A TAXONOMIC REVISION OF THE GENUS BONAMIA (CONVOLVULACEAE)

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This study is derived from a doctoral dissertation written by the senior author, University of Florida, 1964, under the direction of the junior author. The authors' gratitude is hereby expressed to the Government of the Union of Burma, who met important expenses by a State Scholarship grant, to the curators of those herbaria who generously sent their specimens, including types, for examination, to the Center for Tropical Agriculture, University of Florida, for preparation of the typescript, and to the Department of Botany, University of Florida, for meeting the direct cost of publication.

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Introduction

The genus Bonamia belongs to the Convolvulaceae, a family of flowering plants. According to the concept presented in this study, it is a genus of forty-five species and eleven varieties. Bonamia is a fairly large genus compared with some of its close relatives, Stylisma (represented by six species), Calycobolus (represented by eleven or twelve species) and Seddera (represented by about fifteen or twenty species). In contrast to the narrow distribution of these genera, Bonamia occurs throughout the tropical and warm temperate regions of both hemispheres, with a concentration of species in South America, Australia and Madagascar. Several species are known only by type collections or only from type localities and are poorly represented in the herbaria of the world. Several others are known only by a modest number of specimens. Only fourteen species are known from ten or more collections, and only five species are not restricted to a narrow geographical region.

The only synopsis of the genus Bonamia, that of H. Hallier (1897), contained twenty-eight species, one of which definitely belongs to the genus Seddera and another to the genus Metaporana; no key was given. Recent studies of the genus (van Ooststroom, 1954, O'Donell, 1959, Verdcourt, 1963 and Myint, 1968) deal only with a few species of particular areas or countries. Other recent students (Meeuse, 1957, Wilson, 1960, and Shinners, 1962), have applied the name Bonamia in a somewhat broader sense by inclusion of some species here considered as belonging to related genera. In contrast to these authors, Roberty (1952) breaks Bonamia into more than one genus. These conflicting treatments create doubt as to generic limits and invite a thorough investigation of the entire genus. That some clarification of the species and varieties comprising the genus Bonamia is needed is evident from the large number of misidentified or misplaced specimens extant in most herbaria. With the addition of many species to the original genus, and due to the inclusion of several species of related genera, it becomes desirable to redefine the generic limits of Bonamia, to form three sections within the genus, to evaluate some characters that have not been used in its classification, and to determine boundaries of several species which were inadequately described and are poorly known.

Bonamia is characterized technically by the possession of free or partially free styles, nonaccrescent sepals, and ovate, obovate or ovate-cordate cotyledons. It is not surprising that Asa Gray, recognizing the overall similarity of Bonamia and Stylisma, put the members of the latter in Bonamia. However, a recent monographic study of Stylisma by the senior author (Myint, 1966) together with additional information gathered during the present investigation, strongly indicates the feasibility and desirability of treating them as separate genera, while admitting the existence of connection between them.

In the present study, one new species, two new varieties and one new form are described; three new combinations are made; and three sections are proposed. A key to sections, a general key to all species, and three regional keys to species are presented. All specimens (assigned to the genus Bonamia and its related genera) available from the following herbaria were examined. The abbreviations are listed here according to Lanjouw and Stafleu (1964).

A- Arnold Arboretum, Cambridge, Massachusetts.
B - Botanisches Museum, Berlin-Dahlem, Germany.
BM - British Museum of Natural History, London, Great Britian.
BRI - Botanic Museum and Herbarium, Brisbane, Queensland, Australia.
EA - The East African Herbarium, Nairobi, Kenya.
F - Chicago Natural History Museum, Chicago, Illinois.
G - Conservatoire et Jardin Botaniques, Geneve, Switzerland.
GH - The Gray Herbarium of Harvard University, Cambridge, Massachusetts.
HBG - Stattsinstitut fur allgemeine Botanik, Hamburg, Germany.
K - The Herbarium, Royal Botanic Gardens, Kew, Great Britian.
L - Rijksherbarium, Leiden, Netherlands.
MEXU - Herbario Nacional del Instituto de Biologia, Mexico, D.F. Mexico
NY - New York Botanical Garden, New York, New York.
R - Divisao de Botanica do Museu Nacional, Rio de Janeiro, Brazil.
RB - Jardim Botanico, Rio de Janeiro, Brazil.
UC - Herbarium of the University of California, Berkeley, California.
US - National Museum, Smithsonian Institution, Washington, D.C.
W - Naturhistorisches Museum, Wien, Austria.

In addition to the species from the above-mentioned herbaria, specimens of B. grandiflora, B. multicaulis and B. ovalifolia from the following herbaria were examined.

DUKE - Duke University, Durham, North Carolina.
FLAS - Herbarium of the University of Florida, Gainesville, Florida.
FSU - Florida State University Herbarium, Tallahassee, Florida.
GA - Herbarium of the University of Georgia, Athen, Georgia.
MICH - University Herbarium, University of Michigan, Ann Arbor, Michigan.
NCU - Herbarium of University of North Carolina, Chapel Hill, North Carolina.
NSC - Department of Botany, North Carolina State College, Raleigh, North Carolina.
PH - Academy of Natural Sciences, Philadelphia, Pennsylvania.
SMU - Herbarium of Southern Methodist University, Dallas, Texas.

History

The generic name Bonamia was established by DuPetit-Thouars (1804) in honor of Francois Bonami (1710-1786), a French physician and botanist who wrote the Flora of the Environ of Nantes in 1782.

It was based on a woody vine of Madagascar, later described as B. alternifolia by Jaume Saint-Hilaire (1805) and as B. madagascariensis by Poiret (1810).

The generic name Breweria was proposed by Robert Brown (1810) in honor of Samuel Brewer (1670-1743), an English amateur botanist. The generic description was based on three Australian species, Brewerla linearis, Br. media and Br. pannosa (i.e. Bonamia linearis, B. media and B. pannosa of the present treatment). Before the comparative study of the Convolvulaceae by Hallier (1893), Breweria was most commonly treated as a genus distinct from Bonamia.

The generic name Trichantha was described by Karsten and Triana (1856), based on a woody vine of Columbia, described by them as Trichantha ferruginea (=Bonamia trichantha of the present treatment). However, this generic name is invalid, since it is preoccupied by Trichantha Hooker (1844) of the Gesneriaceae.

The name Perispermum was established by Otto Degener (1932), based on a woody vine, Perispermum albiflorum (=Bonamia menziesii of the present treatment), which is endemic to the Hawaiian Islands.

A fifth generic name, Breweriopsis, was proposed by G. Roberty in his new and strange system of classification of the Convolvulaceae (1952). It was based on Breweriopsis elegans (=Bonamia elegans of the present treatment), an endemic of lower Burma.

Although these five generic names were described from different plants from various parts of the world (Madagascar, Australia, Columbia, Hawaii and tropical Asia), they all are characterized by essentially similar floral features. Other generic names of close nomenclatural association, especially to the names Breweria and Bonamia, are Stylisma Rafinesque (1818), Seddera Hochst. (1844), Calycobolus Willd. ex Roem. and Schult. (1819), Prevostea Choisy (1825), Dufourea H.B.K. (1818), Reinwardtia Spreng. (1825), Dethardigia Nees et Mart. (1823), Codonanthus G. Don (1856), and Metaporana N.E. Brown (1914).

The treatment of these genera in the past has varied widely. Choisy (1845) treated Bonamia, Breweria, Stylisma, Seddera and Prevostea (=Calycobolus) as distinct genera. Gray, in his earlier manual (1856), treated Stylisma as a distinct genus; but later (1862) he questioned the validity of Breweria and Stylisma, and suggested their reduction to Bonamia. Bentham and Hooker (1876) did not accept Gray's suggestion and treated Bonamia as a monotypic genus of Madagascar and Breweria in a very broad sense by including species previously assigned to Seddera, Stylisma and Calycobolus, in addition to species described under Breweria and Trichantha. Peter (1897) slightly modified Bentham and Hooker's classification by treating Bonamia as containing two species (B. alternifolia and B. menziesii), members of Calcycobolus and one species of Bonamia (B. ferruginea) under the generic name Prevostea, and the rest in three subgenera (namely Seddera,

Stylisma and Eubreweria) under the generic name Breweria.

Hallier (1893) was the first to call attention to the weakness of the differences observed between Bonamia and Breweria sen. str. He combined the two groups into a single genus, and the older name Bonamia was substituted for the later Breweria. He retained Stylisma, Seddera and Prevostea as distinct genera from Bonamia (although his choice of the name Prevostea rather than Calycobolus was incorrect). The generic delimitation thus adopted and revised by Hallier was accepted by House (1907), but he treated three species of Bonamia under Calycobolus, since he missed the fact that members of Calycobolus are characterized by accrescent sepals rather than by unequal sepals. Amongst the authors of some local floras, Baker and Rendle (1906), Hutchinson and Dalziel (1931), Small (1933), van Ooststroom (1932; 1954), O'Donell (1959) and Vercourt (1963) followed Hallier, whereas Clarke (1883), Bailey (1901), Baker and Wright (1904) and Fernald (1950) apparently followed Bentham and Hooker. In the more recent studies Meeuse (1957), working on south African species, referred a species of Seddera to Bonamia, and Wilson (1960) and Shinners (1962), independently working on the North American species, referred all species of Stylisma to Bonamia.

Roberty's treatment of Bonamia and its related genera in his new system of classification (1952) is so different from all other authors mentioned above and so artificial in selection of the distinguishing characters that it is not at all acceptable and deserves no special attention except a short comment. His proposal of the new genus Breweriopsis and treatment of Bonamia and Breweria as distinct genera are based on insufficient knowledge of the plants, as is evident from the fact that he included B. spectabilis in Breweriopsis (under B. elegans) and B. minor in Bonamia (under B. cymosa), whereas these two are definitely conspecific (the difference being only in the pubescence of stems, which is variable). Further, he included three species of Bonamia in Stylisma humistrata in addition to all known species of that genus; he also associated Bonamia ferruginea with Dipteropeltis ferruginea, an entirely different plant of tropical Africa. Several other serious errors have been pointed out by Verdcourt (1957; 1963).

Morphology

The morphological characteristics of species of Bonamia are poorly known because of the infrequent or rare occurrence and sporadic or limited distribution of many species. Most previous studies, except Hallier's comparative study of the family and synopsis of Bonamia, have been directed mainly to the descriptions of essential features for delimiting different species.

HABIT: Plants of Bonamia are perennial, woody, suffrutescent or rarely herbaceous vines, occasionally small shrubs or

subshrubs, growing from deep-seated roots. The roots are mostly woody and never tuberous as they are in some species of Ipomoea, the largest genus of the Convolvulaceae. The tap roots are thick, at least near the bases of the shoots, and gradually taper downward. Adventitious roots at the nodes are not common, even in the prostrate or trailing species.

The stem is generally weak and slender or occasionally woody, mostly prostrate, twining or scandent, infrequently procumbent, suberect or erect. Members of section Trichantha are consistently woody and high-climbing vines or small erect shrubs, as in B. corumbaensis. The habit of members belonging to section Bonamia is quite variable from species to species, from suberect or procumbent as in B. sericea and B. ovalifolia, prostrate, twining or scandent as in most other species, to very high climbing as in B. brevipedicellata, B. maripoides, B. ferruginea, and B. semidigyna. B. brevipedicellata has been recorded as "50 ft. high, 1 inch in diameter." Members belonging to the section Breweria are generally smaller, somewhat herbaceous, suffrutescent or becoming woody. They are mostly prostrate, procumbent or erect, rarely twining. The stem is usually slender, as in B. linearis, B. media and B. brevifolia, or thick and erect as in B. rosea and B. velutina. In general, section Trichantha and section Breweria show the extreme types of habit, whereas section Bonamia is somewhat intermediate.

STEM: The stems are mostly terete or slightly angular, smooth, minutely striated, punctate or provided with lenticels, glabrous, sparsely pubescent, glabrescent, moderately to densely sericeous, villous, tomentose, velutinous or ferrugineous. Internodes, highly variable in length from species to species, are one or two centimeters long, as in most species of section Breweria and some species of section Bonamia, to several centimeters long, as in most species of section Trichantha and a few species of section Bonamia. The colors are light green, greyish green, silvery grey or brownish grey depending on the absence or presence of a dense coating of hairs. Underground stems have not been seen, although they might be present in several species. Branching is not alternate, and frequent or occasional. Extent of branching is not a constant feature and is variable even in a single species. In some species there is a little or no secondary branching.

LEAVES: In general, the leaves show a homoblastic series, with all leaves similar in shape, although with the upper smaller than the lower. B. elegans shows a heteroblastic series, with the juvenile leaves ovate, elliptic or ovate-elliptic, and the upper leaves (on flowering branches) oblong.

Leaf shape in members of the genus Bonamia varies from elliptic, ovate, cordate, or orbicular (with length-width ratios of one or very close to one) to oblong, lanceolate or linear (with length-width ratios of two or higher). Leaf size also varies from one

centimeter of slightly longer as in B. brevifolia, B. media and B. rosea, to several centimeters long as in B. agrostopolis, B. ferruginea, B. mattogrossensis, B. kuhlmannii, B. subsessilis and B. trichantha. In general, the leaves are smaller in members of section Breweria and larger in those belonging to section Trichantha, while most species of section Bonamia possess leaves of somewhat intermediate sizes.

Leaves are sessile, subsessile or shortly petiolate in the members of section Breweria, whereas they are distinctly petiolate or long-petiolate in those of section Trichantha. Leaves in members of section Bonamia may be sessile, subsessile, shortly petiolate or long-petiolate. Leaves are thin, herbaceous or slightly subcoriaceous as in section Breweria, thin or thick, soft or subcoriaceous, as in most species of section Bonamia, or thick, subcoriaceous, coriaceous or leathery as in section Trichantha. Leaf base and apex vary inconsistently from acute and attenuate to obtuse, rounded, truncate and cordate or emarginate; leaves are frequently mucronate or mucronulate. Such wide variations of leaf base and apex are shown in all three sections.

Leaves are entire in most species, slightly undulate in B. alternifolia and slightly crenate or somewhat wavy in B. burchellii. They are mostly green, dark green or greyish green on the upper surface, pale or light green on the lower surface. Leaf surfaces are glabrous, sparsely pubescent, puberulous, sericeous, velutinous, tomentose, strigose, or ferrugineous, frequently more densely so on the lower surface or on the veins. Veins are thin and obscure as in some species of section Breweria or very prominent as in most species of section Trichantha, in which even the intercostal veins are prominent. In the species of section Bonamia, veins are not distinct as in B. densiflora, B. multicaulis, and B. sericea, or are very prominent as in B. alternifolia and B. ferruginea. Lateral veins are few (2-5), as in some Australian species, or several (6-11), as in most South American species.

INDUMENTUM: Hairs, except glandular ones, in all species of Bonamia are two-celled, and are usually appressed. The stalk-cell is extremely small, and the terminal cell bears two elongated arms. Both stalk and two-armed cells are mostly thick-walled or rarely thin-walled. The two arms of hairs on the vegetative parts and on the sepals are equal or slightly unequal and usually point in opposite directions. However, hairs on the margin of the sepals, when present, possess erect arms, thus pointing approximately in a single direction (i.e. away from surface); hairs on interplicae of the corolla and upper part of the tube possess unequal arms, with one extremely long arm pointing toward the apex of the petals and another very short or almost indistinguishable arm pointing toward the base of the corolla; hairs on the filaments of the stamens are curly and soft and occasionally glandular; hairs on the ovary, mostly at the apex, have two straight arms pointing toward the mouth of the corolla.

The type of hairs is generally uniform in the whole genus, although their density, length or arms and occurrence on different parts vary from species to species and are taxonomically important. They are distinctly appressed when their occurrence on certain parts is sparse or scattered; but when the hairs are dense, they are less appressed and sometimes crisped.

INFLORESCENCE: The flowers are axillary and mostly solitary or in simple dichasial cymes in the members of section Breweria. In the members of section Trichantha, the flowers are mostly in axillary compound or simple cymes, or in terminal panicles, rarely solitary or in simple cymes. The flowers in the members of section Bonamia are variable from axillary and solitary to dense clusters in an axillary or terminal position. Solitary flowers seem to be a result of reduction of compound inflorescences, since the less advanced species possess inflorescences of large number of flowers, whereas the more advanced species generally possess solitary flowers or simple cymes. This is evident in some species in which the aborted floral buds occur in the axils of bracts or bracteoles.

FLOWER: The flowers are sessile, shortly pedunculate or shortly pedicellate, distinctly pedunculate and pedicellate or long-peduculate. Such a wide variation is most evident in the section Bonamia. In B. ovalifolia, B. grandiflora, B. multicaulis, and B. sericea, the flowers are sessile, subsessile, shortly pedunculate or shortly pedicellate, whereas in B. semidigyna and B. cordata the peducles are comparatively very long. In B. peruviana and B. kuhlmannii the pedicels and secondary peduncles are nearly as long as the primary peduncles, whereas in B. maripoides and B. sulphurea the pedicels are fairly long, sometimes longer than the short peduncles. This feature is rather uniform in the members of section Breweria and section Trichantha.

Bracts and bracteoles are usually small, reduced and scale-like, with a few exceptions. In most species they are linear, linear-lanceolate or subulate and mostly shorter than pedicels. However, bracts in B. pannosa are long-linear, distinctly longer than pedicels; bracts in B. brevifolia are as long as the pedicels; bracts in B. cordata and B. mossambicensis are foliaceous, mostly ovate-lanceolate or elliptic-lanceolate in shape and as long as or longer than the sepals. Bracteoles also show the same range of shapes, although their size is smaller. Both bracts and bracteoles in most species are alternate. The alternate position is not conspicuous in B. mossambicensis and B. sphaerocephala, whose inflorescences are multiflorus and dense because of absence of pedicels. The bracts and bracteoles are persistent in most species but deciduous in some species of section Trichantha.

CALYX: All species have calyces composed of five quincuncially imbricated sepals, which are free or slightly fused at their extreme base. In all species of the genus the sepals are

not accrescent. This is the most important characteristic distinguishing the genus Bonamia from the genus Calycobolus. The sepals in Bonamia are coriaceous, subcoriaceous or rarely soft and somewhat herbaceous, but never membranous. The shape and size are highly variable from species to species. In general, they are lanceolate, ovate, ovate-lanceolate, oblong-ovate, elliptic, orbicular or rarely ovate-subcordate, obovate or oblique-ovate. They are acute, obtuse, acuminate, obtuse-mucronate, rounded, truncate or slightly emarginate at the apex. They are equal or subequal in most species and distinctly unequal in some species, such as B. cordata, B. ferruginea, B. mossambicensis, B. pannosa, B. peruviana and B. kuhlmannii. In all these species, the outer two sepals are large, ovate, ovate-orbicular, ovate-cordate, or rarely ovate-lanceolate, densely tomentose, ferrugineous, or pilose outside, densely sericeous or velutinous inside except at the center, or glabrous. The in-out sepal (third sepal) is smaller like the inner two, or large and oblique-ovate in shape and similar to the outer sepals in its pubescence (except at the inner margin). In the members of section Breweria, sepals are mostly ovate-lanceolate, small and equal or subequal except in B. pannosa. They are sericeous, tomentose, pilose or velutinous outside in all members of this section. In the members of section Trichantha, sepals are ovate, ovate-orbicular, oblong-ovate or orbicular, equal or slightly unequal, and tomentose, sericeous, sparsely pubescent, puberulous or rarely glabrous outside. The sepals are glabrous inside except in B. mattogrossensis. In the members of section Bonamia the sepals are highly variable from species to species in their shape, from lanceolate to ovate or orbicular, from equal to unequal, in their size from small to large, in their apices from acute and acuminate to obtuse and rounded, and in their surface from glabrous or sparsely puberulous to densely tomentose, villous or ferrugineous. Sepals are generally thin, herbaceous or rarely subcoriaceous in section Breweria, thick and coriaceous in Trichantha and variable in section Bonamia.

COROLLA: The corolla is sympetalous, funnel-shaped, shortly tubular campanulate, narrow-campanulate or campanulate-funnelform, and plicate in the bud stage. It is shallowly lobed as in B. alternifolia, somewhat lobulate, entire or subentire as in most species of the genus. During the bud-stage the lateral edges of each petal are hidden by being folded inwardly along the line of fusion between the petals. The infolded areas, termed plicae, are roughly triangular with their apices extending toward the tubular portion of the corolla, with the lateral angles of adjacent plicae nearly meeting at the apex of each petal. Between the plicae, the central portions of the petals or mesopetaline bands, termed interplicae, form the exposed surface of the bud. Each interplica is narrowly triangular tapering toward the apex of the petal, with the base merging with adjacent interplicae to form the tubular portion of the corolla. The size of the corolla varies from small to large. In the section Breweria, the corolla is usually small, 8-15 mm. long, rarely longer. In the section Trichantha, the corolla is somewhat larger, mostly 18-25 mm. long. In the section

Bonamia, the corolla is large or small.

The pigmentation of the corolla varies from species to species, but it is constant within a single species--blue, deep blue, purplish blue, or purple in B. grandiflora, B. elliptica, B. ovalifolia, B. multicaulis, B. elegans, B. spectabilis, B. mossambicensis, B. mattogrossensis, B. pannosa, and B. media; red, rose, or pink in B. abscissa and B. rosea; yellow or yellowish in B. balansae and perhaps in B. corumbaensis and B. menziesii. In the remaining species, the corolla is white, or, in a few of them, unknown. The color of the corolla is variable from blue to white in B. media and B. pannosa, and from red to pink or white in B. rosea.

ANDROECIUM: The stamens are five, alternate to the petals. They are mostly inserted, or rarely exserted as in B. alternifolia. The filaments are epipetalous, being adnate to the corolla at the basal portion. They are usually slightly longer than the styles, but may be appreciably longer or shorter. They are equal, subequal or unequal in length, and generally filiform above and flattened or widened near the base. The filaments are glabrous, sparsely or densely villous, at least the lower part. The anthers are bilocular, introrse or partially introrse, dehiscing by longitudinal slits. Their attachment to the filaments is mostly dorsal or basidorsal, and sagittate, cordate or subcordate at the base. They are oblong, oblong-ovate or lanceolate and usually 1.5-5 mm. long.

GYNOECIUM: The gynoecium is composed of two carpels, fused except for the stigmas and a portion of the styles. The degree of fusion of the stylar branches, termed stylodia, is variable from species to species; but in general the stylar branches are free at least for the upper one-fourth and in many species they are free to the middle, nearly to the base or readily separable to the base. The stylar branches are filiform, glabrous or rarely with scattered hairs, and equal or unequal in length. Each stylar branch is provided with a single vascular strand, which branches near the stigmas in the members of section Trichantha; in the members of two other sections it is unbranched. The stigmas are globose, subglobose, globose-capitate, capitate, conical, reniform, or bilobed, rarely peltate. They are usually wider than the tips of stylar branches, and rarely small and not distinctly distinguishable. The surfaces of stigmas are smooth, warted or occasionally rugose or rugulose. In the section Breweria stigmas are usually large, globose, subglobose or globose-capitate, rarely peltate and mostly smooth. In the section Trichantha stigmas are large, reniform, bilobed or capitate and smooth. In the section Bonamia stigmas are variable from small to large, globose to capitate or peltate, and from smooth to rugose or rugulose.

The ovary contains two chambers, each of which encloses two erect ovules in axile placentation. It is ovoid, ovoid-conical, oblong or conical. It is sparsely long-pilose, densely long-pilose, tomentose or glabrous, often pilose only at the apex. The ovary

at its base is usually surrounded by a thin or thick annular disc, very prominent in several species and frequently enlarged in the fruit.

FRUIT: The fruits in all species are valvular capsules with persistent sepals. They are most frequently two- to four-seeded, but occasionally one-seeded. Although the number of seeds per capsule is variable and is not a good characteristic for distinguishing Bonamia from Stylisma (as was done by Hallier), the mean number differs between the two genera (higher in Bonamia and lower in Stylisma) and in several species two- or one-seeded capsules are rare. The capsules are thin-walled or thick-walled and four- or eight-valvular, rarely two-valvular. In some species the individual valves may break again into smaller pieces, and thus the capsules may superficially appear to be multivalvular. In the members of section Trichantha, the capsule walls are thick and hard, frequently breaking into two pieces, although they are four-valvular in reality. Occasionally the capsules may remain indehiscent for a long time as in B. menziesii. The septum in the capsule is thin in most species of section Breweria and section Bonamia, whereas it is thick and hard in the members of section Trichantha. The capsules are small in section Breweria and are large in section Trichantha, whereas they are variable in size in section Bonamia.

SEED: Seeds are somewhat similar in shape from species to species, but are variable in size, color, surface and indumentum. In section Bonamia seeds are small or large, varying from 3-6 (7) mm. in length, brown, dark brown, or black in color and smooth or punctate and glabrous on the surface. In section Breweria, seeds are small, 2-4 mm. long, brown or dark brown, smooth or punctate and glabrous. In section Trichantha, seeds are small or large, 4-7 mm. long, brown or dark brown, and long-haired along the edge and villous or long-haired on the ventral and dorsal surface. The seedcoat is hard in all species and is frequently covered with a thin perisperm.

The embryo is embedded in cartilaginous endosperm, which on wetting swells into a gelatinous mass. The embryonic axis is short with an indistinguishable hypocotyl or elongate with a short hypocotyl. The plumule is located between the two cotyledonary petioles or on the side of the stalk formed by the fusion of the two cotyledonary petioles. The cotyledons are petiolate, foliaceous, thin and herbaceous. They are generally ovate, obovate, ovate-cordate, orbicular, obscurely bilobed or rarely linear-bifid, rounded, truncate or emarginate at the apex, cordate or truncate at the base, and mostly symmetrical or rarely somewhat oblique. The two cotyledons are closely appressed to each other and the two fold together repeatedly (thus appearing to be multiplicate and corrugate) and also fold against the radicle. In some species the closely appressed cotyledons are flat and folded once or twice and then against the radicle.

Systematic Treatment

Bonamia DuPetit-Thouars, Hist. Veg. Isl. France Reunion, Madagascar 1:33, pl. 8. 1804, nom. cons.

Breweria R. Br. Prodr. Fl. Nov. Holl. 487. 1810. Type: Bonamia linearis (R. Br.) Hall. f. (as Breweria linearis R. Br. 1810--BM! W!).

Trichantha Karst. et Triana, Linnaea 28:437. 1856. Type: Bonamia trichantha Hall. f. (as Trichantha ferruginea K. et T. 1856--G! BM! W!); not Trichantha Hooker, Icon. Pl. tt. 666,667. 1844.

Perispermum O. Degener, Flora Hawaiiensis, Fam. 307. 1932. Type: Bonamia menziesii Gray (as Perispermum albiflorum Degener, 1932--MO!).

Breweriopsis G. Roberty, Candollea 14:31. 1952. Type: Bonamia elegans (Wall.) Hall. f. (as Breweriopsis elegans (Wall.) Roberty, 1952--BM! G!).

Perennial, herbaceous, suffrutescent or woody, twining, prostrate or trailing, occasionally procumbent or suberect, shubby vines or erect subshrubs; shoots a few to several, simple or branched, growing all year around or arising annually from old shoots, bases of previous shoots, crowns, horzontally spreading subterranean stems, or from roots. Roots deep-penetrating, often becoming thick in some, frequently with pulpy bark, never bulbous nor fleshy. Stems mostly thin, elongate, occasionally becoming as thick as 2.5 cm. at the base, as long as a few decimeters to several meters in height, smooth or lenticellate, glabrous to densely pubescent, villous, sericeous or ferrugineous. Leaves petiolate, subsessile or sessile, estipulate, herbaceous or subcoriaceous, occasionally leathery; blades simple, entire, occasionally undulate or slightly wavy, ovate, ovate-cordate, elliptic, ovate-elliptic, oblong-ovate, lanceolate, oblong, linear or linear-lanceolate, often large, acute, obtuse, acuminate, acute-mucronate, obtuse-mucronate or slightly emarginate at the apex, acute, attenuate, cordate, rounded or truncate at the base; veins prominent to inconspicuous except the midribs, mostly impressed above, often with distinct intercostal veins; hairs appressed, two-armed, straight or crisped, very fine to distinctly long, scattered or dense, silvery grey, greyish white, pale brown or grey, often becoming rusty brown when dry. Inflorescences axillary or terminal, pedunculate or subsessile, simple or compound dichasial cymes of few to several flowers, often solitary or terminal panicles composed of several dichasial cymes; peduncles short or elongate, usually shorter than leaves, or absent; pedicels usually short, occasionally elongate (becoming as long as 2 cm.); bracts small and linear or distinctly foliaceous, mostly two for each individual flower, opposite or slightly alternate, sometimes crowded in congested clusters. Sepals five, quincuncially imbricate, free or rarely united at the extreme base,

mostly ovate, ovate-lanceolate, broadly lanceolate, orbicular, or oblong-orbicular, equal or unequal, acute, acuminate, obtuse, rounded or slightly emarginate at the apex, sericeous, tomentose, pilose, velutinous, ferrugineous or glabrous on the inner surface, persistent in capsules. Corolla white, blue, bluish purple, pink or red, yellow, yellowish white or greenish white, funnel-shaped, campanulate or shortly tubular campanulate, plicate in bud, sympetalous with entire, subentire, lobed or lobulate limb, outside sparsely or densely pilose on interplicae (midpetaline bands), glabrous on plicae (infolded areas); individual hairs on interplicae with two unequal arms (long arms directed toward apices of petals). Stamens five, alternate with petals, inserted or rarely exserted, all fertile; filaments epipetalous (being adnate to the lower, narrow part of the corolla), straight, filiform or somewhat dilated below, dorsiventrally flattened, unequal, subequal or equal in length, glabrous or thinly to densely villous or glandular-villous (with crisped or curly hairs), frequently villous only on the basal dilated portions; anthers two-celled, oblong or oblong-lanceolate, dorsifixed or apparently basifixed, frequently sagittate or cordate at the base, introrse or partially extrorse by vertically dehiscing slits; pollen colpate and punctitegillate, not spiniferous. Ovary superior, bicarpellate, bilocular, long-pilose or hirsute with two-armed hairs (both arms of each hair directing toward the mouth of the corolla) or glabrous, surrounded by annular disc at the base; ovules two in each loculus, erect, anatropous, in axile placentation, appearing to be basal; styles terminal, two, almost free to partially united, included in the corolla to partially exserted; stylar branches (or stylodia) equal to unequal, filiform, mostly glabrous, occasionally with scattered hairs; stigmas large or small, globose, subglobose, capitate, reniform, bilobed conical or rarely peltate, smooth or rugose, occasionally lobulate. Fruits 1- to 4-seeded, 4- to 8-valvular, rarely 2-valvular capsules with thin and chartaceous or thick and ligneous walls, ovoid, globose or conical-ovoid, apiculate at the apex, glabrous or with scattered hairs, two-celled with thin or thick septum, with persistent sepals, dehiscing by valves, occasionally dehiscing by basal circumcision, rarely remaining indehiscent for a long time after ripeness. Seeds brown, dark brown or black, smooth or punctate,glabrous or lanate, oval and plano-convex or roughly three-angled, with hard or rarely soft seedcoat, covered with thin transparent perisperm; endosperm scanty or copious, cartilagenous, swelling on wetting. Cotyledons thin, foliaceous, ovate, obovate, ovate-cordate or orbicular, rarely linear-bifid, mostly symmetrical, rarely slightly oblique, corrugate-plicate and folded against radicle or simply flat or slightly folded along central line and folded against radicle; cotyledonary petioles free or fused. Flowering from summer to winter.

Type: B. madagascariensis Poiret, in Lamarck, Encycl. Meth. Bot. suppl. 1:677. 1810, nom. illeg. (B. alternifolia J. St. Hilaire, Expos. Fam. 2:349. 1805.)

Dry sandy soils of various types, rarely moist or wet ground, frequently coastal plains and dunes, occasionally inland high ground, open forests, grassy plains, scrubby lands, edges of dense forests, frequently along streams and riverbanks; of tropics, subtropics and warm temperate regions of both hemispheres, with a concentration of more species in South America, Australia and Madagascar, and fewer species in Asia, North America and mainland Africa.

The genus is heterogeneous and is roughly separable into three sections.

Key to Sections of Bonamia

1. Seeds glabrous; fruits with thin walls, dehiscing into four or eight valves, rarely indehiscent, with thin or membranous septa; flowers solitary, in simple or compound cymes, umbellate or capitate heads (axillary or terminal). 2

1. Seeds fulvous-villous on the ventral and dorsal sides, long-haired along the edge; fruits with ligneous and thick walls, dehiscing into two or four valves, with ligneous or thick septa; flowers mostly in panicles or pseudopanicles, rarely solitary or simple cymes. Sect. Trichantha

2. Corolla 1.8 cm. or longer, if shorter, flowers in dense capitate clusters; peduncles or pedicels or the two together consistently as long as 1 cm. or longer, rarely shorter; leaves 3 cm. or longer; flowers mostly in cymes, dense clusters, or occasionally solitary. Sect. Bonamia

2. Corolla shorter than 1.8 cm.; peduncles or pedicels or the two together mostly 5 mm. or shorter, rarely longer; leaves shorter than 3 cm., narrower than 2 cm., if longer or wider, corolla shorter than 1.8 cm.; flowers mostly solitary, occasionally in simple cymes, rarely 5 to 7-flowered cymes. Sect. Breweria

General Key to Species of Bonamia

1. Outer sepals larger than inner sepals, as wide as or wider than twice the width of inner sepals and more densely tomentose. 2

1. Outer and inner sepals equal, subequal or slightly unequal (outer sepals 1.5 X inner sepals or narrower). 7

2. Leaves shorter than 4 cm.; flowers solitary or rarely in simple cymes, sessile or subsessile, rarely short-pedunculate or short-pedicellate. 31. B. pannosa

2. Leaves longer than 4.5 cm.; flowers mostly in compound cymes, usually numerous or in capitate cymes, or long-pedunculate and/or long-pedicellate. 3

3. Pedicels longer than 1 cm. or peduncles 3 cm. or longer; inflorescences loose cymes or few-flowered cymes; leaves ovate or ovate-cordate. 4

3. Pedicels very short, rarely as long as 7 mm.; inflorescences dense capitate, sessile or shortly pedunculate; leaves ovate-lanceolate, ovate-elliptic or oblong-ovate. 6

4. Bracts foliaceous, ovate or ovate-lanceolate, 5 mm. or longer; pedicels short; peduncles 3 cm. or longer. 6. B. cordata

4. Bracts minute, scale-like, linear or subulate, 2-4 mm. long; pedicels longer than 1 cm.; peduncles 2.5 cm. or shorter. 5

5. Leaves 5-12 cm. by 3-8 cm., cordate or subcordate at the base; outer sepals 2 cm. by 1.7 cm.; styles free almost to the ovary. 24. B. kuhlmannii

5. Leaves 5.5-7 cm. by 3-4 cm., obtuse or truncate at the base; outer sepals 8-12 mm. by 7-10 mm.; styles fused at least lower one-third. 25. B. peruviana

6. Sepals ferrugineous or tomentose (with short hairs); outer sepals thick, ovate or ovate-subcordate, obtuse at the apex; leaves obtuse or acute at the apex; bracts inconspicuous. 21. B. ferruginea

6. Sepals long-sericeous or hirsute (with long hairs); outer sepals thin and somewhat foliaceous (with distinct venation), ovate-lanceolate, acute or acuminate at the apex; leaves acute or acuminate at the apex; bracts 1 cm. long. 5. B. mossambicensis

7. Sepals consistently (both outer and inner) acute or acuminate at the apex; if obtuse then 10 mm. or longer. 8

7. Sepals (at least the inner or the outer) obtuse, rounded, obtuse-mucronate or emarginate. 29

8. Flowers in dense clusters, capitate or dense umbellate cymes, mostly sessile, subsessile or rarely shortly pedicellate. 9

8. Flowers solitary or in axillary loose cymes of 3-7; if more, pedicels or peduncles 2 cm. or longer. 11

9. Leaves elliptic, oblong or oblong-elliptic, 4 cm. or shorter, 2 cm. or narrower, long-mucronate at the apex, dense lanate on the surface; corolla 1 cm. or shorter. 23. B. sphaerocephala

9. Leaves elliptic-lanceolate or ovate-lanceolate, longer than 4 cm. or wider than 2 cm., attenuate at the apex, sericeous, hirsute or glabrate on the surface; corolla longer than 1.5 cm. 10

10. Sepals hirsute with long hairs, unequal; corolla blue; bracts pilose or hirsute with long hairs. 5. B. mossambicensis

10. Sepals pubescent with short hairs, equal or subequal; corolla white; bracts puberulous, finely sericeous or nearly glabrous. 18. B. holtii

11. Pedicels or peduncles or the two together as long as 1 cm. or longer consistently. 12

11. Pedicels or peduncles or the two together shorter than 1 cm. (at least a few of them). 23

12. Sepals ovate or ovate-lanceolate, usually shorter than 1.5 X width, tomentose, villous, densely sericeous or ferrugineous, mostly 12 mm. or shorter, rarely longer. 13

12. Sepals lanceolate or oblong-lanceolate, usually as long as 1.5 X width or longer, glabrous or puberulous, mostly 12 mm. or longer, rarely slightly shorter. 19

13. Sepals 7-12 mm. wide, densely villous or ferrugineous. 14

13. Sepals 4-6 mm. wide, softly pubescent, tomentose, sericeous or nearly glabrous. 18

14. Leaves linear-lanceolate, 10 mm. or narrower, with length-width ratio of 2.5 or higher; corolla blue. 15. B. multicaulis

14. Leaves ovate, cordate, elliptic, oblong-elliptic or rotund, wider than 10 mm. and/or with length-width ratio of 2 or lower; if higher, corolla white. 15

15. Leaves cordate at the base, 4 cm. or wider; peduncles 3 cm. or longer. 16

15. Leaves rounded, obtuse or rarely subcordate at the base, 3 cm. or narrower; peduncles shorter than 3 cm. 17

16. Corolla white or yellowish white, with slightly lobulate limb; flowers mostly in simple or compound cymes. 7. B. semidigyna

16. Corolla red or pink, with entire or subentire limb; flowers mostly solitary, rarely in simple cymes. 41. B. abscissa

17. Leaves ovate or orbicular, 2.5 cm. or shorter; corolla blue, 3 cm. or longer; stem 1 m. or shorter, procumbent or suberect. 14. B. ovalifolia

17. Leaves oblong-elliptic, elliptic, oblong-lanceolate or rarely rotund, mostly longer than 2.5 cm.; corolla white or yellowish, 2.5 cm. or shorter; stem longer than 1 m., scandent or twining, rarely prostrate. 10. B. menziesii

18. Leaves 4 cm. or shorter, 1.8 cm. or narrower, acute or attenuate at the base; flowers solitary or in simple cymes, never in dense clusters; stem 1 m. or shorter. 16. B. sericea

18. Leaves longer than 4 cm., 2 cm. or wider, obtuse or truncate at the base; flowers in dense clusters (composed of numerous simple or compound cymes); stem longer than 1 cm. 4. B. thunbergiana

19. Styles free for no more than one-third of length; stigma capitate or peltate; leaves, subtending flowers, narrowly oblong or oblong-lanceolate, with length-width ratio of 2 or higher. 8. B. elegans

19. Styles free to the middle or lower; stigma globose or subglobose; leaves, subtending flowers, ovate or elliptic, with length-width ratio of 1.8 or less. 20

20. Corolla shorter than 2.5 cm., 2.3 cm. or narrower at the limb. 13. B. sulphurea

20. Corolla 3 cm. or longer, wider than 2.5 cm. at the limb. 21

21. Flowers in simple or compound cymes; pedicels as long as 1 cm. or longer; leaves elliptic or ovate-elliptic, 3.5-6 cm. by 2.5-4 cm. 12. B. elliptica

21. Flowers solitary or in simple cymes of 2 or 3; pedicels shorter than 1 cm.; leaves ovate, rotund or ovate-subcordate, 2-3 cm. by 1.7-2.5 cm; if larger, long-mucronate at the apex. 22

22. Leaves ovate or ovate-subcordate, widest near the base, with long mucros; petioles 5 mm. or longer; stem slender, shorter than 2 m. 9. B. dietrichiana

22. Leaves orbicular or ovate-orbicular, widest at the middle; mucros, if present, very minute; petioles 1-4 mm.; stem mostly 2 m. or longer. 11. B. grandiflora

23. Corolla 3 cm. or longer; sepals wider than 5 mm. 15. B. multicaulis

23. Corolla shorter than 2 cm.; sepals narrower than 5 mm. 24

24. Leaves orbicular; corolla red, pink or white; stem erect or suberect. 30. B. rosea

24. Leaves linear, oblong, linear-oblong, ovate, elliptic or rarely somewhat orbicular; corolla white or blue; stem prostrate or twining; if erect, leaves elliptic. 25

25. Leaves cordate at the base, acute at the apex, with length-width ratio 1 or close to 1. 28. B. brevifolia

25. Leaves obtuse, acute, truncate or subcordate at the base, obtuse, acute or emarginate at the apex, with length-width ratio more than 1; if 1 or close to 1, emarginate or obtuse at the apex. 26

26. Leaves linear, linear-lanceolate or narrow-oblong, usually 5 mm. or narrower. 27

26. Leaves ovate, ovate-oblong, obovate, elliptic, usually wider than 5 mm. 28

27. Leaves narrow-oblong, rounded at both ends, sessile or subsessile, densely sericeous or villous. 27. B. oblongifolia

27. Leaves linear or linear-lanceolate, acute, obtuse or attenuate at the base, obtuse or acute at the apex; petiolate, sparsely or rarely densely sericeous. 26. B. linearis

28. Leaves elliptic, 2.5-4.5 (5.5) cm. long, 1-2.5 cm. broad; stem erect or suberect; sepals spathulate. 32. B. velutina

28. Leaves ovate, ovate-oblong, rarely elliptic, 1-2.3 cm. long, rarely longer, 8-15 mm. wide; stem prostrate or climbing; sepals ovate or ovate-acuminate. 29. B. media

29. Sepals glabrous or merely ciliate at the margin, rarely sparsely pubescent; leaves glabrous or sparsely pubescent. 30

29. Sepals, at least inner sepals, pubescent, tomentose or sericeous; leaves tomentose, sericeous or villous at least on the lower surface, rarely glabrate. 32

30. Leaves oblong or oblong-elliptic; inflorescences umbellate cymes of 5 or more flowers. 22. B. umbellata

30. Leaves ovate or ovate-cordate; flowers solitary or in simple cymes of 2 or 3. 31

31. Stem longer than 1 m., twining or scandent; styles fused to the middle or higher; leaves glabrous, attenuate or acute at the apex. 34. B. balansae

31. Stem 70 cm. or shorter, erect or suberect; styles free nearly to the base; leaves with scattered hairs, obtuse or truncate and mucronate at the apex. 35. B. corumbaensis

32. Corolla distinctly lobed; stamens exserted; leaves with very distinct minor venations, undulate at the margin. 1. B. alternifolia

32. Corolla entire, subentire or merely lobulate or angular; stamens inserted; minor veins, except intercostal veins, scarcely distinct. 33

33. Leaves narrowly elliptic, narrowly oblong or oblong-elliptic, narrower than 2 cm.; if wider, length-width ratio 1.5 or more and acute or attenuate at the base. 34

33. Leaves ovate, ovate-cordate, broadly elliptic, oblong-ovate or oblong-cordate, 2 cm. or wider; if narrower, length-width ratio less than 1.5 and obtuse, truncate or subcordate at the base. 35

34. Sepals 2-3 mm. long; corolla white, 1.8 cm. long or shorter; leaves with scattered hairs or nearly glabrous, obtuse or truncate at the base. 3. B. densiflora

34. Sepals 4-6 (8) mm. long; corolla blue, 2 cm. or longer, rarely shorter; leaves distinctly pubescent at least on the lower surface, acute or cuneate at the base. 2. B. spectabilis

35. Individual flowers sessile or subsessile, occasionally with pedicels up to 1-2 (3) mm. long; peduncles of individual cymes absent. 36

35. Individual flowers pedicellate or solitary and peduncular, with pedicels 3 mm. or longer; if shorter, peduncles present. 38

36. Corolla 1.2 cm. or shorter; leaves glabrous above. 20. B. brevipedicellata

36. Corolla 1.5 cm. or longer; leaves sericeous or tomentose above. 37

37. Corolla white. 39. B. subsessilis

37. Corolla purple, violet or with purple eye. 40. B. mattogrossensis

38. Stem 1 m. or shorter; if longer, leaves 3.5 cm. or shorter and rounded or obtuse at the apex. 39

38. Stem mostly longer than 1.5 m. 40

39. Stem erect or suberect, 30-60 cm. long; leaves sparsely pubescent or becoming glabrous. 35. B. corumbaensis

39. Stem slender, prostrate, procumbent or climbing, longer than 70 cm.; leaves densely sericeous or villous. 17. B. boliviana

40. Flowers solitary, rarely in simple cymes. 43. B. langsdorffii

40. Flowers in simple or compound cymes, pseudopanicles or racemose panicles. 41

41. Leaves glabrous on the upper surface, rarely with scattered hairs. 42

41. Leaves sericeous or tomentose on the upper surface. 45

42. Corolla 1.2 cm. or shorter; flowers in dense capitate clusters; styles shorter than 1 cm. 20. B. brevipedicellata

42. Corolla 1.5 cm. or longer; flowers in loose cymes, panicles or pseudopanicles. 43

43. Pedicels 1 cm. or longer; inner sepals rounded at the apex; outer sepals uniformly appressed sericeous. 19. B. maripoides

43. Pedicels shorter than 1 cm.; inner sepals truncate or slightly emarginate at the apex; outer sepals tomentose or glabrate. 44

44. Leaves with veins distinctly impressed above; intercostal veins prominent at least on the lower surface; leaves mostly elliptic, 9 cm. or longer. 33. B. agrostopolis

44. Veins not impressed on the upper surface; intercostal veins obscure, if distinct not impressed; leaves mostly ovate, if oblong or elliptic, blades 8 cm. or shorter. 33. B. trichantha

45. Leaves obtuse, rounded or truncate at the base; acuminate or acute, rarely obtuse at the apex. 46

45. Leaves subcordate or rarely truncate at the base; obtuse, rounded or slightly emarginate at the apex. 38. B. tomentosa

46. Leaves elliptic or oblong-elliptic, 9 cm. or longer, sparsely pubescent or glabrescent above; ovary glabrous. 36. B. agrostopolis

46. Leaves ovate or ovate-elliptic, shorter than 8 cm., densely tomentose or sericeous, rarely sparsely so on the upper surface; ovary pilose at least at the apex. 37. B. burchellii

Regional Keys

The following regional keys are given as supplementary to the general key because the identification of a specimen belonging to Bonamia is much simplified if the geographical source is known.

Key to the African and Asian Species

1. Outer sepals distinctly larger than inner sepals or with indumentum of dense, long, spreading hairs (drying golden brown); bracts mostly foliaceous. 2

1. Outer and inner sepals equal, subequal or slightly unequal; bracts mostly small, occasionally foliaceous (as in B. semidigyna) 3

2. Sepals, at least outer ones, obtuse, with short appressed hairs; leaves cordate or ovate-cordate; peduncles long, mostly 1 to 7-flowered; corolla white. 6. B. cordata

2. Sepals acuminate or acute, with long spreading hairs; leaves elliptic-lanceolate to oblong-ovate; peduncles short, multi-florous; corolla blue. 5. B. mossambicensis

3. Sepals, both outer and inner, consistently acute or acuminate at the apex. 4

3. Sepals obtuse or rounded, rarely broadly acute, at the apex. 8

4. Peduncles 3 cm. or longer, rarely slightly shorter; leaves cordate or ovate-cordate, usually long-attenuate at the apex, 4 cm. or wider. 5

4. Peduncles shorter than 2 cm.; leaves elliptic, ovate-elliptic, oblong-elliptic or oblong, rarely slightly cordate at the base, obtuse, acute or acuminate at the apex, narrower than 3.5 cm. 6

5. Corolla white or yellowish white, with slightly lobulate limb; flowers mostly in simple or compound cymes. 7. B. semidigyna

5. Corolla red or pink, with entire or subentire limb; flowers mostly solitary, rarely in simple cymes. 41. B. abscissa

6. Flowers in cymes of few to several, usually forming secund dense clusters; leaves glabrous or sparsely pubescent on the upper surface. 4. B. thunbergiana

6. Flowers solitary or in cymes of two or three; leaves densely velutinous or pilose on both surfaces. 7

7. Corolla blue, longer than 2.5 cm.; sepals longer than 10 mm.; stems long, climbing or prostrate, weak. 8. B. elegans

7. Corolla white, shorter than 2 cm.; sepals shorter than 10 mm.; stems short, erect. 32. B. velutina

8. Stamens exserted; corolla distinctly lobed; leaves undulate at the margin, strongly nerved, shortly petiolate or subsessile, with length-width ratio less than 2. 1. B. alternifolia

8. Stamens inserted; corolla subentire or merely sub-lobulate; leaves entire at the margin, with indistinct minor venation, distinctly petiolate, with length-width ratio 2 or more. 9

9. Sepals orbicular or ovate-orbicular, 3.5 mm. or shorter, sparsely pubescent or glabrescent; leaves sparsely pubescent or becoming glabrous, obtuse, rounded or truncate at the base; corolla white. 3. B. densiflora

9. Sepals ovate or oblong-ovate, 4.5 mm. or longer, densely sericeous; leaves mostly sericeous, rarely becoming glabrous, cuneate, subcuneate or acute at the base; corolla blue or bluish white. 2. B. spectabilis

Key to the Australian Species

1. Outer sepals obtuse, large, as wide as or wider than twice the width of inner sepals; third (or in-out) sepal oblique. 31. B. pannosa

1. Outer and inner sepals equal, subequal or slightly unequal; third (or in-out) sepal symmetrical. 2

2. Corolla large, longer than 2.5 cm.; leaves mostly 3 cm. or longer, rarely shorter, 2 cm. or wider, mucronate at the apex. 9. B. dietrichiana

2. Corolla small, 2 cm. or shorter; leaves 2.5 cm. or shorter, if longer, blades linear or oblong and narrower than 1.5 cm., acute, obtuse or emarginate at the apex, if mucronate, mucro minute, shorter than 1 mm. 3

3. Leaves linear, linear-lanceolate or narrow-oblong, usually 5 mm. or narrower; length-width ratio mostly 3 or more. 4

3. Leaves orbicular, ovate, ovate-elliptic, oblong-ovate or ovate-cordate, with length-width ratio less than 2.5. 5

4. Leaves linear, acute or acuminate at both ends, rarely rounded at the base, with length-width ratio of 4 or more; petioles 1-4 mm. long. 26. B. linearis

4. Leaves oblong or linear-oblong, obtuse or rounded at both ends, with length-width ratio less than 4; petioles 0-1 mm. long. 27. B. oblongifolia

5. Plant erect or suberect; leaves orbicular, rarely broadly ovate, emarginate, rounded or obtuse at the apex; sepals densely long-haired; corolla rose, pink or rarely white. 30. B. rosea

5. Plant prostrate or procumbent; leaves ovate, ovate-elliptic or ovate-subcordate, acute or obtuse, rarely emarginate at the apex; sepals finely pubescent or villous; corolla white or blue. 6

6. Leaves cordate at the base and acute at the apex. 28. B. brevifolia

6. Leaves rounded, obtuse or subcordate at the base, obtuse or emarginate at the apex; if acute then base not cordate. 29. B. media

Key to the American and Hawaiian Species

1. Outer sepals twice the width of inner sepals or wider, obtuse or rounded in contrast to inner acute or acuminate sepals. 2

1. Outer and inner sepals equal, subequal or slightly unequal, acute, obtuse or acuminate at the apex, rarely slightly different. 4

2. Pedicels longer than 1 cm.; inflorescences loose cymes of 3-7 flowers, rarely more than 7 flowers; peduncles long; secondary peduncles longer than 1 cm. 3

2. Pedicels very short, rarely as long as 7 mm.; inflorescences dense capitate clusters of more than 10 flowers; peduncles short; secondary peduncles absent. 21. B. ferruginea

3. Leaves 5-12 cm. by 3-8 cm., cordate or subcordate at the base; outer sepals 2 cm. by 1.7 cm.; styles free almost to the ovary. 24. B. kuhlmannii

3. Leaves 5.5-7 cm. by 3-4 cm., obtuse or truncate at the base; outer sepals 8-12 mm. by 7-10 mm.; styles fused at least lower one-third or half. 25. B. peruviana

4. Sepals consistently, both outer and inner, acute or acuminate at the apex. 5

4. Sepals obtuse, rounded or slightly emarginate at the apex. 13

5. Flowers in dense capitate or umbellate cymes; individual flowers sessile, rarely shortly pedicellate. 6

5. Flowers solitary or loose cymes of 3-7; individual flowers pedicellate. 7

6. Leaves elliptic, oblong-elliptic, 4 cm. or shorter, 2 cm. or narrower, obtuse-mucronate or acute-mucronate at the apex, lanate at least on the lower surface; corolla shorter than 1.5 cm.; inflorescence a dense terminal head. 23. B. sphaerocephala

6. Leaves ovate or ovate-lanceolate, longer than 4 cm. or wider than 2.5 cm.; acuminate or acute at the apex, glabrous or puberulous; corolla 1.8 cm. or longer; inflorescence axillary. 18. B. holtii

7. Leaves linear, linear-lanceolate, narrowly elliptic or narrowly oval-elliptic, with length-width ratio of 2 or more, usually narrower than 1.5 cm., rarely slightly wider. 8

7. Leaves ovate, broadly elliptic or ovate-elliptic, with length-width ratio of less than 2; if 2 or more, stem longer than 1 m., usually wider than 1.5 cm.; if narrower then ovate or orbicular. 9

8. Corolla blue or purplish blue, 3 cm. or longer; sepals 7 mm. or wider, densely villous, velutinous or tomentose; leaves densely velutinous. 15. B. multicaulis

8. Corolla white, shorter than 3 cm.; sepals 6 mm. or narrower, finely or densely sericeous; leaves sericeous. 16. B. sericea

9. Sepals ovate or ovate-lanceolate, with length-width ratio of 1.5 or less, usually 11 mm. or shorter, densely tomentose, velutinous or villous. 10

9. Sepals lanceolate or oblong-lanceolate, with length-width ratio of more than 1.5, glabrous, puberulous or finely sericeous. 11

10. Corolla blue, 3 cm. or longer; leaves ovate or orbicular, 2.5 cm. or shorter; stem 1 m. or shorter, procumbent or suberect. 14. B. ovalifolia

10. Corolla white or yellowish, 2.5 cm. or shorter; leaves elliptic, oblong-elliptic, oblong-lanceolate or rarely ovate or orbicular; stem longer than 1 m., scandent or twining. 10. B. menziesii

11. Corolla shorter than 2.5 cm., 2.3 cm. or narrower at the limb. 13. B. sulphurea

11. Corolla 3 cm. or longer, wider than 2.5 cm at the limb. 12

12. Flowers in simple or compound cymes; pedicels 1 cm. or longer; leaves elliptic or ovate-elliptic, 3.5 cm. or longer. 12. B. elliptica

12. Flowers solitary or rarely in simple cymes; pedicels shorter than 1 cm.; leaves ovate or ovate-orbicular, 3 cm. or shorter. 11. B. grandiflora

13. Sepals glabrous or merely ciliate at the margin, rarely sparsely pubescent; leaves glabrous or sparsely pubescent. 14

13. Sepals, at least inner sepals, tomentose, sericeous or ferrugineous, rarely glabrescent; leaves tomentose, sericeous or villous at least on the lower surface, rarely glabrate. 16

14. Leaves oblong or oblong-elliptic; inflorescences umbellate cymes of 5 or more flowers, rarely 3 flowers. 22. B. umbellata

14. Leaves ovate or ovate-subcordate; flowers solitary or in simple cymes of 2 or 3. 15

15. Stem longer than 1 m., twining or scandent; styles fused to the middle or higher; leaves glabrous, attenuate or acute at the apex. 34. B. balansae

15. Stem 70 cm. or shorter, erect or suberect; styles free nearly to the base; leaves with scattered hairs, obtuse or truncate and mucronate at the apex. 35. B. corumbaensis

16. Individual flowers sessile or subsessile, occasionally with pedicels up to 1-2 (3) mm. long; peduncles of individual cymes absent. 17

16. Individual flowers pedicellate or solitary and pedunculate, with pedicels 3 mm. or longer; if shorter, individual cymes or flowers pedunculate. 19

17. Corolla 1.2 cm. or shorter; leaves glabrous above. 20. B. brevipedicellata

17. Corolla 1.5 cm. or longer; leaves sericeous or tomentose above. 18

18. Corolla white. 39. B. subsessilis

18. Corolla purple, violet or with purple eye. 40. B. mattogrossensis

19. Stem 1 m. or shorter; if longer, leaves 3.5 cm. or shorter, rounded or obtuse at the apex. 20

19. Stem mostly longer than 1.5 m.; if shorter, leaves acute or acuminate at the apex. 21

20. Stem erect or suberect, 30-60 cm. long; leaves sparsely pubescent or becoming glabrous. 35. B. corumbaensis

20. Stem slender, prostrate or climbing, usually longer than 70 cm.; leaves densely sericeous or villous. 17. B. boliviana

21. Flowers solitary, rarely in simple cymes. 43. B. langsdorffii

21. Flowers in simple or compound cymes, pseudopanicles or racemose panicles. 22

22. Leaves glabrous on the upper surface, rarely with scattered hairs. 23

22. Leaves sericeous or tomentose on the upper surface. 26

23. Corolla 1.2 cm. or longer; flowers in dense capitate clusters; styles shorter than 1 cm. 20. B. brevipedicellata

23. Corolla 1.5 cm. or longer; flowers in loose cymes, panicles or pseudopanicles. 24

24. Pedicels 1 cm. or longer; inner sepals rounded at the apex; outer sepals uniformly appressed sericeous. 19. B. maripoides

24. Pedicels shorter than 1 cm.; inner sepals truncate or slightly emarginate, rarely rounded at the apex; outer sepals tomentose or glabrate. 25

25. Veins distinctly impressed on the upper surface; intercostal veins prominent at least on the lower surface; leaves mostly elliptic, 9 cm. or longer, acute or obtuse at the base. 36. B. agrostopolis

25. Veins not impressed on the upper surface; intercostal veins obscure; leaves mostly ovate; if oblong or elliptic, blades 8 cm. or shorter, rounded, obtuse or subcordate at the base. 33. B. trichantha

26. Leaves subcordate or rarely truncate at the base; obtuse, rounded or slightly emarginate at the apex. 38. B. tomentosa

26. Leaves obtuse, rounded or truncate at the base; acuminate or acute, rarely obtuse at the apex. 27

27. Leaves elliptic or oblong-elliptic, 9 cm. or longer, sparsely pubescent or glabrescent above; ovary glabrous. 36. B. agrostopolis

27. Leaves ovate or ovate-elliptic, shorter than 8 cm., densely tomentose or sericeous, rarely sparsely so on the upper surface; ovary pilose at least at the apex. 37. B. burchellii

I. Section: Bonamia

Stems woody or becoming woody, occasionally slender, twining, scandent, prostrate, procumbent or suberect, commonly long, rarely slightly shorter than 1 m., occasionally attaining several meters long. Leaves petiolate or shortly petiolate, soft, herbaceous, subcoriaceous or somewhat leathery, rarely thin; blades mostly elliptic, elliptic-oblong, ovate, cordate or rarely lanceolate or oblong, usually large, 2.5 cm. or longer, 1 cm. or wider, rarely slightly short or slightly narrower, rounded, truncate, subcordate or cordate, rarely slightly attenuate at the base, acuminate, obtuse or acute at the apex. Flowers solitary or in cymes of few to several flowers, in cymose panicles or in capitate or dense clusters, usually pedunculate; individual flowers distinctly pedicellate; pedicels short or up to 2 cm. long; bracts small or foliaceous. Sepals subcoriaceous or coriaceous, equal or unequal, often large, ovate, lanceolate, oblong-ovate or ovate-acuminate,

acute or obtuse, occasionally short-acuminate at the apex. Corolla blue, purplish blue, white or red, usually large, 2 cm. or longer, sometimes slightly shorter, subentire, lobulate or lobed at the margin. Stamens included or partially exserted; filaments sparsely or densely long-villous or pilose, often glabrous or nearly glabrous; anthers 2 mm. or longer, sagittate or cordate at the base. Ovary ovoid or ovoid-conical, long pilose or glabrous; styles free nearly to the base or fused to the middle or higher with a single vascular bundle (up to stigma) in each stylar branch; stigmas small or large, globose, subglobose, conical or capitate. Fruits 4- to 8-valvular capsules, thin-walled, rarely 0.5 mm. thick; seeds glabrous, smooth or punctate, brown or black, 3-6 mm. long, rarely smaller. Cotyledons ovate, ovate-cordate, obovate or linear-bifid, corrugate, multiplicate or slightly folded.

Type: B. alternifolia J. St. Hilaire.

Tropics, subtropics and warm temperate of both hemispheres, covering the whole range of the genus, occurring on all continents.

This section is less homogeneous than the other two sections because of inclusion of several species whose morphology is incompletely known. Future studies may lead to separating it into more than one section or subsection.

1. Bonamia alternifolia J. St. Hilaire, Expos. Fam. 2:349. 1805.
   Bonamia madagascariensis Poir. Encycl. Meth. Bot. Suppl. 1:677. 1810.
   Bonamia thouarsii Elliot, Journ. Linn. Soc. Bot. 29:35. 1891.

Perennial shrubs or woody vines. Stems erect or suberect, with weak branches, terete, finely pubescent or villous while young, becoming sparsely pubescent or glabrescent in age, 1.5-1.8 m. high. Leaves shortly petiolate, coriaceous or subcoriaceous, sparsely appressed-pubescent, more densely so while young; petioles 2-7 mm. long, brown-villous; blades elliptic, ovate-acuminate or obovate, 3-7 cm. long, 2-4 cm. wide, undulate at the margin, acute or obtuse at the base, obtuse-acuminate, obtuse or acute-mucronate at the apex; midrib prominent, with 3-5 pairs of prominent lateral veins; finer veins distinct, clearly visible with naked eye, especially on the lower surface. Inflorescence commonly congested terminal panicles of numerous flowers or few-flowered cymes in axils of upper leaves, shortly pedunculate; peduncles short, 5-10 mm. long. villous or finely pubescent; pedicels as long as peduncles or slightly longer, brown-villous; bracts subulate, 2-4 mm. long or sometimes smaller, deciduous or persistent. Sepals orbicular or ovate, coriaceous, villous, unequal or subequal; the two exterior smaller, mostly 4.5-5.5 mm. long, orbicular, slightly emarginate or rounded at the apex; the interior longer, 6-7 mm. long, rounded or rarely obtuse at the apex. Corolla white, tubular campanulate or funnel-shaped, with cylindrical narrow tube and distinctly lobed limb, indup-

licate in the bud, 1.4-2 cm. long, pilose on interplicae and upper part of tube; corolla lobes 2-3 mm. long, mostly 3 mm. wide, rounded or obtuse at the apex. Stamens exserted; filaments adnate to the corolla tube, glabrous above, with scattered long hairs below, distinctly longer than styles; anthers dorsifixed, versatile, introrse, oblong, 2.5-3 mm. long. Ovary conical, glabrous; styles free to the base, glabrous; stigmas capitate, warted or rugose. Capsules with tightly appressed sepals, glabrous, slightly woody, ovoid, cuspidate or apiculate, 2- to 4-seeded, apparently two-valved (really four-valved), somewhat woody; seeds glabrous. Cotyledons ovate, folded.

Type: Madagascar. Type specimen not seen, presemably at Paris.

This species is endemic to Madagascar, where it grows at low altitude (Map 1). One collector (Mocquerys 176) noted forest as the habitat of this species. It has been collected in flower in November. The flowering period otherwise is not definitely known.

Bonamia alternifolia is somewhat related to B. spectabilis but differs from it in many features. It is a very recognizable species of the genus with the following distinctive characteristics: (1) strongly nerved leaves with undulate margin, (2) terminal congested panicles, (3) closely appressed sepals, (4) distinctly lobed corolla with narrow limb and long tube, (5) exserted stamens with versatile anthers, (6) styles free to the base, (7) warted or rugose stigmas, (8) somewhat woody capsules with slightly appressed sepals, and (9) glabrous seeds. Of these several differences from other species in the genus, lobed corolla and exserted stamens are most outstanding and were paid serious attention by earlier botanists in maintaining it as a monotypic genus. Its slightly woody capsules (which dehisce into two valves) indicate a slight affinity to the members of section Trichantha, but it differs from the latter by its glabrous seeds.

This species is the type species of the genus, first described by Thouars (1805) without a binomial name. In the following year J. St. Hilaire published Bonamia alternifolia for the plant Thouars had described. Although this binomial was published earlier for the species later described as B. madagascariensis Poiret (1810), the latter name has replaced it in most recent literature. This adoption of the later name is probably owing to the fact that St. Hilaire's publication was rare, and since the name was included only in the appendix of Index Kewensis, it was overlooked. House (1907) first found this overlooked name and designated it as the type species of the genus. But the compiler of conserved generic names did not note House's designation of the type, thus resulting in the citation of B. madagascariensis as the type species of Bonamia in the International Code.

Distribution of

⊛ B. alternifolia ✸ B. mossambicensis

● B. spectabilis ✻ B. velutina

Map 1

B. alternifolia must be reinstated as the correct name for the species, and the improper choice of name in the Code should be corrected in the future.

Specimens examined:
MADAGASCAR: Soanierana, Rivieroever, liana, bl. wit, welriekend, Lam en Meeuse 5548, 30.11.1938 (L); Maroa, Forets a l'interieur de la baie d'Antongil, Arbre mince, elance, fleurs blanches, A. Mocquerys 176, 1897 (G); M. Richard de Bourbon 1966 (G). Unknown collector: N. de Madagascar, #367 (L).

2. Bonamia spectabilis (Choisy) Hall. f. Bot. Jahrb. 16:529. 1893.
Breweria spectabilis Choisy. Mem. Soc. Phys. Geneve 8:68 1839.
Breweria hildebrandtii Vatke, Linnaea 43:523. 1882.
Type: Hildebrandt 2903
Bonamia hildebrandtii (Vatke) Hall. f. Bot. Jahrb. 18:91 1893.
Bonamia minor Hall. f. Bot. Jahrb. 18:91. 1893.
Type: Pogge 1214
Bonamia minor var. argentea Fries, Wiss. Ergebn. Schwed. Rhod.--Kongo--Exped. 1:268. 1916. Type: Fries 827

Perennial, woody, climbing or twining, rarely trailing vines, growing all year around. Root thick, woody; stems terete, frequently ridged, sparsely appressed-pubescent, becoming glabrous in age, about 1.5-2.5 mm. in diameter. Leaves petiolate, membranous to subcoriaceous, glabrescent and green or silvery pubescent above; moderately or densely silky pubescent below; petioles mostly 5-12 mm. long, slightly winged and canaliculate above, minutely appressed-pubescent or becoming glabrous in age; blades elliptic, 1.8-5.5 cm. long, occasionally shorter, 6-20 mm. wide, sometimes slightly wider, entire at the margin, attenuate or cuneate at the base, acute or obtuse and apiculate at the apex, with about 5-8 pairs of lateral veins. Inflorescences shortly pedunculate cymes of 2-3 or few flowers, aggregated towards the end of branchlets; peduncles and pedicels mostly 5-10 mm. long, pubescent or glabrescent; bracts small. Sepals oblong-elliptic, 7-8 mm. long, abruptly acute, rarely obtuse, silky pubescent outside. Corolla blue, funnel-shaped, (1.5) 2-2.5 cm. long, silky pilose on interplicae, entire or subentire. Stamens included; filaments dilated and hairy below; anthers oblong with cordate base. Ovary glabrous; style bifid from about the middle or lower; stigmas ellipsoidal, rugulose. Capsule globose, about 7 mm. in diameter, shortly apiculate, glabrous. Seeds ovate-oblong, compressed on the inner side, 3-4 mm. long, brownish or blackish, with hyaline golden wings on edges. Cotyledons oblong, deeply bifid; cotyledonary petioles fused.

Type: Madagascar, Bombatok, Bojer (K - lectotype, not available; W - isotype!)

Republic of Congo, Northern Rhodesia, Tanganyika and Madagascar (Map 1).

Collectors recorded edge of dense forest, savannah forest on steep rockhills, mixed woodlands on sandy slopes, and degraded thickets on Kalahari sands at edge of river flats as habitats of this species. It has been collected in flower from March through December and in fruit from July through December.

Hallier (1897), after careful study of the Madagascarian species, treated B. hildebrandtii as conspecific with B. spectabilis, although he had accepted them previously (1893) as distinct species. He retained B. minor which he described in his earlier work. The type specimen of B. minor has not been seen in the present study, but a number of sheets which Hallier annotated have been examined. Hallier used the glabrous stem as a principal feature to distinguish it from B. spectabilis. Examination of sheets annotated by him shows pubescence to be consistent only if they are compared with specimens annotated by him as B. spectabilis. If one considers the additional collections now available it seems apparent that the characteristic which Hallier mentioned falls well within the total range of variation of a single species. Verdcourt (1963), realizing this fact, remarked, "Hallier unites B. hildebrandtii and B. spectabilis but retains B. minor as distinct. B. hildebrandtii is, however, undoubtedly identical with B. minor....."

This species is highly polymorphic in several features, particularly leaf shape and size (Figure 1), and villosity on stem and leaves. Future collections might reveal consistent features to account for the infraspecific groups in it.

Specimens examined:

REPUBLIC OF CONGO: KATANGA: Kasenga, W. Robyns 1845, 3. IV. 1926 (K).

MADAGASCAR: Env. de Majunga, C.D. Alleizette, 30. XI. 1906 (L); Central Madagascar, R. Baron 4906 (BM); Seandit in sylvis juxta Mazangay in Bombatok ora occidentalis ins. Madagas: Flor. Aug. 5. Flores in spicam longam congregati Cyanei, Bojer, II. q. 1830 (W); Nosse-be, J.M. Hildebrandt 2903, April 1879 (BM, L, W); Beravi interior: Gebrige, fl. albi, Hildebrandt 3093, July 1879 (BM, W); Nosifaly 8 (L); Iles Maurice, de Madagascar et Comorres, Mac William, Aout-Octobre 1838 (G).

NORTHERN RHODESIA: Barotse: Sesheke, climbing over small shrubs on edge of dense Baikiaea "mutemwa", Longe Forest, N. of Machile, climber with bright blue flowers, A. Angus 956, 19. 12. 1952 (EA); on Kalahari sand in open degraded Baikiaea "mutemwa" on edge of Kazu Forest near Machile, suffrutex with woody rootstock and numerous small shoots together, flower blue, Angus 983, 20. 12. 1952 (EA); Abercorn Dist. 2700 ft. B.D. Burtt 6325, 20. 5. 1936 (BM, EA); Barotseland, Nangweshi, 3400 ft., semiwoody climber in mixed woodlands on sandy slopes, blue flowers, L.E. Codd 7156, 23. 7. 1952 (L); between Pemba and Mazabuka, I.B. Pole Evans 2807, 11. 7. 30 (K); L. Mweru Dist. common vine scrambling over evergreen thicket, blue, showy with paler or white guide lines, D.B. Fanshawe F-4653, 6. 8. 1958 (EA); Abercorn Dist., A.H. Gamwell 68 (BM); Abercorn Dist. Alt. 4800 ft., A.H. Gamwell 94, August 1935

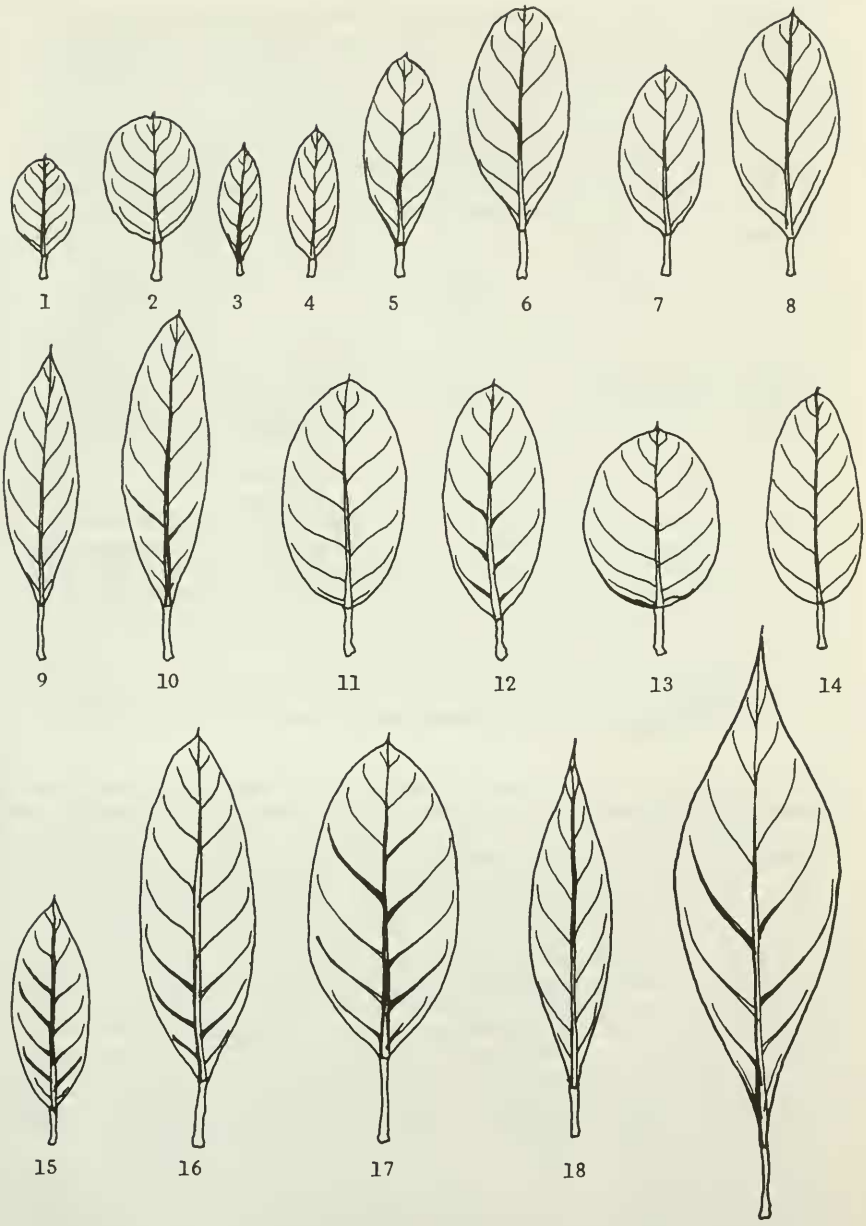


Figure 1

Variations in sizes and shapes of leaves in Bonamia spectabilis

(BM); Kafue 35 mi. s. of Lusaka, near Kafue Methodist Mission, roadside, climbing over shrubs and on red soils, A.E. King 55, 11 July 1955 (K); Mpulunga Road 10 mi. from Abercorn, 4000-5000 ft., herbaceous climber, flowers delicate sky blue, leaves dull green, pubescent, R.M. Lawton 208, June 1955 (EA); roadside, Kafue River, flower blue, plant mat forming, Leach and Brunton 9997, 12. 6. 60 (EA); J.D. Martin 196 (K); Abercorn Mpulunga Road, not far from Mukoma turning, alt. 4000 ft. on bank and trailing over low bushes, in a tangled mass, Mrs. H.M. Richards 5307, 5. 4. 1955 (EA); Mporokoso Dist., Sumba Malango Road, 900 m. in sandy soil on side of road, trailing plant, Mrs. Richards 6264, 24. 9. 1956 (EA); 26 mi. north of Choma, dry bush by roadside, climber rising on shrubs to height of 12 ft., E.A. Robinson 767, 17. V. 1954 (K); southern prov., Mazabuka Dist., Choma to Lusaka, Gt. North Road, mile 34, growing in Pterocarpus angolensis--Combretum mechowianum woodland, F. White 2285, 19. III. 1952 (EA); Namwala Dist., 20 mi. west of Mamwala Boma, growing in degraded thicket on Kalahari sands at edge of Kafue Flats, White 2962, 22. VI. 1952 (EA).

TANGANYIKA: Mpanda Dist., Masigo, Mulele Hills Forest Reserve, alt. 4500 ft., blue flowered creepers in thicket, J. Proctor 2086, July 1962 (EA); Ufipa Dist., Kasanga, alt. 840 m., side of road in very gritty soils, climbing over low bushes, Mrs. Richards 10093, 13. 6. 1957 (EA, K); Escarpment above Kasanga, alt. 900 m., climbing over dense vegetation by twining stems, Mrs. Richards 11001, 30. 3. 1959 (EA).

3. Bonamia densiflora (Baker) Hall. f. Bull. Herb. Boiss. 5:999. 1879.
Breweria densiflora Baker, Journ. Linn. Soc. Bot. 25:336. 1890.

Perennial twining vines. Stems slender, woody or becoming woody, terete, finely striated or smooth, finely pubescent and glabrescent; internodes mostly 2-5 cm. Leaves shortly petiolate, soft-subcoriaceous or herbaceous, sericeous with very fine, soft, appressed hairs when young, becoming sparsely sericeous or nearly glabrous (except on veins) in age; petioles 2-4 mm. long, 0.5 mm. thick, sparsely sericeous with soft hairs; blades oblong-elliptic or lanceolate-elliptic, 3-4.8 cm. long, 1-1.4 cm. broad, rounded or subtruncate at the base, obtuse-mucronate or acute-mucronate at the apex; midrib slightly impressed above, distinct beneath, with 6-8 pairs of thin lateral veins. Inflorescences axillary, pedunculate, umbellate cymes of three to seven flowers or terminal panicles; peduncles slender, short, 1-2 cm. long, finely pubescent or becoming sparsely so; pedicels slender, 3-6 mm. long, becoming slightly longer in fruit-bearing stage, sparsely soft-sericeous; bracts minute, linear, 0.5-1.5 mm. long. Sepals ovate or ovate-orbicular, rounded or slightly emarginate at the apex, coriaceous or subcoriaceous, soft-sericeous outside, slightly unequal; outer two ovate, mostly 3 mm. long, 2 mm. broad, and rounded at the apex; inner three orbicular or ovate-orbicular, 3-4 mm. long, mostly 3 mm. broad and slightly emarginate at the apex, scarious at the margin. Corolla white,

shortly tubular-campanulate or funnel-shaped, 1.2-1.8 cm. long, densely soft-pilose on interplicae. Stamens inserted; filaments filiform and glabrous above, dilated and villous below; anthers oblong, 1.5-2 mm. long, sagittate at the base. Ovary ovoid-conical, with distinct circular disc at the base, glabrous; styles filiform, glabrous, bifid for upper one-third or one-fourth; stigmas small, capitate. Capsules globose-subacute, 4-6 mm. long, apiculate, glabrous, 2- to 4-seeded, 4 valvular; seeds ovate-oblong, 3 mm. long, black or dark brown. Cotyledons deeply bifid; cotyledonary petioles short.

Type: Madagascar, R. Baron 5868 (K-not seen).

Known only from Madagascar.

Collectors give no definite location nor habitat. It was collected only a few times during the last century, and no recent collection is available for the present study. The species is poorly known, and the above description is mainly based on a single specimen and the original description by Baker.

The outstanding features of this species are (1) slender and sparsely sericeous stem, (2) softly sericeous and glabrescent leaves, thin in texture, (3) ovate-orbicular or orbicular and small sepals and (4) smaller corolla. It is a close relative of B. spectabilis from which it can be distinguished by its finely sericeous and glabrescent leaves, smaller sepals and shorter corolla. When a larger number of specimens of this species, showing more completely the variations to be found in it, is available in the future, its separation from B. spectabilis might be reconsidered.

Specimen examined:
MADAGASCAR: "N. de Madagascar, No. 213" unknown collector (L).

4. Bonamia thunbergiana (Roem. et Schult.) Williams, Bull. Herb. Boiss. (ser. II) 7:371. 1907.
Convolvulus Thunbergianus Roem. et Schult., Syst. Veg. IV: 884. 1819.
Convolvulus cymosus Thunberg ex Roem. et Schult., Syst. Veg. IV:303. 1819; not C. cymosus Desr. in Lamarck Encycl. Meth. III: 556. 1792.
Bonamia cymosa (Roem. et Schult.) Hall. f. Bot. Jahrb. 18: 91. 1893.
Convolvulus senegambiae Spreng., Syst. Veg. 1:610. 1825.
Ipomoea senegambiae Choisy, in DC Prodr. 9:351. 1845.
Ipomoea secunda Don, Gen. Syst. IV:282. 1838.
Breweria secunda Benth. in Hook. Niger Fl. 470. 1849.

Perennial, woody climber reaching 4 m. long. Stems twining, terete, 1.5-4 mm. thick, pubescent with brown hairs, densely so while young, becoming glabrous in age. Leaves petiolate, subcoriaceous or membranous, green and glabrous or rarely thinly

puberulous above, densely pubescent with golden brown hairs beneath; petioles mostly 5-13 mm. long, 1 (-1.5) mm. thick, pubescent; blades oblong to oblong-lanceolate, about 2.5-8.5 cm. long, 1.5-3.5 cm. broad, entire at the margin, rounded at the base, obtuse-mucronulate, rarely acute or acuminate at the apex; nerves sunken above, prominent beneath; lateral nerves about 6-10 pairs. Inflorescences dense cymes of many flowers, usually second on short peduncles or congested into a terminal panicle; peduncles 5-15 mm., tomentose; pedicels 5-10 mm, tomentose; bracts minute, lanceolate. Sepals oblong-lanceolate to ovate, acuminate or acute at the apex, about 6-8 mm. long, the inner slightly shorter, coriaceous to glumaceous, densely silky tomentose on the back. Corolla white, 1.6-2 cm. long, obscurely lobed or subentire; outside pilose or hirsute on the interplicae, glabrous on the plicae. Stamens included; filaments unequal, filiform, widening toward the base, glabrous above, pilose along the edge near the base; anthers oblong, cordate at the base. Ovary ovoid, with a disc at the base, pilose near the apex; style bifid above the middle, with scattered long hairs; stigmas conical, rugose. Capsule ovoid, 8-valved, 4-seeded, rarely less, apiculate, glabrous, about 5-8 mm. long; seeds black, ovate-oblong, glabrous.

Type: Sierra Leone.

Coastal districts of tropical west Africa, from Gambia, French Guinea, Sierra Leone, Liberia, Ivory Coast, Gold Coast, Nigeria, Cameroun and the western part of Congo Republic (?) (Map 2).

It has been collected in flower from November to May and in fruit from December to April.

Hallier in his Convolvulaceae of Africa and monograph of the genus, used the specific epithet cymosa, since he had overlooked Roemer and Schultes' correction of cymosus to thunbergianus in the errata at the end of the volume. As pointed out by Williams (1907), the epithet cymosus is illegitimate since it is preoccupied by C. cymosus of Desrousseaux. The species was first collected by Thunberg in Sierra Leone and was named in his honor.

Specimens examined:

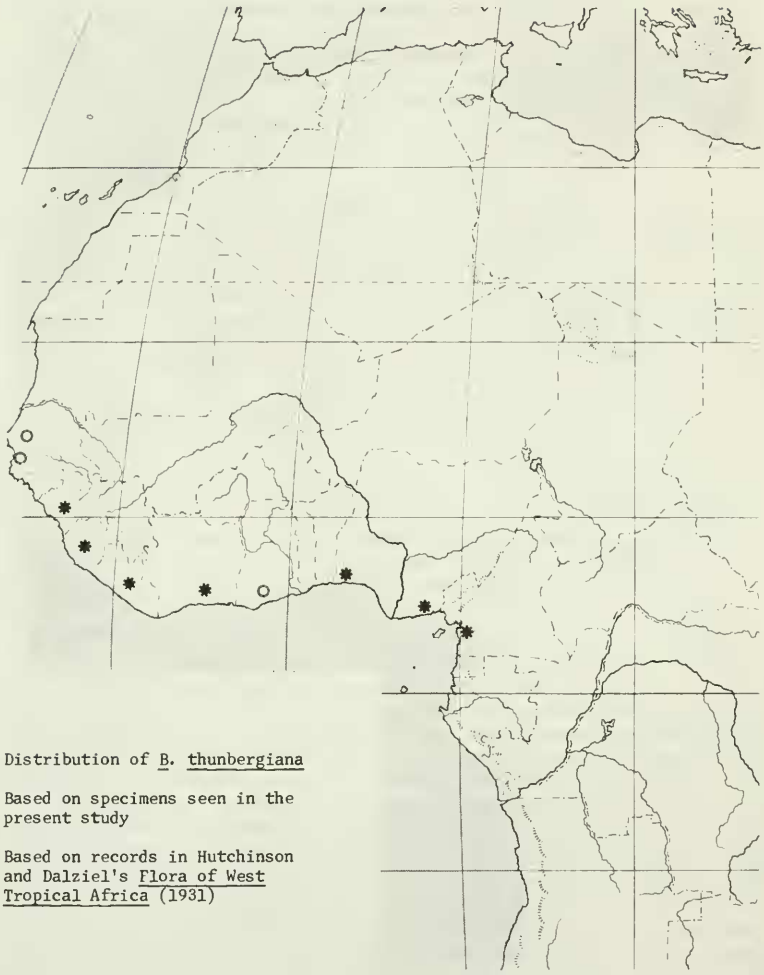
CAMEROUN: Gross-Batanga, M. Dinklage 684, Ende Juni 1890 (HBG); Dinklage 684, 16. XI. 1890 (HBG); Bipende, Urwaldgebiet, G. Zenker 4112, 1911 (BM).

FRENCH GUINEA: Kouakry, Boue 38, II. 1910 (G); Mamou, G. Roberty 10600, 9. 2. 1948 (G).

FRENCH WEST AFRICA: Adiopodoume N (B. 30. 8. Df.), Roberty 15655, 24. 11. 1954 (G); U Zo, NW. (B. 29. 22. Bd.), Roberty 16076, 17. 12. 1954 (G).

IVORY COAST: Mau, Roberty 6737, 26. 12. 1946 (G); Basse cote d'Ivoire, secteur cotier, boisements perilagunaires, Dabou, Roberty 13626, 1950-51 (G).

LIBERIA: Along Dukwia R., vine with white flowers, common name Doo, G.P. Cooper 220, 1929 (F, NY, US); Monrovia, Max Dinklage 2148,



Distribution of B. thunbergiana

✱ Based on specimens seen in the present study

○ Based on records in Hutchinson and Dalziel's Flora of West Tropical Africa (1931)

1903-04 and 2399, 9 Jaunar. 1909 (B); 3 mi. north-east of Suacoco, Gbarnga, central prov., thicket, gravelly soil, vine 9 ft. tall, V.P. Konneh 125, Feb. 17, 1951 (MO); within a radius of 20 mi. from Kakatown, A. Whyte, April 1904 (BM, W).

NIGERIA: Baikie's Nigeria Expedition (Lagos), C. Barter 2227, 1857-59 (GH); main road from Oron to Eket--28 mi., mostly farm clearing, Eket Dist., southern Nigeria, P.A. Talbot, 1912-13 (BM); white, tinted palest mauve at edge of corolla, Oban, P.A. Talbot 88A (=1535), 1909 (BM).

SIERRA LEONE: Afzelius (BM); R.H. Bunting, 1913-14 (BM); Njala, Allison v. Armour Expedition 1926-27, J.M. Dalziel 8048, 20. 1. 27 (US); Makump, roadside and old farms, creeper with white flowers, Temne--"Rakil," R.R. Glanville 108, 9. 12. 1928 (K); Mamansu, V. Marmo 145, 30. 11. 1958 (K); bush near Regent, Mahera, Kitchom, G.F. Scott-Elliot 3930, Dec. 6. (BM, GH); Scott-Elliot 5835, March 4, 1892 (BM); climbing over bushes near Madina, Scott-Elliot 5865 (BM); Smeatman (BM); Rornks, alt. 200 ft., N.W. Thomas 5780, 24. 11. 1914 (EA); Magvile, alt. 100 ft., Thomas 6385, Dec. 8, 1915 (BM); Thomas 6604, 1915 (B), 6818, Dec. 23 - Jan. 2, 1914-15 (B), 6860, 1915 (B), 7051, Dec. 31, 1914 (B), 8513, 1915 (W).

(?) CONGO REPUBLIC: oubangui, Reg. de Tanga, Herb. de C. d'Alleizette, May 1920 (L).

5. Bonamia mossambicensis (Klotzsch) Hall. f. Bot. Jahrb. 18:91. 1893.

Prevostea mossambicensis Klotzsch in Peters, Reise Mossamb. Bot. 1:244, t. 39. 1861.

Breweria buddleoides Baker, Kew Bull. 1894:69. 1894.

Perennial, shrubby climbers to 4-5 m. Stems terete, velvety with patent and tangled hairs, white or grey in life, golden-brown when dry. Leaves shortly petiolate, coriaceous or subcoriaceous, velvety pubescent, more densely so beneath; petioles 4-10 mm. long, velvety pubescent with hairs similar to those on the stems, blades elliptic lanceolate to oblong-ovate, 2.5-8.5 cm. long, 1-4.8 cm. wide, rounded or slightly cordate at the base; acute, acute-mucronulate, acuminate or apiculate at the apex; veins distinctly depressed above, prominent below; about 6-10 pairs of lateral veins. Inflorescences capitate, bracteate, densely hirsute, shortly pedunculate or nearly sessile; peduncles up to 3.2 cm. long; pedicels almost absent; bracts elliptic or oblong-elliptic, 1-1.2 cm. long, 5-8 mm. wide, hirsute outside, almost glabrous inside. Sepals unequal, coriaceous except near the apices of outer ones; the two exterior larger and hirsute near the apices. Corolla blue, funnel-shaped, 2 cm. long, subentire or almost entire; outside pilose on interplicae, glabrous on plicae. Stamens included; filaments short, unequal, adnate to corolla tube, glabrous or with scattered hairs; anthers oblong, about 2 mm. long and 1 mm. broad. Ovary hairy at the apex; style bifid above the middle; stylar branches unequal; stigmas ovoid or globose, rugose. Capsule 4-valved, 2 (-4)-seeded, thin-walled, hairy outside, at least at the apex; seeds ovate-oblong, 2-3 mm. long, dark brown with narrow hyaline wings on edge. Cotyledons ovate-cordate.

Type: Mozambique, Sena, Peters (B-holotype-not available).

Restricted to thickets and secondary evergreen forests on loam and sand in coastal districts at the altitude of 120-450 m. in Mozambique and Tanganyika (Map 1).

The outstanding characteristics of this species are: (1) densely velvety pubescent leaves and stems, (2) foliaceous bracts, (3) capitate, densely hirsute inflorescences, (4) absence of pedicels and (5) short peduncles.

Specimens examined:

MOZAMBIQUE: Port Amelia, white, R. Dummer 64, July 1913 (BM); Niasa Dist., Port Amelia, 150 ft. "fl. sky blue," J. Gerster 7172, 24. 6. 1949 (L, K); 4 mi. west of Lumbo; pale mauve blue, L.C. Leach and Rutherford-Smith 10944, 21. 5. 1961 (EA); 11 km. on the road to Monapo on light sandy soil, Pedro-Pedrogar 3139, May 5, 1948 (EA); between Femad Veloso and Nacala on red sandy soil in dense secondary bush-thicket, Pedro-Pedrogar 4813, Aug. 15, 1948 (EA); Trepadeira de flores azul-purpures, Mocimboa da Praia, entre Diaca e Meuda, Pedro-Pedrogar 5216, Sept. 15, 1948 (EA).

TANGANYIKA: Orero-Kilwa Kivindje, Braun 1304, 4. 11. 1906 (EA); Daressalaam Dist., Puguhills; exposed banks and railway cuttings; trailing or rambling habit to 4 ft.; fl. pretty sky blue, leaves silver green, B.D. Burtt 4470, 25. 4. 1933 (K); W. Busse 2565 (1903) (EA) and 2467a (EA); Kisarawe, Karonzurir (Kizaramo), a scandent shrub with clusters of pale blue flowers, very common with Dichapetalum spp. and Acacia pennata in Antidesma, Xylopia, Trema, Diospyros, Enclea; secondary evergreen forest on red sandy soils, 1000 ft. alt., P.J. Greenway 4993, 1. 8. 1937 (EA); Lindi, Mkae Plantation; blue creeper which affects badly most of the land on the estate, Manager 14, 5. 1932 (EA); Tandagura to Lindi, foot of Notoplateau, alt. 900 ft., old farm land, climber furry stalk and leaves, fl. terminal buff bracts, blue, monopetal, F.W.H. Migeod 812 and 813, 22. 8. 30 (BM); Usaramo, Puguberge, bem. 21. 5-24, 5, entland der Bahnstrecke, blace, A. Peter 31316, 24. X. 1926 (B); Daressalam--Mbagara--see, P. Schlingt, blau, Peter 44927, 5. IX. 1926 (B); Bagamoyo--Mapinga, Meist Verblicht, tila, Peter 51646, 5. XII. 1915 (B); Usaramo bei Toga, Peter 51649, 13. XII. 1915 (B); Usambara, Bwiti Urwald bei Maramba, Blau, ca. 280 m., Peter 51705, 6. VI. 1917 (B); Mahenge, Sali, ca. 35 km. sudlich Station Mahenge Savanne and Bushland, 900-1000 m. scclinger, vereinzelt, Blute blau, H.J. Schlieben 2242, 24. 5. 1932 (B, BM, G, HBG); 40 km. west of Lindi, 240 m. u. M. Lutamba-see, schlinger in gr. Gruppen uber Stranchern sehr haufig, Schlieben 5193, 29. 8. 1934 (B, BM, G, HBG); Usaramo, Stuhlmann 105, 18. VIII. (18)88 (HBG); Pugu Hills, powder blue flowers, very common all up the road, J.H. Vangham 2340, April 13, 1936 (EA); 41 mi. from Daressalaam on main road to Morogoro, climbing over trees and shrubs in hillside thicket margins; also trailing plant on roadsides; climber, 10-12 ft.; stem covered with greyish white hairs, sage green, paler on backs; corolla tube cream. lobes pale blue, very common, J.R. Welch 303, July 4, 1955 (K).

6. Bonamia cordata (Hall. f.) Hall. f. Bull. Herb. Boiss. 7:43 1899.
Prevostea cordata Hall. f. Bot. Jahrb. 18:93. 1894.
Not Breweria cordata Blume. Bydr. Fl. Nederl. Ind. 722. 1825.

Perennial twining vines. Stems woody, terete, twining, long, finely villous, more densely villous when young; internodes 6-10 cm. long. Leaves petiolate, soft, herbaceous, thin or sometimes submembranous, moderately or densely villous or scabrous on the upper surface, densely villous of ferrugineous on the lower surface; petioles 1.5-3 cm. long, villous; blades ovate-cordate to ovate-acuminate, 4.5-7.5 cm. long, 3-5 cm. wide, cordate at the base, acuminate or acute at the apex; midrib impressed above, prominent beneath, with 6-10 pairs of lateral veins. Inflorescences axillary, pedunculate cymes of few to several flowers; peduncles long, usually 3-8 cm., 1.5-2 mm. thick, rigid, densely villous or tomentose; secondary peduncles 4-6 mm. or rarely longer; pedicels short or nearly absent; bracts foliaceous, petiolate, ovate-lanceolate, 1-2 cm. long, 6-10 mm. wide, indumentum as on leaves; bracteoles lanceolate or ovate-lanceolate, 5-8 mm. long, sepals coriaceous or soft-coriaceous, unequal; outer sepals orbicular-mucronate or ovate-orbicular, 11-14 mm. in diameter, villous or ferrugineous outside, moderately or densely ferrugineous inside, abruptly acuminate or obtuse-acuminate at the apex; inner sepals small, ovate or ovate-lanceolate, 7-9 mm. long, 4-6 mm. wide, densely ferrugineous or villous outside, glabrous inside, acute at the apex. Corolla and stamens not known. Ovary globose or subglobose, sparsely short-pilose or glabrous; styles bifid to the middle or higher, glabrous; stigmas small, globose. Fruits and seeds not known.

Type: Madagascar (Cote orientale), Boivin 2184, 1846-1852 (G-lectotype).

Endemic to east coast of Madagascar, and known only by type collection, which is incomplete, lacking corolla, stamens, fruits and seeds.

Although the only available material is the type which is fragmentary, this is a very distinct species and can easily be recognized by its unequal sepals, outer enlarged sepals being pubescent on both surfaces, foliaceous bracts and large cordate leaves. It superficially resembles B. semidigyna, to which it seems to be more closely related than to any other species, because of similarity in their indumentum, large cordate leaves, long pedunculate cymes and long internodes. It differs from B. semidigyna in its unequal sepals and foliaceous bracts.

Hallier (1894) hesitantly described this species under the genus Prevostea, presumably because of its unequal sepals. He later transferred it to Bonamia because the sepals are merely unequal and not accrescent as in the genus Calycobolus (=Prevostea).

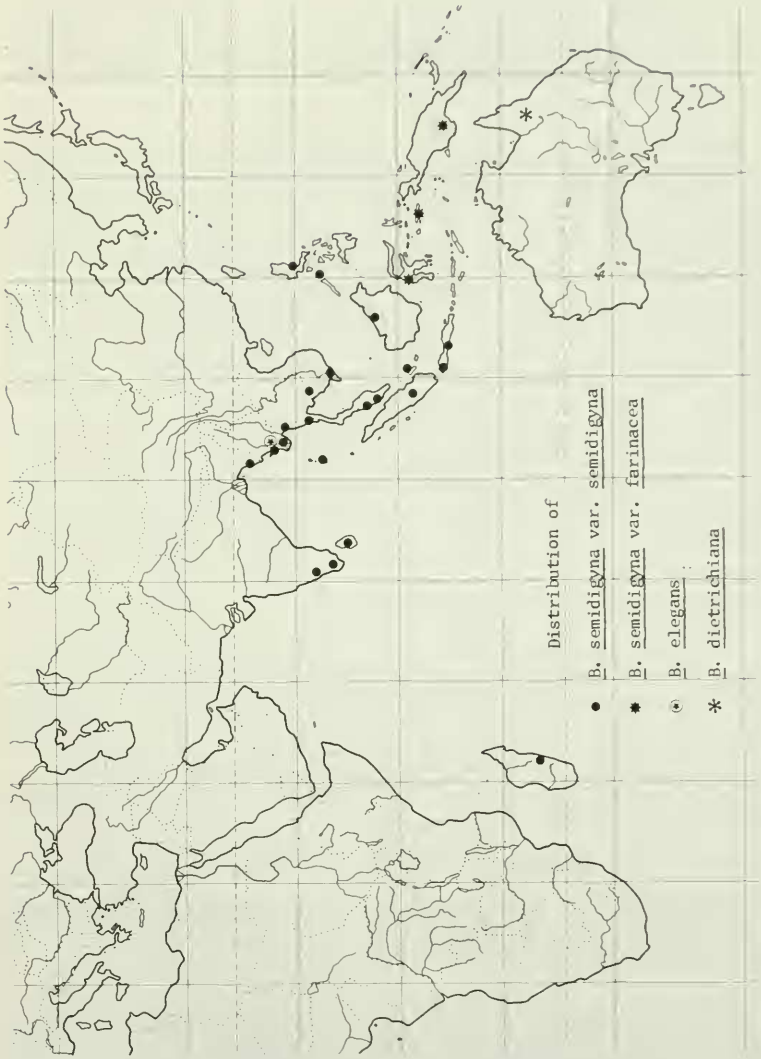
7. Bonamia semidigyna (Roxb.) Hall. f. Bot. Jahrb. 16:528. 1893.
Convolvulous semidigynus Roxb. Fl. Ind. (ed. Carey et Wall.) 2:47. 1824.
Breweria cordata Blume, Byrd. Fl. Nederl. Ind. 722. 1825; not Bonamia cordata (Hall. f.) Hall. f. Bull. Herb. Boiss. 7:43. 1899.
Breweria roxburghii Choisy, Mem. Soc. Phys. Geneve 6:493. 1833.
Breweria madagascariensis Choisy, l. c. 1933; not Bonamia madagascariensis Poir, Encycl. Meth. Bot. Suppl. 1:677. 1810.

Perennial, woody vines. Stems twining to a height of 15 m., terete, densely brown or reddish brown tomentose. Leaves petiolate, subcoriaceous, soft, leathery or membranous, densely or sparsely tomentose underneath; petioles 18-35 (-60) mm. long, tomentose like stems, canaliculate above; blades broadly to narrowly ovate, 6.5-15 cm. long, 4-10 cm. wide, broadly cordate or occasionally truncate at the base, shortly acuminate or cuspidate at the apex; veins impressed above, prominent underneath; lateral veins 5-7 pairs. Inflorescences axillary, pedunculate, umbelliform cymes of 2-5 (-7) flowers, rarely solitary by abortion of lateral flowers; peduncles long, variable in length, mostly 2-12 cm. long, 1.5-2.5 mm. thick, tomentose as the stems; pedicels variable in length, 4-15 mm. long, 1.5-2 mm. thick, densely tomentose; bracts linear or lanceolate, mostly small, rarely foliaceous, 5-10 mm. long, rarely 20 mm. long. Sepals ovate, or ovate-oblong, or ovate-acuminate, equal, subequal or the inner slightly shorter, 7-14 mm. long, densely tomentose, acuminate or acute at the apex. Corolla white, campanulate to funnel-shaped, 3-5 cm. long, lobulate or subentire at the margin, long-pilose on interplicae, glabrous on plicae. Stamens included; filaments glabrous above, sparsely pilose near the base; anthers oblong, 3-4 mm. long, cordate at the base. Ovary ovoid, with dense long hairs; styles bifid to the middle or lower, glabrous above with scattered hairs near the base; stigmas globose-peltate. Capsules broad-ovoid to subglobose, apiculate, hairy at the apex, about 10-14 mm. in diameter, 2 celled, 4- to 8-valved, 4-seeded, rarely less seeded by abortion; seeds glabrous, black, oval in outline, convex on one side, and plane on two other sides, 5-6 mm. long. Cotyledons ovate, broadly cordate at the base, folded; cotyledonary petioles fused.

Type: India; type specimen not available.

From Madagascar through Ceylon, India, Pakistan, Burma, Thailand, South Vietnam, Malaya, Borneo, Sumatra, Java, Celebes, Culion and Luzon to Moluccas and New Guinea (Map 3).

This is the only species of the genus so widely distributed, commonly collected and represented in most large herbaria of the world. Hallier recognized three varieties under this species mainly on account of differences in indumentum. However, Van Ooststroom (1954) skeptically treated var. ambigua, stating,


Distribution of
B. semidigyna var. semidigyna
B. semidigyna var. farinacea
B. elegans
B. dietrichiana

Map 3

"It is...more difficult to draw a satisfactory line between var. semidigyna and this variety, than with var. farinacea. It is not impossible that Hallier is right that we have here a hybrid before us." Specimens (bearing the varietal epithet ambigua and annotated by Hallier) are somewhat variable in several features, but presumably all were collected by Hallier from a single plant in the Botanical Garden of Bogor. It had best be retained as an aberrant form of var. semidigyna from which it differs mainly by its very large leaves.

Key to Varieties

1. Stems and lower leaves with a dense brown or reddish brown tomentum; finer nervations of leaves indistinct or rarely transverse veins between adjacent lateral veins (or intercostal veins) barely visible; outer sepals acute to acuminate..... ..... var. semidigyna.

1. Stems and lower leaves sparsely tomentose or covered with short, closely appressed paler hairs; finer nervations of the leaves often more visible by the absence of a dense hair coating; outer sepals acute..... var. farinacea.

7a. B. semidigyna (Roxb.) Hall. f. var. semidigyna.
B. semidigyna (Roxb.) Hall. f. var. ambigua Hall. f. Bull. Herb. Boiss. 5:817. 1897.

Stems tomentose with brown or reddish brown hairs. Leaves densely tomentose underneath, with barely visible finer nerves (because of dense coating of hairs). Sepals 10-14 mm. long, rarely slightly shorter, densely brown tomentose, acute or acuminate at the apex, thick, rarely with slightly visible nerves.

Edges of secondary forests, thickets, hedges, waysides and river banks, from sea-level to about 250 m., rarely to higher altitudes.

B. semidigyna var. ambigua of Hallier is treated here as a form of the typical variety.

Specimens examined:

ANDAMAN ISLANDS: S. Andaman, Port Monat-hill jungle, King's Collector, 19. 12. 1891 (US); Prain's collector 21, 8. 3. 1901 (BM, G); Prain's collector 95, March 1901 (G); (doubtful) "Tenasserim and Andamans," Helfer 5874 (W).

BURMA: Maulmein, Sammlugen O. Kuntze's Weltreise 6289, X. 75 (NY); Sandoway, Arracan, Capt. Margrave (L); Tenasserim, J.D.V. Packman (BM); Pegu, Scott (L); without loc. J.H.B.C. 1405 (L).

CEYLON: James Macrae 533 (BM); H.K. Thwaites 2853, 1855 (BM, G, GH, W); Col. Walker (G).

COCHINCHINA (SOUTH VIETNAM): M. Germain 78, 1879 (G), Recule, 1 Avril 1880 (F, L, UC); fl. albi. Hab. ad Um dzan mot in Oust. Coch. L. Pierre, 1. 1864 (BM); ad Um dzan mot. in Ouest. Coch. fl.

albi., L. Pierre 22, 1. 1867 (A,F,G,GH,NY); ad Bien hoa in Ouest. Coch. fl. albi., Pierre, 12. 1869 (F. L. UC) [many of Pierre's label notes not deciphered]; M. le Dr. Thorel 612, 1862-1866 (A).

INDIA: Travancore, Madaras, J.S. Gamble 14778, Sept. 1884 (HBG, K); Prope Mercara, Terr. Canara, R.F. Hohenacker 563, Jan., Febr., M. 1847 (BM, G); Tidal Creek, Naiti, N. Kanara Dist., W.A. Talbot 2868, 10. 1. 93 (G); "India," Wallich 1405. 1, 1405. 2, 1405. 3 (BM).

INDONESIA: JAVA: Batavia, Heurdterrein z. van Djassinga, 250 m., Backer 26030 (L); Blume 1851 (L); Buitenzorg, Boerlage (L); Java Res. Batavia Barengkok. W. v. Leuviliang, alt. 250 m., Bakhuizen von den Brink Jr. 770, 16. 6. 1921 (L, W); corolla lactea, cult. in Hort. Bog., Hallier C. 18. a., 24. V. 1893 (G, L), C. 18. b., 5. V. 1893 (L), C. 18. c., 13 V. 1895 (L); Hallier 104d, 14. 8. 1896 (L); Cult. in Hort. Bog., Hallier (L); Korthals 226 (L); Kandang Japi, Korthals (L); Zollingero 1339, 1844 (G). Location indefinite. Blume (L); Reinwardt 362 (L). Unknown collector: "Java" (1). SUMATRA: Korthals 48 (L), 1711 (L); Pasier Cantang, lat. 2°S, sea level, fl. white, H.C. Robinson and C.B. Kloss 2, 18. VI. 1914 (BM). SUNDA: Straights of Sunda, Macartney and Staunton (BM).

MADAGASCAR: Envir. Tamatave, C.D'Alleizette, Nov. 1906 (L); central Madagascar, Rev. R. Baron 2773, Dec. 1883 (BM); M. Goudot 222 (?), 1833 (G); Hab. ad Tamatave, flores albi, Helsemberg (BM); Hunblet 211 (W); Tamatave, D. Paulay, June 1887 (W).

MALAYA: Kuband Ulu, Province Wellesley, C. Curtis, July 1890 (BM); Pulo-Pinang, A. Delessert 632, 1835 (G); Selangor, C.W. Franck 1013, 16. 9. 1937 (A); Perlis, Kangas, alt. low, M.R. Henderson 22858, Nov. 16, 1829 (BM, BRI); "2" specim. lect. in Ins. Penang, G. Porter, in 1822 (NY); Penang, unknown collector, with Wallich Herbarium No. 1405.2, 1832 (G).

PAKISTAN: Chittagong, Regio tropl. alt. 1000 ped. J.D. Hooker and T. Thomson, 1861 (BM, G, GH, L, W); The Chittagong Hill Tracts, Dr. King's collector 206, 1885 (K), 615, 1887 (L).

PHILLIPPINES: Central Luzon, A. Loher 4155(US); Culion Island, E.D. Merrill 538, Dec. 18, 1902 (NY, US), 618, Jan. 1, 1903 (NY, US).

SARAWAK: Baram Mouth, Baram Dist., C. Hose 27, Dec. 1894 (BM).

THAILAND: Kao Saming (Krat), under 50 m., A.F.G. Kerr 9399, 25. 11. 1924 (A, L); Hat Yai (near Songkhla), under 50 m., Kerr 13535, 22. 12. 1927 (A, L).

Locations not determined: Anamallays, R.H. Beddome 5627 (BM); Sillet (Indes Or.), Wallich 1405. 1, 1832 (G); Peninsula Indiae Orientalis, Wight 1999 (GH, L, NY). Locations unknown: Wallich 1405, 1832 (G); Wallich 1405.2 (L). Collector unknown: (G).

7aα. B. semidigyna var. semidigyna forma ambigua (Hall. f.) Myint and Ward, comb. nov.

B. semidigyna (Roxb.) Hall. f. var. ambigua Hall. f. Bull. Herb. Boiss. 5:817. 1897.

Differs from the typical form by its greyish and thinner indumentum, larger and wider leaves with broadly rotund-cordate bases, longer petioles, larger bracts and bracteoles, and larger corolla.

Type: Bangka (culta in horto Bogor.), Hallier C. 17. a., 23. V. 1893 (L-lectotype!).

Known only from type location.

All specimens deposited at the Rijksherbarium were collected from a single plant grown in the Botanical Garden at Bogor, according to Van Ooststroom (1954). Since no further collection has been made, Van Ooststroom questioned it as a distinct variety. When it was described, Hallier suggested it as a hybrid between var. semidigyna and var. farinacea, and Van Ooststroom remarked that Hallier may well be right. Future collections are much desired.

Specimens examined:
INDONESIA: Bangka, culta in horto Bogor., H. Hallier C. 17. a., 23. V. 1893 (L); C. 17. b., 7. IV. 1893 (L); C. 17. c., 29. III. 1893 (L); C. 17. d., 5. V. 1893 (L); Hallier X. F. 75 (L).

7b. B. semidigyna (Roxb.) Hall. f. var. farinacea Hall. f. Versl.'s Lands Pl.-tuin Btzg. 125. 1895 (1896).
Lettsomia bancana Miq. Fl. Ind. Bat. Suppl. 561. 1861.

Differs from var. semidigyna in stems and lower leaves covered with short, closely appressed hairs of a paler color, grey or light brown; finer nerves of leaves distinctly visible (because of thin coating of soft hairs); sepals 7-12 mm. long, sparsely or moderately tomentose (not densely tomentose except in young buds), mostly acute or shortly acuminate, frequently with distinct nerves.

Type: Celebes, cult. in horto Bogor., H. Hallier C. 16. a., 23. V. 1893 (L-lectotype!).

Thickets on beaches and rocks, both in marshy and dry localities, from sea-level to 75 m., in Malaysia from Banka and Celebes to Moluccas (Ceram) and New Guinea. Van Ooststroom notes that Ceram and Celebes specimens possess aberrant characters (longer pedicels and elliptic-obtuse sepals) which with future collections might prove to be taxonomically important.

Specimens examined:
CELEBES: Sudwest Celebes, Bau-Bau, Gestrupp, 0-75 m., sehr trocken, korallenkalk, J. Elbert 2641, Sept. 5, 1909 (L); Padangoma, 0-10 m., Mangrovenwald, Strandbusch, Sumpf, lehmig, Elbert 3250, Oktober, 1909 (L); Cult. in horto Bogor., H. Hallier C. 16. a, 23. V. 1893 (L), C. 16. b, 17. II. 1893 (L), C. 16. c, 13. V. 1895 (L), C. 18. c, 13. V. 1895 (G); Provincia Minahassa, S.H. Koorders 16559B (L); Bonto Parang, Rachmat 4 (exp. van Vuuren), 24. 6. 1913 (L).

SERAM (CERAM): Poeloe Tikoes, ± 0 m., Kornassi 1274 (exp. Rutten), 10. 5. 1918 (L).

NEW GUINEA: Papua: Lower Fly River, east bank, opposite Sturt Island, robust climber in second growth, rain forest, flower white, L.J. Brass 8180, Oct. 1936 (A).

8. Bonamia elegans (Wall.) Hall. f. Bot. Jahrb. 16:529. 1893.
Convolvulus elegans Wall. Cata. p. 38, no. 1392. 1828.
Breweria elegans (Wall.) Choisy, Mem. Soc. Geneve 6:193. 1833.
Breweriopsis elegans (Wall.) Roberty, Candollea 14:31. 1952.

Perennial, woody vines. Stems terete, twining, pilose or becoming glabrous in age, thin and wiry or becoming 2-3 mm. thick. Leaves shortly petiolate, subcoriaceous or soft-coriaceous, thinly pilose above, densely strigose beneath; petioles 2-8 mm. long, densely sericeous or pilose; blades variable in shape and size, older being ovate-elliptic; younger leaves lanceolate or sublinear, 2-4 cm. long, rounded or slightly cordate at the base, obtuse or obtuse-mucronate at the apex; veins impressed above, prominent beneath; lateral veins about 3-4 pairs. Flowers axillary, solitary or rarely in shortly pedunculate cymes of 2-3 flowers; peduncles 5-18 mm. long, mostly 1 mm. thick, finely pubescent; pedicels 2-5 mm. long, frequently slightly thicker than peduncles, brown-pubescent; bracts two, opposite, linear or linear-lanceolate, 3-6 mm. long. Sepals coriaceous or subcoriaceous, ovate-lanceolate, 12-15 mm. long, 4-5 mm. wide, acuminate or acute at the apex, equal or slightly unequal, finely pubescent, more densely so near the base. Corolla blue, campanulate-infundibuliform, 4-5 cm. long, slightly lobulate or subentire, pilose on interplicae, glabrous on plicae; tube cylindrical, wide, not distinct from the limb. Stamens included; filaments glabrous above, with scattered hairs below, at least along the edges; anthers oblong or oblong-lanceolate, 3-4 mm. long, cordate at the base. Ovary conical, with long hairs at the apex, glabrous near the base; styles fused near to the stigma, with scattered hairs on the lower part; short stylar branches unequal; stigmas depressed-capitate. Fruits not known. Cotyledons oval, not folded in young stage, unknown in mature stage; cotyledonary petioles fused.

Type: Burma: Prome, Wallich (G-lectotype!, BM-isotype!)

Known only from the type locality (Map 3).

This species is poorly known and rarely collected. It is represented in a few large herbaria of Europe only by an old collection made by the author of the species more than a century ago. Apparently no further collections have been made since that time. The type collection is fragmentary, since it is only of a flowering branch and is without leaves of the vegetative parts. According to Clarke (1885), the juvenile leaves are much larger, attaining 7.5 by 3.1 cm, whereas the leaves on flowering branches are 3.8 by 0.8 cm. Since the vegetative branches and fruiting

material are not available in the present study, a more complete description of the species has to await future collections.

Roberty (1952), in erecting his new genus Breweriopsis typified by this species, lumped B. elegans, B. grandiflora and B. minor as constituting a single species. These three species of different continents differ in several important features. The most obvious common feature is their blue flowers, by which Roberty characterized his new genus. His treatment is quite artificial in many respects. He excluded several species possessing blue flowers, two of which were treated under an entirely distinct genus, Stylisma. But perhaps the most unacceptable part of his classification was his treating B. spectabilis and B. minor under two different genera, whereas these two, as pointed out by Verdcourt, are so similar in all features that they are conspecific.

9. Bonamia dietrichiana Hall. f. Bull. Herb. Boiss. 5:1012. 1897. Bonamia pannosa sensu Hall. f. l. c. 5:810, as to the description and quoted specimen, not Breweria pannosa R. Br. Prodr. 488. 1810.

Perennial twining vines. Stems slender, terete, becoming woody, mostly 1-2 m. long, 1-2 mm. thick, fulvous-tomentose or subsericeous; internodes variable in length, 1.5-5 cm. long. Leaves shortly petiolate, soft and thick or slightly leathery, sericeous and apparently dark green above, densely sericeous and pale green beneath; petioles 4-8 mm. long, sometimes slightly shorter, sericeous; blades ovate or ovate-subcordate, 2.5-4 cm. long, 1.7-2.7 cm. broad (smaller on upper leaves), subcordate or truncate at the base, obtuse-mucronate or emarginate-mucronate at the apex; mucro 1 mm. long; nerves indistinct above, prominent beneath; lateral nerves 5-7 pairs. Flowers axillary, solitary or in simple cymes of 2-3, shortly pedunculate; peduncles 3-7 mm. long, terete, slender, sericeous; pedicels 2-4 mm. long; bracts opposite, ovate, shortly petiolate, 7-10 mm. long, 4-6 mm. broad, finely tomentose or sericeous. Sepals lanceolate or ovate-lanceolate, 12-13 mm. long, subcoriaceous or coriaceous; outer sepals densely villous or sericeous outside, acuminate at the apex, slightly longer than inner ones; inner sepals sparsely pubescent or nearly glabrous outside, acute or shortly acuminate at the apex. Corolla white (?), funnel-shaped, 3.5-4.5 cm. long, 3-3.5 m. broad, subentire or slightly lobulate at the limb, long-pilose on interplicae. Stamens inserted; filaform, glabrous above, pilose near the base; anthers linear-oblong, 2-3.5 mm. long, cordate at the base. Ovary ovoid, long-pilose at the apex, glabrous below; styles bifid to the middle or nearly to the base, filiform, glabrous or with scattered hairs near the base; stigmas large, globose-capitate. Fruits and seeds not known.

Type: Queensland, Australia, A. Dietrich 19 (HBG).

This species, endemic to Queensland, Australia (Map 3), is distinct from all other Australian species in its longer and lanceo-

late sepals, larger corolla and foliaceous bracts. It is somewhat related to B. pannosa because of similarity in its indumentum, slightly unequal sepals and larger subcordate leaves. It is probably more closely related to B. elegans of the Orient because of similarity in their sepals and corolla.

Hallier, in his earlier treatment, included this species under B. pannosa and later realized its distinction from the latter. It differs from B. pannosa in its larger and white corolla, nearly equal, closely appressed and lanceolate sepals, outer sepals being glabrous inside, and leaves being obtuse-mucronate or emarginate-mucronate at the apex (Figure 5).

Specimens examined:
AUSTRALIA: Queensland: A. Dietrich 19 (HBG-lectotype and isotype); Stony Creek, Stuart, Townsville, "K. K." 8, April 4, 1954 (BRI).

10. Bonamia menziesii Gray, Proc. Am. Acad. 5:336. 1862.
Breweria menziesii (Gray) Bentham and Hooker, Gen. Pl. 2:877. 1876.
Bonamia Herminieri Hall. f. Bot. Jahrb. 16:529. 1893.
Perispermum albiflorum O. Degener, Fl. Hawaiiensis, Fam. 307. 1932. Type: Degener, Park and Nitta 4111!
Perispermum menziesii (Gray) O. Degener, Fl. Hawaiiensis, K6. 1934.

Perennial, woody, slow-growing, coarse vines, up to 10 m. Stems twining, terete, long, without milky juice, glabrescent and with pale yellowish bark, fulvous-tomentose when young, distantly leafy, soon becoming woody, later bearing short leafy spurs. Leaves petiolate, soft-coriaceous, tomentulose and hoary to glabrous above, densely fulvous-tomentose below; petioles 8-25 mm. long, sulcate, fulvous-tomentose or becoming less tomentose in age; blades oblong-elliptic, ovate or rarely orbicular, 3.2-9 cm. long, 1.5-3.5 cm. broad, rounded at the base; truncate, emarginate, obtuse or acute at the apex. Flowers axillary, solitary, rarely in cymes of two to few flowers; peduncles short, 2-5 mm. long, demarcated from pedicels by two inconspicuous bracts, fulvous-tomentose, mostly thicker than pedicels; pedicels longer than peduncles, commonly 1.2-2 cm. long; floral buds mostly erect. Sepals ovate, densely fulvous-tomentose outside, glabrous inside, soft-coriaceous, persistent and brittle in the fruit, subequal; the two exterior about 10 mm. long, 8 mm. wide; the three interior mostly 7 mm. long. 7 mm. wide, thinner, less densely fulvous-tomentose and less acute at the apex. Corolla white, yellowish brown or greenish, funnel-shaped with narrow spreading limb of 5 subtruncate lobes (or lobules), 22 mm. long, 16 mm. wide; outside glabrous on plicae, hirsute with pale tawny silky hairs on interplicae. Stamens inserted; filaments slightly lower than the corolla, filiform, stiff, adnate to corolla for about 6 mm.; anthers white, oblong, about 3-3.5 mm. long. Ovary with narrow dixc, ovoid-conical; styles connate for about 2 mm. near the base, about 15 mm. long; stigmas rugose-capitate, 1 mm. wide. Capsules pendent on stiff pedicels, hardly dehiscent,

Distribution of Bonamia menziesii
var. menziesii
var. rockii

Map 4

glabrous with chartaceous wall, about 10-15 mm. long and 8-10 mm. wide, ovoid-conical, straw colored, 4- to 2- (-1) seeded, with very thin and soft septum; persistent sepals spreading and brittle. Seeds covered with black perisperm, glabrous, about 6-8 mm. long, and almost 5 mm. wide, ovoid-angular-convex, with yellowish brown or crimson testa. Cotyledons corrugate and folded, bilobed, cordate at the base, with fused cotyledonary petiole.

Type: Iles Sandwich--Maui, M.J.Remy 420, 1851-1855 (GH).

On rocky slopes and valleys on Hawaii, Lanai, Maui, Molokai and Oahu Islands (Map 4).

Hallier (1893) gave the name B. herminieri, in honor of the collector, Herminier, to a specimen presumably from Guadeloupe, West Indies. Since this range disjuction has not been supported by further collections, it seems reasonable to suppose the original label in error. The type specimen has not been examined, and, in fact, cannot now be located at the herbarium of Boissier, Geneva, where it was presumably deposited, but the name is placed in synonymy under B. menziesii on the authority of Hallier (1897) who, on further study, considered B. herminieri to be no more than a somewhat aberrant form of B. menziesii.

O. Degener (1932) erected a new genus for this species because of its hardly dehiscent capsules, perispermous seeds and supposed lack of septa. Since the fruits (capsules) remain closed for a long period after ripeness, he assumed them as completely indehiscent, which does not seem to be true. Further, he missed the fact that the presence of perisperm on the seeds is common throughout the genus Bonamia. Degener definitely overlooked the presence of thin septa, thus characterizing his new genus with nonseptate capsules. He also proposed a new species, which he treated under this genus. The specimens collected on the island of Hawaii differ appreciably from the specimens collected on Lanai, Maui, Molokai and Oahu, and thus are treated here as belonging to a distinct variety (Figure 2).

Specimens examined:

LANAI: Dry forests, west end, C.N. Forbes 152.L, June 1913 (A, F, MO, NY, UC, US); W. Hillebrand, 1874 (GH); Hillebrand, 1890 (BM); A.S. Hitchcock 14712, Sept. 22, 1916 (US); Paomaio, G.C. Munro, 3. 19. 1914 (BM), 4. 18. 1914 (NY, UC, US).

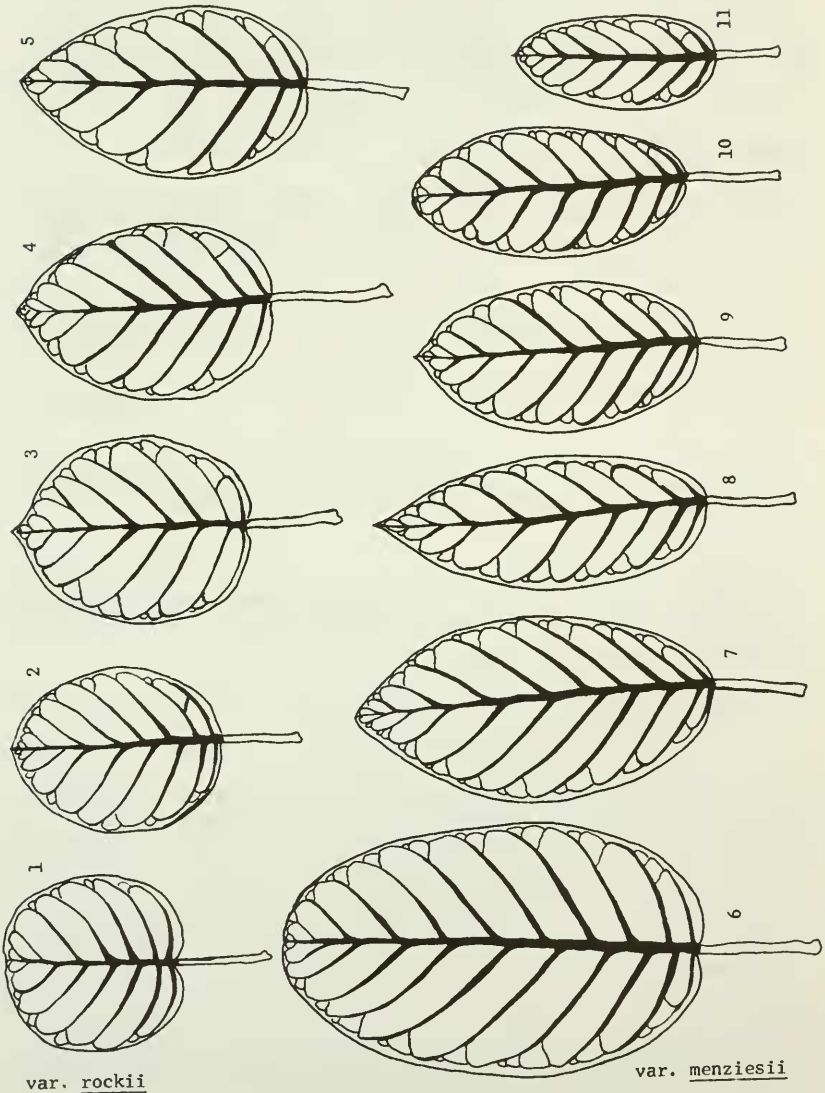
MAUI: Pakiloi, Forbes 2067 M, Mar. 23, 1920 (NY, UC, US); Komauu, Forbes 2067 MO, Mar. 23, 1920 (UC); M.T. Remy 420, 1851-1855 (GH, lectotype), 421 (L).

MOLOKAI: Kalapamoa, Forbes 430 MO, Aug. 1912 (MO, UC, US); west end, Kokio Gulch, J.F. Rock 14015, May 21, 1918 (NY, UC, US); west end, Rock, Feb. 1920.

OAHU: Small, arid, rocky gully two-thirds of a mile from the sea on the south slope of Keaau Valley, O. Degener, K.K. Park and Y. Nitta 4111, Feb. 7, 1932 (MO); middle ridge of Niu Valley, on

Figure 2

Leaf shapes and sizes in the varieties of Bonamia menziesii



partly wooded, sunny slope, 50 ft. above stream, Degener, Park and Nitta 5975, June 4, 1932 (MO); small east-central ridge near head of Wailupe Valley, over bushes and low trees at 1500 ft., Degener 21186 and W. Hatheway, Dec. 19, 1950 (BM, MO, UC); south-west side of Poamoho Gulch; south-west side of Brodie Camp, on rocky, grassy, sparingly shrubby, precipitous slope at 1500 ft. elevation, Degener 21257 and Hatheway, Jan. 25, 1951 (UC, US); Kaala Mountains, H. Mann and W.T. Brigham 618 (BM, F, G, GH, MO, NY, US); U.S. Exploring Expedition under the command of Captain Wilkes (US). Unknown location: Hillebrand 1889 (US).

Bonamia menziesii var. rockii Myint and Ward, var. nov.

Differt a varietate typica foliis orbicularibus, orbiculari-ovatis, vel ovatis, 2.5-4. cm. longis, 1-1.2plo longioribus quam latioribus, raro 1.5plo, apice emarginato, truncato, obtuso vel raro abrupte acuto.

Differs from the typical variety in possessing orbicular, orbicular-ovate or ovate leaves, 2.5-4 cm. long, with a length-width ratio of 1-1.2, rarely 1.5, emarginate, truncate, obtuse or rarely abruptly acute at the apex.

Type: Kona: Puu Waawaa, J.F. Rock, March, 1912 (GH).

All three specimens cited here were collected by J.F. Rock between Kona and Puu Waawaa at varying dates; this variety is named in his honor.

Specimens examined:
HAWAII: Kona: Lava beds between Huehue and Puu Waawaa, J.F. Rock 3541, June 4, 1909 (GH); Puu Waawaa, Rock, March, 1912 (GH); Puu Waawaa, Kamanomano, Rock (NY).

11. Bonamia grandiflora (Gray) Hall. f. Bull. Herb. Boiss. 5:810. 1897.
Breweria grandiflora A. Gray, Proc. Am. Acad. 15:49. 1880.

Perennial, trailing, herbaceous or suffrutescent pseudoliana, growing annually from lower nodes of previous shoots or from slightly enlarged roots. Stems terete, rarely ridged or subterete, glabrous to finely puberulous, 2-4 mm. thick, becoming 3-5 m. long, with frequent branching. Leaves sessile or subsessile, subcoriaceous to membranous, glabrous or finely puberulous and glabrescent; petioles almost absent or 1-3 mm. long, and curved; blades ovate, 2.2-3 cm. long, 2-2.5 cm. broad, rounded or slightly cordate at the base; obtuse, acute or rarely retuse at the apex; lateral veins mostly 4-7 pairs. Flowers axillary, solitary; two lateral abortive buds sometimes present in the axils of the bracts; peduncles 1-4 cm. long, sometimes becoming longer in age, grey pubescent or puberulous; pedicels short, slightly thicker than peduncles, densely pubescent while young; bracts small, linear or scale-like, 1-2

mm. long. Sepals broadly lanceolate or oblong-ovate-lanceolate, acute or acuminate at the apex, equal, or unequal, outer being slightly shorter, 1.5-2.6 (2.8) cm. long, 4-10 mm. wide, membranous or subcoriaceous, outside finely puberulous with grey or silvery hairs. Corolla deep blue or purplish blue, lighter towards tubular base, tubular-campanulate or funnel-form, 7-8.5 cm. long, 5-7 cm. wide, shallowly lobulate, silky pilose with long hairs on interplicae, glabrous on plicae. Stamens included; filaments epipetalous, shorter than styles, as high as half the length of the corolla, slightly unequal, glabrous above, villous below; anthers 4-5 mm. long, oblong-lanceolate, cordate at the base, introrse by longitudinal slits. Ovary conical, glabrous with four vertical ridges, with a circular disc near the base; styles inserted, terminal, mostly 5 cm. long or sometimes longer, bifid above the middle (rarely trifid, then ovary trilocular and six-ovulate); stigmas globose-peltate. Capsules conical, apiculate, 4- or 8-valved, rarely 6-valved, 4-seeded, rarely 6-seeded. Seeds oval, brownish, glabrous, rarely with scattered hairs on dorsal sides. Cotyledons oval or oboval with emarginate apices, folded against the radicle, with free cotyledonary petioles.

Type: Manatee and Sarasota, Florida, A.P. Garber, June, 1878 (GH-Lectotype! F, FLAS, MO, PH, US - Isotypes!).

Dry, deep sandy areas in scrubs or edge of scrubs, more commonly in open ground and disturbed areas, occasionally on ancient sand dunes, ranging from south to central Florida (Map 5).

Bonamia grandiflora is geographically completely isolated from related species of Mexico and Central America, and it is the only species entirely restricted to the continental United States. It has been included in B. elegans of the Orient by Roberty (1952) who treated it under his new genus Breweriopsis, which he characterized by the large corolla. However, B. grandiflora shows several distinct features from B. elegans, particularly leaf shape and size, fusion of the stylar branches and stigmas. In B. grandiflora the leaves are orbicular or ovate, 2.2-3 cm. long and 2.2-5 cm. wide, stylar branches are connate only for the lower half, and the stigmas are small and globose, whereas in B. elegans, the leaves are oblong or oblong-ovate, 3-4.5 cm. long and 8-15 mm. wide (except the lower ones which are slightly wider), the stylar branches are connate for three-fourths of the total length or higher, and the stigmas are larger and depressed-capitate.

The derivation of the specific name is quite appropriate for its large, conspicuous and beautiful flowers, purplish blue in color.

Specimens examined:
FLORIDA: Highland County: Open, dry, sandy slope among the "inland sand dunes" near Sebring, D.S. Correll and J.B. McFarlin 6227, August 3, 1936 (DUKE); Scrub, south end of Lake Jackson,

Distribution of
• B. grandiflora
B. elliptica
B. sulphurea
B. ovalifolia
B. multicaulis
B. brevipedicellata

Map 5

Sebring, Ray Garrett, April 21, 1948 (GA); sand dunes, Sebring, F.W. Hunnewell 1049, May 15, 1927 (GH); sand hills, Sebring, J.B. McFarlin 9414, September 6, 1934 (FLAS), 5701, 6. 9. 1931 (MICH); sandy scrub, Lake Placid, F.H. Sargent 7180, May 23, 1955 (SMU); scrub, Sebring, J.K. Small and E. West, September 5, 1934 (FLAS). Lake County: In scrub near Mt. Dora, J.J. Fennel 463, July 18, 1937 (UC); in vicinity of Eustis, A.S. Hitchcock, June-July, 1894 (F, FLAS, MO); in vicinity of Eustis, G.V. Nash 1326, July 16-31, 1894 (F, G, GH, MICH, MO, PH, UC, US); near Lake Dora, Tavares, P.H. Rolfs 511, June 29, 1893 (F, FLAS, MO). Manatee County: Sand ridge, Manatee River, Bradenton, A. Cuthbert 1358, June 23, 1916 (FLAS); A.P. Garber, June, 1878 (F, FLAS, GH, MO, PH, US); J.H. Simpson, 1889 (US); Palma Sola, S.M. Tracy 6431, September 10, 1889 (NCU). Marion County: Sandy roadsides, Nat. Forest, A.V. Cleet, August 2, 1937 (NSU); near observation tower on highway, Ocala National Forest, Bailey and Hume, August 19, 1935 (FLAS); in a scrub, Ocala National Forest, Hugh O'Neill, September 12, 1929 (FLAS, US); frequent; 1 mi. east and 4.8 mi. south of Central Tower, Ocala National Forest, D.B. Ward and T. Myint 2126, July 28, 1960, (FLAS, FSU). Orange County: In sand scrub, Orlando, Hugh O'Neill 88, August, 1924 (US); sandy scrub near Windemere, P.O. Scallert 20849, October 4, 1947 (SMU); sand hill among scrub oak, Orlando, E. West, May 24, 1929 (FLAS); Clarocona, C.S. Williamson, July, 1895 (PH). Osceola County: Sandy soil, near swamp, Tampa highway, Mary L. Singletary 370, May 24, 1938 (DUKE, NSC). Polk County: Vicinity of Crooked Lake, J.B. McFarlin 3365, October 28, 1930 (FLAS, MICH). Sarasota County: Sarasota, A.P. Garber 46, June, 1878 (F, FLAS, PH, US). Volusia County: Dry scrub near Seville, A.H. Curtiss 6687, July 16, 1900 (G, GA, GH, L, MO, UC, US). County unknown: F. Rugel, 1842-1849 (MO, US).

12. Bonamia elliptica (Smith & Schubert) Myint & Ward, comb. nov.
Breweria elliptica Smith & Schubert, Contr. Gray Herb. n. s. No. CXXVII: 31, tab. II, fig. 31 & 32. 1939.

Perennial, shrubby, twining vines. Stems woody, terete, white, densely pilose, mostly 2-4 mm. thick. Leaves petiolate, soft, leathery or subcoriaceous, long-strigose above, densely strigose beneath; petioles 7-10 mm. long, densely strigose; blades elliptic, 3-5.5 cm. long, mostly 2.5-4 cm. wide, rounded and slightly oblique at the base, obtuse-mucronate at the apex; veins distinct, with about 6-8 pairs of lateral veins. Inflorescences axillary, cymose, of 5-12 (-15) flowers, pedunculate; peduncles 2.5-5.5 cm. long, 1-1.5 mm. thick, densely strigose; secondary peduncles as long as pedicels; pedicels 7-10 mm. long, densely strigose as peduncles, mostly 1 mm. thick; bracts linear or lanceolate, pilose, 3-10 mm. long, acuminate. Sepals ovate-acuminate, equal or slightly unequal, densely strigose or becoming less so, with ciliate, thin margins, 12-15 mm. long, 4-7 mm. wide. Corolla blue or pale blue, infundibuliform, mostly 4-5 cm. long, slightly lobulate or subentire, long-strigose on interplicae, glabrous on plicae. Stamens

inserted; filaments glabrous or only with scattered short hairs, unequal (two short, two long and one medium, which are as high as styles); anthers oblong, 3-4 mm. long, cordate at the base. Ovary conical, glabrous; styles bifid three-fourths the length, glabrous, as long as the medium stamen; stigma capitate. Fruit unknown.

Type: Chorrera, Temascaltepec Dist. Mexico, G.B. Hinton 2176, 10. 14. 1932 (GH-holotype).

Known only from Temascaltepec Dist., Chihuahua, Mexico (Map 5).

Further collections of this species are to be desired, since it is known only from two collections from the same district, and fruit and seed are not yet known. The second collection has been associated with the vernacular name "manto."

This species is related to B. sulphurea of southern Mexico and Central America, from which it is different by its long pedunculate, much branched cymes of large numerous flowers, borne in the axils of the leaves of the primary branches.

Specimens examined:
MEXICO: Chihuahua: Chorrera, 1230 m., Temascaltepec Dist., vine, flower blue, G.B. Hinton 2176, 10. 14. 1932 (F, GH, MO, US); Volcan, Temascaltepec Dist., flower blue, Hinton et al. 8487, 9. 24. 1935 (MO, US).

13. Bonamia sulphurea (Brandg.) Myint & Ward, comb. nov.
Breweria sulphurea Brandegee, Univ. Calif. Publ. Bot. 4:384. 1913.

Perennial, shrubby climber. Stems terete, mostly twining, pubescent and becoming glabrous in age, about 2-5 mm. in diameter. Leaves petiolate, coriaceous or subcoriaceous, greenish pubescent and glabrescent above, densely brown tomentose below; petioles 3-20 mm. long, 1-1.5 mm. thick, sulcate above, finely pubescent or becoming glabrous; blades broadly ovate or elliptic, 3.5-7.5 cm. long, 2-4.5 cm. broad, entire at the margin, rounded or slightly cordate at the base, and acuminate, obtuse-mucronate or rarely acute-mucronate at the apex; veins inconspicuous above, prominent beneath; about 4-7 pairs of lateral veins. Inflorescences loose cymes of few flowers, rarely solitary in the axils of small leaves, frequently pseudopanicles composed of numerous cymes on short leafy twigs; peduncles variable in length, sometimes hardly present; pedicels distinctly elongate, 1-2 (2.5) cm. long, 1-1.5 mm. wide, pubescent; bracts small, lanceolate, mostly inconspicuous. Sepals ovate-lanceolate, acute or obtuse at the apex, equal or subequal, densely brown-tomentose outside, inner two less densely so, 8-13 mm. long, 3-7 mm. wide, coriaceous or membranous. Corolla white, mostly 1.5-2 cm. long, tubular-campanulate with narrow limb, lobulate at the margin; outside surface pilose on the interplicae,

glabrous on the plicae. Stamens included; filaments adnate to the corolla tube, glabrous above, pilose near the base, shorter than styles; anthers oblong, about 2 mm. long, 1 mm. broad. Ovary hirsute; styles bifid above the middle; stylar branches unequal; stigmas globose-capitate. Fruit subconical capsule, valvular, shorter than persistent sepals, brown hirsute at the apex. Seeds ovate, glabrous, black. Cotyledons ovate-orbicular.

Type: Mexico: Vera Cruz, Banos de Carizal, C.A. Purpus 5995 (UC, 155241).

Southern Mexico, Gautemala and Honduras at the altitude of 200-1000 m. (Map 5).

Most collectors reported damp bushy slopes, damp thickets, and rocky slopes as the habitat of this species. More collections will be needed to determine its general distributions, type of habitat and flowering periods. Specimens, mostly in flower, have been collected in August, September and October.

This species is undoubtedly related to B. elliptica of northern Mexico. From the latter it is different in possessing flowers with longer pedicels and smaller corolla and less branched cymose inflorescences which are borne in the axils of leaves of the secondary leafy branches, rather than in the axils of leaves of the primary branches.

Both this genus and this species are reported here from Guatemala and Honduras for the first time. Previously this species has been known only from southern Mexico. In this general area B. brevipedicellata is also reported from British Honduras for the first time.

Specimens examined:

GUATEMALA: Chiquimula: Divide on the railway above El Ricon, alt. 870 m., damp bushy slope, woody vine, Paul C. Standley 74730, October 17, 1940 (F); damp bushy slope, vine over trees, corolla white, Standley 74755, October 17, 1940 (F). Zacapa: Vicinity of Zacapa, alt. ca. 200 m., damp thicket, large woody vine, buds only, Standley 74201, October 7-16, 1940 (F, US); rocky slopes between San Pablo and Pepezca, alt. 200-250 m., climbing in thickets, corolla white, leaves olive-dull green, yellow-green beneath, Julian A. Steyermark 29337, October 8, 1939 (A, F).

HONDURAS: Morazan: La Granja, along Rio Choluteca near Tequcigalpa, alt. 936 m., fls. white, vine, Antonio Molina R. 10493, September 8, 1946 (BM, MO, US).

MEXICO: Vera Cruz: Banos del Carizal, C.A. Purpus 5998, August, 1912 (UC-holotype! BM, F, MO, NY, US-isotype).

14. Bonamia ovalifolia (Torr.) Hall. f. Bot. Jahrb. 16:528. 1893.
Evolvulus ovalifolius Torr. Bot. Mex. Bound. 150. 1859.
Breweria ovalifolia (Torr.) A. Gray, Syn. Fl. N. Am. 2(1): 217. 1878.

Perennial, procumbent or suberect, occasionally prostrate, shrubby vines, growing from lower nodes of old shoot or root. Root thick, mostly 5-12 mm. near the base, with pulpy bark. Old stems 3-10 mm. or thicker, woody; new branches 3-6 dm. tall, wiry or slightly woody, light green, densely sericeous or velutinous. Leaves sessile or subsessile, rarely with short petioles of 1-3 mm. long, soft and leathery or subcoriaceous, densely velutinous on both upper and lower surfaces; blades ovate, oblong-ovate or rounded, 1.4-2.6 (3.0) cm. long, mostly 1-2 cm. wide, occasionally smaller, rounded or obtuse or slightly cordate at the base, obtuse or abruptly acute at the apex; lateral veins 2-5 pairs, most commonly 3 or 4 pairs. Flowers axillary, solitary, shortly pedicellate or almost sessile, bracteate; peduncles almost absent; pedicels 2-8 mm. long, densely villous; bracts two, opposite, close to leaf axils, linear or linear-lanceolate, 3-6 mm. long. Sepals ovate or ovate-lanceolate, acute or acuminate at the apex, 9-14 mm. long, 7-12 mm. wide, slightly unequal, or subequal, partially united at the extreme base, densely villous outside, soft-coriaceous or subcoriaceous. Corolla blue or bluish purple, paler on interplicae and lower part, 3.5-5 cm. long, 2.8-4 cm. wide, funnel-form or tubular campanulate, 5-10 lobulate or subentire, hirsute with scattered long hairs on interplicae, glabrous on plicae. Stamens included; filaments with long, frequently interwoven, white hairs, unequal; anthers 3-4 mm. long, cordate at the base. Ovary conical, with long hairs near the apex; styles bifid about one-fourth the length, slightly to distinctly longer than filaments, with scattered and long hairs to nearly glabrous, with unequal stylar branches; stigmas minute. Capsules globose, apiculate, villous near the apex, usually 2- to 4-seeded, rarely 1-seeded by abortion; seeds globose, compressed on the inner side, glabrous, brown. Cotyledons bilobed (being emarginate at the apex and cordate at the base), flat while young, folded when mature.

Type: Mexico: On the Rio Grande below San Carlos, C.C. Parry, October (GH).

Limited to the valley of the Rio Grande River, on deep, sandy, arid plains in Mexico and Texas (Map 5).

The distribution of this species has been extended to New Mexico by House (1907), but no specimen has been seen to authenticate such extension. Further collections of this species are needed, as it is known only from two locations and representative specimens are very rare, even in the larger herbaria.

This species is more closely related to B. multicaulis than to any other known species of the genus. It can, however, be distinguished from the latter by its oval leaves, wiry or thin procumbent stems, filaments with long hairs and longer stylar fusion.

Specimens examined:
MEXICO: Coahuila: Rio Grande, below San Carlos, C.C. Parry, October, Mexican Boundary Survey under the direction of Major W.H. Emory (GH).
UNITED STATES: Texas: Brewster County: Big Bend National Park, arid desert plains and hills, Boquillas Canyon, locally common along edge of slope of deep sand, G.L. Webster 4482, July 22, 1952 (SMU, W).

15. Bonamia multicaulis (Brandg.) House, N.Y. State Mus. Bull. 233-234: 61. 1922.
Breweria multicaulis Brandegee, Univ. Calif. Pub. Bot. 4:185. 1911.

Perennial, woody subshrubs. Roots woody, thick, with pulpy bark. Stems woody, terete, densely sericeous with silvery hairs, numerous annual culms from thick stumps of previous-year shoots, 5-6 mm. near the base, occasionally thicker, 2-6 dm. high. Leaves sessile, rarely with short petioles of 1-2 mm., soft and leathery or subcoriaceous, densely sericeous on both surfaces; blades lanceolate, 1.5-3.5 cm. long, 4-10 mm. wide, mostly cuneate or rarely acute or obtuse at the base, acuminate or acute at the apex; veins inconspicuous except the midrib, rarely lower pair of lateral veins barely visible. Flowers axillary, solitary, shortly pedunculate or shortly pedicellate or almost sessile; bracts two, linear or linear-lanceolate, 4-6 mm. long, 1-1.5 mm. wide, densely sericeous. Sepals ovate or ovate-lanceolate, acuminate at the apex, 10-13 mm. long, 6-8 mm. wide, equal or slightly unequal, densely sericeous or villous, soft-coriaceous or subcoriaceous. Corolla blue, paler on interplicae and lower part, 3-4 cm. long, with limb of about 2.5-3.5 cm. in diameter, tubular-campanulate, entire or subentire, hirsute on interplicae, glabrous on plicae; tube short, about 1 cm. long. Stamens included; filaments glabrous with short, scattered hairs above, pilose on the basal parts adnate to corolla tube; anthers oblong or oblong-ovate, 3-5 mm. long, slightly cordate at the base, rounded at the apex. Ovary long-hirsute or sericeous, conical; styles bifid toward the middle or higher, glabrous above, with scattered hairs near the base, longer than filaments, slightly shorter than corolla; stigmas minute. Fruits valvular capsules, 2- to 4-seeded, or one-seeded due to aborted condition, conical, sericeous, becoming less sericeous in age; seeds glabrous, black or dark brown. Cotyledons oboval or bilobed with emarginate apices; cotyledonary petioles free.

Type: On sand dunes near Sierra del Rey, Coahuila, Mexico, C.A. Purpus 4457, June, 1910 (UC).

From the material examined, it appears that this species is localized in Coahuila in northern Mexico (Map 5).

Brandegee, in describing this species, correctly stated that it is nearest to B. ovalifolia. The two species are similar in

their habit, indumentum, sepals and corolla. However, B. multicaulis can readily be distinguished from B. ovalifolia by its narrow, lanceolate leaves, thicker and erect stems, and nearly glabrous filaments.

Specimens examined:
MEXICO: Coahuila: On sand dunes, near Sierra del Rey, C.A. Purpus 4457, June, 1910 (UC-holotype; BM, F, GH, MO, US-isotypes); 21 mi. west of El Oro, road to Guimbalete, flowers blue, S.S. White 2013, July 24, 1939 (GH, MEXU, MICH).

16. Bonamia sericea (Griseb.) Hall. f. Bot. Jahrb. 16:528. 1893.
Breweria sericea Griseb. Pl. Lorentz. 181. 1874.
Convolvulus Breweraceus O. Ktze. Rev. Gen. 3(2):212. 1898.

Perennial shrubby or herbaceous-suffrutescent, erect or procumbent plants. Roots woody, thick near the base. Stems woody at the base, 5-15 mm. thick; new stems herbaceous above, somewhat woody at the base, 15-40 cm. high, 1-3 mm. thick, densely to finely sericeous with soft-appressed short hairs; internodes 5-40 mm. long. Leaves shortly petiolate, coriaceous, subcoriaceous or membranous, sericeous on both upper and lower surfaces; petioles 1-7 mm. long; blades elliptic, elliptic-lanceolate or elliptic-ovate, 8-35 mm. long, 3-20 mm. wide, obtuse, acute or attenuate at the base, obtuse or abruptly acute and mucronate at the apex; midrib prominent with 4-6 pairs of lateral veins. Flowers shortly pedunculate, solitary or in cymes of 2-3, axillary or frequently terminal; peduncles short, 3-10 mm. long, sericeous; pedicels 2-5 mm. long, sericeous; bracts linear or linear-lanceolate, minute, 2-3 mm. long. Sepals ovate or ovate-acuminate, acute or acuminate at the apex, concave, 7-10 mm. long, 3-4.5 mm. wide, pubescent. Corolla white, infundibuliform-campanulate, 15-30 mm. long, ferrugineous-pubescent on interplicae. Stamens included; filaments glandular villous near the base; anthers oblong-sagittate, 3.5-4.5 mm. long. Ovary conical, densely pilose-hirsute near the apex; styles 12-14 mm. long, bifid above the middle; stigmas subglobose-capitate, papilose. Capsules subglobose or conical, 5-6 mm. in diameter, pilose-hirsute at the apex; seeds black, 3-5 mm. long, glabrous. Cotyledons oval, cordate at the base; cotyledonary petioles fused.

Type: Argentina: Cordoba; not available.

Known only from northern Argentina, where it seems to be fairly abundant at an altitude of about 400-500 m. at a few localities (Map 6). Although it has been collected more than other species from southern South America, its habitat is poorly known. One collector (Venturi 2074) noted its habitat as a railroad embankment. It has been collected in flower in October, November and December and in fruit in December.

This species is rather variable in leaf shape and size, and in indumentum of stems and leaves. Mainly on account of these features, O'Donnell separated it into two varieties.


Distribution of
B. sericea
var. sericea
var. latifolia
B. boliviana
B. holtii

Map 6

Key to Varieties

1. Plants densely sericeous; leaves 3-10 mm. wide, 8-20 mm. long, narrowly elliptic to lanceolate. . . . . var. sericea

1. Plants less densely or sparsely sericeous or puberulous, with softer and shorter hairs; leaves 4-20 mm. wide, 15-35 mm. long, elliptic to elliptic-ovate. . . . . .var. latifolia

B. sericea (Griseb.) Hall. f. var. sericea.

Stems 15-30 cm. long, densely pubescent; old stems woody, 5-15 mm. thick; internodes 5-15 mm. long. Leaves shortly petiolate, densely sericeous on both upper and lower surfaces; petioles 1-4 mm. long; blades narrowly elliptic to lanceolate, 8-20 mm. long, 3-10 mm. wide, acute or obtuse and mucronate at the apex. Pedicels 5-14 long; bracts 2-3 mm. long. Sepals 8-10 mm. long, 3-4.5 mm. wide. Corolla 15-30 mm. long.

Specimens examined:
ARGENTINA: Cordoba: Althos del S. Y. O. B.W. Bodenbender 8823 (NY, R); E. Fielding (BM); Ischilin, Quilino al km. 855, T. Meyer 13543, 16. XII. 1947 (W); Ischilin, La Florida, Meyer 13730, 16. XII. 1947 (W); Barrio S. Martin, C.A. O'Donnel y. J.M. Rodriguez 329, 17. III. 1944 (F, UC). Chaco (RA): en los campos, flor. blanco, alt. 250, S. Venturi 9794, November 19, 1929 (BM).

B. sericea (Griseb.) Hall. f. var. latifolia O'Donell, Lilloa 29:31. 1959.

Stems 20-40 cm. long, sparsely sericeous; old stems woody, 5-30 mm. thick; internodes 1-4 cm. long. Leaves shortly petiolate, sparsely sericeous; petioles 2-7 mm. long; blades elliptic to elliptic-ovate, 15-35 mm. long, 4-20 mm. wide, obtuse or occasionally acute and mucronate at the apex. Pedicels 5-8 mm. long; bracts 2-4 mm. long. Sepals 7-10 mm. long, 3-4.5 mm. wide. Corolla 30 mm. long.

Type: Argentina: type specimen not available.

Specimens examined:
ARGENTINA: Sgo del Estero, Ojo de Agua (alrededores), B. Baleguo 1379, 17. XII. 1947 (W); Tucuman, Cruz Alta, saliendo de Las Cejas por el ramal que va a Antilla, C.A. O'Donell 5413, 14. XI. 1947 (W); Las Cejas, Tucuman, 450 m., Schreiter 3956 ("1799"), 18. XL. 1923 (GH, NY, US); Santiago del Estero, El Palomara Pampa Pozo, 400 m., fl. blanca, Schreiter 6706 ("4046"), 15. XI. 1931 (NY); Las Cejas, Cruz Alta, 400 m., blanca, 0.40 m., en campos abiertos, S. Venturi 1525, December 3, 1921 (US); Las Cejas, Cruz Alta, 400 m., flor blanca (Terraplen del F.C. a Antillas), Venturi 2074, October 21, 1923 (A, GH, NY, US).

17. Bonamia boliviana O'Donell, Lilloa 23:458, tab. 1. 1950.

Perennial woody climbers. Stems twining, terete, 1-2.5 mm. in diameter, tomentose, with internodes of 1-4 cm. long. Leaves petiolate, subcoriaceous or soft-coriaceous, tomentose and glabrescent above, more densely tomentose underneath; petioles 2-9 mm. long, tomentose; blades elliptic to ovate, 1-4 cm. long, mostly 7-23 mm. wide, rounded, subcordate or truncate at the base, obtuse-mucronate or acute-mucronate at the apex; midrib impressed above, prominent beneath, with 5-7 pairs of lateral veins. Flowers solitary, in axils of normal or reduced leaves or in axillary racemose inflorescences of few flowers on short branches; peduncles short, 1-4 mm. or rarely longer, tomentose; pedicels 3-9 mm. long, tomentose; bracts linear, alternate or occasionally opposite, 2-4 mm. long, tomentose. Sepals slightly unequal or equal, coriaceous or subcoriaceous; outer ovate to subovate, 5-6 mm. long, 4.5-5 mm. wide, concave, obtuse, tomentose; inner suborbicular, 4.5-5.5 mm. long. 4.5-5 mm. wide, obtuse, tomentose above, glabrous along lateral hyaline margins. Corolla pale yellow, campanulate, 17-18 mm. long, with entire or subentire limb, ferrugineous with long hairs on interplicae. Stamens included, 12-13 mm. long; filaments pilose with long hairs near the base; anthers oblong, 2.5-3 mm. long. Ovary fusiform and attenuate to the stylar base, glabrous; styles free nearly to the base, glabrous, unequal; stigmas reniform. Fruits and seeds unknown.

Type: Bolivia: Cordillera, La Cuesta, 386 m., flor amarillenta, I. Peredo, 8. II. 1946 (F, NY, US, W-isotypes).

Known only by the type collection from Bolivia (Map 6).

This species is poorly known. Since furit and seed are not known, its placement in the section Bonamia is tentative until future collections are available.

In superficial appearance, this species resembles some Brazilian species, particularly B. subsessilis and B. burchellii. However, it is well distinguished from these by its smaller leaves with indistinct intercostal veins, shorter stem and solitary or few-flowered cymes. It is also distinct from B. subsessilis by its pedicelled flowers. Future collections might show that this species should properly be placed in the section Trichantha together with these Brazilian species.

18. Bonamia holtii O'Donell, Lilloa 30:59. 1960.

Perennial twining vines. Stems becoming woody, terete or slightly angular and striated, 1-2.5 mm. thick, sparsely and minutely pubescent; internodes mostly 4-8 cm. long. Leaves shortly petiolate, subcoriaceous or leathery, sparsely pilose or becoming glabrous; petioles 8-17 mm. long, sparsely pilose; blades elliptic or elliptic-ovate, 5-9 cm. long, 3-5 cm. wide, rounded and slightly asymmetrical at the base, acute-mucronate or acuminate at the

apex; midrib prominent beneath, with 4-6 pairs of lateral veins. Inflorescences shortly pedunculate, axillary, dense-capitate cymes of few to several flowers; peduncles short, 2-9 mm. long, 1-1.5 mm. thick, minutely pubescent or sericeous; bracts foliaceous, elliptic or elliptic-lanceolate, 6-12 mm. long, 1.5-5 mm. broad; bracteoles lanceolate, 3-5 mm. long, sericeous. Sepals coriaceous or subcoriaceous, slightly unequal; outer sepals lanceolate or ovate-lanceolate, 8-10 mm. long, 3-5 mm. wide, acute or acuminate at the apex, appressed-tomentose or finely pubescent outside; inner sepals elliptic, ovate or ovate-elliptic, 6-7 mm. long, 4-5 mm. wide, obtuse or obtuse-acute at the apex, nearly glabrous or somewhat pubescent on the median lines. Corolla white, infundibuliform, 1.2-1.9 cm. long, with 5-lobulate or subentire limb, long-pilose on interplicae. Stamens inserted; filaments 7-14 mm. long, glabrous; anthers oblong, 3 mm. long, dorsifixed, sagittate at the base. Ovary ovoid, long-pilose at the apex, glabrous below; styles fused for lower one-fourth and free above, filiform, glabrous; stigmas capitate. Capsules subglobose, 4 mm. in diameter, long-pilose at the apex, 4-valvular, 4-seeded; seeds black, 3 mm. long, glabrous, rugose. Cotyledons cordate, slightly asymmetrical, rounded at the apex; cotyledonary petioles fused.

Type: Colombia: Rio Orinoco, Boca del Vichada, alt. about 100 m., E.G. Holt and W. Gehriger 223, January 12-24, 1930 (US-holotype; isotype at Caracas, Venezuela, not seen). The labels of the type carried the data, "Venezuela, Amazonas Territory: Rio Orinoco; Boca del Vichada;" thus specifying a location in Colombia at the mouth of the Rio Vichada. The species is endemic to this region and known only by the type collection (Map 6).

This species is different from all other South American species by its capitate inflorescence, acute or acuminate sepals, foliaceous bracts and bracteoles, and slightly twining and somewhat striated stem. It is, however, distantly related to B. umbellata because of the similarity in their inflorescence and indumentum. Bonamia holtii is poorly known and is described from two sheets of the same collection. The specific name is derived from the name of its collector and was first used as an unpublished name under the genus Prevostea by Dr. H. Pittier, a field botanist of Venezuela.

19. Bonamia maripoides Hall. f. Bot. Jahrb. 16:529. 1893.
Maripa spectabilis Choisy, in D. C. Prodr. 9:327. 1845.
Prevostea spectabilis Meissner, in Mart. Fl. Bras. 7:325. 1869.
Calycobolus spectabilis (Choisy) House, Bull. Torr. Bot. Club. 34: 146. 1907.

Perennial, twining liana growing all year around. Stems woody, terete, yellowish or brownish tomentose, glabrescent, climbing to 20 m. or higher. Leaves petiolate, subcoriaceous, glabrous and shing above, golden or yellowish sericeous (with unidirectional hairs) beneath; petioles 8-15 mm. long, sericeous and glabrescent;

Map 7

blades broad-ovate or elliptic, 6-14 mm. long, mostly 3-7.5 cm. broad, shortly acuminate or obtuse at the apex, rounded at the base, with 6-10 pairs of lateral veins. Inflorescences axillary, shortly peduncled, compound, umbelliform cymes, often secund; pedicels distinctly elongate, usually 1-2 cm. long, densely sericeous and glabrescent, ridged; bracts small, lanceolate, often inconspicuous. Sepals coriaceous, mostly equal or slightly unequal in length, the two exterior orbicular or broad-elliptic, acutish and tomentose, the three interior orbicular, obtuse and nearly glabrous. Corolla white, funnel-shaped, mostly 2-2.5 cm. long, yellow-villous on interplicae, glabrous on plicae, entire or subentire. Stamens included; filaments, short, adnate to corolla tube, glabrous; anthers oblong, about 2 mm. long. Ovary hairy; styles bifid or free nearly to the base, longer than filaments; stigmas globose. Capsule ovate, acute, hairy at the apex, 8-valved, 4- (2-) seeded, about 6 mm. long and 5 mm. in diameter. Seeds ovate, compressed on the inner side, 3-4 mm. long, black, glabrous. Cotyledons ovate or obovate.

Type: Brazil: type specimen not available.

Northern Brazil, British Guiana and Surinam (Map 7).

According to the collectors, this species is a high-climbing woody vine to 20 m. on lofty shrubs or in virgin forest. No definite habitat has been recorded by any collector. It has been collected in flower in March, April, August and October, and in fruit in February, March, May, June and July.

Specimens examined:

BRAZIL: Amazonas: Borba, Rio Madeira, R.L. Froes 26109, 28. 11. 1950 (US). Para: Belem do Para, A. Ducke 3304, 5. 3. 1903 (RB, US); Belem do Para, M. Guedes 1602, 28. 5. 1898 (US). Perambuco: Estrada de aldeia, flores alvas, trepadeira, C. Leal e Otavis Silva, 19. 7. 1950 (RB); flowers very numerous, white, abundant at one spot in the matto of Berberibe, climbing over the tops of lofty shrubs, Ridley, Lea and Ramage, October 4, 1887 (BM).

BRITISH GUIANA: Bullet Tree Island: Ebini Experiment Station, Berbice River, margin of jungle, S.G. Harrison 1243, 28. VI. 1958 (K).

SURINAM: M. Berthond-Coulon 219, 1841 (BM); Forest Reserve Zanderiz 1, sand virgin forest, bud brown, liana, J. Lanjouw 362, July 31, 1933 (NY); Saramacca River, liana climbing to 20 m., leaves dark green above, tawny sericeous beneath, bush to rear of Jacob Kondre, Bassett Maguire 23761, June 19, 1944 (BM, F, NY, US); Coppername River near Onobissi, "B.W." 1103, 4. 3. 1915 (L); Coppername River, Raleighfalls, "B.W." 6232, 2. 8. 1923 (NY, US). Location indefinite: Berlyn, Scandens in sylvis Paraensis prope plant, flores albi, F.L. Splitgerber 743 (L); Splitgerber 362 (L).

20. Bonamia brevipedicellata Myint and Ward, sp. nov.

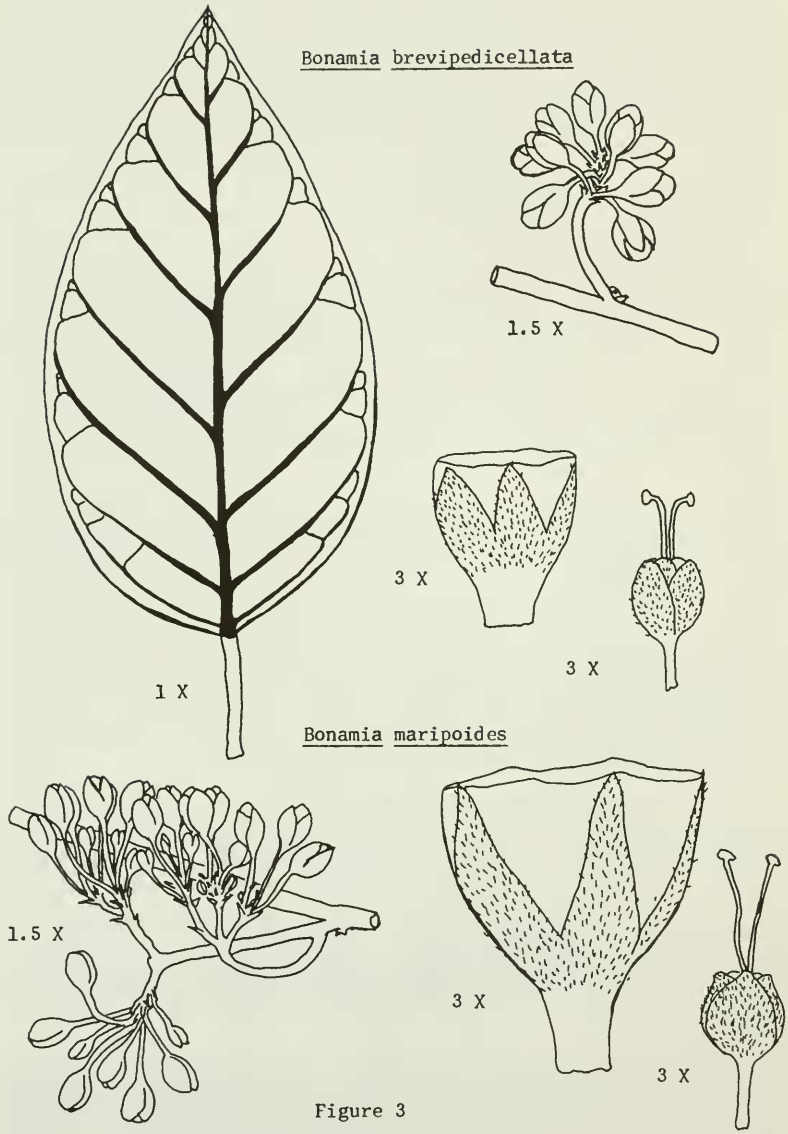


Figure 3

Leaf shape, inflorescence and floral parts of B. brevipedicellata, and inflorescence and floral parts of B. maripoides

Frutex alte scandens, usque 16 m. Folia petiolis 2-3 cm. longis; laminae ellipticae vel ovato-ellipticae, 8-12 cm. longae, 4-7 cm. latae, basi rotundata vel obtusa, apice breviter acuminato, supra glabrae, infra dense tenui-pubescentes. Inflorescentiae cymae breviter pedunculatae, dense multiflorae. Pedunculi breves, plerumque 1-3 cm. longi. Sepalo ovato-orbicularia, subaequalia, 4-5 mm. longa, dense tenui-pubescentia. Corolla campanulata, 1-1.2 cm. longa, limbo angusto, viridi-alba, prompta decidua. Stamina inclusa; fila glabra; antherae basi cordata. Styli libri ad basim, minores quam 1 cm. longi; stigmata peltato-subglobosa. Fructus et semina ignota.

Perennial, woody vines. Stems terete, about 1-2.5 cm. in diameter and 16 m. tall, puberulous or glabrescent. Leaves petiolate, membranous to subcoriaceous, glabrous above, densely fine-pubescent with unidirectional hairs underneath; petioles 2-3 cm. long, 1.5-2.5 mm. thick, finely pubescent or puberulous and glabrescent, canaliculate above; blades elliptic to ovate-elliptic, 8-12 cm. long, 4-7 cm. wide, rounded or obtuse at the base, shortly acuminate or acute at the apex; midrib impressed above, prominent beneath, with 5-6 pairs of lateral veins. Inflorescences shortly pedunculate, dense multiflorous cymes in the axils of young or reduced leaves on short branches; peduncles 4-10 mm. long, finely pubescent; pedicels short, mostly 1-3 mm. long, pubescent; bracts minute, 1-2 mm. long, linear. Sepals ovate-orbicular, subequal, 4-5 mm. long, 3-4 mm. wide, densely fine-pubescent with grey or silvery grey hairs. Corolla greenish tinged, readily dropping off, campanulate, 1-1.2 cm. long, with narrow limb, hirsute on interplicae; tube cylindrical, wide, about 4 mm. long. Stamens included; filaments glabrous; anthers oblong, 2.5-3.5 mm. long, cordate at the base. Ovary conical, with long hairs at the apex, glabrous near the base; styles free to the base, glabrous, equal or slightly unequal, the longer less than 1 cm. long; stigmas peltate-subglobose. Fruits and seeds not known.

Type: British Honduras: Machaca, alt. 50 ft., very tall vine growing in broken forest in swampy places; flowers light green which easily drop off in the process of felling. "Rare," 50 ft., 1 in. diameter, W.A. Schipp 1210, September 11, 1933 (GH).

Although the type material is incomplete, it is clearly distinct from all other known species. The material, even though lacking fruits and seeds, is sufficient to permit a technical description. The name B. brevipedicellata is derived from the very brief pedicels.

This species is superficially very suggestive of B. maripoides, to which it is definitely related because of similarity of leaves, indumentum, sepals, cordate anthers, glabrous filaments, free styles and subglobose stigmas. However, B. brevipedicellata shows a series of distinctive features which appear to offer a sound basis for adjudging it a separate species. The leaves in B. maripoides are densely pubescent with long appressed hairs, whereas the hairs are

shorter and soft in the B. brevipedicellata. The inflorescences in B. maripoides are loose compound cymes, while the cymes in B. brevipedicellata are dense. Individual flowers are long-pedicellate in B. maripoides, while they are short-pedicellate or almost sessile in B. brevipedicellata. The corolla in this species is very small (with a narrow and short limb) compared to the large corolla in B. maripoides and, as described by the collector, is greenish and readily deciduous (Figure 3).

This species probably is a large climber, reaching to a height of 16 m., and is rare according to the collector. It has been misidentified as a species of the Solanaceous genus Lysianthes.

21. Bonamia ferruginea (Choisy) Hall. f. Bot. Jahrb. 16:530. 1893.
Prevostea ferruginea Choisy, Annal. Sci. Nat. 4:498. 1825.
Breweria ferruginea Hook. f. & Jackson, Ind. Kew. 1:337. 1893.
Calycobolus ferruginea (Choisy) House, Bull. Torr. Bot. Club. 34:146. 1907.
Not Trichantha ferruginea Karst. & Triana, Linnaea 28:438. 1856.

Perennial, densely ferrugineous, woody climbers. Stems twining or scandent, terete, densely tomentose-ferrugineous with crisped and brownish hairs, frequently branching. Leaves shortly petiolate, herbaceous, subcoriaceous and soft or leathery, densely ferrugineous on both surfaces, more densely so underneath, with brown or reddish brown hairs; blades broad-ovate or elliptic-ovate, 5-13 cm. long, 3-8 cm. wide (upper leaves subtending inflorescence and on young shoots smaller), abruptly acute or obtuse and mucronate at the apex, rounded or cordate at the base; midrib prominent, with about 6-10 pairs of lateral veins. Inflorescences sessile or pedunculate, multiflorous, capitate cymes in the axils of upper or reduced leaves, frequently on short lateral branches; peduncles, when present, ferrugineous like stems; pedicels absent or very short, frequently somewhat elongate in fruiting stage; bracts linear, 5-10 mm. long, occasionally reduced, ferrugineous. Sepals coriaceous, unequal; the two exterior larger, broad-ovate, 8-10 mm. long, 5-7 mm. wide, occasionally smaller, densely ferrugineous outside, pubescent along recurved margin inside, obtuse and reflexed at the apex; the three interior smaller, orbicular or ovate-orbicular, 4-6 mm. long, 3-5 mm. wide, glabrous or sparsely minute-pubescent, rounded or truncate at the apex. Corolla white, tubular-campanulate, 1.2-1.8 mm. long, with sublobulate limb, pilose outside on interplicae, glabrous on plicae; tube distinct, narrow. Stamens included; filaments glabrous; anthers oblong, 3-4 mm. long, cordate at the base. Ovary globose or conical-globose, apiculate, 4-valved, 2- to 4-seeded; seeds triangular-ovate, brown, glabrous. Cotyledons oval-cordate, rounded or truncate at the apex, broadly cordate at the base, in hard cartilagenous endosperm; cotyledonary petioles fused.

Type: Brazil, Amazonas: type specimen not available.

Judging from the specimens examined in this study, this species appears to be localized in the states of Amazonas, northwestern Brazil, from Manaus and Borba to Tefe (Map 7). A few collectors recorded edge of forest and dry highland as the habitat of this species. It has been collected in flower from May to September and in fruit from August to October.

This species was originally described under Prevostea (=Calycobolus) by Choisy and was accepted by Meissner. Hallier, realizing that its sepals are not accrescent, transferred it to Bonamia. House later transferred the species to Calycobolus because of the unequal sepals which he erroneously thought characterized this latter genus.

Specimens examined:
BRAZIL: Amazonas: Manaos, loco Flores, silva secundaria non inundabili, Frutex scandens, flor. albis, Ducke 210, 30. 5. 1936 (A, R); Tefe, A. Ducke 18017, 15. 6. 1906 (RB); municipality of Borba, near Urucurituba, basin of Tio Madeira, B.A. Kruoff 5952, September 4-6, 1934 (BM), 5953 (G); Ega Amazonas, in Sylvan Margin, Poeppig 2589, September, 1831 (F, GH, W); Manaos, Estrada da Raiz, vine, flower white, R.E. Schultes and G.A. Black 8085, August 7-12, 1946 (GH, MO, NY, US); Manaus, Schwacke 210, 1882 (R); ad oram meridionalem Rio Negro, usque ad coneursum flum. Solimoes, R. Spruce 1568, Maio 1851 (BM, G, W); flowers white, J.W.H. Traill 558, 12. 6. 1874 (K); Rio Negro, Windent auf Gestraiich bei Flores, Manaus, Bluto Weiss, E. Ule 5195, July 29, 1900 (G, HBG, L). Unknown collector: Fragment ex Herbario Musei Parisiensis (F).

22. Bonamia umbellata (Choisy) Hall. f. Bot. Jahrb. 16:530. 1893.
Prevostea umbellata Choisy, Ann. Sci. Nat. 4:497. 1825.
Calycobolus umbellata (Choisy) House, Bull. Torr. Bot. Club 34:146. 1907.

Perennial, ligneous or herbaceous and suffrutescent vines. Stems twining or scandent, 1.5-3 mm. thick, pilose while young, puberulous or becoming glabrous in age; internodes usually 3-8 cm. long, occasionally shorter. Leaves petiolate, soft and herbaceous, rarely leathery, appressed-pilose on upper surface, more densely so underneath, becoming less pilose or nearly glabrous in age; petioles 4-17 mm. long, 1-1.5 mm. thick, pilose or glabrate; blades oblong-ovate, mostly 3.5-8 cm. long, 2-4.5 cm. wide, cordate, subcordate or occasionally rounded at the base, obtuse-mucronate at the apex, with about 5-7 pairs of lateral veins. Inflorescences pedunculate, axillary, subumbellate cymes of few to many flowers (mostly 5-15); peduncles variable in length, mostly 2-7 cm. long, occasionally much shorter, 1.5-2 mm. thick, slightly thicker when fruits mature, pilose as in stems; pedicels 5-15 mm. long, thinner than peduncles, pilose; bracts minute or foliaceous, lanceolate, 2-17 mm. long. Sepals herbaceous or subcoriaceous, puberulous, glabrescent or with scattered hairs; exterior two larger, ovate, 6-10 mm. long, 5-9 mm. wide, obtuse or rounded at the apex; in-

terior three narrower or shorter, usually glabrous (except at the base), ciliate. Corolla white, funnel-shaped, 2.5-3 cm. long, with tube slightly longer than sepals, subentire or lobulate at the limb, long-pilose on interplicae. Stamens included; filaments glabrous, shorter than styles; anthers oblong, about 3.3 mm. long, cordate at the base. Ovary conical, about 3-4 mm. long, glabrous; styles bifid for upper one-fourth or one-fifth, glabrous; stigmas globose-capitate. Capsules globose, 5-6 mm. in diameter, 4-valvular, 2- to 4-seeded; seeds triangular-ovate, 3-4 mm. long, dark brown, glabrous. Cotyledons ovate-cordate, rounded at the apex; cotyledonary petioles fused.

Type: Brazil: type specimen not available.

Known only from southern Brazil (Map 8).

Meissner (1869), while treating this species under the genus Prevostea, proposed a new variety in addition to the typical one, mainly based on the length of petioles. This feature, however, is extremely variable and no satisfactory line can be drawn to account for infraspecific segregation in the species. As Hallier did not make a transfer of Meissner's new variety, it is evident that Hallier did not accept it.

Specimens examined:
BRAZIL: Burchell 775 (NY); Burchell 1858 (K); bushy places by Rio de Janeiro, Gardner 5560, July, 1841 (BM); Santa Theresa (Rio de Janeiro) voluvel, flores blanca, r. 26 de Dezembro de 1869, G. Glaziou 4131 (R); Rio de Janeiro, Schott 5462 (W); Rio de Janeiro, Sellow 225 (NY); Rio de Janeiro, G. Staunton (BM, W); Estado de Rio, Morro da Nova, Cintra, Trepadeira, E. Ule 3849, February 25, 1896 (HBG, R).

23. Bonamia sphaerocephala (Dammer) v. Ooststr. Rec. Trav. Bot. Neerl. 33:212. 1936.
Prevostea sphaerocephala Dammer, Bot. Jahrb. 23 (Beibl. 57): 37. 1897.

Perennial shrubby herbs growing erect from the base of old shoot. Stems woody, erect or suberect, about 50-80 cm. long, densely tomentose or lanate with grey or silvery grey soft hairs; young stems 3-4 mm. thick, single or occasionally with one or two lateral branches. Leaves sessile or subsessile, subcoriaceous, lanate or tomentose on upper surface, densely white woolly underneath; blades oblong-elliptic, ovate-elliptic or elliptic-lanceolate, 2-4.5 cm. long, 1-2 cm. wide, sometimes slightly narrower, subcordate or truncate at the base, obtuse-mucronate or acute-mucronate at the apex; revolute at the margin; veins distinctly impressed above, prominent underneath; lateral veins 3-5 (6) pairs. Inflorescence terminal, multiflorous, dense capitate, 2-3.5 cm. in diameter; flowers sessile or shortly pedicellate; bracts linear, as long as and long-pilose as the sepals. Sepals coriaceous or subcoriaceous, unequal; exterior two larger, thicker, lanceolate-acuminate, 6-8 mm. long, 1.5-2 mm. wide, densely long-pilose outside; inner three


Distribution of
B. umbellata
B. sphaerocephala
B. kuhlmannii
B. peruviana

Map 8

smaller and submembranous, lanceolate and shortly acuminate or acute, 4-5 mm. long, 1.5-2 mm. wide, long-pilose outside. Corolla white or blue, tubular-campanulate or funnel-form, slightly longer than outer sepals, mostly 9-12 mm. long, densely long-pilose on interplicae, with narrow, entire or subentire limb. Stamens included; filaments glabrous, slightly shorter than styles; anthers oblong. Ovary conical, with dense, long hairs near the apex; styles bifid for upper half, hairy at the base; stylar branches glabrous; stigmas globose-capitate. Capsules subangular globose, apiculate, finely pubescent near the apex, glabrous below, with coriaceous wall, 2- to 4-seeded, breaking by annular scission at the base; seeds oval, glabrous, dark brown. Cotyledons oval.

Type: Brazil, Haut de la Serra Dourada, a Olha d'Agua pres de Goyaz, M.A. Glaziou 21797, August 13, 1895 (BM-lectotype, R-isotype). Van Ooststroom designated a specimen at Berlin as the type; this material, however, was not included in a recent loan and is presumed to have been destroyed during the war. A duplicate specimen at the British Museum is designated here as the lectotype.

This species is known from southern Brazil (Map 8). Van Ooststroom reported it from Minas Geraes, but no specimen was seen in the present study. Further collections with detailed description of habitat and flower color are to be desired, since its habitat is not recorded by the collectors and flower color is differently recorded by the same collector (Glaziou 21797, BM, R).

The outstanding features of this species are the strongly nerved and lanate leaves with long mucros, the erect and single stem, terminal globose heads, lanceolate-acuminate sepals with long hairs and small corolla. It seems to be related to the African species, B. mossambicensis, because of the following common features: inflorescence dense, unequal sepals with long hairs, and long bracts with long hairs. However, the two can be readily distinguished by their habit, length of stem, shape, size, apices and petioles of leaves and size of sepals and corolla.

Specimens examined:
BRAZIL: Haut de la Serra Dourada, Goyaz, fl. blanc, M.A. Glaziou 21797, August 13, 1895 (BM); Serra Dourada (Goyaz), frutescente, flores azulos, Glaziou 21797, August 13, 1895 (R); Serra Dourada, Goias, subarbusto campestre, Agnes, A. Macedo 3730, 30. VII. 1952 (MO, NY).

24. Bonamia kuhlmannii Hoehne, Anex. Mem. Inst. Butantan 1 (4): 44, tab. 2. 1922.

Perennial, high-climbing, shrubby vines. Stems woody, 2-4 mm. thick, densely short-ferrugineous or subvelutinous. Leaves petiolate, submembranous or soft and leathery, softly velutinous on both surfaces, lighter in color underneath; petioles 1-2.5 cm. long,

1-2 mm. thick, shortly ferrugineous; blades ovate or ovate-cordate, 5-12 cm. long, 3-8 cm. wide, cordate or truncate, rarely rounded at the base, obtuse-mucronate at the apex; midrib slightly impressed above, prominent beneath, with 5-7 pairs of lateral veins. Inflorescences shortly pedunculate, axillary, simple or compound cymes of few to several flowers; peduncles 1-2 cm. long, 1-2 mm. thick, short-ferrugineous as peduncles, bracts small, linear or triangular-acuminate, 1-2 mm. long, ferrugineous. Sepals subcoriaceous or herbaceous, unequal; exterior two larger, ovate or ovate-subcordate, 1.2-2 cm. long, 10-17 mm. wide, occasionally smaller, adnate to pedicels at the base, obtuse at the apex, densely velutinous-ferrugineous outside, shortly ferrugineous inside (except at the glabrous center), interior three ovate-orbicular, 5-7 mm. long, glabrous or sparsely pubescent. Corolla white, narrowly campanulate or funnel-form, 2.5 cm. long, sparsely pilose on interplicae. Stamens included; filaments glabrous; anthers oblong, sagittate at the base. Ovary ovoid-conical, glabrous; styles bifid to the middle or nearly to the base; stigmas globose. Fruits unknown.

Type: Brazil: Mato-Grosso: Comissao Rondon, entre Buriti e Formigueiro, liana do cerrado, fl. alva, J.G. Kuhlmann 2268, 6-1918 (R-isotype).

This is a poorly known species, rarely collected and so far known only by the type collection from southwestern Brazil (Map 8). The type specimen was collected with flowers which mostly are only in bud. Its fruit is unknown and a complete description of the species has to wait future collections.

This species is characterized by its completely ferrugineous parts, large leaves (cordate or subcordate at the base), unequal sepals, short peduncles and nearly free styles. It, however, is distinct in its densely ferrugineous leaves, which are cordate or subcordate at the base and obtuse-mucronate at the apex, larger sepals, shorter peduncles and pedicels, and deeper bifurcation of styles.

25. Bonamia peruviana van Ooststroom, Recu. Trav. Bot. Neerl. 30: 192. 1933.

Perennial liana. Stems woody, scandent, 2-4 mm. thick, densely ferrugineous-tomentose; internodes 2-6.5 cm. long. Leaves petiolate, subcoriaceous or soft and leathery, minutely tomentose above, more densely so underneath; petioles 6-16 mm. long, mostly 1 mm. thick, tomentose similar to stems; blades ovate or ovate-elliptic, 5-7 cm. long, 2.5-4 cm. wide, rounded at the base, shortly and acutely acuminate at the apex; midrib distinctly impressed above, prominent beneath, with 6-8 pairs of lateral nerves. Inflorescences pedunculate, axillary, simple or compound cymes of few to several flowers; peduncles 1.5-4.5 cm. long, sometimes apparently dichotomous due to absence of central flowers; pedicels slender, elongate 1.5-2 cm. long, occasionally longer, minutely

tomentose, bracts linear-subulate, about 2 mm. long. Sepals subcoriaceous or herbaceous, unequal; exterior two larger, broadly ovate, 8-14 mm. long, 7-12 mm. wide, densely ferrugineous-tomentose on both surfaces except glabrous center inside, subcordate at the base, obtuse or subobtuse at the apex; interior three smaller, orbicular, 4-5 mm. long, glabrous. Corolla white, infundibuliform, 2-2.5 cm. long, sparsely pilose on interplicae. Stamens included; filaments filiform, glabrous; anthers oblong, 2.5-3 mm. long, cordate at the base. Ovary ovoid-conical, glabrous; styles bifid for the upper half, with slightly unequal branches; stigmas globose. Fruits glabrous, known only in immature stage; seeds glabrous.

Type: Peru: Loreto: Michuyaeu, near Iquitos, at 100 m., liana, fls. white, clearing (forest) G. Klug 232, October-November, 1929 (F-holotype; NY, US-isotypes; G, L-fragments).

The type collection, the only material available for this study, was collected in flower and in young fruit, and is not sufficient for a description of the fruit. Cotyledons dissected from immature seeds appear to be ovate-cordate with fused cotyledonary petioles.

This species is closely related to B. kuhlmannii of southwestern Brazil; however, it is different from the Brazilian species by its leaf size, form, apex and base, indumentum and smaller sepals. Macbride (1959), in his Convolvulaceae of Peru, added a comment that the differences between B. peruviana and B. kuhlmannii may prove to be due to age and variability in a series of collections. Since both species are known only from type collections, this statement cannot now be verified. From the materials available at present they appear to differ in several features and thus are treated here as distinct species.

II. Section: Breweria (R. Br.) Myint, Burma Jour. Life Sci. 1:31. 1968.
Breweria R. Br. Prodr. Fl. Nov. Holl. 487, 1910.

Stems herbaceous, woody or becoming woody, prostrate, procumbent, twining or erect, usually short, 1-2 m. long, rarely longer, mostly 1-2 mm. thick or slightly thicker. Leaves sessile or short-petiolate, soft, herbaceous, rarely subcoriaceous, mostly thin; blades elliptic, ovate-elliptic, oblong-elliptic, linear, lanceolate, oblong-ovate, ovate, ovate-subcordate or occasionally orbicular, 3 cm. or shorter, rarely somewhat longer, mostly 2 cm. or narrower, rarely 2.5 cm. or slightly wider, with length-width ratio of 1.5 or higher, occasionally lower, rounded, subcordate or truncate at the base; obtuse, rounded or slightly emarginate and mucronate at the apex. Flowers axillary, sessile or shortly pedunculate, solitary or rarely in simple cymes of two or three; bracts linear, small or as long as pedicels or longer, persistent. Sepals herbaceous, subcoriaceous or rarely somewhat coriaceous, equal or unequal, lanceolate, ovate-lanceolate, ovate or ovate-acuminate, acute,

acuminate or rarely obtuse at the apex, mostly 4-8 mm. long, outer sepals 12 mm. long (when unequal). Corolla white, blue, pink or red, 8-15 mm. long, occasionally longer, subentire or 5- to 10-lobulate at the margin. Stamens included; filaments glabrous or sparsely villous or rarely densely villous below and glabrous above; anthers 1-2 mm. long, rarely longer, slightly cordate at the base. Ovary ovoid or oblong-ovoid, sparsely or densely pilose or glabrous; styles free nearly to the base or fused to the middle and readily separable to the base; vascular traces single in the stylar branches, not branched; stigmas globose, subglobose or capitate, usually large. Fruits 4- to 8-valvular, 2- to 4-seeded, thin-walled; septum thin; seeds glabrous, smooth or punctate. Cotyledons ovate, obovate, ovate-cordate or orbicular, flat, folded or somewhat corrugate.

Type: Bonamia linearis (R. Br.) Hall. f. (as Breweria linearis R. Br., 1810.)

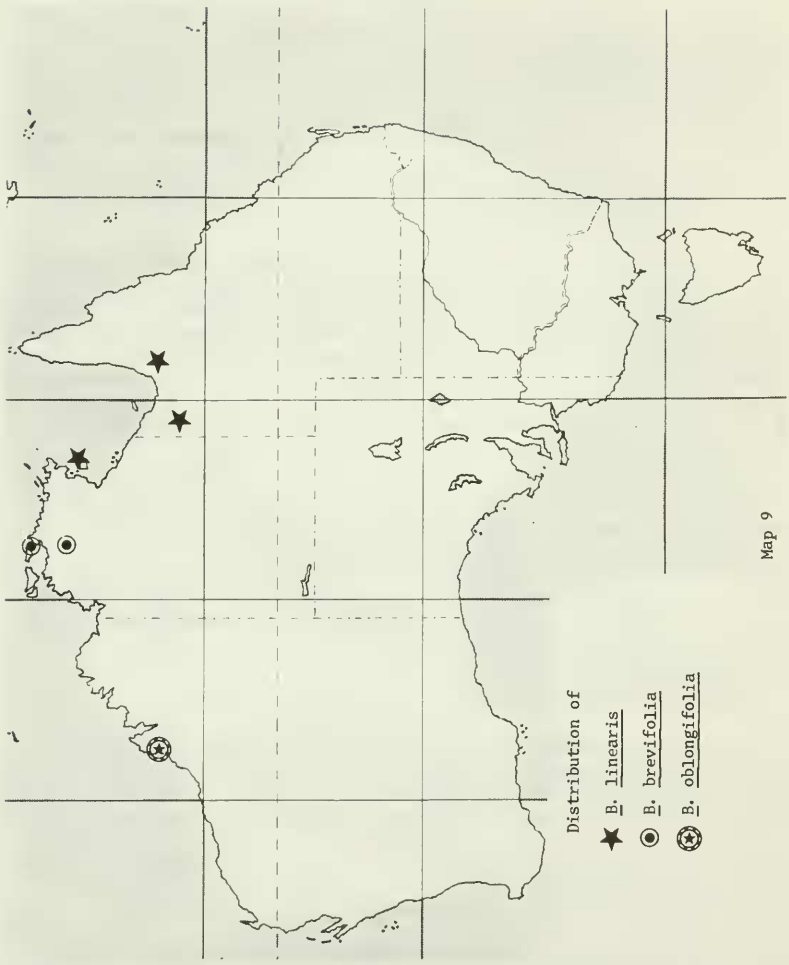
Tropical Australia and southern Africa.

This section is very sharply defined from section Trichantha, but not very distinctly from section Bonamia, from which it differs by its smaller corolla, thin and mostly smaller leaves, smaller sepals, solitary flowers or simple cymes, and peduncles very short or absent.

The circumscription of this section and section Bonamia may necessarily be modified when the morphology of the plants involved is known better.

26. Bonamia linearis (R. Br.) Hall. f. Bot. Jahrb. 16:530. 1893.
Breweria linearis R. Br. Prodr. Fl. Nov. Holl. 488. 1810.
Bonamia linearis (R. Br.) Hall. f. var. genuina Hall. f. Bull. Herb. Boiss. 5:1011. 1897.

Perennial, herbaceous or suffrutescent vines. Stems prostrate or shortly twining, slender terete, becoming 3-9 dm. long, mostly 1-2 mm. thick, soft-pilose or sparsely pilose, becoming almost glabrous in age; old stems 2-4 mm. thick; internodes 1-2.5 cm. long. Leaves shortly petiolate, soft, thin or submembranous, pilose with long and very fine hairs or becoming sparsely so or nearly glabrous; petioles slender, 2-4 mm. long, pilose; blades linear or linear-lanceolate, 1.5-3.5 cm. long, 2-6 mm. broad, occasionally slightly broader, acute or attenuate, rarely rounded or subtruncate at the base, acute or acuminate at the apex; veins indistinct except thin midrib. Flowers axillary, solitary, shortly pedicellate or nearly sessile; peduncles absent; pedicels 0-3 mm., pilose; bracts small, linear or filiform, 1-3 mm. long. Sepals ovate-lanceolate or ovate-acuminate, 5-7 mm. long, 2-3 mm. broad, herbaceous, subcoriaceous near the base, equal or subequal, pilose or sericeous outside, acuminate or acute at the apex. Corolla white, funnel-shaped, 1-1.5 cm. long, long-pilose on interplicae. Stamens included; filaments filiform, glabrous above, scattered-villous on the



Map 9

lower parts adnate to corolla tube; anthers oblong-oval, cordate at the base. Ovary oblong-oval, long-pilose; styles bifid to the middle or lower, filiform, glabrous; stigmas capitate or subglobose-capitate. Capsules ovate-apiculate, pilose at the apex, 2- to 4-seeded, 4-valvular; seeds oblong-ellipsoid, glabrous, black or brown. Cotyledons orbicular.

Type: Australia (Nov. Hollandia tropical), F. Bauer 318, "1801-05" (W-isotype).

Known from northern Queensland and islands of the Gulf of Carpentaria, growing mostly on sandy grounds and coastal dunes (Map 9).

This species has been collected in flower in April and June. Specimens with mature fruits were not available for this study.

This species is closely related to B. media. Specimens (such as F.W. Whitehouse - BRI) with wider leaves are very similar to the typical variety of B. media and are vegetatively hardly distinguishable from the latter. Hallier treated B. linearis and B. media as two distinct species in the first part of his synopsis, but later in the same paper he treated them as varieties of the same species. However, B. linearis seems to be distinct from B. media because of its larger corolla and generally narrower leaves (Figure 4).

Specimens examined:
AUSTRALIA: Northern Territory: On landward edge of coastal dune, Little Lagoon, Groote Eylandt, in the Gulf of Carpentaria, prostrate herb, corolla white, R.L. Specht 230, April 13, 1948 (L, US). Queensland: Gilvert River, Elgrey per N.A.R. Pollock (BRI); Doomadgee Mission, F.W. Whitehouse (BRI). Location indefinite: Stannary Hills, T.L. Bancroft, June, 1909 (BRI); Nova Hollandia tropica, Ferd. Bauer 318 (W).

27. Bonamia oblongifolia Myint, Burma Jour. Life. Sci. 1:32. 1968.

Perennial, herbaceous or suffrutescent, densely ferrugineous plants. Stems terete, erect or suberect, densely ferrugineous with brown hairs, 1.5-2 dm. tall, about 3 mm. thick at the base; branches 1-1.5 mm. thick. Leaves shortly petiolate or subsessile, subcoria-

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Figure 4

Variations in sizes and shapes of leaves in B. media, B. brevifolia, B. oblongifolia and B. linearis

1-9 B. media var. media x 2.
10-13 B. media var. villosa x 2.
14-16 B. brevifolia x 2.
17-21 B. oblongifolia x 2.
22-26 B. linearis x 2.

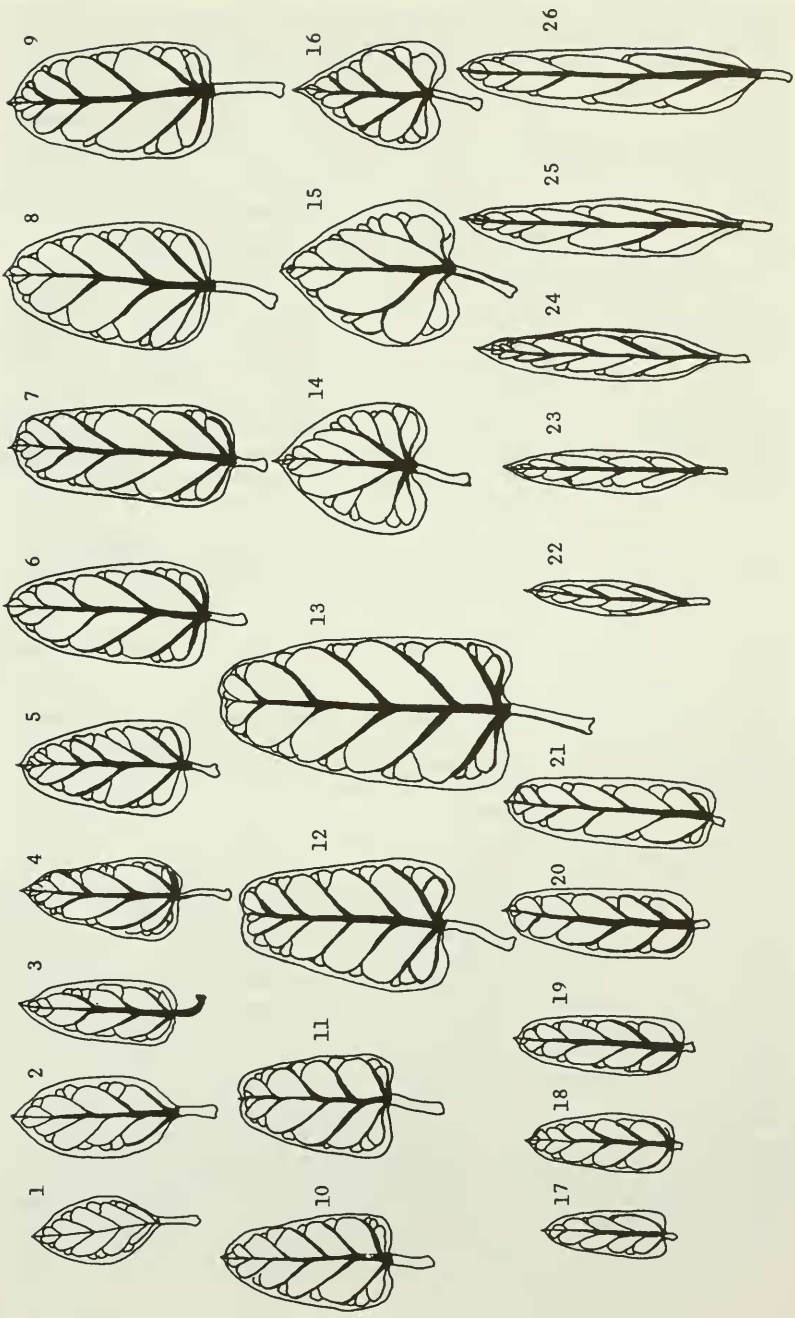


Figure 4

ceous or leathery, densely ferrugineous on both surfaces; petioles 1-2 mm. long or indistinct; blades oblong or rarely oblong-elliptic, 1-2 cm. long, 3-4 mm. wide, rounded at the base and apex; midrib slightly impressed above, distinct below; lateral veins invisible (because of thick coating of hairs), 4-5 pairs. Flowers axillary, solitary, shortly pedicellate or almost sessile; peduncles absent; pedicels 1-1.5 mm. long, ferrugineous; bracts small, linear, 1-1.5 mm. long, frequently slightly exceeding pedicels in length. Sepals ovate, oblong-ovate, or ovate-acute, equal or slightly unequal, 3-4 mm. long, rarely slightly longer, coriaceous or subcoriaceous, acute or shortly acuminate at the apex, densely ferrugineous or sericeous with brownish hairs outside. Corolla blue, campanulate-funnelform, 6-8 mm. long, subentire or slightly lobulate at the margin, pilose on interplicae. Stamens included; filaments filiform, glabrous; anthers dorsifixed, oblong, 0.5-1 mm. long. Ovary oblong with circular disc at the base, long-pilose near the apex; styles bifid to the middle, filiform, glabrous; stigmas capitate. Capsules ovoid-conical, 5-6 mm. long, pilose at the apex, glabrous below, 2- to 4-seeded, 4-valvular; seeds oblong-ellipsoid, 2.5 mm. long, black or dark brown, glabrous. Cotyledons orbicular or orbicular-ovate.

Type: Western Australia: Ville de Broome, dans le gazon sur le sable "rues" de Broome, alt. ca. 5-10 m., herba, flos. bleue, B.P.G. Hochreutiner 2840, 4. II. 1905 (G).

Known only from the type location, growing on a sandy or gravelly meadow (Map 9).

The collector mentioned that this plant was herbaceous, but gave no actual habit. From the material examined, it appears to be erect. His specimen has been erroneously referred to as B. pannosa, which is very distinct in possessing unequal sepals, long bracts, and broad leaves.

This plant is undoubtedly related to B. media because of similarity of the indumentum and to B. linearis because of narrow leaves (Figure 4). However, B. oblongifolia possesses a series of distinctive features which offers a sound basis for adjudging it a separate species. The stem and its branches in B. oblongifolia are short, stout and thick at the base, and possess short internodes, while they are long, slender and weak in B. media and B. linearis. Leaves in B. oblongifolia are oblong or oblong-elliptic, sessile or subsessile, and rounded at both ends. But leaves in B. media are ovate-lanceolate or ovate-subcordate, shortly petiolate, obtuse, truncate or subcordate at the base, and acute, obtuse or emarginate at the apex. Leaves in B. linearis are linear or linear-lanceolate, distinctly petiolate, attenuate, acute or obtuse at the base and acute at the apex. Sepals in B. oblongifolia are smaller and acute or obtuse at the apex, while they are larger and mostly acuminate at the apex in B. linearis.

B. oblongifolia, as the name signifies, is characterized by oblong leaves. Other distinguishing features of this species are erect or suberect habit, short stems and branches, indumentum of dense brown hairs, smaller sepals, shorter corolla and filiform, glabrous stamens.

28. Bonamia brevifolia (Benth.) Myint, Burma Jour. Life Sci. 1: 33. 1968.
Breweria brevifolia Benth. Fl. Austr. 4:436. 1869.
Bonamia linearis (R. Br.) Hall. f. var. brevifolia (Benth.) Hall. f. Bull. Herb. Boiss. 5:1012. 1897.

Perennial, herbaceous or suffrutescent vines, growing from thick and hard rootstock. Stems prostrate, slender, terete, 8-10 dm. long, long-sericeous or pilose, with grey or silvery grey hairs, becoming less hairy in age; internodes 1-2.5 cm. long. Leaves shortly petiolate, soft, herbaceous or somewhat leathery, rarely subcoriaceous, with scattered long hairs or glabrous above, densely appressed-pilose with silvery grey or light brownish hairs below; petioles slender, 2-7 mm. long, pilose; blades ovate-cordate, 1-1.7 cm. long, 9-14 mm. broad, cordate at the base, acute or acute-mucronate at the apex; veins impressed above, distinct below; lateral veins 3-5 pairs. Flowers axillary, solitary, shortly pedicellate; peduncles very short or absent; pedicels 2-4 mm. long, sericeous or pilose; bracts linear or narrowly subulate, as long as pedicels or longer, mostly 3-4 mm. long. Sepals lanceolate or ovate-lanceolate, 3.5-5 mm. long, 2-3 mm. broad, herbaceous or subcoriaceous, equal or slightly unequal, long-pilose or long-sericeous outside, acuminate or acute at the apex. Corolla blue, funnelform or shortly tubular-campanulate, 8-11 mm. long, pilose on the interplicae. Stamens included, filaments filiform, sparsely villous at the base or nearly glabrous; anthers oblong-ovate, cordate at the base. Ovary ovoid-conical, long-pilose or sparsely long-pilose or nearly glabrous; styles connate for lower one-fourth, readily separable nearly to the base, filiform, glabrous; stylar branches unequal; stigmas globose, rarely subglobose. Capsules not available for study.

Type: Australia, Port Essington, Armstrong (BM-isotype!).

Known only from northern districts of Northern Territory, Australia (Map 9).

Collectors have given no information about the habitat of the plant. It has been collected in flower in February.

Hallier (1897), in the first part of his synopsis, treated this species as belonging to Bonamia media, but later both B. media and B. brevifolia were treated as two different varieties of B. linearis. B. brevifolia is only distantly related to this latter species because of its shorter, broader and cordate leaves (Figure 4), longer bracts, smaller sepals, blue corolla and sparsely pilose ovary, whereas B. linearis possesses long, narrow and linear or

linear-lanceolate leaves, minute bracts, longer sepals, white corolla and densely pilose ovary. B. brevifolia seems to be more closely related to B. media, from which it differs by its distinctly cordate and acute leaves (widest near the base), longer bracts, smaller sepals, sparsely villous filaments and sparsely pilose ovary. These characteristics, in addition to the differences in the general appearance of plant, length of stem and indumentum, appear to offer a sound basis for treating it as a distinct species.

Specimens examined:
AUSTRALIA: Northern Territory: Port Essington, Armstrong, 1840 (BM); Humpty Doo, prostrate, leaves dark green above, light green below, flowers blue, N.S. McKee 8328, February 10, 1961 (BRI).

29. Bonamia media (R. Br.) Hall. f. Bot. Jahrb. 16:528. 1893.
Breweria media R. Br. Prodr. Fl. Nov. Holl. 488. 1810.
Bonamia linearis (R. Br.) Hall. f. var. media (R. Br.) Hall. f. Bull. Herb. Boiss. 5:1011. 1898.

Perennial, herbaceous or suffrutescent vines. Stems prostrate, occasionally procumbent or suberect, slender or stout, terete, becoming 2-15 dm. long, rarely longer, mostly 1-3 mm. thick, soft-sericeous with silvery grey or light brownish hairs and becoming less sericeous in age or nearly glabrous; internodes 1-2 (-3) cm. long. Leaves shortly petiolate, soft and thin to subcoriaceous, sericeous, villous or ferrugineous or nearly glabrous or glabrate; petioles 2-7 (-11) mm. long, slender; blades highly variable, ovate, elliptic-ovate, ovate-subcordate, oblong-ovate, ovate-lanceolate, ovate-emarginate or ovate-cordate, mostly 1-2.5 cm. long, 6-15 mm. broad, usually with length-width ratio of 2 or less, truncate, subcordate or obtuse at the base; obtuse, abruptly acute, truncate, obtuse-mucronate or slightly emarginate at the apex; veins impressed above and distinct beneath to scarcely perceptible because of dense coating of hairs; lateral veins 3-5 pairs. Flowers shortly pedicellate or nearly sessile, axillary, solitary or occasionally in simple cymes of two or three; peduncles very short or absent; pedicels 1-5 mm. long, sericeous; bracts small, linear, 1-2 mm. long. Sepals ovate-lanceolate or ovate-elliptic, mostly 5-7 mm. long, 2.5-3.5 mm. broad, herbaceous, subcoriaceous near the base, equal or slightly unequal, sericeous, densely sericeous or villous outside, acute or acuminate at the apex. Corolla blue, light blue, or often white, shortly tubular-campanulate or funnelform, 8-15 mm. long, pilose on interplicae. Stamens included; filaments filiform, glabrous; anthers oblong or oblong-oval, cordate at the base. Ovary ovoid, long-pilose near the apex, with scattered hairs or glabrous below; styles bifid to the middle or lower, filiform, glabrous; stigmas subglobose-capitate. Capsules ovoid-apiculate, pilose at the apex, glabrous or rarely with scattered, minute hairs below; seeds brown or black. Cotyledons orbicular or ovate-cordate, folded.

Type: Australia (Nova Hollandia tropical), F. Bauer 321, "1801-05" (W-isotype).

Red sand, yellow sand, sandy loam, lateritic or nonlateritic soils in open Eucalyptus forest, dry banks, gullies, timbered flats or desert from Northern Territory to Queensland and New South Wales (Map 10).

This is the most wide-ranging species in Australia. It has been collected in flower in January, February, March and October, and in fruit in January, March, June and December. One collector noted the flowering period from summer to winter.

This species has been treated as a variety of Bonamia linearis by Hallier, who treated it as a distinct species in his earlier work. However, B. media is distinct, characterized by elliptic, ovate-elliptic, ovate-subcordate or ovate-cordate leaves, mostly obtuse at the apex.

Although Hallier (1897) has pointed out the similarity of leaf tissue of B. media with those of B. spectabilis and B. sericea, it is most closely related to B. linearis and B. brevifolia.

This species is quite variable in leaf shape, size and pubescence (Figure 4). It is clearly separable into three varieties.

29a. Bonamia media (R. Br.) Hall. f. var. media.
Bonamia linearis (R. Br.) Hall. f. var. media (R. Br.) Hall. f. Bull. Herb. Boiss. 5:1011. 1897.

Stems long, slender, finely soft-sericeous or pilose or occasionally sparsely so, rarely dense-sericeous. Leaves sericeous, pilose, with scattered hairs or almost glabrous on the upper surface, sparsely pilose, sericeous or rarely densely sericeous below, with clearly visible lateral veins, obtuse or obtuse-mucronate at the apex.

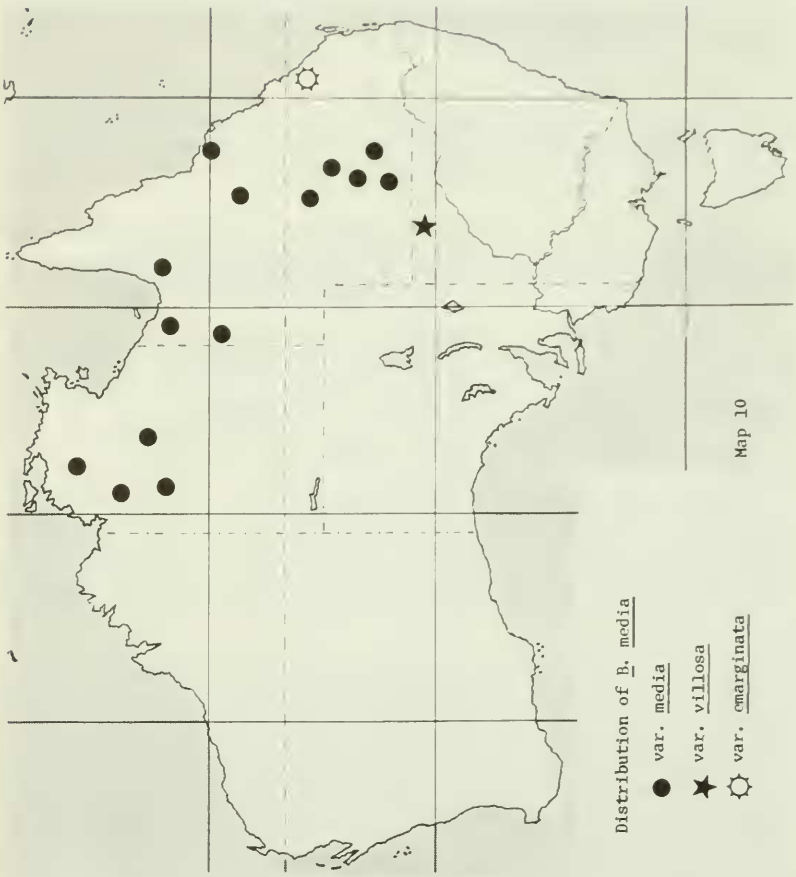
This variety is inconsistent in several features and future studies may find it to be composed of more than one variety. Since the material available at present is scanty, it is treated here as a large, polymorphic group. The following specimens are worth describing briefly to show the variations within this variety:

Bauer 321 (W): Leaves narrower, with length-width ratio exceeding 2, glabrous on the upper surface, sparsely long-pilose on the lower surface.

Collector unknown; "129" Settlement Ck., N.T. (BRI): Leaves larger, with leaf blades as long as 3 cm., glabrous on the upper surface, sparsely long-pilose or glabrescent on the lower surface; bracts 2-3 mm. long.

R.A. Perry 3433 (BRI, US): Leaves very small, 14 mm. or shorter and 9 mm. or narrower (thus erroneously annotated as B. brevifolia), sericeous on both surfaces.

S.L. Everist 2903 (BRI): Numerous slender stems from a single rootstock; leaves with longer petioles, somewhat attenuate at the base, truncate or slightly emarginate at the apex; upper flowers in cluster of two or three.


Distribution of B. media
● var. media
★ var. villosa
☆ var. emarginata
Map 10

James Keys 637 (BRI): Slender and frequently branching stems; leaves smaller, dense long-sericeous or densely pilose on the lower surface.

M.S. Clemens, October 16, 1945 (BRI, L): Leaves densely sericeous; corolla blue.

S.L. Everist 1910 (GH): Stems and leaves densely sericeous--- thus somewhat intermediate between the two varieties, media and villosa.

Specimens examined:

AUSTRALIA: Northern Territory: 31 mi. north of Devil's Marbles, prostrate herb, white flowers, rare in red sand, G. Chippendale 949, 8. 3. 1955 (BRI); 21 mi. south of Elliott, prostrate spreading herb, flowers white, common in light red sand, Chippendale 1024, 9. 3. 1955 (BRI); 6 mi. north of Katherine, in limestone pavement country with red soil, prostrate, leaves grey green, flowers white, H.S. McKee 8515, February 17, 1961 (BRI); 15 mi. north of Victoria River Down Station, creeping greyish plant common on skeletal soils on cherts with E. brevifolia and Plectrachne sp., R.A. Perry 2111, 10. 6. 1949 (BRI, US); 30 mi. south-southwest of Wavehill Station, common near edge of truncated lateritic desert, prostrate creeping plant with runners several feet long, Perry 2217, 21. 6. 1949 (BRI, US); 20 mi. northwest of Ooratippa Station, prostrate, grey plant, trailing for several feet with white flowers, common on red tertiary nonlateritic soil with Eucalyptus gamophylla, Perry 3433, 14. 3. 1953 (BRI, US). Unknown collector: Settlement Ck., 129, February, 1922 (BRI). QUEENSIAND: Sandy place, race course, Charleville, Warrego Dist., M.S. Clemens, October 6, 1945 (G); Cemetry, Charleville, Warrego Dist., flower blue, Clemens, October 16, 1945 (BRI, L); Yalleroi-Jericho and vicinity, Mitchell Dist., stems prostrate, Clemens, April 1, 1946 (F, UC); Nive River, about 30 mi. north of Augathella, prostrate plant, common in yellow sand, leaves silvery, silky tomentose, flowers white, S.L. Everist 1910, October, 1939 (GH); Boatman Station, Maranoa Dist., in red sandy soils, herb with many slender prostrate stems, radiating from woody rootstock, flowers white, Everist 2903, 24. 3. 1947 (BRI); "Curragh" Station near Cunnamulla, around bore in paddock in brown loam, prostrate herb, greyish green leaves, white corolla, alt. 620 ft., C.E. Hubbard and C.W. Windero 6220, 4. 1. 1931 (BRI); Adel's Grove, via Camooweal, trailing perennial herb, stems to 6 ft. long, fls. white, summer to winter, dry banks, gullies and timbered flats, A. De Lestang 162, 20. 1. 1946 (BRI); Ayr. Rev. N. Michael 1522 (BRI); Gilbert River, N.A.R. Pollock (US). Torrens Creek, common in sandy soil, open Eucalyptus forest, fls. white, C.T. White 8931, 18. 3. 1933 (BRI, US); Carbean near Cunnamulla, Warrego Dist.; numerous prostrate stems from a long taproot, flowers white, White 12014, 26. 3. 1941 (A, BRI); Doomadgee Mission, W. Whitehouse (BRI); Charleville, "J.F.B." March, 98 (BRI). Locations indefinite: Nova Hollandia tropica, Ferd. Bauer 321 (W); "Bustarst Hern, James Keys 637" (BRI).

29b. Bonamia media (R. Br.) Hall. f. var. villosa (Benth.) Myint, Burma Jour. Life Sci. 1:33. 1948.

Breweria media R. Br. var. villosa Benth. Fl. Austr. 4: 436. 1869.
Bonamia linearis var. media subvar. villosa (Benth.) Hall. f. Bull. Herb. Boiss. 5:1011. 1897.

Differs from the typical variety by densely sericeous and stouter stems frequently branching; densely sericeous and thicker leaves, truncate or slightly emarginate at the apex; the hairs on all parts turning to brown on drying, thus appearing to be ferrugineous; lateral veins indistinct.

Type: Australia: Victoria River, F. Mueller (presumably at BM, not seen).

Known from Northern Territory and New South Wales, growing on red sandy soil (Map 10).

This variety was described by Bentham (1869), who questioned its validity, and later was treated as a subvariety by Hallier (1897). However, it appears to be a very distinct variety because of the dense coating of hairs over the entire plant. Future study of more materials may modify the circumscription of this variety.

Specimen examined:
AUSTRALIA: New South Wales: 30 mi. west of Uantabulla, red sandy soil, N.C.W. Beadle 36308, 1. XII. 1944 (US).

29c. Bonamia media (R. Br.) Hall. f. var. emarginata Myint & Ward, var. nov.

Differt a var. media et var. villosa foliis apice emarginato, basi distincte cordata vel subcordata, sparse pilosis, 1.2plo longioribus quam latioribus vel paulo; venis lateralibus plerumque 3 binis; bractis 1.5-2.5 mm. longis; stigmatibus depresso-capitatis vel peltatis.

Differs from var. media and var. villosa by leaves emarginate at the apex, distinctly cordate or subcordate at the base, sparsely pilose, with length-width ratio of 1.2 or less; lateral veins mostly 3 pairs; bracts 1.5-2.5 mm. long; stigmas depressed-capitate or peltate.

Type: Australia: Queensland: Gladstone, unknown collector (BRI).

Known only by a single collection from the east coast of Queensland, Australia (Map 10).

The collector gives no information on the habit, flower color and habitat of this variety. It is quite distinct from the other two varieties of the species and it may be found to be a separate species in future studies, when more specimens of better condition become available. Because the only available specimen is fragmen-

tary, it is treated here as a variety of B. media.

This variety is more closely related to var. media than to var. villosa because of its indumentum, and smaller leaves.

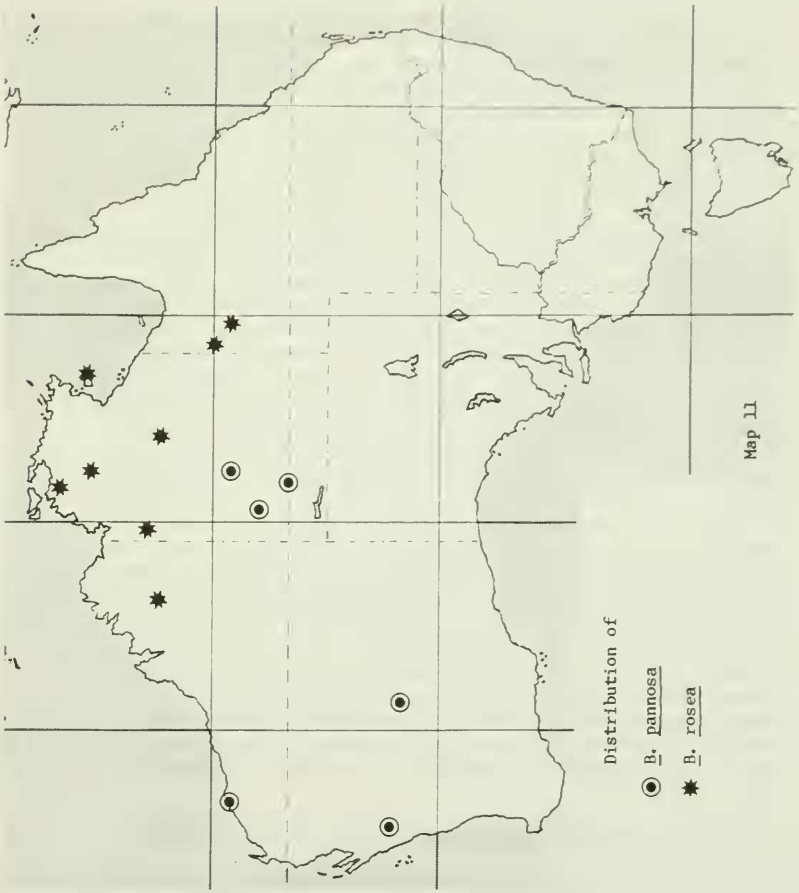
30. Bonamia rosea (F. v. Muell.) Hall. f. Bot. Jahrb. 16:528. 1893.
Breweria rosea F. v. Muell. Fragon. Phytogr. Aust. 1:233. 1859.

Perennial, erect subshrubs or undershrubs of 3-9 (10) dm. tall. Roots thick, woody, deep-penetrating. Stems terete, densely tomentose, hirsute or ferrugineous with grey or brownish hairs; main stems about 2-5 mm. thick, with pulpy bark near the base, readily branching, thus having numerous culms; older stems becoming less tomentose. Leaves shortly petiolate or frequently subsessile, thick, leathery, subcoriaceous or coriaceous, densely ferrugineous or hirsute on both upper and lower surface; petioles 1-5 mm. long or almost absent, 1-1.5 mm. thick, densely ferrugineous or hirsute; blades orbicular, ovate or obovate, mostly 7-15 mm. long, about 6-13 mm. wide, with length-width ratio of mostly one, entire at the margin, rounded or slightly cordate at the base, truncate, slightly emarginate, obtuse or obtuse-mucronate at the apex, with about 3-5 pairs of indistinct lateral veins. Flowers, axillary, sessile or shortly pedunculate, solitary or occasionally in cymes of two or three, frequently aggregated near the terminal ends of branches; peduncles, when present, up to 15 mm. long, mostly 1 mm. thick, densely ferrugineous; bracts linear or linear-lanceolate, as long as 6 mm. or very small and inconspicuous. Sepals ovate-lanceolate, 5-9 mm. long, acute or abruptly acute, rarely obtuse, densely long-hirsute outside, the inner ones smaller or narrower. Corolla pink or white, tubular-campanulate, or broadly urceolate, 1-1.8 cm. long, with limb of 8-15 mm. broad, long-hirsute on interplicae, glabrous on plicae, 5-10-lobulate at the margin; tube broad, cylindrical and distinct, stamens included; filaments adnate and hairy at the base, free and glabrous above; anthers broadly oblong. Ovary hirsute with long hairs near the apex, glabrous below, conical; styles bifid above two-thirds or lower, filiform, glabrous except near the base; stylar branches unequal; stigmas large globose. Capsule valvular, 2- to 4- seeded, conical, hirsute at the apex. Seeds ovate or ovate-oblong, glabrous. Cotyledons ovate or ovate-orbicular.

Type: West Australia; type specimen not available.

Western and central Australia from Nichol Bay and Dampier Archipelago south to Lake Moore and east to southern districts of the Northern Territory (Map 11).

Collectors note "coarse sandy desert or grassland," "spinifex sand plain," "bushes on sands," "deep red sands in area of burnt Triodia pungens" and "sand heath" as the habitat of this species.


Distribution of
B. pannosa
B. rosea
Map 11

Specimens recently collected from central Australia by Chippendale and Lazarides are distinct in certain morphological features, particularly in minute or inconspicuous bracts, smaller corolla, completely sessile flowers and numerous stems from a single shoot. These morphological characteristics (especially the minute vs. long bracts and small vs. large corolla) seem to support the supposition that the central Australian plants deserve a distinct taxonomic status, at least at the varietal level. But, with just a handful of material available at this time, it is not described here.

The leaves vary relatively little (Figure 5).

Specimens examined:
AUSTRALIA: Northern Territory: Near Ulambaura Spring, Haast Bluff, subshrub 1 ft., infl. white, infrequent in Triodia pungens assoc., G. Chippendale 2568, 23. 8. 1956 (BRI); 31. 6 m. northwest of Mt. Patricia, grey perennial herb 1 ft., common in small area in deep red sand, in area of burnt Triodia pungens, Chippendale 4297, 5. 5. 1958 (BRI); 65 m. northwest of Willowra H.S., dwarf shrub 1 ft., buds brown green, common in deep red sand, in area of burnt Triodia pungens, Chippendale 4792, 31. 7. 1958 (BRI); 59 mi. northwest of Mt. Doreen Station, dominant in patches in coarse sandy desert dominated by Plectrachne schinzii grassland, low hairy grey subshrub to 12 in. high and as wide, flowers white, culms numerous, branching and spreading, M. Lazarides 6020, 17. 9. 1957 (BRI, US). Western Australia: Dampiers Archipelago, B.F. von Mueller (BM); Greenoughs River, Mueller (GH, US); Nichol Bay, Mueller (BM); Murchison River, Oldfield (W); in fruticetis arenosis inter flumina Moore et Murchison, E. Pritzel 606, IX, 1901 (HBG, W), 616, IX, 1901 (A, BM, GH, L, MO, US); northeast of Melrose, N.H. Speck 1388, 8. 9. 1958 (MO); 13 mi. northwest of Albion Downs, woolshed, Eremean Province, spinifex sandplain, Speck 1477, 17. 9. 1958 (BRI, MO).

31. Bonamia pannosa (R. Br.) Hall. f. Bot. Jahrb. 16:530. 1893.
Breweria pannosa R. Br. Prodr. 488. 1810.

Prostrate or twining vines growing from perennial rootstock. Stems terete, soft and herbaceous while young, soon becoming woody, mostly 2-3 mm. thick, densely hirsute with soft ferrugineous or silky hairs. Leaves shortly petiolate, herbaceous or soft-coriaceous, densely hirsute on both upper and lower surface; petioles 3-20 mm. long, densely hirsute; blade ovate or orbicular, rarely ovate-oblong, 2-4 cm. long, mostly (1-) 1.2-3 cm. broad, truncate, subcordate or rounded at the base (lower leaves sometimes attenuate at the base), obtuse, rounded or obtuse-acute at the apex. Flowers axillary, solitary or in cymes of two to few flowers, rarely several flowers (forming dense cluster), sessile or shortly pedunculate and/or shortly pedicellate; bracts subulate 5-10 mm., becoming slightly longer in age, hirsute. Sepals soft and thick or subcoriaceous, unequal; outer two sepals large, ovate, 8-11 mm. long, 7-8 mm. broad, hirsute on the back, hirsute inside except glabrous center, acute at the apex; in-out sepal (third sepal) oblique-ovate, as

long as outer two sepals, 4-6 mm. broad, hirsute as outer sepals; inner two sepals smaller, ovate-acuminate or broadly lanceolate, 6-7 mm. long, 3-4 mm. broad, hirsute outside, glabrous inside, acuminate at the apex. Corolla blue or violet blue, rarely white, funnel-shaped, 1.2-1.5 cm. long, with spreading and sublobulate or nearly entire limb, hirsute or pilose on interplicae, glabrous on plicae. Stamens inserted; filaments villous, slightly broadened at the base; anthers oblong, 1-1.5 mm. long, dorsifixed, cordate at the base. Ovary ovoid-conical, long-hirsute at the apex; styles bifid to the middle, with unequal stylar branches; stigmas globose-capitate. Capsules thin-walled, 4- to 8-valved, 4-seeded, ovoid, 5-6 mm. long, 4-5 mm. in diameter, hirsute at the apex, glabrous below; seeds glabrous, ovate-triangular, 2-3 mm. long. Cotyledons ovate-cordate, rounded or slightly emarginate at the apex; cotyledonary petioles fused.

Type: (Nova Hollandia tropica) Tropical Australia, Bauer 325 (BM-lectotype?; W-isotype!)

Sandy soil, gravelly sand, limestone, shale and dry ridges, rarely in wet ground in tropical regions of Australia from Queensland to the northeastern districts of western Australia (Map 11).

This species has been collected in flower from February to June and in fruit from April to July. The isotype at Vienna has been mislabelled as Polymeria lunata presumably by R. Brown.

Specimens examined:
AUSTRALIA: Northern Territory: 28 mi. south of Elliott, prostrate spreading herbs, corolla blue, common on gravelly sand, C. Chippendale 1021, 9. 3. 1955 (BRI); Spring Vale, Port Darwin, Alfred Giles (BRI); 5 mi. from Katherine, on Wyndham Road in wet ground, prostrate, leaves pale green, flowers bright blue, H.S. McKee 8536, February 18, 1961 (BRI); 12 mi. southwest of Katherine Township, prostrate grey bush several feet long, common on sandy soil with E. miniata open forest, R. A. Perry 1978, 2. 6. 1949 (BRI, US); 6 mi. south of Limbunya Station, prostrate plant with grey foliage, common on limestone outcrop, Perry 2337, 4. 7. 1949 (BRI, US); Groote Eylandt, S.H. Wilkin 98, February, 1929 (BM). Queensland: Adel's Grove via Camooweal, trailing plant, young stems erect to 9 in. high, flower dark blue, velvety, rather pretty, grows on dry ridges, A. De Lestang 5 (BRI); Mt. Isa, Burke District,

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Figure 5

Variations in sizes and shapes of leaves in B. pannosa, B. dietrichiana and B. rosea

1-5 B. pannosa x 2.
6-8 B. dietrichiana x 2.
9-13 B. rosea x 2.

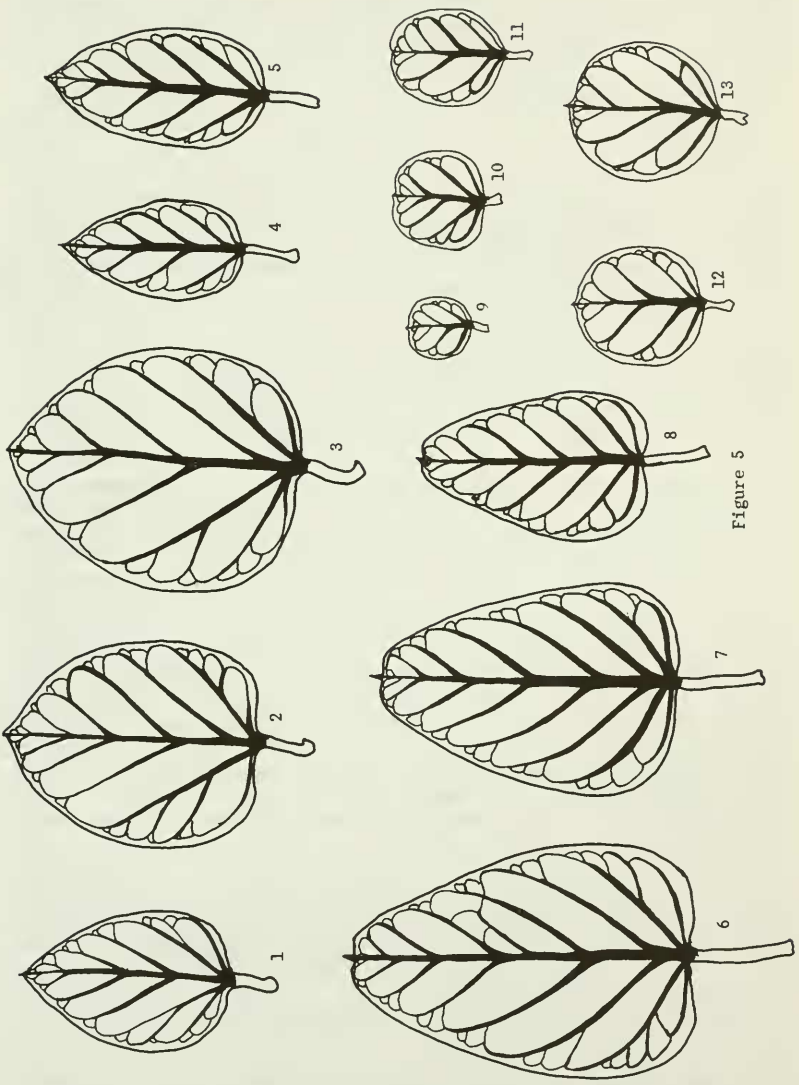


Figure 5

Mrs. M. Morris, May, 1952 (BRI). Western Australia: Slatey Creek, 16 mi. northwest of Glenroy Meatworks, prostrate, grey green, hairy plant with runners several feet long and blue flowers, common in shaley bed of creek, M. Lazarides 5155, 22. 4. 1955 (BRI). Location indefinite: Nova Hollandia tropica, Bauer 325 (W-isotype).

32. Bonamia velutina Verdcourt, Kirkia 1:27, tab. III. 1961.

Perennial, erect or suberect subshrubs. Stems woody or becoming woody, terete, tomentose, or densely appressed-sericeous, as high as 9 dm., 1-3.5 mm. thick, frequently branching; internodes 5-25 mm. long. Leaves shortly petiolate, or subsessile, soft and herbaceous or leathery, rarely subcoriaceous, densely velutinous with silvery grey or brownish hairs on both surfaces; petioles 1.5-4 mm. long, densely velutinous; blades elliptic or elliptic-oblong, 1.2-4.5 (-6) cm. long, 4-15 mm. broad, upper leaves smaller and lower leaves somewhat larger, rounded or subtruncate at the base; acute-mucronate or rarely obtuse-mucronate at the apex; veins impressed above, prominent underneath; lateral veins 4-6 pairs. Flowers shortly pedunculate or sessile, axillary, solitary or in cymes of two or three; peduncles 0-3.5 (-6) mm. long; pedicels 0-1.5 mm. long; bracts linear, 2-4 mm. long, velutinous. Sepals ovate-lanceolate, obovate or spathulate, subcoriaceous at the base, foliaceous at the apex, slightly unequal; outer three spathulate with oblong base as long as 3 mm. and 1.5 mm. wide, with dilated apex 3.5-4 mm. long and 2.5-3.5 mm. wide, densely velutinous outside; inner two ovate-lanceolate, 6.5 mm. long, 2.5 mm. wide, acute at the apex, not dilated, velutinous outside. Corolla white, infundibuliform, 9-12 mm. long, 13 mm. wide at the apex, slightly 5-lobulate, densely pilose on interplicae. Stamens inserted; filaments filiform, dilated at the base, glabrous; anthers 1 mm. long, cordate at the base. Ovary ovoid, densely long-pilose; styles bifid, shortly connate (1-2 mm.) at the base, glabrous; stigmas lobulate-peltate. Capsules ellipsoid or globose-ellipsoid, 6 mm. long, subacute, minutely appressed-pilose, 2- to 4-seeded, 4-valvular; seeds angular-ellipsoid, 2-3 mm. long, glabrous, minutely punctate. Cotyledons orbicular or ovate-orbicular; cotyledonary petioles short or absent.

Type: Southern Rhodesia: Nuanetsi District, 0.4 km. within Southern Rhodesian border opposite Malvernia, in Guibourtia - Mopane Woodland on Umkondo sands, 450 m., K. Wild 4688, November 1, 1955 (K-holotype, SRGH-isotype-not seen).

Known only from Southern Rhodesia, southeastern border in Nuanetsi District (Map 1).

According to the collectors this is an erect herb or subshrub in mopane or mixed woodland on sandstone, Umkondo sand or sandstone plateau. It has been collected in flower in November and in fruit in April.

This species was originally annotated as Seddera sp., presumably because of its smaller flowers and shrubby habit. Although this species possesses certain morphological features and the habit of that genus, it is definitely a species of Bonamia as pointed out by Verdcourt. It seems to be more closely related to some Australian species of that genus than to the other African species, because of its erect habit, shorter stems, sessile or very shortly pedunculate flowers (mostly solitary or in simple cymes), smaller sepals and shorter corolla.

Specimens examined:
SOUTHERN RHODESIA: Nuanetsi District: Combretum Mopane, sandstone, 1650 ft., herb 2-3 ft., R. Davis 1629, November, 1955 (EA-paratype); Clarendon Cliffs, mixed woodland on sandstone plateau, erect 2 ft., perennial, corolla white, R.B. Drummond 7809, April 29, 1962 (EA).

III. Section: Trichantha Myint, Burma Jour. Life Sci. 1:34, 1968.
Trichantha Karst. et Triana, Limnaea 28:437. 1856, not Trichantha Hooker, Icon. Pl. tt. 666, 667. 1844.

Stems woody, twining or scandent, usually long and high-climbing, rarely short and suberect or erect, mostly 3 mm. or thicker. Leaves distinctly petiolate, often long-petiolate, soft, herbaceous, subcoriaceous or leathery, not membranous; blades mostly ovate, ovate-acuminate, or ovate-subcordate, rarely broadly elliptic, usually large, 3.5 cm. or longer, 2.5 cm. or wider, with length-width ratio of 1-1.5, rarely slightly higher, rounded, truncate, subcordate or cordate at the base; acute, obtuse, acuminate, rounded or emarginate and distinctly mucronate at the apex. Inflorescences axillary compound or simple cymes of few to numerous flowers or terminal panicles, rarely uniflorous, pedunculate or sessile; bracts small, never foliaceous, deciduous or persistent. Sepals coriaceous, rarely subcoriaceous, mostly equal or slightly unequal, ovate, oblong-ovate or orbicular, obtuse, rounded or emarginate, rarely acute at the apex, mostly 3-6 mm. long. Corolla white, yellowish white, yellow or purple, 2-2.5 cm. long, rarely slightly shorter, subentire or 5- to 10-lobulate at the margin. Stamens included; filaments mostly villous or sparsely villous below, glabrous above; anthers 2 mm. or longer, sagittate or cordate at the base. Ovary conical, ovoid-conical or ovoid-oblong, pilose, sparsely pilose or glabrous; styles free nearly to the base, fused to the middle or slightly higher; vascular traces branched into two in the upper part of stylar branches; stigmas reniform or obscurely bilobed, large. Fruits mostly 4- or rarely 2-valvular, thick-walled, (0.5-1 mm. or thicker); septum hard, not membranous. Seeds densely villous or woolly, with long, soft hairs; hairs 1-3 mm. or shorter on the dorsal and ventral surfaces, 5 mm. or longer along the edges of seeds. Cotyledons ovate, ovate-cordate or obovate, corrugate or multiplicate when mature; non-corrugate or flat when young.

Type: Bonamia trichantha Hall. f. (as Trichantha ferruginea Karst. & Triana, 1856).

Tropical America from Panama to Brazil and Paraguay.

This section is very distinct from the other two sections and is characterized by ligneous fruits, villous seeds, a branched vascular strand in each stylar branch, reniform or obscurely bi-lobed stigmas, and orbicular or ovate-orbicular sepals.

33. Bonamia trichantha Hall. f., Bot. Jahrb. 16:528. 1893.
Trichantha ferruginea Karst. & Triana, Linnaea 28:438. 1856.
Breweria mollis Pittier, Jour. Wash. Acad. Sci. 17:284. 1927.
Breweria longipaniculata Pittier, Jour. Wash. Acad. Sci. 17:284. 1927.

Perennial, woody climber, apparently growing all year around. Stems twining, terete, smooth or warty, tomentose while young and becoming glabrous in age; about 1 cm. in diameter, becoming 10 m. long or longer. Leaves petiolate, coriaceous or submembranous, glabrous or sparsely pubescent above and densely tomentose or glabrate on the lower surface, more densely so on the veins (especially in the glabrate forms); petioles 1-3 cm. long, 1-2 mm. thick, round or canaliculate above, minutely appressed pubescent or becoming glabrous; blades ovate, oblong or ovate-oblong, entire at the margin, obtuse or cordate at the base and acute, obtuse, attenuate or obtuse-mucronate at the apex; nerves slightly impressed above, prominent below; about 5-8 pairs of lateral veins. Inflorescences axillary cymes of few to many flowers or terminal pseudopanicles; cymes pedunculate; peduncles and pedicels minutely appressed pubescent or becoming glabrous; bracts small or inconspicuous. Sepals orbicular or orbicular-ovate, subequal or slightly unequal; outer two ferrugineous or pubescent-glabrescent; inner ones sparsely pubescent-glabrescent, with hyaline margins, 5-7 mm. long, 4-5 mm. wide. Corolla white, 1.2-2 cm. long, about 1-1.5 cm. wide, tubular-campanulate, entire; outside surface with long hairs on interplicae, glabrous on plicae; tube short, about 3-5 mm. Stamens inserted, epipetalous; filaments glabrous or villous, incurved or straight; anthers oblong or ovate, dorsifixed, emarginate or slightly cordate at the base, narrow at the apex. Ovary ovoid, with circular disc at the base, glabrous or villous at the apex; styles shortly connate at the base, glabrous or with scattered hairs; stigmas globose or capitate, mostly sub-bilobed. Fruit capsule, valvular with thick and ligneous wall, dehiscing mostly into two or four valves; partition wall thin, coriaceous. Seeds ovoid, plano-compressed, densely villous, with longer marginal hairs. Cotyledons obovate or orbicular, emarginate at the apex; cotyledonary petioles fused.

Type: Colombia: Magdalena: Piedras, Vallee du Magdalena, Nouvelle-Grande, prov. de Mariquita, J. Triana 2146, 1851-1857 (G-lectotype, BM, W-isotypes).

Distribution of B. trichantha
var. trichantha
var. oblonga
var. ovata f. ovata
var. ovata f. glabrata

Map 12

From sea level to 600 m. in Panama, Colombia and Venezuela (Map 12).

The collectors recorded this species as occurring in light forests on rocky hills, borders of forests, thickets on open rocky slopes or hill sides, river banks, arid bushy slopes and valleys. This species is separable, though not very clearly, into three varieties of which one may be divided into two forms.

33a. Bonamia trichantha Hall. f. var. trichantha.
Bonamia trichantha Hall. f. var. typica v. Ooststroom, Rec. Trav. Bot. Neerlandais 33:213. 1936.

This variety is characterized by broadly elliptic leaves, obtuse, rounded or slightly emarginate at the apex and densely ferrugineous underneath. (Figure 6).

Restricted to Colombia, from Magdalena south into Tolima and Huila departments (Map 12).

Specimens examined:
COLOMBIA: Huila: Natagaima, rocky hill at gorge above N. Altitude 450-500 m., light forest, shrubby vine, H.H. Rusby and F.W. Pennell 1159, August 12, 1917 (GH). Magdalena: Piedras, Vallee du Magdalena, Nouvelle-Grande, prov. de Mariquita, 500 m. J. Triana 2146, 1851-1857 (BM, G, W); Nouvelle-Grande, prov. de Jequendema, Triana 3801, 1853 (BM). Tolima: E.P. Arbelaez 2173, XII. 1932 (US).

33b. Bonamia trichantha Hall. f. var. oblonga v. Ooststroom, Rec. Trav. Bot. Neerlandais 33:213. 1936.

This variety is characterized by its oblong or oblong-lanceolate leaves, mostly 5-8 cm. long and 2-2.5 cm. wide (Figure 6), and loose cymes of fewer flowers which usually are in terminal panicles.

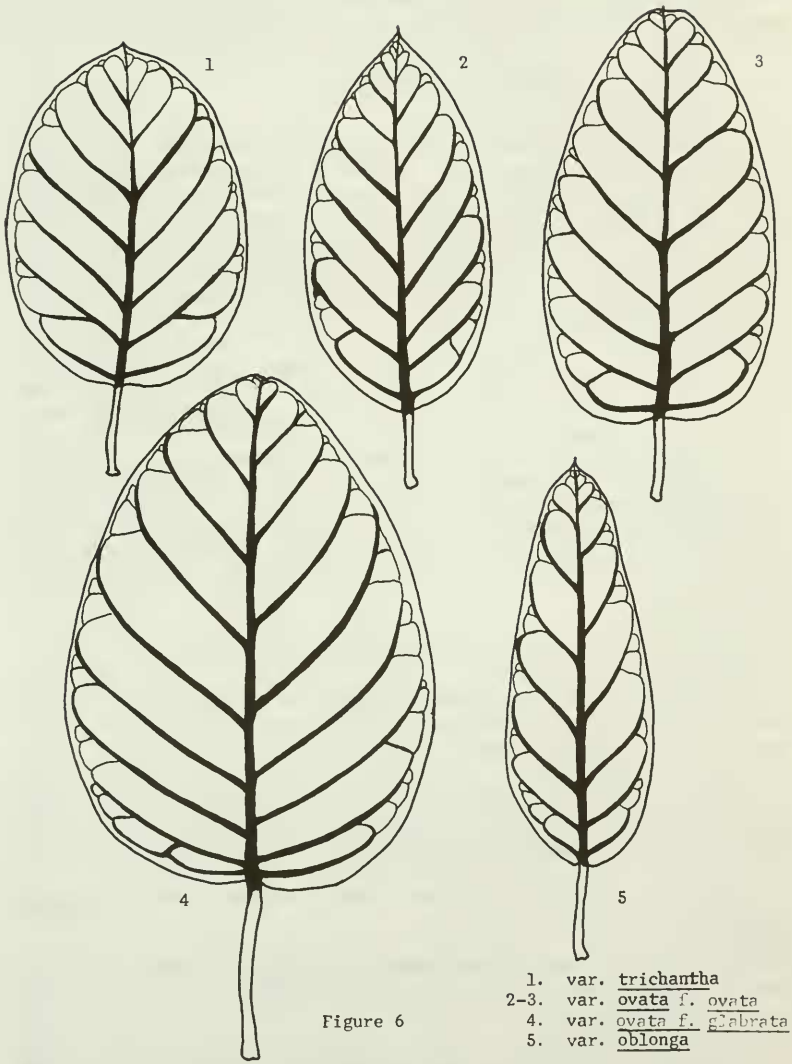
Type: Colombia: Santa Marta, Herbert H. Smith 1871, 1898-1899 (US-holotype, F, GH-isotypes).

This variety is apparently endemic to northern Colombia and is known only from the type collection (Map 12). Its habitat is not known and the collector gives no more than the location. A description of fruit and seed has to await future collections.

33c. Bonamia trichantha Hall. f. var. ovata v. Ooststroom, Rec. Trav. Bot. Neerlandais 33:213. 1936.

This variety is characterized by its ovate or ovate-acuminate leaves, rarely emarginate at the apex, and much varied in size and pubescence (Figure 6).

Type: Colombia: Tolima: Honda, open rocky slope, alt. 300-400 m., F.W. Pennell 3575, January 3-4, 1918 (US-holotype, GH-isotype).



1. var. trichantha
2-3. var. ovata f. ovata
4. var. ovata f. glabrata
5. var. oblonga

Figure 6

Leaf shapes and sizes in Bonamia trichantha

This variety ranges from Panama and Colombia east into eastern Venezuela. It is separable into two forms.

B. trichantha var. ovata f. ovata.

This form is characterized by its ovate leaves, densely villous underneath, and distinctly ferrugineous sepals.

Known from Colombia and Venezuela.

Specimens examined:
COLOMBIA: Cundinamarca: Hillside east of Apulo, thickets along trail to Anapoima, alt. 460-600 m., woody vine, E.P. Killip, A. Dugand and R. Jaramillo 38147, May 4, 1944 (US). Magdalena: Valle de Magdalena, R. Garsten (?) (W); Bond, Enredadera, Caliz Verde, Velloso, Anteras Verdes, dorsimelifijas, biloculares, Ovario blanco en la base y verde en el apice, Fruto globoso, verde, R. Romero-Castaneda 703, February, 1948 (F); Santa Marta: alt. 500, Herbert H. Smith 876, December, 1898-1899 (GH, K, US); Santa Marta, a twiner to 20 ft., rare on border of forest below 1000 ft., fl. October-November, leaves subcordate at base, Smith 877, November 21, 1890-1901 (GH). Tolima: Honda, open rocky slope, alt. 300-400 m., shrubby vine, corolla white, F.W. Pennell 3575, January 3-4, 1918 (GH, US).
VENEZUELA: Lara: Entre Carora y Trentino, Jose Saer 724, Enero, 1931 (F). Portuguesa: Vine on Calvario Hill, Guanare, H. Pittier 12046, December 28, 1925 (NY, US). Trujillo: Loma de Moron near Valera, a vine, flower white, Pittier 10733, November 18, 1922 (GH, NY, US). Yaracuy: Iboa, 450 m. trailing on bushes, a woody vine, fl. white, Pittier 13074, January 1, 1929 (F, GH, US).

B. trichantha var. ovata f. glabrata Myint & Ward, f. nov.

Differt a forma typica var. ovatae foliis glabratis, sepala et pedicellis minus dense pubescentibus vel fere glabris, et pedicellis parum longioris.

This form is characterized by its much varied, usually large, glabrate leaves, less densely pubescent or nearly glabrous sepals and pedicels, and slightly longer pedicels.

Type: Colombia: Atlantico, entre Baranoa y Galapa, A. Dugand 5643, April 2, 1961 (US).

This form is known from Panama, Colombia and eastern Venezuela, thus covering the whole range of the species.

Specimens examined:
COLOMBIA: Atlantico: Entre Baranoa y Galapa, 100 m. bosque marginal de un arroyo temporario, bejuco 10 m. long tallo lenoso delgad, 1 cm. diam., A. Dugand 5643, April 2, 1961 (US); entre Lena y Candelaria, alt. 30-50 m., Dugand and R. Jaramillo 2789,

Enero 11, 1941 (US). Bolivar: Vicinity of Turbaco, Bro. Heriberto 448, November 1920 (US); north of Arjona, alt. 30-50 m., thickets, vine, corolla white, E.P. Killip and A.C. Smith 14532, November 15, 1926 (GH, US). Cundinamarca: Bejuco trepador, frutos armarillos, Ferrocarril a Salgar, rio Guaduero, alt. 450 m., H. Garcia-Barriga 12296, July 23, 1947 (US). Santander: Rio Surata valley near Bucaramanga, alt. 400-600 m., woody vine, corolla white, thicket, Killip and Smith 16218, December 28, 1926 (GH); river bank, upper Rio Lebrija valley, northwest of Bucaramanga, alt. 400-700 m., vine somewhat woody, corolla white, Killip and Smith 16300, December 29, 1926 (GH). Doubtful specimen (no leaves nor flowers); Boyaca: Los Llanos, Rio Meta, Orocue, alt. 140 m., Sabana, J. Cuatrecasas 4438, November 3, 1938 (US).

PANAMA: Toboquilla Island, vine, G.S. Miller, Jr. 2000, March 30, 1937 (US); Penonome and vicinity, 50-1000 ft. elevation, climbing over bushes, R.S. Williams 93, February 23 - March 22, 1908 (NY).

VENEZUELA: Delta Amacuro: Curiapo, alt. 0 m., enredadera, flores blanca, Hermano Gines 4945, December, 1952 (US).

34. Bonamia balansae Hall. f. Bull. Herb. Boiss. 5:1002. 1897.

Perennial, woody climbers. Stems twining, terete, 7 m. long, 2-5 mm. thick, glabrous, minutely striated; older branches with whitish lenticels; young branches sparsely punctate. Leaves petiolate, coriaceous or submembranous, glabrous, shining above, dull underneath; petioles, 5-14 mm. long, canaliculate above, glabrous or sparsely pubescent when young; blades ovate-acuminate, 3-6 cm. long, 2-3.5 cm. wide, rounded or subcordate at the base, subcuspidate-acuminate or acute mucronate at the apex; midrib impressed above, prominent underneath, with 5-7 pairs of lateral veins; finer veins distinct underneath. Flowers axillary, in few-flowered cymes or solitary, frequently in pseudo-racemes on short lateral branches; peduncles terete, rigid, 4-20 mm. long, glabrous or sparsely pubescent, pedicels 4-7 mm. long, turning to black when dry; bracts subulate, 1 mm. long, deciduous. Sepals coriaceous, equal or slightly unequal, orbicular, 5-6 mm. long, glabrous, turning to black when dry, subscarious along narrow margin, finely ciliate. Corolla yellow, campanulate-infundibuliform, 2 cm. long, long-pilose on interplicae, glabrous on plicae, with entire or subentire limb. Stamens included; filaments puberulous or villous, adnate to corolla tube for 6 mm.; anthers oval-oblong, 3 mm. long, sagittate at the base. Ovary with narrow annular disc, conical, 2 mm. long, glabrous; styles bifid for upper one-third, glabrous; stigmas orbicular-subbilobed. Capsules ovoid-quadrangular, 14-15 mm. long, 12-13 mm. in diameter, subacute or obtuse at the apex, glabrous, with ligneous wall of 0.5-1 mm. thick, 4-seeded, breaking into two valves (really 4-valved); septum hard; seeds 5-6 mm. long, short-villous on ventral sides, densely fulvous-villous with white or yellowish white, long hairs on dorsal sides and along the edges. Cotyledons cordate-bilobed, emarginate at the apex; cotyledonary petioles fused.

Type: Paraguay, San Salvador, dans les campos, Balansa 1078, May 26, 1876 (G!).

Known only from a few collections made at a high elevation in Paraguay (Map 13). According to one collector, this species grows in forest on calcareous black soil. It has been collected in flower in January and February.

Bonamia balansae is closely related to B. corumbaensis of southern Brazil, from which it differs by its longer stem, glabrous leaves, longer petioles, acuminate or cuspidate leaf tip, ciliate sepals, and shorter stylar branches.

Specimens examined:
PARAGUAY: San Salvador, dans les campos, B. Balansa 1078, May 26, 1876 (G); Zwischen Rio Apa und Rio Aquidaban, goldgelb, 7 m. hochsteigend, Waldparcelle, Kalkahaltiger, schwarzer Boden, Hugel, K. Fiebrig 4531, January 1908-1909 (BM, G, GH, L, W); San Salvador, F. Rojas 3028 (1802), II, 1917 (GH).

35. Bonamia corumbaensis Hoehne, Anex. Mem. Inst. Butantan 1 (4):45, tab. 3. 1922.

Perennial, suberect, shrubby plants, 30-60 cm. high; stems woody, suberect or scandent and slightly twining at the top; old branches rigid, with white lenticels, glabrous; young branches smooth, sparsely pubescent, becoming striated in age. Leaves shortly petiolate, subcoriaceous or leathery and soft, sparsely pilose; becoming glabrous; petioles 3-10 mm. long; blades ovate-lanceolate or ovate-elliptic, 3-7 cm. long, 1.5-3 cm. broad, rounded or slightly cordate at the base, obtuse-mucronate or acute-mucronate at the apex; midrib impressed above, with 5-7 pairs of lateral veins. Inflorescences pedunculate, axillary cymes or racemes of two to few flowers, rarely solitary; peduncles short, 1-2 cm. long, sparsely pilose; pedicels 4-6 mm. long or sometimes longer; bracts small, scale-like, triangular, 1-1.5 mm. long, glabrous. Sepals coriaceous or subcoriaceous, slightly unequal glabrous; outer sepals frequently smaller, oblong or suborbicular-oblong, 5-7 mm. long, rounded at the apex; inner sepals slightly larger, suborbicular, 6-8 mm. long, ciliate, rounded or emarginate at the apex. Corolla yellow or yellowish white, campanulate, 2 cm. long, 5-lobulate, densely ferrugineous-pilose on interplicae. Stamens inserted; filaments glabrous above, villous near the base; anthers oblong, 3.5-4.5 mm. long. Ovary ovoid-conical, glabrous; styles bifid to the middle or lower, filiform, glabrous; stigmas globose-capitate. Capsules conical-acuminate, glabrous, 4-seeded, slightly exceeding the length of sepals; seeds fulvous-villous (according to Hoehne). Cotyledons not known.

Type: Brazil: Commissao Rondon: Corumba, Mato-Grosso, Campo seco, F.C. Hoehne 3042, 2, 1911 (R-isotype); Corumba, Mato-Grosso, parto do paiol de polvora, F.C. Hoehne 3044, 2, 1911 (R-paratype).

Endemic to dry soil in southwestern Brazil near the borders of Bolivia and Paraguay (Map 13). It is represented by only two collections from the same location. The color of the corolla was not

Map 13

recorded by the collector and it is doubtful whether it is yellow or yellowish as it seems to be on the dry specimen.

Although Hoehne stated that this species closely resembles B. burchellii, it seems to be more closely related to B. balansae of northern Paraguay, from which it differs in its erect habit, sparsely pubescent leaves, at least on the veins, obtuse or obtuse-mucronate leaves, and longer stylar branches (or shortly connate styles).

36. Bonamia agrostopolis (Vell.) Hall. f. Bot. Jahrb. 16:529. 1893.
Convolvulus agrostopolis Vell. Fl. Flum. 68, tab. 51. 1825.
Breweria venulosa Meissn. in Martius, Fl. Bras. 7:326. 1869.
Breweria agrostopolis (Vell.) Roberty, Candollea 14:30. 1952.

Perennial, woody vines. Stems scandent or twining, terete, slender or 3-5 mm. thick, finely tomentose or puberulous while young, becoming glabrous in age, longitudinally rugose, rugulose or verruculose, rarely smooth; internodes variable in length, mostly 2-8 cm., occasionally longer. Leaves petiolate, herbaceous or subcoriaceous, occasionally submembranous, thin; upper surface sparsely or rarely densely appressed-pilose while young, becoming glabrous in age; lower surface pilose or tomentose while young, becoming sparsely pilose in age; petioles 2.5-5 cm. long, finely tomentose or sericeous while young, becoming sparsely pilose or nearly glabrous in age, distinctly canaliculate above; blades elliptic, elliptic-ovate or elliptic-acuminate, 10-16 cm. long, 5-9 cm. broad (slightly smaller on the upper leaves), mostly entire, occasionally somewhat undulate or wavy at the margin, obtuse, acute or rounded at the base, acuminate-mucronate or acute-mucronate at the apex; veins distinctly impressed above, prominent below; lateral veins mostly 9-13 pairs, with distinct intercostal veins. Inflorescences axillary or terminal, long, multiflorus panicles, composed of numerous cymes; individual cymes 3- to 5-flowered, occasionally 1- to 2-flowered or rarely 7-flowered, shortly pedunculate; peduncles variable in length, slender or stout; pedicels short, mostly 2-4 mm. long, tomentose; bracts small, scale-like, linear or linear-lanceolate, 2-3 mm. long, deciduous; bracteoles similar to bracts, smaller. Sepals coriaceous, slightly unequal or subequal; outer two slightly shorter and narrower, ovate or ovate-orbicular, 5-6 mm. long, 3.5-4.5 mm. broad, obtuse or rounded at the apex, tomentose and glabrescent; inner three larger, orbicular, orbicular-obovate, 5.5-7 mm. long, 5.5-8 mm. broad, slightly emarginate or truncate at the apex, tomentose outside. Corolla purplish white (according to Velloso) or purple (according to Meissner), funnelform or subcampanulate, mostly 2 cm. long or slightly shorter, with entire limb, brown-sericeous or pilose on the interplicae. Stamens included; filaments filiform, short; anthers moderate in size, introrse, cordate at the base (according to Hallier). Ovary ellipsoid-conical or ovoid, glabrous, with obscure disc; styles bifid to the middle, filiform, unequal, glabrous; stigmas obscurely bilobed or globose. Capsules ovoid-conical or ellipsoid-conical, 1.5-2 cm. long, glabrous, brown or dark brown, hard-walled, 4-valvular, rarely 2-valvular, 4-seeded,

with thin or thick septum; seeds oval-oblong, or ellipsoid, 9-15 mm. long, densely pilose with soft and brown hairs along the edge, brown-tomentose on the dorsal and ventral sides. Cotyledons ovate-cordate, multiplicate or corrugate and folded against radicle; cotyledonary petioles free for upper one-fourth.

Type: Brazil: "Habitat silvis arenosis maritimis ad Agrostopolim;" type specimen not seen. presumably not extant.

Known only from southeastern Brazil (Map 13).

According to Meissner, this is the plant of highland regions. Flowering, according to Velloso, is in June and July. The only fruiting specimen examined in the present study was collected in late August. No flowering specimen was available for study. This was the first species of the genus described from South America, but under Convolvulus, and as such has been much confused with B. burchellii, to which it seems to be closely related. Large, glabrate, elliptic or oblong-elliptic leaves with impressed veins are its most distinctive feature.

Choisy (1845) included this species under his Breweria burchellii. Hallier realized its distinction from Bonamia burchellii, but its limits, as conceived by him, are somewhat doubtful because of his inclusion of Gaudichaud 567 as var. velutina, a specimen which should properly be assigned to B. burchellii because of its pilose ovary and tomentose leaves.

Specimen examined:
BRAZIL: Minas Geraes: Dist. Ilheu, Fazenda da Tabunha, main road to northwest in cut-over woods, alt. 210 m., woody vine climbing trees, green fruit, Ynes Mexia 4999, August 24, 1930 (BM, F, G, GH, MO, NY, UC, US).

37. Bonamia burchellii (Choisy) Hall. f. Bot. Jahrb. 16:529. 1893.
Breweria burchellii Choisy, Mem. Soc. Phys. Hist. Nat. Geneve 6:493. 1833.
Ipomoea terminalis Choisy, Mem. Soc. Phys. Hist. Nat. Geneve 8:54. 1838.
Ipomoea lundii Choisy, Mem. Soc. Phys. Hist. Nat. Geneve 8:56. 1838.
Bonamia agrostopolis var. velutina Hall. f. Bull. Herb. Boiss. 5:1005, 1897. Type: Gaudichaud 567 (G!).
Convolvulus agrostopolis var. burchellii (Choisy) O. Ktze. Rev. Gen. 3 (2):212. 1898.

Perennial, woody climbing vines. Stems twining or scandent, terete, 1.5-1.9 m. long (according to Meissner, 1869), slender or as thick as 4-5 mm., tomentose, villous or puberulous when young, glabrous or rarely puberulous in age, sparsely white-dotted, more densely so on older region; internodes mostly 4-7 (-10) cm. long, shorter on younger branches. Leaves petiolate, herbaceous, densely tomentose or velutinous on both surfaces, dark green above, light

green below; petioles 8-25 mm. long, tomentose, canaliculate above; blades ovate or ovate-acuminate, mostly 3-10 cm. long, 2.5-7 cm. broad, slightly shorter or narrower on the upper leaves, slightly undulate or subundulate at the margin, rounded, truncate or rarely subcordate at the base, acuminate, shortly acuminate-mucronate or acute-mucronate, rarely obtuse-mucronate at the apex; veins obscure or rarely slightly impressed above, prominent below; lateral veins 4-7 pairs; intercostal veins more distinct below, subparallel. Inflorescences multiflorus, pedunculate panicles, axillary to the leaves or terminal on the lateral branchlets; peduncles slender, variable in length, tomentose; pedicels 3-5 mm. long, slender, tomentose; bracts and bracteoles small, scale-like, linear or linear-lanceolate, 2-3 mm. long, deciduous. Sepals coriaceous, ovate, orbicular or ovate-orbicular, slightly unequal or subequal; outer two are smaller, mostly 3-4 mm. long, 2-3 mm. broad, sericeous or glabrate, obtuse, rounded or rarely broadly acute at the apex; inner sepals orbicular, 3.5-4.5 mm. long, densely sericeous outside at the center, glabrous at the margin, rounded or emarginate at the apex. Corolla white and with purplish or dark-colored eye or purple, infundibuliform, 2-2.5 cm. long, densely fulvous-sericeous (while young) and becoming fine-sericeous (in age) on interplicae. Stamens included; filaments filiform, shorter than styles, glabrous above, villous below; anthers oblong 2-3 mm. long, dorsifixed. Ovary ovoid-conical, pilose or sericeous at least near the apex; styles bifid to the middle or lower, filiform, glabrous, rarely with soft, scattered hairs on the lower part, longer than filaments; stigmas reniform or subbilobed. Capsules ovate-conical, 1-1.5 cm. long, brown or dark-brown, with hard thick wall, opening into two or four valves, 4-seeded, rarely 2-seeded; seeds ovoid or ellipsoid, 5-7 mm. long, densely long-pilose along the edge, densely sericeous or tomentose on the dorsal and ventral sides. Cotyledons ovate-cordate, corrugate.

Type: Brazil, Burchell 2778 (K-lectotype-not seen, GH-isotype!).

From the specimens examined, this species seems to be localized in coastal regions of southeastern Brazil (Map 14). Its habitat is not known except for shallow sandbanks (restinga) recorded by one collector. It has been collected in flower from December to April; fruiting specimens bear no date of collection.

This species is closely related to B. agrostopolis and B. tomentosa, from both of which it is poorly defined. Future study may find these three merely as varieties of a single species.

Specimens examined:

BRAZIL: Rio de Janeiro, Burchell 2778 (F, GH, L, NY): Rio de Janeiro, Jacarepagua in fruticetis, P. Dusen 1985, 22. 3. 1903 (F, GH, US); Rio de Janeiro, M. Gaudichaud 567, 1833 (G); Cosme Velho a' Laranjeiras (Rio de Jan.), cipo, flores rosadas, Glaziou 4142 (BM, NY, R); Env. de Rio de Janeiro, Glaziou 13027, 1882 (G); Flore des environs de Rio de Janeiro, Glaziou 13037 (G); Environs of Rio de Janeiro, Glaziou 14127, 1882 (K); Morro da Babylonia (R. J.) cipo, fl. blancas, Glaziou 18381, March 29, 1891 (NY, R);


Distribution of
B. burchellii
B. tomentosa
B. subsessilis
B. mattogrossensis

Map 14

Forest, Lindley, 1840 (K); Restinga da Tijuca, Estado da Juanabara, Othon Machado, 21. 12. 1943 (RB); Restinga da Gavea, Estado da Juanabara, Othon Machado (RB); Schling pflanze bei Jacarepagua, E. Ule 4675, May, 1898 (HBG).

38. Bonamia tomentosa Hassler, Repert. Sp. Nov. 9:148. 1911.

Perennial, woody, high-climbing vines. Stems scandent or twining, terete, 6-8 m. long (according to Hassler), slender or as thick as 4-6 mm., densely fulvous-tomentose while young, sparsely puberulous or nearly glabrous in age; bark smooth or warty-plicate, with few or numerous lenticels; internodes mostly 3-6 cm. long, occasionally shorter or reduced on the younger branches. Leaves petiolate, herbaceous, densely tomentose, fulvous-tomentose or velutinous on both surfaces, dark green and occasionally glabrescent above, pale green below; petioles 10-30 (-40) mm. long, canaliculate above, densely tomentose or rarely becoming sparsely tomentose; blades ovate, ovate-elliptic or occasionally suborbicular, or subcordate, mostly 5-11 cm. long, 4.5-10 cm. broad, entire or slightly undulate at the margin, subcordate or truncate at the base, obtuse-mucronate, emarginate, rounded-mucronate or rarely short-acuminate at the apex; veins very prominent below; lateral veins 6-8 pairs; intercostal veins obscure above, prominent below. Inflorescences axillary or terminal pseudopanicles or panicles, multiflorus; peduncles short, variable in length, densely tomentose; pedicels short, 3-5 mm. long, tomentose, bracts linear or linear-lanceolate, 2-3.5 mm. long, deciduous; bracteoles similar to bracts, smaller, persistent or deciduous. Sepals coriaceous, ovate or ovate-orbicular, slightly unequal or subequal; outer two smaller 4-6 mm. long, 3-4 mm. broad, tomentose or glabrescent near the margin, obtuse or rounded at the apex; inner three larger, suborbicular, 5-8 mm. long, densely sericeous or tomentose outside, emarginate at the apex, scarious at the margin. Corolla white, infundibuliform-campanulate, 2.3-2.8 cm. long, lobulate or subentire, soft-sericeous or short pilose on interplicae. Stamens included; filaments short, glabrous above, villous or puberulous below; anthers oblong, 2-3 mm. long, dorsifixed. Ovary conical or ellipsoid-conical, glabrous or sparsely pilose; styles bifid to the middle or lower, filiform, longer than filaments, glabrous; stigmas reniform or capitate-subbilobed, papillose-verrulose. Fruits not known.

Type: Paraguay: In viciniis Caaguazu, E. Hassler 9038, 1905 (G-lectotype, BM, F, MO, NY, W-isotypes!)

Known from southeast coastal region of Brazil to Paraguay (Map 14).

According to Hassler, this is a plant of calcareous areas. It has been collected in flower in March but its fruiting period is not known. One is struck by the close relationship of this species to B. burchellii, and study of future collections may show it to be only a variety of the latter. From this species, it seems to

differ by its emarginate, obtuse-mucronate or rounded leaves (subcordate or truncate at the base), slightly larger sepals and distinctly white corolla. Hassler, in describing B. tomentosa, noted a supposed close relationship to B. agrostopolis.

Specimens examined:
BRAZIL: Ilha do Governador, Distrito Federal, G. Pabst (4.424) 4908, 30. 3. 1958 (F).
PARAGUAY: Hernandarias, Sta. Teresa, Bertoni 4887, 9. III. 1950 (L, W); In viciniis Caaguazu, frutex scandens 6-8 m., corolla alba, E. Hassler 9038, 1905 (BM, F, G, MO, NY, W); Regio calcarea cursus superioris fluminis Apa, alt. 5-8 m., petala blanca, Hassler 11044, 1912-13 (A, G, MO, NY, UC, US).

39. Bonamia subsessilis Hassler, Repert. Sp. Nov. 9:149. 1911.

Perennial, high climbing vines. Stems woody, twining, terete, 2-4 mm. thick or slightly thicker, about 4 m. long, densely brown villous or tomentose when young, becoming glabrous or minutely puberulous in age; old branches with purplish bark, minutely verruculose-punctate, longitudinally plicate-rugose; internodes 4-10 cm. or slightly longer. Leaves petiolate, soft, subcoriaceous or submembranous, dark green and softly tomentose above, grey-green and densely tomentose on the lower surface; petioles 5-20 mm. long, canaliculate above, fulvous-tomentose; blades ovate or ovate-orbicular, 7-13 cm. long and 6-10 cm. wide (upper leaves subtending individual cymes much smaller), subcuneate or obtuse-acute at the base, obtuse-mucronate, rounded-mucronate, acute-mucronate or emarginate-mucronate at the apex; lateral veins 6-9 pairs; intercostal veins conspicuous, subparallel. Inflorescences axillary, racemes or panicles, composed of sessile or subsessile cymes of 1-5 flowers; raceme rachis 10-60 mm. or longer, tomentose with brown hairs; individual cymes sessile or subsessile; pedicels and peduncles very short or absent; bracts and bracteroles small, lanceolate, 2-3 mm. long-tomentose. Sepals coriaceous or subcoriaceous, equal or slightly unequal, orbicular, ovate or ovate-orbicular; outer sepals 4-5 mm. long, 3-4 mm. broad, densely tomentose or ferrugineous outside, glabrous inside, obtuse or rounded at the apex; inner sepals 5-6 mm. long, 5 mm. broad, sparsely tomentose or nearly glabrous outside, glabrous inside, rounded or emarginate at the apex. Corolla white, campanulate-infundibuliform, about 2 cm. long, entire or subentire at the margin, fulvous-pilose on interplicae. Stamens included; filaments villous; anthers oblong, 2-3 mm. long, dorsifixed. Ovary ovoid-conical, glabrous; styles bifid to the middle or lower, glabrous; stigmas reniform or subbilobed. Capsules not known.

Type: Paraguay: Caballero-cue (Zwischer Rio Apa und Rio Aquidaban), Trochnen Camp, mit Bursch bewaldete Anhohe, bis 4 m. hoch, kletternd, Weiss, K. Fiebrig 4764, February, 1908-1909 (G-lectotype, BM, GH, L-isotypes!).

Dry highland of northern Paraguay near the Brazilian border (Map 14). It is known only from the type collection, which was collected in flower.

Although the author of this species stated that it is related to B. tomentosa, it seems to be more closely related to the Brazilian species, B. mattogrossensis, from which it differs only by a white corolla and sepals glabrous inside. Future study might prove B. subsessilis and B. mattogrossensis to be conspecific.

40. Bonamia mattogrossensis Hoehne, An. Mem. Inst. Butantan 1 (fasc. 4): 45, tab. 4. 1922.

Perennial, high climbing vines. Stems woody, terete, twining or scandent, 2-4 mm. thick or thicker, densely brown-tomentose or ferrugineous when young, becoming glabrous in age; old branches sparsely punctate or with scattered, white lenticels. Leaves petiolate, soft, thick, subcoriaceous, densely soft-velutinous and dark green above, densely brown-tomentose or ferrugineous and light green underneath; petioles 1-2 cm. long, mostly 1.5-2 mm. thick, canaliculate above, densely tomentose or becoming sparsely puberulous in age; blades ovate, ovate-elliptic or ovate-acuminate, 5-12 cm. long, 3.5-8 cm. broad (slightly smaller on upper leaves), attenuate, subattenuate, obtuse or rarely subcordate at the base; acuminate, obtuse-mucronate or rounded-mucronate at the apex; lateral veins 6-10 pairs, with distinct intercostal veins. Inflorescences axillary, sessile cymes of 3-7 flowers or on axillary short branches forming panicles composed of sessile cymes or axillary racemes; individual flowers sessile or subsessile; bracts and bracteoles small, 1-3 mm., lanceolate-linear, deciduous. Sepals coriaceous, equal or slightly unequal; outer two sepals ovate, 4-5 mm. long, 3.5-4.5 mm. wide, densely tomentose or ferrugineous outside, densely sericeous inside except glabrous center, obtuse-acute or broadly acute at the apex; in-out sepal (third sepal) oblique or orbicular-oblique, densely tomentose outside except glabrous inner margin, densely soft-sericeous inside on the outer margin, glabrous at the center and on the inner margin; inner two sepals orbicular or obovate-orbicular, sparsely or densely tomentose outside at the center, nearly glabrous at the margin, glabrous inside, rounded, truncate or slightly emarginate at the apex. Corolla purple, pale purple or violet, campanulate-infundibuliform, mostly 2 cm. long, subentire, entire or slightly lobulate at the margin, brown-pilose or villous with brownish long hairs on interplicae. Stamens included; filaments villous, at least lower parts; anthers oblong or narrowly elliptic-oblong, 2-3 mm. long, dorsifixed. Ovary oblong-conical or ovoid-conical, glabrous; styles bifid to the middle or lower, with distinct stylopodia, glabrous or with scattered hairs; stigmas reniform or subbilobed. Capsules not known.

Type: Brazil: Mato-Grosso: Commissao Rondon, Coxipo da Ponte, Cuiaba. flor. alvo-arroxeada, F.C. Hoehne 4655, em Marco (1911) (R-lectotype!).

Known only from the type location in the northern part of Mato-Grosso in western Brazil (Map 14). According to the author of the species, the plant grows in dry regions. Further collections are desired, since fruit, seeds and definite flowering and fruiting

periods are not yet known. The only material available for the present study was collected in flower.

The outstanding features of this species are (1) sessile flowers, (2) large leaves, slightly cuneate at the base, (3) outer sepals sericeous inside and (4) corollas purple. It is closely related to B. subsessilis or Paraguay, from which it differs only by its outer sepals being sericeous inside and a purple corolla. This species is separable, although not clearly, into two varieties.

40a. Bonamia mattogrossensis Hoehne var. mattogrossensis.

This variety is characterized by ovate-acuminate or ovate-elliptic leaves, acute, acuminate or rarely obtuse-acuminate and mucronate at the apex, cuneate or subcuneate at the base, and long raceme-rachis.

Known only from the type collection.

40b. Bonamia mattogrossensis Hoehne var. obtusifolia Hoehne, An. Mem. Inst. Butantan 1 (fasc. 4):46, tab. 5. 1922.

This variety differs from the typical variety by its smaller, ovate, obovate or broadly elliptic leaves, rounded, truncate or obtuse and mucronate at the apex, and short raceme-rachis or inflorescence axillary and sessile.

Type: Brazil: Mato-Grosso: Commissao Rondon, Coxipo da Ponte, Cuiaba, flor roxa, F.C. Hoehne 3039, 3. 1911 (R-lectotype!).

Known only from the type collection from western Brazil.

Little-Known Species

The following species are poorly known and no specimens were available for study. The descriptions given here are based on the original descriptions. If material becomes available for comparison, they may prove to be merely abnormal forms or local variants of the other species covered previously. They are included here to make this study as complete as possible.

41. Bonamia abscissa (Choisy) Hall. f. Bull. Herb. Boiss. 5:812. 1897.
Breweria abscissa Choisy, in DC. Prodr. 9:438. 1845.

Stems elongate, ferrugineous. Leaves petiolate, slightly ferrugineous or glabrate; petioles 2.5 cm. long, ferrugineous; blades cordate-ovate, 5-7.5 cm. long, entire at the margin, slightly acuminate at the apex. Flowers axillary, mostly solitary; peduncles not equalling petioles; pedicels ferrugineous. Sepals ovate-orbicular, 6-8 mm. long, subequal, ferrugineous outside, acutish at the apex. Corolla red, campanulate, 2.5-3.2 cm. long, truncate or

entire at the margin. Ovary villous; styles bifid almost to the base. Capsules glabrous.

Type: Madagascar, Bojer.

Reported from woods at Mooza in eastern Madagascar.

In many characteristics this species resembles B. semidigyna, to which it must be closely related. Hallier treated B. abscissa under B. semidigyna in his earlier paper (1893), but later (1897) he treated the two as distinct species. According to Hallier, this species differs from B. semidigyna by its red corolla with truncate or entire limb and uniflorous inflorescence.

42. Bonamia boivinii Hall. f. Bot. Jahrb. 18:91. 1894.

Stems woody, elongate, twining, terete, glabrous; lower internodes 10 cm. long. Leaves shortly petiolate, glabrous; blades ovate, 4 cm. long, 15 mm. broad, gradually smaller toward the apex of stem, falcate-recurved and folded, subacute at the base, acute and mucronate at the apex. Inflorescences dense, multiflorous, terminal, composed of dichasial cymes or subumbellate, shortly pedunculate; flowers small; peduncles short, 2 cm. long, longer than petioles, finely subsericeous; bracteoles small, aggregate, scale-like. Sepals coriaceous, orbicular, equal, glabrous, black, ciliate at the margin. Corolla (not yet unfolded) sericeous outside.

Type: Northwest Madagascar: Ins. Nossi-be, Boivin, 1853.

This species was offered by Hallier as new with an accompanying description far too brief for satisfactory comparison with other species. From the description, it seems to be similar to B. densiflora, except in leaves. Hallier designated the type specimen as deposited at the herbarium of Boissier; this specimen cannot be located.

43. Bonamia langsdorffii (Meissn.) Hall. f. Bull. Herb. Boiss. 5:814. 1897.
Breweria Langsdorffii Meissn. in Martius, Fl. Bras. 7:325. 1869.

Stems slender, perhaps twining, adpressed-pilose or glabrate. Leaves petiolate, subcoriaceous; petioles 2-6 mm. long, slender, canaliculate; blades ovate or oblong-elliptic, 2.5-4.2 cm. long, 1.7-2.5 cm. broad, entire or slightly wavy at the margin, slightly cordate at the base, obtuse-mucronate at the apex. Flowers solitary, axillary, pedunculate; peduncles unequal with the leaves, pubescent; pedicels as long as peduncles, the two together 1.8-2 cm. long; bracts two, opposite, minute, about 2 mm. long, acute. Sepals ovate, 8 mm. long, 4-5 mm. broad, coriaceous-herbaceous, equal, obtuse, glabrous. Corolla white (?), broadly infundibuliform, 2-2.5 cm. long, slightly less than 2.5 cm. in diameter at the limb, pilose outside on interplicae. Styles shorter than corolla, filiform, bifid, connate for lower 4 mm.

Type: Brazil: Rio de Janeiro, Langsdorff.

This species is very closely allied to, and perhaps conspecific with, B. burchellii, B. agrostopolis or B. tomentosa, from which it differs by its solitary flowers.

44. Bonamia capitata (Dammer) v. Ooststroom, Rec. Trav. Bot. Neerl. 33:212. 1936.
Prevostea capitata Dammer, Bot. Jahrb. 23 (Beibl. 57):36. 1897.

Shrubby plants; branches tomentose. Leaves closely spaced, sessile, coriaceous, pubescent above, grey-tomentose below, the margin revolute; blades lanceolate, rounded at the base, mucronate at the apex; nerves scarcely prominent below. Inflorescences terminal, of densely compacted, subglobose cymes. Sepals lanceolate, setose-acuminate at the apex, the outer somewhat larger, densely pilose, ciliate on margins. Corolla blue, densely pilose on upper part (interplicae?). Styles bifid to the middle, pilose at the base; stigmas reniform, capitate. Fruits not known.

Type: Brazil: "Civitate Goyaz ad Fazenda da Boa Vista in Campo," Glaziou 21799, Jan. 14, 1895; not seen.

Known only from south-central Brazil.

As noted by Dammer, this species appears well marked by its distinctive inflorescences. It would seem allied to B. tomentosa and B. subsessilis.

45. Bonamia sedderoides Rendle, Jour. Bot. 46:178. 1908.

Spreading undershrub. Stem 4-6 dm. long, 2 mm. thick, slender, covered with silky, whitish hairs. Leaves 1.3 cm. long, 3 mm. wide. Bracteoles 7-8 mm. long. Sepals 1.1-1.2 cm. long, 5 mm. broad. Corolla probably 2.5 cm. long. Stamens 8 mm. long; anthers linear-oblong, 3 mm. long. Styles free nearly to the base.

Type: Southeast Angola, in shrub-grown pasturage on sandy alluvial soil at the foot of the Serra Ferreire de Amiral, western side, Gossweiler 2888, February 9 (BM-holotype, K-isotype); not available.

Doubtful and Excluded Species

Doubtful Species

Bonamia vignei Hoyle, Kew Bull. 1934:188. 1934.

Although the author of this species stated that it is related to B. cymosa (=B. thunbergiana of the present treatment), it appears to be quite different from the latter in several features, especially

by its accrescent sepals, which are not characteristic of the genus Bonamia. Since no specimen was available for the present study, its transfer to the genus Calycobolus is not attempted here.

Excluded Species

Bonamia althoffiana Dammer, Pflanz. Ostafr. C:329. 1895.
=Convolvulus kilimandschari Engler, Hochgeb. Trop. Afr. 348. 1392.

Bonamia angustifolia (Nash) Wilson, Jour. Arnold Arb. 41:306. 1960.
=Stylisma patens (Desr.) Myint, ssp. angustifolia (Nash) Myint, Brittonia 18:112. 1966.

Bonamia aquatica (Walt.) Gray, Man. ed. 5. 376. 1867.
=Stylisma aquatica (Walt.) Raf. Fl. Tell. 4:83. 1838.

Bonamia capensis (Baker) Burtt Darvy, Ann. Trans. Mus. 3:121. 1912.
=Seddera capensis (Meyer) Hall. f. Bot. Jahrb. 18:86. 1893.

Bonamia glomerata (Balf. f.) Hall. f. Bot. Jahrb. 18:90. 1893.
=Seddera glomerata (Balf. f.) O. Schwartz, Mitt. Inst. Allgemeine Bot. Hamburg 10:1971. 1939.

Bonamia humistrata (Walt.) Gray, Proc. Am. Acad. 5:337. 1862.
=Stylisma humistrata (Walt.) Chapm. Fl. S. U. S. ed. 1, 346. 1860.

Bonamia michauxii (Fern. and Schub.) Wilson, Jour. Arnold Arb. 41: 306. 1960.
=Stylisma aquatica (Walt.) Raf. Fl. Tell. 4:83. 1838.

Bonamia patens (Desr.) Shinners, Castanea 27:75. 1962.
=Stylisma patens (Desr.) Myint, Brittonia 18:110. 1966.

Bonamia pickeringii (Torr. ex Curtis) Gray, Man. ed. 5. 376. 1867.
=Stylisma pickeringii (Torr. ex Curtis) Gray, Man. ed. 2. 335. 1856.

Bonamia poranoides Hall. f. Bull. Herb. Boiss. 5:1007. 1897.
=Metaporana densiflora (Hall. f.) N.E. Brown, Kew Bull. 1914: 169. 1914.

Bonamia schizantha (Hall. f.) Meeuse, Bothalia 6:665. 1957.
=Seddera schizantha Hall. f. Bull. Herb. Boiss. 6:532. 1898.

Bonamia spinosa Vierhapper, Oesterr. Bot. Zeitschr. 287. 1904.
=?Seddera sp. or ?Convolvulus socotranus Verdcourt, Kew Bull. 1957:344.

Bonamia suffruticoa (Schinz) Burtt-Davy, Ann. Transvaal Mus. 3:121. 1912.
=Seddera suffruticosa (Schinz) Hall. f. Bot. Jahrb. 18:88. 1893.

Bonamia villosa (Nash) Wilson, Jour. Arnold Arb. 41:306. 1960.
=Stylisma villosa (Nash) House, Bull. Torr. Bot. Club 34:149. 1907.

Bonamia volkensii Dammer, Pflanz. Ostafr. C:329. 1895.
=Hewittia sublobata (L.f.) O. Ktze. Rev. Gen. Pl. 2:441. 1891.

Breweria africana (G. Don) Benth. and Hook. f. Gen. Pl. 2:877. 1876.
=Calycobolus africanus (G. Don) Myint, comb. nov.

Breweria alsinoides Merrill, Interpr. Rumph. Herb. Amboin. 46. 1917.
=Evolvulus alsinoides (L.) L. Sp. Pl. ed. 2. 392. 1762.

Breweria alternifolia Radlk. Abhandl. Nat. Ver. Bremen 8:413. 1884.
=Calycobolus africanus (G. Don) Myint, supra.

Breweria angustifolia Nash, Bull. Torr. Bot. Club 22:155. 1895.

=Stylisma patens (Desr.) Myint, var. angustifolia (Nash) Myint, Brittonia 18:112. 1966.

Breweria aquatica (Walt.) Gray, Syn. Fl. N. Am. 2 (1):217. 1878.
=Stylisma aquatica (Walt.) Raf. Fl. Tell. 4:83. 1838.

Breweria argentea Terrace, Ann. Inst. Bot. Roma 5:104. 1893.
=Seddera latifolia Hochst. and Steud. Flora 27, Beil. 8, t. 5. 1844.

Breweria baccharoides Baker, Kew Bull. 1894:68. 1894.
=Seddera suffruticosa (Schinz) Hall. f. Bot. Jahrb. 18:88. 1893.

Breweria campanulata Baker, Kew Bull. 1894:68. 1894.
=Calycobolus campanulatus (Baker) Myint, comb. nov.

Breweria capensis (Meyer) Baker, in Dyer, Fl. Cap. 4 (2):80. 1904.
=Seddera capensis (Meyer) Hall. f. Bot. Jahrb. 18:86. 1893.

Breweria choisyana Steud. Nomencl. ed. 2, 1:224. 1840.
=Seddera evolvuloides (Choisy) Wight, Icon. 4 (2):13, t. 1369. 1848.

Breweria Codonanthus Baker ex Oliver, Hook. f. Icon. pl. 23.
=Calycobolus africanus (G. Don) Myint, supra.

Breweria conglomerata Baker, Kew Bull. 1894:68. 1894.
=Seddera conglomerata (Baker) Hall. f. Bull. Herb. Boiss. 5:1008. 1897.

Breweria evolvuloides R. Br. Salt. Abyss. App. 65. 1814.
=Seddera arabica (Forsk.) Choisy, in DC., Prodr. 9:441. 1845.

Breweria evolvuloides Choisy, Mem. Soc. Phys. Genev. 6:494. 1833.
=Seddera evolvuloides (Choisy) Wight, Icon. 4 (2):13, t. 1369. 1848.

Breweria evolvuloides Vatke, Linnaea 43:523. 1882.
=Seddera latifolia Hochst. et Steud. Flora, Beil. 8, t. 5. 1844.

Breweria fastigiata Balf. f. Proc. Roy. Soc. Edin. 12:83. 1883.
=Convolvulus socotranus Verdcourt, Kew Bull. 1957:344. 1957.

Breweria glaucata Peter, in Engler and Prantl., Naturl. Pflanzenfam. 4 (3a):17. 1897.
=Seddera glomerata (Balf. f.) O. Schwartz, Mitt. Inst. Allgemeine Bot. Hamburg 10:1971. 1939.

Breweria glomerata Balf. f. Proc. Roy. Soc. Edin. 12:83. 1883.
=Seddera glomerata (Balf. f.) O. Schwartz, l. c. 1939.

Breweria Hassleriana Chod. Bull. Herb. Boiss. Ser. II. 5:683.
=Convolvulus hasslerianus (Chod.) O'Donell, Lilloa 23:430. 1950.

Breweria heudelotii Baker, Kew Bull. 1894:68. 1894.
=Calycobolus heudelotii (Baker) Myint, comb. nov.

Breweria hispida Franchet, Sert. Somal. p. 43. 1882.
=Seddera somalensis (Vatke) Hall. f. Bot. Jahrb. 18:90. 1893.

Breweria humistrata (Walt.) Gray, Syn. Fl. N. Am. 2 (1):217. 1878.
=Stylisma humistrata (Walt.) Chapm. Fl. S. U. S. ed. 1, 346. 1860.

Breweria intermedia Hochst. Flora 27, Beil. 8. 1844.
=Seddera intermedia Hochst. et Steud. Flora 27, Beil. 8. 1844.

Breweria latifolia Hochst. Flora 27, Beil. 8. 1844.
=Seddera latifolia Hochst. and Steud., Flora 27, Beil. 8, t. 5. 1844.

Breweria linifolia Spreng. Syst. 1:614. 1825.
=Wahlenbergia linarioides (Lam.) A. DC. in DC. Prodr. 7(2):440. 1839.

Breweria malvacea Klotzsch, in Peters, Reise Mossamb. Bot. 245. t. 37. 1861.
=Astripomoea malvacea (Klotzsch) Meeuse, Bothalia 6:710. 1957.
Breweria mexicana Hemsl. Biol. Central Am. Bot. 2:400. 1882.
=Calycobolus velutinus (Mart. and Gal.) House, Bull. Torr. Bot. Club 34:14. 1907.
Breweria michauxii Fern. and Schub. Rhodora 51:37. 1949.
=Stylisma aquatica (Walt.) Raf. Fl. Tell. 4:83. 1838.
Breweria microcephala Baker, Kew Bull. 1894:68. 1894.
=Seddera welwitschii Hall. f. Bot. Jahrb. 18:88. 1893.
Breweria minima Gray, Proc. Am. Acad. 17:228. 1881-82.
=Convolvulus simulans L.M. Perry, Rhodora 33:76. 1931.
Breweria mirabilis Baker ex Oliver, Hooker. f. Icon. Pl. 23, t. 2276. 1894.
=Calycobolus campanulatus (Baker) Myint, supra.
Breweria montevidensis Peter, in Engler et Prantl., Naturl. Pflanzenfam. 4 (Abt. 3a):16. 1897.
=Convolvulus ottonis Meissn. in Martius, Fl. Bras. 7:311. 1869.
Breweria oxycarpa A. Rich. Tent. Fl. Abyss. 2:76. 1851.
=Seddera arabica (Forsk.) Choisy in DC. Prodr. 9:441. 1845.
Breweria parviflora Arn. ex Steud. Nomencl. ed. 2, 1:224. 1840.
=Seddera evolvuloides (Choisy) Wight, Icon. 4 (2):13, t. 1369. 1848.
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=Seddera pedunculata (Balf. f.) Hall. f. Bull. Herb. Boiss. 5: 1010. 1897.
Breweria pickeringii (Torr. ex Curtis) Gray, Syn. Fl. N. Am. 2 (1): 217. 1878.
=Stylisma pickeringii (Torr. ex Curtis) Gray, Man. ed. 2, 335. 1856.
Breweria rotundifolia Watson, Proc. Am. Acad. 23:281. 1888.
=Evolvulus rotundifolius (Watson) Hall. f. Bot. Jahrb. 16:530. 1893.
Breweria scoparia Lindl. Fl. Med. 400. 1838.
=Convolvulus scoparius L. f. Suppl. 135. 1781.
Breweria sessiliflora Baker, Kew Bull. 1894:68. 1894.
=Seddera suffruticosa (Schinz) Hall. f. Bot. Jahrb. 18:88. 1893.
Breweria somalensis Vatke, Linnaea 43:523. 1882.
=Seddera arabica (Forsk.) Choisy in DC. Prodr. 9:441. 1845.
Breweria suffruticosa Schinz in Verh. Bot. Ver. Brand. 30:275. 1888.
=Seddera suffruticosa (Schinz) Hall. f. Bot. Jahrb. 18:88. 1893.
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=Stylisma humistrata (Walt.) Chapm. Fl. S. U. S. ed. 1, 346. 1860.
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Breweria trichosanthes (Michx.) Small, Fl. S. E. U. S. 595. 1903.
=Stylisma patens (Desr.) Myint, Brittonia 18:110. 1966.
Breweria valerianoides Villar, Nov. App. 143. 1880.

=Jacquemontia paniculata (Burm. f.) Hall. f. Bot. Jahrb. 16: 541. 1893.

Breweria villosa Nash, Bull. Torr. Bot. Club 22:154. 1895.
=Stylisma villosa (Nash) House, Bull. Torr. Bot. Club 34:149. 1907.

Breweria virgata Vatke, Linnaea 43:523. 1882.
=Seddera virgata Hochst. et Steud. Flora, Beil. 8, t. 5. 1844.

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Appendix

New Names and Combinations

New species:

B. brevipedicellata Myint & Ward

New varieties:

B. media var. *emarginata* Myint & Ward
B. menziesii var. *rockii* Myint & Ward

New forms:

B. trichantha var. *ovata* forma *glabrata* Myint & Ward

New combinations:

B. elliptica (Smith & Schubert) Myint & Ward
B. semidigyna var. *semidigyna* f. *ambigua* (Hall. f.) Myint & Ward
B. sulphurea (Brandg.) Myint & Ward

New combinations in *Calycobolus*:

C. africanus (G. Don) Myint
C. campanulatus (Baker) Myint
C. heudelotii (Baker) Myint