

De Plantis Toxicariis e Mundo Novo Tropicale Commentationes XXXIX Febrifuges of northwest Amazonia

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Abstract. Fever is one of the most common symptoms of illness. In the northwestern Amazon basin malaria, with its accompanying fever, is wide-spread. We present here a list of northwest Amazonian plants which have been recorded as used by native people as febrifuges.

Ethnopharmacological field research on medicinal plants used by Indians of northwest Amazonia, particularly in the Colombian part, has registered some 1500 species (Schultes and Raffauf, 1990). Undoubtedly, there are many more. In fact, of the 80,000 species of higher plants estimated for the Amazonian flora, it must be true that native medicinal practices employ a number far greater than 1500.

Very few of these plants have been chemically analyzed, much less pharmacologically studied. The few that have been subjected to technical investigation suggest that the flora of Amazon represents an extraordinary wealth of chemical constituents new to science. Many of these compounds may find no use in modern medicine; others may be used in advanced societies for quite different purposes (e. g., rotenone and the alkaloids of curare) a very limited number may possibly serve the same purpose as in primitive societies.

The association of fever with illness is perhaps as old as medicine itself. The shaman or the primitive physician recognized its presence simply by touching the patient, and the belief was held that lowering fever was an end in itself. In ancient India, it was considered "a disease with no satisfactory treatment." In Chinese medicine the heat of fever and inflammation was a part of "yang" (Majno, 1977). Gradually there came the realization that fever was an outward sign or symptom of some underlying ailment; Jan Baptiste van Helmont, a leading iatrochemist of the seventeenth century, believed it to be "a reaction to an invad-

ing, irritating agent" (Lyons & Petrucelli, 1987). Greater understanding came with the invention and eventual acceptance of the clinical thermometer which achieved its modern, familiar design only in 1870. There are now some one hundred medical conditions in which fever is a symptom.

A relatively large number of plants are employed in the northwest Amazon to terminate fever or to lessen its severity; this may be true in other rain forest regions of the tropics. One of the reasons for the high percentage of febrifugal plants is undoubtedly the prevalence of malaria in these equatorial areas. While fevers, which are unusually frequent in the northwest Amazon, may be the result of sundry other illnesses - and there are many that induce fevers - malaria is certainly a major cause of fevers in many parts of the world's tropical rain forests.

In light of the resurgence in many parts of the world of types of malaria resistant to modern medical treatments, and of the possibility that they may spread, and in view of the need for newer, and possibly less toxic febrifugal medicaments, it seems appropriate that those species which native peoples have found, by experimentation over millenia, to be of some use as febrifuges should be scientifically investigated.

In a recent compilation of the drugs used by many of the tribal peoples of the northwest Amazon (Schultes & Raffauf, 1990), several of the preparations were mentioned as being effective in the treatment of "fever." With the

exception, perhaps, of malaria which is recognized as a febrile illness, fever still is looked upon by these people as an illness in its own right and is treated accordingly. Thus, the specific nature or cause of the rise in body temperature is difficult to determine.

In our field work, carried out with medicine men and with knowledgeable individuals of the general native population, we have not attempted to diagnose the cause of fevers and other illnesses - unless the problem be obviously malaria, leprosy, a fungal infection of the skin, or some other obvious abnormality. Even a physician without laboratory and equipment might not be able to diagnose many of the diseases or other disorders relying on native information on symptoms. Consequently, in the great majority of cases, we have recorded the recitation by the person of the symptoms; e. g., "for chest pains," "to reduce fevers," etc., usually in the form of a direct translation of the indigenous informer's words.

We are pleased to acknowledge our indebtedness to the many native medicine men and ordinary knowledgeable herbalists who freely cooperated in our studies and who were extremely friendly and cooperative in sharing their knowledge with us. We never found any hesitancy or antipathy towards sharing with us their familiarity with, and their knowledge of the uses of, medicinal, hallucinogenic or toxic plants, and of the physical and mental effects which their use produced.

For each species voucher specimens are cited. These vouchers are deposited in the several herbaria at Harvard University and in the Herbario Nacional at the Universidad Nacional de Colombia in Bogotá.

The families are, for convenience, arranged alphabetically, not in phylogenetic order, and the species are alphabetized under the family.

ACANTHIACEAE

A review of Sri Lankan species of the family has appeared (Sothceswaran et al., 1986). Much interest has been expressed in species of *Justicia* for their reputed hallucinogenic action. *Justicia pectoralis* is discussed below. The alkaloids of *Adhatoda vasica* have been reviewed (Jain et al., 1984).

APHELANDRA PILOSA Leonard, Contrib. U. S. Natl. Herb. 31: 209. 1958. COLOMBIA. Vaupés. *Schultes & Cabrera 19633*.

Among the Kuripakos of the Río Guainia, the leaves of this small shrub are said to have febrifugal properties when prepared as a tea.

Recently new spermine-type alkaloids have been isolated from the roots of *Aphelandra tetragona* (Tawil et al., 1989).

JUSTICIA PECTORALIS Jacquin, Enum. Fl. Carib. 11. 1760. COLOMBIA. Amazonas. *La Rotta 15, 544*.

na-có-me-da (Miraña).

The Andoques take a warm infusion of the leaves to relieve chills and fever. The Mirañas cultivate this plant in land that has been burnt over and consider that it has excellent fever-reducing properties.

Coumarin, dihydrocoumarin, umbelliferone and other compounds were identified in *Justicia pectoralis* by gas chromatography/mass spectrometry (De Vries et al., 1988). A naphthalide lignan with in vitro anti-leukemic activity has been isolated (Joseph et al., 1988) and the flavones have been described (Joseph et al., 1988a).

RUELLIA COLORATA Baillon, Bull. Mens. Soc. Linn. Paris 2:853. 1890. COLOMBIA. Comisaria del Amazonas. Río Loretoyacu. *Glenboski 109*.

mo-ru-á-chi (Tikuna).

Tikunas poultice the crushed leaves on the forehead to reduce high fevers.

Ruellia emarginata is reported to be strongly cyanogenic (Hegnauer, vol. 8). An aqueous extract of *R. prostrata* has an anti-fertility action in female rats; the petroleum ether extract contained lupeol and a variety of sterols (Andhiwal et al, 1986). A series of iridoid glycosides were isolated from *Ruellia rosea*; these and quaternary compounds, also detected throughout the family, were considered to be taxonomic markers for the Acanthaceae (Fischer et al., 1988).

ALISMATACEAE

Recent interest in this family revolves around *Alisma orientale*, a traditional Chinese drug, which has been extensively studied by

Japanese workers. A review of the chemistry and pharmacology of alismol, a sesquiterpenoid, has been published (Hikino, 1986); it is reported to have therapeutic effects on the heart (Yamahara et al., 1989). Protostanes isolated from the roots (Fukuyama et al., 1988) have been claimed in Japanese patents to be useful diuretics (Fukuyama et al., 1988a; Murayama & Oosawa, 1989).

ALISMA sp. ECUADOR. Sucumbios. Río Sucumbios. *Pinkley 131, 390.*

find-y-dicho-sê-hê-pa (Kofán).

A tea of the leaves is taken to reduce fevers and to treat stomach pains and diarrhea.

AMARANTHACEAE

Earlier references to the chemistry of the family and to the genus here cited can be supplemented by a reference to sterols identified in *Amaranthus* and *Celosia* (Xu et al., 1986) and to ecdysones in *Amaranthus* and *Pfaffia* (Nishimoto et al., 1988).

PFAFFIA GLOMERATA (Spreng.) Peterson, Pl. Prov. Buenos Aires, pt. 3, 146. 1967. COLOMBIA. Amazonas. Leticia. *Smith 5046.*

In the Trapécio Amazónico of Colombia a tea of the leaves, mixed with lemon juice, is considered to be an effective febrifuge.

ANNONACEAE

The alkaloids and other constituents of the Annonaceae are well known. Recent reviews include those of the monomeric and bisbenzylisoquinolines (Cave, 1985), the tetra- and pentacyclic indolosesquiterpenes and their biosynthesis (Waterman, 1985), and the aporphine alkaloids (Cave et al., 1987).

CYMBOPETALUM BRASILIENSE Benth., J. Linn. Soc. 5:69. 1861. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes 6664.*

The Tikunas take a hot, strong decoction prepared from the bark of this tree to treat weakness following an attack of fever.

An alkaloid, liriodenine, and a flavonoid glycoside have been found in *Cymbopetalum penduliflorum* from Mexico (Le Quesne, Raffauf & al., 1992).

GUATTERIA MEGALOPHYLLA Diels, Verh. Bot. Ver. Brandenburg 47: 127. 1905. COLOMBIA. Amazonas. *Schultes 3937.*

The Witotos prepare a decoction of the leaves of this small tree which is then taken warm to reduce malarial fevers.

GUATTERIA SCHUNKE-VIGOI D. R. Simpson, *Phytologia* 30:307. 1975. ECUADOR. Napo. *Davis & Yost 1011.*

mene-dowe (Waorani) ("tree of the jaguar").

The crushed bark mixed with water is "rubbed over the head and shoulders to force fevers to flee" by the Waoranis of Ecuador.

APOCYNACEAE

This family has had intensive chemical and pharmacological study over the past forty years; the literature is extensive. Recent reviews have appeared covering the cardenolides, iridoids and pregnanes (Yamauchi, 1985), the steroidal alkaloids (Atta-ur-Rahman & Muzaffa, 1988) and the antibiotic activity of the alkaloids (Van Beek, 1990).

HIMATANTHUS BRACTEATUS (A. DC.) Woodson, *Ann. Missouri Bot. Gard.* 25:200. 1938. COLOMBIA. Vaupés. *Schultes, Raffauf & Soejarto 24276.*

a-na-roó (Makuna); a-na-dá-go (Barasana); platanote (Colombia).

Despite the fact that among native people the plant is reputed to be toxic, the leaves are prepared in a decoction for use as a febrifuge.

MUCOA DUCKEI (Markgraf) Zarucchi, *Papers Agric. Wageningen* 87:42. 1987. COLOMBIA. Amazonas. *Schultes 3877, 3877a.*

dó-kay-gay (Witoto); palo de leche (Colombia).

The few Karijonas living in the Witoto region of the Colombian Amazon believe this plant to be a valuable febrifuge.

TABERNAEMONTANA RIMULOSA Woodson, *Bot. Mus. Leaflet. Harvard Univ.* 18:179. 1958. PERU. Loreto. *Tello & Tina 2043.*

This species has many medicinal uses. In the vicinity of Leticia and Iquitos the leaves are said to be used to reduce fevers.

TABERNAEMONTANA SANANHO Ruiz & Pavon, *Fl. Chile* 2:22, t. 144. 1794. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes, Raffauf & Soejarto 24110.*

yucu-sanango (Peru); sanango de altura (Colombia).

Like many other species of this genus, *Tabernaemontana sananho* has many medicinal uses among the Indians. In Leticia where Colombians, Peruvians, and Brazilians live together, its chief use is as a febrifuge.

ARACEAE

In a recent study of this family, free sterols found in the latex were determined to be characteristic of the subfamily Colocasioideae (Fox, 1988).

PHILODENDRON cf. ULEANUM Engler, Karsten & Schenk, Vegetationsbilder 131. 1905. COLOMBIA. Amazonas. *La Rotta 153*. tó-ro-je (Miraña).

The Mirañas prepare from the whole plant a warm infusion to reduce chills and fevers (malaria?).

The red pigments of the spathes of *Philodendron hastata* are anthocyanins (Alfa et al, 1987), and red is a most important color in Amazonian tribal ritual and mythology. Triterpenes have been found in the fruits of *Philodendron chinense*.

BEGONIACEAE

Most of what is known of the chemistry of this family concerns the genus *Begonia* in which flavonoids and cucurbitacins have been found.

BEGONIA LONGIROSTRIS Bentham, Pl. Hartweg. 185. 1845. COLOMBIA. Putumayo. *Schultes 22543*.

The people of Mocoa believe that a tea prepared from lemon grass (*Cymbopogon* sp.) and the leaves of this species of *Begonia* is effective in reducing a fever.

BIGNONIACEAE

Iridoids occurring in endemic Chilean Bignoniaceae have been recently discussed (Garbarino & Nicoletti, 1989).

LUNDIA ERIONEMA DC., Prodrum 9:215. 1845. COLOMBIA. Vaupés. Cerro Isibukure. *Schultes & Cabrera 13319, 13909*.

This liana is the source of a strong febrifuge, used as an infusion of the bark, by the Taiwanos of the Río Kananari.

A study of the chemistry of the genus has not been undertaken.

MANSOA STANDLEYI (Steyermark) A. Gentry, Ann. Missouri Bot. Gard. 66:783. 1980. COLOMBIA. *Idrobo 4687*. sacha-ojo (Colombia).

The Tikunas use the crushed leaves to treat fevers and headaches.

No recent chemical studies of *Mansoa* have been reported.

MEMORA PSEUDOPATULA A. Gentry, Ann. Missouri Bot. Gard. 68:119. 1981. COLOMBIA. Vaupés. *Gutiérrez & Schultes 824*.

In the uppermost Río Vaupés, the few remaining Karijonas consider the leaves of this plant to be an efficient febrifuge.

Nothing is known of the chemistry of this genus.

COCHLOSPERMACEAE

New references to the chemistry and pharmacology of species of *Cochlospermum* include studies on the antiviral activity of extracts of *C. angolense* and of *C. planchanoi*. The former had activity against influenza A and B in cell culture, but not against viral hepatitis (Presber et al., 1987). The latter had activity against the hepatitis in cell cultures and was patented for this effect (Wolga, 1989). The alkaloids identified in *Cochlospermum planchanoi* were included in a study of such compounds in West African plants (Aschenbach, 1986).

COCHLOSPERMUM ORINOCENSE Spruce, J. Linn. Soc. 11:161. 1871. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes 8439*. ee-weé-ra (Tikuna); poro-poro, quinilla (Colombia).

Amongst the Tikunas of the Río Loretoyacu the bark of this tree is used in a tea to treat fevers.

COMPOSITAE

Books have been written on the individual classes of chemical compounds found in this family; the literature is huge, not unexpected considering the size, some 900 genera and 13,000 species, and the economic importance of the family.

The thiophenes of *Tagetes erecta* have been produced in root cultures (Mukundan & Hjortso, 1990).

NEUROLAENA LOBATA (L.) R. Brown, Trans. Linn. Soc. 12:120. 1817. COLOMBIA. Amazonas. Río Loretoyacu. *Glenboski* 138.

The leaves are crushed in warm water to provide a preparation that the Tikunas use as a wash on the head for headache and fever.

This species has yielded a group of sesquiterpene lactones (Borges del Castillo et al., 1982); flavonoids have been recognized in *Neurolaena venturana* (Ulubelen et al., 1981), and a group of compounds, named caleinolides because first identified in species of *Calea*, were found, too, in species of *Neurolaena* (Borges del Castillo et al., 1984).

TAGETES ERECTA Linn., Sp. Pl. 887. 1753. COLOMBIA. Amazonas. Río Loretoyacu. *Glenboski* 45.

flor de muerte (Colombia).

Tikunas bathe in a tea of this herb as a treatment of fevers.

DICHAPETALACEAE

There have been no recent publications on the chemistry of this family; nothing is known of the chemistry of *Tapura*.

STEPHANOPIDIUM PERUVIANUM Poeppig & Endlicher, Nov. Gen. Sp. 3:40. 1843. COLOMBIA. Vaupés. Soratama. *Schultes & Cabrera* 14157.

me-wee-teé-ka-te (Taiwano); calentura caspi (Colombia).

As the Colombian name for this plant ("fever tree") suggests, it is used by natives of the Río Apaporis in the Colombian Amazonia, particularly by the Taiwanos of the Río Kanarí, to reduce fevers.

TAPURA PERUVIANA var. PETIOLIFOLIA G. A. Prance, Fl. Neotrop. 10:57. 1972. COLOMBIA. Putumayo. *Plowman* 2042.

calentura chiricaspi (Colombia).

The collector's field notes state that in the Putumayo the leaves of this small tree are "taken in cold water for fever."

ELAEOCARPACEAE

This family is treated in Hegnauer (vol. 6) as a subfamily of the Tiliaceae. It is reported to

contain mucilage, polyphenols, tannins, flavonoids, cardenolides in some species, tripterpenes, sterols, saponins and alkaloids in a few species of *Elaeocarpus*.

Sloanea dentata contains polyphenols, and *S. javanica* contains saponins and tannins.

SLOANEA sp. COLOMBIA. Amazonas. *La Rotta* 384.

to-yí-che-je (Miraña).

Among the Miraña the inner bark is crushed to make an infusion which, taken unheated, is said to reduce fever.

The synthesis of indolizidines and quinolizidines, alkaloids found in this and in other families, has been reviewed (Herbert, 1985).

EUPHORBIACEAE

This family is rich in several kinds of chemical constituents (Hegnauer, vols. 4, 8). Reviews dealing with the bioactive diterpenoid constituents (Hirata, 1987) and the phorbol esters (Schmidt, 1986) have appeared.

JATROPHA CURCAS L., Sp. Pl. 1006. 1753. COLOMBIA. Amazonas. Leticia. *Glenboski* 74.

piñon (Colombia).

The Tikunas of the Río Loretoyacu use the leaves to prepare a bath used to treat headache and fever.

Studies of several species of *Jatropha* have recently been reported, but none, so far as we can determine, of *J. curcas*.

GENTIANACEAE

Much of what is known of the chemistry of this family concerns the genus *Gentiana*, long known for its bitter principles and their use in medicine. Members of the family contain alkaloids, polyphenols and triterpenes; the flavonoids have been recently described (Lub-sandorzhieva et al., 1986).

TACHIA GUIANENSIS Aublet, Hist. Pl. Guian. Franc. 3, t. 29. 1775. COLOMBIA. Vaupés. Río Apaporis. *Schultes* 3876; *Schultes & Cabrera* 12476, 14670, 19883; *Allen* 3084.

The Indians living on the Río Apaporis and its lower branches value the root of this plant in decoction as an effective febrifuge. This use seems to be widespread in the Amazon; according to Le Cointe (1934), Indians in the Brazilian Amazon use it for the same purpose.

GRAMINEAE

In addition to its importance in nutrition, the grass family is rich in biodynamic compounds; the genus *Cymbopogon* is well-known for its ethereal oil (Hegnauer, vol. 8).

CYMOPOGON CITRATUS (DC.) Stapf, Kew Bull. 1906: 322, 357. 1906. COLOMBIA. Amazonas. Río Loretoyacu. *Glenboski* 88.

Among the Tikunas, the highly aromatic leaves are crushed and made into a drink taken as a febrifuge.

Heiba & Rizk (1986) published a review of the constituents of species of *Cymbopogon*.

HENRIQUEZIACEAE

PLATYCARPUM SCHULTESII Steyermark, Bot. Mus. Leaflet. Harvard Univ. 17:96. 1955. COLOMBIA. Vaupés. Paraná-Píchuna. *Schultes & Cabrera* 19929.

to-reé-a-ka (Taiwano).

According to the Taiwanos the roots of this tree have strong febrifugal properties.

No recent chemical studies of this genus have come to our attention.

HYMENOPHYLLACEAE

TRICHOMANES ANKERSII Parker in Hooker & Grenville, Icon. Fil. t. 201. 1831. COLOMBIA. Amazonas. *La Rotta* 337.

doro-ppéhi (Miraña).

The Mirañas use a cold infusion of the fronds of this scandent fern to lower fevers in animals.

TRICHOMANES ELEGANS L. C. Richard, Act. Soc. Hist. Nat. Paris 1:114. 1792. COLOMBIA. Amazonas. *La Rotta* 192.

de-né-me-ba (Miraña).

This species is used in the same way and for the same purpose as *T. ankersii*.

TRICHOMANES PINNATUM Hedwig, Fil. Gen. Sp. t. 4, fig. 1. 1799. COLOMBIA. Amazonas. *La Rotta* 338.

náko (Miraña).

The Mirañas crush the fronds of this species and add the material to a similar preparation of *Trichomanes ankersii*. The mixture is applied to the tongue, forehead and chest of animals to reduce fevers.

LABIATAE

The mint family is quite well known chemically. Recent reviews have included those treating the general chemistry of the family (Rivett, 1984), the carbohydrates (Prokopenko & Chushenko, 1986), the flavonoids, including their pharmacology (Barberan, 1986) and the monoterpenoid amaroids, especially those used in Ukrainian folk medicine (Fursa & Litvinenko, 1987).

OCIMUM MICRANTHUM Willd., Enum. Hort. Berol. 630. 1809. COLOMBIA. Amazonas. Río Loretoyacu. *Glenboski* 108.

hua-cá (Tikuna).

The Tikunas crush the leaves in water and wash the head with the resulting liquid to reduce fevers.

LAURACEAE

The richness of this family in many types of compounds of potential biodynamic activity is well known (Hegnauer, vol. 8). The genus *Nectandra* is one of many recognized for its alkaloid content, but no information on the chemistry of *N. globosa* has come to our attention.

NECTANDRA GLOBOSA (Aubl.) Mez, Jahrb. Bot. Gard. Berlin 5:415. 1889. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes, Raffauf & Soejarto* 24121.

The Tikuna Indians of the Río Loretoyacu consider an infusion of the bark of this tree to have febrifugal properties.

LEGUMINOSAE

Several classes of potentially bioactive compounds have been found in this large family, divided by many workers into three. Recent reviews include those of the xanthones (Ramachandralah, 1988), the quinolizidine alkaloids (Kingham & Balandrin, 1984) and the anticholesteremic effects of various constituents of the family (Shutler et al., 1987).

BAUHINIA SPLENDENS Kunth, Nov. Gen. Sp. 6:321. 1824.

According to García-Barriga (1974-5), a decoction of this plant is one of the most popular medicines in the Colombian Amazon where it is valued as an astringent and febrifuge.

BAUHINA sp. COLOMBIA. Amazonas. *La Rotta* 358.

ne-bá-ni-keke (Miraña).

The fresh sap of this vine is used by the Mirañas to reduce fever.

CHAMAESENNA RETICULATA (Willd.) Pittier, *Trab. Mus. Com. Venez.* 3:160. 1928. COLOMBIA. Amazonas. Río Karapará. *Schultes* 3807.

o-reé (Tukano).

The Witotos of the Río Karapará make a febrifugal tea by boiling together the roots of this bush and those of a species of *Chelonanthus*.

Nothing is known of the chemistry of this genus.

DIOCLEA sp. COLOMBIA. Vaupés. Cerro Isibukuri. *Schultes & Cabrera* 13986.

Informants from several of the tribes in the Vaupés - the Kubeos, Taiwanos and Makunas - state that a tea prepared from the bark of this species is "good for malaria."

DIOCLEA aff. APURENSIS Kunth, *Nov. Gen. Sp.* 6:457. 1823. COLOMBIA. Vaupés. Soratama. *Schultes & Cabrera* 12828.

Among the Taiwanos the leaves are boiled and the tea is taken for headaches and to reduce fevers.

DIOCLEA GLABRA Benth, *Ann. Wien. Mus.* 2:133. 1838. COLOMBIA. Vaupés. Soratama. *Schultes & Cabrera* 15005.

The Barasana Indians report that this species is good for fevers.

DIOCLEA UCAYALINA Harms, *Notizbl.* 9:262. 1925. COLOMBIA. Amazonas. Río Amacayacu. *Schultes* 6964.

Among the Tikunas the bark is said to have febrifugal properties.

The poisonous amino acid canavanine has been isolated from *Dioclea megacarpa* (Rosenthal, 1983).

DIPTERYX CORDATA (Ducke) Cowan, *Mem. New York Bot. Gard.* 10:152. 1958. COLOMBIA. Vaupés. Río Kuduyarí. Yapobodá. *Schultes & Cabrera* 14529.

Among the Taiwanos the bark of this small tree is the source of medicine used to reduce fevers associated with severe colds.

Diterpenes were found in the seeds of *Dipteryx odorata* (Godoy et al., 1989).

PTEROCARPUS ROHRII Vahl, *Symb. Bot.* 2:79. 1791. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes, Raffauf & Soejarto* 24163.

The Tikunas believe that a tea prepared from leaves of this species is the most efficient febrifuge.

Species of this genus have been reported to contain flavonoids and their glycosides, phenolics and auronones.

MALPIGHIACEAE

The importance of *Banisteriopsis* in South American folklore and ethnobotany has given emphasis to the investigation of this genus in much detail. The history of the use of *B. caapi* and of plants containing beta-carbolines has been written (Schultes, 1982; Bongiorno de Pfirter & Mandrile, 1984). Recently non-psychoactive constituents (sterols and triterpenes) were described (Aquino et al., 1991).

TETRAPTERYS STYLOPTERA Jussieu, *Ann. Sci. Nat. Bot.*, ser. 2, 13:262. 1840. COLOMBIA. Vaupés. Raudal de Jerijerimo, Río Apaporis. *Schultes & Cabrera* 15784.

wé-po-awk (Tanimuka).

The Tanimukas, living on the Río Miritipará, boil the rasped bark to make a very bitter febrifuge.

We have no new data on the chemistry or pharmacology of this genus.

MALVACEAE

Recent additions to the chemistry of this family include a study of the cyclopropenoid fatty acids of seven species (Schmid & Patterson, 1988) and a review of polyphenols found in the group (Bandyukova & Ligai, 1989).

MALACHRA CAPITATA L., *Syst. Veg.*, ed. 12, 169. 1782. COLOMBIA. Amazonas. Río Loretoyacu. *Glenboski* 50.

malva (Colombia).

A tea of the leaves is valued by the Tikunas in treating fevers and colds.

There have been no recent chemical studies of this genus.

MELIACEAE

A few new reviews have contributed to the literature of the family; those on tetranortri-

terpenoids (Banerji & Nigam, 1984), limonoids (Taylor, 1984), bioactive compounds (Kraus, 1984) and the constituents of *Melia azadirach* (Mahato et al., 1987).

CARAPA GUIANENSIS Aublet, Hist. Pl. Guian. Franc., Suppl., 32, t. 387. 1775.

carapa (Venezuela); andiroba (Brazil).

According to Le Cointe (1934), the very bitter bark and the leaves, in decoction, together make a febrifugal and vermifugal preparation.

Procera was studied for the effectiveness of extracts against various destructive insects (Mikolajczak & Reed, 1987). Species of *Trichilia* (see below) were included in the same study.

TRICHILIA PLEEANA (Juss.) C. DC., Martius, Fl. bras. 11(1):215. 1878. *Schultes & Cabrera 13527*.

we-ti-bee-yë-haw (Taiwano).

The bark of this small tree is reported by the Taiwano to be very astringent and to be used in a decoction against fevers.

TRICHILIA SEPTENTRIONALIS C. DC., Martius, Fl. Bras. 11(1):220. 1878. COLOMBIA. Putumayo. *Schultes 3303*.

In the region of Mocoa, Colombia, the Inganos say that a tea of the leaves has febrifugal properties.

TRICHILIA aff. SINGULARIS C. DC., Martius, Fl. Bras. 11(1): 217. 1878. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes 6946*; Vaupés. Río Piraparaná. *Silverwood-Cope 16*.

A favorite febrifugal medicine of the Tikunas is made from the leaves of this tree. In the Río Piraparaná the nomadic Makú Indians use the "scrapings from the stem and roots rubbed in water" which is drunk as a vermifuge.

A new hexacyclic limonoid was isolated from *Trichilia roka* (Nakatani et al., 1987); three new limonoides from *T. havanensis* (Arenas & Rodríguez-Hahn, 1990), and tetracyclic triterpenes from *T. prieuriana* (Olugbade, 1991).

MENISPERMACEAE

Various natural products, especially the bisbenzylisoquinoline alkaloids, of this family have been reviewed (Pachaly, 1988).

ABUTA CONCOLOR Poepp. & Endl., Nov. Gen. Sp. 2:64, t. 188. 1836.

According to Le Cointe (1934) the root is valued in the Brazilian Amazon as a tonic and febrifuge.

The monoamine oxidase inhibitors of some Amazonian species, including those of *Abuta grandifolia*, were treated in a thesis (McKenna, 1985).

MONIMIACEAE

The presence of alkaloids in at least three species of *Siparuna* was recognized a few years ago (Gerard et al, 1986). Those in *Siparuna dresseriana* and *S. pauciflora* were identified (López et al., 1988), as were those of *S. tonduziana* (López et al., 1990).

SIPARUNA GUIANENSIS Aublet, Hist. Pl. Guian. Franc. 2: 865, t. 333. 1775. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes 6707a*.

The Tikunas of the Río Loretoyacu value a decoction of the leaves as an antimalarial preparation.

SIPARUNA MAGNIFICA Perkins, Bot. Jahrb. Syst. 28:699. 1901. COLOMBIA. Amazonas. Leticia. *Schultes, Raffauf & Soejarto 24072*.

In the Leticia area, the Tikunas and the colonos maintain that a tea of the leaves of this plant is the best remedy for high fevers. The crushed fruits are applied to sore gums.

SIPARUNA MOLLICONIA (Mart.) A. DC., Prodr. 16(2):653. 1868. COLOMBIA. Amazonas. Río Karaparaná. *Schultes 3880*.
o6-mo-go (Witoto).

This species, used as a decoction of the leaves, is the favorite febrifuge of the Witotos in the Río Karaparaná.

SIPARUNA TERNATA Perkins, Jahrb. 28:691. 1901. COLOMBIA. Vaupés. Cachivera de Tatú. *Schultes, Raffauf & Soejarto 24375*.

Several reports indicated that this species is also used to prepare a medicine used to reduce fevers.

This collection was alkaloid-negative with a Dragendorff field test.

MORACEAE

A wide variety of substances including phenols, flavonoids, triterpenes and alkaloids

have been characterized in this family (Hegauer, vol. 5). The phenolic constituents have been reviewed (Nomura, 1988).

COUSSAPOA INTERMEDIA Miquel, Martius, Fl. Bras. 4(1):133. 1853. COLOMBIA. Amazonas. Río Loretoyacu. *Schultes 6726*.

The Tikunas drink an infusion of the fruits over a three-day period to treat fevers.

Nothing is known of the chemistry of this genus.

MYRISTICACEAE

The family is known for the economic importance of nutmeg and for the hallucinogenic tryptamines of the South American species. Recently the anti-bacterial and anti-oxidant properties of *Myristica fragrans* have been reported (Nakatani & Kikuzaki, 1988).

IRYANTHERA ULEI Warburg, Verh. Bot. Ver. Prov. Brandenb. 47:137. 1905. COLOMBIA. Amazonas. *Schultes & Cabrera 13623*.
pi-rí-jae (Miraña).

The Mirañas crush the leaves and mix the mass with crushed leaves of *Renealmia thyrsoides* and *Adiantum tomentosum*. The mixture is applied to the skin to dispel forest spirits which cause fevers and other ills. This is one of the few cases in which the Indian considers a "medicine" to act directly in a way which, to us, seems superstitious.

Compounds isolated from *Iryanthera* include two dihydrochalcones, five diaryl propanes and two neolignans (Conserva et al., 1990).

VIROLA CALOPHYLLA Warburg, Nova Acta Acad. Leop.-Carol. 68:231. 1897.

Among the nomadic Makús of the Río Uneiuxí in Amazonian Brazil the bark of this tree is scraped and boiled to prepare a tea to treat malaria (Le Cointe, 1934).

In addition to the now well-known tryptamines which bring bioactivity to extracts of this species, neolignans found in other species of *Virola* have now been identified in *V. calophylla* (Conserva et al., 1990).

MYRSINACEAE

No recent reviews of the chemistry of the family have appeared.

CONOMORPHA CITRIFOLIA Mez, Pflanzenreich. Myrsinaceae 256. 1902. COLOMBIA. Vau-

pés. Jinogojé, Río Apaporis. *Schultes & Cabrera 17593*.

The bark, taken in decoction, is valued among the Puinaves for febrifugal properties.

PASSIFLORACEAE

Members of this family contain, among other classes of compounds, phenols, tannins and cyanogenic substances, these last having a cyclopentenoid structure (Jaroszewski & Fog, 1989).

PASSIFLORA CUMBALENSIS (Karst.) Harms, Bot. Jahrb. 18, Beibl. 46:13. 1894. COLOMBIA. Putumayo. Sibundoy. *Schultes & Villarreal 7527*.

Indians of the Sibundoy valley use a decoction of leaves as a febrifuge.

PASSIFLORA KILLIPIANA Cuatrec., Contr. U. S. Natl. Herb. 35:17, t. 10. 1960. COLOMBIA. Vaupés. Mitú. *Schultes, Raffauf & Soejarto 24207*.

The Taiwanos use leaves of this vine in a febrifugal tea.

PHYTOLACCACEAE

Triterpenes, sterols, and saponins have been found in this family, most recently in seeds of several species of *Phytolacca* (Kang & Woo, 1986). Protein fractions of approximately 29,000 molecular weight have been obtained from extracts of *P. acinosa* and were found to have anti-herpes activity (Yin et al., 1985).

PHYTOLACCA SANGUINEA H. Walter, Pflanzenreich, Phytolacc. 46. 1909. COLOMBIA. Putumayo. Sibundoy. *Schultes & Villarreal 7643*.

Among Kamsá medicine men in the valley of Sibundoy, tea prepared from the root of this species is said to have febrifugal properties.

PIPERACEAE

A wide variety of compounds, economic, agricultural and folk-medicinal uses are known for this family.

LEPIANTHES PELTATUM Raf., Sylva Tellur. 85. 1838. COLOMBIA. Amazonas. *La Rotta 23*. budaré (Andoke).

An infusion of the leaves of this species, widely known as *Pothomorphe peltata*, is used

as a bath when the patient is perspiring to treat chills and fevers.

No recent chemical studies of this genus have come to our attention.

PEPEROMIA MACROSTACHYA var. *NEMATOSTACHYA* (Link) Trelease & Yuncker, Piperaceae N. Amer. 2:661. 1950. COLOMBIA. Vaupés. Río Kananarí, Cerro Isibukuri. *Schultes & Cabrera 13260*.

The Taiwanos boil the leaves of this small plant and use the resulting tea as an effective febrifuge.

This genus contains secolignans; those of *Peperomia japonica* have been studied (Chen et al., 1989).

PIPER AMAZONICUM (Miq.) C. DC., Prodr. 16(1):272. 1869. COLOMBIA. Putumayo. Puerto Asís. *Schultes 3515, 3373*.

gou-pipí (Siona); karapa-sikihecu (Kofán).

The Sionas of the Putumayo consider this pepper to be an effective febrifuge.

PLANTAGINACEAE

This small family (three genera) has been most studied with respect to the genus *Plantago* which has a long history of medicinal use. Known from it are aucubin, alkaloids and, in some species, cinnamic acid derivatives, triterpenes, sterols and mucilage.

PLANTAGO MAJOR L., Sp. Pl. 112. 1753. COLOMBIA. Amazonas. Río Loretoyacu. *Glenboski 129*.

llantén (Colombia).

A Tikuna remedy for fevers and bronchitis consists of the crushed leaves mixed with a raw egg; two teaspoonfuls are taken twice daily.

POTALIACEAE

No new chemical or pharmacological information on this family has been published.

POTALIA AMARA Aublet, Hist. Pl. Guian. Franc. 394, t. 151. 1773. PERU. Dept. Loreto. Río Yaguasyacu. *Schultes & Cabrera 137726, 13972; Plowman, Schultes & Továr 6803, 6895*.

okají-kahpuú (Bora)

For most tribes in the northwest Amazon this plant is a near panacea. The Boras and Witotos of the Río Yaguasyacu and the Río

Ampiyacu use it in treating snakebite and, as a decoction of the leaves, as a febrifuge. Indians of the region near Mitú say that leaves of the plant are given when malarial fever is at its height, and that its febrifugal activity is high.

QUIINACEAE

The chemistry of this family seems not to have been examined.

QUINA AMAZONICA A. C. Smith, Trop. Woods 58:30. 1939. COLOMBIA. Vaupés. Raudal Jerijerimo. *Schultes & Cabrera 14660*.

The Kubeos of the Río Vaupés make a very bitter decoction of the leaves as a treatment for fevers.

RUBIACEAE

This family is rich in compounds of actual, as well as potential biological activity. Recent reviews have dealt with the monoterpenoid amaroids (Litvinenko et al., 1985), the anthraquinones (Wijnsma & Verpoorte, 1986) and the emetine alkaloids (Wiegrebbe et al., 1984).

BATHYSA OBOVATA Standley, Publ. Field Columbian Mus., Bot. Ser. 7:280. 1931. COLOMBIA. Vaupés. Mitú. *Schultes, Raffauf & Soejarto 24351*.

The chemistry of this genus is unknown, except that the anthocyanin, peonin, found in many other species as well, is known from *Bathysa*. (Weeks et al., 1977).

FARAMEA GLANDULOSA Poepp. & Endl., Nov. Gen. Sp. 3:29. 1845. COLOMBIA. Putumayo. *Schultes 3301*.

Indians living in the Putumayo use a decoction of the roots in treating fevers.

FARAMEA SALICIFOLIA Presl, Symb. Bot. 2: 24, t. 70. 1833. COLOMBIA. Vaupés. Soratama, Río Apaporis. *Schultes & Cabrera 12795, 13648*.

The Makuna Indians use a decoction of the bark in treating fevers.

Two naphthopyrans have been isolated from *F. cyanea* (Ferrari et al., 1985).

ISERTIA ROSEA Spruce, Martius, Fl. Bras. 6(6): 284. 1889. COLOMBIA. Vaupés. Río Vaupés, Circasia. *Schultes 19292*.

na-ta-kó-ree (Taiwano).

The Taiwano use the leaves to make a tea which must be drunk every few hours to reduce fever by increasing perspiration.

Recent investigation of *Isertia haenkeana* resulted in discovery of several new compounds: eight secoiridoids (Rumbero-Sánchez & Vásquez, 1988), two triterpene glycosides (Arriaga et al., 1990), nortriterpene glycosides (Rumbero-Sánchez & Vásquez, 1991) and a group of quinic acid esters (Rumbero-Sánchez & Vásquez, 1991a).

RUTACEAE

There have been several recent reviews of the constituents of this important family; pharmacology (Lewis, 1983); the quinolines, alkaloids, and the coumarins (Grundon, 1983); triterpenes with reference to biogenetic relationships (Dreyer, 1983); the limonoids (Dreyer, 1982); and the dimeric quinoline alkaloids (Waterman, 1986).

SAPINDACEAE

PAULLINIA SPLENDIDA R. E. Schultes, *Caldasia* 2:421. 1944. COLOMBIA. Vaupés. Upper Río Apaporis. *Schultes* 5677.

mê-ta-ma-moó (Karijona).

The Karijonas use a tonic prepared from the leaves to combat post-malarial weakness.

PAULLINIA YOCO R. E. Schultes & Killip, *Bot. Mus. Leafl.* 10:302, t. 27-29. 1942. COLOMBIA. Putumayo. *Schultes* 3341, 3426, 3543, 4028; *Schultes & Cabrera s.n.*, *Schultes & Smith* 3045, 3045A; *García-Barriga* 18695; *Klug* 1930, 1933, 1935, 1946, 1955, 1957.

yoco; taruco yoco (Witoto); totoa yoco, poyoca, yoco-cu (Kofan); yoco blanco, canaguiche yoco, tigre yoco, yajé yoco, yoco colorado, yoco negro (Colombia).

In the region of the Putumayo and Caqueta and in adjacent parts of Ecuador, the Sionas, Kofáns, Witotos, Koreguajes, Inganos and others use the bark of this forest liana in a cold water infusion as a morning stimulant (the plant has a respectable caffeine content). It is occasionally used in treatment of fevers.

There are many strains of this species which are recognized by the Indians and which have distinguishing vernacular names.

We have seen no recent publications on the chemistry or pharmacology of the Sapindaceae.

SELAGINELLACEAE

Flavonoids have been found in several members of this relatively large family; glycosides of hordenine and tyramine have been isolated from *Selaginella doederleinii* (Chao et al., 1987). The synthesis of the hordenine glycoside, its acetyl derivatives and a revision of the previously postulated structure was recently published (Chao et al., 1990).

SELAGINELLA AMAZONICA Spring, *Martius, Fl. Bras.* 1(2):124. 1840. COLOMBIA. Comisaria del Vaupés. Raudal Jerijerimo, Río Apaporis. *Schultes & Cabrera* 12458.

Taiwano medicine men have great faith in the value of this species in treating high fevers; the leaves are rubbed over the body of the patient.

SOLANACEAE

This family is well-known for its diversity of compounds, many of them having well established uses in medicine. A review of steroidal alkaloids from various families, including the Solanaceae, was published several years ago (Harrison, 1986). A review of the withanolides, including information on methods of isolation, on chemistry and on pharmacology has appeared (Christen, 1989).

BRUGMANSIA AUREA Lagerheim, *Gartenflora* 42: 33. 1893. COLOMBIA. Putumayo. Sibundoy. *Schultes* 7620, 22555; *Idrobo* 2204, 2257; *Schultes & Villarreal* 9717; *Bristol* 887, 1122, 1124, 1268, 1333.

borrachero, quinde borrachero, munchira borrachero.

One of the many ways in which medicine men of the valley of Sibundoy use this species is in treatment of chills and fevers. A cold water infusion of the crushed leaves, often with added sugar, and sometimes taken with an alcoholic drink, is used. A simple decoction of the leaves may also be used.

There are many strains of *Brugmansia aurea* which seem to differ in chemical constitution. Medicine men distinguish between forms more and less toxic and the forms have specific names in native languages.

Some of the species of *Brugmansia* in Colombia, including *B. aurea*, were assayed for their content of atropine/scopolamine. *Brugmansia sanguinea* was proposed as a commer-

cial source of scopolamine (De Garcia et al., 1985), but these authors were apparently unaware that this species has for several years been the source of part of the world's supply of scopolamine. A similar assay was done on plants collected in Argentina (Roses et al., 1987).

BRUNFELSIA CHIRICASPI Plowman, Bot. Mus. Leaf. 23: 255, t. 17. 1973. COLOMBIA. Putumayo. *Plowman 2080, 2081, 2092*. ECUADOR. Sucumbios. Pinkley 563.

kovi-tsoninbá-ko (Kofán); chircaspi (Colombia, Ecuador).

This woody shrub is the most used febrifuge among Indians of the Putumayo and Caquetá and adjacent Ecuador - the Kofáns, Sionas, Inganos, Koreguajes and others. In large doses it is a strong hallucinogen. Its fame as a febrifuge is indicated by the vernacular name in Spanish, obviously from a Ketchwa word meaning "chill tree." When ingested *Brunfelsia chircaspi* immediately causes chills and a sensation of tingling.

BRUNFELSIA GRANDIFLORA subsp. SCHULTESII Plowman, Bot. Mus. Leaf. 23: 259, t. 18. 1973. COLOMBIA. Putumayo. *Cuatrecasas 10795; García-Barriga 4586; Plowman 2090; Pinkley 575; Klug 2880*.

Brunfelsia grandiflora itself is found wild, while the subspecies is widely cultivated in the western Amazon basin and in adjacent parts of Venezuela. It is used for various medical problems, and especially to reduce fevers. Like *Brunfelsia chircaspi*, it is often taken in strong decoction for purely hallucinogenic effects or as an additive to ayahuasca or yajé, a psychoactive drink prepared from *Banisteriopsis caapi*.

An alkaloid isolated from *Brunfelsia* (Lloyd, 1985) having anticonvulsant activity was likewise isolated from *B. hopeana* and patented as an anti-inflammatory agent (Birkner et al., 1986). Scopoletin and oleanolic acid were isolated from *B. nitida* (Magadan et al., 1986).

JALTOMATA PROCUMBENS (Cav.) J. L. Gentry, *Phytologia 27:287*. 1973. COLOMBIA. Putumayo. Sibundoy. *Schultes & Villarreal 7615, Bristol 495, 1191, 1328*.

cuftanguemeshta (Kamsá).

The Kamsá Indians of Sibundoy use a tea of the leaves as a diuretic and febrifuge.

Nothing is known of the chemistry of this species.

METHYSTICODENDRON AMESIANUM R. E. Schultes, Bot. Mus. Leaf. 17: 2, t. 1-4. 1955. COLOMBIA. Putumayo. Sibundoy. *Schultes 3256, 26351; Schultes & Cabrera 18911, 20079; Bristol 1112; Fosberg 20406; Villareal 68, 72; Fernández-Perez 2641; Mora Osejo 1023. Idrobo 2221*.

mets-kwaí-borracherro; goon-ssí-an-borrachero; quinchoro borrachero (Kamsá); kindebor-rachero (Ingano); culebra borrachero (Colombia).

This unique tree is, without doubt, the most important item in the garden of a medicine man of the Valley of Sibundoy. When used to make a tea, it provides the most potent hallucinogen of the region. It is much used medicinally, especially in the treatment for persistent chills and fevers which may be symptoms of advanced tuberculosis.

This monotypic genus is known as a cultigen. It may be related to *Brugmansia*, but it has proven impossible to assign it to any species of that genus.

This species has a high concentration of scopolamine (Theilkühl, 1975). Scopolamine was determined to constitute 80% of the total alkaloids of the plant by Pachter and Hopkinson (1960).

VERBENACEAE

Constituents identified in, or isolated from, the family include iridoids, phenolics and tannins, flavones, quinones, ethereal oils, di- and tri- terpenes, sterols, saponins and alkaloids.

CITHAREXYLUM POEPPIGII Walpers, Ann. Bot. Syst 4:76. 1844. COLOMBIA. Putumayo. *Schultes 3381*.

yujaco (Colombia).

Indians in the Putumayo use the leaves of this shrub to make a febrifugal tea and the Mirafías use an aqueous preparation of this plant as a febrifuge and against severe colds.

Iridoid glycosides have been isolated from *Citharexylum fruticosum* (Ganapaty et al., 1988).

VOCHYSIACEAE

The only recently published information on this family which we have seen deals with

isolation of some pentacyclic triterpene acids from *Vochysia vismiaefolia* (Araujo & Souza, 1990).

VOCHYSIA SACCATA Stafleu, Rev. Trav. Bot. Neerl. 41:508. 1948. COLOMBIA. Vaupés. Río Guainía. *Schultes & López 10110*

Bark of this species in decoction is considered by the Kuripakos of the Río Guainía to be a powerful febrifuge.

ZINGIBERACEAE

Earlier references to the chemistry of this family have been supplemented by recent reviews of species used in Asia as food and as medicines (Manunapichu, 1985) and of chemistry and pharmacology (Hokawa, 1988).

RENEALMIA THYRSOIDES (Ruiz & Pavon) Poeppig & Endlicher, Nov. Gen. Sp. 2:25, t. 134. 1838. ECUADOR. Napo. *Davis & Yost 934, 935*. COLOMBIA. Putumayo. *La Rotta 141*.

yei (Andoke); teentekage, teentemo (Wao-rani)

The Andokes rub crushed leaves over the body as treatment for the cold phases of malarial fever. Among the Wao-rani, this species is used to treat snake bites.

A labdane aldehyde has been isolated from *Renealmia guianensis* (Ramianandrosoa et al., 1986); the seed oil of *R. alpina* consists of fixed oils and sterols (Lognay et al., 1989).

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