

The poisons and narcotics of the Amazonian Indians

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ABSTRACT – The indigenous tribes of the Amazonian rainforest have discovered a vast array of poisons and narcotics from the plant species which surround them. Examples are given from the author's personal experience of a variety of arrow poisons, fish poisons and narcotics used by six different tribes. There is a great variety of different plant species used for each category and no two tribes studied employ exactly the same array of plant species. This makes it important to survey a wide range of tribes and to document this information before it is too late as these people are fast losing their traditional culture. Several of the substances used by Amazonian Indians, such as curare and coca, have entered into western medicine and others such as rotenone, an ingredient of their fish poison, has become a useful insecticide. Further useful chemicals are likely to be discovered from ethnobotanical work among indigenous peoples and it is vital that any commercial gain from their knowledge be of direct benefit to these people in accordance with the rules of the Convention on Biological Diversity.

During my career as a field botanist in Amazonia, primarily conducting surveys of the Amazon vegetation, I have had the opportunity and privilege of visiting many of the indigenous tribes and of conducting ethnobotanical studies among them. One of the most striking aspects of travelling widely among different tribes is that there are certain basic requirements of plant products for their forest life which they seem to be able to fulfil in whatever part of the forest they dwell. Almost every tribe has one or more arrow poisons, fish poisons, medicines for common diseases and stimulants and narcotics. However, the plants which they put to use vary considerably from one tribe to another. In the several thousand years that these people have occupied the Amazon region they have been most creative in their ability to discover a vast array of different sources of these chemical compounds. Richard Schultes, who was the pioneer of Amazonian ethnobotany, and chemist Robert Raffauf listed just over 1500 different species of plants used in indigenous medicine in their book 'The Healing Forest'¹.

This paper describes the poisons and narcotics of six of the 14 tribes I have visited, and illustrates the botanical and

cultural diversity of the Amazonian Indians. The geographical locations of these tribes are shown in Fig 1.

The Yanomami

The Yanomami are a forest dwelling tribe that live on the borders of Brazil and Venezuela, with about an equal number residing in each country. Until recently they were one of the most pristine and least disturbed tribes²⁻³ (Fig 2). Unfortunately their territory was invaded by a massive gold rush during the 1980s which brought in many problems including western diseases. The medicinal plants used by the Yanomami were recently studied by Milliken and Albert⁴.

Arrow poisons and snuffs

The Yanomami generally make their arrow and blow gun dart poison from the bark resin of *Virola theiodora* (Spruce ex Benth.) Warb., a tree in the nutmeg family (Myristicaceae). I have observed the use of *Virola* bark in three different widely spaced villages within Yanomami Territory, Auaris, Serra dos Surucucus and at Watorikitheri on the abandoned Perimetral Norte highway. The bark is stripped off a tree and then placed over a fire which is lit nearby (Fig. 3). The heat causes much of the sticky red sap to ooze out of the inner bark. This is then collected and placed back on the fire to boil down to a sticky consistency. Arrows and darts are then dipped into the liquid and allowed to dry (Fig. 4). The use of *Virola* as an arrow poison was first reported by Schultes and Holmstedt⁵, see also Prance⁶⁻⁷. What is most interesting in the case of *Virola* is, that after the arrows have been coated, the remaining *Virola* sap is boiled dry and then pulverized for use as a snuff. In some villages the *Virola* powder is mixed with the dried leaves of *Justicia pectoralis* Jacq. (Acanthaceae) which is rich in coumarins and gives a pleasant odour to the snuff. (Coumarins were banned from food products long ago because of their carcinogenic properties.) The active compounds found in *Virola* are the hallucinatory tryptamines. *Virola* resin contains approximately eight per cent 5-methoxy-N, N-dimethyltryptamine, and lesser amounts of N, N-dimethyltryptamine.

The snuff is mainly taken by the shamans before treating a patient with their magic, but is also taken by adult males in certain ceremonies such as the final day ritual after the death of a member of the village. It is also taken following certain hunting parties. The Yanomami administer the snuff with small blow pipes. One Indian blows snuff into another's nostrils to introduce a sufficient quantity to be effective. The



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intoxication is rapid and powerful. One ceremony which follows the administration of the snuff was explained by Prance⁶ where a chest hitting and shouting ritual is described.

Even within the Yanomami there is variation in the plant used as a source of snuff for their ceremonies. The other main source is *Anadenanthera peregrina* L. Spig.^{8,9} The disc-like seeds of this tree in the Legume family are pulverized with alkaline ash to produce yopo. This snuff contains β carbolines, and bufotenin, a substance that also occurs in the poison arrow frogs used by Colombian tribes.

Other narcotics

In addition to the strongly hallucinogenic substances which are used for strictly ceremonial purposes, the Yanomami grow tobacco. They do not smoke it, but soften the leaves by crushing them, sprinkle them with ash to create an alkaline environment and roll them into a quid which is placed between the lower lip and teeth and allowed gradually to percolate its stimulatory juices into the digestive system (Fig 5). One of the few items of Yanomami hospitality I have been unable to accept is when a friendly person takes his quid from his mouth and offers it to me!

Diet

Prior to the recent introduction of many western diseases by gold miners, the Yanomami were a healthy people, perhaps due to their varied diet. It is also interesting that the staple crop of the Yanomami is banana, a post Colombian introduction to South America¹⁰. In addition to their cultivated crops and the products of hunting, they eat a large number of other forest products, especially insects (beetles and termite larvae) and fungi. The Yanomami appear to be the only Amazonian people who make extensive use of fungi. We have now identified over 30 species eaten by them¹¹⁻¹². Most of the fungal species used are wood rotting and grow on dead logs that remain in the fields. The Yanomami are therefore inadvertently cultivating an important second crop. Most evenings in a village one can observe women returning from their fields with a collection of fungi wrapped up in a banana leaf.



Fig 1. Map of the localities of the Brazilian Amazon tribes described in this paper.



Fig 2. Yanomami couple with body paint at Toototobi, Amazonas, Brazil.

Medicines

Most early literature claimed that the Yanomami did not use medicinal plants and that their medicine was based entirely on shamanistic practices. However, Milliken and Albert⁴ showed that they possess a substantial pharmacopoeia using at least 113 species of plants and fungi. Malaria is an increasing problem among the Yanomami since the invasion of the gold miners. Milliken¹³ studied the plants used to combat malaria by other tribes and the Luso-Brazilian population in Roraima State of Brazil. The purpose



Fig 3. Bark of *Virola theiodora* placed on a fire to extract the sap for use as arrow poison and hallucinogenic snuff.

was to find the most effective plants and introduce them to the Yanomami. Ninety-nine species and 82 genera were indicated as having been used to treat malaria in the area. These plants are currently undergoing laboratory screening in Brazil and at Kew for anti-malarial activity and toxicity, and several show strong anti-malarial properties. The importance of this particular ethnobotanical study is that it was conducted for the purpose of helping the Yanomami rather than just removing their data for use and possible exploitation elsewhere. This type of study, for the benefit of a people, is an area that needs much further work in the future.

The Makú

The Makú people inhabit the upper Rio Negro region. The village which I visited was on the upper reaches of the Rio Uneixi. The people of this village are to some extent acculturated because they work for Brazilians gathering sôrva latex (*Couma* sp.) and other forest products, and a few of the younger adults have had an elementary school education at a Salesian mission. In spite of this, the Makús retain much of their traditional culture and uses of plants.

Arrow poison

The Makú have an effective poison for their darts which is the untreated latex of a member of the fig family *Naucleopsis mello-barretoii* (Standl.) C.C. Berg (Moraceae). A small slit is made in the bark of a tree and the latex is collected into a leaf. The blow gun darts are dipped directly into the latex without any heating or concentration. The active substances in this poison are cardiac glycosides (my collection of this latex was analysed by Bissett & Hylands¹⁴, see also Shrestha *et al*¹⁵). The latex was shown to have a complex mixture of cardenolide glycosides including α -antiarin. Poison actually scraped from a blow gun dart of the Makú contained about 4.4% of a cardiac-glycoside mixture with α -antiarin as one of the main components. Shrestha *et al*¹⁵



Fig 4. Yanomami group with bow and arrows coated with *Virola* arrow poison.

gave a good summary of the use of Moraceous dart poisons in South America and showed that species of both *Naucleopsis* and *Maquira* are used in the Chocó of Colombia, in Ecuador and by the Tikuna Indians of Brazil.

Stimulants

The Makú group which I visited do not have a narcotic snuff but they use coca (*Erythroxylum coca* L. variety *ipadu*) which they call 'botô'. They cultivate this species in large quantities in their fields. The leaves are harvested and placed in a large flat pan to toast until they are crisp and dry. At the same time a fire is made and green banana leaves are burned. The dried leaves are placed in a wooden bowl and ground into a powder and mixed with the banana leaf ash. There is a ceremony attached to the pulverizing, and a rhythm is often beaten out with the wooden grinding stick while other Indians chant. The extremely deep, long, hollow mortar which they use makes a loud drum-like noise when the wooden pestle is knocked against the side (Fig 6). The different rhythms which they beat tell the rest of the Indians how the preparation is progressing. When the ash and leaves are ground into a fine powder they are ready



Fig 5. Yanomami youth with quid of tobacco leaves rolled in ash which they place between lower lip and teeth.

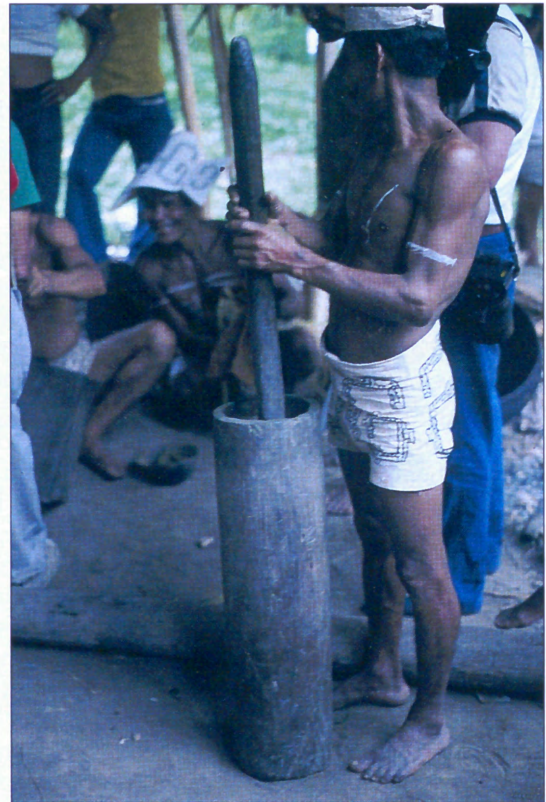


Fig 6. Bora Indian in Peru pounding the leaves of coca (*Erythroxylum coca* variety *ipadu*).

for use. The powder is mixed with cassava, either with farinha flour or tapioca flour. This coca powder forms a part of the daily diet of the Makús, and they prepare it fresh every evening. The powder is not unpleasant to eat, it tastes only of dried leaves, and did not have any adverse effect on the members of our expedition who sampled it.

Other reports on the use of coca by the lowland Amazon tribes, eg Schultes¹⁶ described the preparation of coca leaves by pulverization, but the method of use is generally different from that of the Makús. Coca is more often taken into the mouth and slowly worked with the tongue into a packed mass between the cheek and the gums. This mass is dissolved slowly rather than eaten with food, as in the case of the Makús.

I have observed this use among the Bora Indians in Peru where they use the ash of the leaves of *Pourouma cecropiifolia* Mart. to mix with the coca leaves.

Fish poisons

Every group of indigenous peoples I have visited use plants to stun fish. A good worldwide review of this was given by Acevedo-Rodríguez¹⁷ who listed 935 species of plants employed to poison fish. The active substances of many fish poisons are either rotenones, which are also used as insecticides; or saponins which interfere with the gill membrane of the fish. The poison is placed into small streams and fish are poisoned or asphyxiated for a considerable distance below.

It is a drastic way of fishing as even the smallest fish are poisoned. The Makú seemed very aware of this and only poisoned a particular stream occasionally to avoid depleting the fish stock.

The Makú used at least five different species with four types of poison⁷ (Table 1). Two of these species are the same as those used by the Yanomami who use *Lonchocarpus utilis* and *Clibadium sylvestre* for the same purpose. I watched the Makú use *Euphorbia cotinifolia*. They built a bridge over the stream and laid baskets of leaves on it. They then beat the leaves with sticks to allow the juices to drip into the river. Meanwhile some of the women stirred up the stream above

Table 1 Families and species of poison used by the Makú

Family	Species	Part used	Poison
Asteraceae	<i>Clibadium sylvestre</i> (Aubl.) Baill.	Fruit	Ichthyothereol
Caryocaraceae	<i>Caryocar glabrum</i> (Aubl.) Pers.	Pericarp of fruit	Saponins
Euphorbiaceae	<i>Euphorbia cotinifolia</i> L.	Leaves	Triterpenes
Euphorbiaceae	<i>Phyllanthus brasiliensis</i> (Aubl.) Poir.	Leaves	Triterpenes
Fabaceae	<i>Lonchocarpus cf utilis</i> A.C. Smith	Stems	Rotenone

the site of the poison and others gathered up the fish that surfaced downstream from the poison. That evening we had an enormous fish feast. The Yanomami poisoning I witnessed used the beaten stems of *Lonchocarpus* which were simply thrown into a small stream.

The Jamamadí

Arrow poisons

The Jamamadí are an Arawak tribe living in the upper Rio Purus region. They use a curare arrow poison mainly for blow-gun darts, but also for arrows. The vegetal contents of the Jamamadí poison are given in Table 2.

The stem of all seven species is used, with the *Strychnos* and *Curarea* being used in greater quantities than the others, and slightly more *Strychnos* than *Curarea*. The bark mixture is heated, boiled and concentrated into a sticky, but still liquid residue which is then used to coat blow-gun darts and arrows. The wet darts are passed through a fire to dry the poison. *Strychnos* based arrow poisons or curares are the best known arrow poisons, and have been much discussed in the literature. The Jamamadí arrow poison was mentioned briefly by Métraux¹⁸ where he pointed out that it was the only fluid arrow poison of the region. *Strychnos solimoiesana* was first reported as the principal ingredient of a curare by Krukoff¹⁹ where it was cited as the main constituent of the Cauchanum Indian arrow poison from the Rio Tocantins region. *S. solimoiesana* was studied chemically by Marini-Bettolo *et al*²⁰ who reported the presence of 40 alkaloids in the stem bark. *S. solimoiesana* base poison is said to be one of the most powerful and effective paralysing curares.

Curarea toxicifera is discussed as an arrow poison ingredient in Krukoff and Barneby²¹ under the old name *Chondrodendron toxicoferum* Wedd. Various members of the Annonaceae have been reported as arrow poison ingredients, but not the species of *Duguetia* listed in Table 2. For example, *Unonopsis veneficiorum* Mart. R.E. Fries was reported as an ingredient of curare by Schultes²².

The two Meliaceae in the genus *Guarea* and the

Picrolemma in the Simaroubaceae were reported for the first time as arrow poison ingredients²³.

The Jamamadí are most particular about their arrow points. They make the arrow points from a Bamboo (*Bambusa* sp.) which they call 'Hado'. Before the addition of poison the shaped arrow points are smoked in the smoke of the Annonaceae, *Duguetia asterotricha* Diels. The bark of the *Duguetia* is burnt and the arrow points are held in the smoke. The Indians are most insistent that the poison arrows are more effective after this treatment.

Fish poisons

The Jamamadí use fish poisons frequently and mainly use the legume vine *Derris latifolia* H.B.K. which they now cultivate in their fields rather than collect from the forest.

Snuff

The Jamamadí and their neighbours the Dení, have essentially the same snuff which is based on tobacco (*Nicotiana tabacum* L.) mixed with the bark ash of various species of *Cacau* (eg *Theobroma subincanum* Mart.). The snuff is called by the same name in both tribes which have different languages: Shinā by the Jamamadís; and Tsinā by the Denís.

The tobacco leaves are gathered and heated on top of a convex metal bowl, and are rolled with a wooden rolling-pin to squeeze out all the juices. It takes about 20 minutes to dry the leaves crisp by this process. At the same time a fire is made from the bark of the *Theobroma*. When the leaves are crisp and dry they are broken up into a wooden bowl and ground into a fine powder with a wooden pestle. The ash from the *Cacau* bark is added in roughly equal quantities. The snuff is then ready for use. The group definitely prefers fresh snuff, and appears to make it most evenings. Most members of the tribe carry a small amount of the snuff with them in an assortment of containers.

The snuff is administered by sucking it into the nostrils through a small pipe made from a hollow monkey leg bone. One person will hold out the snuff on a leaf while the other takes it, drawing in turn into each nostril. Almost all the tribe, including children, carried the bone pipes (Fig 7).

The snuff has an intoxicating effect on the user. The users appear inebriated and they talk of light headedness. This snuff is certainly a powerful intoxicant, but it is not hallucinogenic as no one spoke of hallucinations in connection with it. The Jamamadís appear to take it from early childhood; we observed a four-year old taking it regularly, and a ten-year old girl traded her supply of snuff and her pipe with us.

The Indians are insistent that the snuff is ineffective without the *Theobroma* bark ash, and said that they never take a pure tobacco snuff. The use of this tobacco-cacau snuff covers quite a large area of Amazonia between the Rios Purus and Juruá, the range of these two tribes and of other Arawak tribes which use the same snuff.

Table 2. The constituents of the Jamamadí arrow poison

Jamamadí name	Family	Scientific name
Ihá	<i>Strychnos solimoiesana</i> Krukoff	Loganiaceae
Bicafa	<i>Curarea toxicifera</i> (Wedd.) Barneby & Krukoff	Menispermaceae
Bicafa	<i>Abuta splendida</i> Krukoff & Moldenke	Menispermaceae
?	<i>Guarea carinata</i> Ducke	Meliaceae
Barafa	<i>Guarea</i> cf. <i>grandifolia</i> C.DC.	Meliaceae
?	<i>Picrolemma sprucei</i> Benth.	Simaroubaceae
Boa	<i>Duguetia asterotricha</i> Diels	Annonaceae



Fig 7. Jamamadi child snorting their tobacco-based snuff which all members of the tribe, including children, seemed to use.



Fig 8. Dení Indian woman beating a section of the vine *Curarea tecunarium* to extract juices for preparation of their contraceptive beverage.

The Dení

The Dení village which we visited is situated on the upper Rio Cunhuá (marked as Rio Tapauá on most maps) at 6°21'S; 67°40'W. The Denís inhabit the region from the Rio Juruá to west of the village. They have only recently come into regular contact with western civilisation. The group we visited is the most westernised village of the tribe; they depend heavily upon local Brazilians to supplement their food supply. However, they retain much of their own culture especially in their usage of plants.

Contraceptives

All tribes I have visited have a range of abortifacients and a few tribes, including the Dení, have a contraceptive (Fig 8). The use of contraception by Amazonian tribes is probably more widespread than has been realised in the past. It is prepared from the menispermaceous vine, *Curarea tecunarium* Krukoff & Barneby which they call bekú. A missionary couple, Paul and Dorothy Moran, who work among the Dení, observed the regular spacing of children in a family, and that the tribe had a definite cycle of conception by which only one woman in the group is pregnant at any given time. The Morans started to enquire within the tribe about their apparent birth control and deduced that it

was linked to the drinking of an extract made from the stem of a common menispermaceous liana.

The Dení collect the main stem of the liana and pound it with a hard wood or stone to open it up. The beaten vine is placed in a pan of water to extract the sap. This is filtered through a cloth and is then drunk. The liquid is usually taken a few weeks after a birth. It is drunk in large quantities by both men and women. They drink about a gallon of the preparation until it induces vomiting. It is then vomited and followed by a smaller dose which is retained. According to the Indians a single dose of Bekú is effective for a long time, up to two years. From observations in the tribe it seems possible that the active ingredient affects the men rather than the women as the only two women to be pregnant at the same time were the wives of the same man.

It is interesting that this plant, the sap of which is drunk in large quantities by the Dení Indians, is from the genus *Curarea*, and from a species which is well known as an ingredient of arrow poisons²¹. It is cited as the arrow poison of both the Kofán Indians in Colombia (under the old name *Chondrodendron iquitatum*), and the Tecuna Indians (under *Chondrodendron limaciifolium*). Krukoff and Barneby²¹ give chemical details of three alkaloids found in *C. limaciifolium* by Barltrop and Jeffreys²⁴. The latter authors state 'the extracts were very toxic but did not produce paralysis'.

Ayahuasca

In western Amazonia the most widely used hallucinogenic plant is the vine *Banisteriopsis* (Malpighiaceae). It is used by many shamans as they treat patients and has been much described in the literature²⁵. My only experience of the use of this plant has been with local people in the town of Tarauacá in the state of Acre. In the case of ayahuasca, or uascá as it is called in Brazil, a beverage is made from the stems and bark of a vine.

Unlike the snuffs described above, the Tarauacá drink is primarily used nowadays not by the Indians but by the local Brazilian population. The beverage was obviously of Indian (perhaps Cachinahua) origin. It is still taken by the Indians who inhabit the upper region of the Rio Tarauacá. One of my collections was from the Indians, while the other was from the Brazilians in Tarauacá. The Indian population on the Rio Tarauacá is small, and the village which I visited was acculturated. These observations were made on the local Brazilian population of Tarauacá.

Many of the inhabitants of the village, when questioned, admitted to having experimented with the beverage at least once, and some families use it regularly. In Tarauacá, the population all refer to the beverage as cipó (the Portuguese word for 'liana'). None of the people in Tarauacá used the more widely known name 'ayahuasca', perhaps because of the secretiveness shown by all who use the drink.

The use of the beverage has spread from Tarauacá through Acre to the state capital of Rio Branco where it is always referred to as uascá. In Rio Branco, there are several groups that meet to drink the narcotic in much the same way as described below for Tarauacá.

It is interesting that the Brazilian users of hallucinogens, in contrast to the Indians, have adapted the indigenous tribal use of a narcotic for their own purposes but have attached their own folklore to its use and made their own ceremony rather than using the Indian one. Cipó has become part of the Acre culture. The ceremony described below is quite different from any Indian ritual.

There are two ingredients of cipó or uascá in Tarauacá: one a shrub, the other a vine. The shrub is a *Psychotria*, *P. viridis* R. and P., the vine a member of the malpighiaceae genus *Banisteriopsis*. It is obviously this liana which gives the beverage the name 'cipó' in Tarauacá. The use of the latter as a hallucinogen has long been known. It was first reported in 1852 by Spruce²⁶, and discussed in detail by Schultes²⁷. The use of *Psychotria* as an ingredient of native hallucinogens was reported for the first time as recently as 1967 by Schultes. It is particularly interesting that the combination of these two plant genera in narcotic beverages has been observed in three geographically widely separated localities: amongst the Kofán Indians of Amazonian Ecuador by Pinkley²⁸; the Cachinahua Indians of Amazonian Peru, by der Maderosian *et al*²⁹; and now by the Indians and Brazilians in the vicinity of Tarauacá, Brazil.

Psychotria is a common species in the forests near Tarauacá and was easy to find. The local people distinguish

the correct species from other rather similar rubiaceae shrubs by the presence of domatia at the base of the primary leaf veins. *Banisteriopsis* is much harder to find, because its supply has been severely depleted by use. One has to go a long way into the forest to find the vine growing naturally. It is cultivated by a few people in Tarauacá for a more easily obtainable supply. The vine is easy to propagate; and, when a small section of the root is planted, it sprouts and grows quickly.

Banisteriopsis contains the hallucinatory compounds harmine and harmaline²⁹, and *Psychotria psychotriaefolia*, the admixture for *Banisteriopsis* drink in Ecuador, has been found to contain N, N-dimethyltryptamines³⁰. It is, therefore, to be expected that *Psychotria viridis* may likewise contain this tryptamine.

The natives of Tarauacá were insistent that both plants are needed for the beverage to have the desired effect. Some people told me that they had used the drink without the *Psychotria* leaves and as a consequence had experienced a vastly inferior hallucinogenic experience.

The *Banisteriopsis* vine is cut into sections and put into a saucepan of water which is allowed to heat up almost to a boil. The leaves of *Psychotria* are added and allowed to simmer for another half hour. The liquid is left to cool and is bottled and corked. The liquid obtained is rust-brown with much plant residue remaining in it. It has an acrid taste. According to the users, the beverage remains effective and is stored for up to four weeks.

In Tarauacá, cipó is taken in connection with spirit worship, a cult that is extremely common and growing in the region.

Apart from the use in spirit worship, individuals in Tarauacá and other towns in the region frequently gather to drink the beverage. The group begins by taking a large quantity of the drink except for one man, the 'mestre' (or master) who is in charge and who does not drink on that occasion. They then shut their eyes and wait for the hallucinogen to take effect, while background music is played. During this time, a few of them vomit up the drink. The hallucinations then begin. The job of the mestre is to bring anyone out of his hallucination experience when it appears to be a bad one. He does this either by touching him, which usually works, or by putting a strong smell under his nostrils. The smell was produced by ammonia, or apparently in some cases by a leaf of an unidentified plant, which I was unable to obtain during my visit. When the mestre has brought a person out of his hallucination, the intoxicated individual needs only to close his eyes again to resume his hallucinations. They continue under the supervision of the mestre, until the effect of the hallucinogen wears off. During the entire process, loud music usually is playing in the room.

Those who have taken the beverage referred to having seen particularly bright colours and large sized objects and animals, particularly snakes and jaguars.

A legal battle is currently in progress over ayahuasca because a California based company has patented what

they claim to be a novel variety of the vine. This is being contested by an organisation of Amazon tribes. It is to be hoped that they are successful because there seems to be no significant difference in the patented variety.

The Paumarí

The Paumarí are also an Arawak tribe that inhabit the Rio Purus basin near to the town of Lábrea. Their snuff, which they call 'koribó', is made from a mixture of tobacco (*Nicotiana tabacum* L.) and *Tanaecium nocturnum* (Barb. Rodr.) Bur. & K. Schum in the Bignoniaceae²³, and has interesting medical implications.

The leaves of koribó, which are very pungent with an almond-like smell when mashed, are used to prepare the most frequently used snuff of the Paumarí Indians. The green leaves are shredded, then roasted until they are dry. In this crisp condition, they are ground to a fine powder with a mortar (made from the empty pxydium of a Brazil nut) and pestle, then rubbed through a cloth for a final pulverisation. The resultant powder is then mixed with tobacco snuff prepared by the same method, and the mixture is called Koribó-nafuni.

The snuff is used only on special occasions and by the shamans before treatment of a patient (Fig 9). It is mainly used in rituals which are performed for the protection of children and taken by men only. These rituals are frequent and are performed so that a child may begin to eat any new food. They are accompanied by sacred songs, the singing of which is restricted to such festivities. The ritual takes place for each kind of animal food, and a child may not begin to eat the meat of any animal, nor any new food, until he has been through this ceremony. The ceremony is performed by the men of the tribe for their children, and prior to the ceremony, the men take Koribó. They rub their hands on the food, or on the bones of the animal which is to be introduced into the diet of the child, then on the head of the child. Next, the men circle the area, imitating the animal which the child may begin to eat. This is performed in a state of trance.

Koribó-nafuni is also taken by the tribesmen at the puberty rites of the girls of the tribe. The snuff is inhaled through a hollow bone, usually the leg bone of a water bird. Apart from the ritualistic use of Koribó, the shamans use it before they treat any illness. The usual treatment is for the shamans to suck violently on the patient, sometimes on the affected part, in order to extract the illness. After they have sucked on the patient, they run into the forest and retch violently until they vomit, they then return to the patient and display some object such as a grasshopper, or a piece of wood or bone, which they claim to have drawn out of the patient.

Women do not usually use the snuff, but they take Koribó in another form. They drink a tea made from the root bark. About two tablespoons of fresh root bark are brewed in water, and drunk. It produces drowsiness, an inability to concentrate and reduces awareness. The effect of half a cup of this infusion is slight but apparent.



Fig 9. Paumarí Indian preparing their snuff from stems of the vine *Tanaecium nocturnum*.

The bignoniaceous plant Koribó is occasionally cultivated by the Paumarí, but it also occurs naturally in the local forests. They cultivate it, using local stocks, although this cultivation is a newly introduced feature and results from the change from a more nomadic way of life. Their main source of Koribó is still from the surrounding forest.

We accidentally obtained substantial evidence of the toxic effect of Koribó. We collected a large amount of the vine for chemical study and kept it in the room where we were staying. The doctor of our expedition, Dr João José Ferraroni, sat beside the heap of Koribó. Several Indians commented on the smell of Koribó in the room, mentioned its toxic effect and left the room. After half an hour, Dr Ferraroni said he was not feeling well and began to leave the room. He was so dizzy that he had to crawl out on all fours. He headed straight for the lake to take a bath. After he lay down to recuperate, he had a bad headache and then talked a lot in his sleep, not one of his normal habits. We asked an Indian who had taken the snuff what effect it had. He said that it made him dizzy, gave him a headache and the desire to throw himself into the lake at once, the exact symptoms that our doctor experienced. Needless to say, we removed the samples of Koribó from our living quarters.

There was a noticeable difference in intelligence between the women and the men; the women being much more alert and intelligent. This can perhaps be attributed to the fact that they do not take much of the Koribó snuff.

Tanaecium nocturnum was studied in Colombia by Grajales Diaz³¹, who reported an extremely high concentration of hydrogen cyanide in the fresh leaves. Presumably fumes from fresh material are poisonous. We noted the caution of the Paumarí, since they did not want to remain near the fresh plant. The toasting in preparing the snuff probably removes the cyanides leaving intact other intoxicating compounds.

Conclusion

In the ten thousand years that these people have inhabited the lowland rainforests they have been most creative in their discovery of the chemicals offered by the plants. There is no doubt that the diversity of plant species of the Amazon rainforest merits much more study for the pursuit of other new medicines than those which have already been discussed, such as quinine, curare and pilocarpine. However, at the same time it is essential to protect the intellectual property rights of native peoples and to ensure that, if commercial products are developed, they share equitably in the benefits. The Convention on Biological Diversity drawn up at the Rio de Janeiro Earth Summit in 1992 has done a lot to protect the rights of indigenous peoples and it is to be hoped that such offensive action as the patenting of ayahuasca is not repeated.

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