

De Plantis Toxicariis e Mundo Novo Tropicale
Commentationes.

VIII. Miscellaneous Notes on Myristicaceous Plants
of South America.

RICHARD EVANS SCHULTES

Botanical Museum of Harvard University

AND

BO HOLMSTEDT

Karolinska Institutet, Stockholm

During the past ten or twelve years, there has developed an extensive interest from a number of points of view in the myristicaceous genus *Virola* and, to a somewhat lesser extent, in several smaller but closely allied genera: *Compso-
neura*, *Dialyanthera*, *Iryanthera*, *Osteophloeum*.

This interest has ranged from newly expanded large-scale exploitation of several species of *Virola* for commercial wood in South America and the extraction of a fatty oil from the seeds of various species of *Virola* and *Iryanthera* to phytochemical and pharmacological research on a number of species as little known hallucinogenic snuffs or as potential new therapeutic agents.

Although studies in these myristicaceous plants have often been rather sporadic and disjunct, they have been sustained. One of the phases of investigation that appears not to have received attention commensurate with its potential as a pointer to valuable avenues for research is the body of ethnobotanical data on native uses of and beliefs about some of the species and what native names and terminology may have to offer concerning properties of several of the species. This information lies preserved in our herbaria, much of it unpublished, or may be found in the field notes of plant collectors, botanists and anthropologists who have worked amongst natives of tropical America.

The interest of one of the writers (Schultes) in *Virola* was sparked some eighteen years ago when he identified the source of a strongly hallucinogenic snuff of the northwest Amazon as several species of *Virola*. In his subsequent field work in the area, he devoted special attention to *Virola* and has been able to learn of interesting folk uses of several species which justify phytochemical investigation.

From botanical collecting in the past quarter century, it appears that perhaps the northwestern part of the Amazon basin—particularly the sector lying in Colombia and the Rio Negro of Brazil—may represent the region of greatest specific diversity of *Virola* and several allied genera. Some of the recent collections greatly amplify the known range of certain species. For this reason, the publication of these phytogeographical observations, even when the collections are not voucher specimens for ethnobotanical data, has seemed justified. The establishment also of vernacular names through the citation of collections which authenticate them has likewise appeared to be worthwhile.

Many tropical genera in which an interest in potential use has arisen are taxonomically in a chaotic state. This condition does not obtain, however, in the myristicaceous genera of the New World tropics. The earliest studies of importance in *Virola* and its relatives were those of the British plant explorer Spruce who, with Bentham, described sundry species from the northwest Amazon. Warburg, whose work in the Myristicaceae is outstanding, synthesized taxonomic

knowledge of these genera towards the end of the 19th Century. The most recent monographic studies are those of A. C. Smith and date, for the most part, from 1937. While these earlier works have provided excellent bases for contemporary studies, the extensive collections during the past thirty or more years indicate the need for further revisionary investigations.

It was in 1954 that phytochemical and toxicological interest in *Viola* was first evidenced with the discovery that several species—*V. calophylla*, *V. calophylloidea* and possibly *V. elongata*—represented the source of yakee-snuff, a potently hallucinogenic narcotic of the Amazon basin of Colombia. Subsequent field research has indicated that the Waiká Indians of northwesternmost Brazil and adjacent Venezuela prepare their hallucinogenic *epená*- or *nyakwana*-snuff basically from the resin of another species, *V. theiodora*.¹ Very recent studies have uncovered the use of *Viola*-resin, probably from *V. theiodora*, as an orally administered hallucinogen of the Witoto, Bora and other Indians of the Colombian Amazon.

Chemical investigations during the past five or six years have increased our knowledge of the active constituents of *Viola* and have even contributed knowledge of new biodynamic compounds.

The snuff-powder prepared from the bark of *Viola calophylla* has been shown to contain little 5-methoxy-N,N-dimethyltryptamine but more N,N-dimethyltryptamine, while the leaves and flowering shoots of the same plant contain a high amount of the latter compound. *Viola theiodora* and *V. rufula* have an unusually high content of 5-methoxy-N,N-dimethyltryptamine as well as a new β -carboline: 2-methyl-6-methoxy-1,2,3,4-tetrahydro- β -carboline (Aguirell, S., B. Holmstedt, J.-E. Lindgren and R. E. Schultes, *Acta Chem. Scand.* 23: (1969) 903-916). N-monomethyltryptamine has also been reported from *V. theiodora* (Cassady, J. M., V. E. Tyler, M. Williams and G. E. Blair, *Proc. Symp. Biochem. Physiol. Alkaloids (Halle)* 1970). *Viola cuspidata* has yielded, in addition to alkaloids, 3,4', 5-trimethoxy-*trans*-stilbene and the lignans, otobaene and hydroxyotobain (Blair, G. E., J. M. Cassady, J. E. Robbers, V. E. Tyler and R. F. Raffauf, *Phytochem.* 8: (1969) 497-500).

There are, in addition to phytochemical questions, a variety of ethnobotanical problems that need solving. Perhaps one of the most absorbing is an explanation of what constituent makes the unprocessed resin of *Viola theiodora*, smeared fresh on arrow tips and darts and merely smoked, active as one of the Waiká arrow poisons.

In order to stimulate further chemical and other research in this promising group of plants, we have decided to publish the following miscellany of wholly unrelated notes of ethnotoxicological, ethnopharmacological or ethnobotanical interest.

A fatty oil is extracted from the seeds of numerous species of *Viola* and several of its related genera. This is actually the basis in certain localities in Brazil, Colombia and Venezuela of small industries. Because this economic aspect is so well reported in the literature, it will not be mentioned, except incidentally, in the following notes: The utilization of the resin of *V. calophylla*, *V. calophylloidea* and *V. theiodora* in the preparation of hallucinogenic snuffs has been previously detailed in the literature (Schultes, R. E.: *Bot. Mus. Leaflet, Harvard Univ.* 16 (1954) 241-260; *Journ. Agric. Trop. Bot. Appl.*, no. 7-9 (1954) 298-311; *Agric. Trop.* 11 (1955) 329-335; *III. London News* 229 (1956) 520-521; Schultes and B. Holmstedt: *Rhodora* 70 (1968) 113-160) and, consequently, will not be discussed, except tangentially, in the present paper. Furthermore, the use of the resin of *Viola*, probably *V. theiodora*,

¹Biocca has indicated (Biocca, E.: "Mondo Yanoáma. Appunti di un biologo" (1969)) that these people, at least in part of their range, use the hallucinogenic snuff made from seeds of *Anadenanthera peregrina* in addition to that elaborated from *Viola*-resin.

as an orally administered hallucinogen has been reported recently (Schultes, R. E.: *Bot. Mus. Leaflet*, *Harvard Univ.* 22 (1969) 229-240) and, for this reason, need not here be repeated.

The following ethnobotanical notes indicate several interesting avenues for pharmacological investigation. Certain species of *Virola* and related genera are employed by unrelated groups of Indians for the preparation of washes believed to cleanse infected wounds or hasten their healing. Possibly a kind of "doctrine of signature" effect operates in this prevalent use, since the bark of a number of these species of trees contains a blood-red resin that may suggest the healing of cuts and ulcers, but the widespread belief in the effectiveness of this use would seem to justify study. Several other groups of Indians employ the resin of *Virola* in treating skin troubles of one kind or another. Three tribes of the Vaupés area of Colombia assert that they use two species of *Compsoeura* for treating what may be considered "mental conditions"; in view of our lack of knowledge of the chemical composition of *Compsoeura*, such reports should suggest investigations of the constituents of this genus so closely allied to *Virola* in which psychoactive compounds have been discovered.

The collections cited are preserved, for the most part, in the Gray Herbarium, the Arnold Arboretum and the Economic Herbarium of Oakes Ames at Harvard University; and in the Herbario Nacional de Colombia in the Instituto de Ciencias Naturales in Bogotá.

COMPSONEURA

Compsoeura capitellata (A.DC.) Warburg in *Nova Acta Acad. Leop.-Carol.* 68 (1897) 146.

COLOMBIA: Comisaría del Amazonas, Río Apaporis, Soratama. September 28, 1951.

R. E. Schultes et I. Cabrera 14144.—Same locality. January 31, 1952. Schultes et Cabrera 15107.

Amongst the Makuna and Barasana of the middle and lower Apaporis drainage-area, a tea made from leaves and twigs of *Compsoeura capitellata* is given warm to natives who "go crazy and shake all over"; it reportedly helps to "calm them down" from such attacks.

The Witoto Indian name along the Peruvian side of the Río Putumayo is reported (*Klug* 2130) as *senimoro-ey*.

One of these collections (Schultes et Cabrera 15107) was cited (Smith, A. C. in *Am. Journ. Bot.* 43 (1956) 573) as the first for the flora of Colombia. It is a common element of the forest on land above the flood-level in the central Apaporis, far within Colombian territory.

Compsoeura debilis (A.DC.) Warburg in *Nova Acta Acad. Leop.-Carol.* 68 (1897) 144.

COLOMBIA: Comisaría del Vaupés, Río Piraparaná, March 9, 1952, R. E. Schultes et I. Cabrera 15907.—Río Vaupés, between Río Negro, San Felipe and vicinity. October 25,

1952. R. E. Schultes, R.E.D. Baker et I. Cabrera 18018.—Río Vaupés, between Mitú and Javareté, Yutica. May 14-24, 1953. Schultes et Cabrera 19365.—Same locality and date, Schultes et Cabrera 19374.

These collections were cited (Smith, A. C.: loc. cit. 573) as extending the range of *Compsoeura debilis* slightly into the Colombian basin of the Río Negro.

One Desano Indian pointed out this shrub as the source of a "medicine"; a decoction of the bark is valued by the Makuna as a wash for infected open wounds which are said to heal much faster when treated frequently with this preparation (Schultes et Cabrera 15907).

Compsoeura Sprucei (A.DC.) Warburg in *Nova Acta Acad. Leop.-Carol.* 68 (1897) 143.

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Raudal de Jirijirimo. September 3-11, 1952. H. García-Barriga 14398.—Río Apaporis, Soratama, June 21, 1951. R. E.

Schultes et I. Cabrera 12771.—Same locality, August 20, 1951. Schultes et Cabrera 13618.—Río Kananarí, Cachivera Palito. July 25, 1951. Schultes et Cabrera 13105.—Río Kananarí, Cerro Isibukuri, August 4, 1951. Schultes et Cabrera 13346.—Río Vaupés, Mitú and vicinity. October 20, 1966. R. E. Schultes, R. F. Raffauf et D. Soejarto 24191.



Compsonaura Sprucei is an abundant tree in the Comisaría del Vaupés of Colombia. Although its range is wide—from southern Mexico to Amazonian Brazil—the species had not been reported from Colombia before the collection of the material cited above (Smith, A. C., loc. cit. 573).

Spot tests in the field indicate that this species (Schultes, Raffauf et Soejarto 24191) is alkaloid-negative.

DIALYANTHERA

Dialyanthera Otoba (H. et B.) Warburg in Ber. Deutsch. Bot. Ges. 13 (1885) 89.

The seed oil of *otoba* is said to be employed by Colombian peasants to treat skin infections of domestic animals (Pérez-Arbeláez, E. "Plantas Útiles de Colombia" (1947) 255).

Dialyanthera parvifolia Markgraf in Notizbl. Bot. Gart. Berlin 9 (1926) 964.

PERU: Departamento de Loreto, Río Napo, near Negro Urco. August 16, 1966. R. T. Martin et C. A. Lau-Cam 1272.



The vernacular name of *Dialyanthera parvifolia* in eastern Peru is *cumala roja*. The Witoto Indians refer to it as *u-kú-na*, a name very commonly applied in the same region to one or more species of *Virola*.

Dialyanthera sp.

The fat derived by boiling and pressing the seeds of an indeterminate species of *Dialyanthera* is said to be employed as a "remedy for parasites" (Record, S. J. and R. W. Hess: "Timbers of the New World" (1943) 400).

IRYANTHERA

Iryanthera crassifolia A. C. Smith in Brittonia 2 (1938) 431.

COLOMBIA: Comisaría del Vaupés, Río Kananarí, Cachivera Palito. R. E. Schultes et I. Cabrera 13104.

The Kabuyarí Indians living near the base of Cerro Isibukuri on the Río Kananarí make a decoction of the bark of *Iryanthera crassifolia* and leaves of an undetermined bushy species of *Piper* for the washing of ulcers and wounds.

Schultes et Cabrera 13104 was cited (Smith, A. C.: loc. cit. 574) as extending the known range of this rare species of Amazonian Peru and Brazil far into Colombian territory.

Iryanthera grandis Ducke in Journ. Wash. Acad. Sci. 26 (1936) 220.

PERU: Departamento de Loreto, Río Napo, near Huaman Urco. August 19, 1966.
R. T. Martin et C. A. Lau-Cam 1339.

The common name of this species of *Iryanthera* in the Departamento de Loreto is *cumala blanca*, a term employed also in the same area for *I. lancifolia* and *Osteophloeum platyspermum*. It is curious that its Brazilian name is *ucu-úba vermelha*.

The distribution of this species is generally in the central Amazon of Brazil, in the Madeira and Tapajoz basins (Smith, A. C.: Brittonia 2 (1937) 447-448).

Iryanthera juruensis Warburg in Verh. Bot. Ver. Brand. 17 (1905) 137.

COLOMBIA: Comisaría del Vaupés, San José del Guaviare. November 6, 1939.
J. Cuatrecasas 7476.—Río Infrida, San Joaquín. January 27, 1955. A. Fernández-Pérez 2031.

Comisaría del Amazonas, Trapecio Amazónico, mouth of Río Boiaussú. November 25, 1945. J. M. Duque-Jaramillo 2257.—Río Apaporis, Soratama. September 28, 1951. R. E. Schultes et I. Cabrera 14165.—Leticia and vicinity, August-September, 1966. R. E. Schultes, R. F. Raffauf et D. Soejarto 24105.

This widespread species has been collected in the Orinoco drainage-area of Colombia (San Martín, Intendencia del Meta, C. Casto s.n.) and rather extensively on the Pacific coast (F. B. Lamb 188; R. Romero-Castañeda 5107, 5108, 5235, 5278, 5366, 5566). In the Llanos of San Martín, the tree is called *mamita*; on the Pacific coast, *cuángare*.

The seeds of *Iryanthera juruensis* are valued in Brazil, where the plant is called *ucuúba-rana*, for the extraction of an oil, as are those of many species of this and related genera. A field test for alkaloids carried out on fresh material of this species (Schultes, Raffauf et Soejarto 24105) proved to be negative. So far as I am aware, no use is made of this tree amongst the natives of Amazonian Colombia.

Smith (loc. cit. 574) intimates that this "species is less common in that region [the Colombian Amazon] than *I. Ulei*", but the newer collections may lay this statement open to question. It is, locally at least, an abundant element of the flora.

Iryanthera lancifolia Ducke in Journ. Wash. Acad. Sci. 26 (1936) 217.

PERU: Departamento de Loreto, Iquitos region, Río Nanay, near Picuroyacu. August 4, 1966. R. T. Martin et C. A. Lau-Cam 1203.

This species of *Iryanthera* is said to be called *cumala blanca* in the Iquitos region.

The species is known from the Peruvian Amazon and the western Brazilian Amazonia. It has, apparently, not yet been collected in Colombia.

Iryanthera longiflora Ducke in Journ. Wash. Acad. Sci. 26 (1936) 217.

COLOMBIA: Comisaría del Amazonas, Río Loretoyacu. November 1945. J. M. Duque-Jaramillo 2276.—Río Apaporis, Soratama. June 21, 1951. R. E. Schultes et I. Cabrera 12726.—Same locality. August 20, 1951. Schultes et Cabrera 13616.

PERU: Departamento de Loreto, Iquitos and region, Río Itaya, near San Antonio. July 30, 1966. R. T. Martin et C. A. Lau-Cam 1185.

The native population of the Río Kananarí, near Soratama on the Río Apaporis, employ the crushed leaves of *Iryanthera longiflora* as a poultice to clean seriously infected machete cuts or other wounds.

The vernacular name applied to *Iryanthera longiflora* in the Iquitos area is *cumala colorada*, in reference undoubtedly to the reddish bark of the tree.

The collections cited above extend the known range of *I. longifolia* from Amazonian Peru and Brazil well into the Amazon basin of Colombia (Smith, A. C.: loc. cit. 574).

Iryanthera paraensis Huber in Bol. Mus. Goeldi 5 (1909) 358.

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Raudal de Jirijirimo. July 5, 1951.
R. E. Schultes et I. Cabrera 12924.—Río Apaporis, at mouth of Río Pacoa. July 18,



1951. *Schultes et Cabrera 13099*.—Río Kananari, at base of Cerro Isibukuri. August 4, 1951. *Schultes et Cabrera 13380*.

Comisaría del Amazonas, Río Amazonas, Trapecio Amazónico, interior regions of trapecio between Amazon and Putumayo watersheds. October 1945. *R. E. Schultes 6751*.

These collections have been cited as range extensions of *Iryanthera paraensis* into Colombia (Smith, A. C.: loc. cit. 575), where the species is abundant.

Iryanthera polyneura Ducke in Journ. Wash. Acad. Sci. 26 (1936) 216.

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Raudal de Jirijirimo. July 5, 1951. *R. E. Schultes et I. Cabrera 12922*.—Jinogojé. June 15, 1952. *Schultes et Cabrera 16736*.

Comisaría del Vaupés, Río Piraparaná, Caño Tee-mee-fia. *Schultes et Cabrera 17412*.

The Makú Indians of the Apaporis basin employ a plaster made of the crushed leaves of *Iryanthera polyneura* for treating seriously infected wounds and cuts. Although these nomadic and very primitive Indians live in contact

with the settled Makunas and Barasanas of the Río Piraparaná, I was not able to learn that these more advanced neighbours know of or value the remedy; but I witnessed Makú men apply this preparation to leg and arm wounds on several occasions.

The Makú name of the tree is *wa-hawt-be*; the Makuna, *wa-de-bee* (*Schultes et Cabrera 16736*). Even though the two languages are wholly unrelated, it would seem that there may be a connexion between these two terms for *Iryanthera polyneura*.

Iryanthera tricornis Ducke in Trop. Woods 31 (1932) 11.

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Soratama. March 26, 1952. R. E. Schultes et I. Cabrera 16043.

This collection was cited as extending the range of *Iryanthera tricornis*, known from the upper Amazon and Madeira Rivers in Brazil into Colombia (Smith, A. C.: loc. cit. 574).

The Indians resident in Soratama and vicinity maintain that a decoction of this small tree is the best medicament for treating burns and infected cuts.



Iryanthera Ulei (Benth.) Warburg in Verh. Bot. Ver. Prov. Brand. 47 (1905) 137.

BRAZIL: Estado do Amazonas, Manáos, Reserva Florestal Ducke. July 5-August 12, 1967. R. E. Schultes 24610 (R. V. Alpha-Helix Amazon Expedition—1967).

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Soratama. July 10, 1951. R. E. Schultes et I. Cabrera 13009.—Same locality. August 20, 1951. Schultes et Cabrera 13623.—Same locality. August 27, 1951. Schultes et Cabrera 13734.—Same locality. August 27, 1951. Schultes et Cabrera 13745.—Same locality. August 27, 1951. Schultes et Cabrera 14168.—Same locality. March 18, 1952. Schultes et Cabrera 15970.—Río Pacoa. February 7-12, 1952. Schultes et Cabrera 15237. Comisaría del Amazonas Río Karaparaná, San Rafael and vicinity. March 30-April 2, 1970. R. E. Schultes et T. Swain 26079.

This species is called *ucuúba puna* in the vicinity of Manáos.

In the Apaporis River of Colombia, the Puinave Indians prefer the fruit of *Iryanthera Ulei* for baiting fish, but there seems to be no chemical reason for this choice. The Puinave call this plant *chaw* or *shaw*; the Kuripako, *peé-wa-ree*; the Barasana, *ka-wee-a-ka-he*. The Barasana apply the crushed leaves slightly heated in water to clean infected wounds.

In the Comisaría del Amazonas, the Witoto Indians of the Río Karaparaná, who call the plant *tě-roó-rai*, mix the "watery latex" from the bark with warm water to drink when the stomach has been "poisoned" by the ingestion of tainted fish or meat.

OSTEOPHLOEUM

Osteophloeum platyspermum (A.DC.) Warburg in Nova Acta Acad. Leop.-Carol. 68 (1897) 162.

COLOMBIA: Comisaría del Vaupés, Río Piraparaná, Raudal Koro. R. E. Schultes et I. Cabrera 17093. August 30, 1952.—Río Piraparaná, headwaters of Caño Tee-mee-ña, Lobo Igarapé. September 10, 1952. Schultes et Cabrera 17329.

Comisaría del Putumayo, vicinity of Mococa. March 16, 1953. Schultes et Cabrera 19075.

PERU: Departamento de Loreto, Iquitos region, Río Nanay, Road to Picuruyacu. July 5, 1966. R. T. Martin et C. A. Lau-Cam 1086.

Cumala blanca is reported to be the vernacular name of *Osteophloeum platyspermum* in the Iquitos region. This name is applied also to several species of *Iryanthera*.

O. platyspermum is now known to be a not uncommon element of the flora of Amazonian Colombia.

VIROLA

Virola Bicuhyba (Schott) Warburg in Nov. Acta Acad. Leop.-Carol. Germ. Nat. Cur. 68 (1897) 208.

This southeastern Brazilian species has, according to Teixeira (Teixeira da Fonseca, E.: "Indicador de madeiras e plantas uteis do Brasil" (1922) 343), many folk uses. Because some of these uses are very similar to those of other species, especially those from the Amazon, it may be of interest to enumerate them. (See Kistler, L. L.: "Folk uses of the Myristicaceae" Term paper, ined., in Biology 207, Harvard University (1970) 35-36).

The seeds of *Virola Bicuhyba* yield a fat employed to treat rheumatism, asthma, tumours of the joints, intestinal worms, skin diseases, erysipelas, hemorrhoids and bad breath. The kino is utilized as a styptic to treat bleeding breasts, colic, ulcerating sores and wounds and for staunching many kinds of bleeding. It is reported to be a "brain stimulant", reviving the memory and the intelligence. Teixeira further states that the seed ". . . possesses, also, the properties of a narcotic".

Virola calophylla Warburg in Nova Acta Acad. Leop.-Carol. 68 (1897) 231.

COLOMBIA: Comisaría del Amazonas, Río Miritiparaná. May 2, 1952. R. E. Schultes et I. Cabrera 16381.

The use of the resin of *Virola calophylla* in the preparation of an hallucinogenic snuff in Amazonian Colombia has previously been described in the literature (Schultes, R. E. in Bot. Mus. Leaflet, Harvard Univ. 16 (1954) 241-260).

The Yukuna tribe of the Río Miritiparaná, who know this species as *a-re-dje*, are wholly unaware of its narcotic properties. These Indians are excessive users of snuff—but of two kinds of snuff: one prepared from *Nicotiana Tabacum*; one from *Erythroxylon Coca*.

Virola calophylloidea Markgraf in Repert. Sp. Nov. 19 (1923) 24.

COLOMBIA: Comisaría del Vaupés, Río Vaupes, Mitú. June 23-25, 1958. H. García-Barriga, R. E. Schultes et H. Blohm 15800.

The utilization of the resin of *Virola calophylloidea* in the preparation of a narcotic snuff in the Vaupés has previously been reported in the literature (Schultes, R. E.: loc. cit. 241-260).

The Kubeo name for this species is *kó-ga* (García-Barriga, Schultes et Blohm 15800).

Virola carinata (Benth.) Warburg in Nova Acta Acad. Leop.-Carol. 68 (1897) 222.

COLOMBIA: Intendencia del Meta, Puerto López. July 29, 1944. E. L. Little, Jr. et R. R. Little 8319.—Llanos Orientales, vicinity of Villavicencio, near Peralonso. July 24-28, 1946. R. Jaramillo, D. Mesa, J. M. Idrobo, A. Fernández Pérez 359.

Comisaría del Vaupés, Río Piraparaná. August 22-26, 1952. H. García-Barriga 14220.—Ribeiras del Río Inírida, Morichal, cerca de la boca del Río Papuanáua, 200 m. February 11, 1953. A. Fernández-Pérez 2243.—Río Piraparaná. August 24, 1952. Schultes et Cabrera 17006.—Río Piraparaná, Caño Tee-mee-ña, headwaters. September 10, 1952. Schultes et Cabrera 17333.

Comisaría del Amazonas, Río Loretoyacu, Trapecio Amazónico. September 1946. R. E. Schultes et G. A. Black 8352.—Río Apaporis, Soratama. June 25, 1951. Schultes et Cabrera 12808.—Río Apaporis, Jirijirimo. July 7, 1951. Schultes et Cabrera 12947.—Río Apaporis, mouth of Río Pacoa. July 18, 1951. Schultes et Cabrera 13100.—Río Apaporis, Soratama. August 16, 1951. Schultes et Cabrera 13532.—Same locality. September 28, 1951. Schultes et Cabrera 14159.—Same locality. January 28, 1952. Schultes et Cabrera 14987.

Virola carinata appears to be one of the most abundant species of the genus in the Orinoco and Amazon drainage-area of Colombia. It is known by the Barasana name of *na-tzin-ñe-me*; the Makú, *bom-am*; the Makuna, *la-see-ñe-me-hoo*; and the Puinave, *chee-van*. It has several vague or diffuse medicinal uses in the Vaupés, the most specific of which is to treat "carate", a disease causing blotched discoloration of the skin.

The individual tree from which Schultes et Cabrera 14987 was taken presented a very interesting physiological variant in its "resin". It was at first colourless, turning white upon exposure to the air—never becoming red or reddish brown.

Virola cuspidata (Benth.) Warburg in Nova Acta Acad. Leop.-Carol. 68 (1897) 176.

COLOMBIA: Comisaría del Vaupés, Río Vaupés, Mitú and vicinity. September 27-October 20, 1966. R. E. Schultes, R. F. Raffauf et D. Soejarto 24254.

The leaves and bark of the tree from which this collection was taken gave a positive reaction to the field spot test for alkaloids.

According to the medical anthropologist Ettore Biocca (Biocca, E.: "Viaggi tra gli indi—Alto Río Negro—Alto Orinoco" 2 (1966) 239), the Tariano Indians of the Río Uaupés in Amazonian Brazil employ this species in the preparation of the intoxicating snuff called *paricá*. Biocca reports that this identification was made on the basis of a piece of bark given to him by an elderly Tariano practitioner. Such sparse material hardly affords the opportunity for a definitive specific determination.

The collection cited above is the first to be reported from Colombia.

Virola elongata (Benth.) Warburg in Nova Acta Acad. Leop.-Carol. 68 (1897) 178.

COLOMBIA: Intendencia del Meta, 20 km. southeast of Villavicencio, E. P. Killip 34252.

Comisaría del Caquetá, Río Caquetá, below mouth of Río Orteguzza, north of Solano. March 8, 1945. E. L. Little, Jr. et R. R. Little 9666.

Comisaría del Vaupés, Banks of Río Inírida, San Joaquín. January 27, 1953. A. Fernández-Pérez 2024.—Río Pacoa, February 7-12, 1952. R. E. Schultes et I. Cabrera 15262.—Río Kananari, at base of Cerro Isibukuri. August 4, 1951. Schultes et Cabrera 13278.—Río Vaupés, Mitú and vicinity. September 27-October 20, 1966. R. E. Schultes, R. F. Raffauf et D. Soejarto 24253. Río Macúparaná, Caño Castaño. May 21, 1969. P. L. Silverwood-Cope TS1.—Same locality and date. Silverwood-Cope TS 2.

Comisaría del Amazonas, Río Apaporis, Soratama. July 3, 1951. Schultes et Cabrera 21875.—Same locality. August 27, 1951. Schultes et Cabrera 13787.

Comisaría del Putumayo, Mocoa. March 16, 1953. Schultes et Cabrera 19087.

These collections were cited (Smith, A. C.: loc. cit. 575) as greatly extending the known Peruvian, Brazilian and Venezuelan range into the Amazon drainage area of Colombia, where the species is locally very abundant.

The Witoto Indian name along the Río Putumayo is registered as *ucufe-ey* (Klug 1602). In the Apaporis basin in Colombia, the Barasana Indians, who possibly employ this species as a source of an hallucinogenic snuff, call it *ra-se-ñé-mee* (Schultes et Cabrera 15262) and employ the red bark-resin in the treatment of fungal infections of the skin.

The anthropologist Peter L. Silverwood-Cope has recently made two collections (Silverwood-Cope TS-1 and TS-2) in the Colombian Vaupés as the source of the hallucinogenic snuff of the Bara-Makú Indians. Both are referable to *Virola elongata*. The tree is known as *tsu-nem*. These Indians prepare a snuff, but on occasion take the resin into the mouth directly from the bark with no preparation.

Concerning the use of *Virola elongata* by the Makú, Mr. Silverwood-Cope writes: "A *tsu-nem* tree was carefully selected from several growing along the flood bank of Caño Castaño. The tree was between 70 and 80 feet tall and between 8 and 10 inches in diameter at a height of 4 foot from the ground. Fortunately, we found one in flower. We stripped bark from about 30 feet of the lower end of the tree, cutting the bark into 2-foot sections and wiping off the beads of liquid (which quickly formed on the inside of the sections) with scrapings from the trunk itself into about 1 litre of water taken from the river. The liquid collected is represented by TS 3, and it is in this form that *tsu-nem* is normally taken as a snuff. Later, having allowed the sediment to settle, the water was drained off and thrown away. The thick sediment was then boiled in a shallow earthenware dish, and as the water boiled off and rings of crust began to be left on the inside of the dish, WB 2 was burnt and the ash added, causing the remaining liquid to foam up and dry out on the sides. Eventually all the liquid had gone, leaving only the dry foam, which, when scraped off and powdered, is *huyat*."

This species (Schultes, Raffauf et Soejarto 24253) gave a positive alkaloid test in the field.

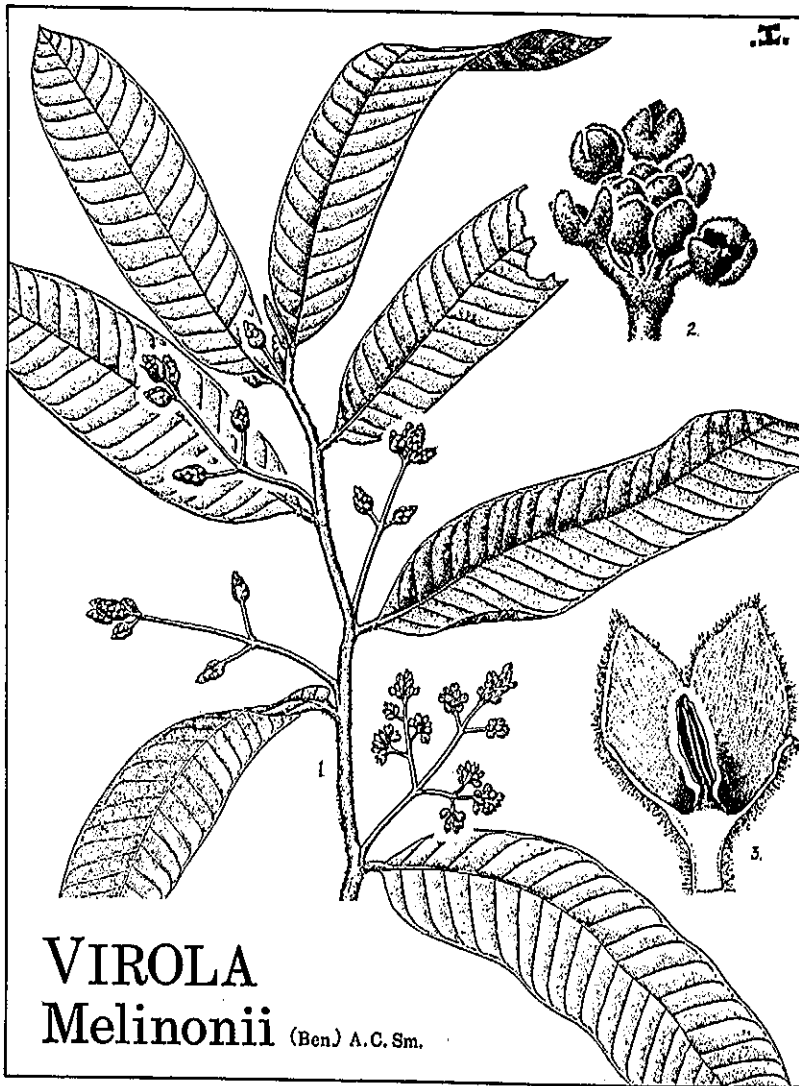
Virola flexuosa A. C. Smith in Brittonia 2 (1936) 151.

COLOMBIA: Comisaría del Amazonas, Río Apaporis, Soratama. "Enormous tree". September 28, 1951. R. E. Schultes et I. Cabrera 14166.

This tree represents the tallest individual of any species of *Virola* that we have seen, attaining a height of approximately 90 feet. The Barasana Indians employ it for the same purpose as *V. Schultesii*: the resin is applied to skin infections which seem to be of a fungal origin.

Virola loretoensis A. C. Smith in Bull. Torr. Bot. Club. 58 (1931) 95.

COLOMBIA: Comisaría del Amazonas, Río Loretoyacu, November 1945. R. E. Schultes 6947.—Same locality. December 15, 1945. J. M. Duque-Jaramillo 2343.



This species, known from Amazonian Peru and Brazil, is now reported for the flora of Colombia.

Virola Melinonii (Benth.) A. C. Smith in Brittonia 2 (1937) 502.

BRAZIL: Estado do Amazonas, Rio Cauaburi, middle course. July 5-August 12, 1967.
R. E. Schultes 24569 (R. V. Alpha-Helix Amazon Expedition—1967).

A field spot test indicates that this species is alkaloid-negative.

Known from British and Dutch Guiana, *Virola Melinonii* may now be reported for the flora of the Rio Negro basin in Brazil. The Waiká Indians of the Cauaburi region plaster the boiled leaves to patches of skin (fungus?) infections in the belief that this treatment relieves itching and reduces infection.

Virola multinervia DuRoi in Journ. Wash. Acad. Sci. 26 (1936) 261.

BRAZIL: Estado do Amazonas, Rio Negro, Manáos. Reserva Florestal Ducke. July 5-August 12, 1967. R. E. Schultes 24614 (R. V. Alpha-Helix Amazon Expedition—1967).—Same locality and date. Schultes 24616.

Viola multinervia contains only minute amounts of 5-methoxy-N, N-dimethyltryptamine, so little that the species may be said to be essentially devoid of alkaloids (Aguirell, S., B. Holmstedt, J.-E. Lindgren, R. E. Schultes in *Biochem. Pharmacol.* 17 (1968) 2487-2488).

The collections cited above are topotypical. The species is distributed in the western part of the Brazilian Amazon and in Loreto, Peru.

Viola Pavonis (A.DC.) A. C. Smith in *Brittonia* 2 (1937) 504.

COLOMBIA: Comisaría del Amazonas, Río Caquetá, La Pedrera. October 1-4, 1952. H. García-Barriga 14584.

The Karijona Indian name of this tree is reported by García-Barriga to be *ve-ri-que*.

This collection establishes the species in the flora of Colombia. It has previously been reported from Amazonian Peru and Brazil.

Viola peruviana (A.DC.) Warburg in *Nova Acta Acad. Leop.-Carol.* 68 (1897) 188.

COLOMBIA: Comisaría del Amazonas, Leticia, October 9, 1961. J. M. Idrobo 4699.—Río Loretoyacu. September-November 1944. R. E. Schultes 6031.—Río Caquetá, La Pedrera. October 5, 1952. R. E. Schultes et I. Cabrera 17736. Same locality. October 1-4, 1952. H. García-Barriga 14644.

Comisaría del Putumayo, Río Putumayo, Puerto Porvenir. November 22, 1940. J. Cuatrecasas 10746.

Comisaría del Vaupés, Río Apaporis, between Río Kananarí and Pacoa. December 1-15, 1951. H. García-Barriga 14006.—Río Piraparaná, Caño Tee-mee-ña. September 5, 1952. Schultes et Cabrera 17182.

This species is abundantly represented in the Amazon basin of Colombia, although it has previously been reported only from Peru.

The resin of the bark is used in the Leticia area to relieve toothache (*Idrobo* 4699). In the Río Apaporis, Punave Indians refer to *Viola peruviana* as *yá-kee* (García-Barriga 14006), suggesting its possible utilization in preparing the hallucinogenic snuff of the same name. Since a spot field test for alkaloids (*Idrobo* 4699) indicated that the twigs are "very positive", it possibly could be hallucinogenically employed.

The Kabuyarí name of the tree is *rá-pa* (Schultes et Cabrera 17736).

Viola rufula (Mart. ex A.DC.) Warburg in *Nova Acta Acad. Leop.-Carol.* 68 (1897) 181.

BRAZIL: Estado do Amazonas, Río Negro, Manãos, Reserva Florestal Ducke. July 5-August 12, 1967. R. E. Schultes 24612 (R. V. Alpha-Helix Amazon Expedition—1967).

Viola rufula has been shown to have an unusually high content of 5-methoxy-N,N-dimethyltryptamine and a new β -carboline alkaloid, 2-methyl-6-methoxy-1,2,3,4-tetrahydro- β -carboline, found also in *V. theiodora* and, as a minor constituent, in the leguminous *Anadenanthera peregrina*.

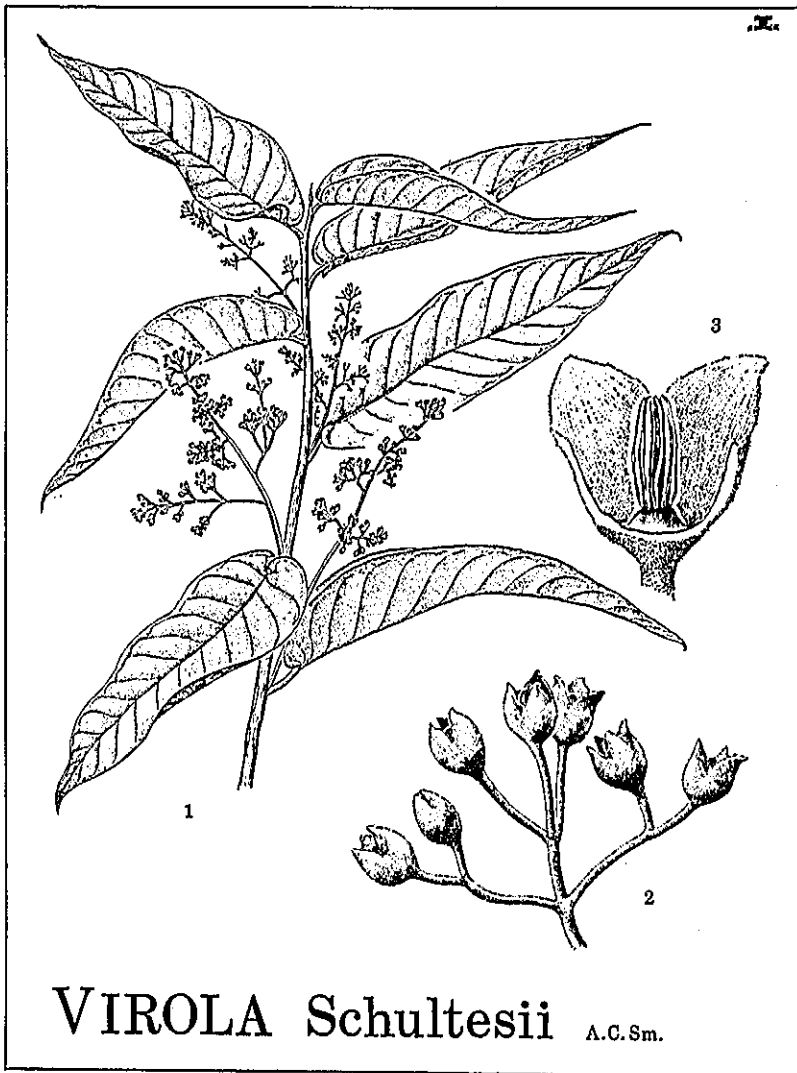
According to Biocca (Biocca, E.: loc. cit. 2 (1966) 235-239), informants living near São Gabriel (below the confluence of the Rios Uaupés and Negro) in Amazonian Brazil prepare *epená*-snuff from the resin of this species.

Viola Schultesii A. C. Smith in *Am. Journ. Bot.* 43 (1956) 575.

COLOMBIA: Comisaría del Vaupés, Río Kananarí, Cachivera Palito. July 25, 1951. R. E. Schultes et I. Cabrera 13119.—Río Piraparaná, Caño Tee-mee-ña. September 9, 1952. Schultes et Cabrera 17293.

The Barasana Indian name for this small and delicate tree is the same as that applied to *Viola elongata*, and both species are employed medicinally in the same way. The red resin of the bark is applied directly to patches of fungus infection on the skin of the face or hands. This treatment is followed for a number of days or until, in the Indian's opinion, it shows itself to be inefficacious.

The Barasana call this species of *Viola re-se-ne-me* (Schultes et Cabrera 17293).



Virola sebifera Aublet Pl. Guian. Fr. 2 (1775) 904.

VENEZUELA: State of Bolívar, Gran Sabana . . . at base of Mt. Roraima. September 24, 1944. J. A. Steyermark 58565.—Río Karuai, base of Sororopán-tepuí. November 27, 1944. Steyermark 60758a.

These two collections of *Virola sebifera* bear brief ethnobotanical annotations that may well be exceedingly significant. They suggest the possibility that witch-doctors may avail themselves of hallucinogenic properties of this species by smoking or otherwise using the bark.

Steyermark 60758a states that the “. . . inner bark is dried and smoked by witch-doctors for smoking at dances when curing fevers; it is very strong”. The other collection reports: “Indians boil bark and use to drive away evil spirit.” The native names of this species are given as *wircaweyek* or *orika-bai-yek* and *piassám*.

The field notes indicate that the bark is “smoked at dances”—obviously part of a curing ritual—and that “it is very strong”. Does the statement that it is

"very strong" suggest its intoxicating properties? Is "smoking" confused possibly with "snuffing"? Does the statement that the Indians "boil the bark" indicate one of the steps in extraction of the resin in preparing a snuff, as with natives in other regions? The prosecution of ethnotoxicological studies on *V. sebifera* in the localities of these two collections would seem to be both promising and urgent.

Phytochemical studies recently published (Corothie, E. and T. Nakano in *Planta Medica* 17 (1969) 184-188) indicate that the bark of *Virola sebifera* contains N,N-dimethyltryptamine as the only basic principle. Corothie and Nakano state: "The fact that N,N-dimethyltryptamine, well known as a psychotomimetic substance, has been found to be the only basic constituent of the bark of *Virola sebifera*, is extremely interesting. Since Holmstedt . . . reported that, although it contains small amounts of N, N-dimethyltryptamine and 5-hydroxy-N,N-dimethyltryptamine, the main component of epená is 5-methoxy-N,N-dimethyltryptamine. It, therefore, strengthens the possibility that, judging from its location, this plant may be one of the major sources used by Waicá Indians as ceremonial snuffs." The material basic to this phytochemical work was identified by Dr. L. Aristeguieta and Ing. C. Blanco of the Instituto Botánico in Caracas. It was collected 5 km. from El Palmar in the Río Grande region, Estado de Bolívar (near the confluence of the Río Grande and Río El Toro).

This species has been reported (as its synonym *V. venezuelensis* Warburg) as a folk medicine in Venezuela, where the fat from its seeds is valued for treating rheumatism (Hoppe, H. A.: "Drogenkunde" Ed. 7 (1958) 951; Uphof, T.: "Dictionary of economic plants" Ed. 2 (1968) 545).

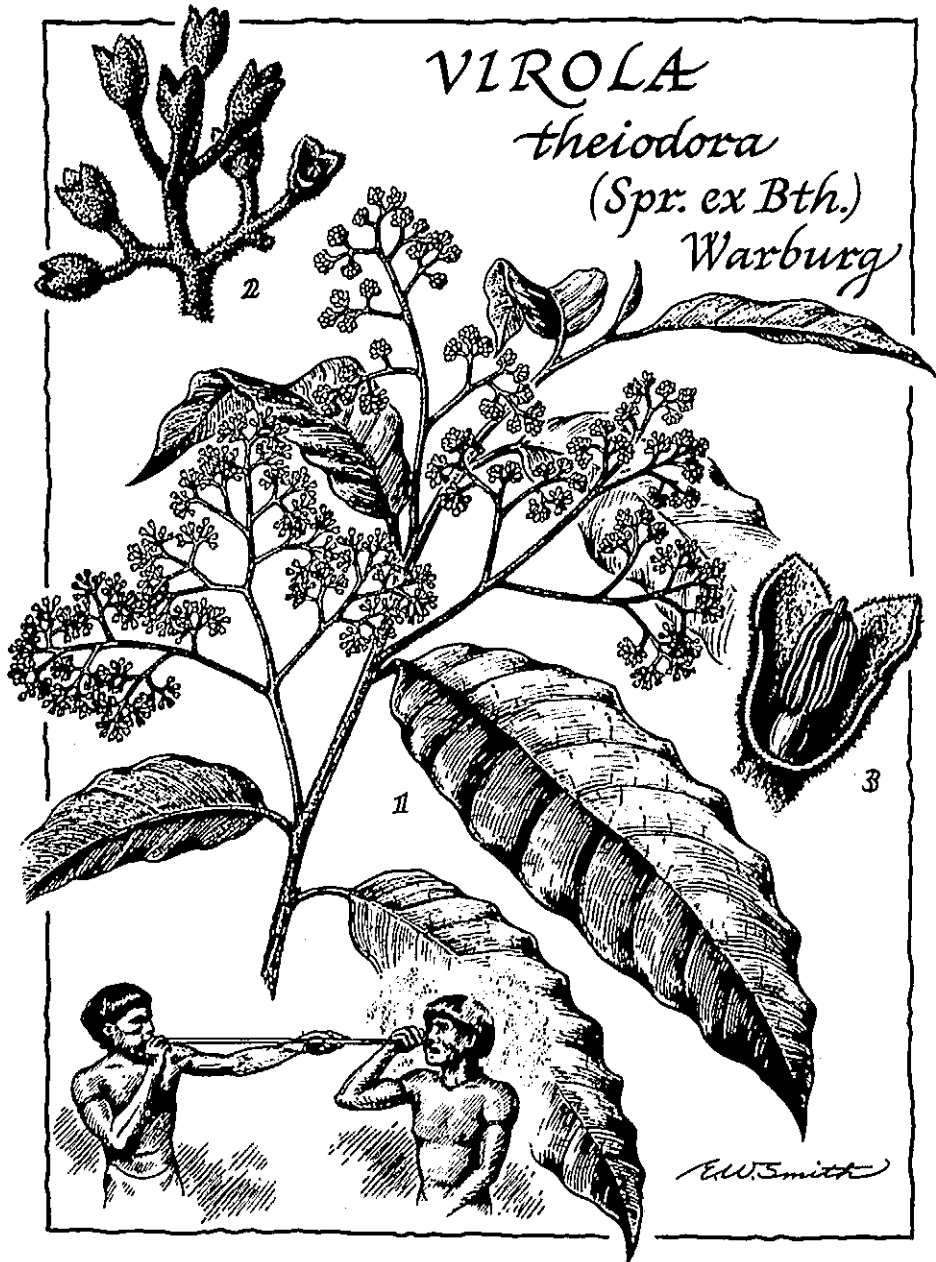
According to Lindgren (personal comm.), *Virola sebifera* contains small amounts of N,N-dimethyltryptamine and 2-methyltetrahydro- β -carboline.

In connexion with the possibility of the use of *Virola sebifera* as an hallucinogen, it seems to be appropriate here to quote verbatim an obscure report of a clinical test on man published over a century ago (Mure, B.: "Materia medica," (transl. C. J. Hempel (1854)), and brought to our attention by Mr. Larry Kistler (Kistler, L. L.: loc. cit. 38-39). The test was made using the red, acrid and "very poisonous" juice obtained by "cutting into the bark" of this tree. The "juice", referring obviously to the resin, was probably ingested, since no other method of administration is specified. The report contains 41 statements of the patient's condition over a five-day period, but only several of these statements concern psychoactive effects, the remainder being concerned with the toxic properties of the drug. These statements are here quoted.

- "2nd day. He is unable to fall asleep in the evening, in bed. Confused dreams about houses which one is building, commencing at the upper stories. He is indifferent and careless about his business.
- 3rd day. Restless sleep, he dreams about violent quarrels. Since 4 in the afternoon he has been unable to fix his mind upon any one point; he continually repeats in his mind a tune, which irritates him, and of which he cannot rid himself.
- 4th day. Restless sleep, with dreams about occupations that are entirely different from his ordinary business; afterwards dreams about disputes.
- 5th day. He is unable to concentrate his attention on one object, though he has important business to attend to."

Virola surinamensis (Rol.) Warburg in *Nova Acta Acad. Leop.-Carol.* 68 (1897) 208.

Known in the Brazilian Amazon as *ucuúba branca*, *Virola surinamensis* enjoys an extensive reputation in folk-medicine. A tea of the leaves is used to treat colic and dyspepsias; the reddish bark resin is applied for erysipelas; a decoction of the bark is valued as a wash to heal wounds; the sap, mixed with



a decoction of *Physalis angulata* L., is applied to hemorrhoids as a treatment (Le Cointe, P.: "A Amazonia Brasileira" 3 (1934) 455).

As in several other species of *Virola* and related genera, the seeds of this species are the source of a valuable fatty oil. An extensive lumber industry has also been established in the exploitation of the abundant stands of *V. surinamensis* in the lower Amazon.

Virola theiodora (Spr. ex Benth.) Warburg in Nova Acta Acad. Leop.-Carol. 68 (1897) 187.
 BRAZIL: Estado do Amazonas, Rio Cauaburi, Maturacá. July 5-August 12, 1967.
 R. E. Schultes 24574.—Same locality and date. Schultes 24575.—Territorio do Roraima, Rio Tototobi, wayhana-oo-thle. August 6, 1967. Schultes 24626 (R. V. Alpha-Helix Amazon Expedition—1967).

Territorio Roraima, Vicinity of Auaris. "Bark used by Mayagao Indians as an arrow poison and by Sanamá Indians as a narcotic snuff." February 6, 1969. G. T. Prance, J. R. Steward, J. F. Rames et L. C. Farias 9638.—Serra dos Surucucus. "Resin from bark used for narcotic snuff and arrow poison by Waika Indians, Waika = *shomiá*." February 20, 1969. Prance, Steward, Rames et Farias 10125.

COLOMBIA: Comisaría del Amazonas, Río Karaparaná, path from El Encanto to La Chorrera. May 31-June 2, 1942. R. E. Schultes 3878.—Río Karaparaná, San Rafael (below El Encanto). March 30-April 2, 1970. R. E. Schultes et T. Swain 26078.

According to Le Cointe (Le Cointe, P.: loc. cit. 59), *Virola theiodora* has leaves which are employed as a substitute for tea. The tea-like fragrance of the foliage is a good field character for quick distinction of this species from *V. elongata*. It was noted by Spruce who collected the type material and is, of course, the reason for the specific epithet, as it is for the Brazilian vernacular name *bicuhyba cheirosa*. We have not noted this characteristic fragrance in any other species of *Virola* encountered in the field, although Ducke asserted (Journ. Wash. Acad. Sci. 26 (1936) 256-257) that the "tea smell, referred to by Spruce, can be noted in the dry leaves of many of the *Virola* species; it is not restricted to *V. theiodora*".

In addition to its extensive use amongst the Waiká Indians as the basis of a highly hallucinogenic snuff, the bark-resin of *Virola theiodora* provides these Indians with one of their arrow poisons. Various writers have indicated that many of these related tribes of the upper Orinoco and northern affluents of the Río Negro make one of their arrow poisons from the bark of a tree. The Karimá, culturally and geographically close to the Waiká of the upper Orinoco, use a poison ". . . *jakuana*, which is extracted from the bark of a tree" (Salathé, G.: Rev. Inst. Ethnol. Univ. Nac. Tucumán 2 (1931) 297-316); the term *jakuana* is obviously related to if not the same as *nyakwana* employed for *Virola* by some of the Waiká groups. The Waiká or Surará of the Río Arará have a ". . . third kind of arrow poison . . . the weakest. It is prepared from the snuff powder *epená* by mixing it with water and letting it boil". This method is likewise known to the Pakidái and Shirianá (Becher, H.: Mitteil. Mus. Völkerkunde Hamburg 26 (1960) 1-138). Biocca (Biocca, E.: loc. cit 2 (1966) fig. 85) illustrated the leaf and bark of what appears to represent *V. theiodora* as the basis of a Waiká arrow poison. The same writer illustrated the bark and leaves of the plant employed for the preparation of *epená*-snuff, and the sinuate and flexuous margin of the leaf would seem to indicate the same species, *V. theiodora* (Biocca, E.: loc. cit. 2 (1966) 111).

This is the first time that *Virola*—or any myristicaceous plant—has been indicated as the source of an arrow poison. Schultes and Holmstedt witnessed the preparation of poisoned darts amongst the Waiká of Río Tototobí (Schultes R. E. and B. Holmstedt: Rhodora 70 (1968) 144-147) and could not explain what constituent of *Virola* might be responsible for the toxic effects. They could establish that this group of Indians use no other kind of arrow poison than the *Virola*-resin.² This interesting use of the resin of *Virola theiodora* has recently been witnessed at Tototobí also by Prance (Prance, G. T.: Econ. Bot. 24 (1970) 62-68; Prance, G. T. and A. E. Prance: Gard. Journ. 20 (1970) 102-105).

The Tototobí Indians, who, as Schultes and Holmstedt could establish, use no other kind of arrow poison than this *Virola*-resin, simply paint the crude resin on the darts and arrows, which are then smoked to coagulate and set the sticky coating that turns a deep, glossy brown. One man occupies himself with smearing the darts and arrows, whilst others are preparing, from the resin of the same tree, the hallucinogenic snuff.

The poisoning of arrows in the Tototobí group is interesting. The Indian in charge of this work runs his index finger up and down the exposed trunk from

²Biocca, however, indicates that other groups of the Waiká may use a mixture of curare and *Virola*-resin in preparing their arrow poison (Biocca, E., C. Galeffi, E. G. Montalvo, G. B. Marini-Bettolo: Ann. Chim. 54 (1964) 1175-1178; Biocca, E., D. Bovet, C. Galeffi, G. B. Marini-Bettolo: R. C. Acc. Lincei, ser. 8, 38 (1965) 34-38; Marini-Bettolo, G. B., C. Galeffi, A. Carpi: Ann. Instit. Super. Sanita 3 (1967) 378-385).

which bark has been stripped, gathers the slime and paints the bamboo arrow heads with it repeatedly. He then heats the arrowheads slowly over a fire to liquefy the resin slightly, spreading it more evenly with his finger. The arrowheads are slowly turned in the smoke of the fire. When they have cooled and the preliminary smearing has completely hardened, the Indian begins to apply pure resin to the tips—resin that he scrapes from the heated strips of bark or that he takes from the accumulation in the pot. There are twenty or thirty applications of resin to the arrow-heads, each application followed by a slow heating in the smoke. Then, finally, the Indian wraps a knot of palm leaves around the top of a stick, inserting the arrow-heads in the knot, setting the stick in the ground for the poisoned heads to dry slowly in the sun. This represents the whole process of poisoning arrows or darts—an exceedingly simple one compared to most of the elaborate curare preparations of South America.

It is very significant that when, in ceremonies, these Waiká run out of snuff that they have prepared for the occasion, they take several bamboo tube cases, in which they packed the poison darts, scrape the *Virola*-resin from the points and use the resulting powder as snuff during the ceremony. It has the same effect as the snuff that was made directly from the fresh resin. Since both the snuff and the arrow-poison are prepared in almost identical procedure from the same trees, there would seem to be no reason why they should not be interchangeable.

The oral use of *Virola*-resin as an hallucinogen by the Witoto, Bora and Muinane Indians of the Río Putumayo drainage of Colombia has been reported (Schultes, R. E.: Bot. Mus. Leafl., Harvard Univ. 22 (1969) 229-240). It has recently been established that the species employed is likewise *Virola theiodora* (Schultes et Swain 26078).

Virola venosa (Benth.) Warburg in Nova Acta Acad. Leop.-Carol. 68 (1897) 224.

BRAZIL: Estado do Amazonas, Rio Negro, Manáos, Reserva Florestal Ducke. July 5-August 12, 1967. R. E. Schultes 24613 (R. V. Alpha-Helix Amazon Expedition—1967).

COLOMBIA: Comisaría del Vichada, Río Inírida, Morichal, near mouth of Papuanáua. February 13, 1955. A. Fernández-Pérez 2246.

Virola venosa has been found to contain so little 5-methoxy-N,N-dimethyl-tryptamine that it may be categorized as essentially alkaloid-free (Agurell, S., B. Holmstedt, J.-E. Lindgren, R. E. Schultes: loc. cit.).

The Brazilian collection cited above is topotypical. The species is distributed in the Amazonas and Pará of Brazil—in the central part of the Amazon basin. In spite of its tremendous distance from the centre of distribution of this species, Fernández-Pérez 2246, from the Orinoco basin of Colombia, seems properly to be assigned to *V. venosa*.

Virola sp.

According to Biocca (Biocca, E.: "Viaggi tra gli indí—Alto Río Negro—Alto Orinoco" 1 (1965) 156; 3 (1966) 239) an undetermined species of *Virola* is used as a contraceptive amongst the Indians near São Gabriel on the Rio Negro of Brazil. It reputedly is effective for a period of two or three years. He gives no indication of how it is employed or of which part of the plant is utilized.

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