

DE PLANTIS TOXICARIIS E MUNDO NOVO TROPICALE COMMENTATIONES I

BY

RICHARD EVANS SCHULTES

As our phytogeographical and ethnobotanical knowledge of the New World tropics increases, additional information on the wealth of toxic plants in the flora of this area is brought to light. Only a small fraction of the hundreds of poisonous species already known has been subjected to chemical and pharmacological study. In addition to those species that have long been recognized as toxic, there are many still to be found—a number of them in families never considered as possessing chemical constituents with marked biological activity.

It would seem that one of the best methods of stimulating concentrated and thorough study of the toxic plants of the New World tropics might be to make available little known or hitherto unreported information on species that are recognized as definite poisons or which, for one reason or another, are suspected of being poisonous. I have, consequently, decided to begin a series of articles with this purpose in mind. They will form part of more extensive investigations into the poisonous plants of the New World tropics which I have been carrying out since 1941 and which is currently being supported by a grant from the National Institutes of Health (No. LM-GM 00071-01).

The sources of the information in this series of articles

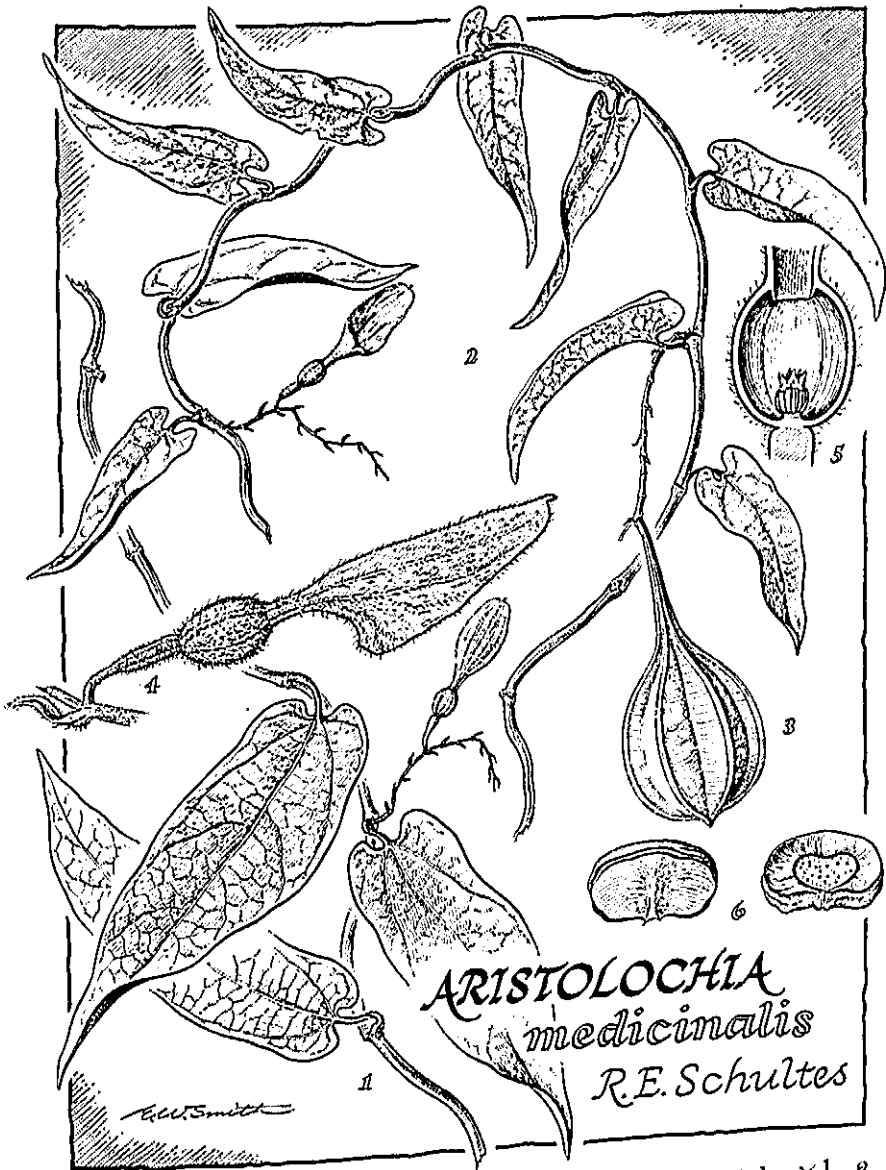
will be varied. Many of the data will be culled from my own ethnobotanical field notes, especially from those gathered in northwestern South America from 1941 to the present time. A wealth of mostly unpublished reports from labels on herbarium specimens has accrued as a result of a search through the more than two million sheets in the Harvard University Herbaria carried out under the direction of Dr. Siri von Reis Altschul of the Botanical Museum of Harvard University and supported by grants from Smith, Kline & French Company, by Eli Lilly Company and (mainly) by the National Institutes of Health (von Reis, S. "Herbaria: sources of medicinal folklore" *Econ. Bot.* 16 (1962) 283-287). Still more data are occasionally found in old or rare books and manuscripts, and information of this kind is often overlooked, if indeed it is even available to research workers. It is hoped that a combination of these and possibly other sources of information may materially advance our understanding of the frontier that still exists for intensive and extensive studies of the toxic plants of the tropical parts of the Western Hemisphere.

While I realize that investigations of toxic plants amongst the cryptogams, especially the fungi, is almost untouched for the American tropics, I must restrict my studies to the spermatophytes. It is to be hoped that one day soon a study of the rich and virgin field of toxic cryptogams of the New World tropics will be adequately undertaken.

ARISTOLOCHIACEAE

Aristolochia medicinalis R. E. Schultes sp. nov.

Frutex scandens, extensus. Caulis volubilis; rami volubiles, teretes, inconspicue striolati, fusco-brunneo, cum cortice tenui, minutissime puberulente. Folia exstipulata, chartacea, oblonga, apice acuminata, basi valde cordata, petiolata (petiolo robusto, plus minusve



ARISTOLOCHIA
medicinalis
R. E. Schultes

Aristolochia medicinalis R. E. Schultes. 1, habit, approximately $\times \frac{1}{2}$. 2, habit, approximately $\times \frac{1}{2}$. 3, fruit, approximately $\times \frac{1}{2}$. 4, lateral view of flower, $\times 2$. 5, longitudinal section of bulbous basal portion of perianth, showing genitalia, $\times 3$. 6, seeds, $\times 1\frac{1}{2}$.
Drawn by ELMER W. SMITH

1.5 cm. longo, minutissime pulverulente), nervis laterali-
bus quattuor vel quinque supra glaberrima, vivo nitida
et atroviridia, siccitate stramineo-viridia, nervis non con-
spicue elevatis, subtus pallide viridia, nervis omnibus
prominenter elevatis, statu juvenile minutissime fusco-
tomentulosa, sine petiolo usque ad 12 cm. longa, 4.5 cm.
lata. Flores in racemis laxis, multifloribus et axillaribus,
plus minusve 4 cm. longis, pedunculo minutissime pul-
verulente, gracile. Perianthii pars basalis ovoidea-
dilatata, plus minusve 10 mm. longa, 6 mm. in diametro,
intus glabra, extus pilis longis appressis subdense obtecta;
tubus asymmetricus obconicus, usque ad 10 mm. longus,
basi 4 mm. sed apice plus minusve 12 mm. diametriens,
intus glabrus, extus subdense pilosus, in faucis ore con-
spicue inciso; limbus oblongo-lanceolatus vel ovalis,
apice truncatus sed mucronatus vel prominenter apicu-
latus, 20 mm. longus, usque ad 12 mm. latus, intus
glabrus, extus pilosus. Columna genitalis plus minusve
3 mm. longa, breviter stipitata, per 0.5 mm. sex divisa,
lobis pseudostylinis triangularibus, acutis. Stamina sex
columnae adnata, antheris linearibus, quattuor 0.8 mm.
longis, cetera 1.2 mm. longis, longitudinaliter dehiscen-
tibus. Capsula ellipsoideo-ovoidea, costis conspicuis, basi
longe attenuata, apice breviter mucronata, plusminusve
9 cm. longa, 4 cm. in diametro; semina obovoideo-
orbicularia, apice truncata, parte centrale valde cordi-
forme, 0.8 mm. longa, 1.3 mm. lata.

COLOMBIA: Comisaria del Vaupés, Río Kuduyari (tributary of Río
Vaupés). Alt. about 700-800 ft. "Vine. Fruit pendent, green.
Flowers brownish purple, striped with yellow-green." October 16,
1952, Richard Evans Schultes & Isidoro Cabrera 17856 (TYPE in Herb.
Gray).

Aristolochia medicinalis, which falls into Hoehne's sec-
tion *Eaxtipulatae*, seems to correspond vegetatively
rather closely with *A. melastoma* Manso., but the inflores-

cence of the former has many more flowers than that of the latter. It is florally perhaps closer to *Aristolochia acutifolia* Duchtr. *Aristolochia medicinalis* would appear to be somewhat intermediate between these two species. The former species is distributed in southern Brazil; the latter comes from the eastern Amazon south to Ceará.

The flowers of *Aristolochia medicinalis* have externally a longer, appressed indumentum differing from the short, erect hairs of *A. acutifolia*; the apicule of the perianth in the former is larger and more obtuse than that of the latter. There is a significant difference also in the structure of the seeds of the two species; the central part of the seed of *Aristolochia medicinalis* is much smaller and much less deeply cordate than the corresponding heart-shaped area in the seed of *A. acutifolia*, and the whole seed is wider in relation to its height. An interesting floral character of *Aristolochia medicinalis* is the difference in size of the stamens: four shorter and two longer.

The plant is an extensive vine not uncommon on the overhanging vegetation, where the river bank is not subject to deep annual flooding.

This new species is pointed out by the Kubeo Indians of the Río Kuduyarí, who know the plant as *da-ko-to-me*, as both toxic and medicinal. The astringent root is dried and pulverized to prepare a very bitter and pungent infusion given to natives who suffer periodic attacks that would seem to be epileptic in nature. Care must be taken not to employ this infusion too frequently nor in doses too large since, according to native medicine men, it may cause permanent insanity and, sometimes, muscular paralysis.

LEGUMINOSAE

Ormosia Jackson

One of the most interesting groups of toxic legumes is the genus *Ormosia*, a tropical genus of Middle and

South America and southeastern Asia, comprising about 100 species of shrubs and trees.

It is usually the seed that is reputed to be toxic, although the bark is not without suspicion in some species. The seeds of most, if not all, species are probably poisonous to some degree. Normally brightly colored, red and black, the beans are often used in making ornamental necklaces by peoples in primitive societies. The technical name of the genus has, in fact, been derived from a Greek word for *necklace*.

Alkaloids have reputedly been isolated from the seeds of at least nine species (Willaman, J.J. and B.G. Schubert "Alkaloid-bearing plants and their contained alkaloids" U.S.D.A. Techn. Bull. No. 1234 (1961) 120-121). These have been named ormosine, ormosanine, ormosinine and panamine; and N-methylcytisine has been reported from one species. Ormosinine is stated to be morphine-like in physiological action (Henry, T. A. "The plant alkaloids" ed. 4 (1949) 776), while panamine has been found to possess hypotensive properties when applied to dogs. In her outstanding monograph of the American species of this genus, Rudd (Rudd, V.E. "The American species of *Ormosia* (Leguminosae)" Contrib. U.S. Nat. Herb. 32 (1965) 279-384) reviews the sparse chemical and pharmacological literature on *Ormosia* and points out that "the plant names used [in this literature] are not necessarily true taxonomic synonyms, and it is not always possible to know what material the chemist had at hand".

The seeds of some of the species have been employed therapeutically in folk-medicine. The collection *Steyermark 61330* reports that, in eastern Venezuela, seeds of *Ormosia monosperma*, known locally as "pionía montañera" are cooked and made into a drink "for pains of the heart" and that the "cooked seed placed in water

[is] given to children to put around the neck for sore throat”.

I have found several species of *Ormosia* avoided or employed as poisons or medicines in the northwest Amazon, while several other species were not regarded as toxic or of economic value. The collections of interest are enumerated below. Those for which no information relative to biological activity could be elicited from native informants are: *Ormosia discolor* Spr. ex Benth. (Río Apaporis, Colombia: *Schultes et Cabrera 12952*) and *O. Williamsii* Rudd (Río Negro, Colombia: *Schultes et López 9888*).

All of the collections cited have been annotated by Rudd and are included in her monograph, with the single exception of the new variety described below.

***Ormosia amazonica* Ducke var. *venenifera* R. E.
Schultes var. *nov.***

Arbor rivularis, 60-70 ped. alta, trunco columnare usque ad 2 ped. in diametro, fulvo-nigro cum cortice crasso. Rami sparse adpresso-tomentosi, ramulis densissime chryso- vel fulvo-tomentosis. Stipulae parvae, strictae, triangulares, usque ad 8 mm. longae. Folia 7- ad 11-foliolata, axibus petiolisque usque ad 40-50 cm. longis, albido-sericeis, petiolulis similibus, plus minusve 5 mm. longis, foliolis plerumque 6-11 cm. distantibus, coriaceis, usualiter obovatis, acuminatis vel saepe obtusis, basi rotundatis vel late subcuneatis, 9-25 cm. longis, 5-10 cm. latis, laeviter marginatis, supra glabris subnitidisque, infra densissime minuteque albido-velutinis, venis prominenter elevatis secundariis quindecim ad viginti, 9-14 mm. distantibus. Inflorescentiae maxime densissimeque floribunda, usque ad 30-40 cm. in diametro, axibus dense chryso- vel albido-velutinis, bracteis elongatis, ligulatis, usque ad 7 mm. longis, basi 1-2 mm.

latis, bracteolis parvis, linearibus. Flores formosi fragrantisque, ad 28 mm. longi; calyx dense fulvo-velutinus, 10 mm. longus, tubo 4-5 mm. diametro, laciniis 5 mm. longis; petala purpurea, glabra, vexillo stipitato-orbiculare, 17 mm. longo, 13-14 mm. lato, lateralibus vel alis 18 mm. longis, 5-6 mm. latis; carina minore; staminibus alternate subaequalibus, 12 mm. longis; ovario elongato-ovoideo, pubescente, 9 mm. longo, 2-3 mm. lato. Fructus dehiscentes, extus rugosi, sublignosi, nigro-fulvi, 3-5 cm. longi, 2-3 cm. lati, valvis ad 2 mm. crassis. Semina 1 vel 2, bicolora, coccinea sed $\frac{1}{4}$ pro parte nigro-maculata, 12-13 mm. longa, 10 mm. lata, 6-7 mm. crassa, hilo 3 mm. longo.

COLOMBIA: Comisaría del Amazonas, mouth of Río Loretoyacu, Tripeño Amazónico. Alt. 100 m. "Common name: *chocho*. Height 55 feet. Calyx brown. Petals white and lavender. Stamens white. Flowers with odour of citronella, strong. Bark smooth, grey-brown. Seeds highly alkaloidal; leaves, twigs only slightly so." September 13-15. *Richard Evans Schultes, Robert F. Raffauf & Doel Soejarto 24107*. (Type in Herb. Gray; DUPLICATE TYPES in Econ. Herb.; Herb. Nac. Col.; U.S. Nat. Herb.).

Same locality. "N.v. *cairuro*. Arbol de 12 m. Semillas rojo y negro. Alcaloides—muy positivo en las semillas; corteza negativa para alcaloides." October 10, 1961. *J. M. Idrobo 4732*.

Same locality. "Arbol de unos 20 m. de alto. Inflorescencias de color café. Prueba de alcaloides ++". August 21, 1964. *A. Fernandez-Peres 6882*.

This variety may represent a western variant of *Ormosia amazonica*. The species itself is distributed in the central part of the Amazon. There are several minor differences in the size of flowers and floral parts, the shape of the base of the leaves, the general texture of the leaves and the density of leaf-indumentum and in habit of the plant, and these would seem to justify its recognition as a distinct subspecific concept.

All three of the collections cited above were made from the same tree which has been under surveillance

PLATE XXXI



(Left) Photograph of the tree from which the type of *Ormosia amazonica* Ducke var. *venerifera* R. E. Schultes was taken. Rio Loretoyacu, Amazonas, Colombia. (Right) Flowering branch from the same tree.

Photographs by RICHARD EVANS SCHULTES

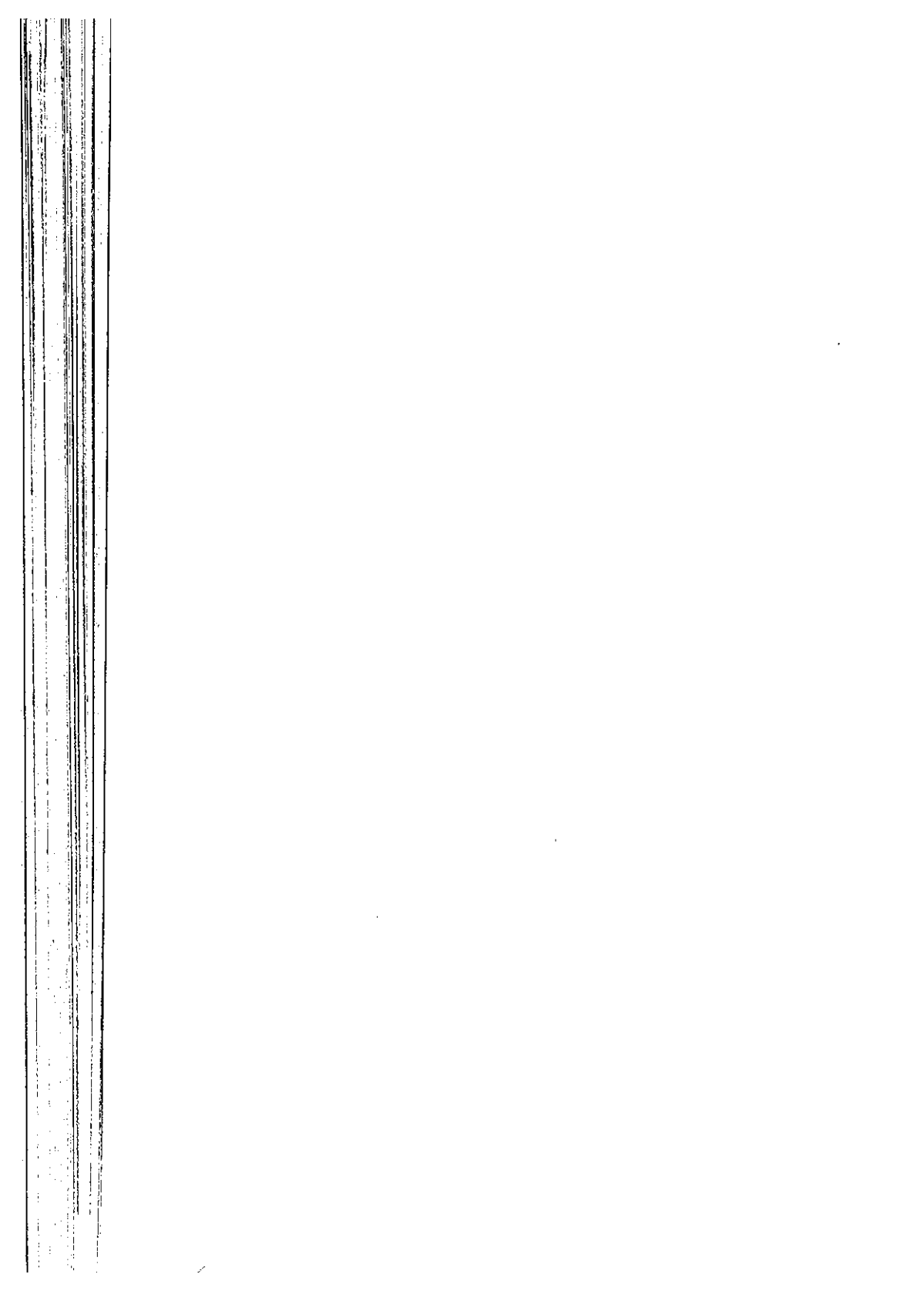
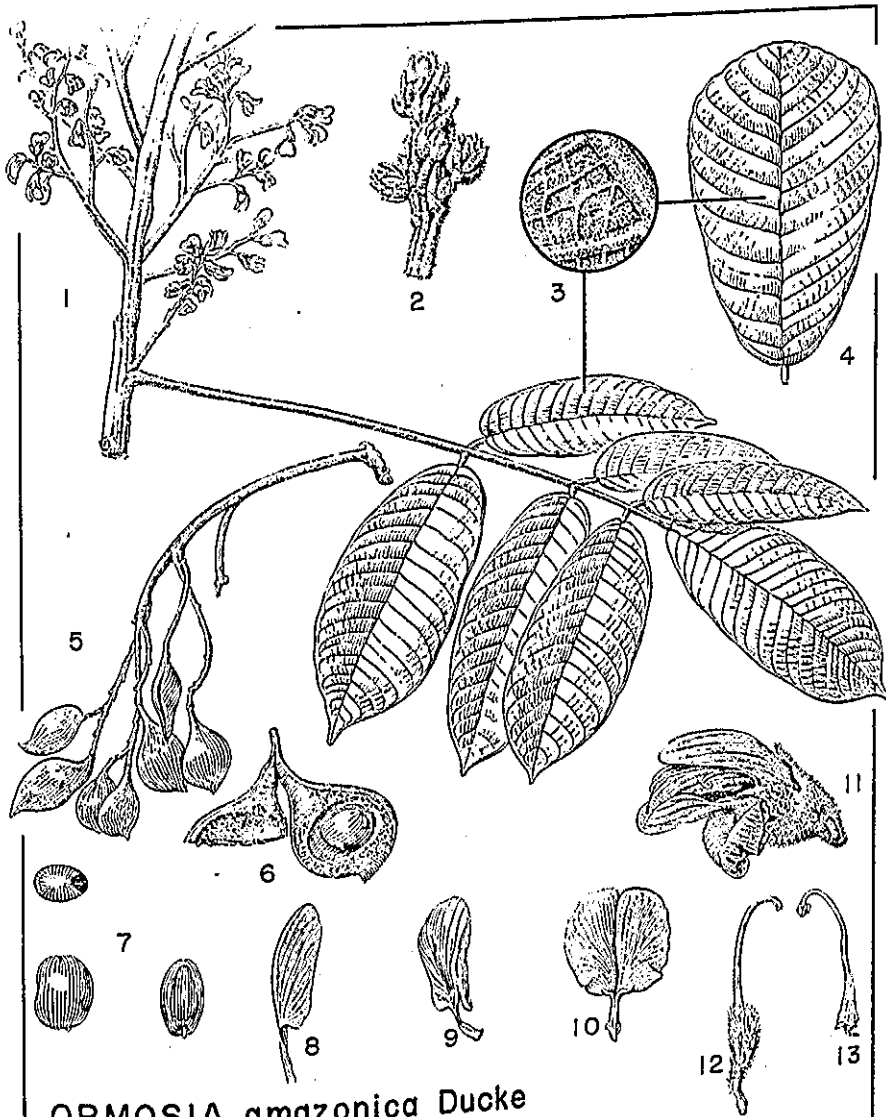


PLATE XXXII



ORMOSIA amazonica Ducke
var. *venenifera* R. E. Schultes

Ormosia amazonica Ducke var. *venenifera* R. E. Schultes. 1, flowering branch, approximately $\times \frac{1}{2}$. 2, buds, approximately $\times \frac{2}{3}$. 3, detail of nether surface of leaf, approximately $\times 2\frac{2}{3}$. 4, leaflet, showing variation in shape, approximately $\times \frac{3}{4}$. 5, fruiting branch of inflorescence, approximately $\times \frac{1}{4}$. 6, open pod with seed, approximately $\times \frac{1}{2}$. 7, seed, approximately $\times \frac{3}{4}$. 8-13, flower and floral parts, approximately $\times 1\frac{1}{2}$.

Drawn by JOSHUA B. CLARK

and study for a number of years, especially since it has shown such highly positive alkaloidal spot test reactions for the seeds. The seeds are recognized by the inhabitants of the area as being toxic.

Ormosia coccinea (*Aubl.*) *Jackson* var. **subsimplax** (*Spr. ex Benth.*) *Rudd* in *Contrib. U.S. Nat. Herb.* 35 (1965) 328.

This tree, with attractive, shiny, deep red pods, is rather abundant in Amazonian Colombia (*Rudd*, loc. cit.), usually in association with the flora of savannahs in the vicinity of the remnant quartzitic mountains of the Guiana-Venezuela land-mass.

The seeds are considered by the Witotos of eastern Colombia to be highly poisonous when ingested, but these Indians do not seem to employ them for any specific purpose. The tree is called *ee-tö'-a* in Witoto.

COLOMBIA: Comisaria del Amazonas, Río Karaparaná, near El Encanto. Alt. about 150 m. "Tall tree up to 20 m. Basal diameter 10 m. Pods deep red. Bark smooth, mottled brown and grey. Wood soft, yellowish." May 22-28, 1942. *R. E. Schultes 3833*.

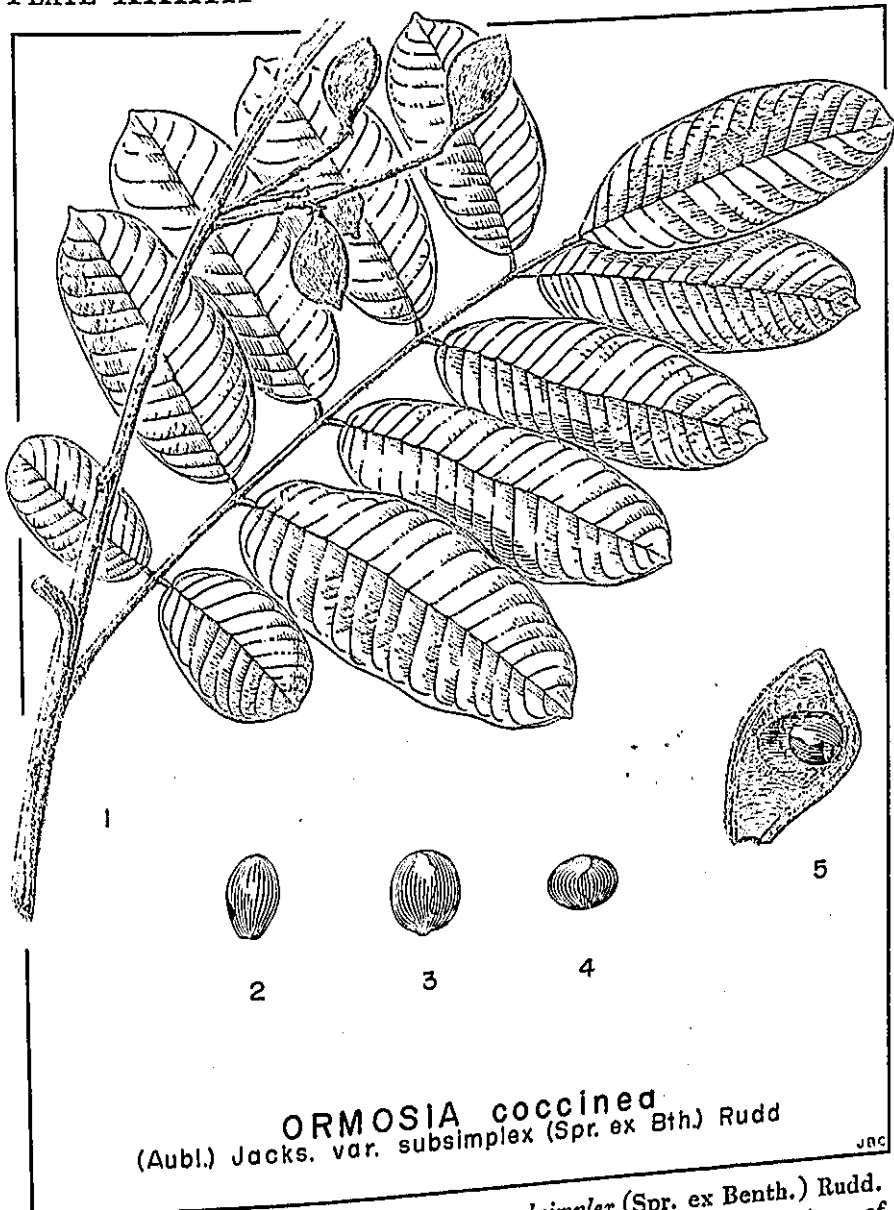
Ormosia isthmensis *Standley* in *Field Mus. Nat. Hist., Bot. Ser.* 17 (1937) 264.

MEXICO: Oaxaca, District of Choapam, San Juan Lalana. Alt. 550 m. May 8, 1939, *Schultes & Reko 322*.

The wood of this very tall and conspicuous tree is employed in Oaxaca for a number of purposes where strength and durability is required (*Schultes* in *Bot. Mus. Leaflet Harvard Univ.* 9 (1941) 176), but no use is known for the seeds which the Chinantec Indians, who call the tree *mu-sa*, consider to be strongly poisonous.

Ormosia lignivalvis *Rudd* in *Contrib. U.S. Nat. Herb.* 32 (1965) 331.

Known from French Guiana, British Guiana, Venezuela, and the central part of the Brazilian Amazon,



ORMOSIA coccinea
 (Aubl.) Jacks. var. *subsimplex* (Spr. ex Bth.) Rudd

Ormosia coccinea (Aubl.) Jackson var. *subsimplex* (Spr. ex Benth.) Rudd.
 1, fruiting branch with leaf, slightly larger than $\times \frac{1}{3}$. 2, 3, 4, views of
 seed, approximately $\times 1$. 5, open pod, approximately $\times \frac{2}{3}$.

Drawn by JOSHUA B. CLARK

Ormosia lignivalvis is here first recorded for the Colombian flora. A very lofty tree with a beautiful cylindrical trunk two feet in diameter and a light reddish brown bark, it is known as "cocho" by Colombian settlers of the Amazon who employ a strong infusion of the bark for washing sores with pus. The same informants consider the black and scarlet seeds to be poisonous.

COLOMBIA: Comisaría del Caquetá, Río Apaporis, Cerro Castillo. Quartzite base. Alt. 350-1000 feet above forest floor, 1250-1900 feet above sea level. "Huge tree, cylindrical, diam. 2 ft., 100 ft. tall. Bark light reddish brown, smooth, wood white, not hard. Seeds black and scarlet. Bark infusion for washing sores with pus, *Cocho*". July 27, 1948. *R.E. Schultes 5731*.

Ormosia macrophylla *Bentham* in *Ann. Wien. Mus.* 2 (1838) 88.

A small but beautiful tree of the central and northwestern Amazon, *Ormosia macrophylla* is valued by the Tawaino Indians of the Río Kananarí of Amazonian Colombia as one of the ingredients in a curare prepared reputedly from the bark of a *Strychnos*, the bark of *Vochysia ferruginea* Mart., the crushed stems and leaves of an aroid (possibly a *Philodendron*) and the bark of *Ormosia macrophylla*. I did not witness the preparation of this curare, but several independent informants agreed on the ingredients of the preparation.

The tree is known as "peonía" amongst the civilized settlers of the Río Vaupés. In Tawaino, it is called *ma-hö'-lčč*.

COLOMBIA: Comisaría del Vaupés, Río Kananarí, Cerro Isibukurí. "Small tree. Flowers brown." October 29, 1951. *R.E. Schultes & I. Cabrera 14533*.—Comisaría del Vaupés, Río Vaupés, Raudal de Yuruparí. Quartzite base. November, 1958. *R.E. Schultes et I. Cabrera 19747*.

ERICACEAE

Pernettya prostrata (*Cav.*) *Sleumer*

Several varieties of *Pernettya prostrata* in Andean

South America are known to possess poisonous properties that effect both man and domesticated animals. The following notes, apparently unpublished, are documented by plant collections preserved in the Gray Herbarium of Harvard University.

***Pernettya prostrata* (Cav.) Sleumer var. *Pentlandii* (DC.) Sleumer** Notizbl. 12 (1935) 290.

BOLIVIA: Province of Chapare, Cochabamba. Alt. 3,000 m. "Frucht . . . soll, wenn reichlich genossen, Schwindel verursachen." March 5, 1929. *J. Steinbach 9514*.

Province of Chapare, Cochabamba. Alt. 3,200 m. "Die Frucht hat eine einschläfernde Eigenschaft. Eine zahmer Affe, welcher die Beeren meiner zum einlegen bestimmten [sic] Pflanzen genascht hatte, wurde total betrunken." March 10, 1929. *J. Steinbach 9583*.

These two references indicate that the ripened fruit of this low shrub of the Bolivian highlands is narcotic and toxic: in the one case, dizziness was caused when ingested by human beings; in the other case, a donkey showed signs of intoxication after eating dried fruits. The vernacular name of this plant in Cochabamba is given as *macha-macha*.

***Pernettya prostrata* (Cav.) Sleumer var. *purpurea* (D. Don) Sleumer** Notizbl. 12 (1935) 290.

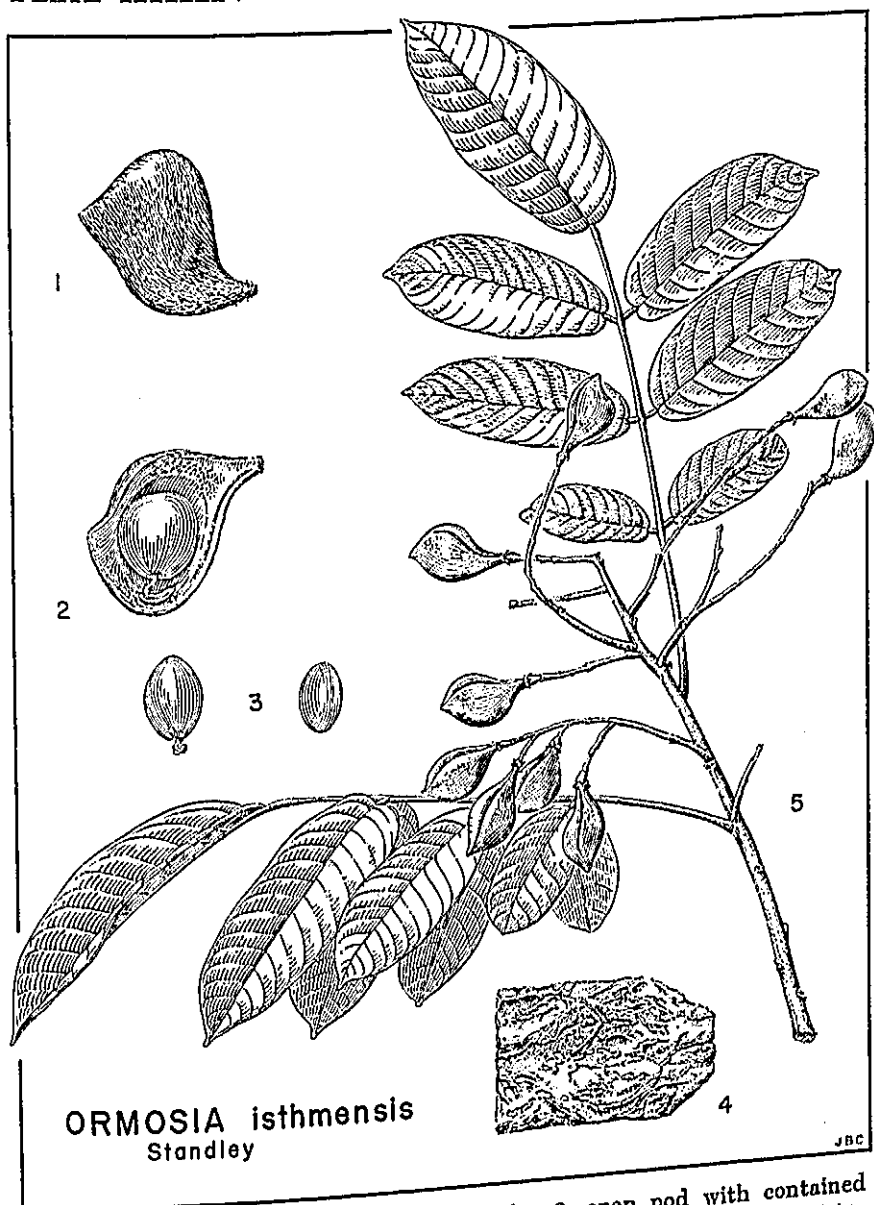
COLOMBIA: Department of Nariño. Alt. 3,000 m. "... fruit . . . are poisonous; adults become violently ill, children dying from eating the berries." August 17, 1938. *Y. Mexia 7642*.

The common name in southern Colombia of this shrub is *moridera*. Accidental poisoning, especially amongst children, is reported as not uncommon in Colombia from the fruit of *Pernettya prostrata*, including undoubtedly this variety which is abundantly represented in the *páramo* vegetation. (Pérez-Arbeláez: *Plantas útiles de Colombia* (1947) 415).

Vaccinium floribundum *HBK.* var. **ramosissimum** (*D. Don.*) *Sleumer* Notizbl. 13 (1936) 131.

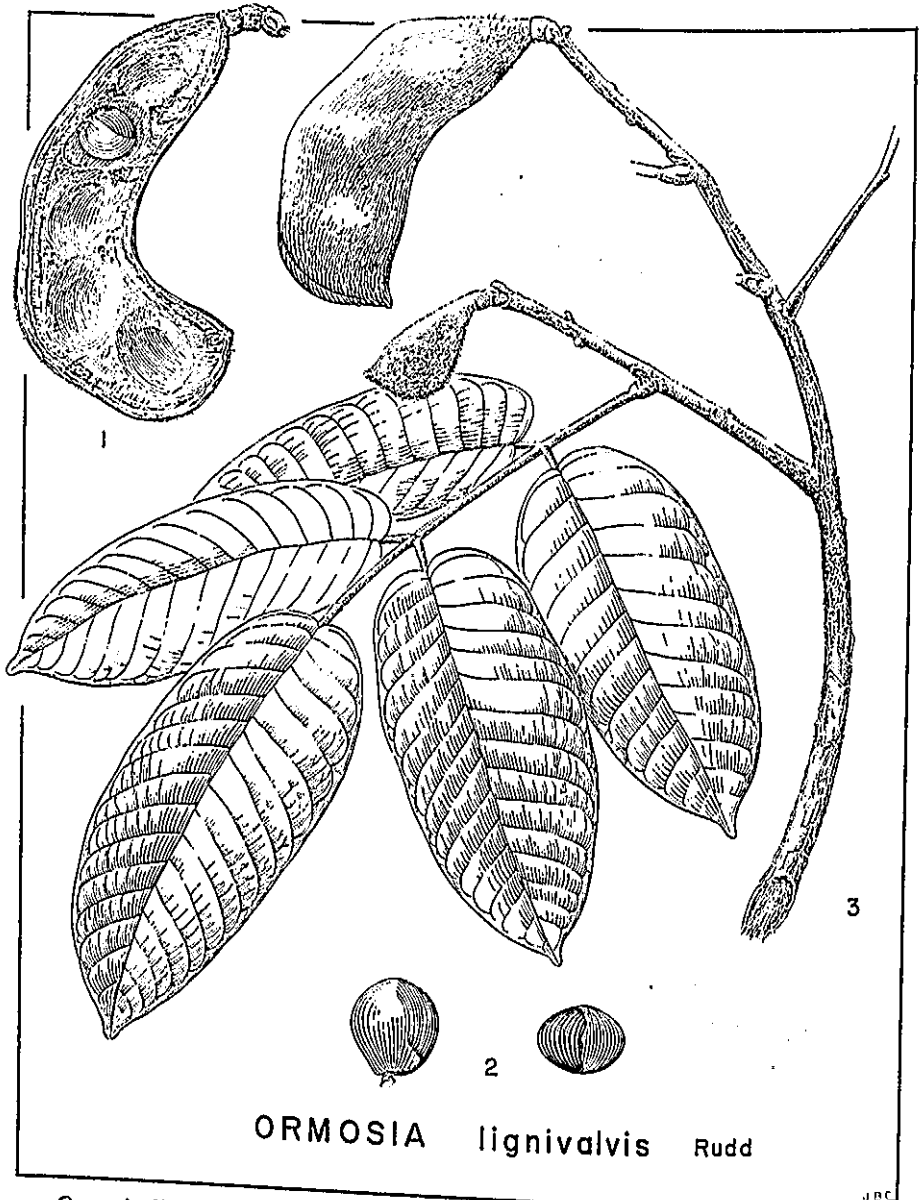
BOLIVIA; Province of Sacaba, Cochabamba, Inachaca. Alt. 2,800 m. "Dicen que las frutas comiendo muchos embriagan." October 14, 1921. *J. Steinbach 5895.*

This abundant highland shrub, locally known in Cochabamba as *macha-macha*, has fruits which intoxicate apparently in the same way as those of the related genus *Pernettya*.



Ormosia isthmensis Standley. 1, pod, $\times 1$. 2, open pod with contained seed, $\times 1$. 3, views of seed, approximately $\times 1$. 4, detail of bark, $\times 1$. 5, fruiting branch with leaves, slightly larger than $\times \frac{1}{2}$.
 Drawn by JOSHUA B. CLARK

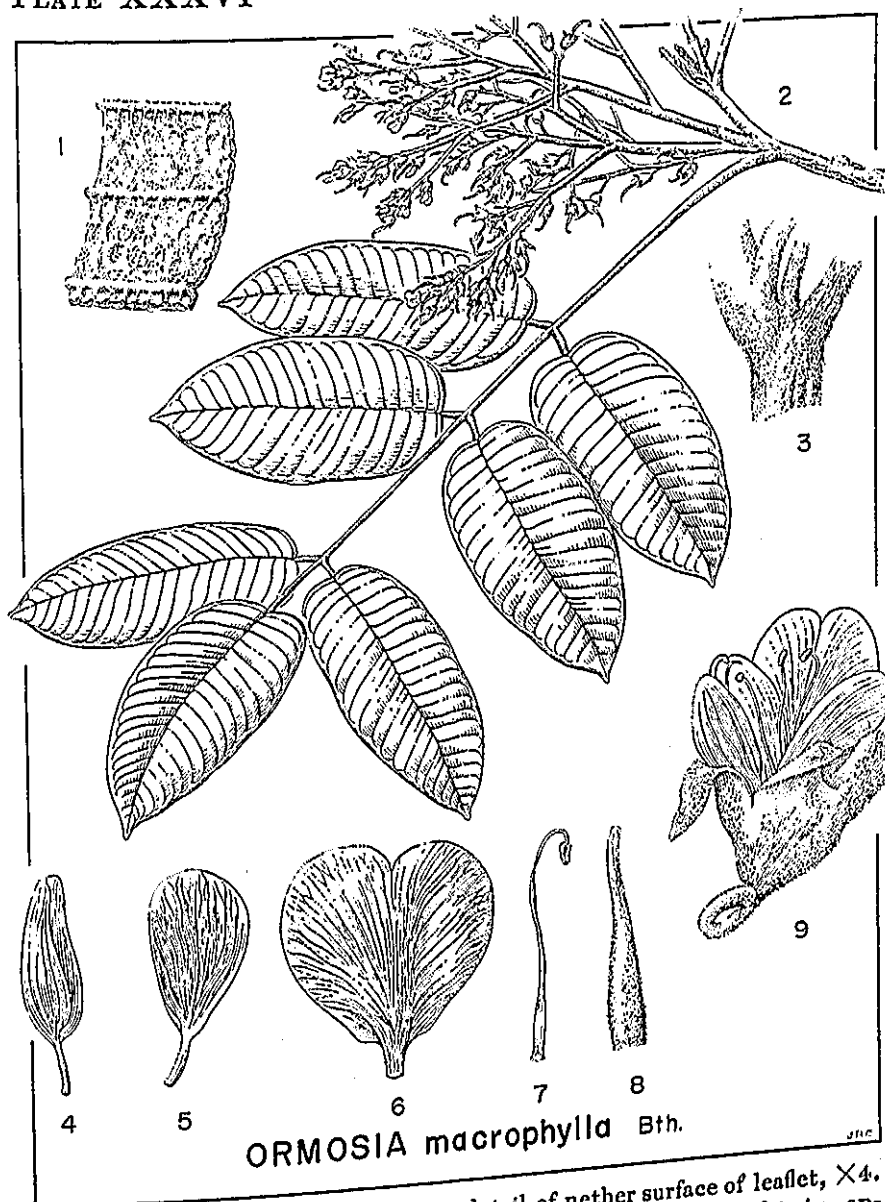
PLATE XXXV



ORMOSIA lignivalvis Rudd

Ormosia lignivalvis Rudd. 1, opened pod, approximately $\times \frac{1}{2}$. 2, seeds, approximately $\times 1$. 3, fruiting branch with leaf, approximately $\times \frac{1}{2}$.

Drawn by JOSHUA B. CLARK



ORMOSIA macrophylla Bth.

Ormosia macrophylla Bentham. 1, detail of nether surface of leaflet, $\times 4$.
 2, flowering branch with leaf, approximately $\times \frac{1}{4}$. 3, detail of twig, approximately $\times 1$. 4, 5, 6, 7, 8, floral parts, approximately $\times 2$; flower, approximately $\times 2$.

Drawn by JOSHUA B. CLARK

PERNETTYA prostrata
(Cav.) Sleumer



Pernettya prostrata (Cav.) Sleumer. 1, habit, approximately $\times 1$. 2, branch, $\times 2$. 3, outline of leaf, $\times 5$. Drawn by JOHN STANWELL-FLETCHER