

THE FLOWERS OF ILEX GUAYUSA

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In 1901, Theodor Loesener described a new species of holly from sterile material collected in 1898 by Warszewicz in eastern Peru. Loesener named the holly *Ilex Guayusa*, because the Indians of eastern Colombia, Ecuador, and Peru used its leaves to prepare a medicinal and beverage tea called *guayusa* (or *huayusa*).

Although the plant is well known to local people, few botanists have collected it, and it is poorly represented in the world's herbaria. The great English plant-explorer, Richard Spruce, did not collect *guayusa*, although he was well acquainted with it and even employed it as a substitute for tea when his supply of the latter ran out (Schultes: "Richard Spruce and the potential for European settlement of the Amazon: an unpublished letter" in Bot. Journ. Linn. Soc. 77 (1978) 131-139). It is so poorly represented in herbaria that a major United States institution mounted leaves from a commercially prepared wreath as their sole representative of the species.

Two reasons can be offered for this poor representation. One is that *guayusa*, a cultivated plant, has been poorly collected by researchers interested in more academic botanical problems connected with the wild flora. Another reason, the more conceivable, is that *Ilex Guayusa* could not be found in flower: botanists are hesitant, given the time and weight constraints of collecting expeditions, to collect non-flowering or non-fruiting material. Consequently, it has been those botanists interested in economically important species who have collected most of the specimens of this plant.

The absence of flowers and fruit has led some botanists to speculate that *guayusa* is an asexually reproduced cultigen which has lost its flowering ability through years of selection and vegetative propagation by man. Like many other cultivated

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plants, it seems to grow only in association with human habitation, either presently or in the past (Schultes: "Discovery of an ancient guayusa plantation in Colombia" in Bot. Mus. Leaflet. Harvard Univ. 27 (1979) 143).

The view that this plant has been in association with man for a long period of time is also reinforced by speculation that *Ilex Guayusa* may possibly represent only a cultivated variant of *I. paraguariensis*. It was, in fact, Loesener himself who, in describing guayusa, first pointed out the possible relationships between *L. Guayusa* and *I. paraguariensis*: "Species ob flores adhuc ignotos valde dubia. Sed si re vera de *Ilice* agitur, species *I. paraguariensis* St. Hil. et *I. nitidae* (Vahl) Maxim. sine dubio affinis. Folia maiora et acutius acuminata quam in affinibus." *I. paraguariensis*, known as *yerba maté* or *Paraguay tea*, grows wild in the mountains of southern Brazil, Paraguay and Argentina; it is also cultivated in these countries.

My interest in *Ilex Guayusa* was sparked by a conversation with Prof. Richard Evans Schultes of the Botanical Museum of Harvard University in 1979. I was preparing an ethnobotanical expedition to Ecuador, and he suggested that a search for guayusa flowers be included in my plans. Prof. Schultes told me of the plant's meager taxonomic representation, its interesting use as a caffeine-containing plant used as a snuff in ancient Bolivia (Schultes: "*Ilex Guayusa* from 500 AD to the present" in Etnolog. Stud. 32 (1972) 115-138) and its importance as a medicinal and ritual tea amongst contemporary Indians in Ecuador (Villavicencio, M.: *Geografía de la República del Ecuador* (1858) 371-374; Patiño, M.: Guayusa—a neglected stimulant from the eastern Andean foothills" in Econ. Bot. 22 (1968) 311-316).

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Soon after arriving in Quito in August 1979, I discovered that the question of guayusa's ability to flower had been answered by a collection in the herbarium at the Universidad Central of that city. On October 4, 1975, an expedition led by Ing. Agr. Alberto Ortega, Professor of Botany at this university, discovered flowers on a tree growing near a market in *Sacua*, Ecuador. Thanks to Ing. Ortega, I have examined this material. It consists entirely of staminate flowers. This collection represents the first flowers

of *Ilex Guayusa* ever collected by botanists: the original material collected by Warszewicz 77 years earlier was sterile—as are all subsequent collections.

Just one week after examining the specimen at the Universidad Central, I was also able to locate flowering material of guayusa. With Mr. Fred Ness of the University of New Mexico, I found a small tree in the tiny village of Río Chico, ten kilometers south of Puyo, Ecuador. Río Chico is inhabited by people known variously as the Canelos Quechua, Sacha Runa or Puyo Runo. The village stands at an altitude of approximately 1000 meters, similar to that of Ortega's collection. Nevertheless, flowering was occurring two months earlier.

The tree, growing next to the school master's house, did not belong to any single local family but was used by all members of the immediate community. My guide and informant, Sr. Rafael Santi, told me that guayusa tea is used before and after drinking the hallucinogen called *ayahuasca* (*Banisteriopsis Caapi*). Drinking the tea kills the bitter taste of the *ayahuasca*, and its use afterwards prevents hangovers. In addition, it gives a person strength to cope with the powerful hallucinogen. Guayusa is also used by local people as a coffee substitute and for stomach trouble, and it is reputedly an aphrodisiac. In Puyo, numerous grocery stores sell "leis" of folded and strung leaves for local consumption.

The tree was 30 feet tall, with a diameter of about 10 inches at breast height. It had whitish bark on all stems older than three years. After waiting for three weeks, I was able to collect specimens with about one third of the flowers open. Sr. Santi told me that the tree produced seeds, but at the time I could verify only that abundant pollen was being released. I located two other guayusa trees growing several hundred meters outside of the same village, but they were not in flower. These trees were approximately 12 feet in height and had the appearance of large shrubs. I was told by several residents that these trees flowered many months later, in the early part of the year.

I examined the flowers and found them all to be staminate. Numerous flowers and buds were cross-sectioned, and only two tiny vestigial locules could be found in the cushion-shaped

gynoecium. No hint of ovules or placental tissue exists. I can offer no reasonable explanation for my guide's asserting that this tree produced seeds, especially since this man is a very astute observer and would not mistake other floral parts for seeds. It is of note, however, that one flower amongst the 60 to 80 examined did resemble the pistillate form of *Ilex paraguariensis*. This one flower possessed a gynoecium slightly constricted into four carpel regions, each bearing a stigma-like structure directly upon it, and it did produce pollen.

With the discovery of flowers, questions about the natural history of *Ilex Guayusa* can be explored. It is interesting that, upon cursory examination, flower morphology and leaf shape are very much like those of *I. paraguariensis*. In contrast, however, guayusa attains heights of 75 feet, while *I. paraguariensis* is a shrub or small tree growing only to 24 feet. Additionally, guayusa leaves are usually much larger. Guayusa is apparently dioecious and may well be accommodated in the reproductive pattern of the genus. However, little more can be said with certainty, and fundamental questions concerning sexual reproduction and lack of vernal synchronization of trees in the same area must be answered.

In conclusion, the next logical step is to search for pistillate flowers of guayusa and to determine whether or not they produce viable seeds. Furthermore, field data on all species of *Ilex* in the New World tropics are needed in order to evaluate effectively the taxonomic position of this species. It is to be hoped that the historical difficulty in finding flowering material will not hinder future studies and that 77 years need not pass before the reproductive biology of this interesting economic plant is more fully understood.

***Ilex Guayusa* Loesener emend. Shemluck**

Arbor magna, robusta, usque ad 75 ped. alta sed praecipue in cultura usualiter minor. Rami glabri vel subglabri, frequenter minute et longitudinaliter delicate striolati. Folia magna, glabra, supra vulgo nitidula viridiaque, subtus pallida, interstitis saepissime 1.5-3 cm. longis dissita; stipulis conspicuis inaequaliter subulato-deltaeideis, cinereis, usque ad 1.8 mm. longis, basiñ 1mm. latis; petioli glabri, plus minusve rugulosi, plerumque

1-1.2 cm. longi; lamina chartacea vel submembranacea, oblonga vel elliptico—oblonga (interdum subovato-lanceolata), margine leviter recurvata, crenato-serrata, base acuta vel subcuneato—obtusa, apice manifeste acuminata, vulgo 9-12 cm. (sed saepe usque ad 21 cm.) longa et 4-5 cm. (sed frequenter usque ad 7.5 cm.) lata, nervis lateralibus 8 ad 10, in angulis 45-60° dispositis, apicem versus curvis, marginem versus reticulatis, supra inconspicuis et subtus prominentibus. Inflorescentiae imperfectae in axillis fasciculatae, cymosae, pedunculo plus minusve 5-9 mm. longo, sparsissime piloso. Flores staminati parvi, albo-virides gemmis 1.5-2 mm. in diametro; pedicelli minute strigosi, plerumque 5 mm. longi; bracteoli brunnei, granulosis, subulati, usque ad 1 mm. longi; calyx crateriformis, lobis 4, brunneis extus marginem versus albidis, dense granulosis, triangularibus, apice obtusulis, plerumque 1-1.4 mm. longis, 1.2-2 mm. latis; petalis plerumque 4, basin conspicue connatis, toto 3.5-4 mm. longis, membranaceis viridulis sed marginem versus albis, extus pilosulis, intus in lineis minutissime papillosis, rotundato-oblongis, 3 mm. longis, base 2.5 mm. latis; stamina plerumque 4 (saepe 5), petalis base adnata, filamentis 1.5 mm. longis, antheris 1.5 mm. longis; ovario rudimentario pulvinato; 1-1.5 mm. in diametro, glabro. Flores pistillati ignoti.

ECUADOR: Provincia de Pastaza, Río Chicó, affluent of Río Pastaza. Village of Río Chicó and vicinity. alt. c. 1000 m. 31 August 1979. *M. Shemluck 236*.—Same tree 25 August 1979, 1979 *M. Shemluck et F. Ness 221*.

EXPLANATION OF PLATE 42.

1. Flowering branch, about 1/2 natural size.
2. Inflorescence (with incipient branch distally), about 1 1/2 natural size.
3. Single staminate flower, about 6 times natural size.
4. Variant, uncommon form of pistil in pollen-bearing staminate flower, about 10 times natural size.
5. Bud, about 5 times natural size. Drawn by E. W. Smith

