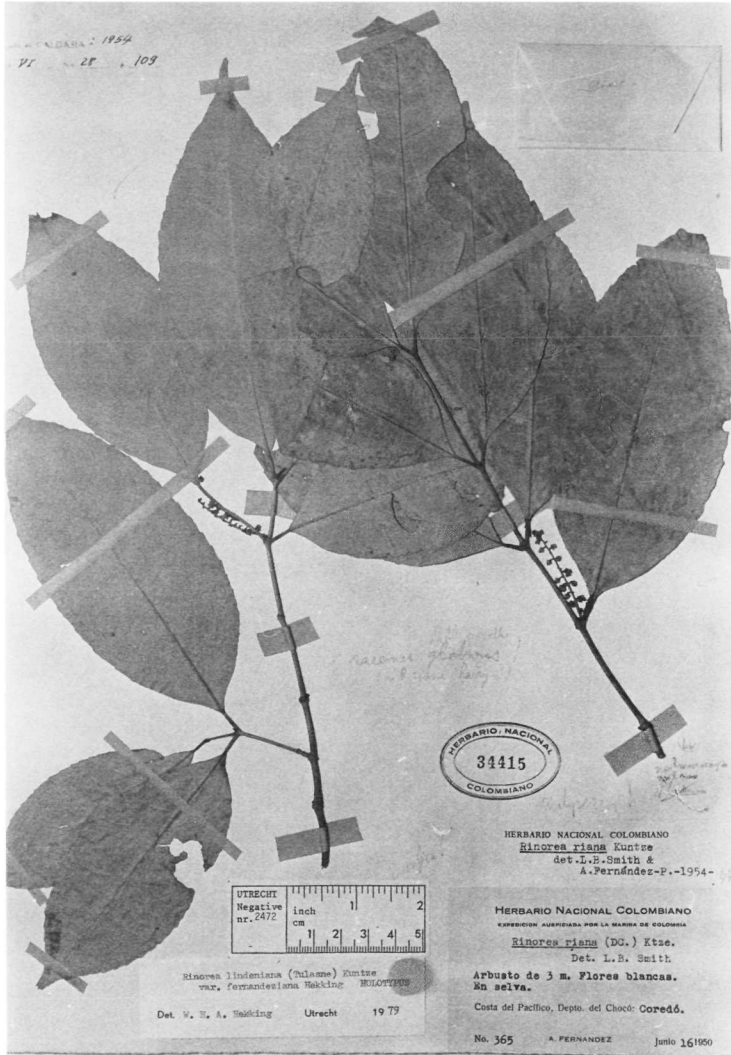
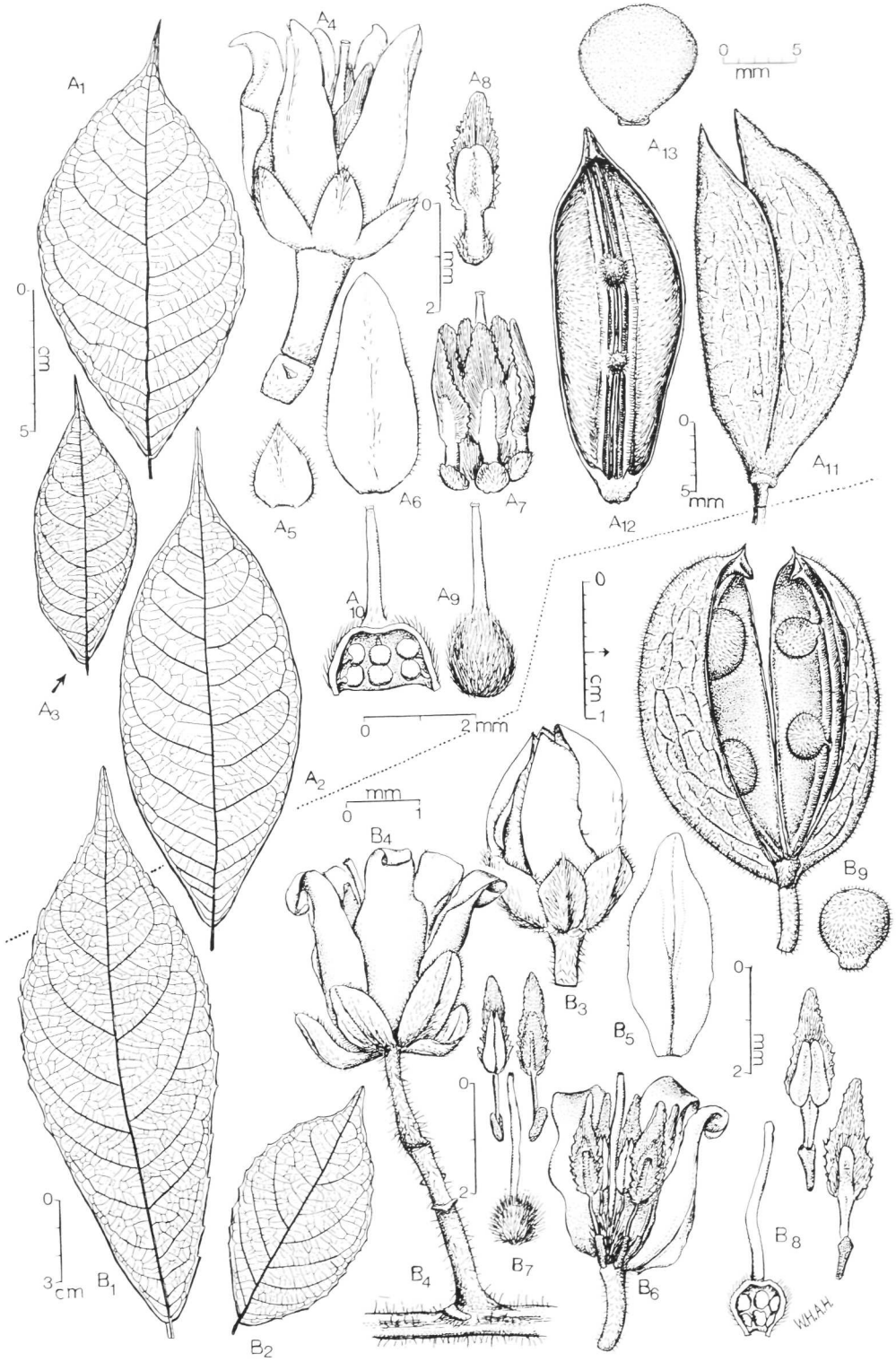


FIG. 44. Holotype specimen of *Rinorea lindeniana* var. *fernandeziana* (Fernández 365, COL).

FIG. 45. **A.** *Rinorea dasyadena* ($A_{1,2}$ from *St. George Expedition 561*; A_{3-9} from *Duke 8159(2)*, paratype; $A_{10,11}$ from *Duke 9941(2)*; $A_{12,13}$ from *Duke 11232(3)*). A_{1-3} , Leaves slightly oblique and subauriculate at the very base. A_4 , Adult flower. A_5 , Sepal. A_6 , Petal. A_7 , Androecium (dorsal), with dorsal glands pilosulous, surrounding pistil. A_8 , Stamen (ventral). A_9 , Pistil. A_{10} , Idem. with l.s. of ovary, showing ovules 3×2 . A_{11} , Capsule, with subequal valves. A_{12} , Valve (inside), with two juvenile seeds. A_{13} , Adult seeds, with pilosulous indument. **B.** *R. deflexiflora* (B_1 from *Deam 61*, type of *R. deflexiflora*; B_2 and B_8 from *Gentle 3222*, type of *R. gentlei*; B_3 from *Burns 19*; B_{4-7} from *Jiménez-M 3932*; B_9 from *Schipp 55*). $B_{1,2}$, Leaves, base tending to oblique subauriculate. B_3 , Flower bud. B_4 , Adult flower. B_5 , Petal. B_6 , Flower (inside), with androecium (dorsal), surrounding pistil. $B_{7,8}$, Stamens, with glabrous dorsal glands (dorsal, ventral); pistil, with habit and l.s. of ovary. B_9 , Capsule with juvenile seeds, showing 3×2 arrangement. Adult seed, pilosulous.



at *R. lindeniana* than to *R. riana*, e.g., the kind of tertiary venation, the absence of large ligneous lenticels on the branchlets, the bracts only up to 1 mm long (versus 1.5 mm or more in *R. riana*), stamens up to 2.5 mm long (versus 2.75–3.75 mm in *R. riana*); the ovary not 'spiny' hispid as in *R. riana* and finally, the style glabrous at the base (versus erect pilosulous in *R. riana*). The capsules of var. *fernandeziana* are sparsely hispidulous, just as in var. *lindeniana*, and not velutinous in combination with sparsely pilose as in *R. riana*.

Because of some similarities with *Rinorea riana*, introgressive hybridization of *R. riana* into *R. lindeniana*, resulting in *R. lindeniana* var. *fernandeziana* might be suggested except that *R. riana* does not occur at all in the area of distribution of the variety *fernandeziana*.

The description of *Rinorea riana*, given by Smith and Fernández-P. (1954) for the Flora of Colombia, refers to a mixture of *R. riana* and *R. lindeniana*, just as in Blake (1924). The cited Colombian specimens do not belong to *R. riana*, but to *R. viridifolia* and both varieties of *R. lindeniana*.

34. *Rinorea dasyadena* A. Robyns. Ann. Missouri Bot. Gard. **54**(2): 186. fig. 1. 1967. Type. Panama. Panamá: halfway between Goofy Lake and Cerro Jefe, 27 Apr 1966 (fl). *Odum* 2273 (holotype, MO). Figs. 45A, 47.

Tree or treelet, 2–13 m tall. Branchlets golden to ferruginous pilosulous in combination with sparsely pilose when young, glabrescent when older. *Leaves* apparently opposite; petioles 2–9 mm long, golden to ferruginous pilosulous; stipules deciduous, narrowly deltoid to linear, 2–2.5 × 0.25–1 mm, herbaceous, densely golden to ferruginous strigillose, ciliolate; lamina (narrowly) elliptic, acuminate, 6–17 × 3–5.5 cm, papery, glabrous on both sides; costa pilosulous to glabrescent above, sparsely golden to ferruginous strigose beneath; domatia usually wanting, sometimes scarcely present; lateral veins 9–14 pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate, slightly asymmetric and oblique, slightly obtuse to subauriculate at the petiole; margin subentire, sometimes subcrenate, mucronulate; acumen 1.25–1.75 cm long, apex subacute to subobtusish mucronulate. *Inflorescences* axillary, lateral and subterminal,

solitary, racemose, 4–23 × 0.4–1 cm; central axis, sparsely golden to ferruginous pilosulous; 'pedicels' 1.25–3 mm long, articulate at $\frac{1}{2}$ – $\frac{1}{3}$ from the base, sparsely golden to ferruginous pilosulous near the articulation; bracts and bractlets deciduous, deltoid to ovate, herbaceous, golden to ferruginous strigose near the apex of the costa, ciliolate, apex subacute; bracts 0.5–1 × 0.5–0.6 mm; bractlets subopposite, ca. 0.5 mm long and wide. *Flower* buds ovoid to tolpoid, acuminate, subobtusish. Flowers drooping, usually unilateral, whitish, creamy or yellowish, occasionally purplish. Sepals subequal, deltoid to ovate, acuminate, 1–1.25 × 0.75–1 mm, herbaceous, golden to ferruginous pilose(ulous) along the costa, 1–5 veined, margin ciliolate, apex subacute. Petals (narrowly) ovate, acuminate, 3.25–3.75 × 1.25–1.5 mm, herbaceous, slightly pilose along the costa, glabrescent, margin ciliolate, apex obtuse. Stamens 2.5–3 mm long; filaments free, 0.6–0.8 × 0.2–0.3 mm, glabrous; dorsal glands free, adnate to the filaments, ellipsoid to obovoid, 0.4–0.6 × 0.3–0.4 mm, usually distinctly shorter than the filaments, carnose, golden-brownish pilosulous, apex obtuse, truncate or emarginate; anthers ellipsoid, deltoid or ovoid, 1–1.25 × 0.5–0.75 mm, glabrous, apex of thecae obtuse and unappendaged; connective outside, narrowly deltoid to ovoid, (sub)obtusish, 0.8 × 0.2 mm, sparsely golden-brownish pilosulous to glabrescent; connective scales lateral as well as apical, ovate, 1.75–2.25 × 0.75–1 mm, scarious, orange-brown to fuscous, uncolored and transparent at the apex of the anthers, strongly erose especially near the base, apex (sub)obtusish. Ovary subglobose, 0.75–1.25 × 0.75–1 mm, golden to ferruginous pilose; ovules usually two, extremely rarely one per placenta; style filiform, erect or slightly curved, 1.75–2 mm long, exceeding the stamens by 0–0.5 mm, erect pilosulous at the base; stigma truncate or obtuse. *Capsule* more or less asymmetric, ovoid, acuminate, coriaceous to subligneous, green to purplish black when fresh, golden to ferruginous pilosulous, veined; valves three, subequal to unequal, 2.25–2.75 × 0.75–1 cm. *Seeds* usually two, rarely one per valve, subglobose, 6–8 mm in diam., brownish with white spots when dried, golden hirtellous.

Distribution (Fig. 47) and ecology. *Rinorea dasyadena* occurs on Isla de Gorgona, W of Colombia, in the forest refuge Nechí in NW Colombia, and in the forest refuge Darién and Chi-

riqui in Panama and Costa Rica. This species is endemic in this area, in the understory of primary tropical rain forests in lowlands as well as submountainous regions. It grows on slopes, summits of hills and lower mountains and along rivers, streams and creeks, from 0 to 1000 m. Soil unknown.

Phenology. Flowering and fruiting throughout the year.

Representative specimens examined: COSTA RICA. ALAJUELA: Finca San Gerardo. Río Jesús, San Ramón, 700 m, 20 May 1982 (fr). *Carvajal 258* (CR, U). PANAMA. BOCAS DEL TORO: 14 Aug 1940 (fr). *von Wedel 444* (MO). COCLÉ: 7 km from Llano Grande to Coclesito, 350 m, Jul 1979 (fr). *Antonio 1390* (MO, U); 27 km N of Coclesito, Continental Divide, ca. 750 m, 20 Feb 1978 (fl, fr). *Hammel 1638* (MO, U); S of Cascajal along Continental Divide, 8°45'N, 80°25'W, 800–900 m (fl). *Knapp 1964* (MO, U); Continental Divide, 4 km past Llano Grande on rd. to Cascajal, NW of Penonomé 500 m, 9 Apr 1981 (fr). *Sytsma 3898* (MO); Continental Divide, vic. of Río Blanco, 8°38'N, 80°36'W, 13 Dec 1980 (fr). *Sytsma et al. 2428* (MO, U). COLÓN: Between Llano Grande and Coclesito, 6 km N of Llano Grande, ca. 30 km N of Penonomé, 600 m, 28 Jan 1980 (fr). *Antonio 3601* (MO, U); from Santa Rita Ridge to Río Piedras, ca. 500 m, 23 Mar 1980 (fr). *Antonio 3872* (MO, U); N of Río Guanache, 9°30'N, 79°40'W, 100–200 m, 16 Nov 1975 (fr). *Davidse & D'Arcy s.n.* (MO, U); riverbanks nr. Alto Calvario, between La Junta and Limón, 800–1000 m, 12 Oct 1977 (fl). *Folsom 5891* (MO, U); Sta. Rita Ridge, 26 Sep 1974 (fr). *Mori & Kallunki 2129* (MO, U); idem, 9°24'N, 79°39'W, 12 Sep 1980 (fr). *Sytsma 1100* (MO, U); idem, 12 Sep 1980 (fr). *1129* (MO, U); idem, 25 Sep 1980 (fr). *1318 & 1333* (MO, U); Sta. Rita Ridge, 9°25'N, 79°35'W, 600–700 m, 30 Apr 1981 (fl). *Sytsma et al. 4173* (MO, U). DARIÉN: Cerro Pirre, 500–1000 m, 30 Dec 1972 (fr). *Gentry & Clewell 7123* (MO, U); S of El Real, on trail up Cerro Pirre, 8°00'N, 77°45'W, 550–1030 m, 29 Mar 1985 (fr). *McPherson 7049* (MO). HERRERA: N slope of Cerro Alto Rigo, 18 km W of las Minas, 750 m, 5 Aug 1978 (fr). *Hammel 4217* (MO). PANAMÁ: Cerro Jeffe, 27 Apr 1966 (fl). *Duke 8159(2)* (U); El Llano—Cartí Rd., 28 Apr 1981 (fr). *Sytsma 4122* (MO, U); Cerro Jeffe, vic. Goofy Lake, 700 m, 27 Dec 1980. *Sytsma et al. 2899* (MO, U). SAN BLÁS: Puerto Obaldía nr. Colombian border, 0–500 m, 28 Apr 1980 (bud). *D'Arcy 1366-A* (MO, U); Comarca de San Blás, El Llano—Cartí Rd., 19 km from Interamerican Hwy., 9°19'N, 78°55'W, 130–350 m, 4 Sep 1984 (fl). *de Nevers et al. 3849* (MO, U); idem, Continental Divide Trail, 12.2 km W of El Llano—Cartí Rd., 350 m, 19 Nov 1984 (fl). *de Nevers et al. 4339* (MO, U); El Llano—Cartí Rd., 24 km from Interamerican Hwy. nr. Punta Mama, 350 m, 16 Jan 1985 (fr). *de Nevers 4580* (MO, U); Comarca de San Blás, El Llano—Cartí Rd., 26.5 km, along Río Cartí Chico, 200 m, 11 Apr 1985 (fl). *de Nevers et al. 5340* (MO, U). VERAGUAS: NW of Santa Fé, 16 Nov 1974 (fr). *Mori*

& Kallunki 3217 (MO, U); idem, 17 May 1976 (fr). 6176 (MO, U).

COLOMBIA. CAJACA. Isle of Gorgona, Oct 1924 (fl). *St. George Expedition 261* (K). CHOCHO: Above Ierisita, below the rapids of Río Truando, 7–8 Feb 1967 (fr). *Duke 9941(2)* (U); idem, 18 May 1967 (juv fr), *11186(3)* (U); N of Alto Curiche, 300 m, 19 May 1967 (fr). *Duke 11232(3)* (U); Quebrada Mutatá, 6°18'N, 77°21'W, 10–50 m, 4 Jan 1984 (fl). *Juncosa 1690* (MO, U).

Rinorea dasyadena differs from *R. lindeniana* and *R. deflexiflora* mainly by: (1) petals 3× as long as the sepals (versus 1.5–2.5×); (2) its filaments 0.6–0.8 mm long (in *R. lindeniana* 0.3–0.4 mm long; in *R. deflexiflora* 1.25–1.5 mm long); (3) its dorsal glands hairy (versus glabrous); (4) its capsule 2.25–2.75 cm long (versus 1–2 cm long); and (5) its seeds 6–8 mm diameter (versus 2–5 mm diameter in *R. deflexiflora*).

Rinorea dasyadena most resembles *R. lindeniana* by reason of the leaf bases slightly oblique and slightly subauriculate at the petiole (versus distinctly oblique and subauriculate in *R. deflexiflora*). Leaves of *R. dasyadena* are acuminate (versus cuspidate in *R. lindeniana*); the leaf margin of *R. dasyadena* is always subentire, whereas that of *R. lindeniana* is predominantly (sub)cren(ul)ate. In *R. dasyadena* the costa is sparsely brownish strigose beneath, versus sparsely erect pilosulous near the base in *R. lindeniana*. Some specimens of *R. dasyadena* are aberrant in some features, e.g.: (1) *Antonio 1390* (Panama: Colón): branchlets, petioles, costa, central axis of inflorescence and fruits glabrescent to completely glabrous; (2) *Sytsma et al. 4173* (Panama: Colón) and *McPherson 7049* (Panama: Darién): number of ovules and seeds one instead of two per carpel.

35. *Rinorea deflexiflora* H. H. Bartlett in B. L. Robinson & H. H. Bartlett, Proc. Amer. Acad. Arts 43: 56, 1907 ('1907–1908'); Blake, Contr. U.S. Natl. Herb. 20(13): 515, 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352, 1925; Standley & Record, Field Mus. Nat. Hist., Bot. Ser. 12: 266, 1936; Standley & L. O. Williams, Fieldiana, Bot. 24(7(1)): 78, 1961. Type. Guatemala, Izabal: Livingston, 18 Feb 1905 (fl). *Deam 61* (holotype, HH: isotypes, F. MICH, MO, US). Figs. 45B, 47.

Rinorea gentlei Lundell, Wrightia 4(1): 39, 1968, 1968. Type. Belize, Stann Creek District: Stann Creek Valley, on hillside, Antelope Hill, 20 Feb 1940 (fl). *Gentle 3222* (holotype, LL: isotypes, HH, MICH, NY).

Tree or treelet 1.5–15 m tall. Branchlets sometimes purplish with whitish callose lenticels when dried, older branchlets becoming grayish, sparsely golden to whitish pilosulous when young, glabrescent when older. *Leaves* apparently opposite, sometimes also ternate; petioles (1–)2–8 mm long, golden hispidulous above, golden strigose beneath when young, glabrescent when older; stipules deciduous, deltoid, acuminate, 2.5–6 × 1–3.25 mm, herbaceous, sparsely golden to whitish strigose along the costa, ciliolate; lamina (narrowly) ovate, acuminate, (1.5–)3–21.5 × (0.5–)1–10 cm, herbaceous to papery, glabrous on both sides; costa above sparsely golden to whitish pilosulous, golden strigose to glabrescent beneath; domatia present, whitish to brownish pilose(ulous); lateral veins 7–14 (acumen excluded); tertiary venation reticulate to ± scalariform; base rounded to cuneate, asymmetric, oblique, subcordate to subauriculate at the petiole; margin (sub)crenate or (sub)serrate to subentire, mucronulate, ciliolate near the base; acumen (0–)0.5–3.5 cm long, apex subobtuse to subacute, often mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, (1–)2–6.5 × 0.6–0.8 cm; central axis golden pilosulous; ‘pedicels’ 1.5–6 mm long, articulate at 1/3 from the base, sparsely golden pilosulous; bracts and bractlets more or less ovate, herbaceous, golden pilosulous, costate, strongly veined, ciliolate, apex subacute, mucronulate; bracts 1.5–2 × 1–1.75 mm, costate, 5–7 veined; bractlets subalternate to subopposite, 1–1.5 × 0.5–1 mm. *Flower buds* ovoid, conical or torpid, subobtuse to subacute. *Flowers* deflexed, whitish or creamy. *Sepals* unequal, (ob)ovate to ellipsoid, 1.25–2 × 0.75–1.5 mm, herbaceous, scarious near the margin, golden strigose along the costa, obscurely 3–9 veined, margin ciliolate, apex (sub)entire, sometimes mucronulate. *Petals* narrowly elliptic to ovate, 3.25–4.25 × 1.5–2 mm, herbaceous, sparsely golden pilose when young, glabrescent when older, margin sparsely ciliolate, apex obtuse to subacute, sometimes sparsely pilosulous. *Stamens* 2.75–3.75 mm long; filaments free, 1.25–1.5 × 0.1–0.25 mm, glabrous; dorsal glands free, surrounding the basal part of the filaments, 0.25–0.75 × 0.1–0.25 mm, carnosic, glabrous, apex obtuse, rounded, truncate or emarginate; anthers ovoid, 0.75–1.25 × 0.25–0.75 mm, glabrous, apex of thecae obtuse to subacute, unappendaged; connective outside, narrowly ovate, del-

toid, elliptic or linear, obtuse, 0.5–1.25 × 0.1–0.25 mm, glabrous; connective scales lateral as well as apical, ovate, 1.5–2.25 × 0.5–1 mm, scarious, brownish, margin erose to lacerate, apex obtuse to rounded, (sub)erose. *Ovary* (sub)globose, 0.75–1.25 × 0.75–1 mm, golden villose; ovules two, occasionally three per placenta. *Style* filiform, erect to slightly curved, 2.25–2.75 mm long, exceeding the stamens by 0.2–0.6 mm, occasionally pilosulous at the base; stigma truncate. *Capsule* more or less symmetric, ellipsoid, shortly acuminate, coriaceous to subligneous, green when fresh, golden hirtellous, veined; valves three, (sub)equal, 1.5–2 × 0.5–0.75 cm. *Seeds* two per valve, subglobose, 2–5 mm in diam., golden hirtellous.

Distribution (Fig. 47) and *ecology*. This species is endemic in Central America over a range from SE Mexico to the eastern border of Panama. Specimens have been collected in SE Mexico (forest refuge Las Tuxtlas), Belize, Guatemala (Vera Paz, Pacífico), Nicaragua (forest refuge Chiriqui) and Panama (forest refuge Darién). The localities of Belize and Guatemala belong to the forest refuge area of Guatemala-North. The species has a scattered occurrence in the understory of those evergreen wet tropical forests which have a pronounced dry period (e.g., during the period December–April in Costa Rica). It is sometimes also collected in disturbed or secondary forests. It grows on slopes of hills and lower mountains or along rivers, streams and creeks, from 0 to 500 m. The soil in Central America is unknown, but in SE Mexico it was collected on karst limestone (Th. Wendt, 1983, information).

Phenology. Flowering and fruiting specimens collected during the period February–May; also flowering in November; probably fruiting in December. Little flowering has been reported during extremely dry periods.

Representative specimens examined: MEXICO, OAXACA: Zona Uxpanapa, Mun. of Matías Romero, 6.5 km E of Col Cuahtemoc, 17°07'N, 94°49'W, 170 m, 16 Feb 1981 (fl), *Wendt et al.* 2901 (MEXU, U). VERA CRUZ: Hidalgotitlán, 17°47'N, 94°35'W, 110 m, 13 Mar 1974 (fr), *Brigada Dorantes* 2540 (MEXU, U); Mun. of Minatitlán, 1 km S of La Garganta, 20 May 1983 (fr), *Wendt et al.* 4128 (MEXU, U). GUATEMALA, BOBOS: 15°21'N, 88°48'W, 27 Feb 1926 (fl, juv fr), *Record G 19* (= *Seria* 8850) (FHO, US). IZABAL: Atlantic coast, between Virginia and Lago Izabal, 4 Apr 1940 (fl), *Steyermark* 38764 (US).

BELIZE, CAYO: 35–40 km S of Belmopán, 22 Jan

1974 (bud). Dwyer & Liesner 12087 (MO, U). STANN CREEK: 13 Jan 1932 (bud). Burns 19 (FHO); Mullins River Road, 300 m 9 Mar 1939 (bud fr) Schipp 55 (G, HH, K, MICH, MO, NY, S, UC, US, Z); idem. *s.n.* (BM). TOLEDO: Coxcomb basin, 21 Mar 1967 (bud). Dwyer et al. 480 (MO, U).

NICARAGUA. CHONTALES: 1867 (bud, fl). Seemann 6 (=Anonymus 6) (BM, K); idem. 1867–1868 (fl, juv fr). Tate 143 (BM, K).

COSTA RICA. ALAJUELA: Beside Rio Peje, 2 km SE of Florencia, +9°75'N, 83°48'W, 1 May 1972 (juv fr). Lent 2528 (F); Santa María National Park, 10°37'N, 85°17'W, ca. 600 m, 7 Feb 1978 (fl). Liesner 5116 (MO, U). GUANACASTE: 3 km N of Rio Naranjo, 100 m S of the Guanacaste–Alajuela border, 10°42'N, 85°04'W, 500 m, 5 Jan 1975 (fl, fr). Taylor 18109 (MO). HEREDIA: Tirimbina, Sarapiquí, 220 m, 26 Nov 1971 (fl). Lent 2240 (F, GB, U). LIMÓN: Puerto Viejo, 9°39'N, 82°45'W, 90 m, 13 Jan 1970 (fl). Frankie 340 (MO) & 340-C (F). PUNTARENAS: Pacific slope of the Talamanca Range, E of Quepos, 19 Feb 1977 (bud). Burger et al. 10584 (AAU); Pacific region, Peninsula Osa nr. Golfo Dulce, vic. Puerto Jimenez, 4 Apr 1930 (fr). Cufodonti 133 (W); idem, 4 Apr 1930 (fl), 175 (G, K, W); La Gloria, 375 m, 2 Apr 1966 (fl). A. Jiménez-M. 3932 (BM, F, LL); 8 km N of Baranca, Quebrada Negros, 10°02'N, 84°45'W, 20–30 m, 30 Apr 1983 (fr). Liesner et al. 15132 & 15134 (MO, U).

PANAMA. DARIÉN: Manene, to mouth of Rio Cuasi, 7°41'N, 77°50'W, 28 Apr 1976 (fr). Kirkbride Jr. & Bristan 1456 (MO).

Local name. Belize: Wild Coffee.

Rinorea deflexiflora differs from *R. dasyadena* and *R. lindeniana* mainly by: (1) leaf bases distinctly oblique and subauriculate at the petiole; (2) domatia present (wanting to scarcely present in *R. dasyadena*; always wanting in *R. lindeniana*); (3) pedicels 1.5–6 mm long (versus 1–3 mm long); (4) flowers distinctly deflexed (in both other species drooping); (5) filaments longer than 1 mm and longer than the anthers (versus shorter than 1 mm and shorter than the anthers); and (6) style 2.25–2.75 mm long (versus 1.25–2 mm long).

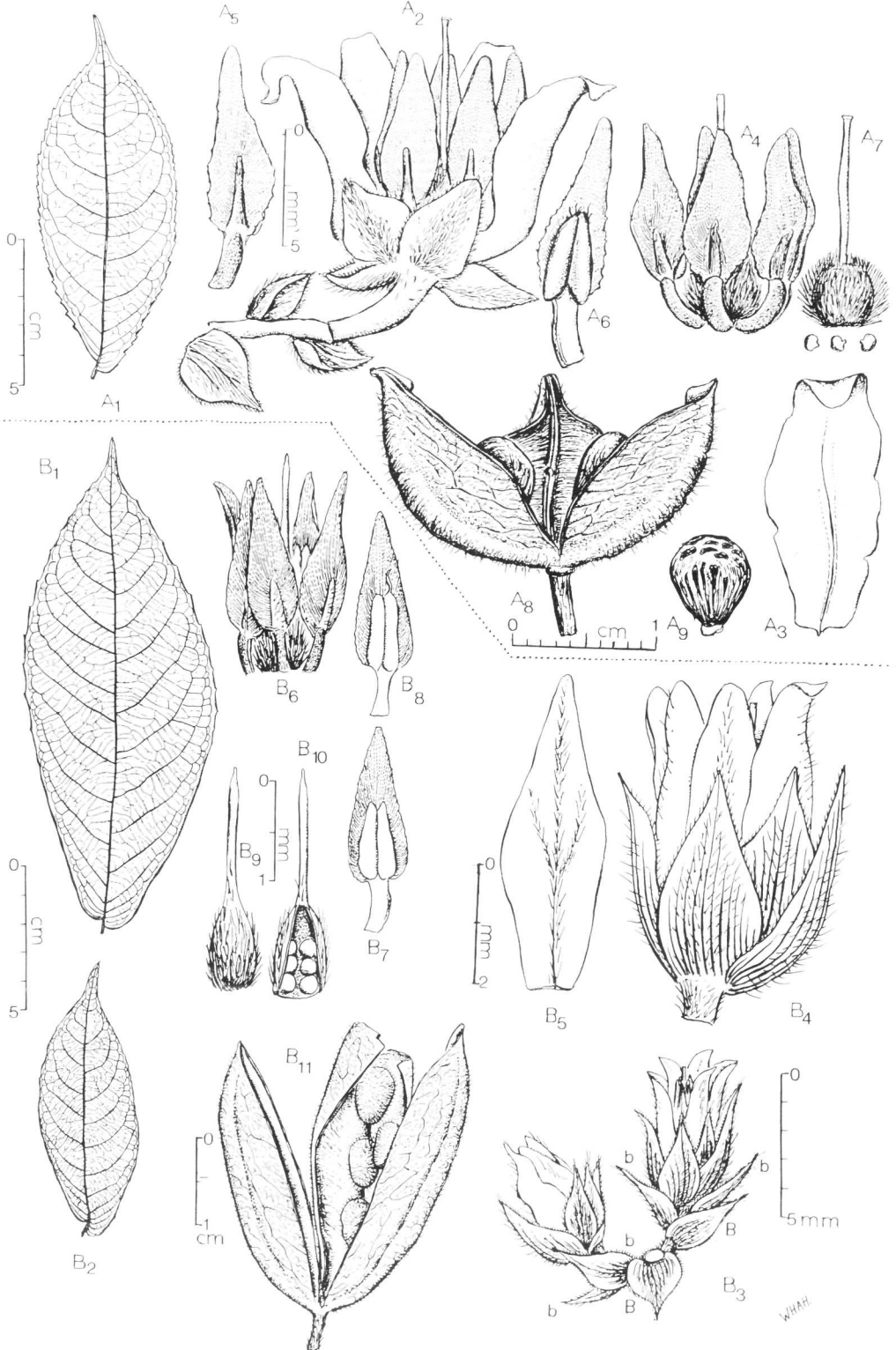
Petals are whitish when fresh, but are chocolate-brown with a yellow margin when dried. By this differing feature exsiccatæ of *Rinorea deflexiflora* can be distinguished from those of *R. dasyadena* and *R. deflexiflora*.

Cufodonti 133 & 175, collected in Costa Rica, have been incorrectly cited by Cufodonti (1935) as *Rinorea squamata*; they belong to *R. deflexiflora*.

36. *Rinorea neglecta* Sandwith. Kew Bull. 1955(3): 371. 1955. Type. Guyana: Mazaruni.

Takutu Creek to Puruni River, 14 Aug 1944 (fl). Fanshawe F 2177 (=Forest Dept. 4913) (holotype, K). Figs. 46A, 47.

Tree 1–7 m tall. Branchlets ferruginous hispid and hispidulous when young, glabrescent when older. Leaves apparently opposite, sometimes also ternate; petioles 1–7 mm long, densely ferruginous hispidulous; stipules deciduous, narrowly ovate to subulate, 4–8 × 1–2 mm, coriaceous, sparsely ferruginous pilose(ulous), ciliolate; lamina (narrowly) obovate to elliptic, acuminate, (3–)5–18 × (1.5–)2–6(–7.5) cm, papery to herbaceous, glabrous on both sides; costa whitish to ferruginous puberulous to glabrescent above, ferruginous strigose beneath, especially near the base; domatia occasionally present; lateral veins 9–14 pairs (acumen excluded), glabrous above, sparsely ferruginous strigose to glabrescent beneath; tertiary venation reticulate; base rounded to cuneate, asymmetric, oblique and subauriculate at the petiole; margin serrulate, mucronulate; acumen 0.5–2(–3) cm long, apex subacute to subobtuse, mucronulate. Inflorescences axillary, lateral and subterminal, solitary, racemose, (1–)1.5–6 × ca. 1.5 cm; central axis ferruginous hispid and hispidulous; 'pedicels' 2–4 mm long when flowering, 4–7 mm long when fruiting, articulate at ½–½ mm from the base, sparsely ferruginous pilosulous to glabrescent; bracts and bractlets ovate, acuminate, herbaceous, ferruginous strigose, ciliolate, apex subacute; bracts 1.5–1.75 × 1–1.5 mm; bractlets subopposite to alternate at the base below the articulation, 1–1.5 × 0.75–1.25 mm. Flower buds ovoid, obtuse. Flowers drooping, white, creamy or yellow, fragrant. Sepals subequal, ovate to deltoid, 1.75–2 × (0.75–)1–1.25(–1.5) mm, herbaceous, scarious near the margin, ferruginous strigose, ciliolate, apex subacute. Petals narrowly elliptic, (3.5–)4–5 × 1.5–2.25 mm, herbaceous, glabrous also along the margin, apex (sub)obtuse. Stamens 2.75–4 mm long; filaments free, 0.5–1 × 0.2–0.4(–0.6) mm, glabrous; dorsal glands free, adnate to the filaments, (narrowly) elliptic, sometimes reduced, 0.2–1.2 × 0.2–0.6 mm, carnos, glabrous, apex obtuse; anthers narrowly ovoid, 1.25–1.5 × 0.4–0.6 mm, glabrous, apex obtuse to subacute, sometimes appended by 1–5 set(ul)ae ca. 0.2 × 0.05–0.1 mm; connective outside narrowly deltoid to elliptic, subobtuse; connective scales lateral as well as apical, ovate, 2–



3 × 0.75–1.25 mm, scarious, brownish, suberose near the base, apex obtuse and subentire. Ovary subglobose to conical, 1 mm in diam., golden whitish pilose; ovules one per placenta. Style filiform, erect (2)–2.5–3.5 mm long, exceeding the stamens by 0.25–0.75 mm, completely glabrous; stigma truncate. *Capsule* symmetric to asymmetric, ovoid, acuminate, coriaceous to subligneous, sparsely ferruginous pilosulous, veined, apex obtuse; valves three, subequal to unequal, 1–1.75 × 0.5–0.75 cm. *Seeds* one per valve, subglobose to pyriform, 5–6 mm in diam., pale green when fresh, purplish stained when dried, glabrous.

Distribution (Fig. 47) and ecology. Widespread over Amazonia (Brazil, S Colombia, S Venezuela, NE Peru) and the Guyanas. It is a common undergrowth tree in the understory of primary tropical rain forests, mixed forests and capoeira in lowlands and submountainous regions from 0 to 800 m. Specimens have been collected on slopes of hills and mountains, in gullies and along rivers and creeks. Along rivers the species prefers unundated areas. It prefers soils consisting of granitic rocks, ferrolateritic gravels, 'latosolo amarelo,' loams and clays.

Phenology. Flowering and fruiting throughout the year.

Representative specimens examined: COLOMBIA. CAQUETÁ: Mouth of Río Caguán, 400 m, 12 Apr 1953 (fr). *Romero-Castañeda 3973* (COL). CHOCÓ: E side of Serranía del Darién, 8°30'N, 77°20'W, 280 m, 15 Jan 1983 (fr). *Juncosa 671* (MO, U); 3 km upstream of mouth of Río Tiopicho into Río Cacarica, 8 Jun 1857 (juv fr). *Romero-Castañeda 6210* (COL).

VENEZUELA. AMAZONAS: Atures, vic. Puerto Ayacucho, 5°44'N, 67°30'W, 90 m, 26 Jan 1978 (bud). *O. Huber & Cerda 1450* (U, VEN).

GUYANA: ESSEQUIBO–DEMERARA: Madray–Buby Trail, 8 Feb 1944 (fr). *Fanshawe in Forest Dept. F 1688 = FDG 4424* (K); Pomeroun River, from Karalli, 11 Aug 1944 (fr). *Fanshawe in Forest Dept. F 3040 = FDG 6370* (K, NY, U).

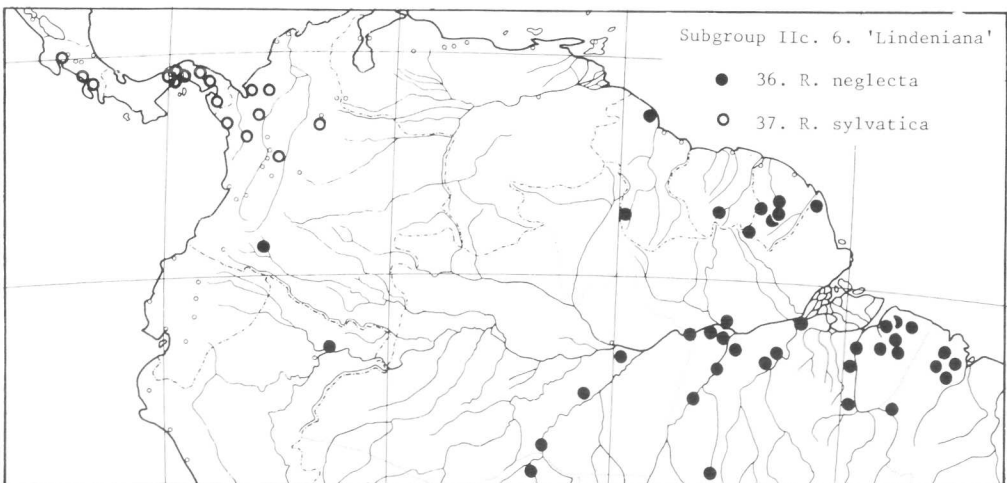
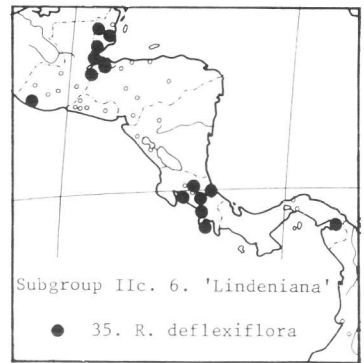
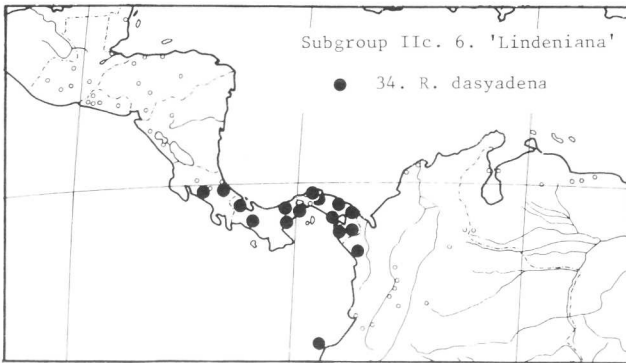
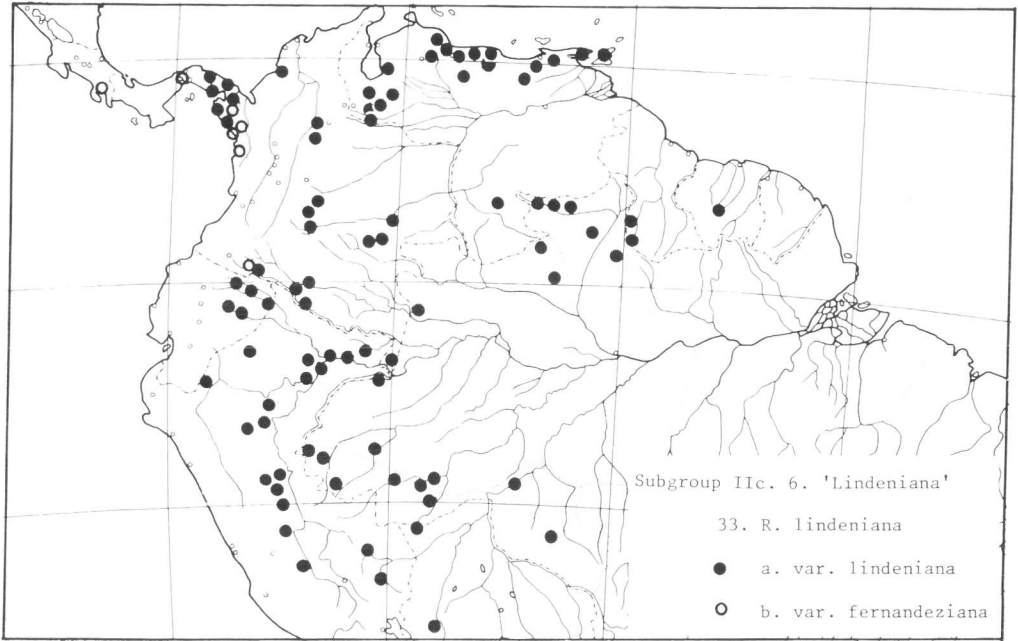
SURINAM: Upper Tapanahony–Awalapé Creek, Jan–Feb 1961 (st). *Elburg LBB 8837* (BBS, U).

FRENCH GUIANA: Mont Atachi Bacca, halfway between two summits of 525 m and 782 m, ±400 m, 3 Mar 1971 (fr). *de Granville 756* (CAY, P); Tumac-Humac, border French Guiana and Suriname, 280 m, 27 Jul 1972 (bud). *de Granville 979* (CAY, P); Basin of Upper Inipi, N of Creek Emerillon, vic. Saül, 25 Sep 1980 (fl). *de Granville 3980* (CAY, U); Saül, along Creek Nouvelle France, 7 km from Roche Bateau, 20 Jan 1972 (fr). *de Granville B-4272* (CAY, P); Tumac-Humac, border Brazil–French Guiana, 250 m, 29 Aug 1972 (fr). *de Granville B-4485* (CAY, P); Tumac-Humac, border Suriname–French Guiana, Indian trail from Creek Waamapahan to Creek Koulè-Koulè 250–400 m, 7 Sep 1972 (juv fr). *de Granville B-4534* (CAY, P); Lower and middle slopes of Mt. Tipoe, 0–200 m, 3°36'N, 51°19'W, 13 Oct 1960 (bud). *Irwin 48675* (IAN, UB); Roche Bateau, vic. Saül, 700 m, Jan 1976 (bud). *Moretti 384* (CAY, U); idem, 23 Dec 1976 (fr). *Moretti & de Granville 8826* (NY, U); Tumac-Humac, frontier Brazil, French Guiana and Suriname. Toukouchipan, 450 m, 19 Aug 1972 (fl). *Sastre 1731* (CAY, P).

PERU. LORETO: Maynas, Quebrada Yanomono, above mouth of Río Napo on Río Amazonas, 9 Nov 1979 (st). *Gentry et al. 27915* (MO, U).

BRAZIL. AMAPÁ: Tumac-Humac, border of Brazil, French Guiana and Suriname Mitaraka, km 4.6, 400 m, 5 Aug 1972 (bud). *Sastre 1573* (P). AMAZONAS: Democracia Madeira, 31 Aug 1923 (fl). *Kuhlmann 258* (RB 21.245). MARANHÃO: S of Fazenda Primavera, Arguaná, km 162 of BR 316, 3°0'S, 45°40'W, 24 Sep 1980 (fr). *Daly et al. D-243* (INPA, NY, U); Fazenda Bacaba, 5 km S of MA 119, 3 km NW of Lago de Junco, 4°26'S, 44°58'W, 4 Oct 1980 (fr). *Daly et al. D-473* (INPA, NY, U); between Viana & Banderante, back rd. from Viana to Pinheiro, ±3°0'S, 45°10'W, 17 Oct 1980 (fl). *Daly et al. D-663* (INPA, NY, U); Fazenda CVB, nr. km 130 of BR 222, 80 km from Sta. Luzia to Açailândia, 4°02'S, 46°05'W, 24 Oct 1980 (fl). *Daly et al. D-750* (INPA, NY, U); Rd. BR 222 km 124, from Sta. Iña to Açailândia, 14 Nov 1979 (fr). *Rosa & Vilar 3019* (INPA, NY, U); 240 km from Tocantins to Belém, 220 m, 11 Nov 1963 (fl). *N. T. Silva 57779* (COL, NY). PARÁ: Santa Izabel, Caraparú, s.d. (fl). *Anonymous s.n.* (MG 10135, RB 21.364, US); Utinga, 1–2 km N of Belém, 24 Aug 1942 (fl). *W. A. Archer 7609* (F, IAN, K, NY); Belém, 1.5 km SW of IAN, 21 Dec 1942 (fr). *W. A. Archer 8016* (F, IAN, K, US); Marabá–Altamira, km 55, 5°05'S, 49°25'W, 13 Jan 1976 (fr). *Bamps 5148* (BR, U); Rd. Altamira–Itaituba, km 115, 3°25'S, 53°15'W, 18 Jan 1976 (fr). *Bamps 5177* (BR, U); Transamazonian Hwy., BR 230, nr. EMBRAPA Station, at 23 km on rd. Altamira–

FIG. 46. A. *Rinorea neglecta* (A_{1,2} from *Archer 7609*; A_{8,9} from *Silva 27*). A₁, Leaf, oblique auriculate at very base. A₂, Flower, showing habit of bracts, bractlets, and sepals. A₃, Petal. A₄, Flower (inside), with androecium (dorsal), surrounding pistil. A₅, Stamen (dorsal). A₇, Pistil, ovules 3 × 1. A₆, Stamen (ventral). A₈, Capsule, dehiscent into three subequal valves. A₉, Seeds, glabrous. B. *R. sylvatica* (B₁ from *P. H. & D. Allen 5262*; B_{2,3} from *P. H. Allen 5507*; B_{10,11} from *Pennell 4212*; B₁₁ from *Pennell 4569*). B_{1,2,3}, Leaves, oblique subcordate to subauriculate at the very base; B₃, Flowers with bracts and bractlets. B₄, Flower. B₅, Petal. B₆, Androecium (dorsal), surrounding pistil. B₇, Stamen (ventral), theca unappendaged. B₈, Idem, theca appendaged. B₉, Pistil. B₁₀, Idem, with l.s. of ovary, showing ovules 3 × 3. B₁₁, Capsule, dehiscent, with 3 × 3 pilosulous seeds.



Itaituba, 29 Oct 1977 (fr), *Berg et al. BG-728* (INPA, NY, U); Guaraná, rd. to Rio Curuá Una, vic. Santarém, 30 Nov 1966 (fr), *Cavalcante & M. Silva 1473* (MG); Mun. of Oriximiná, 20 km from rd. parallel with the Rio Trombetas, km 24, 20 Jun 1980 (fr), *Cid & J. Ramos 1107* (INPA 94.297, NY); Igarapé Cagancho, ± 1 km E of dam of Tucurá, $\pm 3^{\circ}50'S$, $49^{\circ}37'W$, 29 Oct 1981 (fl), *Daly et al. 1038* (INPA, NY, U); ± 18 km S of Tucurui, just E of old BR 422, $3^{\circ}45'S$, $49^{\circ}40'W$, 5 Nov 1981 (fl, juv fr), *Daly et al. 1233* (INPA, NY, U); Obidos, Curuçamba, 27 Dec 1904 (fr), *Ducke 6948* (MG); Rio Tapajós, Lugar Francez, 30 Sep 1922 (fl), *Ducke s.n.* (RB 21.375); idem, 21 Dec 1947 (fl, fr), *s.n.* (RB 85.368); Rio Tocantins, 24 Sep 1948 (bud), *R. L. Froes 23514* (COL, IAN, US); Region of Gato, planalto of Santarém, rd. to Rio Curuá-Una, 22 Aug 1954 (fl), *R. L. Froes 31073* (COL, IAN); Sertão, planalto of Santarém, Nov 1954 (fr), *R. L. Froes 31418* (COL, IAN); Rio Jaraucú, Porto de Móz, 27 Sep 1955 (fl), *R. L. Froes 32112* (COL, IAN); Rd. Belém-Brasília, km 93, 14 Sep 1959 (bud), *Kuhlmann & Jimbo 232* (MG 24.126); idem, km 62.5, 22 Sep 1959 (juv fr), *Oliveira 138* (COL); idem, km 159-166, 26 Apr 1960 (fr), 576 (COL, IAN); E.F.B. Sta. Izabel, Cassuparú Matta, 28 Dec 1908 (fl), *Pessoal do Museo Goeldi MG 10135* (MG); Tomé Assú, Rio Pequeño, tributary of Rio Acará, 27 Dec 1948 (juv fr), *J. M. (urça) Pires 1472* (IAN, US); Branch rd. N of km 20 of Transamazonian Hwy. BR 230, Altamira-Itaituba, 31 Oct 1977 (juv fr.), *Prance et al. P 24718* (NY, U); Cuiabá-Santarém Hwy. RB 163, km 1004, 14 Nov 1977 (fr), *Prance et al. P 25388* (NY, U); Transamazonian Hwy. BR 230, 5 km W of Ruropolis Presidente Medici towards Itaituba, 29 Nov 1977 (juv fr), *Prance et al. P 25855* (NY, U); On lands of Inst. Agronómico do Norte, Belém, 13 Jan 1944 (fr), *A. Silva 27* (IAN, US); Hwy. Cuiabá-Santarém, km 1180, 17 Nov 1977 (fr), *A. G. Silva et al. AS-234* (INPA, NY, U); Hwy. Belém-Brasília, Paragominas, Tomé Açú, 17 Jan 1966 (juv fr), *M. Silva 425* (MG); Parque Nacional do Tapajós, 85 km from Hwy. Itaituba-Jacareacanga, Ramal do Pau Rosa, 14 Nov 1976 (juv fr), *M. G. Silva & Rosario 3716* (INPA, NY, U); Rio Tapajós, Villa Braga, 31 Oct 1908 (fl), *Sneath 10053* (MG, RB); Mun. of Sta. Izabel, ± 35 km Hwy. Belém-Brasília, 5 Sep 1979 (bud), *Zarucchi & Llanos 2520* (INPA, NY, U). RONDÔNIA: Mun. de Porto Velho, Jacunda 106 km from Porto Velho, $9^{\circ}7'24.5''S$, $62^{\circ}54'W$, 4 Oct 1979 (fr), *Vieira et al. 225* (INPA, NY, U); idem, 26 Oct 1979 (fr), 285 (INPA, NY, U); S.L.: N part of Brazil, 1877-1878 (bud), *Jobert 911* (P).

Local names. Guyana: Mamusaré (Arawak language); Surinam: Manarie tikie (local Creole language); French Guiana: Gaulette (local Creole language); Brazil: Burangi (Maranhão), Canela de Garça, Canela de Velho, Carapé, Caripé, Inambu guiana, Jacamin and Marauba (Pará). In

Surinam the branchlets are used for sieve-making.

Rinorea neglecta and *R. sylvatica* can be distinguished from all other species of this subgroup and from the species of the following Subgroup Ilc.7. Ulmifolia by the combination of the following characters: (1) their ferruginous indument; (2) their leaf bases distinctly oblique and distinctly (sub)cordate and (sub)auriculate; and (3) their inflorescences strictly racemose. *Rinorea neglecta* is the only species in this subgroup with glabrous seeds; in all other species the seeds are pilosulous. For differences with *R. sylvatica* see under that species.

The following specimens of the Kew herbarium (K) have been incorrectly labeled as paratypes, because they have not been published as such by Sandwith (1955): *Fanshawe F 1688* (FDG 4424) (fr); *Fanshawe F 3040* (FDG 6370) (fr); *Archer 6370* (fr); *Archer 7609* (fl).

37. *Rinorea sylvatica* (Seemann) Kuntze, Revis. gen. pl. 1: 42. 1891 ('sylvatica'); H. H. Bartlett in B. L. Robinson & H. H. Bartlett, Proc. Amer. Acad. Arts 43: 56. 1907 ('1907-1908') ('sylvatica'); Blake, Contr. U.S. Natl. Herb. 20(13): 506. 1924; Melchior in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 21: 352. 1925 ('sylvatica'); Standley, Smithsonian Misc. Collect. 78(8): 24. 1927; Publ. 392. Field Mus. Nat. Hist., Bot. Ser. 18(2): 715. 1937; Smith & Fernández-P., Caldasia 6(28): 101. 1954; A. Robyns in Woodson, Schery & Coll., Ann. Missouri Bot. Gard. 54(1): 67. 1967. Figs. 46B, 47.

Alsodeia sylvatica Seemann, Bot. H. M. S. Herald 2: 79. pl. 14. Aug 1852 ('1852-1857'); Triana & Planchon, Ann. Sci. Nat., Bot. Sér. 4. 17: 127. 1862; Botting Hemsley in Ducane Godman & Salvin, Biol. centr.-amer. Bot. 1: 53. Sep 1879; Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 186. 1891 ('1890'); Cortés, Fl. Colomb. 1: 77. 1897. Type: Panama: Cruces, Mar 1857 (fl), *Seemann 548* (lectotypus novus, K [herb. Hookerianum 1867]; isotype, BM).

Treelet 0.8-5 m tall. Branchlets reddish-brown when dried, with small whitish callose lenticels, brownish hispid(ul)ous when young, glabrescent when older. *Leaves* apparently opposite, occa-

FIG. 47. Distribution of species of *Rinorea* Subgroup Ilc.6. 'Lindeniana.' (Distribution of *R. deflexiflora* in Mexico not indicated.)

sionally ternate; petioles 1–10 mm long, densely brownish puberulous above, brownish strigose and hispidulous beneath; stipules deciduous, narrowly deltoid to linear, 1.75–8 × 1–1.5 cm, herbaceous, strongly veined, whitish strig(ill)ose and whitish ciliolate; lamina narrowly (ob)ovate to elliptic, shortly acuminate to cuspidate, 3.5–16.5 × 1–1.75 cm, papery to subcoriaceous, usually glabrous, sometimes sparsely brownish hispid and hispidulous on some of the veinlets beneath; costa brownish hispidulous above, especially near the base, brownish strigose and hispidulous beneath; lateral veins 9–16 pairs (acumen excluded), as hairy as the costa or glabrescent; domatia wanting; tertiary venation ± scalariform; base cuneate, asymmetric, oblique, (sub)cordate or (sub)auriculate near the petiole; margin (sub)crenate, (sub)serrate or subentire, mucronulate, acumen 0.2–2 cm long, apex (sub)obtusate to acute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 1–4.5 × 0.5–1 cm; central axis densely ferruginous to whitish hispid(ulous); ‘pedicels’ 1.5–3 mm long, articulate near the middle, densely ferruginous to whitish hispid(ulous) to strig(ill)ose; bracts and bractlets narrowly ovate to deltoid, acuminate, herbaceous and brownish strigose near the costa, scariosus and glabrous near the margin, distinctly 7-veined, 7-ribbed when dried, ciliolate along the margin, apex subacute, mucronulate; bracts 2.75–3.25 × 1–1.5 mm, equaling the pedicels or longer, green when fresh; bractlets subopposite, 2.25–2.75 × 1–1.25 mm, slightly shorter than the pedicels. *Flower* buds ovoid, conical, subobtusate, dull green when fresh. Flowers drooping, white, creamy or yellowish. Sepals subequal, (narrowly) ovate to deltoid, gradually acuminate, 3–4.5 × 2–3 mm, nearly equaling the reflexed petals, herbaceous and densely golden to whitish strig(ill)ose near the costa, scariosus and glabrous near the margin, distinctly 9–15 veined, 9–15 ribbed when dried, margin ciliolate, apex (sub)acute. Petals narrowly elliptic, acuminate, 4.5–5.25 × 1.5–2 mm, herbaceous, whitish to yellowish when fresh, chocolate-brown when dried, densely golden strigose along the costa outside, apex obtuse strongly reflexed. Stamens 3.5–4 mm long; filaments free, 0.75–1 × 0.5–0.75 mm, glabrous; dorsal glands free, fused with their own filaments or apparently wanting; anthers narrowly ovoid, 1–1.25 × ca. 0.5 mm, glabrous, apex obtuse, occasionally ap-

pendaged by a cusp or some setae ca. 0.25 mm long; connective outside (narrowly) deltoid, subacute, ca. 1.25 × ca. 0.25 mm, brownish strigose or glabrescent; connective scales lateral as well as apical, ovate to deltoid, 2.75–3 × 0.75–1 mm, scariosus, brownish, margin suberose to subentire, apex subobtusate. Ovary subglobose to pyriform, 1.25–1.5 × 0.75–1 mm, brownish hispid to strigose; ovules three per placenta. Style filiform, erect 2.25–2.5 mm long, exceeding the stamens by 0–0.25 mm, slightly pilosulous at the base; stigma truncate. *Capsule* symmetric, narrowly elliptic to ovate, acuminate, coriaceous to subligneous, green when fresh, ferruginous puberulous to hirtellous, veined, apex subobtusate to subacute; valves three, equal, 2.5–3.5 × 0.5–0.75 cm. *Seeds* three per valve, globose, 4–5 mm in diam., brownish hirtellous.

Distribution (Fig. 47) and ecology. *Rinorea sylvatica* occurs from Nicaragua to NW Colombia, including the forest refugia: Chiriquí, Darién, Nechí, and Río Magdalena. Locally common in the understory of primary and secondary tropical rain forests. Grows on slopes and ridges, in ravines and gullies and probably also along streams from (0–)100 to 500 m. Soil, limestone and mould with loam.

Phenology. Flowering specimens have been collected in the period September–April, fruiting specimens during January–June.

Representative specimens examined: COSTA RICA. ALAJUELA: 2 km N of Sta. Rosa, 15 km N of Boca Arenal on Quesada–Muelle San Carlos–Los Chiles Rd., 10°38'N, 84°31'W, ca. 100 m, 28 Apr 1983 (fr), *Liesner et al. 15040* (MO, U); Cantón San Carlos, Villa Quesada, 650 m, 16 Mar 1939 (bud), *A. Smith 1811* (F). PUNTARENAS: Cantón de Rosa, vic. Palmar Norte, Río Terraba, ±1 m, 11 Apr 1949 (fr), *P. H. & D. Allen 5262* (F, HH, MICH, MO, UC, US); vic. Palma Norte de Osa, nr. Río Terraba, 30 m, 27 Mar 1950 (fl), *P. H. Allen 5507* (F, G, LIL, NY, US); idem, 1 Apr 1950 (fl), 5222 (F, G, US); 5 km W of Rincón de Osa, Osa Peninsula, 8°42'N, 83°31'W, 50–200 m, 9–12 Jan 1970 (bud, fr), *W. C. Burger & Liesner 7309* (F); along Río Barú nr. Dominical on the Pacific Coast, 9°17'N, 83°52'W, 0–20 m, 20 Feb 1977 (fl), *W. C. Burger et al. 10652* (AAU).

PANAMA. CANAL ZONE: Colón to Empira, Panama railroad, San Pablo, 11–16 Apr 1910 (juv fr), *Crawford s.n.* (PENN); Lathrop trail, 22 Jan 1969, *Croat 7442* (F, MO, U); Barro Colorado Island, 30 May 1969 (fr), *Foster 892* (F); Caño Quebrado, 14 Jun 1914 (fr), *Pittier 6665* (P, US); s.l., 26 Dec 1923 (bud), *Standley 28384* (US); Río Paraíso, above E Paraíso, 7 Jan 1924 (bud), *P. C. Standley 29909* (US); Obispo, 19 Jan 1924 (bud), *Standley 31675* (US); Barro Colorado Island, 18–24

Nov 1925 (bud), *Standley 41019* (US); Quebrada de Oro, 3.5 km S of Gamboa, 12 Mar 1933 (bud), *Wheeler & Zetek s.n.* (US); Barro Colorado Island, 2 Mar 1931 (bud), *C. L. Wilson 84* (F); idem, 6 Mar 1931 (fl), 89 (F). DARIÉN: On ridge NW of Yaviza, 12 Dec 1962 (bud), *Duke 6536* (MO); Cerro Piriaque, 5 Apr 1966 (fl), *Duke 8077* (MO?). PANAMÁ: Río Maje, ca. 50 m, 20 Apr 1976 (fl), *Croat 34430* (MO); Panamerican Hwy., ± half way between El Llano and Río Mamoni, 14–15 Sep 1962 (bud), *Duke 5634* (MO); SE side of Madden Lake nr. the Puente Natural, 190 m, 1 Jan 1975 (fl), *Nee & Hansen 14054* (MO); Empira Station PRK, March 1861 (fl), *Stutton Hayes 30* (BR, M); idem, 10 March 1861 (fl), *s.n.* (K [herb. Hookerianum]); Indio, Madden Lake, 13–15 Apr 1937 (bud), *G. S. Miller 2051* (US) & *2052* (MO, US); N of Panamá City, s.d. (fl), *Brother Paul 460* (F, HH, US); Río Tapia, 7 Dec 1923–11 Jan 1924 (bud), *Standley 28248* (US); S.L.: Shannon Trail 1725, 14 Dec 1967 (bud), *Croat 4283* (F, MO); Mume and Gorgone, Jan 1858 (fl, fr), *Wagner s.n.* (M).

COLOMBIA. ANTIOQUÍA: Turbo, 100 m, 31 Mar 1946 (fl), *Haught 4780* (G, UC, US); Rd. Palma–Puerto Parales, 145 m, 19 Apr 1949 (fr), *Romero-Castañeda 1603* (COL). BOLÍVAR: Río Sinu del Verde, 100–300 m, 13–14 Feb 1918 (fl), *Pennell 4212* (HH, NY, US); Quimari, Cordillera Occidental, 500 m, 27 Mar 1949 (bud), *von Sneider 5734* (COL). CALDAS: Valley of Río Magdalena nr. la Dorada, 200 m, 1–20 Feb 1946 (fl), *Duque-Jaramillo 2611* (COL). CHOCÓ: Vic. confluence of the Ríos Chintadó and Truando, 25 Mar 1958 (bud), *Bernal 58* (AAU, COL); Río Jurado, 100 m, 21 Sep 1940 (bud), *von Sneider 200* (COL). CORDOBA: Río Sinu, Boca Verde, 4 Mar 1918 (bud, fr), *Pennell 4569* (NY, US). SANTANDER: Barranca Bermeja, Magdalena valley, between Sogamoso and Colorado River, 100–500 m, 15 Dec 1954 (fl), *Haught 1469* (F, US).

Local name: Colombia: Rinorea (Caldas).

Rinorea sylvatica and *R. neglecta* resemble each other by their similar habit, their distinctly asymmetric leaves, and their brownish to ferruginous indument, but *R. sylvatica* differs from *R. neglecta* by: (1) its bracts, bractlets and sepals gradually acuminate, having a strongly pronounced venation which becomes strongly ribbed when dried; (2) its bracts distinctly longer than the pedicels (versus distinctly shorter); (3) its sepals nearly equaling the reflexed petals (versus distinctly shorter); (4) its petals densely golden strigose along the costa (versus glabrous); (5) the number of ovules three per placenta (versus one per placenta); and (6) its seeds pilosulous (versus glabrous).

Bracts, bractlets and sepals of *Rinorea sylvatica* are similar to those of *R. endotricha* of Subgroup IIc.5. Melanodonta; leaves of *R. endotricha* taper to the apex (versus shortly acuminate to cuspidate); the number of ovules in *R.*

endotricha is two per placenta (versus three per placenta); seeds of *R. endotricha* are glabrous and purplish spotted (when dried) (versus brownish pilosulous and not spotted in *R. sylvatica*). Dried flowers of *R. sylvatica* and *R. neglecta* are orange, those of *R. endotricha* chocolate-brown.

Subgroup IIc.7. 'Ulmifolia'; species 38–39.

Leaf base distinctly asymmetric, (sub)cordate to (sub)auriculate; tertiary venation ± scalariform; *inflorescences* loosely thyrsoïd; cymules laxiflorous; *flowers* and *fruits* distinctly pedicellate; 'pedicels' articulate above the base; bractlets separately inserted from the bracts; filaments and dorsal glands not fused with each other; ovary (sub)globose, distinct from the style, hairy; ovules one per placenta.

This subgroup is characterized by having distinctly oblique and (sub)cordate to (sub)auriculate leaves in combination with loosely thyrsoïd inflorescences. In these inflorescences the central axis is not so dominant as in those of the species of Subgroup IIc.10. 'Racemosa' which have a 'spicoid' habit.

In *Rinorea hymenosepala* the apical leaves are apparently opposite, the basal leaves, however, alternate. All leaves of the other species of Group IIc. 'Pubiflora' are always apparently opposite.

Distribution (Fig. 49). The two species of this subgroup, *Rinorea ulmifolia* and *R. hymenosepala*, are probably endemic in NW Colombia, originating from a common ancestral stock which became isolated from Amazonia by the high uplift of the Cordilleras during the Pliocene.

38. *Rinorea ulmifolia* (Kunth in Humboldt, Bonpland & Kunth) Kuntze, Revis. gen. pl. **1**: 42. 1891; Blake, Contr. U.S. Natl. Herb. **20**(13): 505. 1924; Smith & Fernández-P., *Caldasia* **6**(28): 95. 1954. Figs. 48A, 49.

Conohoria ulmifolia Kunth in Humboldt, Bonpland & Kunth, Nov. gen. sp. **5**(23): 302(folio), 387(quarto). 24 Mar 1823 ('1821') ('*Conoria*'); in Humboldt, Bonpland & Kunth, Nov. gen. sp. **5**(22): t. 491. Jun 1822 ('1821') ('*Conoria*'); Gingins in A. P. de Candolle, Prodr. **1**: 312. mid Jan 1824; Kunth, Syn. pl. **3**: 306. 28 Feb 1824 ('*Conoria*'); G. Don, Gen. hist. **1**: 340. early Aug. 1831 ('1831–1838') ('*Gonohoria*'); Spach, Hist. nat. Vég. phan. **5**: 524. Jun 1836 ('*Conoria*'); D. Dietrich, Syn. pl. **1**: 831. Jul 1839. Type. Colombia. Antioquia: Border of Río Magdalena nr. la Boca de San Bartolomé. May 1801 (fl, fr), *Bon-*



pland ms. n. 1068 (holotype, P[herb. Humboldt & Bonpland], original illustration in ink by Turpin from this specimen, printed in reverse; isotype [?], *Bonpland ms. n. 1608* [P]).

Alsodeia ulmifolia (Kunth in Humboldt, Bonpland & Kunth) Sprengel, Syst. veg. ed. 16. 1: 807. late 1824 ('1825') ('*Alsodea*'); Triana & Planchon, Ann. Sci. Bot. Sér. 4. 17: 126. 1862; Cortés, Fl. Colomb. 1: 77. 1897.

Treelet 0.25–7 m tall. Branchlets orange-brown to black-purplish when dried, sometimes provided with small (in sicco whitish) lenticels, densely to sparsely brownish strigillose to hispidulous. *Leaves* apparently opposite; petioles 1–5 mm long, densely orange-brownish hispid(ulous) above, orange-brownish hispid beneath; stipules deciduous, narrowly ovate to deltoid, gradually acuminate, 4–7 × 1–1.75 mm, herbaceous and sparsely brownish strigose along the costa to glabrescent, scarious and glabrous near the margin, costate and ±14 veined, irregularly ciliolate, apex subobtuse to subacute, mucronulate; lamina narrowly elliptic to obovate, acuminate, 2.5–23.5 × 1–8.5 cm, herbaceous, usually glabrous on both sides, sometimes brownish hispid(ulous) on both sides when young; costa brownish hispidulous above, brownish to whitish hispid(ulous) beneath; domatia wanting; lateral veins 11–20 pairs (acumen excluded), brownish hispid(ulous) on both sides; tertiary venation ± scalariform, sometimes sparsely brownish hispid(ulous) on both sides; base rounded to cuneate, asymmetric, oblique, (sub)cordate to (sub)auriculate at the petiole; margin serrate, mucronulate; acumen 1–2 cm long, apex subobtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, thyrsoïd, laxiflorous, 4.5–9.5 × 2.5–4.5 cm; central axis brownish to whitish hispidulous; cymes 1–5 flowered; common peduncle 2.25–8.5 cm long, brownish to whitish hispidulous; pedicels 2–6.5 cm long, articulate at 3/5–1/6 from the base, brownish to whitish hispidulous; bracts

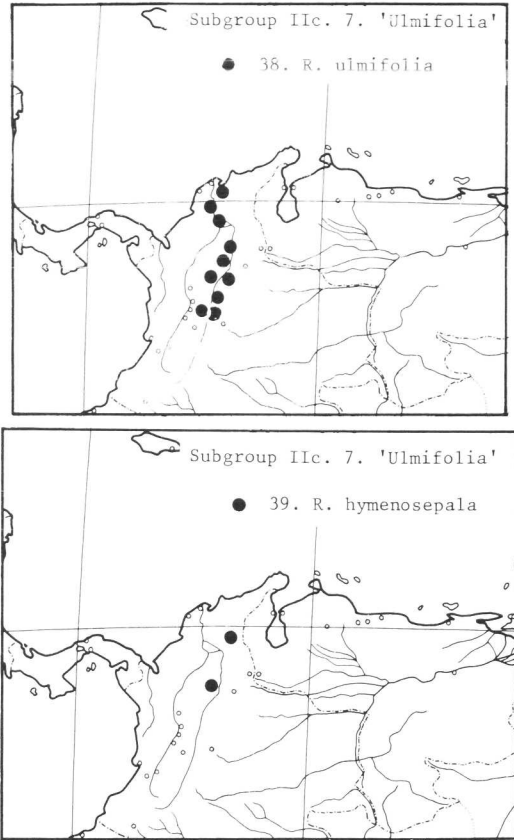


FIG. 49. Distribution of species of *Rinorea* Subgroup IIC.7. 'Ulmifolia.'

and bractlets narrowly deltoid to ovate, acuminate, scarious, brownish to whitish hispidulous near the apex, margin ciliate, apex subacute, mucronulate; bracts 2.5–4.5 × ca. 1 mm, costate and 3–9 veined; bractlets 0.5–1.25 × 0.5–0.75 mm. *Flower buds* ovoid to conical, subacute. *Flowers* drooping, white. *Sepals* subequal, (narrowly) elliptic to ovate, 2.5–3.25 × 1.25–1.5 mm, herbaceous, sparsely whitish pilose near the apex

FIG. 48. A. *Rinorea ulmifolia* (A₁, from Haught 1395; A₂ and A₅₋₇ from Haught 6234; A_{3,4} from Haught 3604; A_{8,9} from Mutis 1158). A₁, Leaf, oblique subcordate to subauriculate at very base. A₂, Flower (inside), showing habit of pistil. A₃, Sepal. A₄, Petal. A₅, Stamen (dorsal). A₆, Stamen (ventral). A₇, Pistil, with style curved at base, with l.s. of ovary, showing ovules 3 × 1. A₈, Capsule, dehiscent into subequal valves, floral parts and style still present respectively basally and apically. A₉, Seeds, glabrous. B. *R. hymenosepala* (B_{1,2} and B₄₋₉ from Pennell 3783, type; B₃ from C. Allen 717). B₁, Leaves, oblique subcordate to subauriculate at very base. B₂, Lateral cymule with bract, bractlets, flower bud, and adult flower. B₃, Flower (inside). B₄, Sepal. B₅, Petal. B₆, Stamen (dorsal), with dorsal gland. B₆, B₇ (in between), Stamen (dorsal), without dorsal gland. B₇, Stamens (ventral), anthers appendaged. B₈, Pistil. B₉, Idem, with l.s. of ovary, showing ovules 3 × 1.

of the costa, costate, obscurely 3–5 veined, margin whitish to brownish ciliate, apex subacute. Petals (narrowly) elliptic to ovate, 4–6 × 2–2.5 mm, herbaceous, glabrous or sometimes pilosulous and ciliolate at the apex, apex obtuse. Stamens 3.25–3.75 mm long; filaments free, 0.25–0.5 × 0.25–0.75 mm, glabrous; dorsal glands free, adnate to the filaments, sometimes fused and apparently wanting, 0–0.5 × 0–0.25(–0.4) mm, carnosous, glabrous; anthers ovoid, 1.25–1.5 × ca. 0.75 mm, glabrous, apex of thecae obtuse to apiculate, each rarely appendaged by a cusp 0.1–0.2 × 0.1 mm; connective outside narrowly deltoid or elliptic, obtuse, 2 × 0.5 mm, glabrous; connective scales lateral as well as apical, narrowly ovate to elliptic, 3–3.35 × 1–1.5 mm, scarious, creamy colored, transparent, margin erose to fringed especially near the base, apex rounded to obtuse, suberose to subentire. Ovary subglobose, 0.5–1 mm long and wide, slanting golden to whitish pilose; ovules one per placenta. Style filiform, erect or curved, 3–3.5 mm long, exceeding the stamens by 0.25–1 mm, pilose at the base. *Capsule* more or less symmetric, ovate to orbicular, slightly acuminate, subtended by subpersistent floral parts, coriaceous, whitish pilose, obscurely veined, usually the style subpersistent at the apex of the valves; valves three, (sub)equal, 0.6–0.75 × ca. 0.35 cm. *Seeds* one per valve, subglobose to obovoid, 3.5 × 2.5 mm, glabrous.

Distribution (Fig. 49) and ecology. *Rinorea ulmifolia* is probably endemic in NW Colombia. Only known in the valley of the Río Magdalena from the vicinity of Bogotá to the Sierra Nevada de Santa Marta from 0 to 600 m, including the forest refugia: Río Magdalena N and S; Santa Marta. Soil unknown.

Phenology. Flowering throughout the year. Fruiting specimens have been collected only during May. Also fruiting throughout the year?

Representative specimens examined: COLOMBIA. ANTIOQUÍA: San Luís de Cocorna. 3 km S of confluence of Cocorna with Río Magdalena. 19 Nov 1963 (juv fr), *Romero-Castañeda 10.090* (AAU, COL); Pto. Berrio, vic. Medellín. 20 Jun 1928 (fl), *Toro 1114 & 1125* (NY). BOLÍVAR: Mompos Island, Río Magdalena. 9°14'N, 74°26'W. 1921 (fl), (*Bro.*) *Ariste-Joseph s.n.* (US); vic. Estrella, Caño Papayal, Brazo de Loba. Apr–May 1916 (fr), *Curran 322* (F, HH, US). CÉSAR: Caño Animas. 100 m. 12 Aug 1943 (fl), *Haught 3604* (K, NY, P). CÓRDOBA: Rd. Monte Líbano to San Pedro. 29 May 1949 (fr), *Romero-Castañeda 1754* (COL);

Monte Líbano. 29 May 1949 (fl), *Romero-Castañeda 1774* (COL). CUNDINAMARCA: San Antonio. ±250 m. 12 Jun 1948 (fl), *Haught 6234* (US). MAGDALENA: Tucurínca. 100–200 m. 20 Aug 1945 (fl), *Romero-Castañeda 381* (COL). NORTE DE SANTANDER: Ocaña, s.d. (fr), *Anonymous s.n.* (LE); Chiriguana, Ocaña, s.d. *Karsten* (LE); Ocaña. Agua Chica. Nov (fl), *Linden 272 + 26* (BR); idem, s.d. (fl), 272 (F, US); idem. Nov 1846–1852 (fl), *Schlimm 272* (BM, G, K, P). SANTANDER: Carare, 6 Jul 1939 (fl), *H. Daniels 2046* (F); Barranca Bermeja, Magdalena Valley, between Sogamosa and Colorado Rivers, 100–150 m, 20 Oct 1934 (fl), *Haught 1395* (HH, MICH, US); San Fernando between Río Carare and Puerto Borrio, 3 Jul 1939 (fl), *Haught 2855* (K, UC, US, S). TOLIMÁ: Sta. Ana. 500 m?, Feb 1843 (fl), *Linden 1168* (LE, P); S.L.: 1842 (fl), *Linden 1162* (G, herb. Boissier et Barbey-Boissier); s.d. (fl), *Linden s.n.* (BM); s.d., 1760–1808 (fr), *Mutis 1158* (US); s.d., 1760–1808 (fr), *Mutis 3988* (US).

Rinorea ulmifolia and *R. hymenosepala* are the only neotropical *Rinorea* with leaves distinctly oblique and distinctly (sub)cordate to (sub)auriculate in combination with inflorescences thyrsoid. Both species are characterized also by connective scales with the margin fringed and the apex rounded.

Rinorea ulmifolia differs from *R. hymenosepala* mainly by: (1) its wider thyrsoid inflorescences, 2.5–4.5 cm wide (versus 1–1.75 cm wide); (2) its sepals 1.25–1.5 mm wide (versus ca. 0.75 mm wide); (3) its dorsal glands distinctly shorter than the filaments, only 0–0.5 mm long (versus slightly exceeding the filaments, ±0.75 mm long); (4) the thecae apically unappendaged or some of them appendaged by minute cusps only 0.1–0.2 mm long (versus usually appendaged by cusps 0.4–0.8 mm long).

39. *Rinorea hymenosepala* Blake, Contr. U.S. Natl. Herb. 20(13): 504. pl. 33. 1924; Smith & Fernández-P., *Caldasia* 6(28): 94. 1954. Type. Colombia. Antioquía: Forest of Río Magdalena, 120–170 m, 12 Jan 1918 (fl), *Pennell 3783* (holotype, NY; photograph US).

Figs. 48B, 49.

Treelet ca. 2 m tall. Branchlets orange-brown to purplish when dried, provided with small whitish callose lenticels, ferruginous hispid and hispidulous. *Leaves* apparently opposite or ternate at the apex of the branchlets, alternate near the base; petioles 1.5–10 mm long, ferruginous hispid(ulous) above, ferruginous strigose beneath; stipules deciduous, narrowly ovate, grad-

ually acuminate, 2.25–5 × 0.75–1.5 mm, herbaceous, sometimes ferruginous hispid along the costa, margin scarious and ferruginous ciliolate; lamina obovate, acuminate, 5.5–17 × 2.5–7 cm, papery to herbaceous, slightly whitish to brownish hispidulous to glabrescent on both sides; costa above whitish to brownish hispidulous, ferruginous to brownish hispid(ulous) beneath; domatia wanting; lateral veins 11–18 pairs (acumen excluded), whitish to ferruginous hispid(ulous) to glabrescent on both sides; tertiary venation ± scalariform, glabrescent or sparsely whitish to brownish hispidulous; base rounded to cuneate, asymmetric, oblique, rounded, subcordate or subauriculate at the petiole; margin serrate to crenate, mucronulate; acumen (0–)1.5–2.5 cm long, apex (sub)obtusate, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, thyrsoid, more or less laxiflorous, 4.5–7 × 1–1.75 cm; central axis ferruginous hirsute, golden to yellowish hirtellous, cymules 1–7 flowered; common peduncle 1.25–2 mm long, golden to brownish hirtellous; pedicels 2.5–3 mm long, articulate near the middle or near the base, golden to brownish hirtellous; bracts and bractlets narrowly ovate, gradually acuminate, herbaceous, scarious near the margin, sometimes golden to whitish hispidulous, costate, veined, ciliolate; bracts 3.5–4.25 × 1–2 mm, 9-veined; bractlets 1–1.25 × 0.3–0.4 mm. *Flower* buds ovoid to conical, obtusish. Flowers drooping, white. Sepals (sub)equal, narrowly ovate to deltoid, acuminate, 2.25–3 × ca. 0.75 mm, scarious, golden pilose near the apex of the costa, obscurely 2–4 veined, margin whitish to golden ciliate, apex subacute. Petals ovate, 4.25–6 × 1.75–2.5 mm, herbaceous, glabrous or rarely sparsely pilose along the costa, margin not ciliolate, apex obtuse. Stamens 3.5–3.75 mm long; filaments free, 0.4–0.5 × ca. 0.25 mm, glabrous; dorsal glands free, adnate to the filaments, narrowly elliptic, ca. 0.75 × ca. 0.25 mm, slightly longer than the filaments, carnose, glabrous; anthers ovoid, 1.5–1.75 × ca. 0.75 mm, glabrous, apex of thecae obtuse to rounded, usually appendaged by 1(–2) cusps, 0.4–0.8 × 0.1 mm; connective outside narrowly deltoid, acute, 1.25 × 0.25 mm, glabrous; connective scales lateral as well as apical, narrowly elliptic, 2.75–3.25 × 0.75–1 mm, scarious, yellowish when fresh, brownish when dried, margin erose to fringed especially near the base,

apex rounded, suberose to subentire. Ovary subglobose, 1–1.25 × 0.75–1.25 mm, slanting to erect brownish pilose; ovules one per placenta. Style filiform, erect or slightly curved, 3–3.75 mm long, exceeding the stamens by 0.5–1 mm, predominantly glabrous. *Fruits* unknown.

Distribution (Fig. 49) and ecology. *Rinorea hymenosepala* is known only from the northern valley of the Río Magdalena and near the Sierra Nevada de Santa Marta, including similarly-named forest refuges. Soil and altitude unknown.

Phenology. Flowering specimens have been collected in January and September. Fruiting specimens are unknown.

Additional specimen examined: COLOMBIA. EL CÉSAR: Valley of Río Magdalena. Poponte, 21 Sep 1924 (fl). C. Allen 717 (MO).

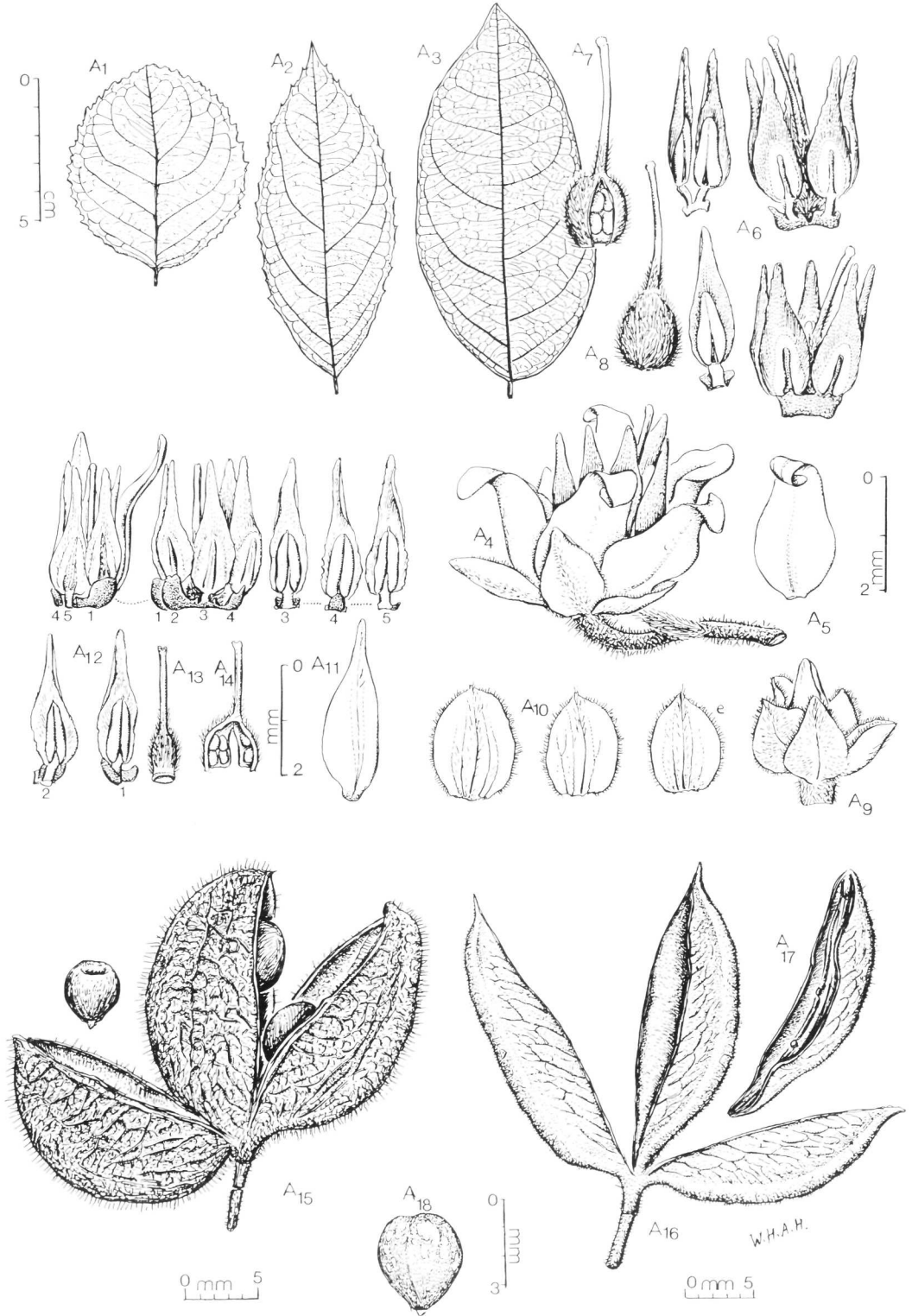
Rinorea hymenosepala is the only neotropical *Rinorea* in which only the apical leaves are apparently opposite, while the lower ones are still alternate. It is closely related to *R. ulmifolia*. For differentiating remarks see under that species.

Subgroup IIc.8. 'Ovalifolia'; species 40–42.

Leaf base symmetric; tertiary venation reticulate; *inflorescence* racemose; *flowers* and *fruits* pedicellate; 'pedicels' articulate (just) above the base; bractlets separately inserted from the bracts; dorsal glands of the anterior filaments fused; those of the posterior filament(s) free; ovary subglobose, distinct from the style, hairy; ovules one to two per placenta.

A tendency to zygomorphy in the shape of the androecium is seen in the fusion of the dorsal glands of the anterior filaments in this subgroup. Its species are also characterized by racemose inflorescences (1) which are densiflorous at the apex and laxiflorous at the base; (2) with the apical part of the inflorescences conical; and (3) with the flower buds vertically erected to the apex, but becoming strongly deflexed when flowering.

Distribution (Fig. 53). *Rinorea ovalifolia* is wide spread over Amazonia and adjacent regions. *Rinorea deflexa* is the only species occurring W of the Cordilleras, probably limited to Ecuador. The isolation of this closely related species is probably a result of the Pliocene Cordilleran uplift. A third species, *R. pectino-squamata* is probably endemic in French Guiana.



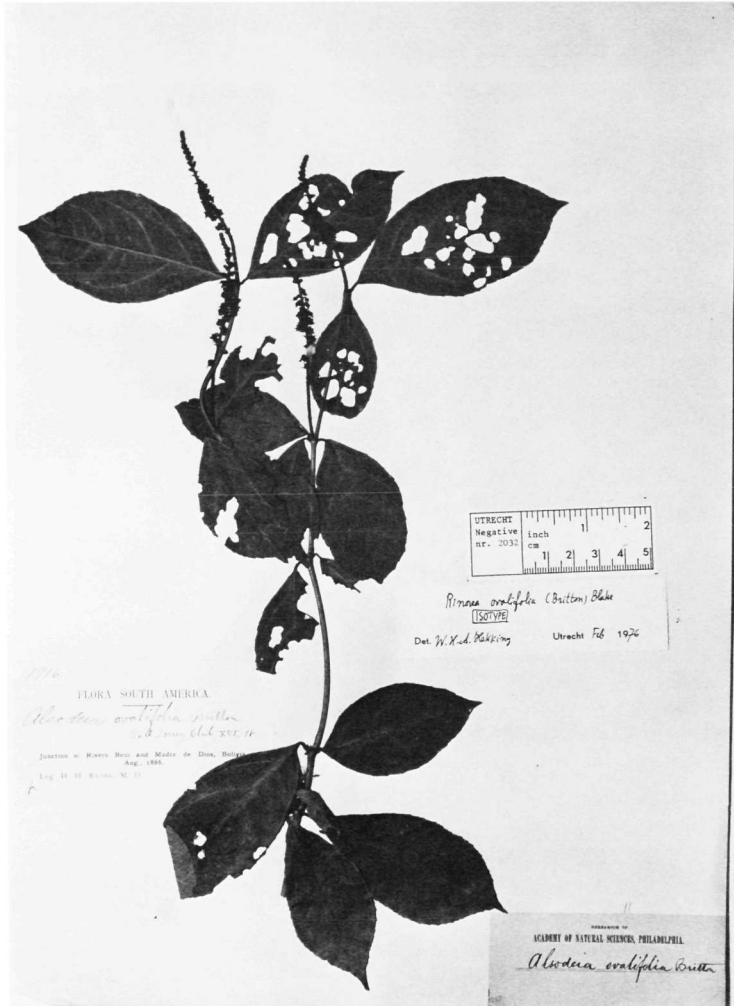


FIG. 51. Isotype specimen of *Rinorea ovalifolia* (Rusby 1916 [Aug. 1886], PENN).

40. *Rinorea ovalifolia* (Britton) Blake, Contr. U.S. Natl. Herb. 20(13): 513. pl. 36. 1924.

Figs. 50A, 51, 53.

Alsodeia ovalifolia Britton, Bull. Borrey Bot. Club 16(1): 18. 1889. Type. Bolivia. Beni-Pando; Junction of the rivers Beni and Madre de Dios, Aug 1886 (fl, fr),

Rusby 1916 (lectotypus novus, NY; isotypes, BM, HH, K, LE, MICH, MO, NY, P, PENN).

Treelet 0.5–5 m tall; branchlets often purplish when dried, golden-brownish to ferruginous hispidulous in combination with sparsely ferruginous hispid. *Leaves* apparently opposite, oc-

FIG. 50. A. *Rinorea ovalifolia* (A_{1,2} and A₄₋₈ from Rusby s.n.; A₃ from Black & Cordeiro 25-15202; A₉₋₁₄ from Prance et al. 6640; A₁₅ from L. Williams 13255; A₁₆₋₁₈ from Spencer (le) Moore 502). A₁₋₃, Leaves. A₄, Flower, with pedicel and bractlets. A₅, Petal. A₆, Androecium (dorsal), surrounding pistil. A₇, Pistil, with l.s. of ovary, showing ovule 3 × 2. A₈, Pistil, habit. A₉, Flower bud. A₁₀, Sepals subequal. A₁₁, Petal. A₁₂, Analysis of androecium; smaller numbers 1–5 refer to identical stamens. A₁₃, Pistil. A₁₄, Idem, with l.s. of ovary, showing ovules 3 × 2. A₁₅₋₁₇, Capsules dehiscent into three valves. A₁₈, Detail of glabrous seed.

casionally ternate; petioles 3–8 mm long, ferruginous hispidulous on both sides; stipules deciduous, narrowly deltoid, 3–4 × ca. 1 mm, herbaceous, densely golden to ferruginous hispidulous to strigillose, ciliolate; lamina elliptic to (ob)ovate, acuminate, 3–16 × 2–7.5 cm, papery to coriaceous; often whitish pilose(ulous) near the margin above, varying from densely ferruginous or golden hispidulous to glabrescent beneath; costa and lateral veins golden or ferruginous hispidulous on both sides; lateral veins (7–)8–10(–12) pairs (acumen excluded); tertiary venation reticulate, sometimes golden or ferruginous hispidulous on both sides; domatia sometimes present; base rounded to cuneate, symmetric, sometimes obtuse to rounded at the petiole; margin (sub)serrate, rarely subentire, usually irregularly whitish cili(ol)ate, mucronulate; acumen 0.3–0.5 cm long, apex subobtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, 4–12 cm long, densiflorous and conical shaped near the apex, laxiflorous near the base; central axis purplish when dried, densely golden to ferruginous hispidulous; ‘pedicels’ (2–)4–6 mm long, articulate near the middle, densely golden to ferruginous hispidulous; bracts and bractlets ovate to deltoid, herbaceous, golden pilosulous; margin cili(ol)ate, apex (sub)obtuse to (sub)acute; bracts 1.5–1.75 × ca. 1 mm; bractlets 0.75–1.25 × ca. 0.75 mm. *Flower buds* tolpoid to conical, subobtuse, slanting erected to the apex of the inflorescence, becoming strongly deflexed when flowering. Flowers greenish-white or yellowish. Sepals subequal to unequal, ovate, 1.5–2(–2.5) × 1–1.75 mm, herbaceous, greenish when fresh, 1–3 veined, golden to whitish strigillose along the costa and near the apex, margin ciliolate, apex obtuse to subacute. Petals (narrowly) ovate, 3.25–4.25 × 1.25–1.5 mm, herbaceous, sparsely pilose near the apex of the costa or glabrescent, apex (sub)obtuse, sometimes sparsely ciliolate. Stamens 2.75–3.25 mm long; anterior filaments embodied in fused dorsal glands, posterior filaments and dorsal glands free; free filaments 0.2–0.5 × 0.2–0.25 mm; free dorsal glands (0–)0.2–0.6 × (0–)0.2–0.3 mm; fused dorsal glands 0.6 mm high; glandular tissue carnosous, usually glabrous, sometimes sparsely pilosulous; anthers narrowly ovoid, 1–1.75 × 0.4–0.8 mm, glabrous, apex obtuse, unappendaged; connective outside narrowly deltoid, acute, 0.75–1.25 × 0.3 mm, glabrous; connective scales lateral as well as apical, ovate, 2.25–

2.75 × ca. 1 mm, scarious, orange-brown, suberose, apex (sub)obtusate. Ovary subglobose to conical, 1 × 0.75–1 mm, golden to ferruginous pilosulous; ovules two per placenta. Style filiform, erect to slightly curved, 2–2.25 × ca. 0.25 mm, slightly exceeding the stamens by 0–0.25 mm, slanting brownish pilosulous near the base; stigma truncate. *Capsule* more or less symmetric, ellipsoid to ovoid, acuminate, coriaceous to subligneous, greenish when fresh, golden to ferruginous hispid(ulous), distinctly veined, style sometimes subpersistent at the apex of one of the valves; valves three, subequal, 1.25–2.25 × ca. 0.5 cm. *Seeds* two per valve, globose, 4 mm in diam., glabrous.

Distribution (Fig. 53) and ecology. *Rinorea ovalifolia* is widespread over Amazonia, from where it penetrated northward to Ventuari (Venezuela, bordering E Colombia), eastward to Maranhão (Brazil), southward to Rio Paraguay (Brazil, bordering Paraguay) and finally westward to Acre-Rondônia (Brazil, N Bolivia). Along the Rio Paraguay it occurs together with *R. laevigata*, which has its center of distribution in SE Brazil. This fact suggests a former more coherent genus area for *Rinorea*, probably during a period before the Pliocene, when the climate was much warmer and more humid (Van der Hammen, 1974). The species does not occur on the other side of the Cordilleras, but is replaced there by the closely related species *R. deflexa*.

Rinorea ovalifolia occurs as an undergrowth in the understory of savanna, gallery or deciduous forests of lowlands or of hilly areas, sometimes with large granitic boulders, from 100 to 500 m. It is also recorded from disturbed areas, dominated by Orbigny-palms. Along rivers it inhabits uninundated areas as well as scarcely inundated areas, in granitic or sandy soil.

Phenology. Flowering specimens have been collected in January and from April to October. Probably flowering and fruiting throughout the year.

Representative specimens examined: BRAZIL, ACRE: Hwy. Rio Branco–Brasília km 60, 7 Oct 1980 (fl), *Lowrie et al.* 432 (INPA, NY, U). AMAZONAS: Rio Purus, Rio Ituxi, nr. Namorado Novo watershed between Rio Curuquêta and Rio Madeira, at Abuña, 5 Aug 1971 (fl), *Prance et al.* 14711 (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, S, U, US, VEN). AMAZONAS–RONDÔNIA: Rio São Miguel, tributary of Guaporé, vic. Serra do Limoeiro, 20 Jun 1952 (bud), *Black & Cordeiro* 52-15202 (COL, IAN). MARANHÃO: Km 447–430, Codó–Peritoro, 100 m, 4°34'S, 44°0'W.

29 Sep 1980 (bud. fr). *Daly et al. D 337* (INPA, NY, U). MATO GROSSO DO SUL: Rio Paraguay between Santa Cruz and Tres Barras, Oct 1891–1892 (fr). (*Spencer le Moor 202* (BM)). RONDONIA, M. Maimoni, 11 Sep 1923 (fl). *Kuhlmann 412* (RB 21.246); Basin of Rio Madeira, 1–2 km N of Riberão, 31 Aug 1968 (fl. fr). *Prance et al. 6640* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, S, U, US). RORAIMA: Mouth of Rio Branco, 8 Jan 1924 (bud). *Kuhlmann 1106* (p.p.) (RB).

BOLIVIA, BENI: Junction of Rivers Beni and Madre de Dios, Aug 1886 (fl). *Rusby s.n.* (BM). Vaca Diez, 18.4 km E of Riberalta, 11°05'S, 65°05'W, ca. 230 m, 4 Sep 1981 (fl. fr). *Solomon 6102* (MO, U); idem, SE edge of the airfield of Riberalta, 11°00'S, 66°05'W, 6 Apr 1982 (fl. fr). *Solomon 7945* (MO, U).

Representative specimens examined showing possible hybridization with *Rinorea pubiflora*-complex: VENEZUELA, AMAZONAS: Atures, ±15 km N of Puerto Ayacucho, along rd. to El Burro, 5°47'N, 67°32'W, 85 m, 15 Apr 1978 (fr). *Davidse & O. Huber 15.070* (MO); Atures, ±23 km NE of Puerto Ayacucho, nr. Cachama, 5°51'N, 67°24'W, 90 m, 17–19 Apr 1978 (fr). *Davidse & O. Huber 15.300* (U, VEN), APURE: Vic. Puerto Páez, 5 May 1946 (st). *Velez 2659* (VEN). BOLIVAR: Caicara, 100 m, 10 Jun 1940 (fr). *Ll. Williams 13.255* (S).

Local name. Venezuela: Cacho venado (Bolívar).

The leaves of *Rinorea ovalifolia* are variable in character, e.g., the underside of the leaves varies from densely hispidulous to glabrescent and domatia may be present or not. This species differs from *R. deflexa* and *R. pectino-squamata* in the following characters: (1) its branchlets densely hispidulous and sparsely hispid (versus sparsely strigose to glabrescent); (2) the upperside of the leaves pilosulous along the margin and the margin itself cili(ol)ate (in the other species glabrous or nearly so); (3) its pedicels usually 4–6 mm long (versus 1–2.5 mm long); (4) its anthers 3–5 × as long as the filaments (versus 2–3 ×); and (5) its connective scales 5–8 × as long as the filaments (versus 3–5 ×).

The seeds of *Rinorea ovalifolia* and *R. pubiflora* var. & fo. *grandifolia* are glabrous. Specimens of both taxa from the Upper Orinoco area in Venezuela resemble each other more than elsewhere. Introgressive hybridization between populations of both taxa is supposed.

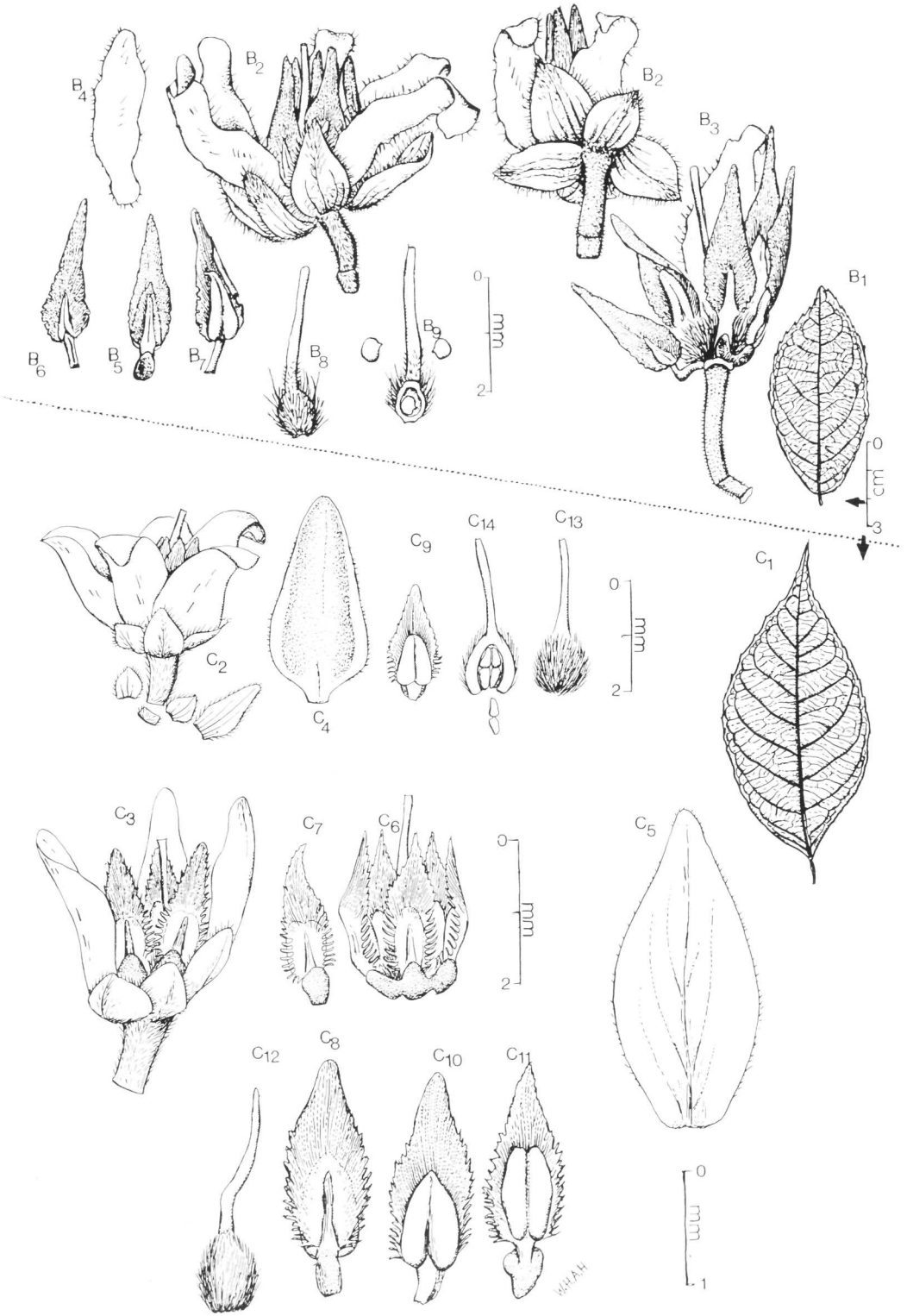
41. *Rinorea deflexa* (Bentham) Blake, Contr. U.S. Natl. Herb. 20(13): 513. 1924. Figs. 52B, 53

Alsodeia deflexa Bentham. Bot. voy. Sulphur 3: 67. 16 Aug 1844. Type. Ecuador. Esmeralda: Atacames, s.d. (fl). *Barclay s.n.* (holotype, K; isotype, US [fragm.]).

Treelet. Branchlets sparsely golden-brownish

strigose when young, glabrescent when older. *Leaves* apparently opposite, more or less sessile; petioles 2–6 mm long, both sides golden strigillose when young, glabrescent when older; stipules deciduous, linear to subulate, ca. 2.25 × 0.1–0.3 mm, golden hispidulous, mucronulate; lamina elliptic to (ob)ovate, acuminate, 4.5–10 × 2.5–5.5 cm, papery, glabrous on both sides; costa brownish pilosulous above, sparsely golden-brownish strigose beneath; domatia present or wanting; lateral veins 8–9 pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate, symmetric, rounded to subcordate or subauriculate at the petiole; margin crenate, not cili(ol)ate, mucronulate; acumen 0–0.3 cm long, apex obtuse, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, ca. 5 cm long, subsiflorous near the apex, laxiflorous near the base; central axis golden-brownish hispidulous and sparsely hispid; 'pedicels' 2–2.5 mm long, articulate at ½–¾ from the base, densely golden-brownish hispidulous; bracts and bractlets soon deciduous, usually wanting in dried specimens. *Flower* buds slanting erected to the apex of the inflorescence, becoming strongly deflexed when flowering. Sepals subequal, deltoid to ovate, 1.5–1.75 × 0.75–1 mm, herbaceous, carnosous near the base, scarious near the margin, golden-brownish pilose along the costa and near the apex, ciliate along the margin, apex obtuse. Petals narrowly elliptic to ovate, tapering to the apex, 3–3.5(–4.5) × ca. 0.75 mm, herbaceous, sparsely golden-brownish pilose along the costa, margin ciliate, apex obtuse. Stamens 2.75–3.5 mm long, anterior filaments embodied in fused dorsal glands, posterior filaments and dorsal glands free; free filaments 0.5–0.75 × 0.25 mm; free dorsal glands (0–)0.5–0.75 × (0–)0.25 mm; fused dorsal glands 0.75 mm high; glandular tissue carnosous, glabrous; anthers narrowly ovoid to deltoid, 1.25 × 0.4 mm, glabrous, apex obtuse to apiculate, not appendaged; connective outside, narrowly deltoid, subobtusous, 0.6–0.9 × 0.1–0.3 mm, glabrous; connective scales lateral as well as apical, ovate to deltoid, 2.25–2.75 × ca. 0.75 mm, scarious, orange-brown, erose near the base, apex obtuse and suberose. Ovary globose, ca. 0.75 mm in diam., golden pilose. Ovules one per placenta. Style filiform, erect or slightly curved, 2–2.5 × 0.2 mm, 0–0.25 mm shorter than the stamens; stigma truncate or pulvinate. *Fruits* unknown.

Distribution (Fig. 53) and ecology. *Rinorea de-*



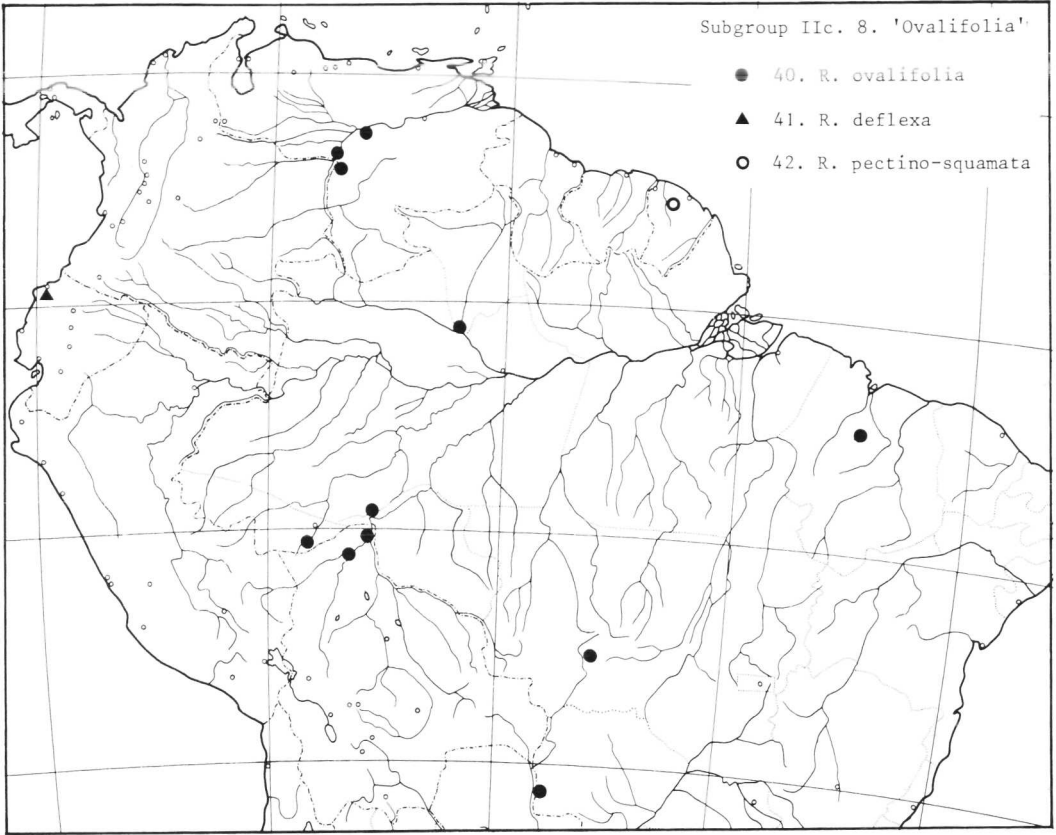


FIG. 53. Distribution of species of *Rinorea* Subgroup Iic.8. 'Ovalifolia.'

flexa is known only from the type collection near Atacama (=Atacames), W of the Cordilleras in Ecuador (Esmeraldas), corresponding with the forest refuge Chimborazo-West.

This species differs from *Rinorea ovalifolia* and *R. pectino-squamata* mainly by: (1) its sepals and petals ciliate (versus sepals ciliate and petals glabrescent along the margin); (2) its petals 4–5× as long as wide (versus 1.5–3×); and (3) its number of ovules one per placenta (versus two per placenta). The shape of the bracts, sepals, petals and connective scales are distinctly more

deltoid and acuminate than in the two other species.

42. *Rinorea pectino-squamata* Hekking, *Phytologia* **53(4)**: 252. pl. 1, fig. 1. 1983. Type. French Guiana: Rd. of St. Elie, km 13, SW of Sinnamary, 18 Jul 1982 (bud, fl), *Riera* 470 (holotype, U; isotype, CAY [n.v.]). Figs. 52C, 53.

Treelet. Branchlets purplish when dried, sparsely golden-brownish strigose when young, glabrescent when older. *Leaves* apparently op-

FIG. 52. **B.** *Rinorea deflexa* (from Barclay s.n., type). **B**₁, Leaf, symmetric obtuse, rounded to subauriculate at very base. **B**₂, Flowers, outside. **B**₃, Flowers (inside), with petal, stamens united by fusion of the dorsal glands. **B**₄, Petal, with margin ciliate. **B**₅, Stamen (dorsal), with free dorsal gland. **B**₆, Idem, without dorsal gland. **B**₇, Stamen (ventral), without dorsal gland. **B**₈, Pistil. **B**₉, Pistil, with l.s. of ovary, showing one ovule on one of the three placentas. **C.** *R. pectino-squamata* (**C**₁ from *Riera* 100; **C**₂₋₁₄ from *Riera* 470, type). **C**₁, Leaf, cuneate at base. **C**₂, Flower, with pedicel above the articulation, and bracts and bractlets. **C**₃, Flowers with one petal omitted, showing androecium (dorsal), surrounding pistil. **C**₄, Petal, carnosely, with margin herbaceous. **C**₅, Petal, detailed, showing venation. **C**₆, Stamens, with dorsal glands fused, surrounding pistil. **C**_{7,8}, Stamen with free filament and dorsal gland (dorsal). **C**₉₋₁₁, stamens (ventral). **C**_{12,13}, Pistil. **C**₁₄, Idem, with l.s. of ovary, showing ovule 3 × 2.

posite; petioles 5–12 mm long, sparsely golden-brownish strigose when young, glabrescent when older; stipules deciduous, (narrowly) deltoid, 0.5–12.5 × 0.25 mm, herbaceous, golden-(brownish) strig(ill)ose to glabrescent, ciliolate, mucronulate; lamina (narrowly) (ob)ovate to elliptic, acuminate to cuspidate, 7–17.5 × 3–6.5 cm, herbaceous, glabrous on both sides; costa glabrous above, sparsely golden-brownish pillosulous beneath when young, glabrescent when older; domatia wanting; lateral veins 9–11 (acumen excluded); tertiary venation reticulate; base rounded to cuneate, sometimes slightly decurrent into the petiole; margin subentire, not cili(ol)ate; acumen 1–2 cm long, sometimes falcate, apex subobtuse to subacute. *Inflorescences* axillary, lateral and subterminal, solitary or 2-fasciculate, racemose (0.5–)1.25–17.5 × ca. 0.25 cm; central axis golden-brownish pilosulous; ‘pedicels’ ca. 1 mm long, articulate at $\frac{1}{2}$ from the base, golden-brownish pilosulous; bracts and bractlets deltoid to ovate, herbaceous, carnosae, golden-brownish pilosulous along the costa, ciliolate, apex subobtuse to subacute, mucronulate; bracts 1–1.25 × 1 mm; bractlets subopposite, 0.3 × 0.25 mm. *Flower buds* ovoid to conical, slanting erected to the apex of the inflorescence, becoming strongly deflexed when flowering. *Sepals* subequal to unequal, ovate to deltoid, 0.5–1 × 0.3–0.6 mm, herbaceous, costate, golden-brownish pilosulous along the costa, ciliolate along the margin, apex obtuse, mucronulate. *Petals* ovate, 2.25–2.5 × 1–1.5 mm, herbaceous, carnosae near the costa and scarious near the margin, glabrous, slightly purplish striate along the costa and near the base, margin sparsely ciliolate, apex obtuse to rounded. *Stamens* ca. 2 mm long; anterior filaments embodied in fused dorsal glands, usually only one posterior filament and dorsal gland free; free filaments ca. 0.25 × ca. 0.2 mm; free dorsal glands ca. 0.3 × ca. 0.25 mm; glandular tissue carnosae, glabrous; anthers ovoid, ca. 0.75 × ca. 0.5 mm, glabrous, apex obtuse, unappendaged; connective outside, linear, subobtuse, ca. 0.6 × 0.1 mm, glabrous; connective scales lateral as well as apical, ovate, ca. 1.75 × ca. 0.25 mm, scarious, orange-brown, pectinate near the base, erose near the apex, apex obtuse. *Ovary* subglobose, ca. 1 mm in diam., golden-brownish pilose; ovules two per placenta. *Style* filiform, erect to slightly curved, ca. 1.5 × 0.2 mm, exceeding the stamens by 0–0.5 mm, completely glabrous; stigma truncate. *Fruits* unknown.

Distribution (Fig. 53) and ecology. *Rinorea pectino-squamata* is known only from the type locality in northern French Guiana, including the forest refuge Guyana-East, which borders that of Oyapock.

Additional specimens cited. FRENCH GUIANA: Piste de St. Elie, km 15, 4 Oct 1982 (st), *Riera 100* (CAY); idem, 26 Mar 1982 (st), *231* (CAY).

Rinorea pectino-squamata is named for its connective scales pectinate-erose at the base. This species differs from *R. ovalifolia* and *R. deflexa* mainly by its distinctly smaller flowers, expressed by: (1) its pedicels 1 mm long (versus 1.5–1.75 mm in *R. deflexa* and 2–6 mm in *R. ovalifolia*); (2) its sepals 0.5–1 mm long (versus 1.5–2.5 mm long); (3) its petals 2.25–2.5 mm long (versus 3–4.5 mm long); and (4) its stamens 2 mm long (versus 2.75–3.5 mm long).

Subgroup IIc. ‘Guatemalensis’: species 43–44.

Leaf base symmetric; tertiary venation reticulate; *inflorescences* varying from (pseudo)racemose to shortly thyrsoid; *flowers* and *fruits* distinctly pedicellate; ‘pedicels’ articulate above the base; bractlets separately inserted from the bracts; dorsal glands of all filaments more or less fused into a brittle tube, or dorsal glands and filaments (nearly) free; ovary (sub)globose, distinct from the style; ovules one to three per placenta.

In both species of this subgroup, *Rinorea guatemalensis* and *R. hummeli*, there is tendency to a fusion of the dorsal glands with the filaments into a brittle tube. They differ from species of other subgroups by their relatively short sepals, relatively long and narrow petals, and relatively long stamens bearing relatively long and narrow connective scales.

Distribution (Fig. 55). Both species are restricted to Central America, probably originating from a now extinct common ancestral stock in Amazonia, from whence they migrated to NW Colombia. They became isolated there from the main area through the high Pliocene Cordilleran uplift. They subsequently migrated to Central America after the closing of the Panama land bridge during the same period. Both are probably extinct in NW Colombia.

43. *Rinorea guatemalensis* (S. Watson) H. H. Bartlett in Robinson & Bartlett, Proc. Amer.

Acad. Arts **43**: 56. 1907 ('1907–1908'); Blake *in* Standley, Contr. U.S. Natl. Herb. **23(3)**: 838. 1923; Blake, Contr. U.S. Natl. Herb. **20(13)**: 509. 1924; Melchior *in* Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925; Standley, Field Mus. Nat. Hist., Bot. Ser. **10**: 288. 1931; Standley & Record, Field Mus. Nat. Hist., Bot. Ser. **12**: 266. 1936; C. V. Morton *in* Yuncker, Publ. Field Mus. Nat. Hist., Bot. Ser. **9(4)**: 310. 1940; Standley & I. O. Williams, Fieldiana, Bot. **24(7(1))**: 78. 1961. Figs. 54A, 55.

Alsodeia guatemalensis S. Watson, Proc. Amer. Acad. Arts Ser. **1**, **21**. (=Ser. **2**, **13**): 458. 1886. Type. Guatemala. Izabal: Chiquimala, on the banks of the Rio Chocón, E position of Vera Paz and Chiquimala, 4 & 25 Mar 1885 (fr), *S. Watson 15* (holotype, HH; isotype, K).

Rinorea pilosula Blake *in* Standley, Contr. U.S. Natl. Herb. **23(3)**: 838. 1923 ('*Rinora*'); Contr. U.S. Natl. Herb. **20(13)**: 516. pl. 37. 1924 p.p. (the additional specimen *Kerber 407* belongs to *R. hummelii* (Sprague); Melchior *in* Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925 ('Standley')). Type. Mexico. Tabasco: El Macayal, vic. San Juan Bautista, 1 Feb 1888 (fl), *Rovirosa 100* (holotype, US 40190; isotype, PENN).

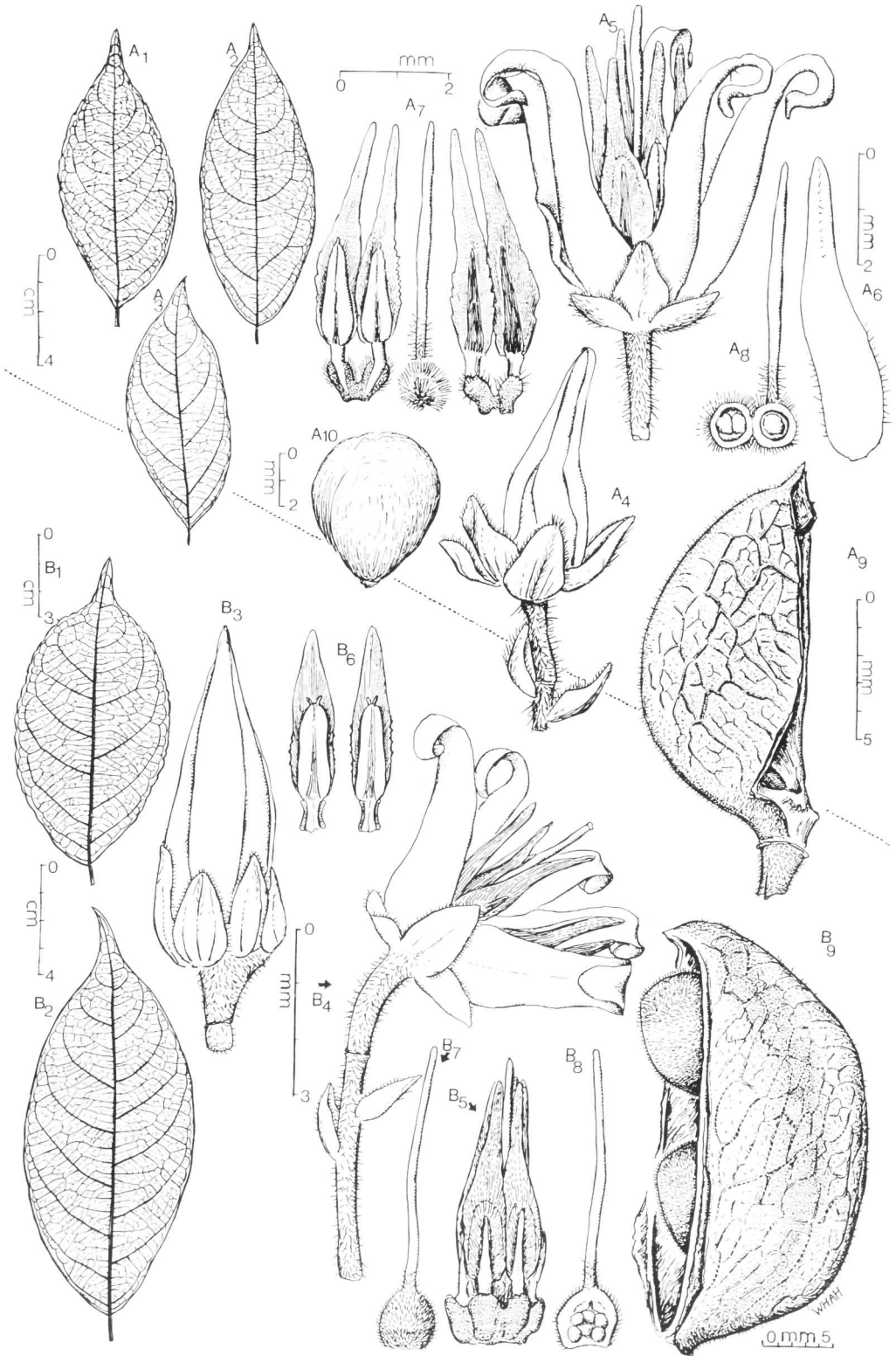
Rinorea belizensis Lundell, Wrightia **4(1)**: 38. 1968. Type. Belize. Toledo: Between Monkey River and Cockscomb, in 'mountain cabbage' ridge, 21 Dec 1942 (fl), *Gentle 4294* (holotype, LL).

Rinorea mexicana Lundell, Wrightia **4(1)**: 39. 1968. Type. Mexico. Chiapas: La Ceiba, along Rio La Venta, 6 km E of Raudales, 130 m, 5 Apr 1966 (fr), *Gonzalez-Quintero 3433* (holotype, LL).

Tree or *treelet* 2–12 m tall. Branchlets brownish puberulous, hirtellous and/or hirsute when young, glabrescent when older. *Leaves* apparently opposite, occasionally ternate or quaternate; petioles 2–12 mm long, densely brownish hirtellous above, brownish hispidulous beneath; stipules deciduous, (narrowly) deltoid to linear, 1.5–5 × 1–2 mm, herbaceous, densely ferruginous strig(ill)ose, ciliate; lamina (narrowly) (ob)ovate, acuminate, (3.5–)5–15 × (1–)1.5–7 cm, papery, glabrous on both sides; costa erect whitish to golden hirtellous above, golden to ferruginous strig(ill)ose beneath; domatia usually present, occasionally wanting, golden to ferruginous pilose(ulous); lateral veins 6–9(–11) pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate, sometimes slightly decurrent into the petiole; margin entire to crenate or serrate, mucronulate; acumen 0.3–2 cm long, apex subobtuse to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, racemose, (1–)3–7.5 cm long; central axis

golden to ferruginous puberulous; 'pedicels' 2–7 mm long, articulate at $\frac{1}{2}$ – $\frac{2}{3}$ from the base, sparsely golden to ferruginous puberulous; bracts and bractlets ovate to deltoid, acuminate, herbaceous, orange-brownish strigillose, ciliate, apex subobtuse to subacute; bracts 1–1.25 mm long and wide, bractlets equaling or slightly smaller. *Flower* buds conical, subobtuse. Flowers drooping, whitish to dull light red, fragrant. Sepals subequal, ovate, sometimes obovate or elliptic (1–)1.25–2 × 0.75–1.25 mm, herbaceous, orange-brownish strigillose, cili(ol)ate, apex subobtuse to subacute. Petals narrowly ovate to deltoid, gradually acuminate, (3.25–)4.75–5.5 × 1.25–1.5 mm, herbaceous, sparsely orange-brownish strig(ill)ose or hispid(ulous) along the costa, margin sparsely ciliate or glabrous, apex obtuse. Stamens 3–5 mm long, all filaments either completely free or embodied in a glandular tube; free filaments 0.5–1 × 0.3–0.4 mm, glabrous; free dorsal glands (0.4–)0.5–0.75 × 0.2–0.4 mm, apex obtuse; glandular tube (0.4–)0.5–0.75 mm high; glandular tissue carnosic, glabrous or orange-brownish hispidulous; anthers narrowly deltoid, 1.25–2 × 0.5–0.75 mm, apex of thecae obtuse, sometimes apiculate or appendaged (each or one of them) by mucros only 0.01–0.05 × ca. 0.01 mm; connective outside narrowly deltoid, subobtuse to subacute, (1–)1.25–2 × ca. 0.25 mm; connective scales lateral as well as apical, narrowly ovate, 2.5–4 × 0.75–1 mm, scarious, orange-brown, glabrous, (sub)erose near the base, apex subobtuse to subacute, subtire. Ovary globose, 0.5–1 mm in diam., golden hispid; ovules one per placenta. Style filiform or slightly sigmoid at the base, (3–)3.5–4.25 mm long, exceeding the stamens by 0–0.75 mm; indument golden-brownish hirtellous near the base; stigma truncate. *Capsule* more or less symmetric, ellipsoid, acuminate, sublignous or coriaceous, sparsely brownish pilosulous to puberulous, veined; valves three, usually subequal, occasionally unequal, (0.75–)1.25–1.75 × 0.5–0.75 cm. *Seeds* one per valve, globose, 4.5–5 mm in diam., glabrous.

Distribution (Fig. 55) and ecology. *Rinorea guatemalensis* is restricted to Central America, where it occurs from SE Mexico to Honduras, which area includes two forest refugia: Los Tuxtlas and Guatemala-North. Locally common in the understory of mixed or wet tropical forests in lowlands and submountainous regions usually with a pronounced dry season, from 30 to 2000



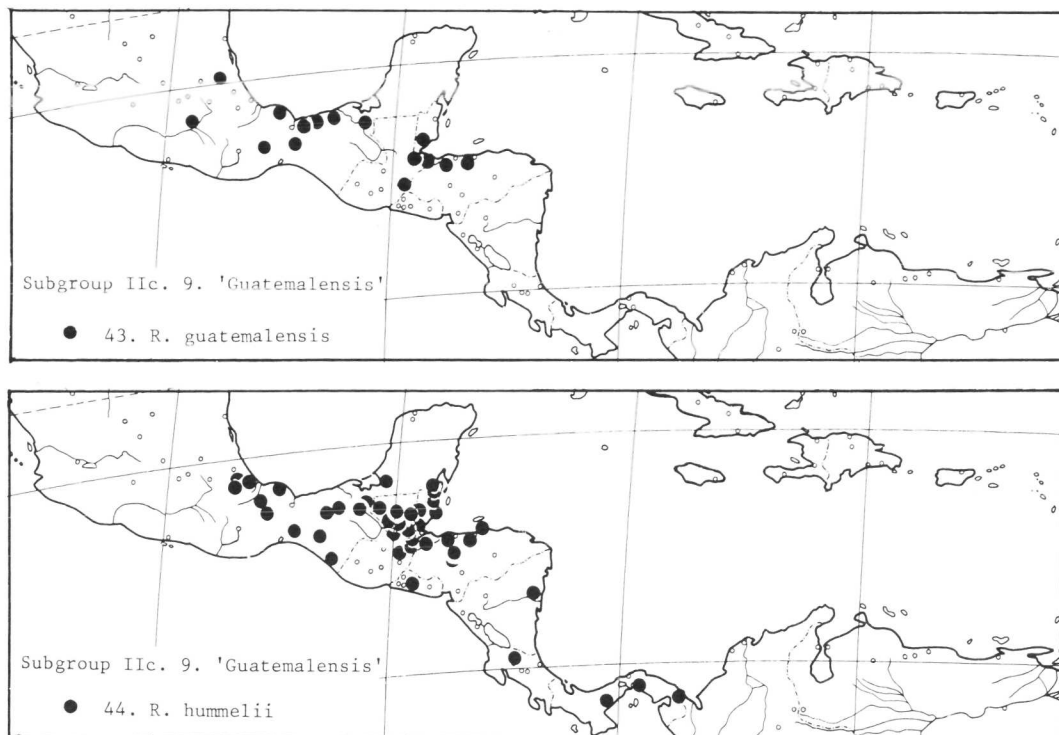


FIG. 55. Distribution of species of *Rinorea* Subgroup IIC.9. 'Guatemalensis.'

m. Sometimes reaching cloud forests in higher mountainous regions. Specimens have been collected on ridges, slopes or summits of hills and mountains as well as along rivers, streams and creeks. Soil often consisting of volcanic rocks or karst limestone; other soil types unknown.

Phenology. Flowering specimens have been collected during the period February–April and in December, fruiting specimens in the period March–June.

Representative specimens examined: MEXICO. GUERRERO: Mun. General Heliodoro Castillo, 35 km N of El Paraiso on rd. to Puerto del Gallo, 2000–2100 m, 9 Jun 1985 (fr), *Thomas & Contreras 3751* (NY,

U); Río Cascabel, 14 Mar 1934 (fl), *Mell 2221* (NY, US); Distr. Choapam, Yaveo, stream of Culebras, 450 m, 21 Mar 1938 (fl), *Mexia 9186* (B, F, G, HH, K, MO, NY, S, U, UC, US); idem, 445 m, 23 Mar 1938 (juv fr), *9198* (B, F, G, HH, K, MO, NY, S, U, UC, US); Distr. Choapam, Yaveo, trail del Chorro, 440 m, 27 Mar 1939 (fr), *Mexia 9219* (B, F, G, HH, K, MO, NY, S, U, UC, US); Teotalcingo–Choapam, 1800 m, 25 Mar 1919 (fr), *Reko 4082* US); Distr. Juchitán, Mun. Sta. María Chimalapa, 16°52'N, 94°47'W, 400 m, 1 Mar 1981 (fl), *Wendt & Villalobos 2954* (MEXU, U); Ubero, 30–90 m, May 1937 (fr), *Ll. Williams 9306* (F) & *9329* (F, MICH, P, US). OAXACA: S. s.d. (FL), *Anonymous s.n.* (W 0016, 0017); s.l. 1859? (f), *Cuming s.n.* (=1859?) (G [herbier de Candolle], P [herbier Drake (del Castillo)]). OAXACA–VERACRUZ: Zona Uxpanapa, mun. Jesús Carranza, 3.9 km S of Ejido, 7 Mar 1982

FIG. 54. **A.** *Rinorea guatemalensis* (**A**₁ from *Ynes Mexia 9198*; **A**₂ from *Quintero 3433*, type of *R. mexicana* (synonym); **A**₃ from *Gentle 9244*, type of *R. belizensis* (synonym); **A**_{4–8} from *Cuming s.n.* (1859); **A**₉ from *S. Watson 15*, type of *R. guatemalensis*; **A**₁₀ from *Matuda 3301*). **A**_{1–3}, Leaves. **A**₄, Flower bud with pedicel and bractlets. **A**₅, Adult flower. **A**₆, Petal (dorsal). **A**₇, Androecium (ventral); pistil; androecium (dorsal). **A**₈, Pistil, with ovary opened, showing ovules 3 × 1. **A**₉, One of the three valves of a capsule. **A**₁₀, Seeds, glabrous. **B.** *R. hummelii* (**B**₁ from *Wawra 836*; **B**₂ from *Contreras 2407*; **B**_{3–5} and **B**_{7–8} from *Burger & Stolze 5040*; **B**₆ from *Lundell 18223*; **B**₉ from *Standley 55602*). **B**_{1,2}, Leaves; **B**₃, Flower bud. **B**₄, Adult flower, with pedicel and bractlets. **B**₅, Androecium (dorsal), dorsal glands fused; stamens surrounding pistil. **B**₆, Stamens (ventral), filaments separated from each other secondarily. **B**₇, Pistil. **B**₈, Idem, with l.s. of the ovary, showing ovules 3 × 2. **B**₉, One of the three valves of a capsule, containing two hairy seeds.

(fl. fr). *Wendt & Villalobos 3604* (MEXU, U). PUEBLA: Chinantla, s.d. (fl). *Sallé s.n.* (BM, K); Ayotoxco, 29 Apr 1970 (fr). *Ventura 1001* (F). TABASCO: Ejido Lázaro Cárdenas, 30 Mar 1979 (fr). *C. Cowan 2020* (MEXU). Achotal, Balancan, 9–14 May 1939 (fr). *Matuda 3101* (F, HH, K, MICH, NY); in El Macayal, vic. San Juan Bautista (=Villa Hermosa), 1 Feb 1888 (fl). *Rovirosa s.n.* (=100?) (US). VERA CRUZ: San Andrés Tuxtla, Los Tuxtlas, 19 April 1972 (fr). *Cedillo-T 194* (MEXU); Cerro el Vigía, Los Tuxtlas, 450 m, 21 Apr 1975 (fr). *Chazaro-B 428* (MEXU); idem, May 1975 (fr). *433* (MEXU); idem, 17 Feb 1971 (fl). *Flores 17* (MEXU); Los Tuxtlas, 200–500 m, 21 May 1981 (fr). *Gentry & Lott 32204* (MO, U); Rd. from Catemaco to Montepío, 11 Dec 1967 (bud). *Pennington & Sarukhan 9425* (K); San Andrés Tuxtla, 18°35'N, 95°01'W, 25 Apr 1973 (fr). *Villegas-H 92* (MEXU).

GUATEMALA. IZABAL: On Petén–Guatemala Rd. between Seja and Fronteras, 10 m, 9 May 1971 (fr). *Contreras 10755* (LL, U); Sierra del Mico between Los Amates and Izabal, 15°24'N, 89°08'W, 2000 m (?), 26 Feb 1908 (fl). *Kellerman 7336*; Entre Ríos, 23 Feb 1927 (fl). *Kuylen s.n.*, Collection G (US).

BELIZE. TOLEDO: Swasey Branch, Monkey River, 26 March 1942 (fl, fr). *Gentle 4009* (F, HH, MICH, MO, NY, U); S.L.: Big Creek, 30 m, 22 Dec 1931 (fl). *Schipp 854* (BM, F, G, HH, K, MICH, MO, NY, S, UC, Z).

HONDURAS. ATLÁNTIDA: Vic. San Alejo, 150–270 m, 22–27 Apr 1947 (fr). *Standley 7677* (F); idem, 22–27 Apr 1947 (fr). *7720* (F); Lancetilla valley nr. Tela, 6 Dec 1927–30 Mar 1928 (bud). *Standley 53541* (BM, F, G, HH, K, MICH, MO, NY, S, UC, Z). SANTA BARBARA: San Pedro Sula, 400 m, mid Apr 1890 (fl). *Thieme 5339* (F, HH, K, LE, M, NY, P, US); S.L.: Puerto Siena, 2 Mar 1903 (fl). *P. Wilson 295* (F, NY) & 297 (US); idem, 5 May 1903 (fr), 675 (NY, US).

Local names. Mexico: Botoncillo (Vera Cruz), Costarrica and Frutillo (Oaxaca); Belize: Cafe-cillo or Wild Coffee.

Rinorea guatemalensis differs from *R. hummelii* mainly by: (1) costa of leaves more or less hairy on both sides (versus usually glabrescent to completely glabrous); (2) domatia usually present in Central American specimens, sometimes also wanting in Mexican specimens (in *R. hummelii* always wanting); (3) number of lateral veins usually 6–9 (in *R. hummelii* usually 8–13); (4) inflorescences strictly racemose (in *R. hummelii* varying from (pseudo)racemose to shortly thyrsoid); (5) the number of ovules one per placenta (versus usually two per placenta); and (6) seeds pyriform and glabrous (versus subglobose and pilosulous).

44. *Rinorea hummelii* Sprague, Bull. Misc. Inform. **1921**(8): 307, 24 Nov 1921; Blake, Contr. U.S. Natl. Herb. **20**(13): 505, 1924; Melchior

in Engler & Prantl, Nat. Pflanzenfam. ed. 2, **21**: 352, 1925; Standley & Record, Field Mus. Nat. Hist., Bot. Ser. **12**: 266, 1936; Lundell, Veg. Petén, **1**: 201, 1937; Standley & L. O. Williams, Fieldiana, Bot. **24**(7(1)): 78, 1961. Type, Belize: Salt Creek, May 1921 (fl), *Hummel 11* (lectotypus novus, K; isotypes, K, US). Figs. 54B, 55.

Tree or treelet 1–14 m tall. Branchlets brownish hirtellous when young, glabrescent. *Leaves* apparently opposite, sometimes ternate; petioles 2–15 mm long, golden hispidulous above, golden strig(ill)ose beneath when young, to glabrescent when older; stipules deciduous, narrowly deltoid, 0.5–4 × 0.5–1 mm, herbaceous, golden strigillose, ciliolate; lamina (narrowly) elliptic to (ob)ovate, acuminate to cuspidate, 4–16.5 × 1.5–9.5 cm, papery to subcoriaceous, glabrous on both sides; costa glabrous above, glabrous to sparsely golden-brownish pilosulous beneath near the base; domatia wanting; lateral veins 8–13 pairs (acumen excluded); tertiary venation reticulate; base rounded to cuneate; margin subentire to (sub)serrate or (sub)crenate, mucronulate; acumen (0–)1.25–3 cm long, apex subobtusate to subacute. *Inflorescences* axillary, lateral and subterminal, solitary, racemose to thyrsoid, 1–8 cm long; central axis golden pilosulous; cymules with 1–3(–9) flowers; 'pedicels' 2.5–6.5 mm, articulate at 1/5–2/3 from the base, golden pilosulous; bracts and bractlets ovate to deltoid, herbaceous, golden strig(ill)ose along the costa, ciliolate, apex sub-obtusate to subacute, sometimes mucronulate; bracts 1–1.75 × 0.75–1.5 mm; bractlets 0.75–1.25 × 0.5–0.75 mm. *Flower* buds ovoid to conical, subobtusate to subacute. *Flowers* drooping, greenish when young, yellowish-white when flowering. *Sepals* subequal, ovate (0.75–)1.25–2.0(–2.5) × 0.75–1.5 mm, herbaceous to scarious, glabrous or sometimes sparsely golden to whitish pilosulous, ciliolate, apex obtuse to subacute. *Petals* narrowly ovate, gradually acuminate, 4–5(–6) × 1.25–2 mm, herbaceous, sparsely golden pilose near the apex of the costa, sometimes sparsely ciliolate, apex obtuse. *Stamens* 3.5–5 mm long; all filaments usually embodied in a brittle glandular tube, occasionally free; free (parts of) filaments 0.5–0.75 × 0.25–0.5 mm; dorsal glands usually fused with each other to a tube ca. 0.75 mm high; glandular tissue carnosate, glabrous, occasionally pilosulous; anthers narrowly deltoid to ovoid, 1.25–2.25 × 0.75–1 mm, apex

obtuse, one or each of the thecae usually appendaged by a cusp or set(ul)a, ca. 0.2 × ca. 0.1 mm; connective outside, narrowly deltoid, subacute 0.5–1.75 × 0.2–0.4 mm, glabrous; connective scales apical as well as lateral, narrowly ovate 3–4 × 1–1.75 mm, scarious, orange-brown, glabrous, (sub)erose near the base, apex subobtuse to subacute, subtentire. Ovary (sub)globose 0.75–1.5 × 0.75–1.25 mm, golden strigillose; ovules two per placenta, occasionally one or three. Style filiform, erect to slightly curved, 2.5–4 mm long, exceeding the stamens by 0–0.25 mm, golden strigillose near the base; stigma truncate. *Capsule* more or less symmetric, ellipsoid, acuminate, subligneous to coriaceous, green when fresh, golden-brownish hispidulous, veined; valves three, (sub)equal, 1.5–3.25 × 0.5–1 cm. *Seeds* two per valve, occasionally one or three, subglobose, 4–8 mm in diam., golden-brownish pilosulous.

Distribution (Fig. 55) and ecology. *Rinorea hummelii* is confined to Central America, occurring from S Mexico to Panama; not recorded but to be expected in Nicaragua. Its area of distribution includes the following forest refugia: Los Tuxtlas, Guatemala-North, Chiriquí, Darién. Locally common in the understory of primary, secondary or disturbed evergreen tropical rain forests in lowlands or submountainous regions usually with a pronounced dry season, from 0 to 1800 m. Specimens have been collected on ridges, slopes or summits of hills and mountains, in valleys or gullies and along rivers, streams and creeks. Soils consisting of volcanic rocks, karst limestone, limestone outcrops and clayish soils.

Phenology. Flowering specimens have been collected during the period April–August and fruiting specimens throughout the year. Probably flowering and fruiting throughout the year.

Representative specimens examined: MEXICO. CAMPECHE: Km 5 Rd. from Escárcega to Candelaria, 8 Jan 1966 (fr). *Chavelas et al. ES-1351* (=CD-5-4236) (F); 5 km W of Escárcega, 50 m, 25 May 1973 (fl), *den Held & van Rhijn FC-92* (U); km 5 Rd. Escárcega to Candelaria, 23 Dec 1965 (fr), *Hernández et al. ES-96* (F). CHIAPAS: Mun. of Las Margaritas, nr. San Quintin along Río Jataté, 400 m, 23 Feb 1965 (fr), *Breedlove 9128* (F); Mun. of Ocozocoautla de Espinosa, 32 km N of Ocozocoautla, along rd. to Mal Paso, 800 m, 19 Oct 1965 (fr), *Breedlove & Raven 13567* (F); 3 km of Chiapas–Tabasco border on Hwy. 186, 150 m, 19 Aug 1974 (fr), *Conrad 2987* (MO, U); ca. 125 km SW of Palenque, rd. between Palenque and Bonampak, 350–370 m, 5 Jul 1977 (fr), *Croat 40201 & 40227* (MO, U); ca. 35 km SE of Palenque, rd. between Palenque

and Chancala, 160 m, 6 Jul 1977 (fr), *Croat 40289* (MO, U); 17 km SE of Palenque on the rd. to Bonampak, Ejido León Brindis, 300 m, 12 May 1982 (fl, fr), *Davidse et al. 20390* (MO, U); Mun. of Ocosingo, 5 km SW of Santo Domingo, 120 km SE of Palenque on rd. to Bonampak, 600 m, 13 May 1982 (fl), *Davidse et al. 20433* (MO, U); Río Lacantun, 9 Feb 1964 (fr), *Lundell 17854* (LL); Mun. of Ocozocoautla de Espinosa, Presa de Malpaso, 700 m, 5 Dec 1967 (fr), *Ton 3304* (F); W side of toll bridge crossing Río Usumacinta along MEX 186, 22 Jul 1971 (fl, fr), *Vaughan et al. 212* (MO). OAXACA: Deep ravine along stream nr. Hwy. 185, ±5 km N of the junction with the rd. to Matias Romero, 200–300 m, 20 Aug 1974 (fr), *Conrad 3001* (MO, U); Tuxtepec district, vic. Chiltepec, 200 m, Oct 1941 (fr), *Martinez-Calderón 683* (MICH); Santo Domingo, Tehuantepec, 12 Jun 1895 (fr), *E. W. Nelson 2661* (US); from Teotalcingo to Choapam, 15 Mar 1919 (fl), *Reko 4090* (US); Tuxtepec, San José Chiltepec, 17°58'N, 69°10'W, 150 m, 12 Apr 1939 (fr), *Schultes & Reko 585* (HH, K, US); idem, 23 Apr 1939 (bud), 693 (NY); Ubero, 30–90 m, Jun 1937 (fl, fr), *L. Williams 9440* (F, K, W) & 9445 (F, G, HH, K, W). QUINTANA ROO: Río Hondo, along frontier with Belize, 15 Feb 1903 (fl), *Pittier 16636* (F, US); 110 km SW of Chetumal, 7 May 1962 (fl, fr), *Chater et al. 56* (MEXU, MO); TABASCO: Cerro Las Campanas, 3 km E of Teapa, 50 km S of villa Hermosa, 18°35'N, 92°56'W, 50–100 m, 9 Aug 1974 (fr), *Conrad et al. 2837* (MO, U); Mun. Teapa, N of Cerro de Azufe, 20 Sep 1944 (fr), *Gilly Sr. & Hernández-X 298* (MICH); San Isidro, 7–11 Jun 1939 (bud, fl, juv fr), *Matuda 3353* (F, HH, K, MICH, NY) & 3354 (HH, K, MICH, MO, NY). VERA CRUZ: Valley of Córdoba, Forest of Chiquihuite, 20 Mar 1886 (fr), *Bourgeau 2114* (BR, G, K, L, LE, P); vic. Córdoba, Río Atoyac, s.d. (fl, fr), *Finck 4* (K); Estación de Biología Tropical Los Tuxtlas, 190 m, 20 Apr 1968 (fl, fr), *M. Rosas-R. 1225* (MEXU, U); El Amate between Catemaco y Coyame, 380 m, 9 Oct 1968 (fr), *M. Rosas-R. 1387* (GH, U); Motzorongo, 11 Feb 1892 (fr), *J. G. Smith s.n.* (MO); Paso Majo, s.d. (bud), *Wawra 836* (W); Portéro de San Sebastián, Apr 1841 (fl, fr), *Liebmann 376* (C), 649 (F, HH, US) & 659 (C); Matilde, Mar 1919 (fr), *Reko 4069* (US).

GUATEMALA. ALTA VERA PAZ: Vic. Seból, ±5 km on Coban Road, 15°48'N, 89°57'W, 1 May 1964 (bud, fr), *Contreras 4569* (LL, U); nr. Finca Sepacuite, 23 Apr 1902 (bud, fr), *Cooks & Griggs 744* (US); S of Cubilgüitz, 15°40'N, 90°25'W, 300–400 m, 3 Mar 1942 (fr), *Steyermark 44508* (F, US); Cerro Chinajá above source of Río San Diego, 150–170 m, 1–2 Apr 1942 (bud, fr), *Steyermark 45577* (F, MICH) & 45659 (F, HH, US). EL PETÉN: Remate, bordering Piedras Blancas, 17°00'N, 89°42'W, Apr 1960 (bud), *Contreras 858* (LL, U); Dolores, 21 Jul 1961 (fr), *Contreras 2643* (LL, U); 3 km W of Lacandon, 9 Mar 1962 (fl), *Contreras 3495* (LL, U); Sta. Teresa, Subin River, 12 Apr 1933 (fl, fr), *Lundell 2683* (F, HH, MICH, S), 2763 (F, HH, MICH, S, US), 2770 (F, K, MICH, S); San Luis, 11 Jul 1959 (fr), *Lundell 16381* (LL, U); Río Passión, Ceibal, 3 Feb 1964 (fr), *Lundell 17652* (LL); Laguna Petexbatun, 30 Mar 1964 (fl), *Lundell 18223* (LL, U); Yaltudú between Cristo Rey and Poptún, 433 m, 11 Nov 1965 (fr), *Molina 15577* (F); 9 km W of Río San

Román. NW of Chinajá. 16°04'N, 90°15'W, 50–70 m. 29 Mar 1942 (fl). *Steyermark 45499* (F, HH, MICH, NY); Cerro Ceibal, between mouths of Río Sta. Mónica and Río San Martín, on left side of Río Cancuen. 29 Apr 1942 (fr). *Steyermark 46066* (F, G, HH, NY, UC). IZABAL: Pto. Mendez. 13 Aug 1966 (fr). *Contreras 5964* (LL, U); vic. Escobas, on the bay opposite Puerto Barrios. ±150 m. 2 Jun 1922 (juv fr). *Standley 24844* (HH, NY, US); between Bananera and La Presa, Montaña del Mico. 15°30'N, 88°55'W. 30–400 m. 28 Mar 1940 (bud, fr). *Steyermark 38102* (F, US); between Milla 49.5 and Cristina. 65–70 m. 2 Apr 1940 (fl). *Steyermark 38679* (F); between Virginia and Lago Izabal, Montaña del Mico. 50–500 m. 5 Apr 1940 (fl, fr). *Steyermark 38909* (F, UC); between Escobas and Montaña Escobas, across bay from Puerto Barrios, 1–100 m. 13 Apr 1940 (fl). *Steyermark 39323* (F); along Río Frio, Cerro San Gril. 75 m. 17 Dec 1941 (fr). *Steyermark 39964* (F, US).

BELIZE. BELIZE: 5 Jul 1973 (fr). *Dwyer 11475* (MO); ±7.5 km S of Belmopán. 29 May 1974 (fl, fr). *Dwyer 12502* (MO); Prospecto–Maskall Rd., Nov 1963 (fr). *Gentle 881* (F, LE, MICH, MO, NY, P, S, UC, US); Maskall. 10 Mar 1934 (fl). *Gentle 1179* (F, G, HH, K, MICH, MO, NY, US); Salt Creek, s.d. (fl). *Hummel 170* (K) & s.n. (F, K); Gracy Rock. 100 m. 21 Jan 1974 (fr). *Liesner & Dwyer 1509* (MO); Santana. 40 km NW of Belize. 27 Sep 1936 (fl). *O'Niell 8781* (HH). BELIZE–EL CAYO: Iraciel Rock, Sibun River. 20 Aug 1935 (fr). *Gentle 1717* (HH, MICH). EL CAYO: Between Yaloch and El Cayo. 8 May 1931 (fl, fr). *H. H. Bartlett 12866* (HH, MICH, MO, NY, S, US); Grano de Oro. 500 m. 2 Jun 1973 (fl). *Croat 23329* (MO, U); Valentin, Jun–Jul 1936 (fl). *Lundell 6279* (F, HH, MICH, NY, US); vic. Chiquibal. 500–600 m. 26 Apr 1969. *Proctor 30142* (BM). NORTHERN DISTRICT: Nr. Gallon Jug. 31 Mar 1958 (fl, fr). *Lancaster 27* (US); Río Hondo (frontier with Quintana Roo, Mexico). 15 Feb 1903 (fl). *Pittier 16636* (F, US). STANN CREEK DISTRICT: Middlesex. 16 Jan 1926 (fr). *Record 8770* (=B.H. 2) (FHO, NY, US). TOLEDO: 8 km N of Colombia Forest Station. 13 Jun 1973 (fl). *Croat 24466* (MO, U); Bolo Camp, upper reach of Golden Stream. 13 Apr 1944 (fl). *Gentle 4531* (LL); Riverbank of Río Grande. 22 Aug 1944 (fr). *Gentle 4770* (LL, UC, US); between Punta Gorda along San Antonio Rd. and Mohon River. 1 Jun 1949 (fl). *Gentle 6757* (LL); 2.5 km S of Mayan village of San José and ±10 km W of Colombia Forest Station. 11 Jun 1973 (fr). *Vanderveen 610* (MO, U); S.L. Cornhouse Creek. 31 Jan 1931 (fr). *H. H. Bartlett 11278* (F, MICH); 1886 (fr). *Hooper s.n.* (K); Roaring Creek. Aug 1929 (fr). *Lundell 301* (US) & *3001* (F, K); Honey Camp. 1930 (fr). *W. C. Meyer 29* (F); Feb–Apr 1928 (fl). *D. N. S. Stevenson Coll. 9 Ser. 12303* (K); s.d. (fl). *Winzlerling 1-6* (US).

HONDURAS. ATLÁNTIDA: Valley nr. dam for water supply of Progreso. 12 Aug 1929 (fl). *Bangham 354* (F, HH) & *355* (F, HH); Montaña Lancetilla. 3 km S of Lancetilla. nr. El Portillo. 19 Mar 1962 (fl). *Molina 10457* (F); Lancetilla valley nr. Tela. 20–600 m. 6 Dec 1927–20 Mar 1928 (fl, fr). *Standley 5560* (HH, US). *53100* (F, US). *53112* (F, HH, US). *53299* (F, HH, US). *54589* (F, HH, US). *55602* (F) & *56700* (F, HH,

K, US); Mt. Cangrejal. nr. Danto river, vic. La Ceiba. 175 m. 30 Jul 1938 (fr). *Yuncker et al. 6892* (F); Mountain slope back of Roma. 22.5 km E of Ceiba. 250 m. 21 Jul 1938 (fr). *Yuncker et al. 8595* (BM, F, G, HH, K, MICH, S, US). COMAYAGUA: Pito Solo. Lake Yojoa. 500 m. 18 Apr 1945 (bud, fr). *J. V. Rodriguez 2947* (F, HH). YORO: Vic. Santa Rita de Yoro. 21 Apr 1971 (fl). *J. Hernández & Mancias 1081* (MO, U).

EL SALVADOR: Volcán de San Salvador. 1000–1800 m. 7 Apr 1922 (st). *Standley 22898* (US).

NICARAGUA. BLUEFIELDS: 3 km SE of Cerro San Isidro. Río Kama. Río Escondido. ±12°10'N, ±84°00'W. 65 m. 5 Mar 1966 (fl, fr). *Proctor et al. 26979* (F).

COSTA RICA. ALAJUELA: E of Río San Rafael and S of hot springs W of La Marina. 10°23'N, 84°23'W. 500 m. 19 May 1968 (fl). *W. C. Burger & Stolze 5040* (F); San Carlos, Quebrada de Palo. 650 m. 16 Apr 1939 (fl). *A. Smith s.n.* (F—1913, MO, NY—1923). GUANACASTE: Slopes of Volcán Miravalles facing Volcán Tenorio above the village of Río Marañón. 750–850 m. 12 Jul 1972 (fr. seeds 3 × 1). *Luteyn 3410* (DUKE). PUNTARENAS: Finca El Edén, km 183 R.2., ca. 400 m, s.d. (fr. seeds 3 × 1). *L. D. Gómez 22958* (CR, U). PANAMA. COCLÉ: 7 km from Llano Grande on rd. to Coclesito. 400 m. 4 Jul 1979 (fr). *Antonio 1352* (MO); PANAMÁ: Finca Indio, Cerro Jefe. 4 May 1971 (fl). *D'Arcy 5243-A* (MO); El Llano–Cartí Rd., 15 Feb 1975 (fl). *Mori & Kallunki 4709* (MO, U). SAN BLÁS: W of Puerto Obaldia on trail toward Kuna village of Puerto Armilo. 8°40'N, 77°25'W. 25–170 m. 23 Mar 1985 (fr). *McPherson 6954* (MO); On trail to inland village of Armila, ca. 5 km SW of Puerto Obaldia, 21 Jun 1975 (fr). *Mori et al. 6799* (MO, U).

Local names. Mexico: Cascarillo (Vera Cruz), Costarrica and Frutillo (Oaxaca), Huesillo (Vera Cruz), Pochitosa (Oaxaca), Tronadora (Campeche). Guatemala: Cuol cuol (Alta Vera Paz). Belize: Cafecillo. Wild Coffee.

Uses. In Guatemala the tree is used for its wood.

In *Rinorea hummelii*, the number of ovules and seeds is normally two per placenta, sometimes three, versus one per placenta in *R. guatemalensis*. In Costa Rica, however, two specimens of *R. hummelii*, *Luteyn 3410* and *L. D. Gómez 22958*, have been collected with capsules containing only one seed per placenta. The occurrence of this lower number is rare in *R. hummelii*. For differences with *R. guatemalensis* see under that species. In *R. hummelii* filaments tend to be more united into a glandular tube than in *R. guatemalensis*. An additional specimen, *Kerber 407* (Mexico), cited as *R. pilosula* Blake (1923) by Blake (1924) does not belong to its synonym *R. guatemalensis*, but to *R. hummelii*.

Subgroup IIc.10. 'Racemosa': species 45–48.

Leaf base symmetric; tertiary venation scalariform; *inflorescences* narrowly thyrsoid by having compact lateral cymules; *flowers* and *fruits* pedicellate; 'pedicels' articulate above the base; bractlets separately inserted from the bracts; filaments and dorsal glands fused to a filamental tube; ovary (sub)globose, conical or trapezoid, distinct from the style; ovules one to two per placenta.

This subgroup is characterized by having narrow thyrsoid inflorescences with a dominating central axis bearing compact cymules as well as by filaments and dorsal glands fused to a filamental tube. The inflorescences of *Rinorea ramiziana* and the species of Subgroup IIa.3. 'Rinorea' are also thyrsoid, but they are distinctly more 'paniculoid' than those of the species of this subgroup, which have a more 'spicoid' character.

The flowers of the species of this subgroup resemble those of *Rinorea ramiziana* of Subgroup IIa.2. 'Laevigata,' the species of Subgroup IIa.3. 'Rinorea' and finally *R. uxpanapana* of Group IIb. 'Uxpanapana.'

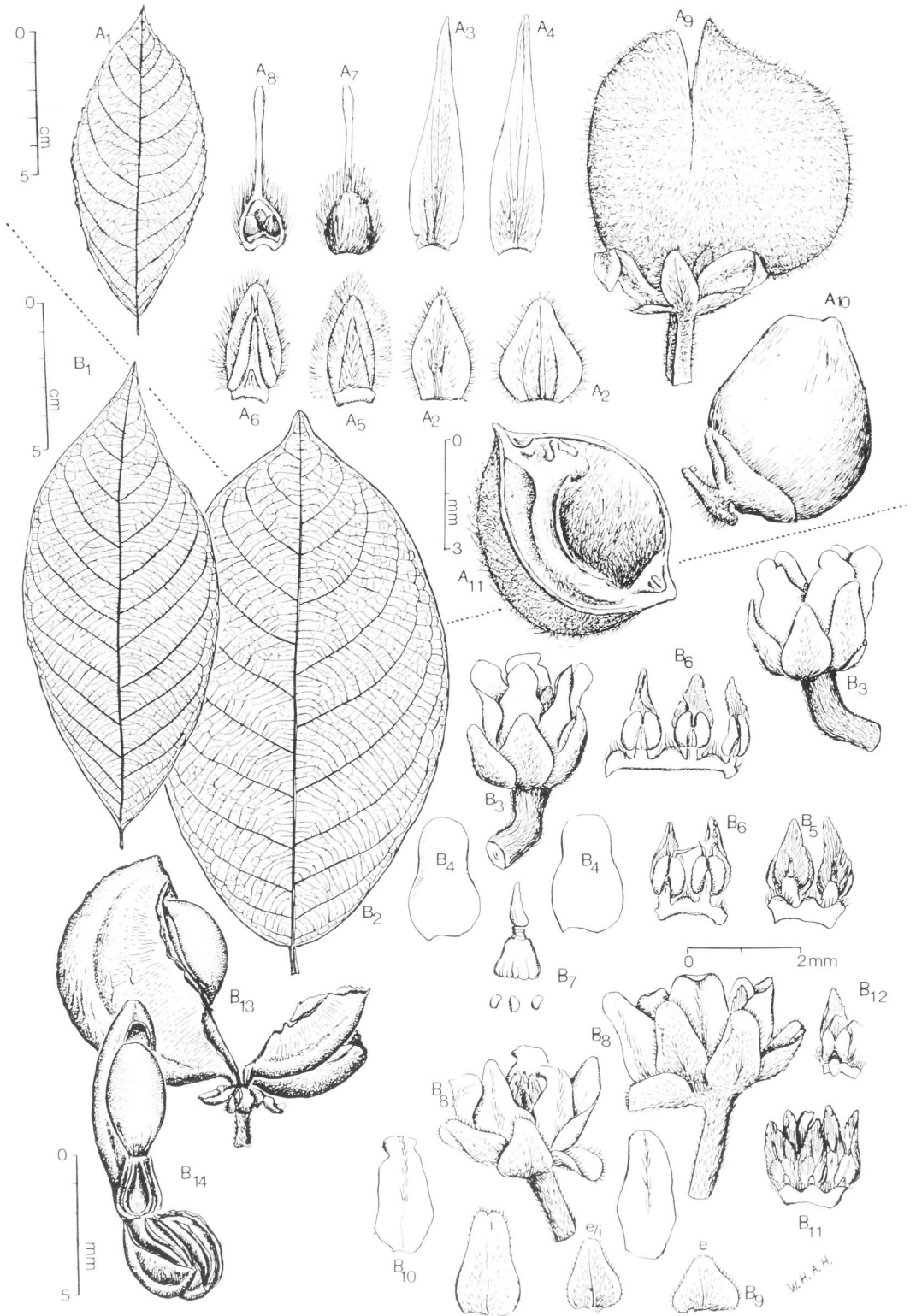
Within this subgroup, *Rinorea racemosa*, *R. sprucei* and *R. vaupesana* are most closely related to each other by their leaves hairy beneath, as well as by the more glabrous character of the flowers. In *R. villosiflora* the leaves are glabrous beneath and the connective scales distinctly villose.

Distribution (Fig. 58). The four species of this subgroup are distributed over Amazonia and adjacent regions; there are no records from the other side of the Cordilleras. *Rinorea racemosa* is most widespread over Amazonia. The western part of the area of *R. racemosa* encloses that of *R. sprucei*, endemic along the Río Negro and the Vaupés. In turn, the area of *R. sprucei* encloses that of *R. vaupesana*, endemic along the Vaupés only. This Vaupés area was probably the center of speciation for these three closely related species. A fourth, less closely related species, is only known from the type locality in Maranhão, much farther eastward. Therefore, we presume that speciation from a common ancestral stock took place over a wider area in Amazonia, first to *R. villosiflora* from the eastern population and subsequently to the other three species of the western population.

45. *Rinorea villosiflora* Hekking. *Phytologia* 53(4): 254, pl. 1, fig. 3, pl. 2, fig. 3, 1983. Type. Brazil Maranhão: Estate of Sta. Maria, along rd. BR-222, km 45 from Açailândia, 17 Dec 1978 (fl, fr), Rosa & Villar 3025 (holotype, U; isotypes, INPA (n.v.), NY (n.v.)).

Figs. 56A, 58.

Treelet 4–5 m tall. Branchlets brownish hispidulous to puberulous. *Leaves* apparently opposite, sometimes ternate; petioles ca. 4–6 mm long, brownish hispidulous to puberulous; stipules deciduous, narrowly deltoid to linear, ca. 0.75 × 0.25 mm, brownish hispidulous to puberulous, ciliolate; lamina elliptic to (ob)ovate, cuspidate, 4–11.5 × 2–5 cm, papery, glabrous on both sides; costa predominantly glabrous above, sometimes sparsely hispidulous near the base, distinctly brownish hispidulous or puberulous beneath near the base; lateral veins 8–14 pairs (acumen excluded); tertiary venation scalariform; base rounded to obtuse; margin cren(ul)ate to serr(ul)ate, mucronulate, brownish ciliolate near the petiole; acumen 0.1–0.6 cm long, apex acute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, narrowly thyrsoid, ca. 7.5 × ca. 1 cm; central axis brownish to yellowish hispidulous; cymules 3(–7?) flowered; common peduncle 2–4 mm long, brownish hispidulous; 'pedicels' 2–3.5 mm long, articulate near the middle, brownish hispidulous; bracts and bractlets ovate to deltoid, herbaceous, brownish hispidulous, ciliolate, apex subacute; bracts ca. 1 mm long and wide; bractlets ca. 0.75 mm long and wide. *Flowers* drooping. Sepals subequal, ovate, 2 × 1–1.5 mm, herbaceous, outside pilosulous, inside glabrous, costate, ciliate, apex obtuse. Petals narrowly deltoid to ovate, acuminate, ca. 4.25 × ca. 1 mm, herbaceous, densely whitish to golden pilose outside and near the base and apex inside, glabrous near the margin, not ciliolate, apex (sub)acute. Stamens 2.5 mm long, subsessile; filaments and dorsal glands fused to a brittle tube, ca. 0.25 mm high, sometimes broken into separate parts ca. 0.5 mm wide; tube glabrous and not cili(ol)ate; anthers deltoid, 1.75 × 1–1.25 mm, glabrous, apex obtuse, often appendaged by (1)–2 cusps ca. 0.3 × 0.05–0.1 mm; connective on both sides deltoid, subobtuse to subacute, 1.75 × 0.25 mm, whitish to golden villose, on both sides; connective scales lateral as well as apical, ovate, gradually acuminate, 2–



2.25 × 1–1.25 mm, scarious, partly brownish, partly uncolored and transparent, outside golden to whitish villose, margin subcrose, ciliate, apex subacute. Ovary subglobose to subconical, 1–1.25 × ca. 1 mm, golden hispidulous; ovules one per placenta. Style filiform to subclavate, erect, 1.75–2 mm long, exceeding the stamens by 0.5–0.75 mm; stigma truncate. *Capsule* asymmetric, ovoid to globose, acuminate, subtended by subpersistent floral parts, coriaceous, outside densely brownish hispidulous to velutinous in combination with sparsely brownish strigose, inside densely villose; valves three, unequal, ca. 0.5 × 0.25–0.5 cm. *Seeds* one per valve, globose to pyriform, 3 × 2.5 mm, glabrous.

Distribution (Fig. 58) and ecology. *Rinorea villosiflora* is known only from the type collection in Maranhão (NE Brazil). The type specimen was collected in an uninundated area along a river.

The species is named *Rinorea villosiflora* for the villose indument of the connective scales and the innerside of the valves.

It differs from *Rinorea racemosa*, *R. sprucei* and *R. vaupesana* by: (1) leaves glabrous beneath (versus appressed pilosulous); (2) petals longer than 4 mm and tapering to an acute apex; (3) anthers 1.75 mm long (versus 0.5–1 mm long); (4) connective scales 1–1.5 × as long as the anthers (versus 2–4 ×); (5) connective and connective scales densely villose outside (versus glabrous); (6) capsules densely hairy as in *R. vaupesana* (versus glabrous in *R. racemosa* and *R. sprucei*); and (7) valves villose inside (versus glabrous inside).

46. *Rinorea racemosa* (Martius) Kuntze, Revis. gen. pl. **1**: 42. 1891; Reiche & Taubert, Nat. Pflanzenfam. ed. 1. **3(6)**: 329. 1895; Blake, Contr. U.S. Natl. Herb. **20(13)**: 502. 1924; Melchior, Nat. Pflanzenfam. ed. 2. **21**: 352. 1925; Baehni & Weibel, Candollea **8**: 196. May

1941; in Macbride, Publ. Field Mus. Nat. Bot. Ser. **13(4(1))**: 61. 30 Jun 1941; Smith & Fernández-P. Calsadia **6(28)**: 100. 1954.

Figs. 56B, 58.

Alsodeia racemosa Martius, Nov. gen. sp. pl. **1(2)**: 29. t. 20. late 1823–Jan–Feb 1824 ('1823–1832') ('*Alsodeia*'); Gingins in A. P. de Candolle, Prodr. **1**: 313. 1824; Sprengel, Syst. veg. ed. 16. **1**: 806. late 1824 ('1825') ('*Alsodeia*'); D. Dietrich, Syn. pl. **1**: 831. Jul 1839 ('*Alsodeia*'); Bentham, J. Bot. (Hooker) **4**: 107. 1842; Eichler in Martius, Fl. bras. **13(1)**: 384. 1871 p.p. (variety excluded); Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München **20**: 187. 1891 ('1890'). Type. Brazil. Amazonas: Tefé, on the border of the Rio Solimões, s.d. (fl. fragm fr). *Martius s.n.* (lectotypus novus, M (178); isotypes (?), M (119, 120, 121, 130, 131, 132, 143, numbers written on small labels attached to the specimens).

Gonohoria racemosa (Martius) G. Don, Gen. hist. **1**: 341. Early Aug. 1831 ('1831–1838') ('*Gonohoria*').

Rinorea japurana (Meisner) Howard, J. Arnold Arbor **41(3)**: 244. 1960.

Alsodeia japurana (Meisner) Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München **20**: 182. 1891 ('1890'); Lindau, Bot. Jahrb. Syst. **13**: 220. 1891; Blake, Contr. U.S. Natl. Herb. **20(13)**: 517. 1924 ('doubtful species').

Coccoloba japurana Meisner in Martius, Fl. bras. **5(1)**: 25. 1855; Lindau, Bot. Jahrb. Syst. **13**: 220. 1891. Type. Brazil: Amazonas: Tefé, along the river Japura, s.d. (fl). *Martius s.n.* (holotype, M [143]).

Tree or treelet, 3–30 m tall. Branchlets (sparsely) ferruginous appressed pilosulous when young, glabrescent when older. *Leaves* apparently opposite; petioles 3–18 mm long, glabrous above, ferruginous pilose(ulous) beneath when young, glabrescent when older; stipules deciduous, narrowly deltoid, subacute, 2.25–4 × 1–1.25 mm, herbaceous, ferruginous pilosulous, ciliate; lamina (narrowly) elliptic to (ob)ovate, acuminate, 6–29 cm long, 2.5–11.5 cm wide, usually papery, sometimes coriaceous or herbaceous, glabrous above, densely appressed whitish pilosulous beneath; costa slightly puberulous above

FIG. 56. A. *Rinorea villosiflora* (Rosa & Vilar 3025, type). A₁, Leaf. A₂, Sepals. A₃, Petal (dorsal), pilose along median part. A₄, Petal (ventral), pilose along median part, especially near base. A₅, Stamen (dorsal), filamental tube glabrous, connective and connective scale villose. A₆, Stamen (ventral). A₇, Pistil. A₈, Idem, with l.s. of ovary, showing ovule 3 × 1. A₉, Capsule, dehiscing into three unequal valves. A₁₀, Seeds, glabrous. A₁₁, Valve of capsule. B. *R. racemosa* (B₁ from *Martius s.n.* (120), isotype; B₂ from *Gutierrez & Schultes 840*; B₃ from *Vogel 304*; B₄ from *Martius s.n.* (178), lectotype; B₅ from *Kuhlmann 1021*). B_{1,2}, Leaves. B₃, Flowers, with subequal sepals. B₄, Petals. B₅, Androecium (dorsal), filamental tube ciliate. B₆, Idem (ventral). B₇, Pistil, with 3 × 1 ovules. B₈, Two other flowers. B₉, Sepals unequal (e = exterior [=outside], i = interior [=inside], e/i = in between). B₁₀, Petal. B₁₁, Androecium (dorsal), surrounding the pistil. B₁₂, Stamens (ventral); thecae, appendaged by long cusps. B_{13,14}, Capsule, dehiscing into three unequal valves, seeds glabrous, 3 × 1.

near the base, lateral veins nearly so; domatia sometimes present; lateral veins 11–21 pairs (acumen excluded); tertiary venation scalariform; base rounded to cuneate; margin (sub)entire; acumen 0.25–2.5 mm long, apex subobtusate to subacute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, narrowly thyrsoïd, 7.75–27.5 × 0.5–2 cm; central axis greenish when fresh, appressed whitish, golden or ferruginous pilosulous; cymules 1–7 flowered; common peduncle 0.5–5.5 mm long, golden to whitish pilosulous; 'pedicels' 0.5–4.25 mm long, articulate below the middle, golden to whitish pilosulous; bracts and bractlets ovate to deltoid, herbaceous, golden to whitish strigillose, cili(ol)ate, apex subacute; bracts 0.5–1.25 × 0.75–1.25 mm; bractlets 0.25–1.25 × 0.5–1.25 mm. Flower buds ovoid, obtuse, greenish-white. Flowers pendulous, creamy to yellowish-white, rarely tending to orange, fragrant. Sepals subequal, ovate, 1–2 × 0.75–1.25 mm, herbaceous, yellowish when fresh, pilosulous along the costa outside, sometimes also pilosulous inside, margin cili(ol)ate, especially near the base, apex obtuse. Petals elliptic to ovate, 1.75–2.25 × 0.75–1.25 mm, herbaceous, sometimes yellowish pilosulous along the costa, margin cili(ol)ate especially near the base, apex rounded to obtuse. Stamens 1.25–1.75 mm long; filaments nearly completely fused to a tube; apical part free, 0.2–0.35 × 0.1–0.2 mm, glabrous; filamental tube 0.2–0.3 mm high, sinuate, ciliolate; dorsal glands completely fused with the tube; anthers ellipsoid 0.5–0.75 × 0.25–0.75 mm, glabrous, apex obtuse, usually appendaged by (1–)2 cusps or setae, both 0.1–0.4 × ca. 0.05 mm; connective outside (narrowly) deltoid, obtuse, 0.3–0.4 × ca. 0.2 mm, glabrous; connective scales lateral as well as apical, ovate, 1–1.5 × 0.4–0.8 mm, scarious, brownish, glabrous, margin subentire, apex obtuse and erose. Ovary subglobose to trapezoid, 0.6–0.9 × 0.3–0.6 mm, glabrous; ovules one, occasionally two, per placenta. Style, more or less sigmoid at the base, thickened near the base, tapering to the apex, 0.75–1 mm long, ± equaling the stamens; stigma truncate or acuminate. *Capsule* usually asymmetric, suborbicular, subtended by subpersistent floral parts, coriaceous, glabrous, greenish, yellowish, reddish-brown or maroon when fresh; valves three, usually unequal, the larger one 0.6–1 × 0.5–0.6 cm, the two smaller ones

0.4–0.7 × 0.2–0.5 cm. *Seeds* one, occasionally two, per valve, subglobose, 4–4.25 × 3.5–4 mm, glabrous, shining.

Distribution (Fig. 58) and *ecology*. *Rinorea racemosa* is widespread over South America (SE Colombia, S Venezuela, N Peru, Brazil), but is not known from the Guianas. An undergrowth tree in primary, secondary or disturbed tropical rain forests in lowlands and submontainous regions from 0 to 700 m. Occurs on hills, in gullies and along rivers, streams and creeks. In lowlands prefers uninundated areas. Grows in soils derived from quartzite base, limestones, white sands and yellowish clayish soils.

Phenology. Flowering and fruiting specimens have been collected during the period June–March.

Representative specimens examined: COLOMBIA. AMAZONAS: Río Popeyacá, affluent of of Río Apaporis, lower course, 25 Nov 1952 (fr), *Schultes & Cabrera 15634* (US). VAUPÉS: Mitú, 200 m, 18 Oct 1939 (fl), *Cuatrecasas 7260* (US); Riverbanks of Río Inirida, Caraná, Alto Caribe, 70°35'W, 220 m, 23 Jan 1933 (juv fr), *Fernández 1926* (COL, US); Upper Río Vaupés, between the Ríos Piendaiva and Karuna, 400 m, 27–29 Oct 1952 (bud), *García-Barriga 14992* (US); Upper Vaupés, nr. Nare Trocha, 18 Feb 1944 (fl), *Gutierrez & Schultes 840* (COL, U); Macaya–Ajaju River confluence, Mt. Chiribiquete, Quartzite base, summit 500–700 m, 15–16 May 1943 (fr), *Schultes 5383* (F, HH, US); Río Apaporis, Jinogojé, nr. mouth of Río Pirapauaná, 0°15'S, 70°30'W, ±225 m, 12 Jun 1952 (fl), *Schultes & Cabrera 16692* (HH, NY); Río Piraparaná, tributary of Río Apaporis, ±0°20'S, 70°30'W, 10 Sep 1952 (fl), *Schultes & Cabrera 17383* (US).

VENEZUELA. AMAZONAS: Dpto. Atures, ca. 1 km N of San Pedro de Catianopo, ca. 60 km NE of Puerto Ayacucho, 4-8-1980 (fl. fr), *Guanchez 83* (MY, U).

PERU. LORETO: Maynas. Mishana, 45 km from Iquitos, up Río Nanay, 150 m, 3 Dec 1976 (fl), *Davidson 5205 & 5333* (F); idem, 30 km SW of Iquitos, 14 Aug 1980 (fl), *Foster 4292* (F, NY, U); Maynas, nr. Brilla Nueva, Upper Río Yaguasyacu, tributary of Río Ampiyacu, 8 Nov 1977 (fl), *Gentry & Revilla 20444* (MO, U); Requena, Genaro Herrera, Río Ucayali, 7 Dec 1977 (fl), *Gentry et al. 21182* (MO, U); Maynas, Río Nanay, half way between Iquitos and Sta. María de Nanay, 3°50'S, 79°30'W, 150 m, 30 May 1978 (fr), *Gentry et al. 22349* (MO, U); idem, 130 m, 24 Feb 1979 (bud), *24982* (MO, U); Nauta, Río Marañón above mouth of Río Ucayali 4°30'S, 73°30'W, 140 m, 11 Oct 1980 (fl), *Gentry et al. 29951* (MO, U); Mishuyacu, nr. Iquitos, Oct–Nov 1929 (fl), *Klug 504* (F, NY, US); Requena, Distr. Jenaro Herrera, trail to Río Yavari, 29 Aug 1976 (fl, fr), *Revilla 1199* (MO, U); idem, along Brazilian border, Arboretum Jenaro Herrera, 26 Aug 1976 (fl), *Revilla 1212* (MO, U); Maynas, Río Yavari, Petropolis, 3 km from Río Amazonas, 8 Sep 1976 (fl,

fr). *Revilla 1309* (MO, U); Maynas, Rio Nanay, Caserio Lupuna, 3°45'S, 73°16'W, 17 Dec 1976 (fr). *Revilla 2074* (MO, U); Maynas, Granja Militar, Quistococha, vic. Iquitos, 25 Feb 1977 (bud). *Revilla 2469* (MO, U); Maynas, Callicebus, Mishana, Rio Nanay, 3°55'W, 130 m, 25 Oct 1980 (fl). *Vasquez et al. 594* (AMAZ, MO, U, USM); Requena, Pari Jenaro Herrera, 4°50'S, 73°45'W, 170 m, 9 Dec 1980 (fl). *Vasquez et al. 1009* (AMAZ, MO, U, USM); Maynas, Upper Rio Nanay, Palto Cocha, 13 Jul 1929 (bud, fr), *Ll. Williams 3195* (F).

BRAZIL. AMAPÁ: Matapi, 28 Nov 1976 (fr), *Ribeiro 1610* (INPA, NY, U); idem, Porto Grande, Rio Matari, 27 Nov 1941 (fl), *N. A. Rosa 1041* (INPA, NY, U). AMAZONAS: Vic. Rio Uatamã, BR 174, Manaus—Caracarái, km 97, 1 Sep 1979 (fl), *Cid et al. 959*; Manaus, Reserva Ducke, Sep 1962 (juv fl), *Duarie 7970* (RB); Manaus, Estrado do Aleixo, 24 Dec 1943 (fl), *Ducke 1474* (F, HH, NY, R, UC, US); Mun. Borba, nr. Bella Vista, 4–6 Sep 1934 (bud), *Krukoff 5973* (US); Mun. Humyata, nr. Livramento, Rio Livramento, 12 Oct–6 Nov 1934 (fl), *Krukoff 6832* (*Uw 7968*) (BR, G, HH, K, LIL, NY, RB, U, US); Basin of Rio Solimões, 26 Oct–11 Dec 1936 (fl), *Krukoff 8829* (BM, BR, G, HH, K, LE, MICH, MO, NY, P, S, US); idem, Tonantins, 24 Jan 1924 (fl), *Kuhlmann 1256* (RB); idem, Rio Javari, Mirafior, 29 Jul 1978 (fl), *Lleras et al. P. 16925* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, S, U, UFMG, US); Manaus, BR 17 km 40, 11 Nov 1955 (fl), *F. Mello s.n. (Xil no 372)* (INPA 2888, U); Tefé, Oct 1981 (fl), *Poeppig 2663* (G, LE, W); Hwy. Manaus—Itacoatiara km 204, 21 Dec 1966 (fl), *Prance et al. 3775* (INPA, NY, U); Paumari, Rio Javari above Attalaia, 14 Oct 1976 (fl), *Prance et al. 23758* (INPA, NY, U); Manaus, Tarumã, 30 Aug 1962 (fl), *W. Rodrigues & Chagas 4613* (INPA, U); Rio Taruma Assu, Vic. Manaus, 15 Dec 1964 (fl), *Vogel 304* (MJG). MATO GROSSO: Basin of Rio Madeira, Upper Machado region, Tabajaza, Nov–Dec 1931 (fl), *Krukoff 1315* (*Uw 19285*) (BM, G, HH, K, MICH, MO, NY, P, S, U, UC). PARÁ: São Jorge, 1950 (fl), *G. A. Black & Ledoux 50-10652* (COL, IAN); Benevides, rd. to Mosqueiro, 10 Feb 1966 (fl), *Cavalcante & J. Elias 1449* (MG); Santarém, 30 Nov 1966 (fl), *Cavalcante & M. Silva 1472* (MG); Mun. of Oriximiná, along Rio Trombetas, 18 Jun 1980 (fr), *Cid & J. Ramos 1057* (INPA, NY, U); 75 km N of Oriximiná, hwy. Oriximiná—Cachoeira Trombetas, BR 163, 3 Jun 1980 (fl, juv fr), *Davidson & Martinelli CD 10021-B* (INPA, NY, U); Mun. of Oriximiná, 8–10 km SE down river from Cachoeira Porteira, Rio Trombetas, 29 Jun 1980 (fr), *Davidson & Martinelli CD 10597* (INPA, NY, U); Oriximiná, 8 Dec 1906 (fl), *Ducke 7865* (P, RB, US); between Cuminámirim and Ariramba, 1 Dec 1910 (fl), *Ducke 11258* (RB, US); Taperinha, Paraná do Ituqui, Planalto de Santarém, 3 Dec 1954 (fl, fr), *Froes 31203* (COL, IAN); S Manoel, Tapajós, s.d. (fr), *Kuhlmann 1021* (R); Belém, Sep–Oct 1961, *J. M. Pires 51810* (K, NY, SP, U, UB, US); Iha de Breu, Rios Pacaja and Muirapiranga, 2°33'–50'N, 50°20'–38'W, 6 Oct 1965 (fl), *Prance et al. 1558* (F, K, NY, US); Cuiabá—Santarém Hwy, RB 163, km 1129, 16 Nov 1977 (fl), *Prance et al. P 25471* (INPA, MG, MY, U); Transamazonian

Hwy. BR 230, 27 km NE of Itaituba, 27 Nov 1977 (fl), *Prance et al. P 25806* (INPA, MG, NY, U); Belém, Bosque Rodrigues Alves, 21 Feb 1944 (fl), *A. Silva 123* (IAN, US); Benevides—Mosquero, 10 Feb 1966 (fl), *M. Silva 479* (MG). RONDÔNIA: Vic. São Lorenço mines, 9°35'S, 65°6'W, 27 Nov 1968 (fr), *Prance et al. 8927* (C, F, G, HH, K, M, MG, MICH, MO, P, R, S, U, US, VEN). RORAIMA: Hwy. Manaus—Caracarái km 329, N of Waimari—Atoari Indian Reserve, 16 Nov 1977 (fl), *Steward et al. 10* (INPA, NY, U). Cult. in RIO DE JANEIRO—GUANABARA: Rio de Janeiro, Feb–Mar (fl), *Glaziou 9877* (K, P).

Local names. Perú: Majaras-caspi/caspu, Najaras-caspi (Loreto, Inca language), Uuwallo-muche (Loreto, Amerindian language); Brazil: Pao Branco (Rondônia).

Rinorea racemosa differs from *R. sprucei* and *R. vaupesana* by: (1) 11–21 pairs of lateral veins (versus 9–16); (2) its smaller flowers as expressed by its smaller petals shorter than 2.5 mm; and (3) its connective scales shorter than 1.5 mm. The ovary and capsule of *R. racemosa* and *R. sprucei* are glabrous, those of *R. vaupesana* distinctly hairy.

Alsodeia (= *Rinorea*) *racemosa* cited by Benham in an "Enumeration of Plants collected by Mr (Robert Hermann) Schomburgk" (1842: 107) as occurring in British Guiana, with a specimen (*R. H.*) *Schomburgk 947* (1840) collected along the Rio Negro is not this species, but *R. sprucei*. The collecting locality was not British Guiana, but Brazil (Amazonas).

Specimens of *Alsodeia* (= *Rinorea*) *racemosa* without collection numbers cited by Klotzsch in Moritz Richard Schomburgk, *Reisen in Britisch-Guiana 1849* ('1848'), as occurring along the Rupununi, the Takutu and the Rio Branco, have not been found by the present author in the Kew Herbarium (K) (cf. Sandwith, 1955) nor in the herbarium of the British Museum (BM).

Exotanthera racemosa Turczaninoff (1854) does not belong either to *Rinorea racemosa* or to *R. sprucei*, but to the genus *Anchietea* (Violaceae).

Alsodeia racemosa J. D. Hooker & Thomson in *Flora of British India* 1: 187, May 1872 ('1875') is a quite different species and a later homonym; the use of this homonym is illegitimate.

47. *Rinorea sprucei* (Eichler in Martius) Kuntze. Revis. gen. pl. 1: 42, 1891; Reiche & Taubert in Engler & Prantl, *Nat. Pflanzenfam.* ed. 1.



3(6): 329. 1895: Blake. *Contr. U.S. Natl. Herb.* **20(13):** 502. 1924: Melchior *in* Engler & Prantl. *Nat. Pflanzenfam.* ed. 2. **21:** 352. 1925: Smith & Fernández-P.. *Caldasia* **6(28):** 100. 1954. Figs. 57A, 58.

Alsodeia sprucei Eichler *in* Martius. *Fl. bras.* **13(1):** 385. 1871. Radlkofer. *Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München* **20:** 184. 1891. ('1890'). Type. Brazil. Amazonas: Between Manaus and Barcellos. Nov 1851 (fl), *Spruce 1834* (lectotypus novus, K [herb. Benthamianum, added in handwriting on label: gapó above Cabe(ur)quena (=Cabuquena). rocky shore of Rio Negro]); isotypes [in combination with *Spruce 1947*, paratype] BM, CGE, F, G, HH, K [herb. Hookerianum], LE, M, OXF, P).

Rinorea exappendiculata Melchior *in* Engler & Prantl. *Nat. Pflanzenfam.* ed. 2. **21:** 331. 1925, nomen nudum. Type not indicated; a herbarium specimen *Spruce 2633* (W), a paratype specimen of *A. sprucei* Eichler *in* Martius, is an inedited type specimen of *R. sprucei* (Eichler *in* Martius) Kuntze var. *exappendiculata* Melchior, which is an unpublished nomen nudum of this variety.

Treelet 2–10 m tall. Branchlets ferruginous puberulous to strigillose when young, glabrescent when older. *Leaves* apparently opposite; petioles (1–)4–18 mm long, golden to ferruginous strigillose on both sides, glabrescent; stipules deciduous, narrowly elliptic or deltoid, subacute, 2–4 × 0.2–1 mm, herbaceous, ferruginous strigillose, ciliolate; lamina narrowly (ob)ovate to elliptic, gradually acuminate, 5.5–27.5 × 1.5–9 cm, papery, glabrous above, appressed whitish, golden or ferruginous pilosulous beneath; costa pilosulous above near the base, strigillose beneath near the base; domatia wanting; lateral veins 9–15 pairs (acumen excluded); tertiary venation scalariform; base rounded to cuneate, margin entire to slightly subcrenate; acumen 1–6 cm long; apex acute, mucronulate. *Inflorescences* axillary, lateral and subterminal, solitary, narrowly thyrsoid,

(6–)8.5–19.5 × 1–1.5 cm; central axis ferruginous to golden strigillose to hispidulous; cymules 1–7 flowered; common peduncle 0.25–3.25 mm long, ferruginous strigillose to hispidulous; 'pedicels' 1–5 mm long, articulate near the middle, ferruginous to golden strigillose or hispidulous; bracts and bractlets ovate, herbaceous, golden to ferruginous strigillose to hispidulous, margin ciliolate, apex subacute; bracts 1–1.25 × 0.75–1 mm; bractlets 0.5–0.75 × ca. 0.5 mm. *Flower buds* tolpoid, obtuse. Flowers drooping, greenish when young, creamy-white when flowering. *Sepals* subequal, ovate, 1–1.75 × 0.75–1 mm, herbaceous, outside densely, inside sparsely golden strigillose along the median part just above the base, glabrous near the margin, ciliolate along the margin, apex obtuse. *Petals* narrowly ovate, 3–3.5 × 1–1.5 mm, herbaceous, golden strigillose outside along the costa, densely golden strigillose inside, sometimes ciliolate along the margin, apex rounded. *Stamens* 2.25–3 mm long, filaments nearly completely fused to a tube; apical part free 0.1–0.3 × 0.2–0.3 mm; filamental tube 0.25–5 mm high, sinuate, pilosulous to ciliate along the margin; dorsal glands completely fused with the filamental tube; anthers ellipsoid, 0.5–1 × 0.5–0.75 mm, glabrous, apex of thecae obtuse, occasionally appendaged by one or two setae, up to 1 mm long; connective outside deltoid, obtuse, 2–2.5 × 0.5–1 mm, minutely golden strigillose to glabrous; connective scales lateral as well as apical, narrowly ovate, 2–2.5 × 0.5–1 mm, scarious, ferruginous, glabrous, margin subentire, sometimes erose, apex obtuse. *Ovary* subglobose 0.75–1 × 0.6–0.8 mm, glabrous, occasionally provided with 1–2 pilose hairs; ovules two per placenta. *Style* filiform to subclavate, erect, 2.25–3.25 mm long, exceeding the stamens by 0–0.25 mm, completely glabrous; stigma pulvinate, deflexed towards the anterior petal. *Cap-*

FIG. 57. A. *Rinorea sprucei* (A_{1,2} from Farina *et al.* 692; A_{3,10} from *Spruce 1834* & *1947*, type; A₁₁ and A_{14,15} from *Ducke 7107*; A_{12,13} from *Ll. Williams 14444* (VEN 8737)). A_{1,2}, Leaves, tapering into the apex. A₃, Flower bud. A₄, Flower, with pedicel, bract, and bractlets. A₅, Sepals, subequal (e = exterior [=outside], i = interior [=inside], i/e = in between). A₆, Petal (dorsal), strigillose along median part. A₇, Androecium (dorsal), filamental tube pilosulous and ciliate. A₈, Androecium (ventral). A₉, Pistil. A₁₀, Idem, with the ovary opened, showing ovules 3 × 2. A_{11,12}, Capsule, dehiscing into three unequal valves, floral parts and style still present basally and apically respectively. A₁₃, One of the valves, showing placentation 3 × 1. A₁₄, Glabrous seeds. A₁₅, Reduced cleistogamous flower with minute capsule. B. *R. vaupesana* (B₁ from *Spruce 2519*; B₂ and B₁₂ from *Fernández 2117*; B_{3,11} from *Prance et al.* 16158). B₁, Leaves. B₂, Flower bud. B_{3,5}, Adult flowers. B₆, Sepals (e = exterior [=outside], i = interior [=inside], e/i = in between). B₈, Petals, more or less densely villose inside. B₉, Androecium (dorsal), with the filamental tube ciliate. B₁₀, Androecium (ventral). B₁₁, Pistil. B₁₂, Capsule, dehiscing into three sub- to unequal valves; seeds glabrous, 3 × 1.

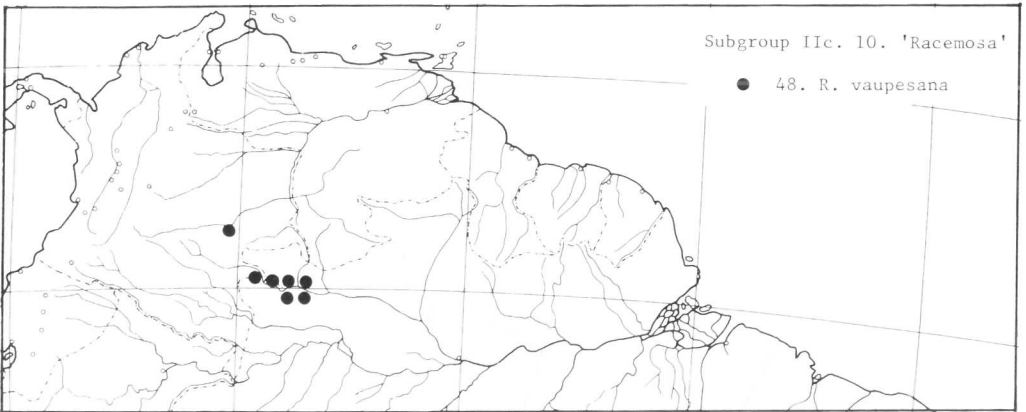
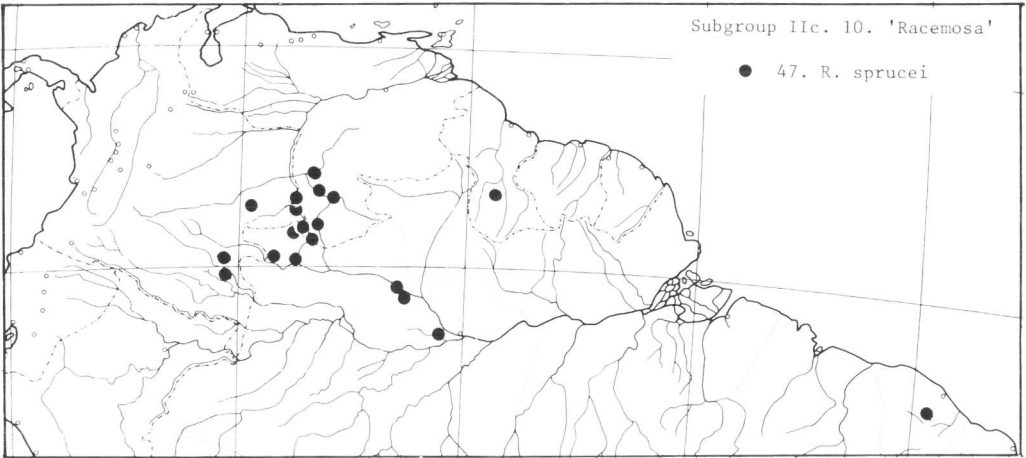
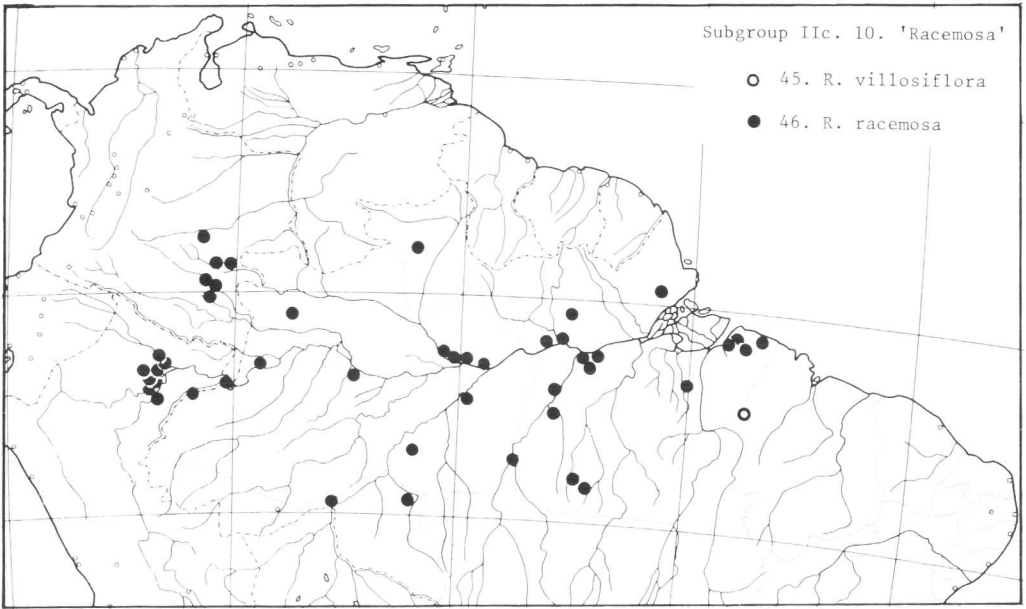


FIG. 58. Distribution of species of *Rinorea* Subgroup IIc.10. 'Racemosa.'

sule often asymmetric, ovate, acuminate, subtended by subsistent floral parts, coriaceous, pale green when fresh glabrous (or only hispidulous at the apex), veined; valves three, subequal to unequal, the larger one 0.6–0.7 × 0.3–0.4 cm, the two smaller ones 0.5–0.7 × 0.2–0.3 cm. *Seeds* two per valve, globose, ca. 3 mm in diam., glabrous, shining.

Distribution (Fig. 58) and ecology. *Rinorea sprucei* is found in NW Amazonia of Brazil, E Colombia and S Venezuela along the rivers Rio Negro, Casiquiare, Upper Orinoco and Vaupés from 125 to 250 m. Its area of distribution includes two forest refugia: Imeri and Ventuari.

It occurs in the understory of primary or secondary tropical rain forests and in scrubs ('bosques enanos'). Inhabits also uninundated areas along rivers, streams and creeks, in quartzzy or sandy soil.

Representative specimens examined: COLOMBIA. AMAZONAS: Rio Popeyacá, affluent of Rio Apaporis Jan–Feb 1952 (fl). *Schultes & Cabrera 15613* (HH, US). AMAZONAS–VAUPÉS: Rio Apaporis, Jirijirimo, vic. Léri-da, 250 m. 25–26 Nov 1951 (fl. fr), *García-Barriga 13711* (COL, US).

VENEZUELA. AMAZONAS: Maroa, Rio Guainia, 127 m. 14 Feb 1942 (bud), *Bernardi 143.46* (G); Rio Caripo, Rio Casiquiare, Jan–Feb 1969 (bud, fr), *Farinas et al. 692* (NY, VEN); Riverbanks of Rio Inirida, site 'Raudal Alto' or Mariapiri, 180–250 m. 3 Feb 1953 (fl), *Fernández 2068 p.p.* (COL, US); 0–1 km NE of San Carlos de Rio Negro, 1°55'N, 67°5'W, 120 m. 4–5 Dec 1977 (bud), *Liesner 4196* (MO, U); 5 km above mouth of Caño Cotua into the Rio Orinoco, SW of Cerra Yapacana, 3°45'N, 66°50'W, 30 Apr 1970 (fr), *Steyermark & Bunting 102982* (U, VEN); nr. Sta. Rosa de Amanadora, 1°25'N, 66°50'W, 120 m, 29 Jan 1968 (fl), *Wessels Boer 2358* (MER, U); Maroa, Rio Guainia, 127 m, 14 Feb 1942 (bud), *Ll. Williams 14346* (F, HH, U, US) & *14349* (VEN 8736); Caño Pimichin, Rio Guainia, 140 m, 20 Feb 1942 (bud, fr), *Ll. Williams 14444* (F, G, RB, U, US, VEN 8737); San Carlos de Rio Negro, 26 Feb 1949 (fl), *Ll. Williams 14487* (F, G, HH, LIL, MO, NY, US, VEN); Upper Orinoco, Delta of Ventuari, Isle of Trapichote, 125 m, 21 Apr 1942 (fl. fr), *Ll. Williams 14989* (F, G, S, US, VEN 8738); Upper Orinoco, Tamatama, 125 m, 6 May 1942 (fr), *Ll. Williams 15210* (F, G, US, VEN).

BRAZIL. AMAZONAS: Rio Negro, Barcellos, 9 Jun 1905 (fr), *Ducke 7107* (MG, R); Rio Negro, São Felipe, 4 Apr 1952 (fl. fr), *Froes 28190* (COL); idem, 22 Apr 1928 (fl), *Luetzelburg 22.236* (R); Rio Negro, 6 Apr 1947 (fl) (*Murça Pires 234* (NY); between Manaus and Barcellos, Rio Negro gap above Cubequena, Nov 1851 (fl), *Spruce 1947* (P); nr. Panuré at Rio Uaupés (=Vaupés), Oct 1852–Jan 1853 (fl), *Spruce 2633* (BM, CGE, K, P, S, W); Barcellos along Rio Negro ('Guiana anglica' erroneously cited), *Schomburgk* (*Robert Her-*

mann) 947 (CGE, F, G, HH, K, L, M, P, US, W). CEARÁ: S.l. s.d. (fl), *Gardner 947* (F, G).

Rinorea sprucei differs from *R. racemosa* and *R. vaupesana* by: (1) its leaves long tapering to the apex; (2) its petals 2–3 × as long as the sepals (versus 1–1.5 ×); (3) its stamens longer than 2 mm; (4) its longer connective scales, 3–4 × as long as the thecae (versus 2–3 × as long as the thecae in the other species); and (5) its smaller seeds, less than 3.5 mm. *Rinorea sprucei* differs also from *R. vaupesana* by: (1) its number of ovules (two per placenta, versus one per placenta); and (2) ovary and capsule glabrous (versus distinctly pilosulous).

In *Rinorea sprucei* there also occur cleistogamous flowers in the lateral cymules with reduced petals, etc., and fruits (e.g., *Ducke 7107*, Brazil (Amazonas)).

48. *Rinorea vaupesana* Smith & Fernández-P., *Caldasia* **6(28):** 98, t. 4, 1954. Type. Colombia. Guainia: Riverside of Rio Inirida, Raudal Guacamayo, 69°45'W, 180 m, 4 Feb 1953 (fl, fr), *A. Fernández 2128* (holotype, COL; isotypes, F, US). Figs. 57B, 58.

Alsodeia racemosa Martius var. '*foliis paullo firmiter* etc.' Eichler in Martius, *Fl. bras.* **13(1):** 384, 1871, nom. var. invalid. Type. Brazil. Amazonas: Nr. Panuré on Rio Uaupés (=Vaupés), Oct 1852–Jan 1853 (fl. juv fr), *Spruce 2519* (holotype, M; isotypes, BM, BR, C, CGE, F, G, HH, K, K [herb. Benthamianum], L, LE, M, MO).

Treelet 2–4 m tall. Branchlets appressed brownish to golden pilosulous. *Leaves* apparently opposite; petioles 2.5–6 mm long, brownish to golden puberulous or pilosulous, especially beneath, glabrescent when older; stipules deciduous, narrowly deltoid, subacute, 2.5–4 × 1–2 mm, herbaceous, brownish to golden strigillose, costate, margin scarious and ciliate; lamina (narrowly) elliptic to obovate, acuminate, (5–)6.5–18.5 × (1.5–)3–6.5 cm, papery to coriaceous, glabrous above, appressed golden to whitish pilosulous beneath; costa and lateral veins glabrous above, sometimes appressed pilosulous near the base; domatia wanting; lateral veins 11–16 pairs (acumen excluded); tertiary venation scalariform; base rounded to cuneate, slightly decurrent into the petiole; margin (sub)entire; acumen 0.4–2 cm long, apex (sub)acute to (sub)obtus. mucronulate. *Inflorescences* axillary, lateral and

subterminal, solitary, narrowly thyrsoïd. (3.5–)8–18.5 × 1–2 cm; central axis golden puberulous to strigillose; cymules 1–7 flowered; common peduncle 0.2–0.3 mm long, golden puberulous to strigillose; 'pedicels' 1–3.5 mm long, articulate below the middle, golden puberulous to strigillose; bracts and bractlets ovate to deltoid, herbaceous, golden strigillose, ciliolate apex subacute; bracts ca. 0.75 mm long and wide; bractlets 0.25–0.75 mm long and wide. Flower buds tolpoid to ovoid. Flowers drooping, whitish. Sepals (sub)equal, narrowly ovate, 2–2.5 ×, 1–1.25 mm, herbaceous, golden strigillose on both sides, margin scarious and ciliate, apex obtuse to emarginate, mucronulate. Petals narrowly ovate, (2.5–)3–4 × 1–1.25 mm, herbaceous, golden strigillose on both sides, especially near the middle inside, margin scarious, ciliate in juvenile flowers, apex obtuse. Stamens 1.75–2.25 mm long, filaments nearly completely fused to a tube; apical part free, 0.1–0.2 × 0.05–0.1 mm, glabrous; filamental tube 0.2–0.3 mm high, sinuate, ciliate; dorsal glands completely fused with the filamental tube; anthers ellipsoid to ovoid, 0.8–1 × 0.5–0.8 mm, glabrous, apex of thecae obtuse, sometimes appendaged by two cusps or setae, up to 1 mm long; connective outside ovate to deltoid, obtuse, 0.3–0.5 × ca. 0.25 mm, glabrous; connective scales lateral as well as apical, (narrowly) ovate, 1.5–2 × 0.5–1 mm, scarious, brownish, glabrous, margin erose, apex obtuse, suberose to subtentire. Ovary (sub)globose to trapezoid, ca. 1 × 0.5–0.75 mm, golden villosulous along the ribs; ovules one per placenta. Style filiform to subclavate, erect, deflexed or slightly sigmoid curved towards the anterior petal, 1.25–1.75(–2) mm long, exceeding the stamens by 0.25–0.5(–0.75) mm, completely glabrous; stigma apiculate to obtuse. Capsule often asymmetric, (sub)orbicular, sometimes subtended by subpersistent floral parts, coriaceous, densely minutely golden to whitish pilosulous; valves three, unequal to subequal, the larger one 0.9–1.2 × 0.2–0.5 cm; the two smaller ones ca. 0.6 × 0.2–0.5 cm. Seeds one per valve, (sub)globose, ca. 5 mm in diam., glabrous, shining.

Distribution (Fig. 58) and ecology. *Rinorea vaupesana* is endemic in a small area of NW Amazonia in Brazil Venezuela, and Colombia, including the forest refuge of Upper Imeri (=Vaupés). Occurs in tropical rain forests as well

as on white sand savanna forests from 90 to 250 m. Along rivers, inhabiting uninundated as well as scarcely inundated areas. Soil sandy.

Phenology. Flowering and fruiting specimens have been collected during the periods February–April and October–November.

Representative specimens examined: COLOMBIA, GUAINIA: Riverbanks of Río Inirida, nr. Raudal Alto or Maripiri, N of Guacomayo, 69°45'W, 180 m, 3 Feb 1957 (fl). *Fernández 2068* p.p. (US) & (fr). *Fernández 2117* (US). VAUPÉS: Sta. Teresita, Río Papurí, 25 Nov 1952 (fr). *Romero-Castañeda 2731* (COL).

VENEZUELA, AMAZONAS: Atures, left border of Río Cataniapo, ca. 60 km SE of Puerto Ayacucho 5°38'N, 67°11'W, 90–110 m, 4-8-1980 (fr). *Guanchez 90* (U, VEN).

BRAZIL, AMAZONAS: Upper Río Negro, Iucuby, above affluence Curicuriary, 28 Nov 1929 (fl), *Ducke 25069* (RB); Río Uaupés, Serra Uapici, 17 Nov 1947 (fl), *Murça Pires 1114* (US); Río Negro, São Gabriel, 20 Apr 1975 (fl), *Nascimento et al. 176* (NY); Basin of Río Negro, foot hills of Serra Curicuriari, 6 Nov 1971 (fl), *Prance et al. 16158* (C, COL, F, G, HH, INPA, K, M, MG, MICH, MO, NY, P, R, U, US, VEN); Serra Wabeesce, left bank below Bella Vista, Río Uaupés between Ipanoré and confluence with Río Negro, 17 Nov 1947 (fl), *Schultes & Murça Pires 9140 c* (US); vic. Panuré (Ipanoré), Río Uaupés, Oct 1852–Jan 1853 (fl, juv fr), *Spruce 2519* (BM, BR, C, CGE, HH, K [herb. Benthamianum], L, LE, M, MO, NY, OXF, P).

Rinorea vaupesana differs from *R. racemosa* and *R. sprucei* by: (1) ovaries and capsules distinctly pilosulous (versus glabrous); (2) its placentation strictly 3 × 1 (in *R. racemosa* 3 × (1–2); in *R. sprucei* strictly 3 × 2); and (3) its seeds larger than 4.5 mm. *Rinorea vaupesana* and *R. villosiflora* share the feature of ovaries and capsules distinctly hairy with each other. For more differentiating remarks see under *R. villosiflora*.

DOUBTFUL NAMES AND EXCLUDED TAXA

Rinorea albicaulis (Turczaninoff) Blake, *Contr. U.S. Natl. Herb.* **20**(13): 517. 1924 = *Alsodeia albicaulis* Turczaninoff, *Bull. Soc. Imp. Naturalistes Moscou* **36**(1): 558. 1863 ('*Alsodeja*'). Type. Bolivia. Santa Cruz: Chiquitos, Río Santo Tomas del Corazón, Oct 1854 (fl), *d'Orbigny 987* (holotype, KW; isotype, W) (= *Hybanthus atropurpureus* (A. de Saint Hilaire) Taubert in Engler & Prantl, *Nat. Pflanzenfam.* ed. 1, **3**(6): 333. 1895 = *Ionidium atropurpureum* A. de Saint Hilaire, *Pl. remarq. Brésil* **1**: 316. Jun 1824; *Mém. Mus. Hist. Nat.* **11**: 490. 1825

- (*1824*); Eichler in Martius Fl. bras. **13**(1): 372. 1871 [Violaceae].
- Rinorea andina* (Tulasne) Kuntze, Revis. gen. pl. **1**: 42. 1892; Blake, Contr. U.S. Natl. Herb. **20**(13): 497. 1924 = *Alsodeia andina* Tulasne, Ann. Sci. Nat. Bot. Sér. 3. **7**: 366. 1847; Walpers, Ann. bot. syst. **1**: 72. 6–7 Nov 1848 (*1848–1849*); Triana & Planchon, Ann. Sci. Nat. Bot. Sér. 4. **17**: 126. 1862 = *Gloeospermum andinum* (Tulasne) Melchior, Notizbl. Bot. Gart. Berlin-Dahlem **9**(81): 58. 1924; Notizbl. Bot. Gart. Berlin-Dahlem **9**(83): 166. 1924; in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 354. 1925; Smith & Fernández-P., *Caldasia* **6**(28): 114. 1954 (see also under *Gloeospermum*).
- Rinorea blakeana* Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. **22**(5): 349. 31 Oct 1940 (*1940–1942*); A. Robyns in Woodson, Schery & Coll., Ann. Missouri Bot. Gard. **54**(1): 71. 1967 = *Gloeospermum blakeanum* (Standley) Hekking, Phytologia **43**(5): 468. pl. 1, fig. 6. 1979 (see also under *Gloeospermum*).
- Rinorea cuspa* (Kunth in Humboldt, Bonpland & Kunth) Baillon, Hist. pl. **2**: 346. 1873; Traité bot. méd. phan. **2**: 836. Mar 1884 (*1883–1884*); Blake, Contr. U.S. Natl. Herb. **20**(13): 518. 1924; Knuth, Repert. Spec. Nov. Regni Veg. Beih. **43**: 489. 15 Nov 1927 (*1928*) = *Conohoria* (?) *cuspa* Kunth in Humboldt, Bonpland & Kunth, Nov. gen. sp. **7**: 188 (folio), 242 (quarto). 25 Apr 1825 (*Conoria*); Kunth, Syn. pl. **4**: 247. 16 Jan 1826 (*1825*) (*Conoria*); G. Don, Gen. hist. **1**: 341. early Aug 1831 (*1831–1838*) (*Gonohoria*); D. Dietrich, Syn. pl. **1**: 832. Jul 1839. Type. Venezuela. Sucre: Bermudez, in mountains between Bordones and Cumana, s.d., *Humboldt & Bonpland mn. nr 94* (holotype, P [herb. Humboldt & Bonpland]) = *Alsodeia cuspa* (Kunth in Humboldt, Bonpland & Kunth) Sprengel, Syst. veg. ed. **16**. **4**(2): 99. Jan–Jun 1827 (*Alsodea*) = *Aspidosperma cuspa* (Kunth in Humboldt, Bonpland & Kunth) Blake ex Pittier, Man. pl. usual. Venez.: 110. 1926; Blake, Bull. Torrey Bot. Club **53**(8): 604. 1926 (= *Aspidosperma sessiliflorum* Mueller Arg., *Linnaea* **20**: 399. 1859–1860. Type. Trinidad: Sieber 53 (n.v.)) (= *Aspidosperma lucentivenium* Blake, Contr. Gray Herb. **53**: 46. 1918 [Apocynaceae]. Type. Venezuela. Sucre: Between La Guaira and Río Grande, Curran & Haman 970 (n.v.)).
- Rinorea* (?) *dichotoma* Rusby, Descr. S. Amer. pl.: 61. 20 Dec. 1920; Blake, Contr. U.S. Natl. Herb. **20**(13): 497. pl. 31. 1924 = *Gloeospermum dichotomum* (Rusby) Melchior, Notizbl. Bot. Gart. Berlin-Dahlem **9**(83): 166. 1924; in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 354. 1925; Smith & Fernández-P., *Caldasia* **6**(28): 114. t. 8. 1954 (see also under *Gloeospermum*).
- Rinorea discolor* Briquet sp. nov. ined. Type. French Guiana: s.l., 1839 (bud), *Leprieur s.n.* (holotypus ineditus, G; isotype, F [=Photograph 24060]).
- Rinorea gossypium* (Tulasne) Kuntze, Revis. gen. pl. **1**: 42. 1891; Blake, Contr. U.S. Natl. Herb. **20**(13): 498. 1924 = *Alsodeia gossypium* Tulasne, Ann. Sci. Nat. Bot. Sér. 3. **7**: 367. 1847; Walpers, Ann. Bot. Syst. **1**: 72. 6–7 Nov 1848 (*1848–1849*); Triana & Planchon, Ann. Sci. Nat. Bot. Sér. 4. **17**: 126. 1862; Baillon, *Adansonia* **10**: 377. 25 Feb 1873 (*Mar 1871–Feb 1873*) = *Gloeospermum gossypium* (Tulasne) Melchior, Notizbl. Bot. Gart. Berlin-Dahlem **9**(81): 58. 1924; Notizbl. Bot. Gart. Berlin-Dahlem **9**(83): 167. 1924; in Engler & Prantl, Nat. Pflanzenfam. ed. 2. **21**: 354. 1925; Smith & Fernández-P., *Caldasia* **6**(28): 116. 1954 (see also under *Gloeospermum*).
- Rinorea* (?) *integrifolia* Gingins in A. P. de Candolle, Prodr. **1**: 313. 1824, nom. illeg. & spec. incertae sedis; G. Don, Gen. hist. **1**: 341. early Aug 1831 (*1831–1838*). Occurring in Brazil, type specimen unknown. = *Alsodeia integrifolia* (Gingins in A. P. de Candolle) Steudel, Nomencl. bot. ed. 2. **1**: 64. 2–8 Aug 1840, nom. illeg. & spec. incertae sedis = *Conohoria alternifolia* Sprengel, Neue Entdeck. **2**: 151. late 1820 (Beck, 28 Feb 1821, t.p. 1821) (*Conoria*) spec. incertae sedis; Garcke, Bot. Zeitung (Leipzig) **25**: 14. 1867; Blake, Contr. U.S. Natl. Herb. **20**(13): 518. 1924. Occurring in Brazil, type specimen unknown.
- Rinorea papyracea* Rusby nov. sp. ined. Type. Bolivia(?), Amazon Basin, Iumcipara, 8 Dec 1921 (fr. gall), *Cardona* 1966 (holotypus ineditus, NY) (= *Rinoreocarpus ulei* (Melchior) Ducke [Violaceae]).

- Alsodeia antifolia* Spencer le M. Moore. Trans. Linn. Soc. London. Ser. 2. **4(3)**: 308. 1895. nomen nudum (type specimen unknown, probably occurring in S America).
- Alsodeia longiflora* Oudemans. Arch. Néerl. Sci. Exact. Nat. **2**: 195. t. 2, pl. 5, figs. 1-2. 1867; in Miquel, Ann. Mus. Bot. Lugduno-Batavum **3**: 68. 1867; Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924. Type. French Guiana, s.d. (fl), *Anonymous s.n.* (holotype, L 908.267-1025 [=601980]; isotype, P); = *Amphirrhox longiflora* (Oudemans) Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924; Lemée, Fl. Guayne franç. **3**: 61. 1953.
- Alsodeia megapotamica* Sprengel, Syst. veg. ed. 16. **4(2)**: 99. Jan-Jun 1827 ('*Alsodea*'); Garcke, Bot. Zeitung (Leipzig) **25**: 13. 1867; Eichler in Martius, Fl. bras. **13(1)**: 388. 1871; Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924. Type. Brazil. Rio Grande do Sul: *Sello s.n.* (n.v.) = *Conohoria megapotamica* (Sprengel) G. Don. Gen. hist. **1**: 341. early Aug 1831 ('1831-1838') ('*Gonohoria*'); D. Dietrich, Syn. pl. **1**: 832. Jul 1839 (= *Dalbergia variabilis* Vogel, Linnaea **11**: 196. 1837; Garcke, Bot. Zeitung (Leipzig) **25**: 13. 1867; Eichler in Martius, Fl. bras. **13(1)**: 388. 1871; Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924. Type. Brazil. Rio de Janeiro: Between Campos and Victoria, and other localities in southern Brazil, s.d., *Sellow s.n.* (n.v.). [Papilionaceae].
- Alsodeia pallida* Klotzsch ex Schomburgk. Vers. Fauna Fl. Br. Guian. in Reis. Br.-Guiana **3**: 1165. 1848. nomen nudum; Blake, Contr. U.S. Natl. Herb. **20(13)**: 517. 1924. (Type not indicated.)
- Alsodeia parvifolia* S. Watson. Proc. Amer. Acad. Arts. ed. **1**. **25** (=ed. **2**. **17**): 142. 1890. Type. Mexico. San Luis Potosí: Hills of Canoas. E of San Luis Potosí. 5 Jul 1890 (fl. fr), *Pringle 3063* (lectotypus novus. NY; isotypes. BR, GOET, MO, P, U) = *Hybanthus mexicanus* Gingins in A. P. de Candolle, Prodr. **1**: 312. 1824; G. Don. Gen. hist. **1**: 340. early Aug 1831 ('1831-1838'); Standley, Contr. U.S. Natl. Herb. **23(3)**: 837. 1923; Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924; Schulze, Bot. Jahrb. Syst. **67**: 449. 1936; Morton, Phytologia **21(1)**: 59. 1971.
- Alsodeia perrini* Sprengel, Syst. veg. ed. 16. **1**: 807. late 1824 ('1825') ('*Alsodea*'); Garcke, Bot. Zeitung (Leipzig) **25**: 14. 1867; Eichler in Martius, Fl. bras. **13(1)**: 388. 1871; Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924. Type. S America (?), Brazil (?). *Perrin s.n.* = *Conohoria perrini* (Sprengel) D. Dietrich, Syn. pl. **1**: 832. Jul 1839 (=probably *Echites* sp. or *Thyrsanthus schomburgkii* Bentham [Apocynaceae species incertae sedis]).
- Alsodeia piparea* Sprengel, Syst. veg. ed. 16. **1**: 807. late 1824 ('1825') ('*Alsodea*') nom. illeg.; Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924 = *Piparea dentata* Aublet, Pl. Guiane franç. 2. app. 31. pl. 386. 1775. Type. French Guiana; Montagne Serpent. *Aublet s.n.* (n.v.) = *Conohoria aubletii* D. Dietrich, Syn. pl. **1**: 831. Jul 1839, nom. illeg. = *Casearia dentata* (Aublet) Eichler, Bixaceae in Martius, Fl. bras. **13(1)**: 484. 1871 [=Flacourtiaceae]; (not *Ceranthera dentata* Palisot de Beauvois, Fl. Oware **2(11)**: 11. pl. 65. 18 Apr 1808 = *Conohoria dentata* (Palisot de Beauvois) D. Dietrich, Syn. pl. **1**: 831. Jul 1839).
- Alsodeia regnellii* (Miquel) Walpers, Ann. Bot. Syst. **2**: 67. 1851; Blake, Contr. U.S. Natl. Herb. **20(13)**: 518. 1924 = *Conohoria regnellii* Miquel, Linnaea **22**: 555. 1849. Type. Brazil. Minas Gerais: A. F. Regnell Ser II. 9 (holotype, (n.v.); isotype, U) (= *Ionidium atropurpureum* A. de Saint Hilaire, Pl. remarq. Brésil **1**: 316. Jun 1824; Mém. Mus. Hist. Nat. **11**: 490. 1825 ('1824'); Fl. Bras. merid. **2(13)**: 106. 1829 (folio); Fl. Bras. merid. **2(14)**: 147. 8 May 1830 ('1828') (quarto); Eichler in Martius, Fl. bras. **13(1)**: 372. 1871 (= *Hybanthus atropurpureum* (A. de Sainte Hilaire) Taubert in Engler & Prantl, Nat. Pflanzenfam. ed. 1. **3(6)**: 333. 1895).
- Capsicum torulosum* Vellozo, Fl. flumin.: 60. t. 4. 1825, species incertae sedis, type not indicated (illustration resembles more a *Rinorea* species than a *Capsicum* [Solanaceae] species); Eichler in Martius, Fl. bras. **13(1)**: 388. 1871.
- Exotanthera racemosa* Turczaninoff, Bull. Soc. Imp. Naturalistes Moscou **27(2)**: 342. 1854; Bentham, Addenda et Corrigenda, Ordo XV. Violarieae in Bentham & Hooker, Gen. pl. **1(3)**: 970. Sep. 1867; Eichler in Martius, Fl. bras. **13(1)**: 385. 1871 (sub *Alsodeia sprucei* Eichler.