

# A REVISION OF THE GENUS *WRIGHTIA* (APOCYNACEAE)

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## INTRODUCTION

The present study is intended to clarify the systematics of the apocynaceous genus *Wrightia*. Since its establishment by R. Brown (Mem. Wern. Soc. **1**: 73. 1811), extensive collections and many new species recorded in various regional floras have increased our knowledge of the genus; however no comprehensive study, except a brief synopsis by Pichon (Not. Syst. **14**: 77. 1951), has been made subsequent to the publication of De Candolle's Prodr. (A. De Candolle in DC., Prodr. **8**: 404. 1844).

The lack of understanding of the variability of species within the genus on the basis of a general treatment has created much confusion in specific delimitation. Furthermore, *Wrightia* has never been well circumscribed from its closely related neighbor *Pleioceras*. In spite of Pichon's partial revision, which was based upon the limited number of specimens deposited at the herbarium of the Muséum National d'Histoire Naturelle at Paris, little has been known concerning the specific delimitation and the major subdivision within the genus.

The preparation of an up-to-date account of *Wrightia* has also become desirable for a better understanding, since much new material has been collected recently in Africa, China, New Guinea and Australia; this has helped to distinguish more clearly certain species within the genus. Herbarium material constitutes the principal basis for this study and nearly all herbarium specimens and types of *Wrightia* available from 30 major herbaria throughout the world have been examined, thanks to the respective curators for their generous loans of material.

## HISTORY

*Wrightia* was first proposed as a genus by Brown in honor of Dr. William Wright, a Scotch physician and botanist who had spent 18 years on the island of Jamaica. The genus at that time included 4 species, of which 2 (*W. antidysenterica* and *W. zeylanica*) had previously been included within *Nerium* by Linnaeus. In the same paper Brown also created a monotypic genus, *Balfouria*, which was found later to be congeneric with *Wrightia*.

Between 1809 and 1844, in spite of the establishment of *Wrightia* with its clearly diagnostic characters based on the structure of the seed and embryo, several species still were described from flowering specimens under the genera *Nerium*, *Strophanthus*, *Cameraria*, *Chonemorpha*, *Anasser* and *Hunteria*. At the time many new species were proposed by various authors, but most of them proved to be re-descriptions of species previously named.

The first extensive and critical review of *Wrightia* was made by A. de Candolle (in DC Prodr. **8**: 404. 1844). He recognized only 14 species at that time and

placed them in 2 sections: *Bammatophyton* which, according to the present International Code, must now be referred to as § *Wrightia* since it includes the type specimen of the genus, *W. pubescens*, and § *Wallida*. The section *Bammatophyton* was characterized by the corolla tube as long as, or twice or rarely 3 times, the length of the calyx whereas § *Wallida* included species with a corolla tube about 6 times longer than the calyx. Actually, A. de Candolle seemed to suspect *Wallida* as a distinct genus by this statement: "Verisimiliter genus distinctum?" and this suggestion was effected by Pichon later on. For this section *Bammatophyton*, A. de Candolle recorded 12 species, among which 5 (*W. calycina*, *W. ovata*, *W. javanica*, *W. wallichii* and *W. laciniata*) were described as new. These species as well as 2 others previously described (*W. rothii* and *W. mollissima*) are not recognized as distinct in this study. His section *wallida* included 2 of Brown's species (*W. antidysenterica* and *W. zeylanica*) which are conspecific.

Bentham and Hooker (Gen. Plant. **2**: 712. 1876) published a synopsis of the genus, recognizing 12 species from tropical Africa, tropical Asia and Australia. They gave a short description of 2 new species, *W. religiosa* and *W. cunninghamii*, the latter with the corolla lobes dextrorsely contorted (never found in species of *Wrightia*), apparently an asclepiad.

In his treatment of the *Apocynaceae*, K. Schumann (in Engler and Prantl, Nat. Pflanzenfam. **4**(2):183. 1895) divided the then known species into 3 sections. He accepted A. de Candolle's two sections and created a third, *Gymnowrightia* which was characterized by the absence of a corona.

Until 1951, no general account of the genus had been made on a world-wide basis. Only treatments of *Wrightia* for restricted floras and various scattered contributions had been recorded, such as Hooker's (Fl. Brit. Ind. **3**: 653. 1882.) contribution on species of India, Pitard's (Lecomte and Humbert, Fl. Gen. Indo-Chine **3**: 1182. 1933) treatment of the Indochinese species, Kerr's (in Craib, Fl. Siam. Enum. **2**: 456. 1939) study on species of Thailand, Chiovenda (Fl. Somola **2**: 290. 1932) and Stapf's (Kew Bull. **1907**: 51. 1907) works on the Somali and East African species respectively. These workers have greatly contributed to our knowledge of *Wrightia* and their studies are marked by a steady progress in circumscribing the genus.

In 1939, Y. Tsiang (Sunyatsenia **4**: 42. 1939) reviewed the Chinese species of *Wrightia* in the course of his study of Apocynales. Tsiang is a competent authority on the family and his work provides the first comprehensive study of *Wrightia* in China and adjacent lands. For the classification of the species he adopted K. Schumann's sections and offered a synoptic subdivision of *Bammatophyton* (= § *Wrightia*), the largest. He selected the corona scales as the most important character for distinguishing the different series. However, the diagnostic characters proposed in his classification for the separation of the series are not workable on a world-wide basis.

In 1951, with material available at the Muséum National d'Histoire Naturelle at Paris, Pichon (Not. Syst. **14**: 77. 1951) attempted to give a general account of the genus. He raised § *Wallida* to a genus with only 1 species and further split

*Wrightia* into 2 genera, *Wrightia* and *Scleranthera*, the latter including 2 species which I have found to be conspecific. His concept of raising the sections to the rank of genus appears to be undesirable since it creates, in place of a single well defined genus, a number of much less sharply defined smaller genera, 2 of them each with only 1 species. In his treatment, on the one hand, he reduced *W. laevis* to a variety of *W. tinctoria* and put *W. lanceolata* in synonymy under *W. tomentosa*; while on the other hand, he placed under the same specific name several apparently valid species such as *W. pubescens*, *W. flavido-rosea*, *W. puberula*, *W. sikkimensis* (= *W. schlechteri* and *W. stellata*) and *W. annamensis*. The last species, with the more or less included anthers and the monochasial inflorescences, is definitely distinct from *W. pubescens*. Apparently he was handicapped by the limited number of specimens available for his study, and thus produced some confusion by his work.

#### GENERIC RELATIONSHIPS

In spite of the many investigations which have been concerned with the *Apocynaceae*, the systematic position of *Wrightia* is still very puzzling. Alphonse de Candolle, in the *Prodromus*, recognized 7 tribes of *Apocynaceae*, and *Wrightia*, with its bicarpellary ovary and basally comose seed, was included within the *Wrightieae* between the *Parsonsieae* and the *Alstonieae* (characterized by apically comose and uniformly comose seed, respectively). Bentham and Hooker, in their *Genera Plantarum*, referred *Wrightia* to the subtribe *Parsonsiinae* of their tribe *Echitideae*. This subtribe was defined as having the corolla subrotate or salverform and the anthers more or less exerted. However, the genus is rather closely related as well to their subtribe *Neriinae*, characterized by the presence of a corolline corona and included anthers provided with a long acumen. K. Schumann, in his treatment of *Apocynaceae* for the *Pflanzenfamilien*, raised the tribe *Echitideae* to the rank of subfamily, *Echitoideae*, and followed Bentham and Hooker in referring *Wrightia* to the *Parsonsieae* with the anthers exerted beyond the corolla tube, in contrast with the *Echitideae* characterized by the anthers inserted within the corolla tube. However, *Wrightia* as well as other genera of his *Parsonsieae*, such as *Prestonia* and *Malouetia*, embrace many species with included stamens.

In his treatise on the *Echitoideae*, Pichon (Mém. Mus. Natio. Hist. Nat., nouv. sér., sér. B, Bot. 1: 1-174. 1950) proposed a new classification of the subfamily based upon the structure of the "retinaculum," an elaboration of the anther connective on the ventral side immediately below the sporangia. He therefore placed *Wrightia* in his *Nerieae*, which he defined as having a brush-like "retinaculum." On the basis of the seed structure with basal coma and convolute cotyledons, he put *Wrightia* close to *Kibatalia* and *Funtumia*, which Woodson (Philipp. Jour. Sci. 60: 205. 1936) relates to *Forsteronia*, *Tintinnabularia*, *Beaumontia* and *Malouetia* on the basis of the presence of foliar foveae, differing in this respect from *Wrightia* which is destitute of these structures. Pichon even recognized the unnatural relationship of his *Wrightiinae* and *Kibataliinae* by this statement: "L'aigrette est basilaire et les cotylédons [of *Wrightiinae*] ne sont pas plans, tout comme chez les *Kibataliinae*. Mais là se borne le rapprochement, et il paraît y avoir convergence plutôt que parenté réelle."

His system of classification of *Echitoideae* is not followed in this study since the so-called "retinaculum" has not proved of sufficient constancy and cannot be observed successfully in dried specimens.

I believe that *Wrightia* is most plausibly referred to the subtribe *Neriineae* in the traditional and narrower sense on the basis of the presence of a corona and the lack of nectaries. This subtribe includes, on the one hand, the genera *Nerium* and *Strophanthus*, which differ from *Wrightia* in the dextrorsely contorted corolla lobes, the apically comose seeds and the flat cotyledons and, on the other hand, *Pleioceras* and *Wrightia*. The most closely related genus to *Wrightia* appears to be *Pleioceras*, which shares with *Wrightia* these common characters: the sinistrorsely contorted corolla lobes, the presence of a well-developed corona, the basally comose seeds and the convolute cotyledons. Subsequently, in the past, *Pleioceras* has been often confused with *Wrightia* from which most taxonomists, following Stapf (in Thiselton-Dyer, Fl. Trop. Afr. 4(1): 165. 1904), distinguished the former only on the basis of the pubescent body of the seed. Unfortunately, Stapf construed the frequent pubescence of the entire seed coat of *Pleioceras* as a decisive generic criterion, while I have found it to be fallible. On the other hand, Pichon stated that the body of the seed in *Pleioceras* is glabrous and the apparent pubescence is due to the reflexed coma appressed against the body of the seed. A careful examination of specimens available to my study indicates that the body of the seed in *Pleioceras* may be either glabrous, as in *P. gilletii*, or definitely pubescent, as in *P. zenkeri*. Actually, *Wrightia* and *Pleioceras* are quite distinct in other respects and sharply distinguished from each other. Their differentiating features may be summarized in the following tabulation:

<i>Wrightia</i>	<i>Pleioceras</i>
Inflorescence a dichasial or monochasial cyme.	Inflorescence a thyrses (save when depauperate).
Orifice of the corolla tube glabrous (except in <i>W. tinctoria</i> ssp. <i>rothii</i> ).	Orifice of the corolla tube pubescent.
Alternating supplementary corona segments (when present) simple and never exceeding the antepetalous segments.	Alternating supplementary corona segments compound at the tips and at least twice as long as the antepetalous segments.
Staminal filaments not decurrent below the insertion within the corolla tube.	Staminal filaments decurrent below the insertion within the corolla tube.
Anthers sagittate-lanceolate.	Anthers sagittate-deltoid.
Body of the seed glabrous.	Body of the seed glabrous or pubescent.

### MORPHOLOGY

**HABIT**—Species of *Wrightia*, except *W. sikkimensis* of Assam which Fischer (Kew Bull. 1940: 38. 1940) has described as a climber, are shrubs or small trees up to 20 m. in height. However the tallest species of the genus, *W. pubescens* and *W. laevis*, sometimes reach a height of 40 m. In the aboreal species the bole is rounded, columnar, without buttresses, and may attain, according to Whitford (The forests of the Philippines. Manila. 1911), a diameter of 6 dm. There are few available records about the texture, thickness and color of the bark. Twigs are slender and divaricate; however, in *W. demartiniana* they are outstanding within

the genus in being relatively short and crooked, a condition apparently due to the environment. This species is confined to the wooded steppe of Somalia, Ethiopia and Kenya.

Species of *Wrightia* may be deciduous, as in *W. tomentosa*, *W. tinctoria* and *W. demartiniana*, or evergreen, as in the remaining species. In deciduous species flowers appear together with young leaves. All the plants are lactescent and the latex is milky, however it may be yellow in *W. tomentosa*, which is used as a dye in India.

LEAVES:—The leaves of *Wrightia* are simple and decussate; the leaf margins are entire throughout the genus. Leaves are variable in size and shape, but they provide fairly reliable characteristics for the distinction of many species. In size they range from 2 cm. long and 0.5 cm. wide in *W. demartiniana* to 24 cm. long and 9 cm. wide in some specimens of *W. tinctoria*. Leaf shape varies from linear-ovate, narrowly ovate to elliptic, broadly elliptic or obovate. *Wrightia angustifolia*, *W. natalensis*, *W. demartiniana* and *W. saligna* possess relatively narrow leaves, those of the latter linear-falcate with inconspicuous nerves. The apex of the leaf may be acute to acuminate or caudate-acuminate; the base is acute or occasionally obtuse.

Leaf venation is pinnate, the secondary veins oblique, more or less arcuate and united near the margins of the blade. The number of the secondary veins sometimes aids in the assignment of specimens to species within § *Wrightia*. In this respect leaves of *W. laevis* are outstanding with usually 6-9 pairs of secondary veins. The texture is mostly membranaceous, but in *W. antidysenterica*, *W. tinctoria*, *W. hanleyi* and *W. lanceolata* it may also be chartaceous or coriaceous apparently due to environmental conditions.

The leaves of *Wrightia* are petiolate or sessile; the petiole varies in length, ranging from 1 to 10 mm. In the leaf axil usually can be found few to many pectinate glands which may be regarded as intrapetiolar stipules.

Pubescence is variable. *Wrightia hanleyi*, *W. saligna* and *W. antidysenterica* have glabrous leaves even when immature. The leaves in *W. laevis*, *W. tinctoria*, *W. pubescens* and *W. coccinea* are either glabrous or puberulent, whereas those of the remaining species are more or less puberulent, at least along the veins. The degree of pubescence varies greatly even within the species. Leaves may be puberulent only along the veins, especially upon the midrib, on both surfaces or densely puberulent throughout or becoming eventually glabrescent above. In *W. angustifolia* trichomes are confined to the midrib, near the base of the blade, beneath. Finally, *W. sikkimensis* is outstanding for its generally minute puberulence above and its glabry beneath, except along the veins.

The gross anatomy of the leaf in *Wrightia* offers little variation within the genus. For these studies, portions of leaves from herbarium material were cleared in 5% NaOH, embedded in paraffin according to the tertiary butyl alcohol schedule, sectioned and stained in safranin-fast green combination. As for studies of the leaf epidermis, pieces of entire leaves were cleared and stained with ferric chloride-tannic acid according to Nevling's method (Jour. Arn. Arb. **17**: 295. 1961).

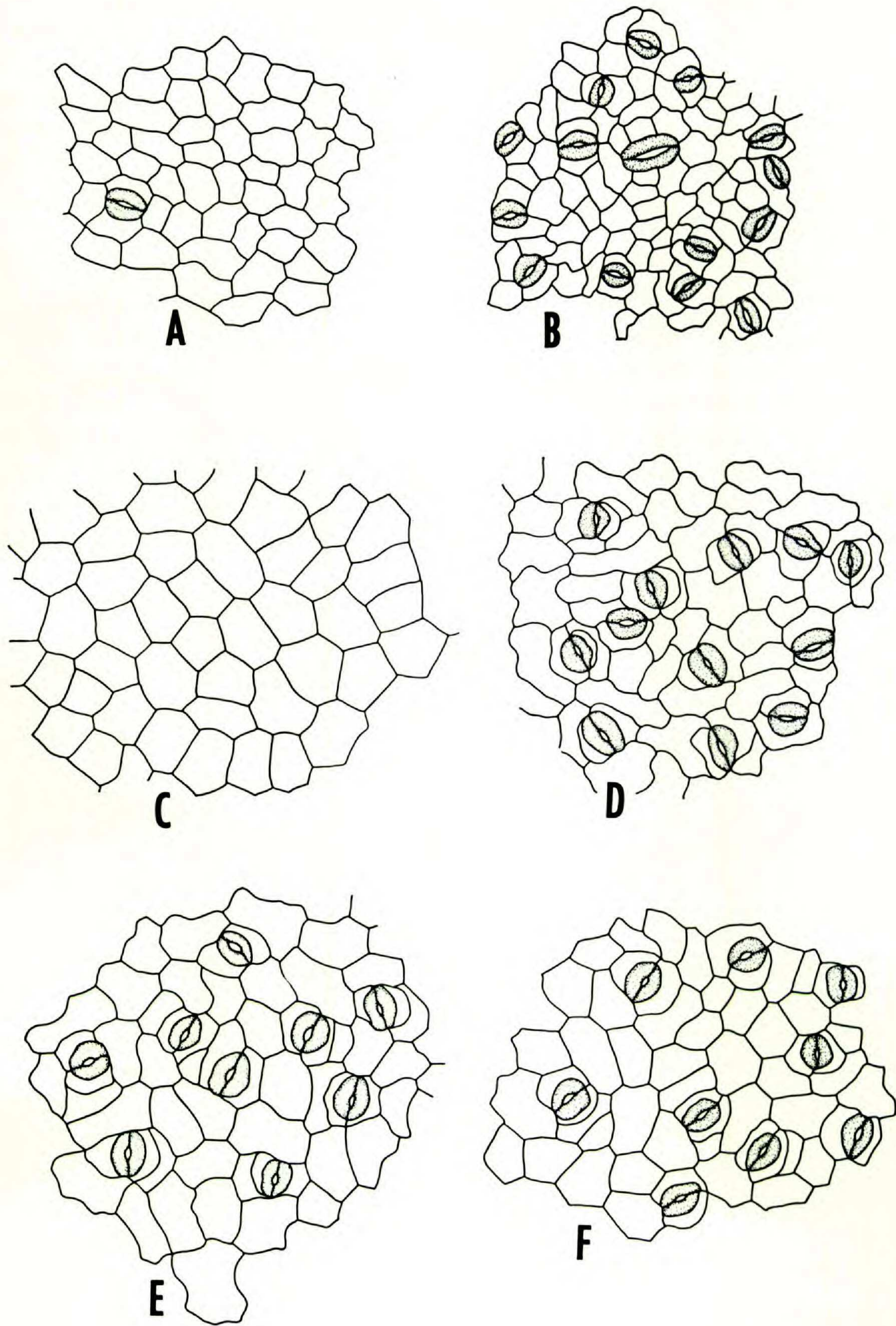


Figure 1. Epidermal structure of leaves of *Wrightia*, adaxial face on the left abaxial face on the right. A-B, *W. laevis* showing scattered stomata on adaxial face and 2 types of stomata on abaxial face; C-D, *W. annamensis*; E-F, *W. saligna* showing stomata on both faces and in approximately equal numbers.

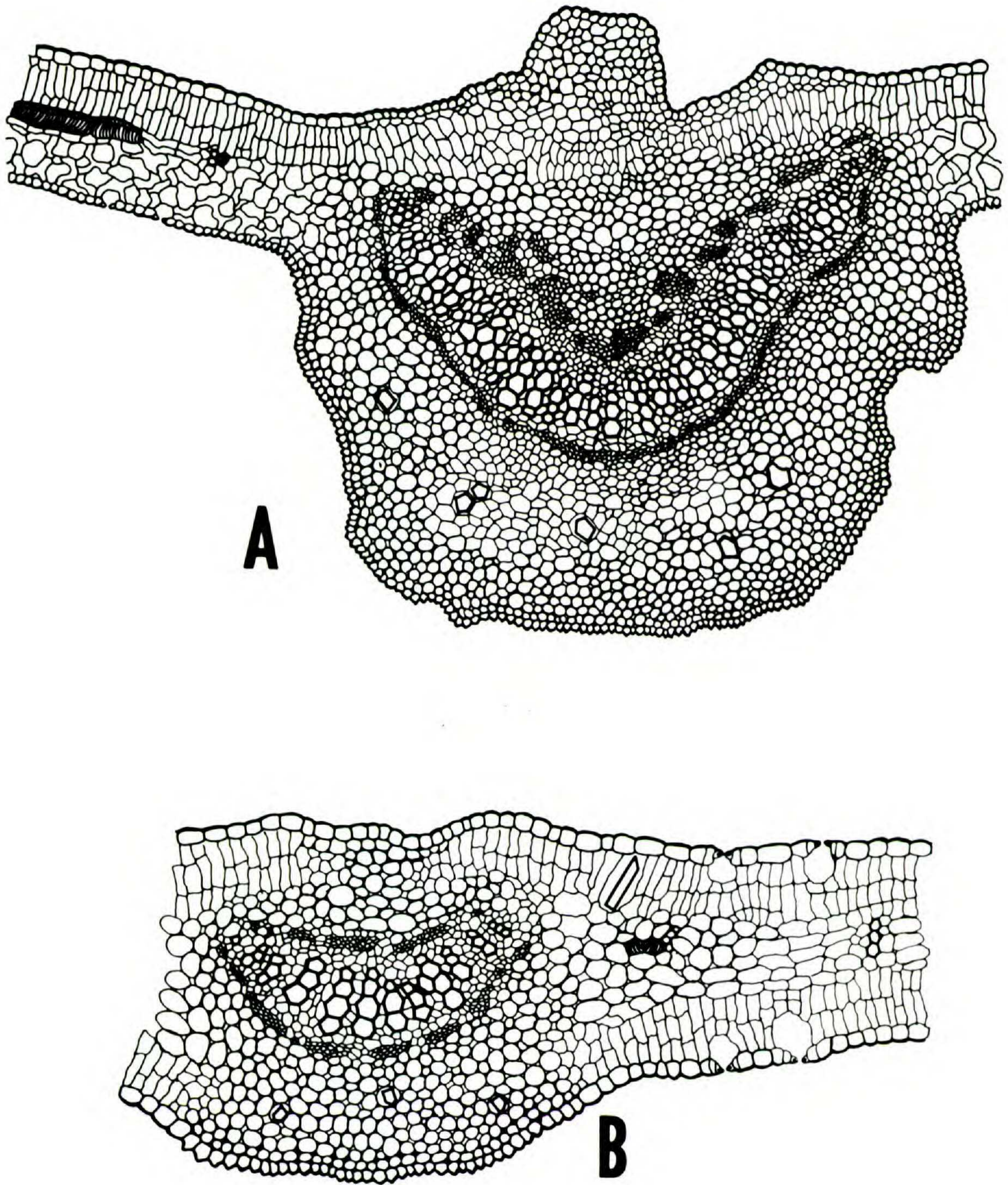


Figure 2. Transsections of leaves of *Wrightia*, showing internal phloem and prismatic crystals of calcium exalate. A, *W. annamensis* with a bifacial structure. B, *W. saligna* with an isobilateral structure.

The lamina is typically dorsiventral: the palisade parenchyma is 1-3 layers thick with the cells as long as broad to 3 times as long, and the spongy parenchyma consists of irregular shaped cells. In the mesophyll are found numerous clustered prismatic crystals of calcium oxalate. The petiole in cross section, near the distal end, is provided with a crescentic, median vascular strand and 2 small accessory bundles in the wings, as in *Nerium and Strophanthus* (Metcalf & Chalk, Anatomy of the dicotyledons **2**: 907. 1950), 2 genera closely related to *Wrightia*. Stomata are of the paracytic type and restricted to the abaxial surface of the leaf; however in some cases they are also found on the adaxial surface but scattered, and this feature appears to have no taxonomic value in *Wrightia*. In many species there are 2 types of stomata on the abaxial surface of the lamina: the paracytic type commonly found in many apocynaceous leaves and a special type with 2 relatively larger guard cells surrounded by 4-8 subsidiary cells (Fig. 1). This feature aids in the distinction of these species from their related neighbors. Finally, leaves of *W. saligna*, a species endemic to Australia, are notable within the genus in having an isobilateral structure with palisade tissue on both surfaces and spongy parenchyma between; furthermore, stomata are present on both surfaces and in approximately equal numbers (Fig. 2). It is appropriate to mention that *W. saligna* has linear-falcate leaves similar to those of *Eucalyptus* and *Acacia* occurring in this area.

INFLORESCENCE:—The fundamental type of inflorescence in *Wrightia* is a terminal "aggregate dichasium" which consists of a series of dichasia inserted at regular, decussate intervals along the primary axis of the inflorescence. Woodson (Ann. Missouri Bot. Gar. **22**: 1-48. 1935), in a study of the inflorescences of *Apocynaceae*, has pointed out that this type of inflorescence has been derived by the "aggregation of a number of terminal dichasia through the elimination of the foliar nodes subtending them." This reduction is best exemplified by many specimens of *W. laevis* and *W. pubescens* in which 1 or both the 2 subsidiary lateral branches accompanying the terminal inflorescence produce, directly, inflorescence without foliage. Different stages of this progression are illustrated in Fig. 3. Evidence of this trend of evolution can also be found in many inflorescences of *W. pubescens*, *W. coccinea* and *W. puberula* in which bracts retain their foliar character and in certain specimens of *W. pubescens* (*Bur. Sci. 18579, McGregor A, BM, MS*) in which the inflorescences still have foliar nodes.

From the aggregate dichasium, the evolution of the inflorescence in *Wrightia* shows a development towards the cincinnus by reduction of a lateral branch of the dichasium alternately to right and left of the central flower (Fig. 4). The first stages of this development are observable in *W. religiosa* with the branches of the aggregate dichasium having undergone scorpioid modification. The inflorescence consists of the main axis bearing 2 pairs of decussate branches, each of which has become monochasial by the repeated reduction of the right and left branches, alternately, to a solitary flower. Further modifications are found in *W. annamensis* with the suppression of the lateral solitary flowers, and the inflorescence consists of an aggregate of cincinni, or can be reduced to a pair of cincinni borne on a dichasial main axis as in many specimens of *W. dubia* and *W. antidysenterica*.



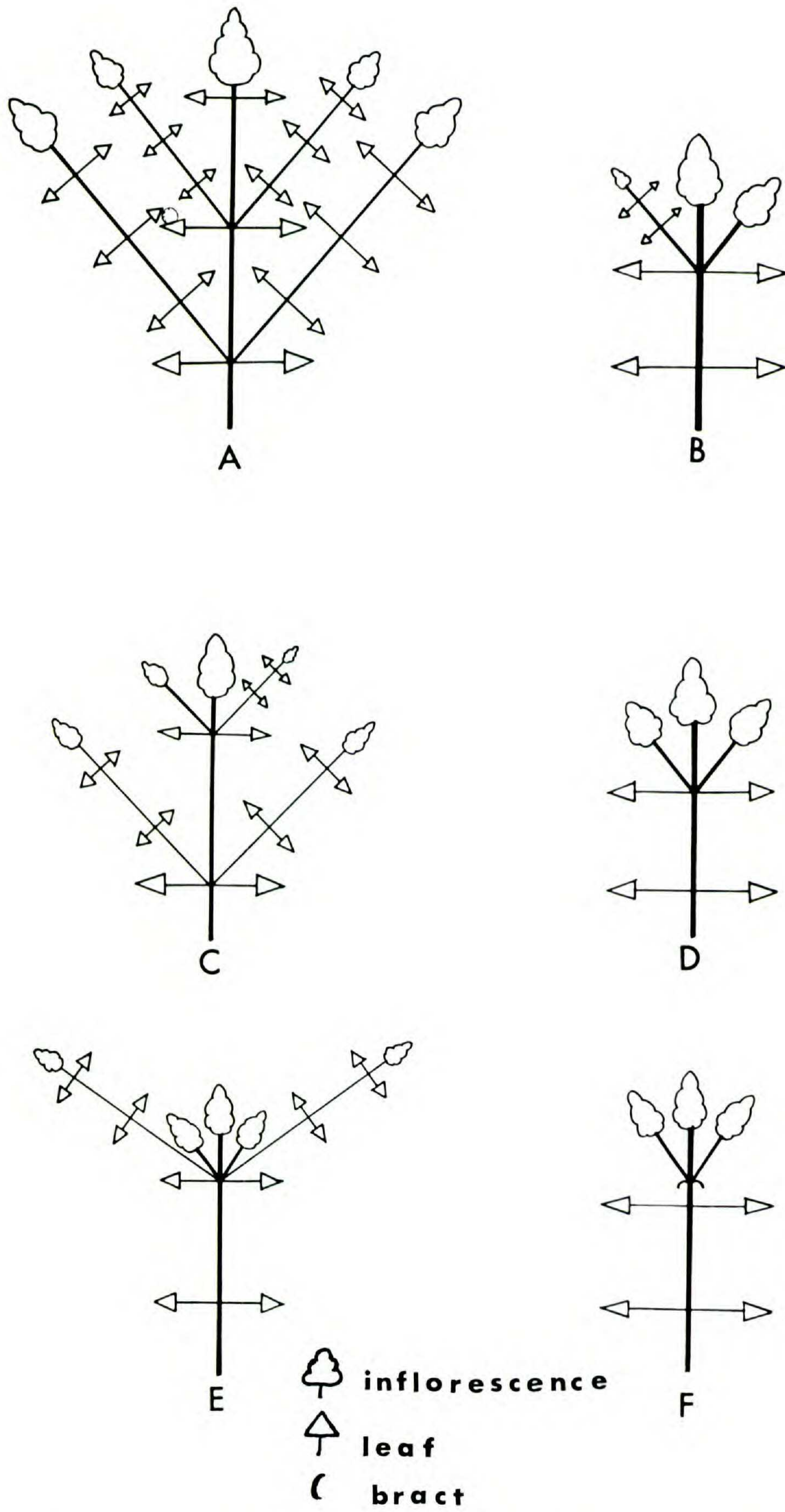


Figure 3. Inflorescence patterns in *Wrightia*. Further explanation in the text.

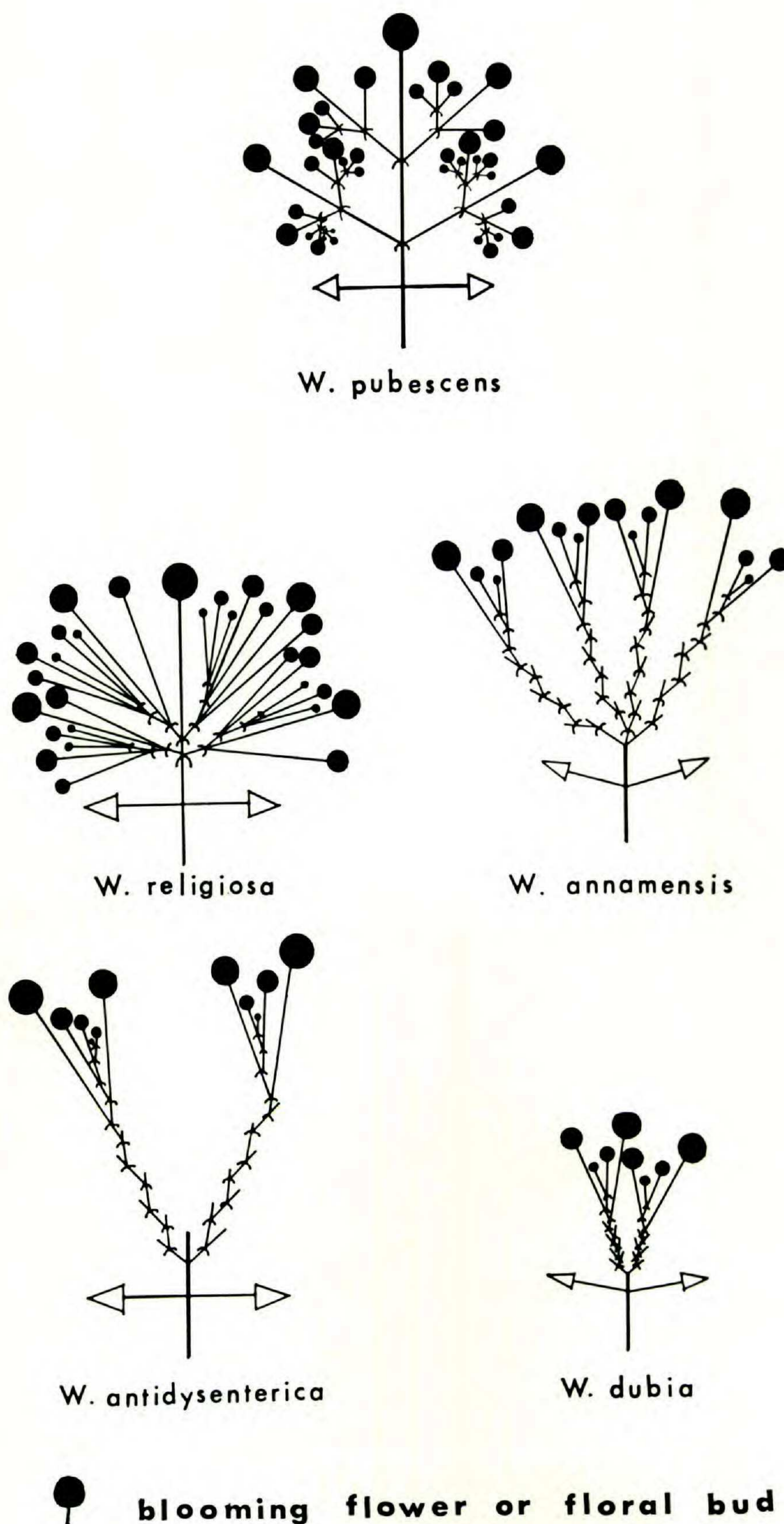


Figure 4. Diagrams illustrating a possible evolutionary trend of inflorescence structure in *Wrightia*. Explanation in the text.

The aggregate dichasia occur throughout the section *Balfouria* and predominate in § *Wrightia* while the cincinni are found in species of § *Wallida* and § *Scleranthera*.

**FLOWER:** The flower in *Wrightia* is actinomorphic, bisexual and pedicellate; size is variable, ranging from 0.7 cm. long in *W. hanleyi* and *W. viridiflora* to about 5.0 cm. long in *W. antidysenterica*. Flowers of most species are fragrant except those of *W. tomentosa* and *W. viridiflora* which have an unpleasant scent, to judge from the local floras and collectors' notes.

**Calyx:** The calyx is synsepalous and consists of 5 lobes which are divided nearly to the base and arranged in a quincunx with 2 exterior lobes, 2 interior lobes and an imbricate lobe. The shape and size of the calyx lobes sometimes offer reliable characteristics for the distinction of species or subspecies. For instance, within § *Scleranthera*, the exceptionally long-acuminate lobes of *W. collettii* and some specimens of *W. dubia* are outstanding. On the other hand, *W. coccinea* is readily distinguished from the related species by its calyx lobes relatively large and auriculate.

The calyx bears at the base of the lobes, on the inner face, 5 to many glandular squamellae which can be regarded as the homologues of foliar stipules. Sometimes each lobe is provided with 2 lateral squamellae as in *W. saligna*, but in most cases these are coherent with those of adjacent calyx lobe and thus appear as only 5 alternating ligules confined to the margins of the 2 interior lobes and to the inner margin of the imbricate lobe. The size and shape of the squamellae vary considerably within the genus, but in some instances can be used for the distinction of species. Squamellae are relatively small (about  $\frac{1}{4}$  the length of the calyx lobe) in *W. coccinea*, *W. hanleyi*, *W. natalensis*, *W. viridiflora* and some specimens of *W. dubia*, whereas in the remaining species they are one-half as long as the calyx or equal to it. Finally, 2 rather closely related species (*W. tinctoria* and *W. laevis*) are easily distinguished by the shape of the squamellae: linear-ovate, acuminate in the former and broadly ovate, acute to serrulate in the latter.

**Corolla:** The corolla is sympetalous and its shape is a valuable taxonomic criterion of the sections: infundibuliform to subinfundibuliform in § *Scleranthera*, salverform in § *Wallida*, subrotate in § *Wrightia* and subrotate to subsalverform in § *Balfouria*. Coloration may be quite variable within the species and cannot be used in classification derived chiefly from herbarium studies because of changes induced by desiccation as well, perhaps, as inadequacy of sampling. Flowers of *W. tomentosa* have been reported as being variously "yellowish-red," "deep blue-purple," "pale rosy" or "pure white" according to the illustrations and descriptions of various authors. Hooker (Fl. Brit. Ind. 3: 654. 1882) has remarked on this variability and stated that "there is some obscurity about the colour of the flower of this species, possibly indicating different species or a change during life" or, I might add, the expression of unknown genes affecting pigmentation.

The corolla lobes are sinistrorsely contorted in aestivation and are usually ovate-elliptic to narrowly obovate or oblong-obovate, rarely obliquely ovate or orbicular. The apex is obtuse to acute except in some specimens of *W. dubia* which has narrowly ovate, long-acuminate lobes.

One important feature of the corolla in *Wrightia* is the presence of a corona (except in *W. religiosa*). This is the most variable structure of the flower. The corona is made up of 5 to numerous appendages within the corolla lobes. These appendages are grouped into 3 series: the *antepetalous segments* often strongly adnate to the blade of the corolla lobes except in § *Balfouria*, the *alternipetalous segments* relatively narrower, usually shorter than the antepetalous, and, between these 2 series are found in many species 10 to numerous *alternating supplementary segments* filiform and shorter than the other 2 (except in *W. flavido-rosea*). Some species possess only 1 series of corona segments, either antepetalous or alternipetalous, most of the remaining species have both segments, free from each other or more or less coherent. Finally, other species have all 3 kinds of corona segments. The shape and size of the corona segments vary considerably within the genus, but are constant or show only minor variations within the species. These characters can also be used for the separation of groups within the sections. Coloration of the corona is sometimes different from, or darker than, that of the corolla and may provide a valuable character.

An interesting aspect of the corona is the vascularization of its segments. The antepetalous and alternating supplementary segments are supplied by vascular bundles from their subtending corolla lobes alone, whilst the alternipetalous segments are vascularized by bundles from both adjacent corolla lobes jointly. Therefore, the 3 series of corona segments are distinct from the stamens and appear to pertain rather to the corolla. The alternipetalous and alternating supplementary segments represent elaborations of the antepetalous, the outermost lateral parts of which are more or less coherent to form the alternipetalous segments. The latter may not develop, as in *W. coccinea* and *W. lanceolata*, or may be minute, as in *W. dubia*, *W. hanleyi* and *W. pubescens* ssp. *novobritannica*. Finally, in *W. lecomtei* and *W. angustifolia*, the antepetalous segments become obsolete and the corolla retains the alternipetalous segments. In any case, by their position with respect to the corolla lobes, the 3 series of corona segments can be regarded as the homologues of the calycine squamellae and foliar stipules.

*Stamens*: As in the other genera of the *Echitoideae*, the stamens of *Wrightia* are epipetalous and have the anthers coherent into a cone about the stigma and closely adherent to this organ by means of glandular secretions. Species of § *Sclerantha* have the stamens inserted within the corolla tube from the base to near the orifice, whereas those of the 3 other sections have the stamens inserted at the orifice. Each anther consists of 4 fertile sporangia borne on the upper third of the ventral face of an enlarged sagittate connective; at maturity of the pollen each pair of dorsal and ventral loculae is ruptured, giving the appearance of a bisporangiate anther. The connective is provided at the base with 2 obtuse or narrowly attenuate basal lobes and at the apex with a membranaceous appendage or acumen. The pubescence of the acumen and dorsal face of the connective is also useful for the distinction of the species.

Very few observations concerning the pollen of *Wrightia* have been made. Pichon (Mém. Mus. Natio. Hist. Nat., nouv. sér. sér. B, Bot. **1**: 1-174. 1950), in

his treatment of the *Echitoideae*, merely mentioned that *Wrightia* has 4-porate pollen grains, but did not give the characteristics of the structure. In the present study pollen grains from herbarium material were boiled in water, stored in FAA, then treated with lactic acid and mounted in Hoyer's medium according to Dressler's method (Contr. Gray Herb. **182**: 1-188. 1957). Pollen samples were also prepared by acetolysis (Erdtman, Pollen morphology and plant taxonomy. Stockholm 1952) for comparison.

Pollen grains of all species of *Wrightia* do not offer great variation. They are 3- to 4-porate, the pores confined to the equator. According to Erdtman's terminology they belong to the category of tri- and tetratreme zonoporate spores. In shape they are oblate. Exine stratification is sometimes obscure; however many pollen samples show distinct structure, with small more or less perpendicular perforations (punctitegillate).

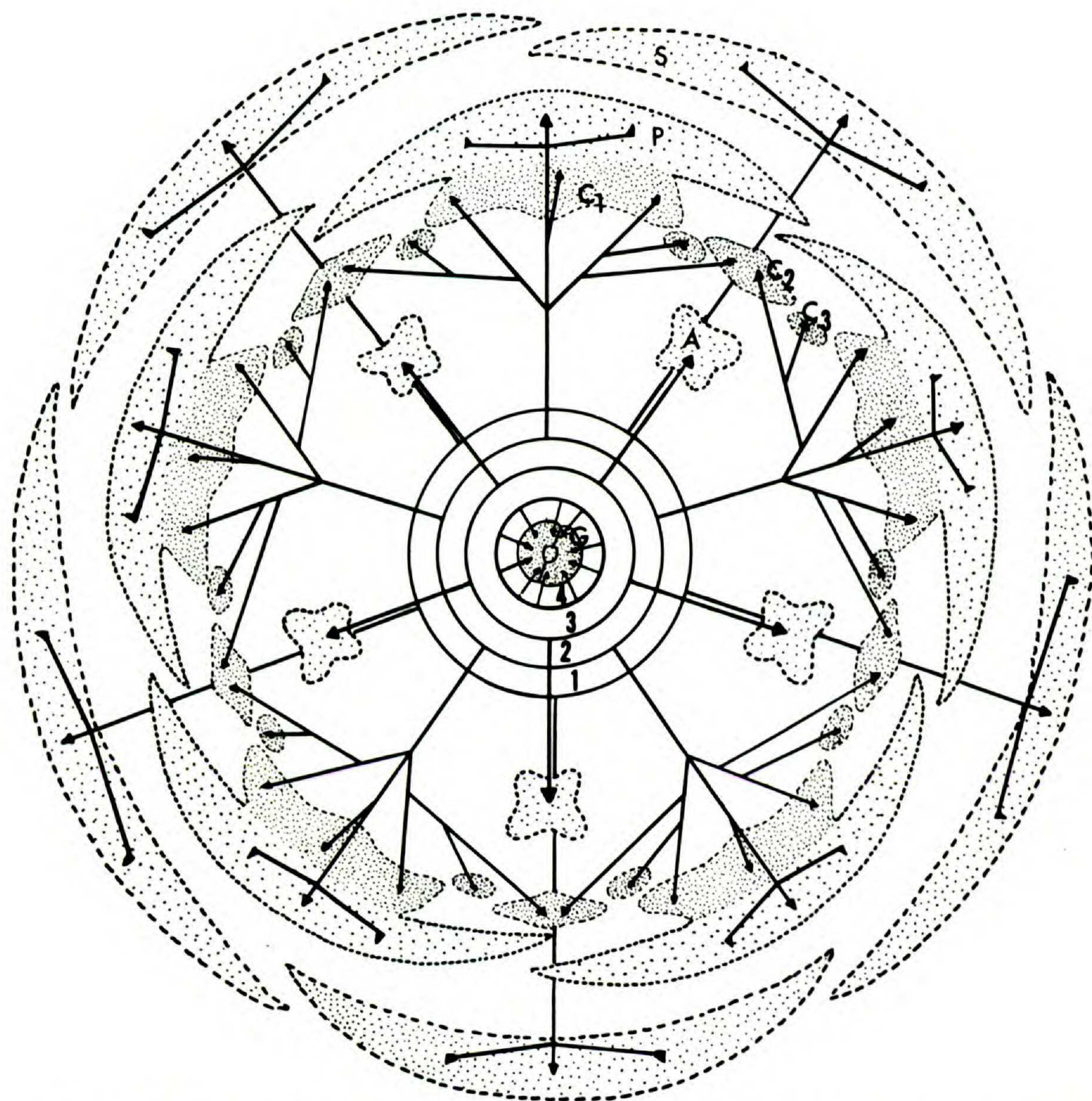


Figure 5. Diagram showing vascular pattern in flower of *Wrightia*. S, calyx lobes, P, corolla lobes, C<sub>1</sub> antepetalous corona segments, C<sub>2</sub> alternipetalous segments, C<sub>3</sub> alternating supplementary segments, A, stamens, G, carpels, 1-4 consecutive residual steles.

*Pistil*: The pistil is always bicarpellary and superior, the 2 carpels being coherent or free from the base to the common style. Unlike the majority of genera of the *Echitoideae*, *Wrightia* has the pistil destitute of glandular organs or nectaries surrounding the ovary. The latter is usually glabrous, except in *W. angustifolia* and *W. flavido-rosea* which have the carpels densely pubescent at the top. The common style is columnar, gradually or abruptly dilated near the stigma. The stigma is subcapitate to subcylindrical with a well-developed basal collar to which are appressed the 5 anthers, a constricted median region, and an enlarged distal portion ending in a more or less bi-apiculate apex.

*Anatomy of the flower*: For this study flowers of *W. pubescens* ssp. *laniti*, *W. religiosa*, *W. dubia* and *W. antidysenterica* were sent to me fixed in FAA from Vietnam and Ceylon. They were passed through the usual series of butyl alcohol to paraffin and serial transverse sections were stained with fast green-safranin. Flowers were also cleared whole in lactic acid for comparison.

The vascular anatomy of the flower in species of *Wrightia* thus observed offers a homogeneous pattern which can be summarized in Fig. 5. The pedicel has a bicollateral stele with a number of protoxylem strands embedded in a cylinder of protophloem parenchyma. The stele, at first circular in outline, gradually becomes pentagonal, and each of the 5 angles will supply a calyx lobe. Shortly after leaving the stele, these traces give rise to many laterals upon either side and the calyx lobes are entirely supplied by their own vascular bundles. It is interesting to note that this organization falls into the type III described by Woodson and Moore (Bull. Torr. Bot. Club **65**: 135. 1938) who also found it in species of *Nerium* and *Strophanthus*, 2 genera closely related to *Wrightia*. After the departure of the calycine traces, 10 other traces leave the stele and give rise to the bundles of the corolla lobes and the 5 epipetalous stamens, and in the center of the receptacle a residual stele remains which is destined to supply the walls of the carpels and the ovules. From the residual stele which is roughly circular, at first, then becomes elliptic, 4 equidistant bundles migrate toward the center to become the placental bundles of the 2 carpels.

At the level of the insertion of the stamens, the corolline bundles branch and the laterals furnish traces which enter the corona segments. The antepetalous segments as well as the alternating supplementary segments are vascularized solely by the traces of the subtending corolla lobe, whilst the alternipetalous segments each receive 2 vascular strands from the outermost lateral bundle of each adjacent corolla lobe. Furthermore, within § *Sclerantha*, characterized by the stamens inserted below the orifice of the corolla tube, the corolline bundles give off branches at the level of insertion of the stamens, some supplying the corona segments, whereas in § *Wrightia*, § *Balfouria* and § *Wallida* they divide only at the orifice of the corolla tube. Finally, *W. hanleyi* is outstanding for the appendages within the corolla tube being vascularized by branches descending from the orifice of the tube.

**FRUIT**. The fruit of *Wrightia* is a pair of pendulous follicles which may be terete-fusiform and free, or laterally compressed along the suture and coherent.

When coherent, they are more or less deeply grooved at the commissure. In some instances at maturity, the free follicles remain coherent at the tip. Their size varies from 10 to 50 cm. long; their color ranges from green-olive to dark green, becoming brown or black in desiccation. The pericarp is glabrous (sometimes minutely puberulent in *W. angustifolia* and *W. flavido-rosea*), more or less striate and often provided with numerous prominent orbicular to ovate-linear lenticels.

SEEDS. The seed is linear-fusiform, attenuate at the tips and provided with a basal, therefore, chalazal, coma as determined by the position of the embryo (Fig. 6). The seed coat is coriaceous and easily separable from the scanty and

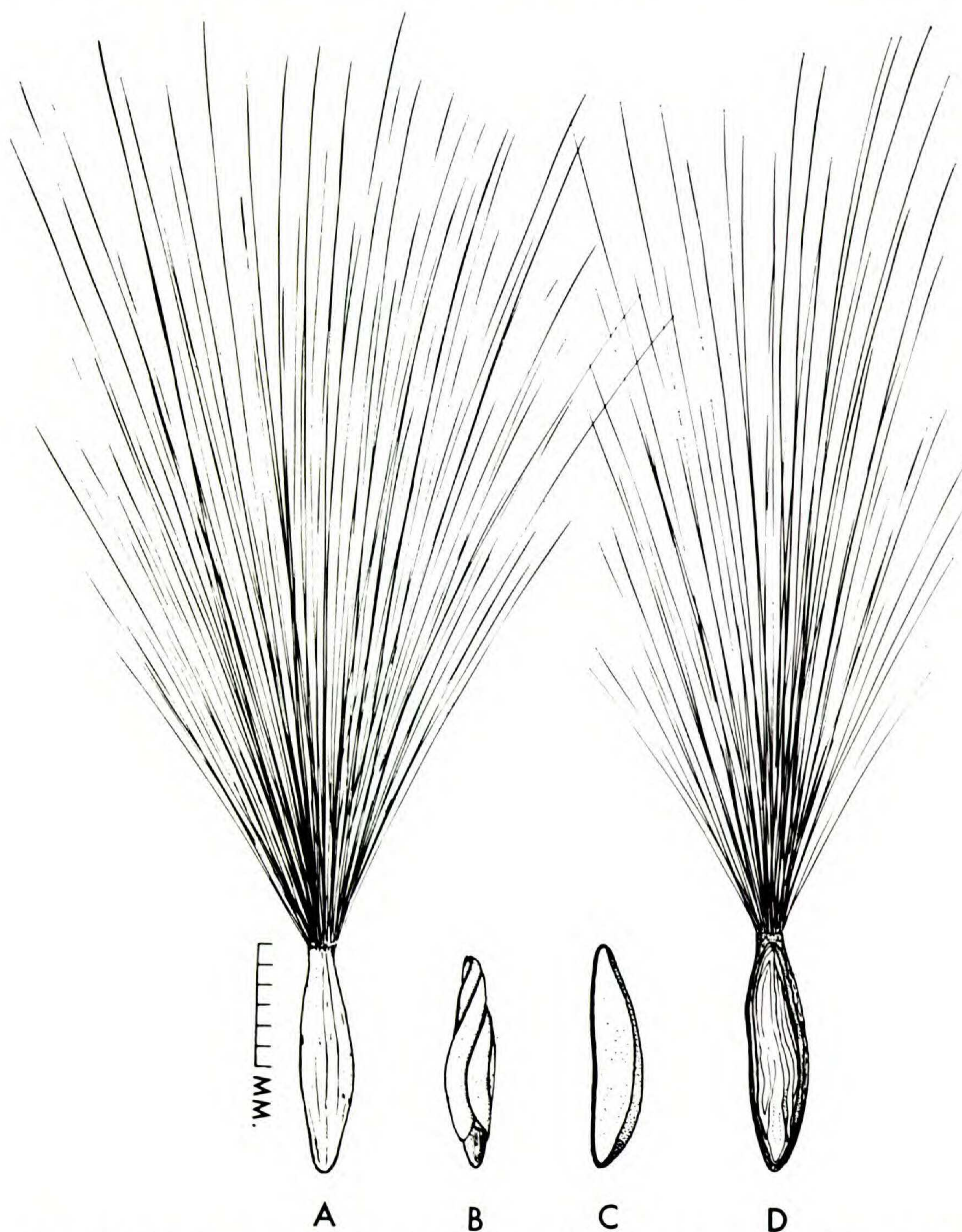


Figure 6. Structure of the seed and embryo of *Wrightia*. A, seed; B, embryo; C, longitudinal section of the endosperm; D, longitudinal section of the seed.

membranaceous endosperm. The embryo is erect and almost as long as the seed, with the cotyledons very broad and convolute. Embryo color ranges from whitish to yellow and reddish.

#### SPECIFIC CONCEPT

There is considerable confusion with regard to the delimitation of some species in *Wrightia* owing to variability in the taxonomic characters; they are formed by a cluster of variants possessing individual morphological differences which intergrade through numerous intermediates. In the past, many authors have assigned specific rank to such populations. Other authors (Pichon, Not. Syst. **14**: 77. 1951) on the contrary, treat the problem in a very inclusive sense and combine into a single taxon many species which seem to me distinct.

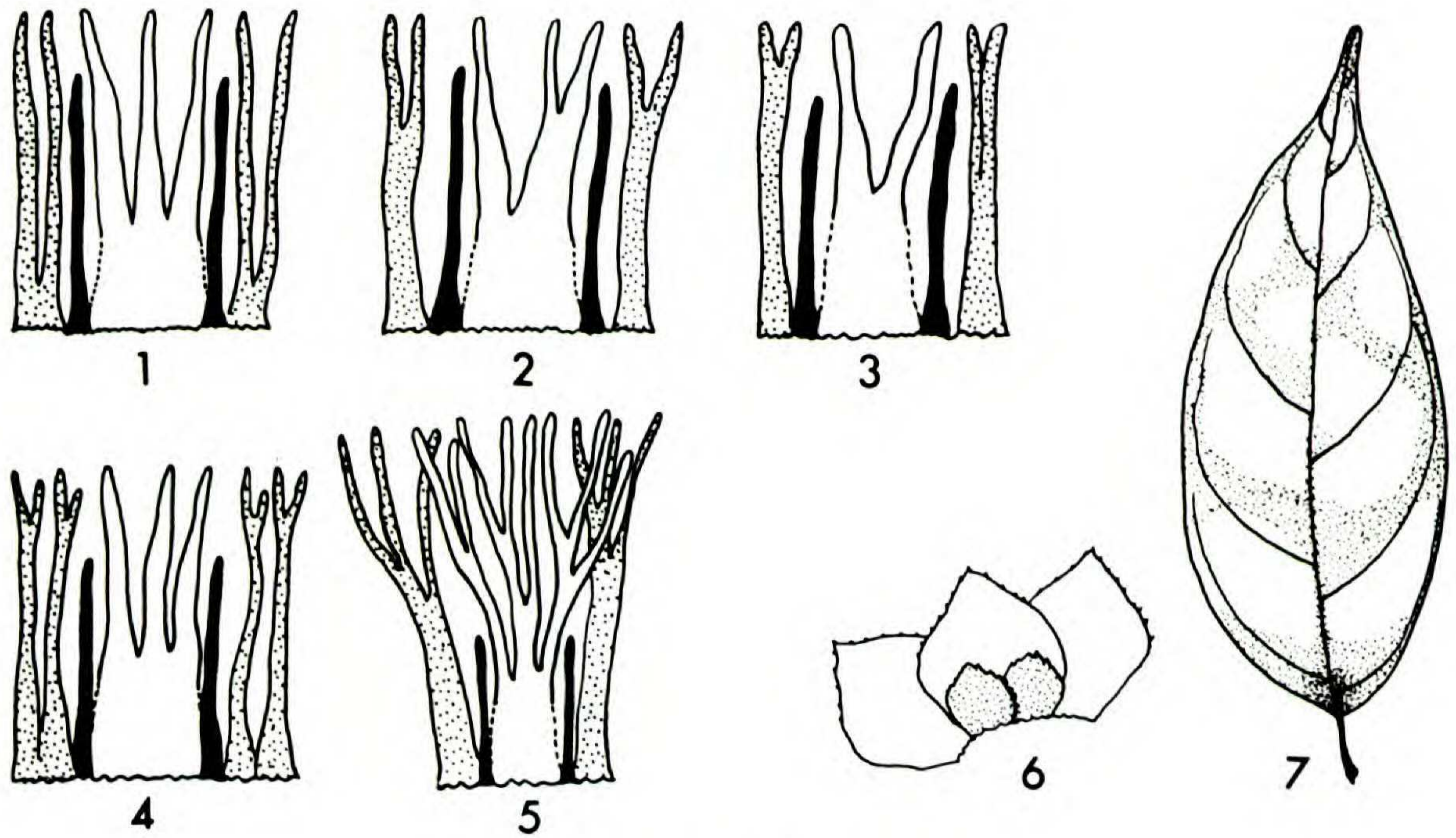
In the present treatment of the genus, special effort was made in an attempt to reach objective criteria which may reveal what a species in *Wrightia* really is. For this purpose I have found the "species—standard" method of Rollins (*Rhodora* **54**: 1-19. 1952) very stimulating and helpful. Within the genus, *W. laevis* and *W. tinctoria* can be used as "biological standards" of comparison because of the relatively ample specimens of them available to this study; they possess reliable characters to be recognized in spite of variability in the size of leaves and in the structure of the corona.

Size of leaves in *W. laevis* and *W. tinctoria* ranges from about 6 to 18 cm. long and from 2 to 8 cm. broad. Flowers of both species have 3 series of corona segments, more or less fimbriate and subject to great variability. The antepetalous and alternipetalous segments may be deeply laciniate to multifimbriate, the fimbriae simple or variously branched as shown in Fig. 7. However, the 2 species can be distinguished from each other by the relative length of corona segments which appears to be constant: in *W. laevis*, the alternipetalous segments are about as long as the antepetalous and in *W. tinctoria*, they are about half as long. Furthermore the alternating supplementary segments are solitary and simple in the former and geminate, simple or bifid in the latter.

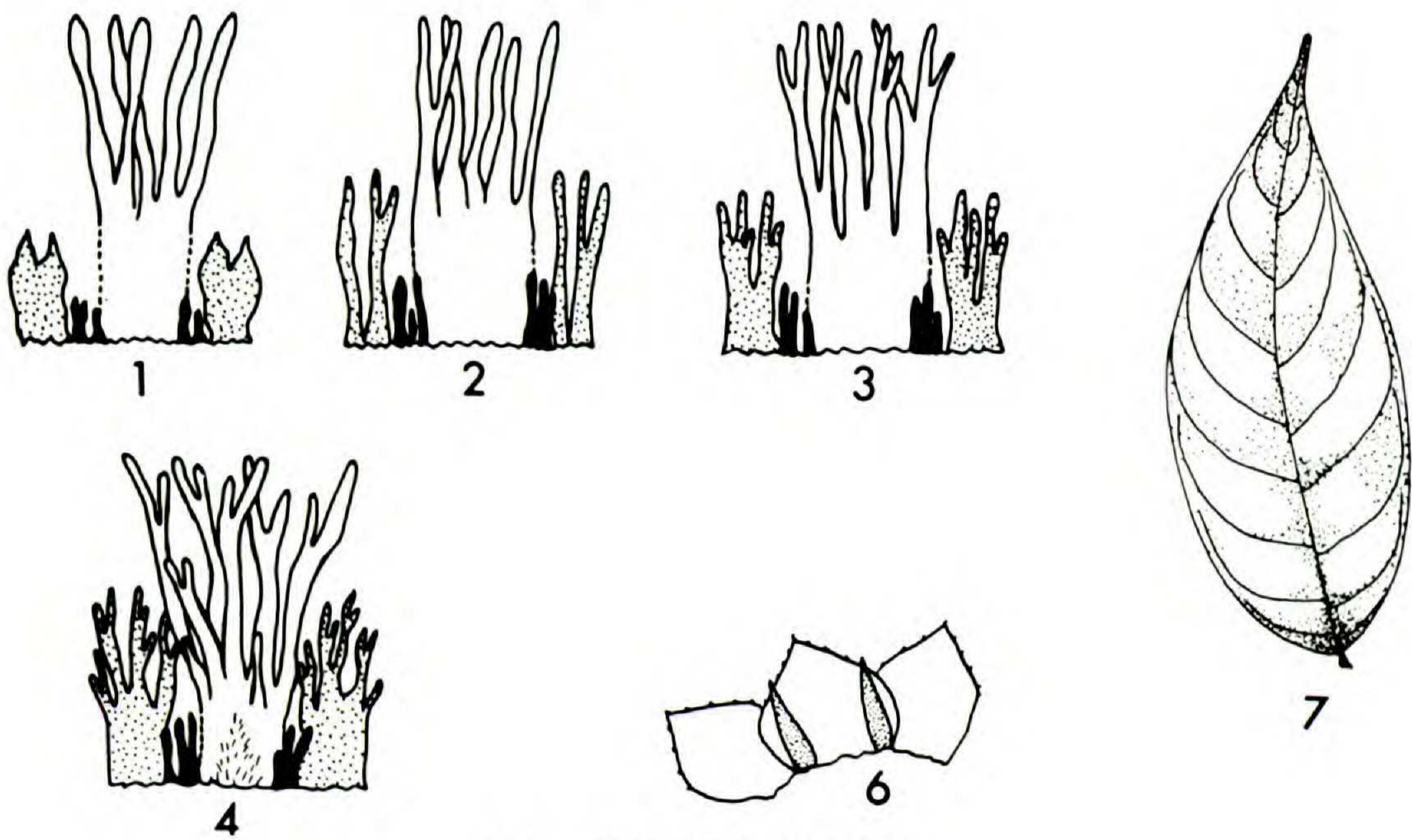
In both species leaves may in general be glabrous, even when immature, or minutely puberulent on the lower surface especially along the midvein, or densely puberulent on both surfaces. However, in *W. tinctoria*, leaves are short-petiolate or sessile with 9-13 pairs of secondary veins, while in *W. laevis* they are long-petiolate with usually 6-9 secondary veins. Finally, the calycine squamellae are linear-ovate, acuminate in the former and broadly ovate, acute to serrulate in the latter. In brief, in spite of the apparent similarity in leaf shape and size, and in corona structure, the 2 species are quite distinct in the relative length of the corona segments. This distinction is reinforced by characters of leaf and squamellae.

The variability in leaf pubescence, corona structure and other floral structures observed within *W. laevis* and *W. tinctoria* provides the basis for interpreting the remaining taxa of *Wrightia*. From this standpoint, I believe that *W. cambodiensis* and *W. rubriflora* are variants of *W. dubia* and that *W. hainanensis*, on the one hand, and *W. stellata* and *W. schlechteri*, on the other hand, should be put in synonymy under *W. laevis* and *W. sikkimensis*, respectively. Yet, *W. laevis* and





## W. LAEVIS



## W. TINCTORIA

Figure 7. Diagrams showing the differences in corona, squamellae and leaf structure between *W. laevis* and *W. tinctoria*. 1-5: variation in corona structure within each species; antepetalous segments white, alternipetalous segments dotted, alternating supplementary segments solid black; 6: calyx lobes and squamellae; 7: leaf.

*W. sikkimensis* are definitely distinct from *W. tinctoria* and *W. pubescens*, respectively. *Wrightia flavido-rosea* has been treated by Pichon (Not. Syst. 14: 77. 1951) as a synonym of *W. pubescens*. However, on the basis of corona structure, *W. flavido-rosea* is more closely related to *W. laevis*, from which it differs in that alternating supplementary corona segments are as long as the other segments. This distinction is substantiated by the fact that in *W. flavido-rosea* the carpels are densely pubescent at the tip, the follicles coherent and the leaves sparsely puberulent on both surfaces. There can be little doubt that this species should be maintained as distinct. *Wrightia lanceolata* should also be regarded as distinct from *W. tomentosa* for it is devoid of alternipetalous segments.

Finally, *W. puberula* has been put in synonymy under *W. tinctoria* or *W. flavido-rosea*. However, it differs from the former in the alternipetalous segments as long as the antepetalous, the absence of alternating supplementary segments, the leaves sparsely puberulent on both surfaces and, from the latter, in the absence of supplementary segments and the glabrous carpels. Therefore, *W. puberula* is treated in this revision as a distinct species even upon the basis of a single collection.

#### GEOGRAPHICAL DISTRIBUTION

*Wrightia* is confined to the eastern hemisphere, from East Africa to the Solomon Islands and from India and southern China to northeastern Australia. Within these bounds, species of *Wrightia* occur between the latitudes of about 30° N. and 30° S; altitudinally they range from sea level to about 1800 m. Their habitats are quite varied, from rain forests, deciduous dry forests to steppes, savannas and sandy thickets on the strand.

The largest section, *Wrightia*, embraces the whole range of the genus except Africa; there are 4 species with relatively extended ranges. The widespread species *W. laevis* and *W. pubescens* occur from southern China to northeastern Australia through Indochina, Thailand, Malaya, Indonesia, the Philippines and New Guinea. *Wrightia tomentosa* centers in India and extends to Ceylon and adjacent China, Burma and Thailand while *W. tinctoria* is confined to India. The remaining species of this section are rather local and endemic; for instance, *W. angustifolia*, *W. flavido-rosea* and *W. puberula* are restricted to Ceylon, *W. lanceolata* and *W. viridiflora* to Thailand, *W. lecomtei* to Thailand and Cambodia, *W. kwangtungensis* to Kwangtung and northern Vietnam, *W. annamensis* to Vietnam.

Species of § *Balfouria* are scattered and very limited in distribution. There are 2 species known only from East Africa: *W. demartiniana*, which frequents the wooded steppe, is found in Somalia and adjacent Ethiopia and Kenya, and *W. natalensis* is endemic to Natal. Finally, the third species of this section is restricted to northern Australia.

Section *Wallida* with one species, *W. antidysenterica*, is endemic to Ceylon.

The 4 species of § *Scleranthera* are also more or less limited in their geographical ranges: *W. dubia* covers Malaya, Thailand, Cambodia and South Vietnam, *W. collettii* is confined to Burma, *W. coccinea* is restricted to eastern India and Yunnan, while *W. hanleyi* is endemic to Palawan Island in the Philippines.

Since the majority of species, including many very restricted endemics, are found in the area between India and Southern China, I infer that the center of dispersal of the species is probably located there.

#### ECONOMIC USES

There are few available records of economic uses for *Wrightia*. Certain members of the genus, *W. pubescens*, *W. laevis*, *W. tomentosa* and *W. tinctoria*, include small or medium-sized trees which are usually classified as a timber for local purposes. The wood is light, soft and fine-textured, hence suitable for carving and turnery. Detailed accounts of the wood anatomy of these species are found in studies by Pearson and Brown (Commercial timbers of India. Calcutta. 1932) and by Ingle and Dadswell (Austral. Jour. Bot. **1**: 10. 1953).

Other species have ornamental value: *W. religiosa* and *W. antidysenterica* are widely cultivated for their beautiful and fragrant white flowers. Species of *Wrightia* have been used to a limited extent by the native population for their chemical and medicinal properties. The seeds, roots and leaves of *W. tinctoria*, *W. tomentosa* and *W. dubia* furnish an indigo-yielding glucoside used for dyeing in India and Cambodia. In India, Cowen (Flowering trees and shrubs in India. Bombay. 1911) states that the sap of *Wrightia tinctoria* has an interesting preservative property since "if a few drops of sap are added to milk, the milk will remain fresh without the necessity of keeping it on ice, the taste remaining unaltered." The bark and seeds of this species have also been used against dysentery and miscellaneous ills (Chopra, R. N., S. L. Nayar, and I. C. Chopra. Glossary of Indian medicinal plants. New Delhi. 1956). Duthie (Fl. Upper Gangetic Plain. Calcutta. 1911) reports that in India "the bark of the stem and root of *W. tomentosa* is regarded as an antidote to snake bite and the sting of scorpions."

#### ACKNOWLEDGEMENTS

I am indebted to the Agency for International Development (A. I. D.) for sponsoring my visit to the United States and for the award of the scholarship which enabled me to undertake this investigation. I wish to thank Dr. F. W. Went, former director of the Missouri Botanical Garden, where this study was completed, for the privilege of using the library and herbarium. I would also like to thank Mr. M. A. Jayaweera, director of the Botanic Garden in Peradeniya (Ceylon), Messrs. Nghiem song Ho and Ly van Hoi of the Botany Dept., University of Saigon for providing preserved flowers for anatomical studies, Miss D. Helmich of the Pollen Laboratory (Dept. of Botany), University of Michigan for preparing a number of pollen samples by acetolysis. Sincere appreciation is extended to Dr. A. Robyns, Dr. G. B. Van Schaack, Dr. J. Duke and Dr. R. L. Dressler for their encouragement and aid during the course of this study. Finally, I am especially grateful to the late Professor R. E. Woodson, Jr. for his constant interest, his valuable guidance and constructive criticism.

For the loan of material from the following herbaria I express my thanks to their curators for the generous loans of material necessary for this investigation.

The abbreviations are from the Index Herbarium, ed. 4, 1959, excepting SAIG which refers to the Directorate of agricultural research, Ministry of Rural Affairs, Saigon, Vietnam. These include: A, BM, BRI, CAL, CANB, E, EA, F, FI, G, GH, HK, K, L, LAE, MEL, MICH, MO, NSW, NT, NY, P, PH, PRE, SING, SRGH, UC, UPS, US, W.

## TAXONOMY\*

WRIGHTIA R. Br., Mem. Wern. Soc. **1**: 73. 1811; Tsiang, Sunyatsenia **4**: 42. 1939; Pichon, Not. Sys. **14**: 77. 1951, non Solander ex Naudin (1852). (T. : *W. pubescens* R. Br.)

*Balfouria* R. Br., Mem. Wern. Soc. **1**: 70. 1811. [T. : *B. saligna* R. Br. ex A. DC] Anasser, Blco. Fl. Philipp. 112. 1837, non. Jussieu. [T. : *A. laniti* Blco.].  
*Piaggiaea* Chiov. Fl. Som. **2**: 290. 1932. [T. : *P. demartiniana* Chiov.].  
*Wallida* Pichon, Not. Syst. **14**: 87. 1951. [T. : *W. antidysenterica* (L.) Pichon].  
*Sclerantha* Pichon, loc. cit. 88. 1951. [T. : *S. cambodiensis* (Pierre) Pichon].

Laticiferous shrubs or trees, occasionally climbers, evergreen or deciduous. Leaves decussate, simple, entire, penninerved, eglandular, the petiole bearing in the axils few to numerous pectinate glands. Inflorescence terminal, aggregate dichasial or monochasial, few- to many-flowered; calyx 5-parted, the lobes equal to subequal, quincuncial, cleft nearly to the receptacle, bearing within 1-2 alternate, glandular squamellae; corolla subrotate to subinfundibuliform, occasionally infundibuliform, subsalverform and salverform, the tube cylindrical to campanulate, constricted or not at the orifice, sometimes annulate, rarely appendaged within, the limb actinomorphic, 5-parted, sinistrorsely contorted in aestivation; corona (absent in *W. religiosa*) of 5-many subentire, dentate, lacinate or fimbriate segments, distinct or coherent; stamens 5, inserted within the corolla tube or at the orifice, the anthers included to wholly exerted, connivent and agglutinate to the stigma, consisting of 4 reduced fertile sporangia borne ventrally at the upper third of an enlarged sagittate connective; carpels 2, coherent or free from the base to the common style, glabrous or occasionally pubescent, the style gradually dilated near the apex and surmounted by a subcapitate to subcylindrical stigma provided with a basal collar and a bi-apiculate apex; nectaries none. Follicles 2, free or coherent, terete to laterally compressed, dehiscing along the ventral suture; seeds numerous, linear-fusiform with a chalazal coma; embryo straight, the cotyledons broad, convolute.

## KEY TO THE SECTIONS

- a. Corolla subrotate, occasionally subsalverform or salverform; stamens inserted at the orifice of the corolla tube (except in *W. annamensis*), the anthers exerted; inflorescence aggregate dichasial rarely monochasial.
- b. Corolla subrotate (subsalsalverform in *W. demartiniana*), the tube relatively stout, shorter than the lobes, 1.5-7.0 mm. long, glabrous within; corona glabrous within, occasionally pubescent; anthers frequently pubescent without, sometimes glabrous, the basal lobes attenuate to auriculate, as

\* Because of space limitations a list of exsiccatae has not been included in this paper, but a mimeographed copy is available from the author upon request.—Editor.

will be soon necessary to apply their knowledge in the search for coal in the old ridge of crumpled palæozoic rocks beneath its northern border.

The West of England has received a few touches here and there ; but the outcrops of the Cretaceous and Upper Oolite beds through Berks, Bucks, and Cambridgeshire have been carefully revised ; and so have the Oolites of Northamptonshire and Oxfordshire. Still more important is the improved work in the Warwickshire and Leicestershire Coal-fields, and in Charnwood Forest, with its Cambrian (if not older) rocks. The North-Staffordshire and Lancashire Coal-fields become, as it were, remodelled by the now accurate outlines of their areas ; and the neighbourhood of Manchester, in particular, passes from an artificial to a natural appearance, geologically viewed. The great Permian range, from Durham southward, is taking its natural form on paper ; for the Survey has reached northwards much beyond Doncaster. The red sandstones of the Eden and of the west coast of Cumberland now appear in their true Permian colours ; and various spots in Northumbria also speak of the researches of several active geologists of to-day. Lastly, in Wales a few modifications of outlines in the Old Red and the complicated patches of igneous rocks may be noticed. The illustrated sections are repeated (with stronger lettering) on the margins, as heretofore.

In this new map there are additions to the railways, bolder distinctive numbers to the different formations, and modifications in some of the tints ; and an important mass of information is added in notes and remarks all around the coast.

The general result is that we have a very useful and handsome Geological Map of England and Wales (12 miles to the inch), not so large as the "Greenough Map" published by the Geological Society of London, but constructed on the same basis, and containing a very large amount of useful information, clearly put by the master-hand of an accomplished geologist, and produced in good style by an intelligent publisher.

## PROCEEDINGS OF LEARNED SOCIETIES.

### ROYAL SOCIETY.

April 26, 1866.—J. P. Gassiot, Vice-President, in the Chair.

"On the Dentition of *Rhinoceros leptorhinus* (Owen)." By W. Boyd Dawkins, M.A., Oxon., F.G.S.

The fossil remains of the genus *Rhinoceros* found in Pleistocene deposits in Great Britain indicate four well-defined species. Of these the *R. tichorhinus*, or the common fossil species, ranged throughout France, Germany, and Northern Russia, and, like its congener the Mammoth, was defended from the intense winter cold by a thick clothing of hair and wool. Its southern limit in the Europæo-Asiatic continent was a line passing through the Pyrenees, the Alps, the northern shore of the Caspian, and the Altai Mountains.

It has not yet been proved to have existed in Europe anterior to the deposit of the Boulder Clay. The second species, the *R. megarhinus* of M. de Christol, characterized by its slender limbs and the absence of the "cloison," has been determined by the author among remains from the brick-earths occupying the lower part of the Thames valley, and from the Preglacial forest-bed of Cromer. The species ranged from the Norfolk shore southwards through Central France into Italy. In France and Italy it characterizes the Pliocene deposits, being found in the former country in association with *Mastodon brevirostris* and *Halitherium Serresii*, in the latter with *M. Arvernensis*. From its southern range we may infer that the megarhine species was fitted to inhabit the warm and temperate zones of Europe, just as the tichorhine was peculiarly fitted for the endurance of an Arctic winter.

The third species is the *R. etruscus* of Dr. Falconer, confined to the forest-bed of the Norfolk shore, and, like the *R. megarhinus*, found in the Pliocenes of France and Italy; it ranged across the Pyrenees as far as Malaga, and is the only species known to occur in Spain.

The fourth, the *R. leptorhinus* of Professor Owen, is the equivalent of the *R. hemitæchus* of Dr. Falconer. It is defined as "*R. à narines demicloisonnées*," and is probably not the same animal as the *R. leptorhinus* or "*R. à narines non-cloisonnées*" of Baron Cuvier, the evidence as to the absence or presence of the cloison in the type of the species being of the most conflicting nature. In Central France it is identical with *R. mesotropus* and *R. velaunus* of M. Aymard, the *R. Aymardi* of M. Pomel, and the *R. leptorhinus* (du Puy) of M. Gervais. Its dentition is characterized by the presence of the *third costa* in the upper molar series, coupled with the stoutness of the cingulum, the suppression of the *anterior combing plate*, the smoothness of the enamel, and the extent to which the upper molars overhang the lower, which causes the enamel on the outer side of the latter to be worn obliquely. The lower molars can be determined by the flattening of the *anterior area*, coupled with the fine sculpturing of the enamel-surface. In common with the other fossil British Rhinoceroses, it possessed a molar series of six only on either side, and was bicorn. It ranged through England, from the Hyæna-den of Kirkdale in Yorkshire in the north, as far south as the plains of Somersetshire, and as far to the West as Pembroke-shire. It is very generally found in association with *Elephas antiquus* and *Hippopotamus major*, both species which lived in Pliocene times. The association in Wookey Hole Hyæna-den with *Elephas primigenius* and *R. tichorhinus* and other characteristic Postglacial mammals proves that it coexisted with the tichorhine species, to which it probably bore the same geographical relation as the Elk does to the Reindeer in the high northern latitudes. The sum of the evidence proves that it was coeval with the Mammoth and tichorhine Rhinoceros, and does not characterize deposits of an earlier epoch in the Pleistocene. It has not as yet been found in Preglacial formations. The *R. leptorhinus* is more closely allied to the bicorn Rhinoceros of Sumatra than to any other living species.

- nn. Leaves elliptic, minutely puberulent throughout; flowers about 1.8 cm. long; corona minute, about 1 mm. long; carpels glabrous .....14. *W. LECOMTEI*  
 mm. Inflorescence monochasial; corona obsolete .....15. *W. RELIGIOSA*

1. *WRIGHTIA LAEVIS* Hook. f. Fl. Brit. Ind. **3**: 654. 1882. (T.: *Maingay 1065!*).

*Wrightia tinctoria* var. *laevis* (Hook. f.) Pichon, Not. Syst. **14**: 80. 1951.

Trees sometimes reaching a height of 35-40 m.; branchlets terete, striate and lenticellate, the current year's growth glabrous. Leaves narrowly elliptic to elliptic, occasionally ovate or obovate, acuminate to caudate-acuminate, rarely mucronate, the base acute, 7-18 cm. long, 2.5-8.0 cm. broad, membranaceous, glabrous to minutely puberulent along the veins beneath, the midrib canaliculate above, prominent beneath, the secondary veins 6-9(-11) pairs, arcuate towards the margins; petiole 0.5-1.0 cm. long, glabrous to puberulent. Inflorescence terminal, aggregate dichasial, usually many-flowered, shorter than the subtending leaves; peduncle about 1 cm. long, glabrous to puberulent, the bracts small, scarious, occasionally linear and foliaceous; pedicels 1.0-1.5 cm. long, glabrous to puberulent. Flowers white to pale yellow, fragrant; calyx lobes ovate to broadly ovate, acute to obtuse, 1-2 mm. long, ciliate, glabrous or puberulent, bearing within 5 ovate to broadly ovate, acute to serrulate squamellae shorter than the lobes; corolla subrotate, the tube cylindrical, relatively slender, 1.5-3.0 mm. long, the lobes narrowly obovate to obovate, 5.5-13.5 mm. long, puberulent-papillate; corona fimbriate, shorter to longer than the stamens, glabrous, the antepetalous segments strongly adnate to the corolla lobes, the fimbriae simple to compound, the alternipetalous as long as the antepetalous, the alternating supplementary segments solitary, filiform and shorter; stamens 5, inserted at the orifice of the corolla tube, the anthers puberulent throughout, occasionally glabrous without, the acumen glabrous to puberulent, the filament longer than the basal anther lobes; carpels 2, free, glabrous, rarely minutely puberulent at the tips, the style slender, dilated near the subcapitate stigma. Follicles 2, free, sometimes coherent at the tips, terete-fusiform, 20-35 cm. long, lenticellate and finely striate; seeds linear, about 2 cm. long, the white coma about 4 cm. long.

Widely distributed in southern China, Burma, Thailand, Indochina, Malaya, Indonesia, Philippines, New Guinea and northern Australia, in evergreen forests, secondary forests and sandy thickets on the strand; flowering from April to July, fruiting from September to January.

Vernacular names: *Lam muk* (China - Lei); *Lam shue* (China - Lei); *Shan Lam shue* (China - Tsang); *Lanete* (Philippines - Sulit).

#### KEY TO THE SUBSPECIES

- a. Corona about as long as the stamens, the fimbriae simple; carpels glabrous.  
 b. Inflorescence glabrous. Plants of China, Burma, Thailand, Indochina, Malaya and Sumatra .....1a. *W. LAEVIS* SSP. *LAEVIS*  
 bb. Inflorescence puberulent. Plants of the Philippines, Indonesia, New Guinea and Australia .....1b. *W. LAEVIS* SSP. *MILLGAR*  
 aa. Corona definitely longer than the stamens, the fimbriae compound; carpels glabrous to very minutely puberulent at the apex. Plants of New Guinea. ....1c. *W. LAEVIS* SSP. *NOVOGUINEENSIS*

## 1a. WRIGHTIA LAEVIS ssp. LAEVIS

- Wrightia hainanensis* Merr. in Philipp., Jour. Sci. **21**: 352. 1922. (T.: *Hongkong Herb.* 425).  
*Wrightia balansae* Pitard in Lecomte & Humbert, Fl. Gen. Indo-Chine **3**: 1188. 1933. (T.: *Balansa 2118!*).  
*Wrightia macrocarpa* Pitard in Lecomte & Humbert, loc. cit. 1190. 1933. (T.: *Balansa 2115!*).  
*Wrightia hainanensis* var. *variabilis* Tsiang, Sunyatsenia **4**: 47. 1939. (T.: *Tsiang 2679!*).  
*Wrightia hainanensis* var. *chingii* Tsiang, loc. cit. 48. 1939, ex char. (T.: *Ching 5539*).

BURMA. S. E. SHAN STATES: Keng Tung Territory, *Rock s. n.* (A).

CHINA. HAINAN: Fan Ya, Ng. Chi Leng, in forested ravine, *Chun & Tso 44159* (A, NY), *McClure 9488* (UC, US, W); Five Finger Mt., *McClure 8685* (A, BM, E, G, HK, K, MO, UC), *Chun 1528* (UC); Hoi ta Shan, Taam Chau distr., *Tsang 823* (A, G, K, NY, UC, US); Hung mo Shan, Lai area, *Tsang, Tang & Fung 174* (BM, G, K, NY, US), *Tsang & Fung 628* (NY); Lokwei, in forest, *How 72313* (BM, F); Pak shik Ling and vicinity, Ching Mai distr. in thicket on sandy soil, *Lei 233* (A, K, NY, SING, UC, US, W), 565 (A, HK, L, NY, SING, UC, US, W); Poting, *How 71703* (A, G), 73280 (A, BM, G); Sha Po Shan, Taam Chau. distr., *Tsang 582* (A, K, UC, US); Tai pin, edge of jungle, *Gressitt 1073* (A, BM, E, G, MO); Tong mok Sze, *Ford 425* (K); Tsat cha ling, Chang kiang distr., *Lau 1761* (A, BM, NY); precise locality unknown, *Liang 63443* (NY, US), 63637 (A, NY), 65059 (A, G, NY), *Tang 412* (A). HONGKONG: Botanic Garden, *Tang 33* (HK), 100 (HK); Kaepong, *unknown collector 446* (HK). KWANGSI: Mung Tung Kow, 65 mi. N. of Luchen, in woods, *unknown collector 5539* (W); Nar Pui, Sup Man Ta Shan, in shaded and mixed woods along the stream side, *Liang 69588* (A); on the way to Suan Tze, from Nanning, in open wood, *Ching 7768* (A, NY, UC, US, W). KWANGTUNG: Taiping tseh, Sunyi in open, bank of river, *Tsiang 2679* (A, K, NY, W). YUNNAN: Szemao, *Henry 12393* (A, NY), 12743 (A, E, NY).

INDONESIA. SUMATRA: vicinity of Loemban Ria, Asahan, *Rahmat si Boeea s. n.* (A); by river Moesi near Lampar, *Forbes 2605* (BM, CAL, K).

LAOS: Pak Munung, Wiengchan, in evergreen forest, *Kerr 21209* (BM, K).

MALAYA. KELANTAN: Goa Panjang at Goa Ninik, *Henderson 19599* (BRI, SING). MALACCA: Mt. Ophir, *Maingay 1065* (CAL, K). NEGRI SEMBILAN: Johol, *Ridley s. n.* (K, SING); Ulu Pedas, *Nur 11728* (SING, UC). PAHANG: near Batu Balai, *Burkill & Haniff 15826* (SING). PERAK: Merah, *Ridley s. n.* (SING); Ulu Temengor, *Ridley 14605* (BM, SING); precise locality unknown, *Scortechini 63b* (CAL), 77b (CAL, K, SING), WRAY 3504 (CAL). SELANGOR: Bukit Lagong Forest reserve, Kepong, *Sinclair SFN 40103* (BM, E, L, SING); Ginting Bidai, *Ridley 7566* (CAL, SING); Seminyih, *Hume 8352* (SING); near Ulu Selangor, *King 8614* (BM, CAL, L, UC).

THAILAND: NAKAWN SRITAMARAT: Kao Luang, *Kerr 15568* (BM, E, L). PUKET: Bangto, Pang-nga, in evergreen forest, *Kerr 17148* (A, BM, E, L); Pang-nga, *Curtis 2943* (K, SING).

VIETNAM: Hācói, Taai Wong Mo Shan & vicinity, *Tsang 27334* (A); Phútho, *Fleury 30105* (P); Sontây, Mt. Bavi, *Pételot 2429* (A, MO, US), 7018 (MO); Sontây, valley of Lankok, *Balansa 2117* (K, L, P); Tháinguyên, Lang Hit, *Pételot 7008* (MO, SAIG, US); Thanhhoa, Lahán, *Poillane 1722* (A, SAIG); Tüpháp, *Balansa 2115* (K), 2118 (K, L); Yên báy, *Pham ngoc Dung 15* (SAIG); precise locality unknown, *Bon 5418* (P), 6057 (P, SAIG), s. n. (A, NY).

## 1b. WRIGHTIA LAEVIS ssp. MILLGAR (F. M. Bailey) P.t. Ngan, stat. nov.

*Wrightia millgar* F. M. Bailey, Dept. Agric. Brisbane, Bot. Bull. **7**: 65. 1893. (T.: *Cowley 7D!*).

*Wrightia sorsogonensis* Elmer, Leaflet. Philipp. Bot. **10**: 3698. 1939. (T.: *Elmer 15595!*).

AUSTRALIA. QUEENSLAND: Barron River, *Cowley 7D* (BRI); Daintree River, *Cowley s. n.* (BRI), *Kajewski 1409* (A, BRI, NSW, NY); near Rockhampton, *Webb 5057* (CANB); Yungaburra, *Michael 334* (BRI, GH).



INDONESIA. SUMATRA: Moesi, Palembang, *unknown collector s. n.* (L); Tandjong Ning, Palembang, *Forbes 2766* (BM, GH, L, MO, SING). WEST IRIAN: Subdistr. Manokwari, Momi, in primary forests, rare, *Kostermans 256* (L, SING); Subdistr. Manokwari, Ransiki, in primary forests on flat stony and sandy ground, *Kostermans 100* (L); plateau north of Pami River, 8 km. N.W. of Manokwari, in primary forests on coral lime, *Koster BW 4349* (CANB), *BW 4355* (CANB, L, LAE); Sansapor, Onderafd. Sorong, in primary forests, *Versteegh BW 3991* (L, LAE), *BW 4628* (L); Sekoli plain, in secondary forests on stony clay *Iwanggin BW 9136* (LAE); Seroei, Japen Island, F. R. I. *bb 30391* (L.), *bb 30417* (L), *bb 30447* (SING), *bb 30530* (A, L, SING); Tiporra, Rijklof van Goens Bay, Subdiv. Fak Fak, *Stefels BW 5105* (L); Wersar, in primary forest on clayey soil, *Versteegh BW 4971* (L.).

NEW GUINEA. Madang subdistr., Ramu valley about 5 miles S.E. Faita airstrip, in rain forests on lower slopes, *Saunders 484* (BRI, CANB, LAE), *505* (BRI, CANB, LAE).

PAPUA: Buna Hinterland, about 7 miles N. W. of Embi Lake, in rain-forest, *Smith 1272* (L, LAE); Tufi subdistr., near Koreaf village, in dense, tall, partly secondary forest, *Hoogland 4840* (A, BM, BRI, CANB, G, L, LAE, US).

BISMARCK ARCHIPELAGO: Admiralty Islands, Manus Island, *N. G. F. 543* (L, LAE).

PHILIPPINES. LUZON: Irosin, Mt. Bulusan, Prov. of Sorsogon, *Elmer 15595* (BM, F, G, GH, K, L, MO, UC, W); Pasacao, Camarines, *Ahern 40* (US). MINDANAO: Davao Prov., *For. Bur. 27538*, *De Mesa* (BM, L, NY, SING). PANAY: Prov. of Capiz, *For. Bur. 17832* *Cortes & Rendal* (US). SAMAR: Mt. Cansayao, Catarman, in forest edge, *Phil. Nat. Herb. 14455*, *Sulit* (A, BM, L); Catubig River, *Bur. Sci. 24201*, *Ramos* (A, US); Loquilocon, Wright, *Bur. Sci. 43854*, *McGregor* (NY, UC), *Phil. Nat. Herb. 6055*, *Sulit* (A, L); without precise locality, *For. Bur. 12615*, *Rosenbluth* (NY, US).

1c. *WRIGHTIA LAEVIS* ssp. **NOVOGUINEENSIS** P.t. Ngan, ssp. nov. Affinis ssp. *millgar* a qua corona antheris paulo longiora et apice inaequaliter fimbriata differt.

NEW GUINEA: Bernhard camp, Idenburg River, in rain forest of mountain slopes, *Brass 13893* (A, BM, BRI, L, LAE); Kubuna, Central div., in rain forest of ridges, *Brass 5570* (A, HOLOTYPE, BM, BRI, K, NY, US).

Pichon was correct in recognizing the identity of *W. hainanensis* with *W. laevis*, yet he referred the latter to a variety of *W. tinctoria*. As I have pointed out in the section on species concept, these 2 species are quite distinct and easily recognized, for they differ not only in leaf characters but in the structure of the flower as well.

Although widely distributed from southern China to northern Australia *W. laevis* is a rather uniform population with the corona fimbriate, the alternating supplementary segments solitary and simple and the leaves glabrous to puberulent upon the veins beneath. In the western range the inflorescence is glabrous, while in the central and eastern ranges it becomes puberulent and the leaves more or less densely puberulent upon the veins beneath. Specimens collected in New Guinea have shown much variation in leaf and flower characters. However the material at hand is scant and many collections are sterile, and it is difficult to have an adequate appreciation of variation within this population. Therefore, in this study, I am referring it to subspecies *millgar* except ssp. *novoguineensis*, which is characterized by the unusually long and compound corona fimbriae.

Finally, *W. laevis* seems to hybridize with *W. viridiflora* occurring in Thailand. There are some specimens (*Kerr 15568*, *17148*) which Pichon interpreted as *W. viridiflora*; however, I suspect that these are hybrids between the 2 species.

Although the few-flowered inflorescence and the stamens glabrous without combine to make these specimens apparently close to *W. viridiflora*, they are morphologically related to *W. laevis* on the basis of the leaves with 6 secondary veins, the relatively large flowers and the alternating corona segments as long as the antepetalous. Hence they are referred to *W. laevis* in this revision.

2. *WRIGHTIA VIRIDIFLORA* Kerr, Kew Bull. **1937**: 90. 1937. (T. : *Put* 3086!).

Shrubs or small trees as much as 5 m. high; branchlets rather slender, terete, glabrous to minutely puberulent, the bark gray to brown, striate. Leaves narrowly elliptic to elliptic, occasionally ovate to obovate, the apex acute to acuminate or mucronate, the base broadly acute, 8-15 cm. long, 2.5-7.0 cm. broad, membranaceous, glabrous above, puberulent to glabrous except upon the veins beneath, the secondary veins 9-12 pairs arcuate; petiole about 0.5 cm. long, puberulent. Inflorescence terminal, aggregate dichasial, few-flowered, much shorter than the subtending leaves; peduncle about 0.5 cm. long, the bracts small, scarious; pedicels rather slender, about 1 cm. long, glabrous to puberulent. Flowers relatively small, greenish, malodorous; calyx lobes ovate, acute about 1 mm. long, ciliate, minutely puberulent, bearing within 5 minute, alternate squamellae; corolla subrotate, the tube about 1.5 mm. long, glabrous, the lobes elliptic-obovate, acute, about 6 mm. long, minutely puberulent-papillate; corona fimbriate, as long as the stamens, glabrous, the antepetalous segments strongly adnate about half their length to the corolla lobes, about 3.5 mm. long, the alternipetalous deeply bifid, about 2.5 mm. long, the alternating supplementary segments simple, filiform, about 1 mm. long; stamens 5, inserted at the orifice of the corolla tube, the anthers glabrous without, puberulent within, the acumen glabrous, the filament relatively short, almost as long as the auriculate, basal anther lobes; carpels 2, free, glabrous, about 0.8 mm. long, the style slender, dilated near the tip. Follicles unknown.

Endemic to Thailand, in evergreen forests, on limestone; flowering from June to September.

THAILAND. AYUTHIA: Hin Lap, Saraburi, on rocky limestone hill, *Kerr* 9128 (A, BM, K, L); Kao Sisiat, *Noe* 105 (A, BM, SING); Menam Sak, Saraburi, on limestone rocks in evergreen forests, *Kerr* 7061 (BM, E); Muak Lek, *Put* 3086 (A, BM, E, K, L). RACHABURI: Brangkasi, about 100 km. south of Wangka, on rocky slope of limestone, *Den Hoed & Kostermans* 678 (A, L); Bau re, Kanburi, *Put* 196 (BM, K, MO); Kin Sayot, about 120 km. N. W. of Kanburi, on dry limestone rocks, *Kostermans* 1093 (A, SING, US).

*Wrightia viridiflora* is closely related to *W. laevis* on the basis of the structure of the corona; however it differs from the latter in the few-flowered inflorescences much shorter than the subtending leaves, the relatively smaller, greenish and malodorous flowers and the alternipetalous corona segments shorter than the antepetalous. Pichon reported that this species also occurs in Vietnam, however I have seen no specimen from that area.

3. *WRIGHTIA FLAVIDO-ROSEA* Trimen, Jour. Bot. **23**: 238. 1885. (T. : *Trimen s. n.* May 1884!).

Small trees, the branchlets slender, lenticellate. Leaves narrowly elliptic, the apex acuminate, the base acute, 10-15 cm. long, 2.5-3.5 cm. broad, membranaceous, sparsely and minutely puberulent on both surfaces, densely so upon the veins beneath, the midrib immersed above, prominent beneath, the secondary veins 10-13 pairs, arcuate towards the margins; petiole about 0.5 cm. long, puberulent. Inflorescence terminal, aggregate dichasial, rather lax, shorter than the subtending leaves; peduncle rather stout, about 0.5 cm. long, puberulent, the bracts minute, about 0.2 cm. long; pedicels about 1.3 cm. long, puberulent. Flowers yellow to pink-orange, becoming purplish-gray when withering; calyx lobes broadly ovate to very broadly ovate, acute, about 1.5 mm. long, puberulent without, bearing within 5 alternate, deltoid squamellae, about half as long as the lobes; corolla subrotate, the tube cylindrical, about 3 mm. long, the lobes narrowly obovate, obtuse, about 12 mm. long, minutely puberulent-papillate; corona of 3 series, fimbriate, a little shorter than the stamens, the antepetalous segments strongly adnate to the corolla lobes, relatively narrow, the alternipetalous bifid, the alternating supplementary segments solitary, simple, as long as the other two; stamens 5, inserted at the orifice of the corolla tube, about 7 mm. long, the anthers sparsely puberulent within, densely so without, the acumen barbate, the filament about 1.5 mm. long, glabrous, the basal anther lobes attenuate; carpels 2, densely pubescent at the tips, the style dilated near the subcapitate stigma. Follicles 2, coherent, about 22 cm. long; seeds about 1.8 cm. long, the yellowish coma about 4.5 cm. long.

Endemic to Ceylon, confined to the wet zone; flowering in May, fruiting in September.

CEYLON. NORTHWESTERN PROVINCE: Kurunegala distr., Doluwa Kande, May 1884, *Trimen s. n.* (K); same locality, September 1888, *Trimen s. n.* (UPS), *unknown collector s. n.* (UPS).

Although Pichon referred this species to *W. pubescens*, I believe that *W. flavido-rosea* is a distinctive species rather closely related to *W. laevis* on the basis of the corona structure. The relationships of this species with *W. laevis* have been discussed in connection with the chapter "Specific Concept." Furthermore, the unusually pubescent carpels also ally this species with *W. angustifolia*, occurring in the same area.

4. *WRIGHTIA INDICA* P.t. Ngan, sp. nov.

Frutices vel arbusculae ramulis teretibus leviter puberulis. Foliorum lamina membranacea elliptica vel obovata apice acuminata vel acuta basi cuneata utrinque puberula costa superne impressa subtus prominente nervis secundariis 8-12 paribus; petiolus ca. 0.3 cm. longus minute puberulus. Inflorescentia terminalis aggregate dichasialis foliis aequalis; pedicellus ca. 0.8 cm. longus puberulusque; calycis laciniae ovatae obtusae ca. 2 mm. longae extus puberulae intus basi squa-

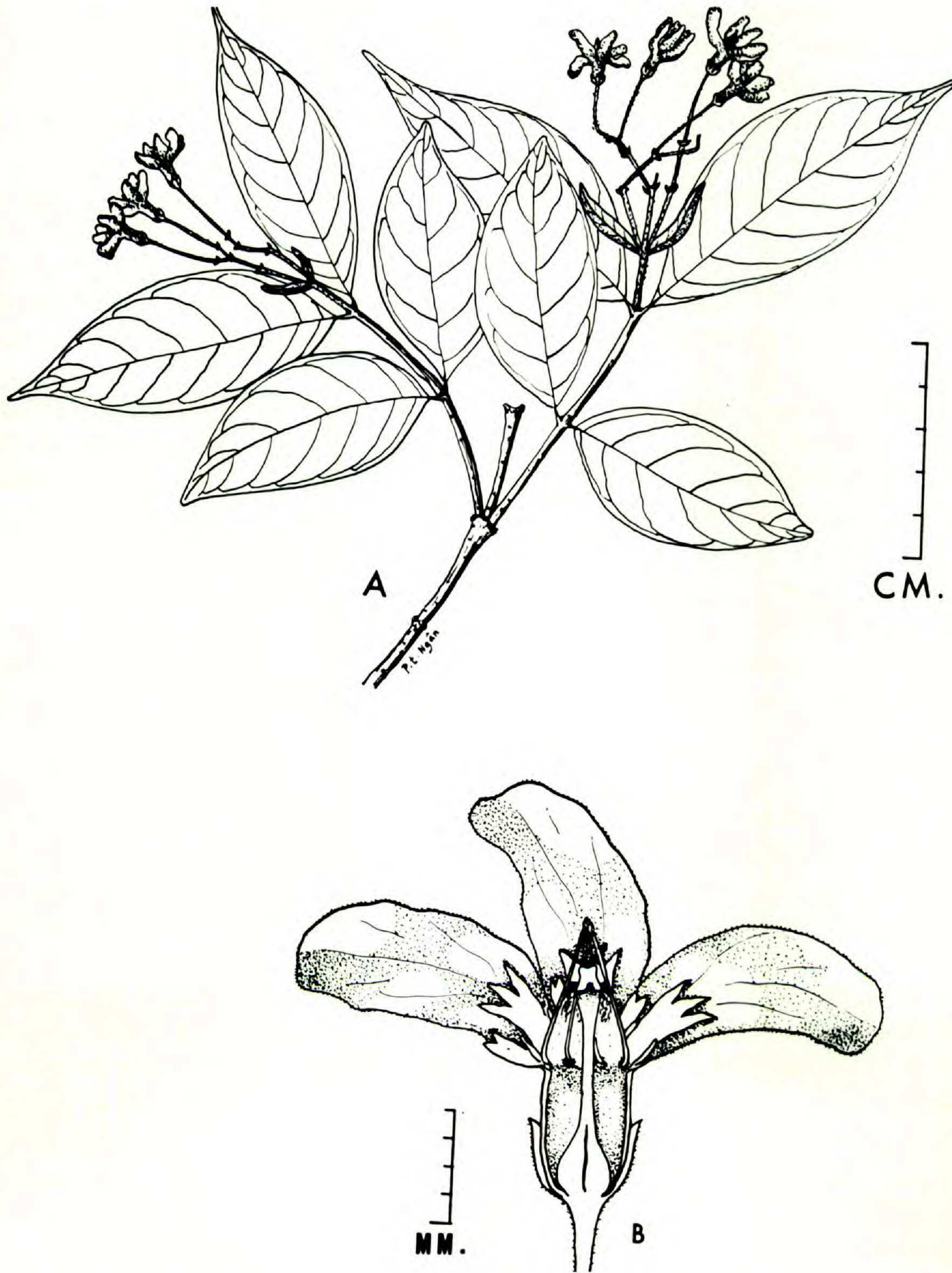


Figure 8. *Wrightia indica* P. t. Ngan; A, twig with inflorescences; B, longisection of the flower.

mellis deltoideo-ligulatis praeditae; corolla subrotata tubo subcylindrico ca. 4 mm. longo lobis anguste subobovatis ca. 10 mm. longis puberulo-papillatis coronae squamis triseriatis glabris antepetalis tridentatis ca. 5 mm. longis alternipetalis brevioribus bifidis segmentis supplementalibus alternantibus solitariis simplicibusque; stamina ad faucem inserta antheris valde exsertis sagittatis ca. 6 mm. longis utrinque minute puberulis; carpella connata ca. 1.7 mm. longa glabra stylo ca. 5 mm. longo apice dilatato et stigmatibus subcapitato. Folliculi ignoti. Holotypus: *unknown collector 5117, Herb. Beddome* (BM).

Endemic to western and central Madras (India); up to 1000 m. elev.; flowering in June.

INDIA. MADRAS: CONOOR GHAT, *unknown collector 5117, Herb. Beddome* (BM); HSSUR, Taluk, Salem distr., *Yeshoda 189* (NY).

This species has been confused in the herbarium with *W. tinctoria* ssp. *rothii* and *W. tomentosa*, from both of which it can be easily distinguished by the structure of the corona. *Wrightia indica* is rather a rare species characterized by the 3 series of corona segments with the alternating supplementary segments solitary and simple and the leaves puberulent throughout. It is closely related to *W. laevis* from which it differs in the antepetalous corona segments laciniate, the alternipetalous shorter and the carpels medially coherent.

5. *WRIGHTIA TINCTORIA* R. Br., Mem. Wern. Soc. **1**: 74. 1811. (T.: Roxburgh s. n!)

Small deciduous trees up to 6 m. high; branchlets terete, glabrous to densely puberulent, the bark smooth, striate, yellowish-gray. Leaves narrowly elliptic, occasionally broadly elliptic to narrowly obovate, acuminate to caudate-acuminate at the apex, acute to obtuse at the base, 6-24 cm. long, 2-9 cm. broad, membranaceous to chartaceous, glabrous to densely puberulent, the midrib immersed above, prominent beneath, the secondary veins 9-13 pairs, arcuate towards the apex; petiole very short, about 0.2 cm. long, glabrous to puberulent. Inflorescence terminal, aggregate dichasial, lax, divaricately branched, usually longer than the subtending leaves; peduncle rather slender, up to 1.5 cm. long, glabrous to puberulent, the bracts linear, about 0.5 cm. long; glabrous to pubescent; pedicels about 1.5 cm. long. Flowers white or lilac, fragrant; calyx lobes ovate to broadly ovate, about 2 mm. long, glabrous to puberulent, ciliate, bearing within 5 to many narrowly ovate squamellae, about as long as the lobes; corolla subrotate, the tube cylindrical, glabrous to puberulent at the orifice within, about 3 mm. long, the lobes narrowly obovate, obtuse, about 9 mm. long, puberulent-papillate; corona fimbriate, shorter than and up to as long as the stamens, the antepetalous segments strongly adnate to the corolla lobes, glabrous within to puberulent near the base, the fimbriae simple or compound, the alternipetalous bi- to multifid, about half the length of the antepetalous, the alternating supplementary segments geminate, much shorter than the antepetalous; stamens 5, inserted at the orifice of the corolla tube, about 7 mm.

long, the anthers puberulent throughout, occasionally glabrous without, the acumen barbate, the filament longer than the basal anther lobes; carpels 2, free, glabrous, the style slender, about 5 mm. long, slightly dilated near the subcapitate stigma. Follicles 2, free, sometimes coherent at the tips, slender and terete, 20-45 cm. long, lenticellate; seeds linear-fusiform, about 1.5 cm. long, the white coma about 4 cm. long.

Throughout India, in dry deciduous forests from approximately 25 to 1300 m. elev.; flowers from March to May, follicles in December-January.

## KEY TO THE SUBSPECIES

- a. Leaves narrowly elliptic or narrowly obovate to elliptic, glabrous, occasionally puberulent along the midrib beneath; inflorescence glabrous, occasionally puberulent upon the pedicels; antipetalous corona segments glabrous near the base within, the fimbriae usually simple. Plants of western, southern and eastern India. ....5a. *W. TINCTORIA* SSP. *TINCTORIA*
- aa. Leaves elliptic to broadly elliptic, puberulent throughout; inflorescence puberulent; antipetalous corona segments puberulent near the base within, the fimbriae compound. Plants of northern and central India. ....5b. *W. TINCTORIA* SSP. *ROTHII*

5a. *WRIGHTIA TINCTORIA* SSP. *TINCTORIA*.

*Nerium tinctorium* Roxb., Hort. Beng. 19. 1818, nom. nud.; Fl. Ind., ed. Carey & Wall. 2:4. 1824, ex char.

*Wrightia laciniata* A. DC. in DC., Prodr. 8: 406. 1844. (T.: unknown collector s. n., photo. Mo!).

*Wrightia timorensis* Miq., Fl. Ind. Bat. 2: 433. 1856. (T.: Rijksherb. 2261/104!).

INDIA. BIHAR: Hazaribagh distr. *Kerr s. n.* (BM). WEST BENGAL: Alipur, Calcutta, *Lancaster s. n.* (CAL); Ballygunge, Calcutta, *unknown collector 6* (CAL); Chandernagore, *Hosein 1* (CAL). BOMBAY: Birchy, north Kanara, *Talbot s. n.* (K); Borioli National Park, *Santapau 13061* (MO); Concan, *Lau & Stock s. n.* (BRI, CAL, G, GH, L, NY, W); Coorg, *unknown collector s. n.* (K); Karjat, north Concan, *Fernandes 251* (A); Khandala, *Santapau 4302* (CAL), *12918* (MO), *unknown collector s. n.* (E); southern Maratha country and north Canara, *Young s. n.* (CAL); Mercara, *unknown collector s. n.* (E, G, K, W); Salsette Island, *Perrottet s. n.* (G); Yellapur, Karwar distr., *Nana 5818* (CAL, K); without precise locality, *Cubbert s. n.* (L). MADRAS: Burliar, Nilgiris distr., *Gamble 11357* (CAL); Chingleput distr., *Gamble 10757* (K); northern Circar, *Campbell 40* (E); Coimbatore distr., *Fischer 1791* (CAL, K), *Rajagolsal Chetty 14* (EA); Dindigul, Pulney hills, Madura distr., *Anglade 647* (G), *914* (G); near Gingee Mt., *Delessert s. n.* (L); Guramkonda, Cuddapah distr., *Gamble 15045* (CAL, K); Jirugalli, Coimbatore, *Fischer 1072* (CAL); Jyamalai, near Coimbatore, *Brandis 1401* (A); Kadirinayanapalle, Nellore distr., *Ramaswami 1217* (CAL); Nilambur, *unknown collector 1031* (CAL); Nilgiri (Neilgherry), *Cleghorn s. n.* (E), *Lobb s. n.* (G, K), *Schmid s. n.* (CAL), *unknown collector s. n.* (E); Pillearnatham, Madura distr., *Fischer 3135* (CAL); Pondichery, *Perrottet 93* (W), *321* (K), *322* (A, K, W), *325* (NY, US, W), *492* (G); Pulney hills, *unknown collector s. n.* (K, NY, UC); Pyapali, Kurnool distr., *Gamble 16493* (CAL); Salem distr., *Krishnan s. n.* (K); Taliparamba, Malabar distr., *Anstead 108* (A), *Barber 7728* (CAL); Tambracherighaut, *unknown collector 5693* (CAL); Tellicherry, *Vaid & Nautiyal 23336* (SING); Tuticorin, *Wright s. n.* (SING); Vizagatan, *Campbell s. n.* (E, G, UC). MYSORE: Maisor & Carnatic, *Thomson s. n.* (BM, CAL, F, G, GH, K, UPS, W); Shimoga, *Barber 7014* (CAL). RAJASTHAN: Abu, Barton Grove s. n. (CAL), *King s. n.* (CAL). TRAVANCORE-COCHIN: Puthanapuram, *Calder 1497* (CAL); without precise locality, *Rama Rao 2099* (CAL). INDIA: without precise locality, *Anglade 1819* (CAL), *Banks s. n.* (W), *Campbell s. n.* (G), *Courtallum 536* (E), *537* (NY), *538* (E), s. n. (BRI), *Hugel 1352* (W), *King s. n.* (CAL), *Ritchie 1117* (E), *Roxburgh, s. n.* (E, G, K), *Russell s. n.* (W), *Wallich n. 1625 a* (G), *1625 B* (L, W), *Wright s. n.* (W).

5b. *WRIGHTIA TINCTORIA* ssp. **ROTHII** (G. Don) P.t. Ngan, stat. nov.

*Wrightia rothii* G. Don, Gen. Syst. GARD. BOT. **4**: 86. 1838, ex char.

*Wrightia tinctoria* var. *rothii* (G. Don) Hook. f., Fl. Brit. Ind. **3**: 653. 1882.

INDIA. AJMER: Ajmer, *Brandis s. n.* (CAL, K). BIHAR: Magadha, *unknown collector* 728 (E); Monghyr hills near Jamalpur, *Kurz s. n.* (BM, CAL); Pokhuria, Manbhum, *Campbell* 9284 (E); Rocky hills, Pathra forest, Gaya, *Haines* 4272 (K). BOMBAY: Badami, Bijapur distr., *Talbot* 2773 (CAL). HYDERABAD: Manal, *Edwards* 23 (K); without precise locality, *Campbell s. n.* (E, G). MADHYA BHARAT: Gwalior, *Maries s. n.* (CAL). MADHYA PRADESH: Akola distr., *Watt* 15 (E); Saugor, *Witt* 24 (A); *Misra* 51 (SING); Wamanpatti, south of Chanda, *Haines* 2424 (K); exact locality unknown, *Hole* 95 (CAL). MADRAS: Adatigala, Yellavarani division, Godavari distr., *Ramaswami* 1691 (CAL); Kadimakonda, Godavari distr., *Bourne* 3571 (CAL, K); Kondapalli hill, Kistna distr., *Barber* 8131 (CAL); Pyapalli, Kurnool distr., *Gamble* 10974 (K), *Barber* 8095 (CAL). ORISSA: Sonabear plateau, Sambalpur, on barren, very compact sandstone, *Mooney* 3290 (K, NY); Montijharan hill, Sambalpur, frequent along the crest of sharp, quartz-schist ridges, *Mooney* 3751 (A, K, NY). PUNJAB: Karnal, *Drummond* 25519 (E, G, UC); without precise locality, *Drummond* 25517 (E, G, K, UC), 25520 (E). RAJASTHAN: Abu, *King* 1115 (E); Abu, Sansevarra *unknown collector s. n.* (CAL); without precise locality, *Duthie* 4736 (MICH). UTTAR PRADESH: Banda, *Bell* 310 (CAL); Delhi ridge, *Maheshwari s. n.* (G), *Stewart* 7656 (A, NY); Manikpur, *Dudgeon & Kenoyer s. n.* (MO). VINDHYA PRADESH: Chhatarpur, *Meebold* 2964 (G). INDIA: without precise locality, *Kabir* 15184 (CAL), *King s. n.* (CAL), *Tamesion s. n.* (E), *unknown collector* 2246 (E).

*Wrightia tinctoria* has been reported from Ceylon and as far east as Timor. Trimen (Jour. Bot. **23**: 238. 1885) pointed out that this species has not been found wild in Ceylon. As for Timor, I have seen specimens from this area identified as *W. tinctoria*, probably by Decaisne; they actually represent glabrous specimens of *W. pubescens* ssp. *pubescens*. Furthermore there is no difference between *W. tinctoria* ssp. *tinctoria* and *W. timorensis*, which was based on specimens referred to *W. antidysenterica* by Decaisne (Nouv. Ann. Mus. Hist. Nat. **3**: 379. 1834) and found in Timor to judge from the label. By virtue of the geographical disjunction I suspect an error in the locality data of these specimens.

Finally I interpret the 2 populations of *W. tinctoria* as allopatric subspecies because of the presence of intermediate specimens found at the commissure of their natural distributions. This suggests hybridization between the 2 subspecies.

6. *WRIGHTIA KWANGTUNGENSIS* Tsiang, *Sunyatsenia* **6**: 118. 1941. ex ic. & char. (T.: Wang 23555).

Shrubs up to 3 m. high; branchlets terete, gray to brownish, the bark striate and conspicuously lenticellate. Leaves elliptic to subobovate, acuminate to abruptly acuminate at the apex, acute at the base, 8-12 cm. long, 3.5-5.0 cm. broad, membranaceous, puberulent along the veins beneath, otherwise glabrescent, the midrib canaliculate above, prominent beneath, the secondary veins 8-10 pairs, arcuate; petiole 0.3-0.4 cm. long, minutely puberulent to glabrous. Inflorescence terminal, aggregate dichasial, half as long as the subtending leaves; peduncle about 0.8 cm. long, the bracts linear, about 1.5 cm. long; pedicels about 1 cm. long, puberulent. Flowers yellow, relatively large, about 2 cm. long; calyx lobes ovate, acute, about 2 mm. long, puberulent without, bearing within 5 broadly ovate, serrulate squa-

mellae about half as long as the lobes; corolla subrotate, the tube campanulate, relatively stout, about 4.5 mm. long, the lobes elliptic-obovate, about 15 mm. long, minutely puberulent-papillate; corona glabrous within, the antepetalous segments laciniate, strongly adnate to the corolla lobes, about 6 mm. long, the alternipetalous bifid, as long as the antepetalous, the alternating supplementary segments solitary and simple, about 3 mm. long; stamens 5, inserted at the orifice of the corolla tube, about 7 mm. long, the anthers densely puberulent, the acumen barbate, the filament definitely longer than the basal anther lobes; carpels 2, coherent, glabrous, the style gradually dilated near the subcapitate stigma. Follicles not seen.

Southern China and adjacent Vietnam, in shrubby savannas; flowering in May-June.

VIETNAM. Dachong, Sontay province, in savannas, *Pételot* 5998 (A, NY).

*Wrightia kwantungensis* must be a rather rare species, to judge from the meagre herbarium representation. I have not seen the type but the description and illustrations of Tsiang match perfectly the specimen collected by Pételot in Vietnam. This species can be mistaken for the widespread *W. laevis* from which it differs in the size of the flowers, the laciniate corona segments and the coherent carpels.

7. **WRIGHTIA PUBERULA** (Thwaites) P.t. Ngan, stat. nov.

*Wrightia rothii* G. Don var. *puberula* Thwaites, Enum. Plant. Zeyl. 193. 1863. (T.: C. P. 1837, *Gardner s. n.*!).

Shrubs or small trees, the branchlets relatively slender, gray to pale brown, the current year's growth puberulent. Leaves narrowly elliptic to ovate, the apex acuminate to obtusely acute, the base cuneate, 8-12 cm. long, 2.5-3.5 cm. broad, membranaceous, sparsely puberulent on both surfaces, the midrib immersed above, prominent beneath, the secondary veins 10-12 pairs, arcuate towards the margins; petiole about 0.7 cm. long, puberulent. Inflorescence terminal, aggregate dichasial, relatively few-flowered, about half the length of the subtending leaves; peduncle rather slender, up to 1 cm. long, the bracts foliaceous, about 1 cm. long, very sparsely puberulent; pedicels about 1.5 cm. long, puberulent. Flowers moderately slender; calyx lobes ovate to broadly ovate, about 3.5 mm. long, minutely puberulent without, bearing within 5 ovate-deltoid squamellae shorter than the lobes; corolla subrotate, the tube cylindrical about 3.5 mm. long, the lobes narrowly oblong-elliptic, about 13 mm. long, puberulent-papillate; corona laciniate, a little shorter than the stamens, the antepetalous segments strongly adnate to the corolla lobes, the alternipetalous relatively broad, bifid to laciniate, as long as the antepetalous; stamens 5, inserted at the orifice of the corolla tube, the anthers very sparsely puberulent within, puberulent without, the acumen barbate, the filament glabrous, longer than the attenuate, basal anther lobes; carpels 2, free, glabrous, the style slender, dilated near the subcapitate stigma. Follicles not seen.

Endemic to Ceylon.

CEYLON. CENTRAL PROVINCE: Dambulla, C.P. 1837 *Gardner s. n.* (BM, G, K, W).



Thwaites, in describing Gardner's specimen, recognized it as a variety of *W. rothii* which, in turn, has been regarded as a variety of *W. tinctoria* by other authors who treated Gardner's collection the same. Although the 2 are superficially alike, *W. puberula* can be distinguished from *W. tinctoria* ssp. *rothii* on the basis of many reliable characters: absence of alternating supplementary segments, alternipetalous segments as long as the antepetalous, calycine squamellae ovate-deltoid, leaves sparsely puberulent throughout.

8. *WRIGHTIA SIKKIMENSIS* Gamble, Kew Bull. **1908**: 447. 1908. (T.: *Gamble 574!*).

*Wrightia schlechteri* Léveillé, Repert. Sp. Nov. 11: 67. 1912 (T.: *Esquirol 111!*).

*Wrightia stellata* Pitard, Lecomte & Humbert, Fl. Gén. Indo-Chine **3**: 1186. 1933. (T.: *Bon s. n.*, photo. MO!).

*Wrightia annamensis* Eberh. & Duby, var. *coronata* Pitard in Lecomte & Humbert, *loc. cit.* 1192. 1933. (T.: *Eberhardt 1513*, photo. MO!).

Climbing shrubs or small trees, up to 10 m. high; branchlets slender, gray to brownish, the current year's growth glabrous to minutely puberulent. Leaves elliptic to oblong or ovate, occasionally obovate, the apex acute to long-acuminate, the base cuneate, 8-15 cm. long, 3-6 cm. broad, membranaceous to chartaceous, very minutely puberulent above, glabrous beneath except along the veins, occasionally glabrous or densely puberulent throughout, the secondary veins 9-12 pairs, oblique and curved towards the apex; petiole about 0.5 cm. long, minutely puberulent. Inflorescence terminal, aggregate dichasial, shorter than the subtending leaves; peduncle relatively long, 1.5-3.0 cm. long, minutely puberulent, the bracts linear-ovate; pedicels about 1 cm. long. Flowers dull yellow to red; calyx lobes ovate, about 2.5 mm. long, puberulent and ciliate, bearing within 5 alternate, ovate and serrulate squamellae; corolla subrotate, the tube about 2.5 mm. long, the lobes narrowly obovate, occasionally obovate, acute 12-14 mm. long, puberulent-papillate; corona glabrous within, the antepetalous segments subobovate, subentire, about 6 mm. long, the alternipetalous entire or bifid, about 2.5 mm. long; stamens 5, inserted at the orifice of the corolla tube, the anthers puberulent, the acumen barbate, the filament relatively slender, about 1 mm. long; carpels 2, free, glabrous, about 1.5 mm. long, the style slender, about 4 mm. long, gradually dilated near the subcapitate stigma. Follicles 2, free, terete-fusiform, 25-30 cm. long, conspicuously lenticellate; seeds linear, about 2 mm. long, the yellowish coma about 4 mm. long.

Northeastern India, southern China and northern Vietnam; at altitudes up to 1500 m.; flowers in April-May, follicles from June to September.

CHINA. KWANGSI: Bako Shan, west of Poshe, in woods, *Ching 7574*, (A, NY, UC, US); Ling Yun, in light woods, *Lau 28572* (A), *Steward & Cheo 515* (A, G, NY); Pan Shan, Ching Sai, in woods by hill, *Ko 55755* (A). KWEICHOW: Bua Li, Cheng feng, in light woods, *Teng 91019* (A); La jong River, *Esquirol 111* (A, E); Lathong Wood, *Esquirol 3723* (E).

INDIA. N. W. BENGAL: Darjeeling, Chunbati, *Gamble 574* (CAL, K), *3210* (CAL, K); below Kurseong, *Brandis s. n.* (K, NY); Panchkilla, *Clarke 26537* (US); Punkabari, *Clarke 35496B* (BM). EAST HIMALAYA: exact locality unknown, *Biswas 3716* (A), *Modde 377K* (CAL). SIKKIM: without precise locality, *King 306* (CAL), *s. n.* (CAL), *unknown collector s. n.* (CAL).

The type specimen of *W. schlechteri* seems to have larger leaves, more or less chartaceous, the inflorescence relatively few-flowered and the flowers dull yellow. However these characters are within the range of the species and the floral structures of the 2 species are similar. Hence I am considering *W. schlechteri* as synonymous with *W. sikkimensis*.

I have not seen the type of *W. stellata* but the photograph and description show clearly its identity with *W. sikkimensis*. As for *W. annamensis* var. *coronata*, the stamens are obviously inserted at the orifice of the corolla tube and the detailed hand-notes on the photograph relate it to *W. sikkimensis*. Therefore I am tentatively including this variety under *W. sikkimensis*.

*Wrightia sikkimensis* appears to hybridize with other species growing within the same range. The puberulent leaves, the foliaceous bracts and the unusually large and dentate corona segments observed on specimens collected in India (*Biswas 3716, Modde 377K*) suggest possible hybridization with *W. tomentosa*.

9. WRIGHTIA TOMENTOSA (Roxb.) R. & S. Syst. Veg. ed. nov., 4: 414. 1819, ex char.

Deciduous trees up to 20 m. high, without buttresses; branchlets gray to brownish, puberulent and lenticellate. Leaves elliptic to broadly elliptic or ovate, broadly ovate to obovate and broadly obovate, the apex acuminate to caudate-acuminate, the base acute, 7-18 cm. long, 3-8 cm. broad, membranaceous, densely puberulent beneath, puberulent to glabrescent above, the midrib immersed above, prominent beneath, the secondary veins 10-15 pairs, arcuate towards the apex; petiole 0.3-0.8 cm. long, densely puberulent. Inflorescence terminal, aggregate dichasial, few- to many-flowered, half to as long as the subtending leaves; peduncle 0.5-2.0 cm. long, puberulent, the bracts usually foliaceous, pubescent; pedicels 1.0-1.5 cm. long, puberulent. Flowers pale yellowish, pinkish or reddish, malodorous; calyx lobes ovate to broadly ovate, about 3 mm. long, puberulent, bearing within 5 ovate, serrulate squamellae, half to as long as the lobes; corolla subrotate, the tube 3-7 mm. long, glabrous, the lobes narrowly elliptic to obovate, 8-16 mm. long, puberulent-papillate; corona dull orange to purple, usually shorter than the stamens, glabrous within, the antepetalous segments crenulate to dentate, relatively broad, occasionally overlapping the alternipetalous, half their length adnate to the corolla lobes, the alternipetalous bifid, relatively broad, about as long as the antepetalous; stamens 5, inserted at the orifice of the corolla tube, the anthers sparsely puberulent to glabrous within, pubescent to minutely puberulent without, the acumen barbate, the filament relatively stout; carpels 2, coherent, about 1.5 mm. long, glabrous, the style columnar, gradually dilated near the subcapitate stigma. Follicles 2, coherent, broadly fusiform, stoutly apiculate, densely and conspicuously lenticellate, 17-35 cm. long; seeds linear-fusiform, about 1.5 cm. long, the white coma about 3.5 cm. long.

India, Ceylon, Burma, Thailand and adjacent China; in deciduous forests, mixed forests, thickets up to 1650 m. in altitude, along streams and on sandy or rocky soil; flowering from April to July, follicles from September to March.

Vernacular names: *Let-thoke* (Burma—Pokhant); *Atkura* (India—unknown collector); *Dudhi* (India—Katakya); *Chuang pa* (Thailand—Kasin); *Mok-man* (Thailand—Kokkamhaeng); *Muk Noi* (Thailand—Kerr).

## KEY TO THE SUBSPECIES

- a. Inflorescence many-flowered, lax; corona segments merely coherent at the base; corolla tube subcylindrical, more or less constricted at the orifice. Plants of India, Burma, Thailand and adjacent China. ....9a. *W. TOMENTOSA* SSP. *TOMENTOSA*  
 aa. Inflorescence few-flowered, condensed; corona segments coherent around the stamens; corolla tube campanulate. Plants of Ceylon. ....9b. *W. TOMENTOSA* SSP. *PAUCIFLORA*

9a. *WRIGHTIA TOMENTOSA* SSP. *TOMENTOSA*

*Nerium tomentosum* Roxb., Hort. Beng. 6. 1814, nom. nud.; Fl. Ind., ed. Carey & Wall 2: 6. 1824, ex char.

*Hunteria eugeniaefolia* Wall., Cat. n. 1615. 1828, fide Ind. Kew.

*Wrightia coraia* Wall., Cat. n. 1615. 1828, fide Ind. Kew.

*Wrightia hamiltoniana* Wall., Cat. n. 4461. 1828, fide Ind. Kew.

*Wrightia mollissima* Wall., Plant. Asiat. Rar. 2: 39. 1831. (T.: Wallich Cat. n. 1627!).

*Chonemorpha vestita* G. Don, Gen. Syst. 4: 76. 1836, fide Ind. Kew.

*Nerium coraia* Buch.-Ham. ex A. DC. in DC., Prodr. 8: 407. 1844, ex char.

*Wrightia tomentosa* var. *roxburghii* A. DC., loc. cit. 405. 1844, ex char.

*Wrightia wallichii* A. DC. loc. cit. 1844. (T.: Wallich Cat. n. 1628!).

BURMA. Chin hill, *Shaik Mokim* 456 (G); Hlegu forest, *Myanh s. n.* (EA); Insein distr., Myaukhlaing reserve, *Po Khant* 248 (A); Kachin hills, *Shaik Mokim s. n.* (A, CAL); Keng Tung, *McGregor* 719 (E); Mandalay, *Meebold* 2988 (G); near Maymyo, *Fatteh Din* 6202 (CAL, E), *Mg Kan* 599 (CAL); Meiktila distr., in Taunggyigon reserve, *Tha Myaing* 283 (E); Mindat, in thickets and forests on steep sunny slopes where forest is burnt, *Kingdon-Ward* 22190 (BM), 22312 (BM); Myaungmya, *Dickason* 6931 (A); Pegu, *Kurz* 2367 (K); Rangoon, *Dickason* 5668 (A); Shan hill, *Collett* 801 (CAL, K); Takaw, *Kingdon-Ward* 12762 (BM, E); Taunggyi, *Dickason* 9320 (A); Tenasserim: Koung gee, *Gallatly* 873 (CAL), Moulmein, *Falconer s. n.* (L), Pagaye, *Meebold* 15013 (CAL), Taepo, *Gallatly* 716 (CAL); Yamethin, *Rogers* 566 (CAL, E). PRECISE LOCALITY UNKNOWN: *Shaik Mokim* 76 (CAL, G), 828 (UPS).

CHINA. KWANGSI: Bako Shan, W. Poseh, in open woods, *Ching* 7672 (W). KWEICHOW: Lohu, *Tsiang* 7270 (NY), 7277 (W). YUNNAN: Che li hsien, Dah meng lung, in mixed woods, *Wang* 77612 (A); Che li hsien, Sheau meng yeang, in woods, *Wang* 75731 (A, UPS), 79618 (A); Chen kang hsien, along road side, *Wang* 72139 (A); Fo Hai, in thickets, *Wang* 74670 (A); between Muang Hai & Keng Hung, on bank of Nam Ha, *Rock* 2483 (A, US).

INDIA. ANDAMAN: Middle Andaman, *Parkinson* 23 (K). ASSAM: Hathegain, *Chatterjee s. n.* (G, L); Silghat, Nowgong, *Prain s. n.* (A, CAL); without precise locality, *Herb. Hamilton* 730 (E), *Jenkins s. n.* (E, L), *Simons s. n.* (CAL). BENGAL: Alipur, *Lancaster s. n.* (CAL); Darjeeling, *Clarke* 26537C (US), *Cowan s. n.* (E, US); Lalltung, *Biswas* 6453 (A); N. Bengal, *Kurz s. n.* (CAL); Parganas distr., Gopikandar to Katikund, *Lace s. n.* (E); Siliguri, *Clarke* 11675 (BM, CAL); precise locality unknown, *Kurz s. n.* (CAL). BHUTAN: Dang ma chu valley, *Cooper* 4696 (BM); Kuruchu valley, *Cooper* 4499 (BM); Singbhum, *Haines* 672 (CAL, K). BIHAR: Baragaon, *Wood s. n.* (CAL, K); Chota Nagpur div., Palamau distr., *Gamble* 8798 (CAL, K); Monghyr, *Lockwood s. n.* (K); without precise locality: *Hooker s. n.* (BM, CAL, G, GH, L, W). BOMBAY: Canara, *Ritchie* 1118 (E); Concan, *Stocks*, *Law s. n.* (BM, BRI, CAL, E, G, GH, K, L, NY, UPS, W); Dharwar, *Dudgeon & Kenoyer* 352 (MO, PH), *Sedgwick* 3950 (A); North Thana div., *Gleadow s. n.* (E); S. Gujarat, Pimpri, *Bell* 5455 (K); precise locality unknown, *Dalzell s. n.* (K), *Gibson s. n.* (E, NY), *Talbot* 5 (CAL). HIMACHAL PRADESH: Simor distr., *Drummond* 20633 (E, K). MADHYA PRADESH: *Chutia Nagpur*, *Campbell* 9158 (E), 9221 (E); Melghat, *Witt* 8026 (A). MADHYA BHARAT: Nimar distr., Punasu reserve, *Witt* 1040 (A). MADRAS:

Coimbatore distr., Kallar, *Fischer* 2059 (CAL); Godavari distr, Rampar, in dry deciduous forest, *Narayanaswami* 622 (CAL); Kurnool, *Beddome* 5122 (BM); Mamboli valley, Anaimalai hills, *Fischer* 3359 (CAL); Nilgiris distr. Burliar, *Gamble* 11359 (CAL, K); without precise locality, *Bourne* 2738 (K), 2739 (K), *Jeffrey* s. n. (E), *Ramaswami* 314 (CAL), 322 (CAL). MYSORE: Kumsi, Shimoga distr., *Meebold* 8490 (CAL). NEPAL: Baglung, Kaligandaki River, on slope above river, *Stainton*, *Sykes & Williams* 2745 (BM, E, UPS), 7006 (BM, E, UPS). PUNJAB: Dalhousie road, *Stewart* 993 (NY, PH); Kangra distr., *Chowdri Ram* 420 (E); Karnal, *Drummond* 25604 (E, G, K, UC); Sutlej valley, *Cooper* 5002 (E). ORISSA: near Labangi, Angul distr., *Lace* 2567 (E). SIKKIM: without precise locality, *Hooker* s. n. (BRI, K, NY, W), *King* 70 (CAL), s. n. (CAL). *Kurz* s. n. (CAL). SIKKIM HIMALAYA: Pankabari, *Cave* s. n. (E), *Clarke* 26817 (CAL), *Gamble* 3211 A (K), 3212 A (K), 3212 B (CAL), 3213 A (CAL), *Lister* s. n. (BM, CAL, NY). TRAVANCORE-COCHIN: Mundakhayam, *Bourdillon* 201 (CAL). UTTAR PRADESH: The Bhabar, Kumaon, *Strachey & Winterbottom* s. n. (CAL, GH, K); Dehra Dun, *Forster* 70 (CAL), *King* s. n. (CAL), *McKinnon* s. n. (CAL), *Raizada* s. n. (NY), *Sahai* 97 (NY); Ghorawal Bhabar, *King* s. n. (CAL); Gonda distr., *Inayat* 23713 (CAL); Kathgodam, *Meebold* 2982 (G), *Poovaiah* s. n. (UC); Kumaon, *Hobart-Hampden* 6 (E); Rajpur, near Dehra Dun, *Kataky* s. n. (NY); Saharanpur, *Gollan* s. n. (CAL); Singhighora Tarai, *Cave* s. n. (E); Terai, Gorakhpur distr. *Kurz* s. n. (CAL). PRECISE LOCALITY UNKNOWN: *Bell* 6086 (CAL), *Brandis* 1513 (CAL), *Clarke* 43114B (G), *Cleghorn* s. n. (CAL), *Cousins* 2 (CAL), *Edgeworth* s. n. (K), *Gopal Nath* 68 (UC), *Hugel* 2847 (W), *Parish* 1038 (K), *Parmeshwari Das* s. n. (W), *Roxburgh* 254 (G), s. n. (E), *Russell* s. n. (W), *Stewart* s. n. (E), *Thomson* 989 (BM), 1312 (BM), *Wallich* Cat. n. 1626a (G, PH), 1627 (W), 1627C (BM, SING), 1628C (L), *unknown collector* s. n. (E).

THAILAND. MAHARAT: Mae huad forest, Lampang, in mixed deciduous forest, *Kokkamhaeng* 2514 (A, US); Me Tan, in mixed jungle, *Kerr* 2564 (BM, E); Muang Pua, in deciduous jungle, *Kerr* 5013 (BM, E, K). NAKAWN SAWAN: Meh Ping, Raheng, in deciduous jungle, *Winit* 234 (BM, K). PAYAP: Chieng Mai, in dry mixed forest, *Kerr* 5404 (BM); Meh Lee, Lampun, *Winit* 235 (BM, K). RACHABURI: Brangkasi, about 100 km. S. of Wang Ka, in mixed forest along the river on sandy loam soil, *Kostermans* 1462 (A, L); Hindato, 160 km. N. W. of Kanburi, in dry mixed forest on either gravel-like soil or rocks, *Kostermans* 1362 (A); Wang Ka, on sandy soil, *Kasin* 159 (A, BRI, G, L, SING); near Wang Ka, in secondary forest on low mountain ridge with much big bamboo, *Bloembergen* 22 (A, BRI, G, K, L, SING).

9b. *WRIGHTIA TOMENTOSA* ssp. **pauciflora** P.t.Ngan, ssp. nov. A ssp. *tomentosa* inflorescentiis paucifloris et coronae squamis coherentibus differt.

CEYLON: WITHOUT PRECISE LOCALITY, *C. P.* 2691 (BM, CAL, G, HOLOTYPE, W.); *Walker* s. n. (G, K).

*Wrightia tomentosa* is easily distinguished from the related species by the malodorous flowers, the corona shorter than the stamens, the antepetalous segments adnate about half their length to the corolla lobes and relatively broad, sometimes overlapping the alternipetalous. Some odd collections (type of *W. wallichii*) may have relatively short alternating supplementary corona segments and this feature has been shown clearly in Wight's illustration (Ic. Pl. Ind. Or. 4: pl. 1296 1850). At first I attempted without success to maintain these specimens as a distinct species upon other morphological characters. However, except for the feature mentioned above, these plants possess all of the attributes of *W. tomentosa* and since there is no geographical demarcation with the remainder of the population, I believe that they cannot be recognized even as subspecies.

Although *W. tomentosa* is relatively widely distributed from western India to Thailand and adjacent China, there is no appreciable variation in the morphological characters which might be correlated with the geographical distribution except the population in Ceylon that I am treating as a distinct subspecies. The

latter, with the few-flowered inflorescences and the coherent corona segments, might be set apart as a species when additional material is available for study.

10. *WRIGHTIA PUBESCENS* R. Br., Mem. Wern. Soc. **1**: 73. 1811. (T.: *Brown* 2861, photo. MO!).

Trees up to 35 m. high, the trunk columnar, without buttresses; branchlets terete, gray to dark brown, glabrous to densely puberulent when immature. Leaves narrowly ovate, ovate to elliptic or oblong-ovate, occasionally obovate, the apex acuminate to abruptly caudate-acuminate, the base acute to obtuse, 5-15 cm. long, 2.0-6.5 cm. broad, membranaceous to subchartaceous, glabrous except upon the veins beneath to densely puberulent or glabrescent above, the midrib canaliculate above, prominent beneath, the secondary veins 8-15 pairs, arcuate toward the apex; petiole 0.4-0.8 cm. long, puberulent. Inflorescence terminal, aggregate dichasial, many-flowered, rarely few-flowered, half to as long as the subtending leaves; peduncle 0.5-1.5 cm. long, puberulent, the bracts tiny and scarious to relatively large and foliaceous; pedicels about 1 cm. long, puberulent. Flowers white, cream, yellow to pink, orange or dark red, fragrant; calyx lobes broadly ovate to ovate, acute to obtuse, 2-5 mm. long, glabrous to densely puberulent without, bearing within 5 ovate, acute to serrulate squamellae about half up to as long as the lobes; corolla subrotate, very rarely infundibuliform, the tube subcylindrical to campanulate but usually constricted at the orifice, sometimes provided with a callous faucal annulus, 5.0-6.5 mm. long, the lobes narrowly obovate to obovate, acute to obtuse, 10-20 mm. long, puberulent-papillate; corona usually about as long as the stamens, glabrous to puberulent within, the segments free from each other or coherent at the base, the antepetalous dentate, crenulate, bifid or subentire, relatively broad, usually medially adnate to the corolla lobe, the alternipetalous much shorter to almost as long as the antepetalous, subentire to bifid; stamens 5, inserted at the orifice of the corolla tube, very rarely below, the anthers exerted, very rarely included, puberulent, the acumen barbate, the filament relatively broad, longer than the basal anther lobes; carpels 2, coherent, glabrous, the style gradually dilated near the subcapitate stigma. Follicles 2, coherent, 15-30 cm. long, finely striate, obscurely to conspicuously lenticellate; seeds linear-fusiform, yellowish to gray, about 1 cm. long, the white coma about 3.5 cm. long.

Widely distributed from southern China to northeastern Australia through Ceylon, Thailand, Indochina, Indonesia, and Philippines and the Solomon Islands; in evergreen and deciduous forests and thickets; flowering mostly from April to September, fruiting from August to February.

Vernacular names: *Cherite* (Australia—Bailey); *Foo yung shue* (China—Lei); *To tiu Pat* (China—McClure); *Ue tsueng shue* (China—Tsang); *Yu chang* (China—Lau); *Muntow* (Malay—Curtis); *Anaotung* (Philippines—Balintay); *Lanete* (Philippines—Lambert & Brunson); *Manlagosi* (Philippines—Zaldua); *Mok* (Thailand—Kerr); *la moc* (Vietnam—Pierre).

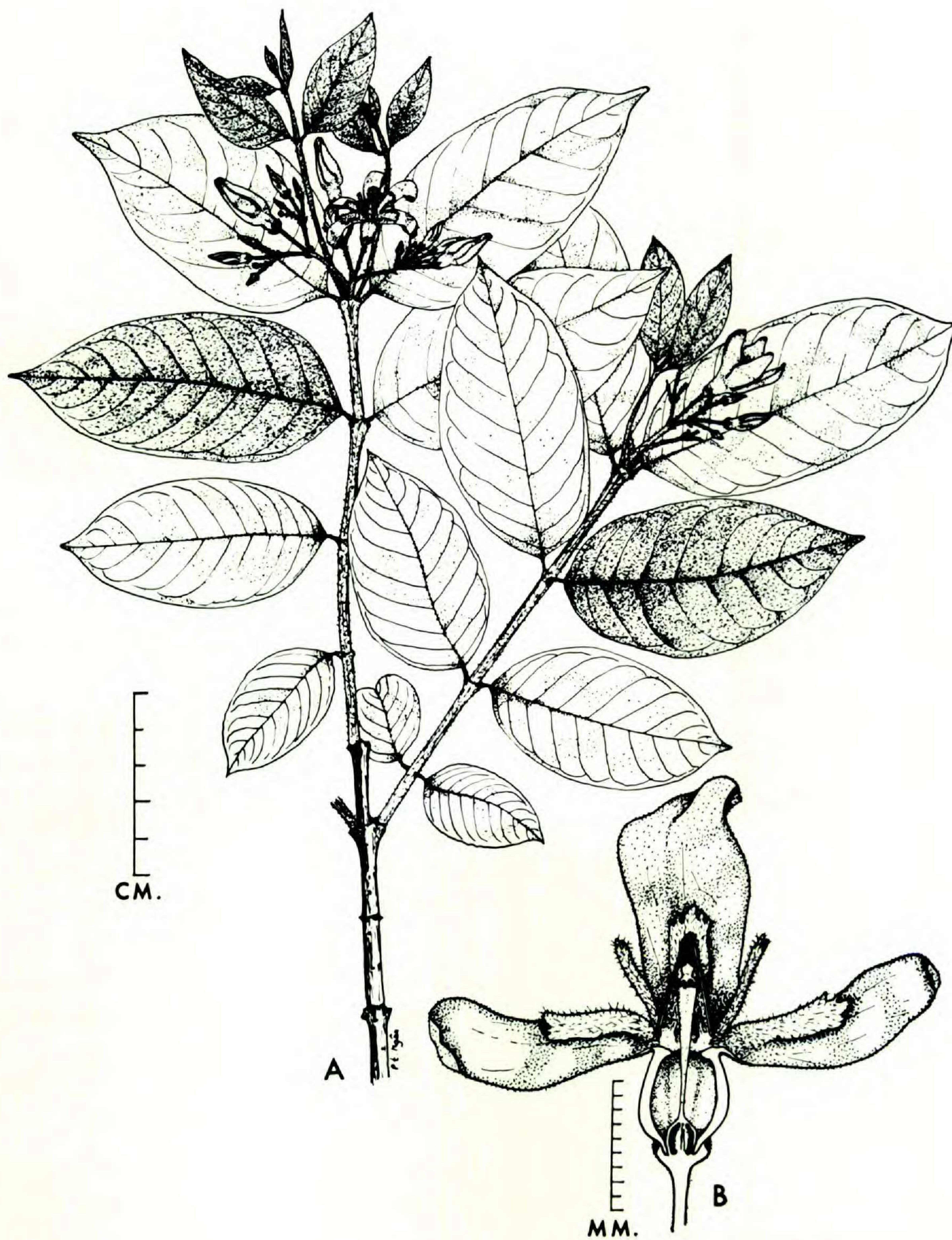


Fig. 9. *Wrightia pubescens* R. Br. ssp. *laniti* (Blco.) P. t. Ngan; A, twig with inflorescences; B, longisection of the flower.

## KEY TO THE SUBSPECIES

- a. Calyx  $\frac{2}{3}$  to as long as the corolla tube, the lobes acute to obtuse, 3.5-5.5 mm. long.
- b. Antepetalous corona segments dentate, puberulent to glabrous within; calyx about the length of the corolla tube. Plants of Indonesia, New Guinea and northwestern Australia. ....10a. *W. PUBESCENS* SSP. *PUBESCENS*
- bb. Antepetalous corona segments subentire, crenulate, rarely dentate, glabrous within; calyx  $\frac{2}{3}$  to as long as the corolla tube. Plants of the Philippines. ....10b. *W. PUBESCENS* SSP. *CANDOLLEI*
- aa. Calyx  $\frac{1}{4}$  to half as long as the corolla tube, the lobes acute, about 2.5 mm. long.
- c. Corona segments subentire, the alternipetalous much shorter than the antepetalous, sometimes inconspicuous. Plants of New Britain. ....10c. *W. PUBESCENS* SSP. *NOVOBRITANNICA*
- cc. Corona segments dentate to crenulate, the alternipetalous  $\frac{2}{3}$  to about as long as the antepetalous.
- d. Corona glabrous within; leaves glabrous, occasionally puberulent. Plants of northeastern Australia .....10d. *W. PUBESCENS* SSP. *PENICILLATA*
- dd. Corona puberulent within; leaves densely puberulent to glabrescent above. Plants of Burma, Ceylon, China, Thailand, Indochina, Malaya, The Philippines and western Java. ....10e. *W. PUBESCENS* SSP. *LANITI*

10a. *WRIGHTIA PUBESCENS* SSP. *PUBESCENS*

*Nerium macrocarpum* Span., *Linnaea* **15**: 325. 1841, nom. nud.

*Nerium jaspideum* Span., *loc. cit.* 1841, nom. nud.

*Nerium multiflora* Zipp. ex Span., *loc. cit.* 1841, nom. nud.

*Wrightia spanogheana* Miq., *Fl. Ind. Bat.* **2**: 434. 1856. (T.: *Spanoghe s. n.*!).

*Wrightia calycina* A. DC. in DC., *Prodr.* **8**: 406. 1834. (T.: *unknown collector in Herb. Mus. Paris 1876!*).

AUSTRALIA. NORTHERN TERRITORY: Bradshaw Creek, *Blake 17295*, Daly River, *Blake 16631* (BRI), *Campbell s. n.* (NSW); Darwin, in monsoon forest on top of sea cliff, *Blake 17327* (BRI); East Point, Darwin, *McKee 8295* (CANB, NSW); Nightcliff, Darwin, in monsoon forest on truncated lateric podsol, *Chippendale 7872* (CANB, NSW), *Spetch 156* (BRI, CANB); Port Darwin, *Holtze 347* (MEL), *629* (MEL); Port Essington, *Armstrong s. n.* (NSW); North of lake Finnis, in monsoon forest on grey lateric soil, *Blake 17015* (BRI); Fitzmaurice River, *Mueller s. n.* (MEL); Oenpelli, at foot of sandstone hill, *Spetch 1168* (CANB, L, MEL, NSW, US); without precise locality, *Holtze 1198* (BRI, MEL).

INDONESIA. ALOR: G. Kojakojo, Kampong Naumang, *Jaag 1084* (BM, L.). BALI: Prapat Agung, *Becking 45* (L), *Kostermans, Kuswata, Soengeng & Soepadmo 10* (L). CELEBES: Bikeru Balang, *Warburg 16325* (A); Kandari, *F. R. I. bb. 24979* (L); Lapankanrae, *Noerkas 251* (L); Manado, *F. R. I. bb. 15045* (L); Moena, Wasalangka, *F. R. I. bb. 21611* (A, L); Saleier, *Teysmann 13602* (L), *F. R. I. bb. 24109* (L.). JAVA: EAST JAVA: Bangil, *Backer 7571* (L); Banjuwangi, *Koorders 38905 $\beta$*  (L); Bondowoso, *Backer 9529* (L), *F. R. I. Ja. 2811* (A, L); Kediri, *Coert 152* (L); Madura Island, near Sumenep, *Zollinger 3824* (W); Probolinggo—G. Tengger (Bromo), *Kuntze 5959* (NY); Puger, *Koorders 199 $\beta$*  (L); Surabaya, *Backer 26577* (L); without precise locality, *de Vriese & Teijsmann s. n.* (L), *Zollinger 1228* (W). CENTRAL JAVA: Surakarta, *Horsfield s. n.* (BM, GH, K). LETI ISLANDS: Moe, Lakor, *Riedel s. n.* (K). LOMBOK: Sadjang, *Elbert 742* (L). N. MOLUCCAS: Tidore, *de Vriese s. n.* (L). SUMBA: 7 km. from Waingapu, *Jaag 21a* (L). SUMBAWA: Bima, *Elbert 3650* (L), *3898* (L, SING), *Warburg 17189* (E). TANIMBAR ISLANDS (TIMOR LAUT): Jamdena, Saumlaki, in abandoned field, *Borssum W3122* (L); Jamdena, Olilit near Saumlaki, on open grounds, *Pleyte 27* (L); without precise locality, *Meyer s. n.* (K), *Pereira, s. n.* (SING). TIMOR: Baucau, *Van Steenis 18029* (BM, CANB, L); Nipol, *Walsh-Held 230* (BM); Obe Naih, in savanna, *Bloembergen 3346* (L); without precise locality, *Spanoghe s. n.* (L), *Zippelius s. n.* (L), *unknown collector in Herb. Mus. Paris 1876* (K), *unknown collector 61* (L), *s. n.* (G, L,

NY). WETAB: Tara, in Eucalyptus forest, *Bloembergen*, 3743 (CANB, L). WEST IRIAN (WEST NEW GUINEA): *Merauke*, *Branderhorst* 284 (K, L), *Versteeg* 1912 (L); *Okaba*, *Branderhorst* 144 (L).

10b. WRIGHTIA PUBESCENS ssp. **candollei** (Vidal) P.t.Ngan, stat. nov.

*Wrightia candollei* Vidal, *Phan. Cuming. Philipp.* 186. 1885. (T.: *Cuming* 1453!).

PHILIPPINES. BILIRAN: without precise locality, *Bur. Sci.* 18579, *McGregor* (A, BM, US). BOHOL: Bihar, thicket forest, *Bur. Sci.* 42712, *Ramos* (A, UC, US). CAMOTES ISLANDS: *Bur. Sci.* 41607, *Ramos* (A, L, US). CEBU: *For. Bur.* 27331, *Lopez & Reyes* (A, BM, L). GUIMARAS ISLANDS: *For. Bur.* 228, *Gammill* (K, US). LUZON: Albay Prov., *Cuming* 1293 (BM, K, W). Bataan Prov., Olongapo Naval reservation *Bartlett* 14074 (A, MICH). Batangas Prov., Mt. Lobo Bo, in secondary growth forest, *Phil. Nat. Herb.* 7428, *Sulit* (A). Bulacan Prov., vicinity of Kay Tianak & Ipo, *Bartlett* 14720 (A). Mountain Prov., Bengued, Twin Peaks, *Elmer* 6348 (K, NY, US); Castilla, La Union, *Loher* 6542 (K, US). Nueva Ecija Prov., *For. Bur.* 8442, *Curran* (MO). Pangasinan Prov., Bolinao, on coral rocks, in thickets by sea, *Clemens* 18171 (SING, UC, W), *Bur. Sci.* 8284, *Ramos* (L). Rizal Prov., Manila, *Gallery s. n.* (G), *Vidal* 1009 (A), 3275 (A, K); Morong, Bosoboso, *Merrill* 2791 (BM, K, NY, US), *Vidal* 3274bis (K); Montalban, *Loher* 3994 (K), 6519 (K), 6530 (K), *s. n.* (UC); San Mateo, *Ahern* 1116 (BM, K, NY, US); without precise locality, *For. Bur.* 3155, *Ahern* (F, K, NY, SING, US), *Cuming* 1453 (BM, G, K, UPS, W), *Bur. Sci.* 6757, *Robinson* (BRI, L). MASBATE ISLAND: *Merrill* 3049 (BM, K, NY, US), 3082 (BM, K, L, US). MINDANAO: Lanao Lake, Camp Keithley, *Clemens* 1060 (F). MINDORO: Mabaho ridge, Kabalwa, *Phil. Nat. Herb.* 17044, *Sulit* (A, BM); without precise locality, *Bur. Sci.* 21296, *Escritor* (BM, K, US). NEGROS: *Bur. Sci.* 23404, *Contreras* (A, US). PALAWAN: Apulit Island, Taytay Bay, *Merrill* 9426 (BM, BRI, F, GH, L, HO, NY, SING) (US); Puerto Princesa, *For. Bur.* 19906, *Danao* (US); without precise locality, *For. Bur.* 4510, *Curran* (K, L, US), *Bur. Sci.* 1183, *Fenix* (BM, G, US). TICAOS ISLAND: *Vidal* 3276 (A, K). WITHOUT PRECISE LOCALITY: *Cuming s. n.* (BM).

10c. WRIGHTIA PUBESCENS ssp. **novobritannica** P.t.Ngan, ssp. nov. Affinis ssp. *calycinae* sed calycis laciniis brevioribus et foliis anguste oblongo-ellipticis differt.

NEW BRITAIN. Nodup area, *Waterhouse* 270 (A, F, NY, HOLOTYPE, US).

10d. WRIGHTIA PUBESCENS ssp. **penicillata** (Bailey) P.t. Ngan, stat. nov.

*Wrightia pubescens* var. *penicillata* *Bailey Queensl. Fl.* 6: 2010. 1902. (T.: *Bailey* 389!). *Wrightia versicolor* S. T. Blake, *Proc. Roy. Soc. Queensl.* 59: 163. 1948. (T.: *Blake* 14702!).

AUSTRALIA. QUEENSLAND: Cook distr.: Fitzroy Island, *unknown collector* 29 (MEL); Lizard Island, *Walter s. n.* (MEL); *Mapoon*, *Bailey* 389 (BRI), *s. n.* (BRI); Mount Surprise Creek, *Armit* 766 (MEL); 100 miles Swamp, in scrub, *Armit* 807 (MEL). North Kennedy distr.: 13 miles N. of Charter Towers, in rather open monsoon forest on hard reddish sandy soil, *Blake* 14672 (BRI); Barrabas Scrub, W. Ravenwood, in monsoon forest on deep loose coarse whitish sand, *Blake* 14702 (BRI), 14893 (BRI).

10e. WRIGHTIA PUBESCENS ssp. **Laniti** (Blco.) P.t. Ngan, stat. nov.

*Anasser laniti* Blanco, *Fl. Philipp.* 112. 1837, ex char.

*Wrightia ovata* A. DC. in DC., *Prodr.* 8: 405. 1844. (T.: *Cuming* 1279, 1802!).

*Wrightia javanica* A. D.C. in DC., *loc. cit.* 1844. (T.: *Kollman s. n.*!)

*Wrightia laniti* (Blco.) *Merrill, Gov. Lab. Publ.* 27: 59. 1905.

*Wrightia tomentosa* var. *cochinchinensis* *Pierre ex Pitard, Lecomte & Humbert, Fl. Gen. Indo-chine* 3: 1186. 1933. (T.: *Pierre* 1047!).



CAMBODIA. Pnompenh, *d'Alleizette s. n.* (L); without precise locality, *Bejeaud 261* (A, NY, SAIG).

CHINA. HAINAN: Chim fung Ling, in thicket on dry, gentle slope, sandy soil, *Lau 3890* (A); Chung kon, *Gressitt 1028* (A, BM, E, G, MO); Fingan, *Katsumata s. n.* (BM); Hoi how, *Bullock s. n.* (BM), *Hancock 38* (K), *Tsang, Tang & Fung 4* (A); Hui ka, Lin Fa Shan, Lam ko distr., *Tsang 203* (A, G, K, NY, UC, US); Lam ko distr. & vicinity, *Lei 1438* (A); Hung mo shan, Lai area, *Tsang & Fung 698* (A, K, NY, US); foot of Hung shek Lang, *Tsang 71* (A, G, MO, UC, US); Ka chik Shan, fairly common in thicket, *Lau 1666* (A, BM, NY); I Kap Shan, Tan Distr., *Lau 1169* (BM, NY); Keuk Ha Tsun, *McClure 8911* (A, BM, E, F, G, K, MO, UC); Kieng chau fu, *Henry 7956* (E, K), *13724* (BM); Kiung chau, *Fung 20314* (A, BM, HK, K, NY, UC, US, W); Lar tai shee, collector unknown 392 (A, K); Nam shan Leng, Ngai distr., in swamp, sea shore, on sandy soil, *Lau 314* (A, BM, E, G, K, MICH, MO, NY, UC, US, W); Nodoa, *McClure 9820* (US); road to Onzin, *Chun 994* (UC); Paai Poon Tsuen, on sea shore, *Fung 20250* (A, BM, E, G, K, NY, UC, US); Pak shik Ling, Ching mai distr., *Lei 608* (K, NY, US); Poting, in forest, *How 71954* (A, SING); east Poting, Lingshui, *Ko 52217* (A, NY); Tai Por, foot of Seven Finger Mt., *Liang 61690* (A, K, NY, US); Tai wong Ling, *Lei 209* (HK, K, NY, SING, UC, US, W); Tai wong Shan, unknown collector 2181 (HK); Ue Lung Shan, Chang kiang distr., *Lau 3188* (A); Yai chau, in forest, *Chun & Tso 44515* (A, E, NY), *How 70752* (A, L, NY), *How & Chun 70218* (A, K, NY, US), *Liang 62396* (NY), *63003* (NY); without precise locality, *Henry 8289* (K), *8751* (GH), *Katsumada s. n.* (UC), *Liang 63660* (NY), *54616* (NY), *66178* (E, G, NY), *Wang 33381* (A, NY, US), *35103* (NY, US), *36202* (A, NY), *Wu 1109* (BM). KWANGTUNG: Canton, *Ford 264* (HK, K, NY), *Levine 221* (A, F, HK, MO, US), *2128* (A, GH, HK, MO), *Merrill 10110* (A, HK, UC); Honam, *Hoffman 72* (NY); Honan, Chik Cha village, on road side, *McClure 1707* (E, G, W); Honan, near Ha to, in bushes, *McClure 1703* (K, UC); Honan, east of Taai Tong, *McClure 1671* (A, BM, K, UC, US), *1672* (E, G); Hop Po city, *Liang 69302* (A); Kochow, *Tsiang 886* (A), *2786* (A); Pei Yun Shan, *Tsiang 450* (A, E, UC); Po tan, Luichow, Hoi kong distr., *Tsiang 2534* (A, BM, NY); Quenyinshan, *Tsiang 406* (BM, E, K, NY, SING); San Ning, *Wong Ke s. n.* (HK); White Cloud Mt., *Levine 2044* (A, HK, MO); Vutzeling, Kochow, in dense scrubs, *Tsiang 2308* (NY); without precise locality, *Ford 335* (K), *Haunton s. n.* (BM), *McClure 13495* (UC). KWANGSI: without precise locality, *Liang 70102* (A).

INDONESIA. JAVA: Bantam: Tjimara, *Koorders 196β* (L); Batavia: *Backer s. n.* (L), *Bakhuizen v. d. Brink 4892* (L); Cheribon: Kalidjohopekik, *Koorders 36598β* (L); Krawang: Poerwakarta, *Koorders 13798* (L), *13799* (CAL, K, L), *14232* (K); Pekalongan: Soebah, *Koorders 13800* (CAL), *13800β* (K), *13801β* (L), *13802* (CAL, K, L), *13802β* (L), *14229* (L), *14232β* (CAL), *14244β* (K, L), *22549β* (L), *27294β* (L); Preanger: Palabuanratu, *Koorders 194β* (L), *200β* (L, UC); Soekaboemi, *Koorders 12232β* (L); Tomo, *Koorders 195β* (L); Semarang: Geboegan, *Koorders 198β* (A, L); Karangasem, *Koorders 38874β* (L); Solo, Kedoengdjati, *Koorders 33704β* (L); without precise locality, *Backer & Coert 804* (L), *Zollinger 598* (A, BM, G, L). SUMATRA: without precise locality, unknown collector 230 (L).

MALAYA. KEDAH: Alor Star, *Ridley 14950* (K, SING), *14951* (BM, K, SING); Jitra, *Burkill S.F.N. 13349* (SING); Taseh Gelugor, *Curtis 3738* (CAL, K, SING); without precise locality, *Kunstler 1762* (CAL). PERAK: Lake Gardens, Taiping, *Corner s. n.* (SING). PERLIS: *Ridley 14952* (BM, SING). TRENGGANU: Kuala Trengganu, *Sinclair S.F.N. 39986* (BM, E, L, SING).

PHILIPPINES. CULION: Calamaian Island, in dry open valley, *Merrill 676* (BM, GM, K, MO, NY, SING, US); without precise locality, *Herre 1049* (A, NY, UC, US). CUYO: *Bur. Sci. 15540*, *Kienholz* (UC). LUZON: Bataan Prov., Dinalupihan, *Merrill 1486* (K, US); Lamao River, Mt. Mariveles, *For. Bur. 770*, *Borden* (F, NY, SING, US), *For. Bur. 3067*, *Borden* (F, NY, US) *Whiteford 1260* (NY, US); without precise locality, *For. Bur. 23206*, *Alambra & Caulas* (A, SING), *For. Bur. 12939*, *Alvarez* (L), *For. Bur. 22701*, *Gangan* (A), *For. Bur. 25694*, *Miras* (UC), *For. Bur. 23062*, *Pascual* (L), *For. Bur. 27780*, *Ranario* (SING), *For. Bur. 25679*, *Sulit* (K), *For. Bur. 20009*, *Topacio* (BM). Batangas Prov., Mt. Lobo, *Phil. Nat. Herb. 15715*, *Sulit* (A); Taal Volcano, *Gates 8373* (MICH), *Gates & Quisumbing 7951* (MICH). Bauco Prov., Bontoc, *Vanoverbergh 3117* (US). Bulacan Prov., *For. Bur. 24730*, *Leuterio* (BM, L). Cagayan Prov., Enrile, *Clemens 17541* (BM, W); vicinity of Peñablanca, *Adduru 197* (A, F, MO, US); without precise locality, *For. Bur. 15138*, *Bernardo* (L), *Bur. Sci. 22746*, *Castillo* (HK, US), *Cuming 1279* (BM, G, K, L, MO,

NY, UPS, W). Cavite Prov., *Bur. Sci.* 22555, *Ramos & Deroy* (GH, MO, SING, US). Ilocos norte Prov., *For. Bur.* 22999, *Adduru* (A, BM). Isabella Prov., San Mariano, *Bur. Sci.* 46675, *Ramos & Edano* (UC), *Bur. Sci.* 47008, *Ramos & Edano* (UC), *For. Bur.* 30396, *Siriban* (NY, SING, UC); without precise locality, *For. Bur.* 26288, *Barros* (GH). Laguna Prov., Los Banos, *Elmer* 8069 (E); Makiling National Park, *Phil. Nat. Herb.* 6875, *Sulit* (A), *Phil. Nat. Herb.* 22879, *Sulit* (BM, US); Mt. Makiling, *For. Bur.* 19784 *Whitford* (BM, K, L). Nueva eciza Prov., *For. Bur.* 24142, *Tungol* (A, F, GH, MO). Nueva vizcaya Prov., vicinity of Dupax, *Bur. Sci.* 11298, *McGregor* (G, MO), *Bur. Sci.* 11300, *McGregor* (BM, K, L, US); without precise locality, *McGregor* 4630 (L). Pangasinan Prov., *For. Bur.* 24577, *Mayor* (BRI). Rizal Prov., Antipolo, *Ahern* 90 (A, US), *Guerrero* 31 (US); Manila, *Garcia s. n.* (W), *Loher* 3999 (US), *Perrottet s. n.* (G); Morong, Bosoboso, *Loher* 4000 (K, US), *Merrill* 1848 (K, US), 2833 (K, NY, US), *Bur. Sci.* 1462, *Ramos* (NY, US); without precise locality, *For. Bur.* 2960, *Ahern* (F, NY, SING, US), *For. Bur.* 3336, *Ahern* (MO, US), *For. Bur.* 17856, *Franco* (GH, US), *For. Bur.* 27160, *Mariano* (F, MO), *Merrill*, species *Blancoanae* 562 (A, BM, F, GH, K, L, MO, NY, US, W), *Ramos* 26 (G, US), *Bur. Sci.* 2042 *Ramos* (BM, BRI, G, GH, L, MO), *Bur. Sci.* 6738, *Robinson* (BRI). Zambales Prov., Mt. Pinatubo-Villar, in Grassland, *Balintay* 555 (A); Subic, *Merrill* 1753 (K, US), 1978 (US), 2112 (K, NY, US). MINDANAO: Cotabato Prov., Buayan, in secondary forest, *Bur. Sci.* 85136, *Ramos & Edaño* (A). Zamboanga Prov., *Ahern s. n.* (US), *For. Bur.* 24590, *Franco* (BM), *Bur. Sci.* 37465, *Ramos & Edaño* (A). MINDORO: Ilin Island, *For. Bur.* 29850, *Zaldua* (NY, UC), *For. Bur.* 29852, *Zaldua* (UC); Paluan, *Bur. Sci.* 39677, *Ramos* (A); Pandarucan, *Merrill* 943 (GH, K, NY, US); Puerto Galera and vicinity, on hill near the shore, *Santos* 5259 (US); vicinity of San José, *Lambert & Brunson* 130 (US); east of Yagaw, *Conklin* 1030 (L, US); precise locality unknown, *For. Bur.* 9801, *Merritt* (MO), *Vidal* 3273bis (K). NEGROS: Negros oriental Prov., Dumaguete, Mts. Cuernos, in dry thickets along the Ocoy River, *Elmer* 10291 (A, BM, E, F, G, L, MO, NY, US, W); without precise locality, *Cuming* 1802 (BM, K, W). PALAWAN: Taytay, *Merrill* 9200 (A, BM, F, GH, L, MO, NY, US); without precise locality, *For. Bur.* 29949, *Cenabre* (UC).

THAILAND. CHANTABURI: Chantabun, *Verterdal* 9L (SING). KRUNGTEP: Bangkok, *Kerr* 10702 (BM, E, L), *Marcan* 2085 (BM). NAKAWN SAWAN: Sriracha, in thickets along the beach, *Collins* 10 (K), *Kerr* 4260 (BM); without precise locality, in mixed forest, *Kerr* 5977 (BM). NAKAWN SRITAMARAT: Saba Yoi, Songkla, *Kerr* 14789 (A, BM, E, K, L). PUKET: Betong, Satul, on rocky ground, *Kerr* 14062 (BM, E, K, L); Tongkah, *Curtis* 3054 (CAL, SING). RACHABURI: Hua Hin, *Kerr* 16199 (BM), Baw Fai, *Marcan* 2482 (BM); Prachuap, *Put* 261 (BM, E, K, L); Sam Roi Yawt, Prachuap, in evergreen forest, *Kerr* 10899 (BM, E, L); Wang Yai, Kanburi, in deciduous forests, *Charoenmayu* 405 (US), in scrub jungle, *Kerr* 10110 (BM, K). SURAT: Kaw Samui, *Put* 863 (BM, E, K, L, SING); Kaw Tao, in dry evergreen forest, *Kerr* 11117 (A, BM, K), in open evergreen forest, *Kerr* 12685 (A, BM, K). WITHOUT PRECISE LOCALITY: *Marcan* 1686 (BM).

VIETNAM. BIÊNROA, *Chevalier* 35562 (SAIG), *Pierre* 1147 (A, SAIG); Choganh. *Du Pasquier* 958 (UC), 995 (A, NY, UC, US), 1267 (UC); Cândia (Poulo Condor), *Harmand* 694 (A); Hânôi, *d'Alleizette s. n.* (L), *Fleury* 37728 (L); Hōabinh, *Pételot* 6991 (A, NY), *Poilane* 13006 (SAIG); Langson, Dongmo, in open forest, *Pételot* 2436 (A, MO); Phu hô, *Du Pasquier* 1875 (UC), 1926 (UC); Nha trang, *Chevalier* 39495 (SAIG); *Phutuson*, *d'Alleizette s. n.* (L); *Phúcýn Pételot* 5944 (A, NY, US); Quang tri, *Poilane* 13323 (SAIG); Săigōn, *Pierre* 1047 (A, K, L, MO, NY, SAIG, SING) *Thorel* 696 (A, F, K, NY, UC); Sonla, *Colani* 4038 (UC); Sontây, *Pételot* 2446 (A, MO), 6003 (A); Tháinguyên, *Pételot* 6988 (A, NY); Tüpháp, *Balansa* 2120 (G, L, NY, SAIG), 2121 (K); Vinh and Baubō, *Spire* 570 (SING). Without precise locality, *Balansa s. n.* (G), *Dong phuc Long* 1303 (SAIG).

The several synonyms here are due to the wide distribution and the morphological variations of this species. In the western and extreme eastern ranges the calyx tends to be relatively short, whereas in the central and southern ranges it is about as long as the corolla tube. The population considered as *ssp. laniti* seems to be the most distinctive, characterized by the short calyx, the corona puberulent within, the leaves densely puberulent or glabrescent above and the follicles usually

inconspicuously lenticellate. This is a rather uniform population although widely distributed from China to the Philippines through Indochina, Thailand, Malaya and western Indonesia. However, mention should be made of one specimen collected in Vietnam (*Colani 4038*): The few-flowered inflorescence, the corona segments coherent and the relatively long calyx lobes of this specimen approach the characters of *W. annamensis* and I suspect that the 2 hybridize.

*Wrightia pubescens* ssp. *pubescens* has the calyx lobes as long as the corolla tube, usually recurved at the apex, and puberulent leaves and corona. However, many collections from Timor (type of *W. calycina*), eastern Java and West Irian possess glabrous leaves and corona and provide a link with the population in the central range known as ssp. *candollei*.

Variation within the latter is so extreme that some specimens from the Philippines, with the inflorescence few-flowered and calyx lobes obtuse and auriculate appear to belong to a distinct species (*W. candollei*). Some odd plants have infundibuliform corollas and the anthers included which recall *W. coccinea* of § SCLERANTHERA. However, there are many intermediate specimens which match so closely those of Timor and eastern Java that I am reluctant to assign a specific rank to this population. Finally, this subspecies shows the possibility of hybridization with *W. laevis* to judge from the examination of one specimen (*Vidal 3276*) with the corona lacinate and provided with minute alternating supplementary segments and the flowers relatively small. There is another specimen (*Vidal 1009*) with the pubescent corona which I interpret as a hybrid with ssp. *laniti* with back-cross to ssp. *candollei*, for it is closer to the latter.

Within ssp. *penicillata*, the calyx is relatively short and the leaves appear to be usually glabrous, but this variation as well as that of the flower color are within the range of the species. Hence this population does not deserve to be maintained as a distinct species. Finally, ssp. *novobritannica*, although characterized by a short calyx, has features which indicate a close relationship with ssp. *candollei* in the subtire corona segments.

11. *WRIGHTIA ANNAMENSIS* Eberth. & Duby, Agron. Colon. (Paris) **1**: 38. 1913. (T. : *Eberhardt s. n.*, photo. MO!).

*Nerium antidysentericum* acc. Lour., Fl. Cochinch. 116. 1790, non L.

Shrubs or rather small trees up to 4 m. tall; branchlets slender, glabrous, the gray-brown bark striate and conspicuously lenticellate. Leaves narrowly elliptic to elliptic, occasionally obovate, caudate-acuminate at the apex, acute to obtuse at the base, 7-12 cm. long, 3-5 cm. broad, membranaceous to chartaceous, glabrous except along the veins beneath, rarely puberulent throughout, the secondary veins 9-12 pairs, impressed above, prominent beneath; petiole about 0.5 cm. long, puberulent. Inflorescence terminal, monochasial, rather lax, almost as long as the subtending leaves; peduncle about 1 cm. long, sparsely puberulent, the bracts narrowly ovate, about 0.3 cm. long; pedicels slender, 0.7-1.2 cm. long, minutely puberulent. Flowers pale greenish or red; calyx lobes ovate, acuminate, about 3 mm. long,

glabrous and ciliolate, bearing within 5 alternate, orbicular or ovate squamellae half as long as the lobes; corolla subrotate, the tube dilated at the insertion of the stamens, more or less constricted at the orifice, about 8 mm. long, minutely puberulent without, the lobes obliquely ovate, acute, 12-16 mm. long, puberulent-papillate; corona coherent at the base and completely adnate to the throat of the corolla tube except the tips of the segments, the antepetalous tridentate and strongly adnate to the blade of the corolla, about 6 mm. long, the alternipetalous bifid, about 4 mm. long; stamens more or less included, inserted within the corolla tube, about 7 mm. long, the anthers more or less exerted, pubescent, the acumen barbate, the filament relatively long, glabrous; carpels 2, coherent, glabrous, about 1.5 mm. long, the style dilated near the subcapitate stigma. Follicles 2, coherent, minutely lenticellate, 15-20 cm. long; seeds linear fusiform, about 1.5 cm. long, the white coma about 4 cm. long.

Vietnam and adjacent China; common in lowlands up to 300 m. elev.; flowering in June, fruiting in August, September.

Vernacular names; *Cay muc bac*, *Cay long muc*.

CHINA. YUNNAN: vicinity of Yunchow, in light woods, *Liang 70124* (A).

VIETNAM. Bienhoa, Longthanh, *Bon 345* (UC); Hue, in thicket, rich, moist loam, *McClure 7267* (US), P.t. *Ngan 1470, 1821* (SAIG); Quangtri, *Chevalier 41242* (NY); Tourane, foothills to Mt. Bana, roadside near dwelling, *Clemens & Clemens 4124* (A, BM, G, K, MICH, NY, UC, US); vicinity of Tourane, along new road by cabin, *Clemens & Clemens 3367* (A, BM, G, K, MICH, MO, NY, PH, UC, US, W), P. t. *Ngan 1862* (SAIG); W. of Day, between Hanoi and Myduc, *Balansa 4720* (P).

*Wrightia annamensis* can be mistaken for the more widespread *W. pubescens* particularly in the structure of the corona flower and the coherent follicles. However its monochasial inflorescence as well as its almost glabrous leaves are characteristics which help in separating *W. annamensis* from *W. pubescens* ssp. *laniti* within its range.

12. WRIGHTIA LANCEOLATA Kerr, Kew Bull. **1937**: 89. 1937. (T.: *Kerr 10926!*).

Shrubs as much as 2 m. high; branches slender, the bark gray to brown, rimose, glabrous, the current year's growth angular, puberulent. Leaves narrowly ovate, long-acuminate at the apex, acute at the base, 5-10 cm. long, 1.5-3.5 cm. broad, chartaceous to coriaceous, puberulent throughout, becoming glabrescent above, except upon the midrib, the secondary veins 15-19 pairs, curved towards the apex, obscure above, prominent beneath; petiole canaliculate, about 0.3 cm. long, puberulent. Inflorescence terminal, aggregate dichasial, few-flowered, about half as long as the subtending leaves; peduncle rather stout, about 0.5 cm. long, puberulent; pedicels about 0.7 cm. long. Flowers red, moderately large; calyx lobes broadly ovate, acute, about 2.5 mm. long, minutely puberulent without, ciliolate, bearing within 5 orbicular to ovate, serrulate squamellae, about half the length of the lobes; corolla subrotate, the tube cylindrical, about 2.5 mm. long, the lobes obovate-elliptic, about 17 mm. long, puberulent-papillate; corona about half the length of the stamens, the antepetalous segments crenulate, almost completely adnate to the

corolla lobes, about 3.5 mm. long, glabrous within, the alternipetalous obsolete; stamens 5, inserted at the orifice of the corolla tube, the anthers sparsely puberulent, the acumen barbate, the filament about 1 mm. long, glabrous; carpels 2, free, glabrous, about 1.7 mm. long, the style slender, slightly dilated near the tip, about 5 mm. long. Follicles 2, coherent, about 15 cm. long; seeds linear-fusiform, about 1 cm. long, the white coma about 3 cm. long.

Endemic to Thailand; flowering in July, fruiting in December.

Thailand. RACHABURI: Sam Roi Yawt, Prachuap, on rocky limestone hill, *Kerr 10926* (A, BM, E, K, L); *Put 2514* (BM, E, L).

Pichon put this species in synonymy under *W. tomentosa*. However, *W. lanceolata* is definitely a very distinctive species characterized by the leaves ovate-lanceolate, long-acuminate, coriaceous with numerous secondary veins, the lack of alternipetalous segments, the corona completely adnate to the corolla lobes and the few-flowered inflorescence. Therefore its relationships are difficult to ascertain and I am unable to determine to which species of *Wrightia* it is most closely related.

13. *WRIGHTIA ANGUSTIFOLIA* Thwaites, Enum. Pl. Ceylon 193. 1860. (T.:C. P. 1839, *Gardner s. n.*!).

Small trees up to 15 m. high; branchlets slender, terete, glabrous even when immature, the bark rimose, pale gray. Leaves drooping, linear-elliptic to linear-ovate, obtuse at the apex, acute at the base, 7-14 cm. long, 1-2 cm. broad, membranaceous, glabrous throughout or sometimes densely puberulent beneath upon the midrib near the base of the blade, the midrib immersed above, prominent below, the secondary veins 8-13 pairs, arcuate toward the margins; petiole relatively short, 0.2-0.6 cm. long, glabrous, occasionally puberulent. Inflorescence terminal, aggregate dichasial, shorter than the subtending leaves; peduncle slender, about 3 mm. long, glabrous, the bracts scarious, about 1.5 mm. long; pedicels slender, about 8 mm. long. Flowers cream-white, malodorous, relatively small, about 8 mm. long; calyx lobes narrowly ovate, about 1.2 mm. long, ciliolate and glabrous, bearing within 5 linear-lanceolate squamellae; corolla subrotate, the tube cylindrical, about 1.8 mm. long, the lobes narrowly oblong, obtuse, about 6 mm. long and 2 mm. wide, minutely papillate; corona relatively long, glabrous, consisting of 5 alternipetalous segments, bifid or laciniate at the tip, about 5 mm. long and 1 mm. broad; stamens 5, inserted at the orifice of the corolla tube, the anthers sparsely puberulent, the filament relatively slender, about 1 mm. long, glabrous, the basal auricles attenuate, the acumen barbate; carpels 2, free, about 1 mm. long, pubescent at the apex, the common style slender, dilated near the subcapitate stigma. Follicles 2, free, slender and terete, finely striate and sparsely lenticellate, 20-27 cm. long, glabrous; seeds linear, about 1.5 cm. long, the yellowish coma 3.5-4.0 cm. long.

Endemic to Ceylon; confined to the dry zone from Central Province toward North East; flowering in June and July.

Vernacular name: *Velai-pal-madan-kai*.

CEYLON. NORTH CENTRAL PROVINCE: Anuradhapura, *Trimen* 35 (UPS); summit of Ritigala, *Willis* 104 (UPS). CENTRAL PROVINCE: Dambulla, *C. P.* 1839, *Gardner* s. n. (BM, G, GH, K, W). PRECISE LOCALITY UNKNOWN: *unknown collector* s. n. (NY).

*Wrightia angustifolia* can easily be recognized by the relatively small flowers, the linear-lanceolate leaves, the pubescent carpels and the corona consisting of 5 alternipetalous segments as long as the stamens.

14. WRIGHTIA LECOMTEI Pitard in Lecomte & Humbert, *Fl. Gén. Indo-chine* **3**: 1118. 1933. (T.: *Gourgand* s. n., photo. MO!).

Small trees up to 5 m. high; branchlets terete, slender, the bark gray to brown, lenticellate, the current year's growth puberulent. Leaves elliptic to obovate, the apex caudate-acuminate, the base acute, 5-8 cm. long, 2.0-3.5 cm. broad, membranaceous, minutely puberulent on both surfaces, the midrib impressed above, prominent beneath, the secondary veins 6-8 pairs, curved towards the apex; petiole canaliculate, 0.2-0.4 cm. long, densely puberulent. Inflorescence terminal, rather lax, aggregate dichasial, about as long as the subtending leaves; peduncle 1.0-1.5 cm. long, puberulent; pedicels slender, 1.5-2.0 cm. long. Flowers white, fragrant; calyx lobes broadly ovate, about 1.8 mm. long, ciliate and puberulent without, bearing within 5 narrowly ovate to ovate squamellae, shorter than the lobes; corolla subrotate, the tube subcylindrical, about 6 mm. long, glabrous, the lobes subobovate, obtuse, about 12 mm. long, minutely puberulent-papillate; corona relatively minute, consisting of 5 alternipetalous segments entire or bifid, about 1 mm. long; stamens 5, inserted at the orifice of the corolla tube, the anthers puberulent without, densely so within, the acumen barbate, the basal lobes slenderly attenuate, the filament about 1.5 mm. long; carpels 2, free, about 1.5 mm. long, glabrous, the style slender, about 7 mm. long, dilated near the subcylindrical stigma. Follicles 2, free, terete-fusiform, about 16 cm. long; seed not seen.

Cambodia to Thailand; flowering in May.

Vernacular name: *Prapech changvâ* (Cambodia—Gourgan).

THAILAND. KRUNGTHEP: Bangkok, in hedge zone, *Kerr* 10703 (BM, E, L). NAKAWN SAWAN: Me Wong, in mixed forest, *Kerr* 6020 (BM, E, K, L). NAKAWN SRITAMARAT: Patalung, *Gwynne-Vaughan* 281 (CAL).

This species is closely related to *W. religiosa* and *W. angustifolia*. It differs from the former by the presence of a corona, the corolla lobes subobovate and from the latter in the minute corona, the carpels glabrous and the relatively larger flowers.

15. WRIGHTIA RELIGIOSA (Teijsm. & Binn.) Benth. in Benth. & Hook., *Gen. Pl.* **2**: 713. 1876.

*Echites religiosa* Teijsm. & Binn., *Tijdschr. Ned. Ind.* **27**: 34. 1864, ex char.  
*Wrightia filipendula* Pierre in Planchon, *Prod. Apoc.* 333. 1894, fide Pichon.

Evergreen shrubs reaching a height of 2 m., the branches rather slender, terete, gray, the current year's growth gray to brown-reddish, minutely puberulent. Leaves elliptic to ovate, the apex acute to obtusely acuminate, the base cuneate, 3-7 cm. long, 1.5-2.5 cm. broad, membranaceous, glabrous throughout, occasionally puberulent upon the midrib and veins, the secondary veins 5-7 pairs, arcuate towards the margins; petiole slender, about 0.2 cm. long, puberulent along the edges. Inflorescence terminal, monochasial, rather lax, about as long as the subtending leaves; peduncle rather stout, about 0.5 cm. long, glabrous. Flowers white, occasionally yellow, fragrant, moderately small; calyx lobes ovate, acute, about 1.5 mm. long, ciliate and glabrous, bearing within 5 alternate, narrowly ovate squamellae; corolla subrotate, the tube cylindrical, about 4 mm. long, slightly constricted at the orifice, glabrous, the lobes obovate, obtuse, about 7 mm. long, reflexed or widely spreading, thinly membranaceous, puberulent-papillate; corona obsolete; stamens 5, inserted at the orifice of the corolla tube, the anthers about 4 mm. long, puberulent within, glabrous without, the acumen glabrous, the basal anther lobes slenderly attenuate, the filament slender, about 2 mm. long, glabrous; carpels 2, free, about 1 mm. long, glabrous, the style slender, about 6 mm. long, the stigma subcylindrical, slightly constricted at the median region, terminated by a biapiculate stigma. Follicles 2, free, slender and terete, 12-17 cm. long, smooth, finely striate and glabrous; seeds linear fusiform, about 0.8 cm. long, the white coma about 3.5 cm. long.

Northern Malaya, Thailand, Cambodia and southern Vietnam; common in evergreen forests but also widely cultivated in gardens and around temples; flowering around the year.

Vernacular names: *Mok* (Thailand—Kerr); *Dam prapech changva* (Cambodia—Pitard); *Mai-hoàng* (Vietnam—An).

CAMBODIA. Angkor, *Thorel* 2084 (A, K); Kampot, *Geoffray* 389 (SAIG, UC); *Gourgaud* s. n. (NY); *Pierre* s. n. (NY); Prek popoul, *Dong phuc Long* 243 (SAIG).

INDONESIA. SUMATRA: Riau archipel, Bintan, Penang, probably cultivated, *Bunnemeijer* 6534 (L).

MALAYA: Perlis, Kangar, on edges of rice fields, *Henderson S.F.N.* 22909 (NY); *Ridley* 14949 (BM, SING); Pulau Lankawi, Kuah, *Haniff* 15482 (SING); Singapore, cult., *Anderson* 115 (CAL); *Maingay* 3334 (K); precise locality unknown, *Maingay* 1071 (CAL).

THAILAND. CHANTABURI: Rayawng, Ban Pe, *Put* 2708 (BM, E, L). KRUNGTHEP: Bangkok, in scrub jungle, *Kerr* 3704 (BM, K); Bangkok, no precise data, *Lakshnakara* 201 (E); Bangkok, on canal bank, *Marcan* 269 (BM, K); in temple gardens, *Marcan* 570 (BM, K, MO), 1980 (BM), 2080 (BM); *Schomburgh* 132 (CAL); *Zimmermann* 24 (BM, G, K, L, MO, US, W), 115 (BM, G, K, L, MO, US, W). NAKAWN SAWAN: Kampengpet, *Kerr* 2995 (BM, K); Me Wong common in evergreen forests, *Kerr* 6018 (BM, K). NAKAWN SRITAMARAT: Ta Samet, *Kerr* 14292 (BM). PAYAP: Chiangmai, *Kerr* s. n. (BM). PRACHINBURI: Ban Sriracha, *Collins* 669 (E, K), 825 (BM, K, US), in evergreen forests, *Marcan* 1201 (BM). PUKET: Krasom, *Curtis* 3241 (SING). SURAT: Champawn, *Haniff & Nur* 4356 (K, SING). Precise locality unknown, *Haase* s. n. (BM).

PHILIPPINES. Manila, cult., *Vidal* 3247 (K).

VIETNAM: Giadinh, *Lý văn Hôi* 1454/Long (MO); Mt. Lap vo, near Saigon River, *Pierre* 3578 (A, K); Phúnhuân, vicinity of Saigon, *An* s. n. (MO); Biên hĩa, Trang bom, *Dao dinh Khang* s. n. (SAIG.)

This is the most distinctive species of § WRIGHTIA, with its flowers devoid of a corona. However, by virtue of the structure of its stamens and the shape of its calycine squamellae, *W. religiosa* is most closely related to *W. angustifolia* and *W. lecomtei*.

SECTION 2. **BALFOURIA** (R. Br.) P.t. Ngan, stat. nov.

*Balfouria* R. Br. in Mem. Wern. Soc. 1: 70. 1811, as genus.

KEY TO THE SPECIES

- a. Leaves elliptic to narrowly elliptic and narrowly ovate; follicles free; flowers relatively large, 12-18 mm. long; corona segments more or less coherent; calycine squamellae 5. Plants of East Africa.
  - b. Leaves narrowly ovate, 6-12 cm. long; flowers about 12 mm. long; corolla subrotate, the lobes pubescent within; corona about 2 mm. long; calyx longer than the corolla tube. ....16. *W. NATALENSIS*
  - bb. Leaves elliptic to narrowly elliptic, 1.5-6.0 cm. long; flowers about 18 cm. long; corolla subsalverform, the lobes minutely puberulent-papillate within; corona about 1 mm. long; calyx much shorter than the corolla tube. ....17. *W. DEMARTINIANA*
- aa. Leaves linear-falcate; follicles coherent; flowers relatively small, 6-10 mm. long; corona segments completely coherent into a cupule surrounding the stamens; calycine squamellae 10. Plants of Australia. ....18. *W. SALIGNA*

16. *WRIGHTIA NATALENSIS* Stapf, Kew Bull. 1907: 51. 1907. (T.: Wood 7861!).

Small trees up to 15 m. high; branchlets gray to brownish, lenticellate and striate, the current year's growth glabrous. Leaves drooping narrowly ovate, occasionally ovate, the apex acuminate, the base acute, 6-12 cm. long, 1.2-2.0 cm. broad, membranaceous, densely puberulent along the base of the midrib beneath, otherwise glabrous, the midrib slightly elevated above, the secondary veins 12-17 pairs, arcuate toward the margins; petiole about 0.5 cm. long, puberulent. Inflorescence terminal, aggregate dichasial, several-flowered, about half as long as the subtending leaves, puberulent; peduncle 0.5-1.0 cm. long, the bracts linear, 0.5-1.0 cm. long, glabrous, pedicels about 0.7 cm. long. Flowers cream to yellow; calyx lobes narrowly ovate, obtuse, cleft nearly to the base, about 5 mm. long, puberulent without, bearing within 5 oblong, crenulate squamellae, about 0.7 mm. long; corolla subrotate, the tube about 4 mm. long, glabrous, the lobes narrowly ovate to ovate, obtuse, about 7.5 mm. long, papillate without, pubescent within; corona relatively short, the antepetalous segments subtruncate to emarginate, more or less coherent and adnate merely to the base of the corolla lobes, about 2 mm. long, bearing within 2 filiform appendages shorter than the segments; stamens 5, inserted at the orifice of the corolla tube, the anthers glabrous without, pubescent within, the acumen minutely puberulent, the filament definitely longer than the basal anther lobes; carpels 2, free, about 1.5 mm. long, glabrous, the common style about 3.5 mm. long, dilated near the subcapitate stigma. Follicles 2, terete and free, 18-35 cm. long, striate; seeds linear, about 1.7 cm. long, the white coma about 4.5 cm. long.



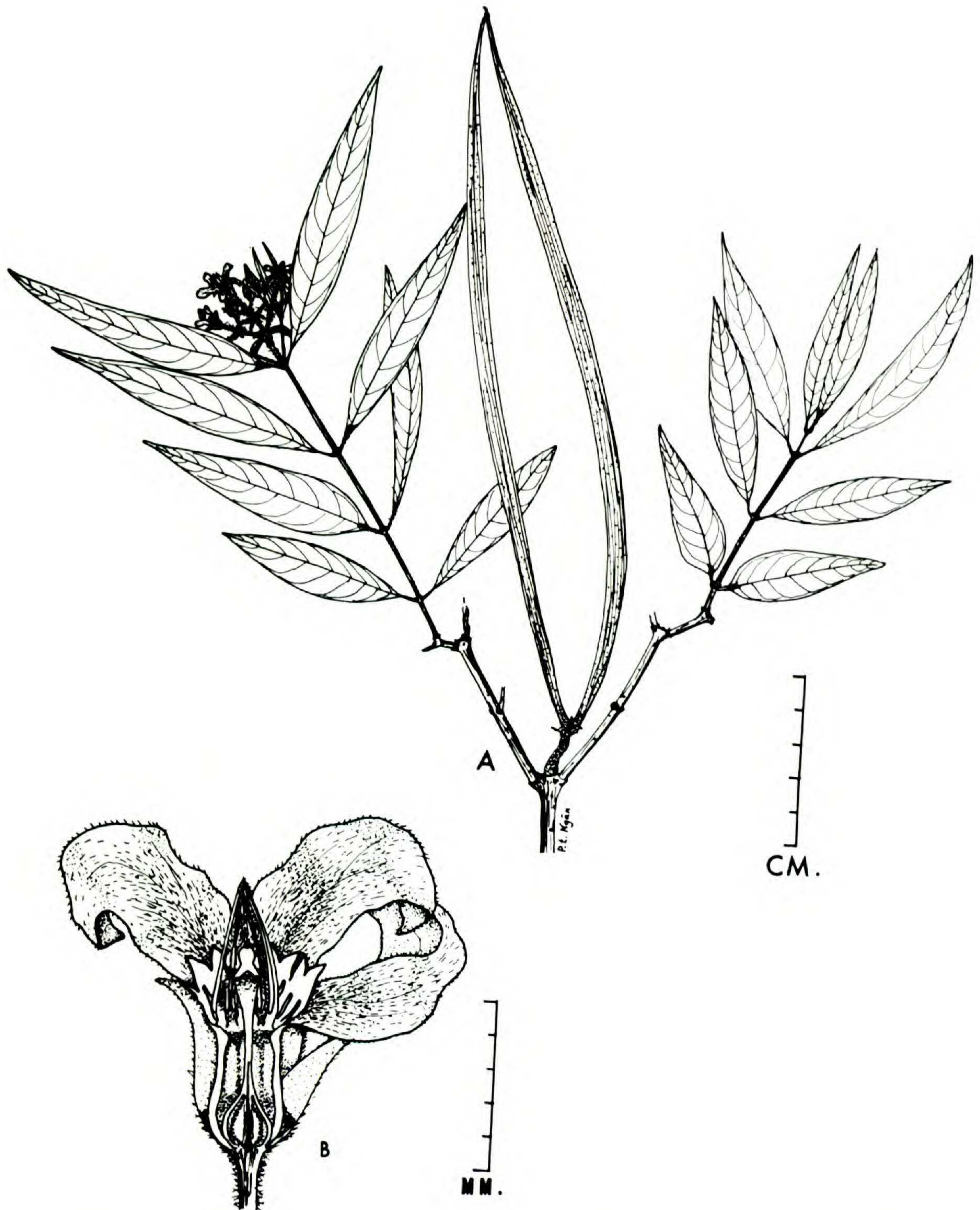


Figure 10. *Wrightia natalensis* Stapf; A, twig with inflorescences and follicles; B, longisection of the flower.

Endemic to southern Mozambique and northeastern Union of South Africa; in mixed bush, wooded grassland on sandy or rocky soil; flowers from August to November, follicles from November to June.

Vernacular names: *M'tsatsala* (Mozambique—Gomes e Sousa); *Mohlazi osa se Bôikgo* (Sekukuniland—Barnard); *Umkhontompuzane* (Zuzuland—Tinley).

MOZAMBIQUE. Maputo distr.: in bushland of Catuan, *Hornby* 2625 (K, PRE, SRGH); S. Lourenço Marques distr.: Santaca, in open forests, on sandy argillous soil, *Gomes e Sousa* 3791 (PRE).

S. AFRICA. NATAL: Hlabisa distr.: False Bay, *Bayer* 20 (PRE); *Ward* 1633 (K, PRE, UPS), 2526 (PRE), 3576 (PRE); Ingwavuma distr.: Nduma game reserve, Zuzuland, in open Albizzia wooded growth grassland, on hard red loamy soil, *Tinley* 411 (PRE, SRGH); Ndwandwe distr.: Umzinyati Falls, *Wood* 7861 (K), 11530 (F, G, PRE); *Haygarth & Wood* 12253 (K); Pietermaritzburg; Umgeni valley near Nagle Dam, *Cheadle* 627 (PRE, SRGH); Lower Tugela distr.: bottom of Tugela valley, below Bulwer farm, *Edwards* 1875 (PRE). TRANSVAAL: Sekukuniland: Lydenburg, *Barnard* 429 (PRE), *Moffatt* 29092 (PRE); Sibasa distr.: Punda Milia, *Lamont* 52 (PRE); Zoutpansberg distr.: N. of Fogwells, *Smuts & Gillett* 3111 (PRE); Wylliesport, in mixed bush on steep, rocky hill side, *Codd & Dyer* 3925 (MO, PRE), *Dyer* 4326 (MO), *Pole Evans* 3421 (MO), 3524 (MO, PRE, SING); Wambia: Kruger National Park, in thick bush on sandveld, *Schijff* 4107 (K, PRE, SRGH, UPS).

SWAZILAND. *Millet* S/58 (PRE).

*Wrightia natalensis* surely is the most distinctive species of the genus with the corolla lobes conspicuously pubescent within, the emarginate corona segments with 2 filiform appendages within and the narrowly ovate calyx lobes longer than the corolla tube.

17. *WRIGHTIA DEMARTINIANA* Chiov., Ann. Bot. Roma **13**: 405. 1915. (T.: *Paoli* 839!).

*Piaggiaea demartiniana* (Chiov.) Chiov., Fl. Somalia **2**: 290. 1932.

*Piaggiaea boranensis* Chiov., Miss. Biol. Borana, Racc. Bot. Angiosp.-Gymnosp. 159. 1939. (T.: *Cufodontis* 86!).

*Wrightia boranensis* (Chiov.) Cuf., Bull. Jard. Bot. État Brux. **30**, Suppl.: 692. 1960.

Deciduous shrubs or small trees up to 10 m. high; branches usually crooked, smooth, gray to brownish, the current year's growth relatively short, puberulent. Leaves elliptic to narrowly elliptic, occasionally obovate, the apex obtuse, the base acute, 1.5-6.0 cm. long, 0.4-1.0 cm. broad, membranaceous, puberulent, the midrib slightly prominent beneath, the secondary veins 6-9 pairs, arcuate; petiole 0.2-0.4 cm. long, puberulent. Inflorescence terminal, aggregate dichasial, as long as the subtending leaves, puberulent; peduncle 0.1-0.2 cm. long, the bracts narrowly ovate to ovate, about 0.2 cm. long; pedicel relatively slender, about 0.5 cm. long. Flowers white or cream, fragrant; calyx lobes ovate, about 2 mm. long, puberulent without, ciliate, bearing within 5 ovate, acute squamellae, as long as the lobes; corolla sub-salverform, the tube subcylindric, slightly dilated at the base, constricted at the orifice, about 7 mm. long, puberulent without, the lobes narrowly obovate, obtuse, about 10 mm. long, puberulent-papillate; corona relatively short, about 1 mm. long, the antepetalous and alternipetalous segments crenulate to slightly dentate, more or less coherent, adnate merely to the base of the corolla lobes; stamens 5, inserted

at the orifice of the corolla tube, the anthers glabrous without except near the tip, puberulent within, the acumen barbate, the filament as long as the basal anther lobes; carpels 2, free, glabrous, the common style gradually dilated near the subcapitate stigma head. Follicles 2, terete-fusiform, 13-30 cm. long, finely striate; seeds linear, about 2 cm. long, the coma white to dull yellow, about 3.5 cm. long.

Endemic to Somalia, southeastern Ethiopia and northern Kenya; in wooded steppe on red sandy soil; lowlands up to 1000 m. elev.; flowers from September to March, follicles from March to October.

Vernacular names: *Habrota* (Boran—Dale); *Maiyu* (Boran—Gillett); *Rabban* (Boran—Gillett); *Silchacho* (Kenya—Adamson); *Haiyo* (Somalia—Hemming).

ETHIOPIA. OGADEN: Wardere, in open Acacia-Commiphora on red sandy soil, *Hemming* 372 (EA, FI); in medium density thorn bush, *Simmons* 2 (EA), 58 (EA); 53 miles E. of Wardere, *Hemming* 1515 (EA); Locust camp ground, Wardere, *Barnes* 11960 (EA).

KENYA. NORTHERN FRONTIER PROVINCE: 16 km. N. of Archers Post, *Dale* k776 (EA, FI); Dandu, in rich Commiphora-Acacia scrub on red sandy soil, *Gillett* 12530 (BM, EA, FI, G, PRE); Garissa area, *McLoughlin s. n.* (EA); Isiolo-Maraabit, on rocky outcrop with Commiphora, *Grewia*, *Tephrosia*, *Verdcourt & Dale* 2212 (EA); Kiliwa Hevi Police Post, Mandera, *Adamson* 77 (EA, PRE).

SOMALIA. Borana, Malca Guba sul Daua-Parma, *Cufodontis* 86 (FI); 20 km. W. of Bur Acaba, *Bond & Pechanee* 2 (EA); Cisjuba, Salagle, *Tozzi* 264 (FI); Dinsor, on rocky hill side, *Bally* B9334 (EA); between Dorianle and Oneiatha, *Paoli* 896 (FI); along Giuba River near Biobahal, *Paoli* 851 (FI); Guiba River near Matagassile, *Paoli* 839 (FI); near Matagoi, *Paoli* 680 (FI).

This species is easily distinguished from the related species within § *Balfouria* by the subsalverform corolla and the small corona with both antepetalous and alternipetalous segments and the relatively small leaves.

18. *WRIGHTIA SALIGNA* (R. Br.) F. Muell. ex Benth., *Fl. Austr.* **4**: 316. 1869.

*Balfouria saligna* R. Br. ex A. DC. in DC., *Prodr.* **8**: 467. 1844. (T.: *Brown* 2865!).

Shrubs or small trees up to 7 m. high; branches terete, very slender, the bark rough, gray to brownish, glabrous. Leaves drooping, linear-falcate, occasionally linear-ovate, the apex acuminate, the base attenuate, narrowly decurrent to the indefinite petiole 8-12 cm. long, 0.3-1.5 cm. broad, coriaceous, glabrous, the midrib obscure above, prominent beneath, the secondary veins numerous but usually inconspicuous. Inflorescence terminal, aggregate dichasial, about one-fourth the length of the subtending leaves; peduncle 1-2 cm. long, glabrous to minutely puberulent, the bracts linear, about 0.4 cm. long; pedicel about 1 cm. long, puberulent. Flowers yellow, relatively small; calyx lobes ovate, acute, about 1.5 mm. long, minutely puberulent without, ciliate, bearing within 10 glandular squamellae, half as long as the lobes; corolla subrotate, the tube 2-3 mm. long, glabrous, the lobes subobovate, obtuse to acute, 4-7 mm. long, puberulent-papillate; corona about 2.5 mm. long, the antepetalous segments adnate merely to the base of the corolla lobes and coherent into a truncate and crenulate cup around the stamens; stamens 5, inserted at the orifice of the corolla tube, the anthers sparsely puberulent within,

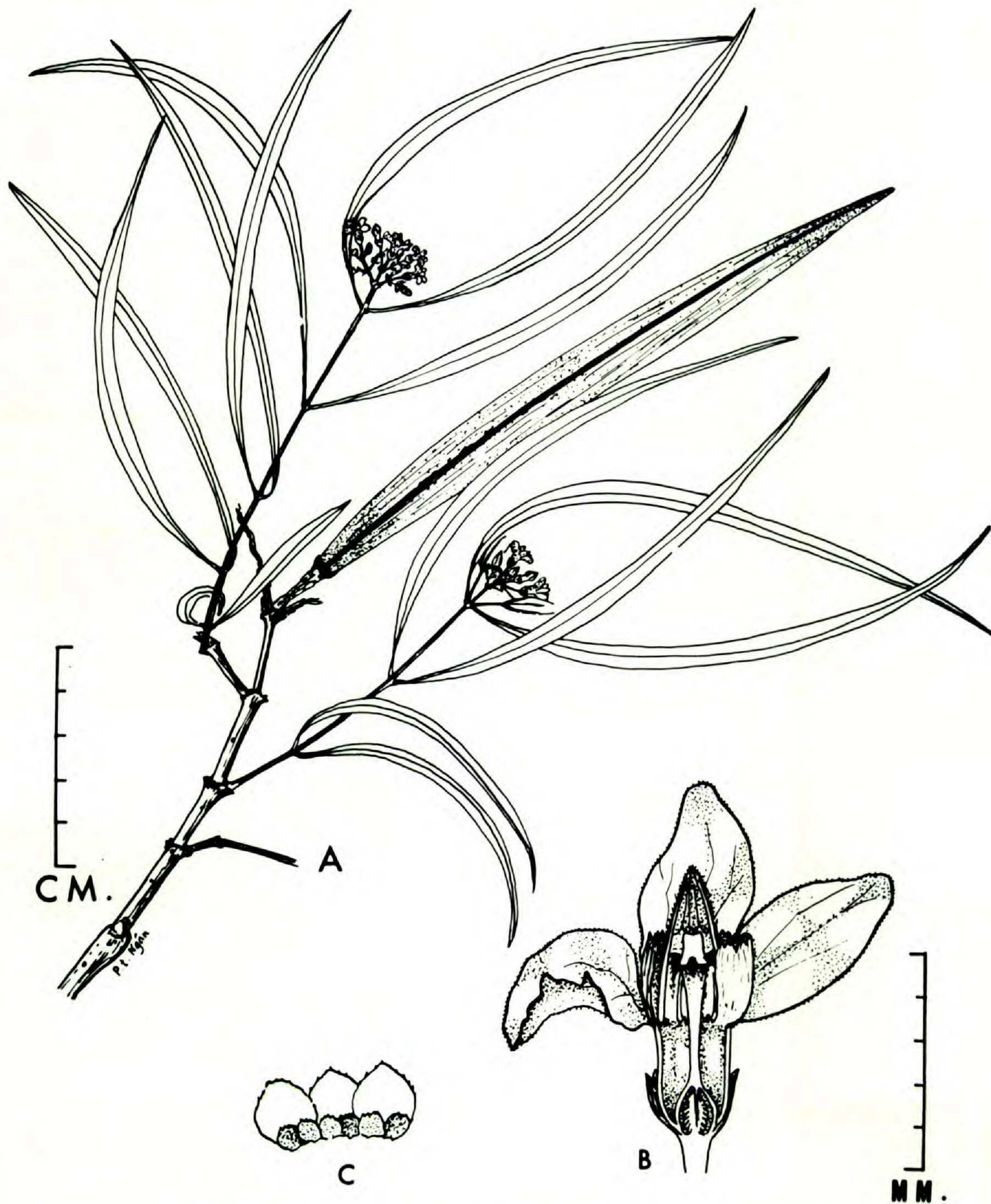


Figure 11. *Wrightia saligna* (R. Br.) F. Mueller ex Benth.; A, twig with inflorescences and follicles; B, longisection of the flower; C, calyx lobes and squamellae.

pubescent without, the acumen barbate, the filament as long as the basal anther lobes; carpels 2, coherent, glabrous, the style gradually dilated near the subcapitate stigma head. Follicles 2, coherent, 15-20 cm. long; seeds linear-fusiform, relatively few in number, 1.0-1.5 cm. long, the white coma about 3.5 cm. long.

Endemic to northern and northeastern Australia, in mixed open forest of *Eucalyptus*, on sandy and rocky soil; flowers from September to May, ripe follicles from May to October.

Vernacular name: *Coolaroo*, "milk bush" (W. Australia—Rust)

AUSTRALIA. NORTHERN TERRITORY: Bickerton Island, South Bay, common in *Eucalyptus spenceriana* woodland on granite outcrop, *Spetch* 602 (BRI, CANB); Borroloola, *Hill* 660 (MEL, NSW); Oenpelli, in mixed open forest on sandy outwash plain, *Spetch* 1267 (BRI, CANB, MEL, NSW, US); *Blake* 16994 (BRI); Port Darwin, *Bleeser* 545 (MEL, NSW); *Holtze* 583 (MEL), 916 (MEL), *s. n.* (NSW), *Schultz* 542 (MEL); Wearyan River, Manangoora, *Travers* 9061 (NT); precise locality unknown: *Hill* 451 (MEL), *unknown collector* 1019 (MEL). QUEENSLAND: Burke: Bentinck Island, *Bailey s. n.* (BRI), *Henne s. n.* (MEL); Croydon, *Wilson s. n.* (BRI); Kimberley, Carpentaria, *Galliver* 37 (MEL); 24.6 mi. N. Lawn Hill station, on stony slope with *E. brevifolia* and *Triodia*, *Perry* 1106 (BRI, CANB, MEL, NSW, NT, US); Sweers Island, *Henne s. n.* (MEL); 6 mi. W. of Westmoreland station, near creek with *E. argillacea*, *Perry* 1324 (CANB, NT, US). Cook: From Cooktown to Gilbert & Flinders rivers, *Palmer* 40 (BRI); Daintree, *Mueller s. n.* (MEL); Emuford, near Irvinebank, *Flecker s. n.* (BRI); Endeavour Strait, *Persieh* 1033 (MEL); Gilbert River, *Wildash s. n.* (BRI); Thursday Island, *Bailey* 5 (BRI), *Podenzana s. n.* (BM); Walsh River, *Miller* 6 (BRI, NSW). N. Kennedy: near junction of Broughton & Burdekin rivers, near Charters Towers, in *Eucalyptus* forest, on stony brown soil, *Hubbard & Winders* 6983 (A, BRI, G, L, W); Burdekin River, *Michael* 1503A (E); Carpentaria Island, *Brown* 2865 (E, MEL, MO); near Charters Towers, *Blake* 14669 (BRI); lake of Elphinstone, Amalia distr., *Mueller* 1663 (MEL); Port Denison, Edgecombe Bay, *Fitzalan* 17519 (BM), *s. n.* (MEL), *Mueller s. n.* (GH, L, MEL, NY, W), *unknown collector s. n.* (L, UPS, W). Ravenswood, *Blake* 14848 (BRI). S. Kennedy: Suttor River, *Mueller* 126 (MEL); without precise locality: *Armit* 542 (MEL), 837 (MEL), *Bauer s. n.* (W), *Brown s. n.* (G), *Michael* 1631 (BRI), *Mueller s. n.* (MEL), *Schomburgk s. n.* (US, W), *Webb* 5109 (CANB). w. AUSTRALIA: Cambridge Gulf, *Wright s. n.* (MEL); Denham River, *Fitzgerald s. n.* (NSW), *Staer s. n.* (E); Karunjie station, Kimberley, *Rust* 75 (CANB), 51K (CANB), 176 (CANB); King River, *Fitzgerald s. n.* (NSW), *Staer s. n.* (E); Kings Sound, *Troggat s. n.* (MEL, NSW); Roebuck Bay, *Mueller* 73 (MEL).

The linear-falcate leaves and the corona segments coherent into a cup about the stamens at once easily separate this species from all others of the genus. R. Brown and A. De Candolle put *W. saligna* in a distinct genus—*Balfouria*; however, the structure of the seed and flower of this species is unmistakably that of the genus *Wrightia*.

### SECTION 3. WALLIDA A. DC. in DC., Prodr. **8**: 404. 1844

*Wallida* Pichon, Not. Syst. **14**: 87. 1951, as genus.

19. WRIGHTIA ANTIDYSENTERICA (L.) R. Br., Mem. Wern. Soc. **1**: 73. 1811. (T.: *Hermann s. n.*, *Koenig s. n.*).

*Nerium antidysentericum* L., Sp. Pl. 209. 1753, ex char.

*Nerium zeylanicum* L., Centur. Pl. **2**: 12. 1756, ex char.

*Wrightia zeylanica* (L.) R. Br., Mem. Wern. Soc. **1**: 73. 1811.

*Wallida antidysenterica* (L.) Pichon, Not. Syst. **14**: 88. 1951.

Small shrubs as much as 2 m. high; branchlets gray to dark brown, lenticellate and glabrous. Leaves obovate to elliptic, occasionally narrowly elliptic, acuminate to caudate-acuminate at the apex, acute at the base, 3-10 cm. long, 1.5-3.5 cm. broad, membranaceous to subcoriaceous, glabrous even when immature, the midrib more or less elevated above, prominent beneath, the secondary veins 6-9 pairs, arcuate, sometimes obscure above, conspicuous beneath; petiole 2-3 mm. long, glabrous to minutely puberulent. Inflorescence terminal, monochasial, about as long

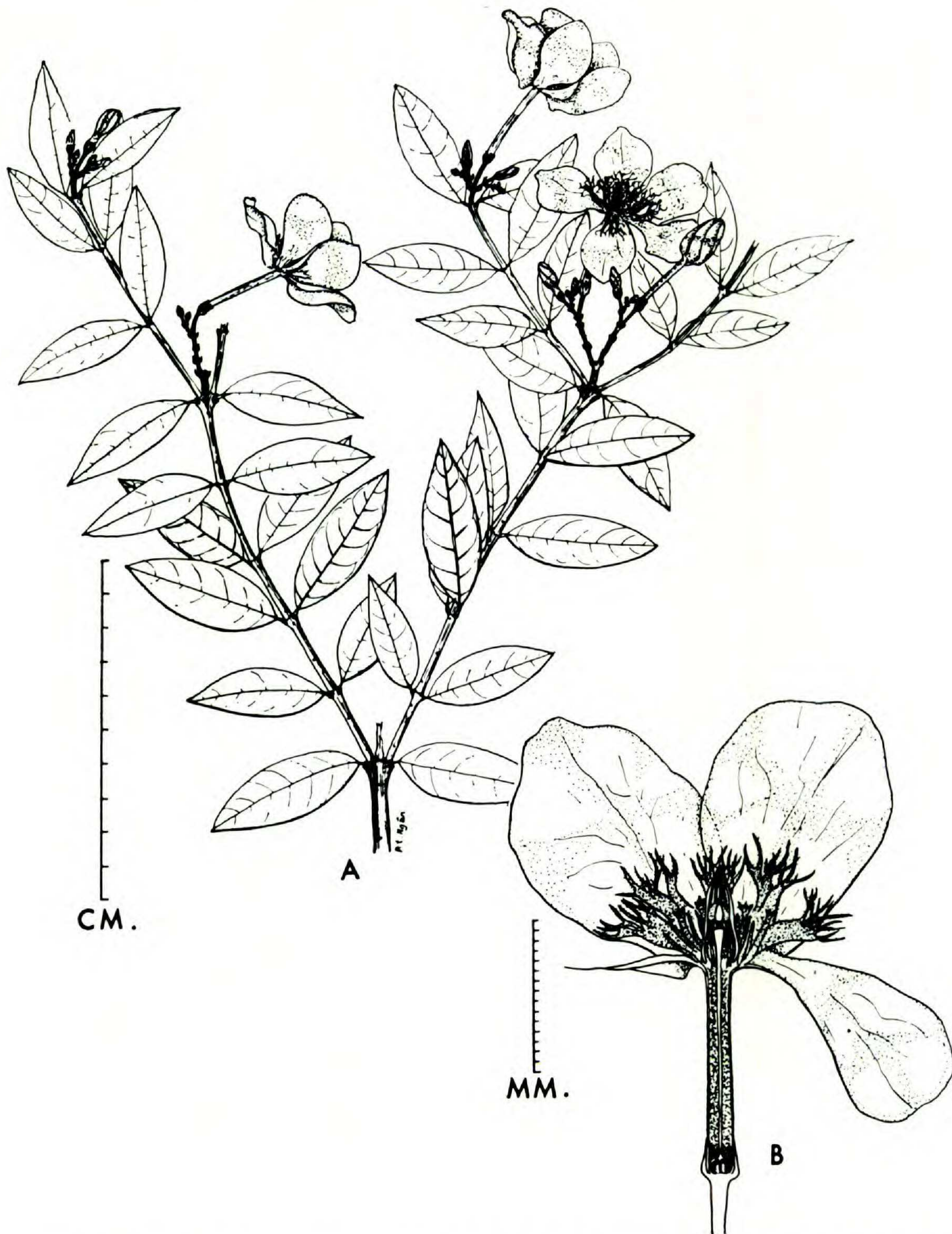


Figure 12. *Wrightia antidysenterica* (L.) R. Br.; A, twig with inflorescences; B, longi-section of the flower.

as the subtending leaves, glabrous peduncle rather stout, the bracts minute and scarious; pedicels about 1 cm. long. Flowers white, fragrant; calyx lobes ovate, 3.0-3.5 mm. long, glabrous and ciliate, bearing within 5 alternate, ovate squamellae about 0.8 mm. long; corolla salverform, the tube slender, 17-28 mm. long, glabrous without, puberulent within, the lobes obovate, obtuse, 15-25 mm. long, puberulent-papillate; corona minutely puberulent throughout, consisting of 3 series of segments, the antepetalous multifid, strongly adnate to the corolla lobes, the alter-

nipetalous multifid, shorter, and the alternating supplementary geminate, simple or compound; stamens 5, inserted at the orifice of the corolla tube, the anthers glabrous without, pubescent within, the basal lobes slenderly attenuate, longer than the filament, the acumen glabrous; carpels 2, free, glabrous, about 1 mm. long, the style very long and slender, gradually dilated near the subcapitate stigma. Follicles 2, free, sometimes coherent at the tips, terete-fusiform, 7-15 cm. long; seeds linear, about 1 cm. long, the white coma about 2.5 cm. long.

Endemic to Ceylon; flowering from March to August.

Vernacular names: *Sooddoo-idda* (Thwaites); *Wal-idda* (de Silva).

CEYLON. Colombo, *Meebold* 2975 (G), 10849 (CAL), *de Silva* 11 (NY), C. P. 1825, *Thwaites* (BM, CAL, G, GH, K, UPS, W); *unknown collector s. n.* (CAL); Galle, *Gardner* 557 (BM, K); Kalaeliya, *Simpson* 9886 (BM); Kalutara, *Schiffner* 2421 (A, L); Kandy, *Moon s. n.* (BM); without precise locality, *Beddome* 5123 (BM); *unknown collector s. n.* (G), *Macrae* 125 (BM), *Walker s. n.* (K), *Walpietze* 56 (L), 104 (G), *s. n.* (L).

This species is so distinct that little can be said about its relationships. The structure of its corona suggests an affinity with *W. tinctoria* of § *Wrightia*.

#### SECTION 4. **SCLERANTHERA** (Pichon) P.t. Nagan, stat. nov.

*Scleranthera* Pichon, in Not. Syst. **14**: 88. 1951, as genus.

##### KEY TO THE SPECIES

- a. Leaves glabrous even when immature; inflorescence glabrous; flowers very small, about 7 mm. long; corolla tube appendiculate within; anthers glabrous without. Plants of Palawan (Philippines). .....20. *W. HANLEYI*
- aa. Leaves puberulent, at least upon the veins beneath; inflorescence minutely puberulent; flowers relatively large, 16-40 mm. long; corolla tube exappendiculate within; anthers pubescent without.
  - b. Corolla infundibuliform, the tube definitely campanulate, shorter than to about as long as the calyx; stamens inserted near the orifice of the corolla tube, the anthers half exerted.
    - c. Flowers about 1.6 cm. long; alternipetalous corona segments present, the antepetalous trilobed, about  $\frac{1}{3}$  the width of the corolla lobe; calyx lobes long-acuminate, not auriculate; carpels free. Plants of Burma .....21. *W. COLLETTII*
    - cc. Flowers 2.0-3.5 cm. long; alternipetalous corona segments obsolete, the antepetalous crenulate, as broad as the corolla lobe; calyx lobes acute to obtuse, usually auriculate; carpels coherent. Plants of East Pakistan, eastern India and adjacent China. ....22. *W. COCCINEA*
  - bb. Corolla subinfundibuliform, the tube usually more or less constricted at the orifice, 2 to 4 times longer than the calyx; stamens inserted near the base of the corolla tube, the anthers included or slightly exerted. ....23. *W. DUBIA*

20. *WRIGHTIA HANLEYI* Elmer, Leaf. Philipp. Bot. **4**: 1465. 1912. (T.: *Elmer* 12873!).

Small shrubs up to 2 m. high; branches terete, slender, the bark rimulose, gray to brownish, the current year's growth glabrous. Leaves narrowly elliptic to elliptic or oblong-elliptic, occasionally ovate or obovate, the apex acuminate to

mucronate, the base broadly acute to obtuse, 6-15 cm. long, 2-6 cm. broad, coriaceous to chartaceous, glabrous throughout, the midrib canaliculate above, prominent beneath, the secondary veins 7-10 pairs, arcuate towards the margins; petiole canaliculate above, about 0.5 cm. long, glabrous. Inflorescence terminal, monochasial, much shorter than the subtending leaves; peduncle about 0.5 cm. long, glabrous, the bracts minute, scarious; pedicels rather short, about 0.3 cm. long, glabrous. Flowers yellow, small about 7 mm. long; calyx lobes ovate, about 2 mm. long, ciliate and glabrous, bearing within 5 alternate, glandular squamellae much smaller than the lobes, corolla subinfundibuliform, the tube campanulate, appendiculate within, about 3 mm. long, the lobes subovate, acute, about 4 mm. long, puberulent-papillate; corona reddish, the antipetalous segments nearly as large as, and strongly adnate to, the corolla lobes, the alternipetalous reduced to 5 small appendages about 1 mm. long; stamens 5, inserted at about half way within the corolla tube, the anthers 3-5 mm. long, glabrous without, the acumen minutely puberulent, the filament as long as the subtruncate, basal anther lobes; carpels 2, free, glabrous, the style slender, gradually dilated near the subcapitate stigma. Follicles 2, free, terete-fusiform, pendent, 15-20 cm. long; seeds linear-fusiform, about 1 cm. long, provided with a white coma about 3.5 cm. long.

Endemic to the islands of Palawan (Philippines); in clearings, thickets and open forests at low altitudes, on compact gravelly soil; flowering from March to May.

PHILIPPINES. PALAWAN: Puerto Princesa, Mt. Pulgar, *Elmer* 12873 (BM, E, F, G, GH, K, L, MO, US, W); Taytay, *Merrill* 9373 (BM, F, K, L, MO, NY, SING, US); without precise locality, *Bur. Sci* 849, Foxworthy (NY, US).

*Wrightia hanleyi* is easily distinguished from the other species of § *Scleranthera* by its glabrous branchlets, leaves and inflorescences, its relatively small flowers and its appendiculate corolla tube.

## 21. WRIGHTIA COLLETTII P.t. Ngan, sp. nov.

Verisimiliter frutices vel arbusculae ramulis juvenalibus dense pubescentibus. Foliorum lamina membranacea elliptica vel obovato-elliptica apice abrupte caudato-acuminata basi cuneata pubescens costa superne impressa subtus prominente nervis secundariis 10-15 partibus. Inflorescentia terminalis monochasialis foliis brevior; pedicellus ca. 0.5 cm. longus puberulusque; calycis laciniae ovatae acuminatae ca. 4 mm. longae extus puberulae intusque basi squamellis alternis praeditae; corolla infundibuliformis tubo campanulato ca. 4 mm. longo lobis subobovatis ca. 12 mm. longis puberulo-papillatis coronae squamis biseriatis glabris basi connatis antepetalis tridentatis ca. 3 mm. longis alternipetalis brevioribus bifidis; stamina prope faucem inserta antheris plus minusve exsertis sagittatis ca. 6 mm. longis utrinque minute puberulis; carpella libera ca. 1.5 mm. longa glabra. Folliculi ignoti. HOLOTYPUS: *Collett* 445 (K).

Endemic to Burma.

BURMA. UPPER BURMA: Shan Hills Terai, 3500 ft. in elev., *Collett* 445 (CAL, K).



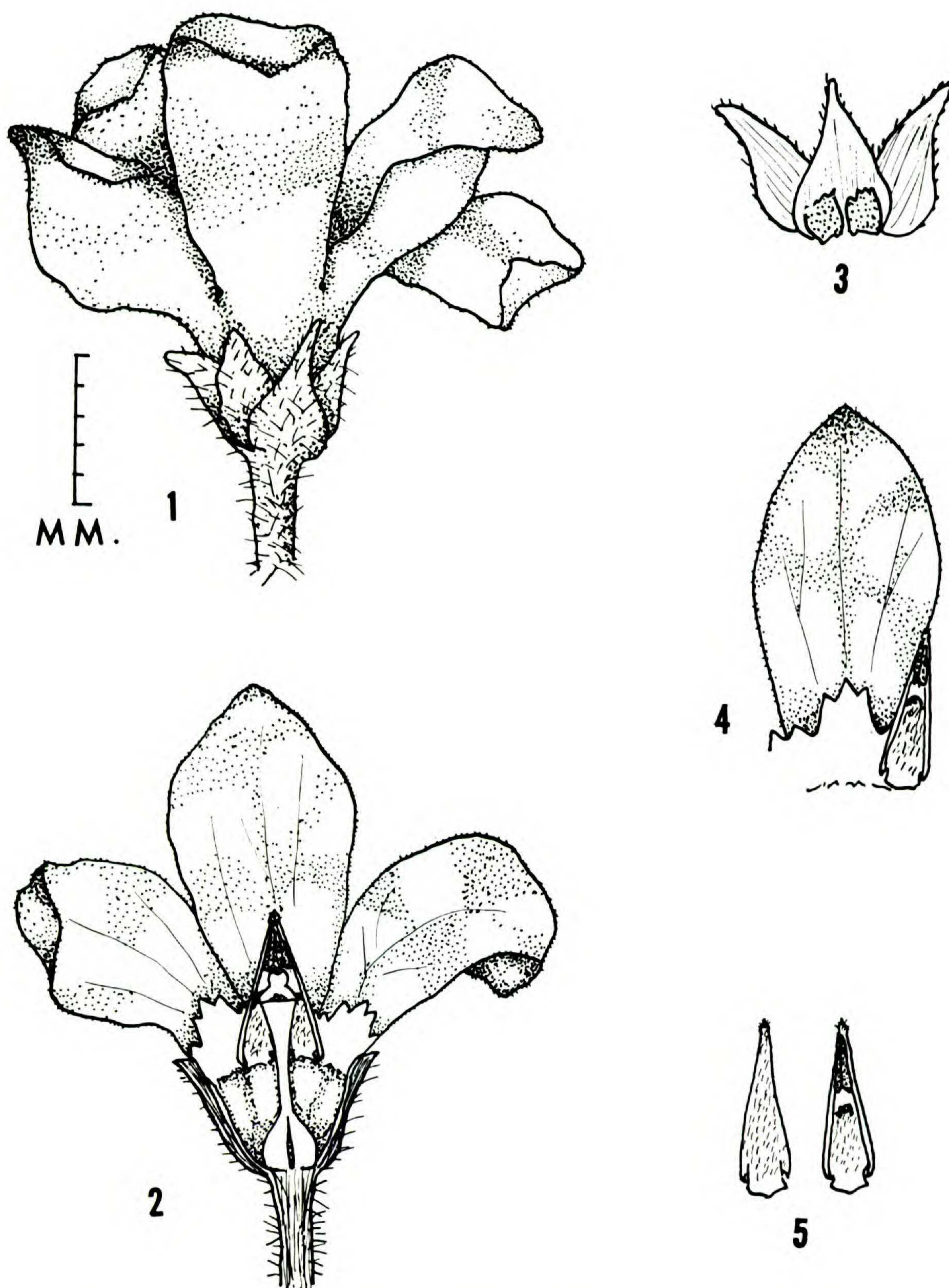


Figure 13. *Wrightia collettii* P. t. Ngan; 1: flower; 2: flower longitudinally opened, showing corona, stamens and ovary; 3: calyx lobes and squamellae; 4: corolla lobe with corona segments and stamen; 5: stamens.

*Wrightia collettii* is closely related to *W. coccinea* and *W. dubia*; however it is easily distinguished by its relatively smaller flowers and its tridentate antepetalous corona segments. The type specimen is in very poor condition, but the structure of the flower is so unusual that I do not hesitate to consider it as a distinct species even on the basis of a single collection.

22. WRIGHTIA COCCINEA (Roxb.) Sims, Bot. Mag. **53**: pl. 2696. 1826, non Soland. ex Naudin (1852). (T. : Wallich, cat. n. 1626!).

*Nerium coccineum* Roxb., Fl. Ind. ed. Carey & Wall. **2**: 2. 1824.

Shrubs or small trees up to 20 m. high; branchlets ascending, terete, the bark pale gray to brownish, glabrous and lenticellate. Leaves elliptic to ovate, caudate-acuminate at the apex, obtuse to acute at the base, 9-15 cm. long, 3.5-7.0 cm. broad, membranaceous, glabrous throughout, except upon the veins beneath, occasionally puberulent, the secondary veins 8-14 pairs, parallel and arcuate toward the margins, immersed above, prominent beneath; petiole 0.3-0.6 cm. long, puberulent. Inflorescence terminal, dichasial, few-flowered, about half as long as the subtending leaves; peduncle relatively stout, about 0.3 cm. long, puberulent, the bracts foliaceous, up to 2 cm. long, glabrous; pedicels stout, relatively short, about 0.5 cm. long, puberulent. Flowers dull red within, greenish without, fragrant, relatively large; calyx deeply 5-lobed, the lobes broadly ovate, obtuse at the apex, usually auriculate at the base, 5-9 mm. long, glabrous and ciliate, the 5 alternate, ovate squamellae much smaller than the lobes; corolla infundibuliform, the tube campanulate, shorter than the calyx, glabrous, the lobes broadly obovate, subacute to obtuse, puberulent-papillate; corona crimson, about 5 mm. long, shorter than the stamens, the antepetalous segments relatively broad, coherent at the base, crenulate and strongly adnate to the corolla lobes, the alternipetalous segments obsolete; stamens 5, inserted near the orifice of the corolla tube, the anthers about 10 mm. long, sparsely puberulent to glabrous, within, densely pubescent without, the acumen barbate, the filament relatively broad, about 2.5 mm. wide, glabrous within, pubescent without; carpels 2, free, glabrous, about 2 mm. long, the style columnar, abruptly dilated near the subcapitate stigma. Follicles 2, free, about 3.0 cm. long, very conspicuously lenticellate; seeds linear, about 2 cm. long, the white coma 3.5-4.0 cm. long.

East Pakistan, West Bengal, Assam and Yunnan; in mixed forests and thickets on mountain slopes from 300 to 1800 m. elev.; flowering from April to June, fruiting from June to September.

Vernacular names: *Panal* (Assam—unknown collector); *Pullum* (East Pakistan—Roxburgh); *Khirra* (W. Bengal—Cowan).

CHINA. YUNNAN: Fo hai, in mixed forests, Wang 73943 (A); I wu, Henry 13574 (K, NY); Nan chia, mountain slope, in forests, Wang 75279 (A); top of mountain, in thicket, Wang 75412 (A).

INDIA. ASSAM: Abor Hills, Barlek, unknown collector 36958 (CAL.) EASTERN HIMALAYA: Birick, Cave s. n. (CAL); Mungkoo Rieng road, Cousins 39 (CAL). SIKKIM: precise locality unknown, Anderson s. n. (CAL); Cave 6656 (CAL). UTTAR PRADESH: Dehra Dun, cult.,

*Kirat Ram* s. n. (A); Saharanpur Botanic Garden, *King* s. n. (CAL), *unknown collector* s. n. (CAL). WEST BENGAL: Darjeeling, *Cowan* s. n. (E, US). PRECISE LOCALITY UNKNOWN: *unknown collector* s. n. (CAL).

PAKISTAN. Calcutta Botanic Garden, *Wallich* cat. n. 1626a (BM), 1626B (G); Tista, Rangpur distr., *Cave* s. n. (E, G), *Clarke* 7164 (BM); Sylhet, *Wallich* cat. n. 1626 (K), 1627C (G), *unknown collector* s. n. (CAL).

In his original description Roxburgh cited no specimen, however he mentioned the plant brought from Sylhet to the Calcutta Botanic Garden. In 1823, Wallich sent specimens to Glasgow Botanic Garden under the catalogue number 1626; for this reason I have chosen that specimen as the provisional lectotype.

This species is easily distinguished by its calyx lobes auriculate at the base, glabrous and longer than the tube, its foliaceous, glabrous bracts and bracteoles and its corona with 5 relatively large antepetalous segments.

23. *WRIGHTIA DUBIA* (Sims) Spreng., Syst. Veg. ed. 16, **1**: 638. 1825.

*Cameraria dubia* Sims in Curtis, Bot. Mag. **39**: pl. 1646. 1814, ex. ic. & char.

*Strophanthus jackianus* Wall., Cat. no. 1643. 1828, nom. nud.

*Wrightia cambodiensis* Pierre ex Pitard in Lecomte & Humbert, Fl. Gén. Indochine **3**: 1184. 1933. (T.: *Pierre* 4402!).

*Wrightia dubia* var. *membranifolia* King & Gamble, Jour. As. Soc. Beng. **74**: 2466. 1907. (T.: *Curtis* 2915!).

*Wrightia rubriflora* Pitard in Lecomte & Humbert, loc. cit. 1185. 1933. (T.: *Hayata* s. n., *Poilane* 5955, photos. MO!).

*Scleranthera cambodiensis* (Pierre) Pichon, Not. Syst. **14**: 89. 1951.

*Scleranthera dubia* (Sims) Pichon, Not. Syst. **14**: 90. 1951.

Shrubs up to 3 m. high; branchlets slender, terete, glabrous to minutely puberulent, the bark gray to brownish, minutely striate and lenticellate. Leaves narrowly elliptic to elliptic or narrowly obovate to obovate, the apex acuminate to caudate-acuminate, the base acute to obtuse, 9-20 cm. long, 2.5-8.0 cm. broad, membranaceous to chartaceous, glabrous to more or less sparsely puberulent along the midrib above, puberulent beneath especially along the nerves, occasionally becoming glabrous, the midrib immersed above, conspicuously elevated beneath, the secondary veins 8-10 pairs, oblique and arcuate toward the margins; petiole canaliculate, 0.3-0.5 cm. long, puberulent. Inflorescence terminal, monochasial, few-flowered, rather condensed, shorter than the subtending leaves, glabrous to minutely puberulent; peduncle about 0.5 cm. long, the bracts ovate, about 0.3 cm. long, scarious; pedicels rather slender, about 0.7 cm. long. Flowers pink, yellow, orange to dull red within, white to yellowish or greenish without, fragrant; calyx lobes narrowly to broadly ovate, 2.5-6.0 mm. long, glabrous or sparsely puberulent, bearing within 5 orbicular to ovate squamellae; corolla subinfundibuliform, the tube suburceolate to campanulate, 6-12 mm. long, minutely puberulent without, the lobes obliquely ovate and acute to ovate-lanceolate, long-acuminate, 16-22 mm. long, minutely puberulent without, glabrous within; corona relatively short and inconspicuous, glabrous, the antepetalous segments reduced to a thickened, triangular ridge completely adnate to the base of the corolla lobes, 2-3 mm. long, the alternipetalous segments entire and obtuse, about 1 mm. long; stamens 5, inserted

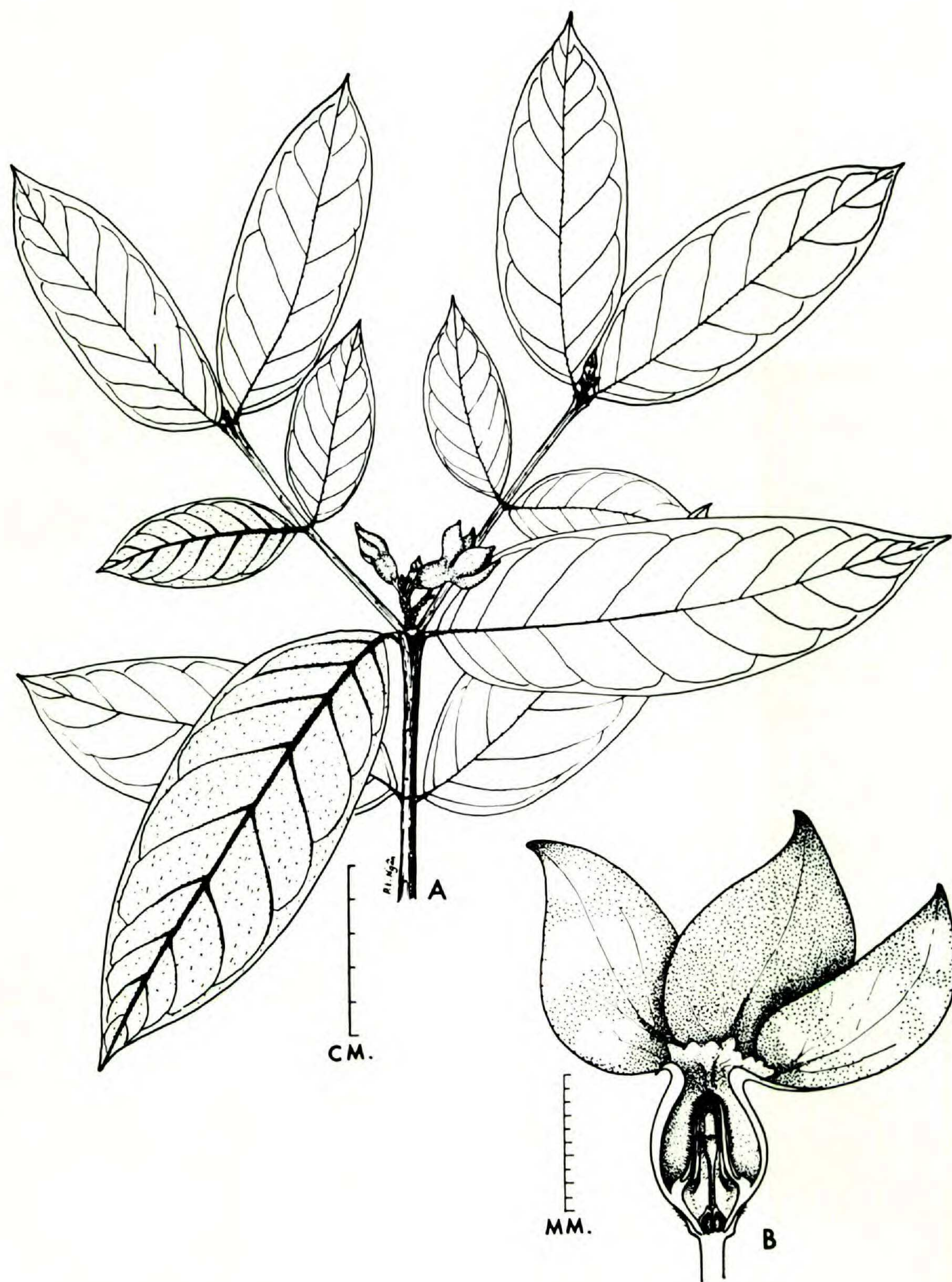


Figure 14. *Wrightia dubia* (Sims) Spreng.; A, twig with inflorescences; B, longisection of the flower.

near the base of the corolla tube, the anthers included or with the tip slightly exerted, about 6 mm. long, sparsely puberulent within, densely pubescent without, the acumen barbate, the filament very broad at the base, glabrous and conspicuously inflexed; carpels 2, free, glabrous, about 1.5 mm. long, the common style gradually dilated near the conical stigma. Follicles 2, free and usually coherent at the tips, slender and terete, about 32 cm. long; seeds linear-fusiform, about 1.5 cm. long, the white coma about 4 cm. long.

Northern Malaya, southern Thailand, Cambodia and southern Vietnam; in bamboo forests, evergreen forests, savannas, on sandy soil, limestone, by stream or along roadside; flowering from November to August.

CAMBODIA. Mont Tamire, Samrong tong, *Pierre* 4402 (NY).

MALAYA. KEDAH: Ara Kudah by Sungei krai bridge, *Ridley* s. n. (SING); Kaki Bukit, *Kiah* s. n. (A, L, SING); Telok Apau, Pulau Langkawi, *Haniff* 7086 (SING); Yan, *Ridley* 5521 (SING). PULAU PENANG: Tanjong Tokong, *Haniff* 296 (UC); Telok Bahang, *Curtis* 188 (CAL, SING); valley near stream below Waterfall Gardens, *Sinclair*, S.F.N. 39023 (SING). SINGAPORE: Botanic Garden, *Nur*, S.F.N. 35471 (L).

THAILAND. PUKET: Ban Takuapa, *Kerr* 17105 (BM, K, L); Krabi, Tambon Kao Panom, *Kerr* 18832 (A, BM, L, MO); Krasom, Khao Pok, *Haniff & Nur* 3638 (SING); Pang-nga, Tap-put, *Kerr* 18361 (BM, K, L); Ranong, Kaw Payam, *Kerr* 16639 (A, BM, K, L); Trang, Chawng, *Kerr* 15154 (BM); Trang, Kaokao, *Rabil* 291 (A, BM), *Vanpruk* 681 (K); Trang, Sikao, *Kerr* 19027 (BM); Tungka, *Curtis* 2915 (CAL, SING); Trang, in open jungle, on hilly ground, *Kunstler* 1400 (CAL); precise locality unknown, *Curtis* s. n. (SING). SURAT: Langsuan, Tako, *Put* 1616 (BM, K); Pato, *Kerr* 12208 (BM, K, L, SING); Surat Panom, *Kerr* 12414 (BM, K, L).

VIETNAM. Biênhōa, Giarây, *Poilane* 185 (F, NY, SAIG); Longthanh, *Thorel* s. n. (A); Trangbom, *Lý van Hôi* s. n. (MO); Trihuyên, *Pierre* 4401 (A, NY, P). Đàlat, *Squires* s. n. (NY); Phan thiet, *Dong phuc Long* 1404 (SAIG), s. n. (SAIG); Phan rang: Cà ná, *Poilane* 5955 (SAIG), 8856 (SAIG); Nhatrang, *Poilane* 5211 (SAIG), 6770 (SAIG).

This species shows great variability in the shape of the calyx and corolla lobes. In the southern range the calyx lobes are narrowly ovate and acuminate, the corolla lobes narrowly ovate to ovate and slenderly acuminate; the population in the center, which has been treated by many authors as a distinct species (*W. cambodiensis*), has ovate calyx lobes with the apex acute and the corolla lobes ovate to broadly ovate and acute. However these variants intergrade and for this reason, I believe that they cannot be recognized even as subspecies.

#### EXCLUDED SPECIES

- Wrightia afzelii* K. Sch. in Engl. Bot. Jahrb. **23**: 231. 1897. = *PLEIOCERAS AFZELII* (K. Sch.) Stapf Dyer, Fl. Trop. Afr. **4**(1): 166. 1904.
- Wrightia baccelliana* F. Muell. in Vict. Natural. **8**: 178. 1892. = *MELODINUS BACCELLIANUS* (F. Muell.) S. T. Blake, Proc. Roy. Soc. Queensl. **59**: 161. 1948.
- Wrightia coalita* Buch.-Ham. ex Pritz., Ic. Ind. **1**: 1175. 1855. = *PERIPLOCA* sp. fide Ind. Kew.
- Wrightia coccinea*, Soland. ex Naudl., Ann. Sc. Nat. Bot., Sér. **3**(18): 126. 1852. = *MERIANIA LEUCANTHA* Sw., Fl. Ind. Occ. **2**: 826. 1800.
- Wrightia cunninghamii* Benth., Fl. Austral. **4**: 317. 1869. This is rather an asclepiad according to my observation of the type specimen from the National Herbarium of New South Wales.
- Wrightia madagascarensis* Boj. ex A. DC. in DC., Prodr. **8**: 408. 1844. = an asclepiad fide A. DC.

- Wrightia ottolanderi* Koord., Ind. Kew. Suppl. **5**: 275. 1921. = *WRIGHTIA OTTOLANDERI* Koord., Excursionsfl. Java **3**: 172. 1912.  
*Wrightia parviflora* Stapf, Kew Bull. **1894**: 124. 1894. = *PLEIOCERAS BARTERI* Baill., Bull. Soc. Linn. Paris. **1**: 759. 1888.  
*Wrightia piscidia* G. Don, Gen. Syst. Gard. Bot. **4**: 86. 1838. = *MELODINUS MONOGYNUS* Roxb., Fl. Ind. ed. Carey & Wall. **2**: 56. 1824.  
*Wrightia stuhlmannii* K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. **4**(2): 183. 1895 = *ALAFIA LUCIDA* Stapf, Kew Bull. **1894**: 122. 1894.

## ENUMERATION OF THE SPECIES

## SECTION 1. WRIGHTIA

1. *laevis* Hook. f.
  - 1a. ssp. *laevis*
  - 1b. ssp. *millgar* (F. Muell.) P.t.Ngan
  - 1c. ssp. *novoguineensis* P.t.Ngan
2. *viridiflora* Kerr
3. *flavido-rosea* Trimen
4. *indica* P.t.Ngan
5. *tinctoria* R. Br.
  - 5a. ssp. *tinctoria*
  - 5b. ssp. *rothii* (G. Don) P.t.Ngan
6. *kwangtungensis* Tsiang
7. *puberula* (Thw.) P.t.Ngan
8. *sikkimensis* Gamble
9. *tomentosa* R. & S.
  - 9a. ssp. *tomentosa*
  - 9b. ssp. *pauciflora* P.t.Ngan
10. *pubescens* R. Br.
  - 10a. ssp. *pubescens*
  - 10b. ssp. *candollei* (Vidal) P.t.Ngan
  - 10c. ssp. *novobritannica* P.t.Ngan
  - 10d. ssp. *penicillata* (Bailey) P.t.Ngan
  - 10e. ssp. *laniti* (Blco.) P.t.Ngan

11. *annamensis* Eberh. & Duby
12. *lanceolata* Kerr
13. *angustifolia* Thwaites
14. *lecomtei* Pitard
15. *religiosa* (Teijsm. & Binn.) Benth.

## SECTION 2. BALFOURIA

16. *natalensis* Stapf
17. *demartiniana* Chiov.
18. *saligna* (R. Br.) F. Muell. ex Benth.

## SECTION 3. WALLIDA

19. *antidysenterica* (L.) R. Br.

## SECTION 4. SCLERANTHERA

20. *hanleyi* Elmer
21. *collettii* P.t.Ngan
22. *coccinea* (Roxb.) Sims
23. *dubia* (Sims) Spreng.