

## THE ETHNOBOTANY OF CHAMAIRO: *MUSSATIA HYACINTHINA*

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### Summary

Recent fieldwork in the eastern lowlands of Bolivia and Peru has revealed a traditional use of coca (*Erythroxylum coca* Lam.) as a medicine and stimulant that is distinct from the well-documented customs of the Northwest Amazon and the Andean highlands. In Bolivia some nine indigenous tribes centered mainly in the Rio Beni drainage masticate entire sun-dried coca leaves, yet use as an alkaline additive the crude ash of the spathe or leafbase of the *motacú* palm (*Scheelea princeps* (Mart.) Karst.). To the quid they add a piece of the bark of the bignoniaceous liana *chamairo* (*Mussatia* sp.), which markedly sweetens the chew. In the montaña of Peru, the liana is also used and a new species is reported from the upper Apurimac river. The ethnobotany of *chamairo* throughout its range is examined and the need for pharmacological screening is emphasised.

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### Introduction

The chewing of coca leaves (*Erythroxylum Coca* Lam.) by native groups in highland and lowland South America has been well documented (Mortmer, 1901; Schultes, 1957; Antonil, 1978; Naranjo, 1981; Plowman, 1981). Recent studies have emphasized the taxonomic (Plowman, 1979), socio-religious (Carter, unpublished data) and nutritional (Duke et al., 1975) aspects of coca use. The nutritional studies have been especially significant: whereas the ritualistic significance of coca has been long acknowledged, it is now apparent that the plant serves as a major source of vitamins and minerals and enhances the body's ability to digest carbohydrates at high elevation (Duke et al., 1975; Burchard, 1980). These studies have left no doubt that the chewing of coca is a vital feature of indigenous adaptation in the Andean cordillera, in the eastern montana of Peru and Bolivia and in the northwest Amazon of Peru, Brazil and Colombia.

A major gap in our knowledge of the use of the coca plant concerns the nature and significance of various admixtures. Every culture that employs

coca has discovered an alkaline substance which, when mixed with the coca leaves, aids in releasing the alkaloid (Rivier, 1981). These alkaline additives differ greatly in form and origin: materials as diverse as seashells, limestone, clay, bones and plant ashes have been reported (Plowman, 1980).

A related and even more poorly understood aspect of coca chewing concerns the plant admixtures that serve both as condiments to enhance the flavor of the chew or as coca substitutes. Recent work has drawn attention to one such plant, *chamairo* (*Mussatia hyacinthina* (Standl.) Sandw.), a liana of the Bignoniaceae native to the *montana* of Bolivia and Peru (Plowman, 1980). Plowman has summarized reports from the literature concerning *chamairo*. This paper presents the first results of a field study of *chamairo*.

### An unusual variant of coca chewing

My first encounter with *chamairo* took place in 1981, when I visited the Chimane Indians of eastern Bolivia. A poorly known, lowland group numbering about 2500, the Chimane are a riverine people who inhabit the gallery forests and sandbars of the Rio Maniqui and its affluents that drain the eastern foothills of the Andes. Additional populations are found from the Rio Chiquibey to the headwaters of the Rio Matos, the Rio Dumi, the Rio Chevejecure and Rio Civerene between 14°30' and 15°30' south latitude and 66°30' and 67°30' west longitude (Riester, 1975). While the Chimane do cultivate small swidden plots of *yuca* (*Manihot esculenta* Crantz) and *platanos* (*Musa* × *paradisica* L.), they are essentially a seasonally nomadic people. They move up and down the rivers and make simple temporary camps as they use a sophisticated *barbasco* (fish-poison) technology in order to exploit a rich migratory fish fauna. The fish-poisons used by the Chimane include *Tephrosia vogelii* Hook. and *Tephrosia sinapou* (Buchhoz) A. Chev., both cultivated shrubs of the Leguminosae.

The Chimane call coca *sa'si*; and, although the plant is not grown in great quantity, virtually every family has one or two bushes for domestic use as both a medicine and a stimulant. The method of masticating coca among the Chimane, while distinct from that of either the Andean highlands or the northwest Amazonian lowlands (cf. Schultes, 1957; Plowman 1981), is common to all the coca chewing tribes of eastern Bolivia. The coca leaves are dried in the sun and consumed whole. A small, 4- 5-cm long piece of the stringy bark of the *chamairo* liana is added to the quid, and then a pinch of crude ash is added as an alkaline admixture. The *chamairo* bark alone has a bitter, astringent taste; but, when added to the mixture of coca and ash (known as *pit'i* to the Chimane), the entire quid becomes very sweet, almost as if a small amount of sugar had been added.

The source of the alkaline ash is unique; only the burnt spathe of the *motacú* palm (*Scheelea princeps* (Mart.) Karst.) is used. This palm, known as *man'i* to the Chimane, grows wild throughout much of eastern Bolivia

in the foothills and lowlands in the Departments of Beni, Santa Cruz, La Paz and Cochabamba (Cardenas, 1969). *Motacu* is a multi-purpose palm: the fronds are used commonly for thatch; the fruit is edible and is sold in markets throughout eastern Bolivia; the seed is eaten and its copious oil is used as a hair conditioner; the adventitious roots are boiled and the infusion drunk for amoebic dysentery.

*Chamairo* does not grow in Chimane territory and must be acquired from white traders who bring it in from the Rio Beni drainage, some 150 km to the northwest. It is sold as long strips of bark, which are very fibrous and tough in texture and whitish brown in color. Although the nomadic Chimane have made no apparent effort to cultivate *chamairo*, they have discovered a number of substitutes growing wild in the forests of the Rio Maniqui. One such plant is *chur'chu*, a tall, as yet unidentified forest tree of the Lauraceae. The Chimane use the orange, aromatic inner bark as a condiment to flavor their coca quids. Of greater interest is the plant that the Chimane use when they have no ready supply of *chamairo*. This substitute is *wambu'hona*, *Clytostoma sciuripabulum* Bur. & Schum. (Bignoniaceae), a climbing liana of the gallery forest. With opposite, compound leaves, with two leaflets and a third petiole modified as a tendril, this plant bears a remarkable resemblance to *chamairo*. Both plants are members of the Bignoniaceae; but, unlike *chamairo*, *Clytostoma sciuripabulum* has copious milky white latex in the stem. According to the Chimane, *wambu'hona* is as good a sweetener as *chamairo* and is used in an identical way. That two separate genera have the same remarkable property suggests that both plants should be screened for pharmacologically active constituents.

### Identification of Bolivian *chamairo*

To obtain voucher specimens for a positive identification of the *chamairo* liana, I left Chimane territory by dugout and crossed into the drainage of the Rio Beni to the town of Rurrenabaque in the Province of Caupolican, Department of La Paz. In Rurrenabaque, I contacted the merchant, Raul Chavez Valdivia who supplied *chamairo* to the Chimane. From Valdivia and various native informants I learned that there are two recognized types of *chamairo* in the Beni. One form, and the only one that enters the commercial trade, is known locally as *chamairo blanco*, the "white *chamairo*". This form grows only on the lower Beni, beginning some 150 air km below Rurrenabaque at the mouth of the Rio Negro and continuing down the Beni to the Brazilian frontier. It grows also along the banks of the Rio Madre de Dios in its lower reaches. *Chamairo blanco* is sold openly in the markets of Rurrenabaque. A 50-cm long piece of bark sells for five pesos (US\$0.20–0.25), while an arroba (11.3 kg) costs 300 pesos (US\$12).

The second form of *chamairo* is known as *chamairo colorado* - the "red *chamairo*". The *colorado* form has a much more limited range, and, according to local informants, it grows along the edge of the Andean foothills in

the Province of Iturralde around the settlements of Ixiamas and Tumupasa at the headwaters of the Rio Emero and Rio Umdumo, and along the upper reaches of the Rio Madidi. It may be found all along the foothills of the Andes from Tumupasa to the Peruvian frontier at Puerto Heath. It does not occur south of the Rio Juyare and hence is not found along the main channel of the Rio Beni. Both forms of *chamairo* have apparently been successfully planted in Rurrenabaque in the past, although no living plants are found there today. One merchant insisted that the center of *chamairo colorado* was the town of Ixiamas.

After some searching, I was able to locate a planting of *chamairo colorado* at the Tacana Indian village of Tumupasa, some 60 km northwest of Rurrenabaque. This specimen has been positively identified as *Mussatia hyacinthina* by Dr. Alwyn Gentry of the Missouri Botanical Garden. The determination sheds some light on the first published identification of *chamairo* as a member of the genus *Mussatia* by Martin Cardenas. Cardenas, who studied the plant in the field as a member of the Mulford Biological Expedition in 1921, reported that *chamairo* "is the bark of a climbing vine of the genus *Mussatia* which corresponds to an undescribed species. . . . (*Chamairo*) is sold as a dry greenish yellow bark, doubled over and tied with string. It is a masticatory used in association with coca. After the leaves are briefly chewed, a small piece of *chamairo* is added and then a pinch of ash is added which is carried in a bull horn. . . . The effect of *chamairo* is immediately noticeable, and the coca is sweetened. We do not know what modifications the addition of ash and *chamairo* could have on the coca chew." Cardenas went on to examine the etymology of *chamairo* and concluded that the word means "wick of delight" because of the euphoric effect of chewing the bark (Cardenas, 1969).

Cardenas collected a herbarium specimen of *chamairo* and used it to illustrate his brief description of the plant (Cardenas, 1969). Herbarium searches among the Mulford Expedition collections at the New York Botanical Garden and among Cardenas' personal herbarium at the Instituto Miguel Lillo at Tucuman, Argentina, have turned up no duplicate specimens (Plowman, 1980). Cardenas reported that *chamairo* grew in the "Region of the Rio Enadere near Ixiamas in the north of the Department of La Paz" (Cardenas, 1969). As this is the only locality mentioned for *chamairo* in his report, we may assume that the collection came from this region. The Rio Enadere rises just northwest of Tumupasa in the Serrania Horrehuapa, well within the reported range of *chamairo colorado*; this river flows into the Rio Beni some 100 km above the reported range of *chamairo blanco*. In all likelihood, Cardenas collection was *chamairo colorado*, which we know to be *Mussatia hyacinthina*. We have no voucher specimens of *chamairo blanco*, so there is no way at present of knowing whether or not the two locally recognized forms represent the same species. According to reliable informants, the *blanco* form may be distinguished by its rose-colored flower and whitish bark, whereas the *colorado* form has a

white flower with distinct purple striations on the lip of the corolla and a reddish bark. The possibility that *chamairo blanco* is a distinct and possibly new species was suggested by a subsequent discovery made some distance away on the upper reaches of the Rio Apurimac in the southern Andes of Peru.

### Identification of Peruvian chamairo

Several historical reports indicate that *chamairo* was used by various indigenous groups in the *montana* of eastern Peru. The first reference to the liana comes from the travels of the Franciscan missionary Augustin Sobreviela on the Rio Apurimac in 1787. He wrote that he met two Indians who were travelling downriver to collect *chamairo*, "a treebark" which they used with coca (Izaquirre, 1923). A hundred years later, the French explorer Olivier Ordinaire reported that *chamairo* was employed by the Campa of the lower Apurimac, on the upper Rio Ene (Ordinaire, 1892). According to Ordinaire, the "Campa make use of this bark, which comes from a liana called *cnumayro*, whenever they have to fight against fatigue. They always have a provision of it in the bag which they carry on their shoulder. When they have run a long distance or made violent exercise, as in the tapir hunt, or when they are caught in a thunderstorm, they do not fail to chew a certain quantity of this bark mixed with coca leaves which they also consume in quantity. But all those whom I was able to ask told me that they can do without coca more easily than without *chumayro*. . . .

"The liana which bears this name and which the same [chief] Puchana showed me later in the forest, grows in the thick jungles, where it attains the thickness of a man's arm. The Indians cut it when it becomes as thick as a finger. They immediately strip the bark, the only part which they use, divide it into pieces about a foot long, dry it and store it in small bundles. To consume the bark, it only remains to remove, with a knife or a fingernail, the rugosities of a calcareous appearance which more or less cover it." (Plowman, 1980).

Another early report of *chamairo*, and the first to identify the plant to family, was made by F.E. Remy during his travels among the Amuesha Indians on the Rio Marellaneri in the Region of Pichis (Remy, 1908). "In these pampas" wrote Remy, "the wild Amuesha grow *chamairo*. It is a liana, a Bignoniaceae, whose stem has a diameter of 6 cm, with alternate lanceolate leaves.

"To harvest this vine, they cut it in large strips and divide them in the middle to take off the bark, which is the part used, packaging them later in pieces 30 cm long. They chew the bark with coca. I had the opportunity to try it, and I found the flavor to be bitter but agreeable, and with a breath of air, one is left with a sweet sensation. Having tried it personally, I know that it alleviates both hunger and thirst.

“One day, tired and not having eaten, I chewed *chamairo*, and just a moment later I was left without hunger and with strength. Coca for me is disagreeable because of its flavour but *chamairo*, as I said before, has a bitterness that is not only harmonious, but which satisfies.” (Remy, 1908).

The first botanical collections of Peruvian *chamairo* were made in this century. A piece of unidentified liana labeled *yarnayru*, collected among the Campa in 1922 by Nordenskjöld and presently in the collections of the Ethnografiska Museum in Göteborg, Sweden, is suspected to be *chamairo* (Plowman, 1980). More recently, in 1964, Dr. Gerald Weiss collected an ethnobotanical specimen among the Campa Indians of the Rio Tambo, on the lower reaches of the Apurimac. This specimen was identified as *Mussatia hyacinthina* (Plowman, 1980). Since then, a second specimen was collected by Gentry, Schunke and Aronson in the Huallaga Valley of Peru near Tocache, and this, too, proved to be *M. hyacinthina*.

### A new species of Peruvian *chamairo*

In the summer of 1981, having completed my work in Bolivia, I pursued the study of *chamairo* in Peru. I began by crossing the Cordillera Vilcabamba to reach the intermontane desert of the upper Apurimac; there, quite by chance, I made a curious discovery. One morning by the river as we broke camp and I prepared a chew of coca, one of the native guides suggested that for a really sweet quid I ought to try a piece of *chamairo*. He did not have any, but he offered to gather some for us in a few days when we reached its range on the lower river near the Hacienda Berg above Osambre, some four days by raft above the settlement of San Francisco. Days later, when I collected the plant, it was immediately clear that this *chamairo* was unlike anything that I had seen in Bolivia. Dr. Gentry, the recognized expert in New World Bignoniaceae, has since studied the material, and, although it was sterile, he is certain that it represents a new species of *Mussatia* (Gentry, pers. commun.). It is readily distinguished from *M. hyacinthina* by the presence of dense, simple, uniseriate trichomes on the abaxial surface of the leaf; the leaf surface of *M. hyacinthina* is glabrous. Although a description of this species will have to await complete material, its existence sheds light on some other aspects of the *chamairo* complex.

Until now, the genus *Mussatia* included only two recognized species: *M. hyacinthina* which ranges from Mexico south to Guyana and Bolivia; and *M. Priurei* (DC.) Bur. ex K. Schum., which occurs in the Guianas and in Amazonian Brazil (Plowman, 1980). All the ethnobotanical collections to date, with the exception of the new Apurimac species, have been identified as *M. hyacinthina*. What are we to make of *chamairo blanco* reported from the lower Beni in Bolivia? It may be but a locally recognized form of *M. hyacinthina* or it may represent *M. priurei* from the Brazilian Amazon. On the other hand, knowing that even the most superficial search turned up a new species in the genus, it is not inconceivable that *chamairo blanco* may

represent yet a fourth species of *Mussatia*. Only complete material from all localities will enable us to answer this question.

### Ethnobotany of *chamairo*

Throughout its range from central Peru south to northern Bolivia, *chamairo* is a popular admixture to coca. According to Padre Andres Ferrero, a Dominican missionary, the Machiguenga of the upper Urubamba "mix *chamuiro* and *tocora* with coca. The former is a small grooved white-barked stick. They always carry it in their traveling bag. They rasp the stick with a knife and put the small shavings in the mouth with a quid of coca. They do the same with the *tocora*, which is the ash of a tree called *choban-quiniro*.

"Often one sees the Machiguenga making a small fire for no apparent reason in the courtyard of his house. This is to prepare the prized ash, which is later put into a cow's horn, or a tube of bamboo which is capped with a piece of wood, generally a piece of balsa. The cow's horn or the bamboo tube always go in the mentioned carrying bag. To 'picchar' the coca, as is called the specific act of chewing coca in hispanised Quechua, one takes with the point of a knife or one's fingernail a bit of the ash and mixes it with the leaf. It seems to have the effect of sweetening the quid." (Ferrero, 1966).

Elsewhere in Peru, the Campa of the Rio Pichis, Nazaratequi and Neguachi (Plowman, 1980) and the Amuesha on the Rio Pichis (Richard Smith, pers. commun.) employ *chamairo*. Its use has also been widely adopted in the upper Apurimac by transplanted colonies of highland Quechua.

*Chamairo* is, in fact, known throughout Peru; and according to informants in both the highlands and lowlands, it is supply, not demand, that limits its availability in the country. Nevertheless, *chamairo* is sold in the markets of Tingo Maria on the Huallaga and San Francisco on the Apurimac and even in the Lima market of La Parada. Further field work will probably turn up *chamairo* among most of the coca chewing groups of the southern *montana* of Peru.

In Bolivia, *chamairo* is an essential element of a unique method of chewing coca that is concentrated among the Tacana-speaking peoples of the vast 300,000 km<sup>2</sup> Rio Beni drainage area. Here the members of many tribes habitually mix *chamairo* and coca with the ash of spathe of the *motacú* palm. This method has been observed among the Tacana at Tumupasa on the Rio Juyare; the Chamas, a riverine people who dwell on the banks of the Beni above and below Rurrenabaque; among the Toromonos of the Rio Madidi and Rio Manupari; and among the Mosetenes of the Alto Beni. It is likely that the Araona near the Peruvian border at Puerto Heath also use *chamairo*. Migrant Trinitarios and Juras on the lower Rio Maniqui have recently adopted the use of *chamairo*. While the use of the *motacú*/

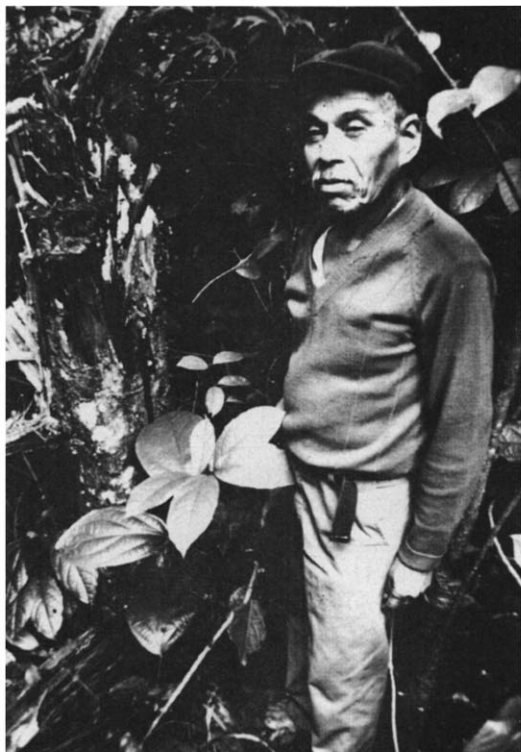


Fig. 1. Tacana Indian with planted *chamairo*, *Mussatia hyacinthina*, Tumupasa, Bolivia.



Fig. 2. *Chamairo* for sale at Rurrenabaque, Bolivia.



*chamairo*/coca complex appears ubiquitous among the tribes of the Beni drainage area, it appears sporadically in other regions of eastern Bolivia. The Aruac speaking Mojos, a large group of some 15,000 centered on the affluents of the Rio Mamore, employ neither coca nor *chamairo* (James Jones, pers. commun.). It is not known at present whether the Pano speaking Pacahuara on the lower Beni and Mamore below Riberalta use *chamairo*. The meztizo populations of the Rio Nareuda, an affluent of the Rio Tahuamanu in the Department of Pando in the northwestern corner of Bolivia, do use *chamairo*. They recognize two varieties on the basis of their bark color. Both local varieties, *chamairo blanco* and *chamairo amarillo* are used with the ashes of the motacu palm (Calvin Sperling, pers. commun.). The limits of *chamairo* use do not seem to represent any obvious cultural affinities as much as they follow the natural range of the plant. The Chimane, one of the few tribes south and east of the Rio Beni drainage that uses *chamairo*, obtain it by trade; and it is possible that they acquired the practice from the Mosecene, their close neighbors to the east.

While *chamairo* is utilized primarily as a condiment to sweeten coca, it also has medicinal applications and may be used alone for its reputed



Fig. 3. Chimane Indians chewing coca: note *motacu* ash, *chamairo* and coca leaves. Rio Maniqui, Bolivia.

euphoric effects. The Tacana of Tumupasa apply the leaves of *chamairo* topically over the temples for headaches. An infusion of the leaves is drunk for stomach aches. The value of *chamairo* for stomach ailments is reported by Oblitas Poblete: “*Chamairo* is a liana found in the region of the Beni. When chewing coca, it serves to sweeten the leaf and make it more digestive. When drunk as an infusion, *chamairo* eliminates fatigue from the body. It is known as a stomachic and tonic and is much employed for colic and flatulence. The ash is used to dust wounds which then heal easily. Coca leaf chewed with *chamairo* is applied in a cataplasm to wounds, bruises, blows and sprains.” (Oblitas, 1969).

The residents of Rurrenabaque also make an alcoholic tonic and beverage from *chamairo*. Pieces of the vine are soaked in crude alcohol for 3 days, to which sugar and water are later added. The resulting whiskey is said to have medicinal properties.

*Chamairo* may be chewed alone, and some groups such as the Campa and Amuesha, apparently do without coca more easily than without *chamairo* (Ordinaire, 1892; Remy, 1908). The Chimane say that *chamairo* chewed alone is effective as long as one has the *piti* (*motacu*) ash to go along with it. From personal experience, fresh *chamairo* when chewed alone does produce a sweet sensation which is enhanced by the addition of alkali.

That *chamairo* may have a cultural significance that goes well beyond its role as a condiment is suggested by the following anecdote of Dr. John Elick (pers. commun.), an anthropologist who studied the ethnomedicine of the Neguachi Campa of Peru: “We knew a girl (Campa) in 1951 whose name was Chaomairo (*chamairo*). Her father died of snakebite, and she was accused of causing his death. We never met another person with that name, and I have always wanted to investigate the degree to which (if any) such a name would affect the bearer’s relations with the rest of the group. Names are of great importance to the Neguachi Campa, and are not merely tags attached for the purpose of identification, but are considered, in a way, to be part of, or indicative of, a person’s personality structure.”

### Chemical considerations

Although the chemistry of the Bignoniaceae is poorly known, certain ethnobotanical discoveries have prompted considerable interest. In the northwest Amazon of Colombia, the Kubeo Indians use the bark of *Jacaranda copaia* D. Don to treat skin infections (Acero Duarte, 1979). The bark has been reported as a purgative and emetic (Usher, 1974), and the root bark is a powerful sudorific. An infusion of the leaves is employed to treat ulcers (Farquhar and Siegal, 1945). The Bush Negroes of Surinam value a medicine prepared by boiling down the leaves to cure leishmaniasis (Plotkin and Werkhoven, unpublished manuscript). A related species, *Jacaranda caucana* Pittier, native to the Rio Magdalena and Rio Cauca valleys of Colombia, have shown anti-tumor activity against P-388 lymphocytic

leukemia (Ogura et al., 1977). Chemical constituents of this species include jacarandic acid (a trihydroxytriterpene acid), jacaranone 1 (phytoquinoid derivative),  $\beta$ -sisterol 9, betulinic acid 8, ursolic acid 10, 2nd 2-hydroxy-ursolic acid. Two other bignoniaceous species have proven anti-tumor activity: *Tabebuia serratifolia* (Vahl.) Nichols and *Tabebuia impetiginosa* (Mart. ex DC.) Standl. The anti-cancer principle in *T. serratifolia* is known: it is a quinone, lapachol ( $C_{15}H_{14}O_3$ ), and it has been found in two other bignoniaceous genera, *Tecoma* and *Paratecoma* (Garcia-Barriga, 1975). Throughout the Amazon, the bark of *T. serratifolia* is taken as a decoction or infusion to cure cancer. It is believed to be so effective that it is regularly prescribed by both folk and Western doctors.

No modern phytochemical work has been done on *chamairo*, but an interesting account of its chemical properties was written early in this century: "The fact that the properties of this plant are so worthwhile, and that it is also the rarest plant used by the natives, made me resolved to analyse it, finding for now a resin resembling Catholic balsam, that is mixed with something else, something unique, somewhat like the fragrance one senses after smoking opium; a glycoside which is bitter, but which by some type of anesthesia produces a sweet flavor. Drunk in solution, it leaves a numbness in one's throat for a long time. Moreover, in *chamairo*, I found an acid, a good dye more soluble in water than in ether or alcohol." (Remy, 1908).

Today the chemistry of the genus *Mussatia* is completely unknown (Plowman, 1980). Given both the occurrence of extremely promising compounds in other genera of Bignoniaceae and the remarkable properties of *chamairo* observed in the field, a complete phytochemical study of the genus would seem to be advisable. Bulk specimens of both *chamairo blanco* from Bolivia and the new Apurimac species are presently being analysed by Dr. Frank Stermitz of the Colorado State University at Fort Collins.

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## References

- Acero Duarte, L.E. (1979) *Principales Plantas Útiles de la Amazonía Colombiana*. Instituto Geográfico "Augustin Codazzi", Bogotá, p. 39.
- Antonil (1978) *Mama Coca*. Hassle Free Press. London, U.K.
- Burchard, R.E. (1980) On coca chewing and the polycythemia hypothesis. *Current Anthropology*, 21, 108–109.
- Cardenas, M. (1969) *Manual de Plantas Económicas de Bolivia*. Imprenta Ichthys. Cochabamba, Bolivia, p. 396.
- Duke, J.A., Aulik, D. and Plowman, T. (1975) Nutritional value of coca. *Botanical Museum Leaflets, Harvard University* 24, 113–119.
- Farquhar, D. and Siegal, B. (1945) *Glossary of Useful Amazonian Flora*. Research Division of University Management. Office of Emergency Management, Washington, DC, p. 21.
- Ferrero, P. Andres. (1966) *Los Machiguengas* Editorial OPE: Villava-Pamplona. Lima, Peru, p. 193.
- García-Barriga, H. (1975) *Flora Medicinal de Colombia*, Vol. 3, Instituto de Ciencias Naturales Universidad Nacional, Bogota, Colombia, pp. 142–145.
- Izaquirre Ispizua, B. (1923) *Historia de las Misiones Franciscanas: 1619–1921*, Vol. 6, La Penitenciaría, Lima, Peru, p. 325.
- Mortimer, W.G. (1901) *History of Coca*, J.H. Vail and Company, New York.
- Naranjo, P. (1981) Social Function of Coca in Pre-Colombian America. *Journal of Ethnopharmacology*, 3, 161–173.
- Oblitas Poblete, E. (1969) *Plantas Medicinales de Bolivia: Farmacopea Callaway*. Editorial "Los Amigos del Libro", Cochabamba, Bolivia, p. 144.
- Ogura, M., Cordell, G.A. and N.R. Farnsworth, N.R. (1977) Potential anticancer agents. III. Jacaranone a novel phytoquinoid from *Jacaranda caucana*. *Lloydia*, 39, 255–257.
- Ordinaire, O. (1892) *Du Pacifique à l'Atlantique par les Andes Péruviennes et l'Amazonie*. Plon, Nourrit & Co., Paris, pp. 131–133.
- Plotkin, M. and Werkhoven, M. (unpublished manuscript) *Notes on the Ethnobotany of the Saramacca and Matowai Bushnegroes*, Economic Botany Library of Oakes Ames, Botanical Museum, Harvard University.
- Plowman, T. (1979) Botanical perspectives on coca. *Journal of Psychedelic Drugs*, 11 103–117.
- Plowman, T. (1980) Chamairo: *Mussatia hyacinthina* — an admixture to coca from Amazonian Peru and Bolivia. *Botanical Museum Leaflets, Harvard University* 28, 253–261.
- Plowman, T. (1981) Amazonian coca. *Journal of Ethnopharmacology*, 3, 195–225.
- Remy, F.E. (1908) Apuntes sobre el Clima y Flora de la Region del Pichis. In: Carlos Larrabure y Correa (Eds.), *Coleccion de Leyes, Decretos y Resoluciones* Lima, Peru, 14, 328–351.
- Riester, J. (1975) Indians of Eastern Bolivia: aspects of their present situation, *International Work Group for Indigenous Affairs (IWGIA) Document*, 3, 43–49.
- Rivier, L. (1981) Analysis of alkaloids in leaves of cultivated *Erythroxylum* and characterization of alkaline substances used during coca chewing. *Journal of Ethnopharmacology*, 3, 313–335.
- Schultes, R.E. (1957) A new method of coca preparation in the Colombian Amazon. *Botanical Museum Leaflets, Harvard University*, 17, 241–245.
- Usher, G. (1974) *Dictionary of Plants Used by Man*, Haffner Press, New York, p. 324.