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PLANTAE COLOMBIANAE II

BY

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YOCO: A STIMULANT OF SOUTHERN COLOMBIA

THE NUMBER OF SPECIES used as narcotics and stimulants by the Indians of Middle and South America is comparatively small. Nevertheless, the botanical source of several, until recently, has remained doubtful or unknown. During the last twenty-five years, extensive research in the identification of narcotics and stimulants has been carried out. As a result, at the present time, nearly all of the species which are used have been identified.

One of the few important exceptions is the remarkable *yoco* which has long been employed as a stimulant by the Indians of a small part of southern Colombia and the adjacent regions of Ecuador and Peru.

During the course of ethnobotanical studies in the Putumayo, Colombia,¹ in 1941 and 1942, I found that the most important non-alimentary plant in the economy of the natives of the tropical areas is *yoco*. The flowering of the *yoco* plant—an extensively climbing liana—is apparently sporadic and capricious, and it was possible to collect fertile material only after months of search. Infrequency of flowering is probably one of the reasons for the neglect by botanists of this important economic plant.

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While there is a possibility that yoco comprises several species, the only one known to be used in the Putumayo among the Inga, Siona and Kofán Indians represents an undescribed species of the sapindaceous genus *Paullinia* which is herewith described. It has been thought appropriate to employ as a specific epithet the common name by which the plant is known in the area where its use as a stimulant is practiced.

I. *Description of yoco*

***Paullinia Yoco* Schultes & Killip sp. nov.**

Frutex scandens, extensus, robustusque. Rami busti, basi usque ad 12 cm. in diametro, lactiferi, laticibus albo astringentique, nigro cum cortice lenticellato sericeo. Ramuli subteretes, obtuse angulati et fibris striati, ferruginei, scabridiusculi, minute pulverulenti puberuli denique subglabrescentes, internodiis brevibus pampinis robustis frequentibusque, circinalibus, denique valde crasso-ligneis. Folia plerumque quinque-pinnata usque ad 35 cm. (rarissime usque ad 45 cm.) longa, basi aequaliter lata. Rhachides nudae, (exalatae), firmae, lateribus ter fibroso-striatae, ferrugineae, parce puberulae, 6-8 cm. longae, 2-3 mm. in diametro, quatuor-sulcatae. Foliola majora, elliptica, 15-25 (plerumque plus minus 20) cm. longa, 8-11 cm. lata, superiora plus minusve ovata, apice breviter acuminata acumine obtuso, margine integerrima, coriaceo-chartacea, utrinque glabra, subsessilia (petiolis nudis, usque ad 5 mm. longis, plus minus 2 mm. in diametro), viva utrinque atroviridia, subtus nuda (in sicco flavo-fulva), clathrato-venosa, lateralibus et nervis septem ad novem supra impressis subtus prominenter et valde elevatis, nervo praecipuo utrinque minus sime scabridiusculo-puberulo. Thyrsi solitarii, sparsissimi et minute pulverulento-puberuli, robusta cum rhachide 7-25 (plerumque 10-15) cm. longa et 3 mm. in diametro

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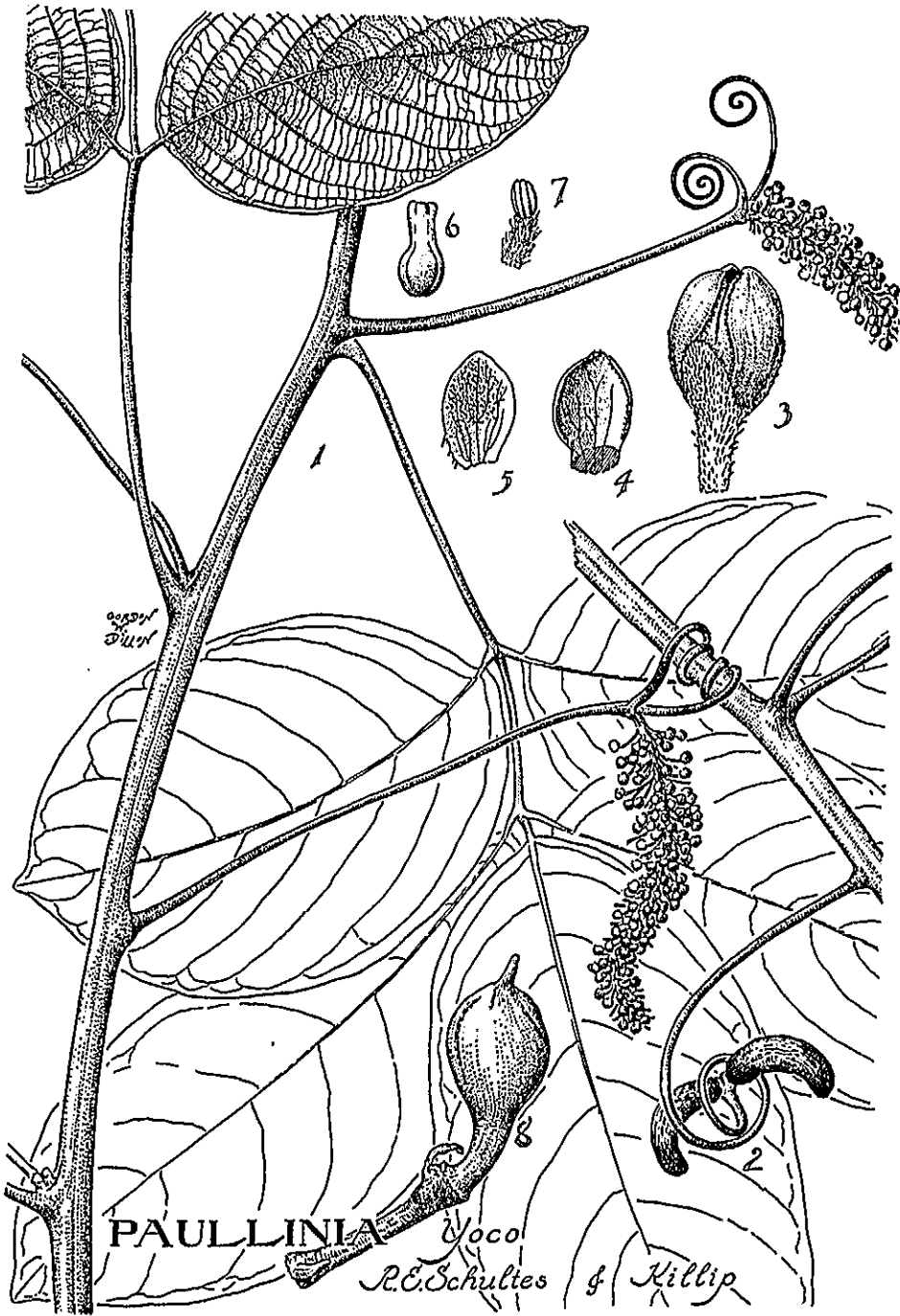
saepe basi contracta. Inflorescentia axillaris, racemiformis, rarenter bifurcata, multi- (usque ad 250-) flora, aliquid cincinnalis, 4-10 (plerumque plus minusve 8) cm. longa. Pedicelli comparate robusti, 3-8 (plerumque 5-6) mm. longi, minute sed densius hirtello-pilosi, gracilibus cum bracteis minutissimis acuminatissime linguiformibus vel triangulari-subulatis, dense hirtello-pilosulis. Flores parvi sed satis robusti, albo-flavidi, aliquid mucosi. Sepala quinque; sepala duo exteriora subcoriacea, extus tomentulosa, intus glabra, subovalia, apice rotundata, plus minusve 1.8 mm. longa et 1.2 mm. lata, margine pseudofimbrillifera vel villosa-ciliata; sepala interiora tria majora, satis membranacea, rotundata, intus glabra, plus minusve 2.8 mm. longa, fere aequaliter lata, valde inflexis cum marginibus sparse villosiusculis. Tori glandulae minutae linguiformes, dense pilosae. Petala quattuor, submembranacea, integra, obovata, intus minute pilosiuscula, 2.3 mm. longa, 2 mm. lata, margine non villosiuscula. Stamina octo, circa pistillum inserta, ex floribus haud exserta. Stamina filamenta complanata, pilis albis longioribus lanatisque extus vestita, 1 mm. longa. Antherae glabrae, 0.7 mm. longae. Ovarium globosum, glabrum, plus minusve 1 mm. in diametro, crasso cum stylo glabro in circuitu triangulari, 0.6 mm. lato, 1 mm. longo; stigma profunde (usque ad 0.3 mm.) trifidum lobis crassis. Fructus capsularis, trivalvis, subdrupaceus, in maturitate rubens, gustatu astringens amarusque; capsula oblique ovoidea, in stipitem attenuata, rostrata (styli reliquiis coronata), ecostata et exalata, epicarpio parum crasso, praeter stipitis basim glabra (capsula sicca valde crustacea, superficie laevigata enervia ecostataque), 10-14 mm. longa, 4-7 mm. lata, rostro usque ad 2 mm. longo. Semina globosa, quasi omnino arillata.

Extensive, woody liana. Stems stout, up to 12 cm. in diameter at the base, with a milky-white astringent

EXPLANATION OF THE ILLUSTRATION

PLATE XXVII. PAULLINIA YOCO *Schulles & Killip*.
1, plant, one half natural size. 2, woody tendril,
one half natural size. 3, flower, five times natural
size. 4, sepal (large), five times natural size. 5,
petal, five times natural size. 6, pistil, five times
natural size. 7, stamen, five times natural size. 8,
fruit with pedicel, two and one-half times natural
size.

PLATE XXVII



PAULLINIA

yoco

R. E. Schultes & Killip



sap. Branchlets subterete, obtusely angled, striate, ferruginous, minutely pulverulent-puberulent becoming almost glabrous, with circinate tendrils which become woody. Leaves usually 5-foliolate. Axes exalate, 4-sulcate, strong, ferruginous, slightly puberulent. Leaflets elliptic (the upper obovate, obtusely acuminate, the lower rotundate), 15–25 cm. long, 8–11 cm. wide, entire, coriaceous-chartaceous, glabrous on both sides, clathrate-nerved with seven to nine nerves. Inflorescence axillary, racemiform, many-flowered, circinate. Pedicels minutely hirtellous, with very small bracts which are acuminately linguiform or triangular-subulate. Sepals five; the outer two subcoriaceous, externally tomentulose, internally glabrous, almost oval, apically rounded with a villose-ciliate margin; the inner three larger, membranaceous, rounded, internally glabrous. Petals four, submembranaceous, entire, obovate, internally minutely pilose. Stamens eight, not exerted, with strong complanate filaments which are covered with white woolly hairs. Ovary globose and glabrous with a fleshy style and a trifid stigma. Fruit subdrupaceous, red when ripe, obliquely ovoid, rostrate.

SPECIMENS EXAMINED:

COLOMBIA: Comisaría del Putumayo, Río Putumayo, Puerto Ospina, 15 kilómetros adentro en la trocha Puerto Ospina—Puerto Asís; alt. ca. 300 m., 6 julio, 1942, *Richard Evans Schultes 4028* (TYPE in Econ. Herb. Oakes Ames Nos. 10432 and 10433, sheets I and II; DUPLICATE TYPES in Herb. Nac. Colomb.; U.S. Nat. Herb.; Herb. Gray).

Comisaría del Putumayo, Umbría, 0° 54' N., 76° 10' W., alt. 325 m., forest, January-February 1931, *G. Klug 1933*, "blanco yoco" (U.S. Nat. Herb. No. 1518079); same locality and date *G. Klug 1935*, "huarmy yoco," (U.S. Nat. Herb. No. 1518082).

The following sterile specimens have been examined and found to be referable to *Paullinia Yoco*:

Comisaría del Putumayo, Río Putumayo, Piñuna Negra, alt. 240 m., diciembre, 1940, *J. Cuatrecasas 10708* (Herb. Nac. Colomb.; U.S. Nat. Herb.).

Comisaría del Putumayo, alta cuenca del Río Uchupayaco, al suroeste de Puerto Limón, alt. 300 m., 27-28 febrero, 1942, *Richard Evans Schultes 3341*; Río Putumayo, Puerto Ospina y los alrededores, alt. ca. 250 m., 23-25 marzo, 1942, *Richard Evans Schultes 3426*; Río San Miguel ó Sucumbios, Conejo y los alrededores, en frente de la Quebrada Conejo, alt. ca. 300 m., 2-5 abril, 1942, *Richard Evans Schultes 3543*, "yoco colorado" (all in Herb. Nac. Colomb. and in Econ. Herb. Oakes Ames).

Comisaría del Putumayo, Mocoa y los alrededores al norte, alt. 750-850 m., 3-7 diciembre, 1941, *Richard Evans Schultes & C. Earle Smith 3045* (Econ. Herb. Oakes Ames).

Comisaría del Putumayo, Umbría, 0° 54' N., 76° 10' W., alt. 325 m., January-February 1931, *G. Klug 1930*, "verde yoco" (U.S. Nat. Herb. No. 1518076); same locality and date, *G. Klug 1937*, "taruco yoco" (U.S. Nat. Herb. No. 1518083); same locality and date, *G. Klug 1946*, "yagé yoco" (U.S. Nat. Herb. No. 1518085); same locality and date, *G. Klug 1947*, "canangucho yoco" (U.S. Nat. Herb. No. 1518086).

ECUADOR: Río San Miguel ó Sucumbios, entre el Río Putumayo y la Quebrada Teteyé, alt. 260 m., "yoco colorado," 29 marzo, 1942, *Richard Evans Schultes 3476* (Econ. Herb. Oakes Ames).

Paullinia Yoco belongs to the section *Enourea* (Aubl.) Radlk. of the genus according to Radlkofer's recent treatment of the Sapindaceae (Pflanzenr. IV, 165 (1931) 232—Sapindaceae I). This section contains eight species, all rather closely allied and all from northern South America (the Guianas, northwestern Brazil, southern Colombia and Peru). *Paullinia Yoco* appears to be most closely related to *P. clathrata* Radlk. of the Amazonas of Brazil, a region floristically very like the Colombian Amazonas and Putumayo where the new species is native. *Paullinia clathrata* (according to descriptions and a photograph of the type) differs from *P. Yoco* in being much larger vegetatively, in having subdentate instead of entire leaves, and in having leaf-pubesence. There are also several floral characters which serve to separate the two species. In Radlkofer's key to the section *Enourea*, the type material of *Paullinia Yoco* traces out to *P. conduplicata* (Klotzsch) Radlk. However, *Paullinia Yoco* is distin-

guished from *P. conduplicata* by its very much smaller size, by the type of its pubescence, and by several floral characters.

II. *The identification of yoco*

Curiously enough, yoco has been given relatively little attention in anthropological and botanical writings. The earliest attempt to identify yoco botanically was apparently that of Dr. Florent Claes of Brussels who made a trip to the Caquetá, Colombia, in 1925 to investigate *yajé* (*Banisteriopsis* spp.) and *yoco*. Dr. Claes made several excursions with Fray Gaspar de Pinell, then a Capuchin missionary in the Putumayo-Caquetá-Amazonas region, and succeeded in collecting a quantity of stems of yoco for chemical analysis and flowering specimens of the plant for taxonomic study. Fray Gaspar, writing in 1929 of Claes' work (Gaspar de Pinell: "Excursión apostólica por los Ríos Putumayo, San Miguel de Sucumbíos, Cuyabeno, Caquetá y Caguan" (1929) 168), said (*translated*):

Dr. Claes was very much interested in trying to classify *yajé* and *yoco* with scientific accuracy; this was the main object of his trip. However, since the flowers of these plants are almost microscopic, he had to content himself merely by collecting several specimens of them to examine under powerful microscopes. . . . Relative to *yoco*, he writes me the following: 'The yoco is more than probably a member of or at any rate very near to the family *amfeliidias* [sic].'

The material which Claes took back to Europe for chemical studies was analyzed and the results were published before the accompanying herbarium specimens were identified. In 1926, Michiels and Denis ("Sur la liane yocco, drogue à caféine du genre '*Paullinia*,'" Bull. Acad. Roy. Méd. Belg. sér. 5, 6, vii (1926) 424) referred yoco to the genus *Paullinia*. Later, however, de Wilde-man ("Sur le yocco, plante à caféine originaire de Colombie" Compte Rend. 183 (1926) 1350) published a note on

Claes' specimens, stating that, with the help of the Royal Botanic Gardens at Kew, he had been able to determine yoco as *Paullinia scarlatina* Radlk.

According to Radlkofer's monographic treatment of the *Sapindaceae*, *Paullinia scarlatina* does not occur in South America and, in fact, is known only from the provinces of Izabál and Alta Verapaz in Guatemala. It therefore seems quite probable that Claes' material was wrongly determined. It is unfortunate that this mistaken identification has found its way into chemical literature. So far as I have been able to ascertain, Radlkofer does not cite Claes' collections in his monograph. It is impossible to borrow this material for study, but I feel certain that it will be found to be referable to *Paullinia Yoco*.

In 1931, Señor Guillermo Klug,² a collector from Iquitos, Peru, explored the Colombian Putumayo. He made an extensive study and several very excellent collections of yoco in the Inga Indian town of Umbría. Klug's collections of yoco, two of which are fertile, are all referable to *Paullinia Yoco*.

Dr. José Cuatrecasas, of the Instituto de Ciencias Naturales, Bogotá, carried out extensive botanical work, in the Putumayo in 1940. Among Cuatrecasas' material is a sterile collection of yoco from Puerto Piñuna Negra on the Río Putumayo. This collection is likewise referable to *Paullinia Yoco*.

It is possible that another species of *Paullinia* may be employed as yoco. In the Herbario Nacional Colombiano, there is preserved a sterile specimen from the upper Caquetá region (*E. Perez-Arbelaes sin. num.*) identified as *Paullinia pterophylla* Tr. & Planch. The collector made an annotation that this species represents the source of

² I am greatly indebted to Mr. Ellsworth P. Killip of the Smithsonian Institution for permission to study Klug's specimens and for placing at my disposal Klug's unpublished notes on *yajé* and *yoco*.

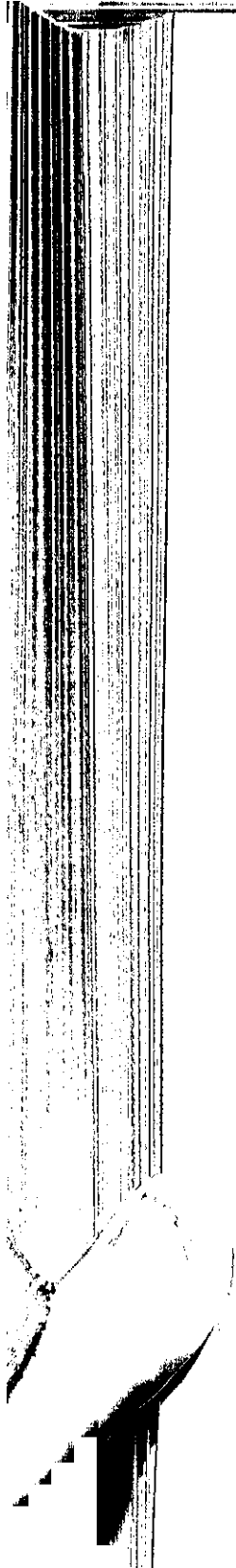
the yoco which the Indians of the upper Caquetá utilize medicinally as a febrifugal tonic.

The Indians of the Caquetá and Putumayo apparently distinguish between different "kinds" of yoco, but I am unable to account for the differences. Nearly forty years ago, Rafael Zerda Bayon ("Informe del jefe de la expedición científica del año de 1905 a 1906. Lista de las muestras de productos del Caquetá y que podrán ser artículos de exportación." (1906) Bogotá), writing briefly on yoco in his report on a scientific expedition to the Caquetá in 1905-06, stated that the natives distinguished four "kinds" of yoco and also reported (*translated*):

There is a *yoco blanco* ["white yoco"] and a *yoco colorado* ["red yoco"].

His specimens have long since been lost, and he does not explain the exact nature of the differences between the kinds of yoco.

During my ethnobotanical studies in the Putumayo, I repeatedly questioned natives concerning the differences between *yoco blanco* and *yoco colorado* with conflicting replies. While it is true that the sap expressed from some stems makes a light chocolate-brown mixture when added to cold water, that from other stems makes a whitish milky mixture. Both taste the same, and both are equally effective as a stimulant. The Indians do not prefer one to the other. I find that it is impossible to distinguish botanically the liana which gives *yoco blanco* from that which yields *yoco colorado*, but the natives can distinguish them immediately by slashing the bark with a machete. I have noted that *yoco colorado* nearly always is a much stouter and apparently older plant than *yoco blanco*. It is possible that there is a chemical difference due to age. It seems hardly probable that the differences are due to seasonal or soil conditions, for *yoco blanco* and *yoco colorado* grow side by side and can be collected at the same time.



Klug has collected data of great interest relative to the different "kinds" of yoco. His five collections from Umbria are annotated with different names which would suggest that the Inga Indians of the region regard them as different. Klug's notes unfortunately do not explain the nature of these differences nor why the Indians have these distinct names. A careful examination of Klug's specimens fails to reveal a single botanical character which would suggest that any other species or variety is represented; all of his collections are referable to *Paullinia Yoco*. The several common names annotated by Klug are as follows: *blanco yoco*; *huarmy yoco*; *taruca yoco*; *yagé yoco*; *canangucha yoco*; *verde yoco*. No mention is made of *yoco colorado*. Two of these names suggest that yoco may be used in connection with other plants. The name *yagé yoco* might mean that *Paullinia Yoco* is used together with the narcotic *yajé* (*Banisteriopsis inebrians*, Morton and other species). *Canangucha yoco* might suggest that *Paullinia Yoco* is taken with *chicha de cananguche*, an alcoholic drink prepared from the fruits of *Mauritia minor* Burret. All of my data, however, as well as those which others have published, indicate that yoco is always used alone.

III. The chemistry of yoco

A number of sections of stem (totalling some ninety-six pounds) of the type plant (*Schultes 4028*) were collected and have been submitted to Dr. Barriga-Villalba of the Laboratorios Samper-Martínez, Bogotá, for phytochemical examination. The results will be published in an early number of *Caldasia*. This analysis will be interesting because former chemical studies of yoco were undertaken with material the exact identity of which is as yet not known.

In 1926, Rouhier and Perrot ("Le 'yocco,' nouvelle

drogue simple à caféine” Bull. Sci. Pharm. 33 (1926) 537-539—Trav. Lab. Mat. Méd. 17, pt. 6² (1926)—Compt. Rend. 182 (1926) 1494—Chem. Zentralbl. 1 (1927) 138) reported on the chemical constitution of yoco stems received from Dr. Claes and from a French consular official in Quito, Ecuador. At the time of the publication of this report, the plant had not been identified even as to the family. For this reason, Rouhier and Perrot were forced to refer to the plant simply as “le yocco, nouvelle drogue simple à caféine.” As I have indicated above, it is probable that these plant materials, which shortly after the appearance of Rouhier and Perrot’s paper were mistakenly identified as *Paullinia scarlatina*, are referable to *Paullinia Yoco*.

According to Rouhier and Perrot, yoco “bark” (by which is meant probably all tissues outside of the xylem) contains 6.1% ash, 12.3% water, and 2.73% caffeine. Michiels and Denis (Journ. Pharm. Belg. 8 (1926) 795—Chem. Zentralbl. 1 (1927) 138) report that the inflorescences of yoco also contain caffeine.³

Thus, yoco may be added to that list of plant species which are rich in caffeine. Among the more important caffeine-yielding plants are: coffee (*Coffea arabica* L. and other species) of the *Rubiaceae*; tea (*Camellia sinensis* (L.) O. Ktze.) of the *Theaceae*; kola nut (*Cola nitida* (Vent.) A. Chev.) and cacao (*Theobroma Cacao* L.) of the *Sterculiaceae*; maté (*Ilex paraguariensis* St. Hil.) of the *Aquifoliaceae*; and guaraná (*Paullinia Cupana* HBK.) of the *Sapindaceae*.

In all of these species, the highest caffeine concentration is found in the leaves, fruits or seeds. Consequently, these are the economically important parts of the plant.

³ The chemical composition of yoco has been summarized in Wehmer: “Die Pflanzenstoffe,” ed. 2, 2 (1931) 730.

Paullinia Yoco is apparently the first plant in which the bark is utilized for its caffeine content.

IV. Notes on related species of *Paullinia*

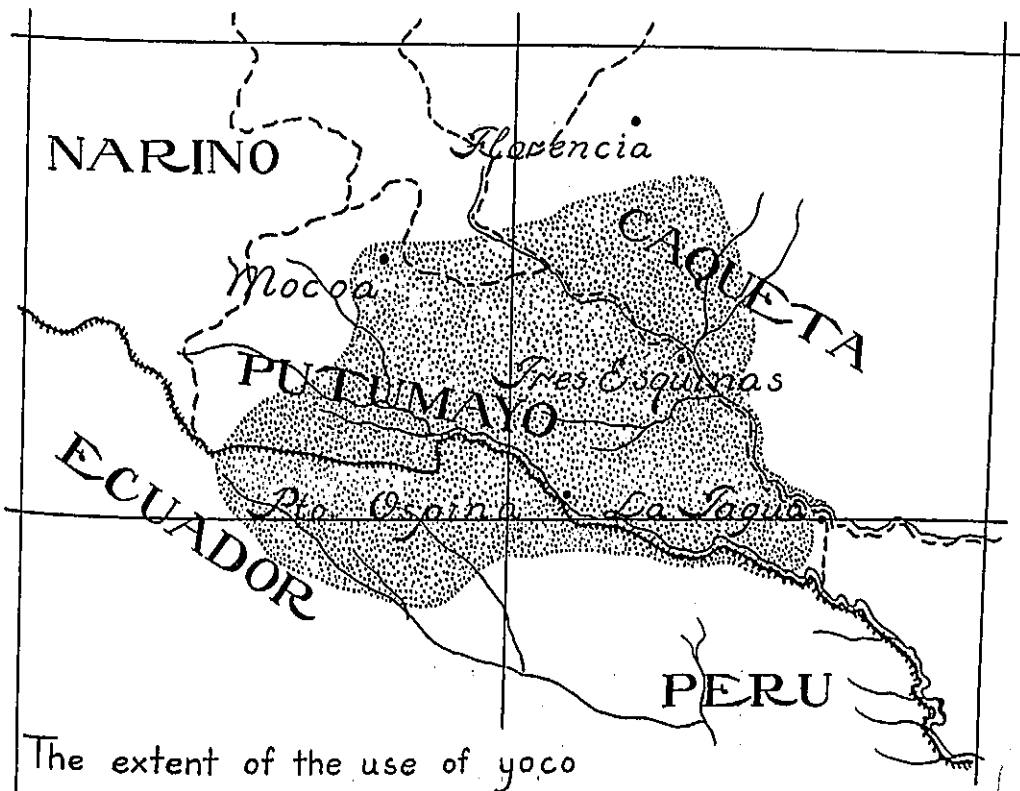
It is of interest to note that *Paullinia* and the very closely related genus *Serjania* contain extremely toxic species, including a number of very active fish-poisons.

Paullinia Cururu L. is an ingredient of a certain type of curare in South America. *Paullinia australis* St. Hil. is a highly toxic Argentinian species containing in its leaves and roots a sedative and narcotic alkaloid. The bark of the roots of *Paullinia pinnata* L. (*timbo*) is a narcotic poison, and in Brazil certain Indians are said to employ it in the preparation of a slow poison.

Guaraná, derived from *Paullinia Cupana* HBK., said to be the most stimulating of all the caffeine beverages, is used in most of the Amazon Valley of Brazil as a coffee substitute. The seeds are pulverized, mixed with cassava flour (*Manihot esculenta* Crantz), and formed into small moulds of various shapes. Upon drying, these moulds become very hard. The beverage, which is made by dissolving this *pasta guaraná* ("guaraná paste") in hot or cold water, is astringent and bitter due to the rather high tannin content (2-3%) of this species. The stimulant properties are due to the high caffeine content which is usually 3-4%, but which may occasionally be as high as 6%. *Paullinia sorbilis* Mart., usually considered to be the same as *P. Cupana*, but which is possibly distinct, is also a source of guaraná.

V. The use of yoco

The area in which yoco is employed as a stimulant is rather restricted, comprising, according to all available reports, the Comisaría del Putumayo and the westernmost part of the Comisaría del Caquetá in Colombia, a



The extent of the use of yoco

EXPLANATION OF THE ILLUSTRATIONS

PLATE XXVIII. *PAULLINIA YOCO Schultes & Killip.*
Upper figure, basal portion of a stem of the liana showing the milky sap exuding from the wound. Puerto Porvenir, on the Río Putumayo near the mouth of the Río San Miguel, Comisaría del Putumayo, Colombia, July 1942. (Photograph of the type: *Schultes 4028.*)—Lower figure, pieces of the stem. Santa Rosa, on the upper Río San Miguel, Comisaría del Putumayo, Colombia, April 1942.

PLATE XXIX. *PAULLINIA YOCO Schultes & Killip.*
Upper figure, a Kofán Indian preparing yoco: rasping the epidermis, cortex and phloem. Puerto Porvenir, on the Río Putumayo near the mouth of the Río San Miguel, Comisaría del Putumayo, Colombia, July 1942.—Lower figure, a Kofán Indian preparing yoco: expressing the milky sap of the rasped material. Puerto Conejo, on the upper Río San Miguel, Comisaría del Putumayo, Colombia, April 1942.

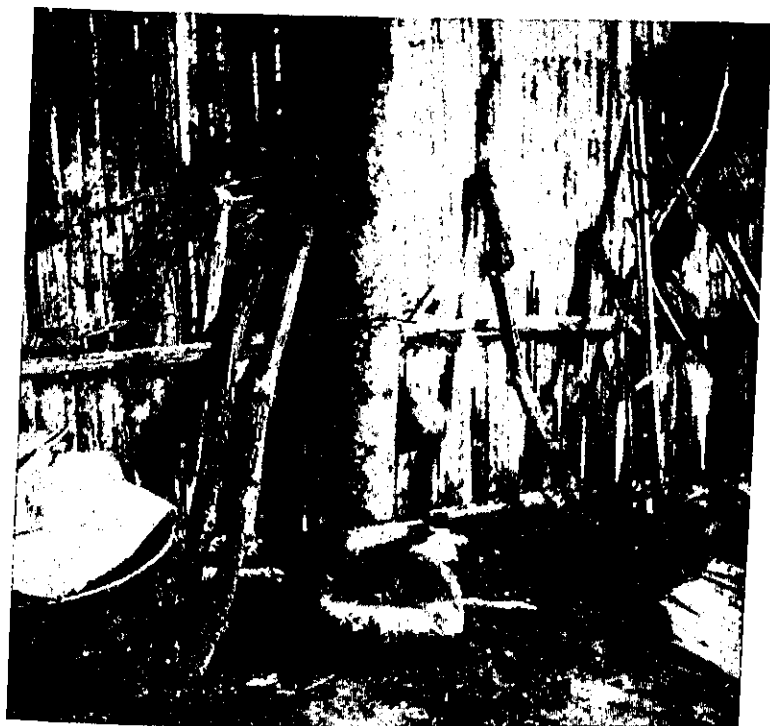




PLATE XXIX





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small portion of Peru which borders upon the Colombian Putumayo, and northeastern Ecuador as far south as Agaurico and possibly beyond.

It is strange that the use of yoco is so restricted since *Paullinia Yoco* or very closely allied species apparently have a wider range. The Huitoto and Bora Indians of the Colombian Intendencia del Amazonas do not use yoco, do not know the plant by this name, and are not aware of the purpose for which Indians of the neighboring parts of the Putumayo employ it. Even those Huitotos who have migrated from the Amazonas to the Coreguaje Indian area of the Caquetá and who have adopted many Coreguaje customs, have not taken up the use of yoco. The fact that the Huitoto Indians use coca habitually might seem to explain their lack of interest in yoco. This is not the case, however, for in the town of Nuevo Mundo (near Tres Esquinas), Caquetá, I found the Coreguaje Indians employing both coca and yoco.

So far as I have been able to ascertain, the only tribes which drink yoco are the Ingas of Mocoa, Umbría, Puerto Limón and other localities in the Putumayo; the Sionas of the Putumayo; the Kofáns of San Antonio Guamues, Puerto Conejo, Santa Rosa, and Puerto Ospina in the Putumayo and of Aguarico in Ecuador, and the Coreguajes of the Caquetá. (cf. also Claes: "Chez les Indiens Huitotos et Correguajes" Bull. Soc. Roy. Belg. Geogr., fasc. 2 (1931) 101—Gaspar de Pinell, loc. cit., 161.) All of these Indians use the name *yoco* which is apparently of Inga origin. In the language of the Kofán, Siona and Coreguaje Indians there is no name for *Paullinia Yoco*.

Although it is a stimulant and not a food, *Paullinia Yoco* is one of the most important plants in the diet of the Indians of the Putumayo and western Caquetá. Every Indian household keeps a large supply of yoco stems,

and few Indians ever make a long trip through the forest or by canoe without carrying two or three pieces. Yoco is cut from wild lianas chiefly. I have never seen *Paullinia Yoco* cultivated, but Padre Javier de Quito, a missionary who has spent nearly forty years in the Putumayo, informs me that occasionally a plant may be found under cultivation in an Indian clearing. In 1906, Bayon reported that the Indians of the Caquetá "cultivate it with care."

Because of the great demand for yoco, wild plants of *Paullinia Yoco* are becoming hard to find wherever there are Indian settlements. It is believed that scarcity of yoco is one of the causes of the occasional abandonment of excellent town-sites by an entire village of Indians, although epidemics account for most of these town-migrations. The Kofáns of Puerto Ospina informed me that there is not a sufficient supply of yoco nearer than twenty kilometers and that the only remedy will be to move the village nearer to the wild supply. At the present time, an Indian from the vicinity of Puerto Ospina must make a long day's trip in order to reach a region where plants of yoco are growing and, after arriving, must search to find a liana suitable for felling.

Lianas of *Paullinia Yoco* which have a stout stem at least three inches in diameter at the base are utilized (plate xxviii, upper figure). Usually several trees must be felled before the liana falls to the ground. Starting at the root, the stem is then cut into pieces which may vary from one to three feet in length. These pieces are stored in cool corners of Indian houses (plate xxviii, lower figure) and retain their stimulating properties for a month or even longer.

In the preparation of the beverage from the yoco stems, the epidermis, cortex and phloem (all of the softer tissues external to the xylem) are rasped (plate xxix, upper fig-

ure). The scraps of material thus obtained are squeezed to express the caffeine-bearing sap into cold water. If the yoco is rather old and dry, the rasped material is allowed to soak (plate xxix, lower figure) and the stimulating principles are quickly removed. After extraction, the remains of the rasped tissues are discarded. When prepared, *yoco blanco* is a cloudy milky-white liquid, but in the case of *yoco colorado* the liquid is light chocolate-brown in color. Both kinds are used without discrimination; apparently one is as strong a stimulant as the other. Yoco is never made with hot water. In this respect it differs markedly from *Paullinia Cupana* and other caffeine-yielding plants, for the extraction of caffeine from these plants is usually accomplished with warm or hot water.

Each dosage of yoco consists of the expressed sap of approximately 90-100 grams of rasped material served in a "jícara," a bowl made from the fruit of *Crescentia Cujete* L.

It is the general custom of the Indians of the Putumayo to eat nothing until noontime. Instead, yoco is taken each morning between five and six o'clock. One or two "jícaras," each half full of the beverage, are sufficient to allay all sensations of hunger for at least three hours and to supply muscular stimulation. I have tried yoco on many occasions and find that the statements of the natives regarding the stimulating and hunger-allaying properties are not in the least exaggerated. The effects of the stimulant are rapid in action. A tingling of the fingers and a general feeling of well-being are noticeable ten minutes after drinking the contents of two "jícaras." I have made long trips through the forests, and, taking nothing but yoco, have felt neither fatigue nor hunger. Klug (unpublished notes: "Plants of Umbria, between the Rivers Alto Putumayo and Alto Caquetá, 360 meters above sea level," preserved in the United

States National Herbarium and in the Library of Economic Botany, Botanical Museum of Harvard University) has written:

"I, myself, as well as three students who accompanied me on my exploration to the upper Río Putumayo, have taken yoco on different occasions, and we were able to state that this happened in every detail: in a whole day of walking (20-25 kilometers) not only have we felt no hunger, but we have felt no fatigue In the regions mentioned one never finds an Indian making a long trip by land or by canoe without taking along a branch of this vine, which is his food and keeps him from feeling the fatigues of his journey."

In 1906, Zerda Bayon (loc. cit.) wrote (*translated*):

They take it to acquire strength, vigor and agility for their long canoe-paddlings, for hunting trips, and for their tiring trips through the jungles; and in order not to feel hunger. Their breakfast is infallibly a draught of yoco

In addition to its use as a stimulant, yoco is employed, in larger dosages, as an anti-malarial febrifuge and as a medicine in the treatment of a bilious disease which is frequent in the Putumayo. I found these uses prevalent among the Inga, Siona, Kofán and Coreguaje Indians. The same uses have been reported by several investigators who have been in other parts of the Putumayo and Caquetá. Klug (loc. cit.), for example, reports:

. . . . this liana has the property, perhaps chiefly antibilious, of curing the malarial fevers in this region

It is with pleasure that I express herewith my appreciation of the assistance given me during my ethnobotanical investigations in the Putumayo by the Colombian Ministerio de Guerra and the Capuchin Mission of the Putumayo and Caquetá. Special thanks are tendered to Colonel Gomez-Pereyra, commander of the base at Caucayá; to Captain Rojas-Scarpeta, commander of the gunboat "Cartagena," and to the Reverend Padres Gaspar de Pinell and Marcelino de Castellví.