

BOTANICA

PLANTAE COLOMBIANAE, IX

Nova species *Senefelderae*.—De natura œcologica montium arenario-saxosorum insulitorum Vaupesense regionis brevis conspectus.

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In March, 1943, Mr. Jules de Wael Mayer, Special Representative of the Rubber Development Corporation in Bogotá, sent me (1) into the upper Apaporis River Basin to initiate explorations of this part of eastern Colombia.

The chief purpose of the explorations was a study of *Hevea* and other commercially valuable lactiferous plants and possibilities of their exploitation. In connection with this work, it was possible to make a cursory examination of the vegetation in general and limited collections of the more interesting species.

This area comprises one of the most critical floristic points of the great Amazonian basin of Colombia. Since no botanical explorations have hitherto been carried out in this region, nothing has been known of its flora. Some of the collections recently made may, for this reason, be of particular phytogeographic interest. The collections representing the lactiferous plants, one of which is described as new in this paper (2) appear to be of such outstanding interest that it has seemed advisable to publish the taxonomic and ecological data in advance of a detailed study of the whole collection.

(1) as Field Technician, Rubber Development Corporation, November 1942 through November 1943.

(2) See also *Caldasia* 9 (1944) p. 375 (*Ficus chiriquetensis* Dugand), and *Caldasia* 11 (1944) 25-32 (*Hevea viridis* var. *toxicodendroides* Schultes & Vinton).

Senefelderia chiribiquetensis R. E. Schultes & L. Croizat, n. sp.

Arbuscula vel arbor parva, in campis montium arenario-saxosorum abunde crescens, usque quindecim (rareiter et solum in silvis usque ad viginti-quinque) pedes alta, conspectu xerophytica. Truncus usque ad 15 cm. diametro sed saepissime minor, copiose lactescens denso cum lacte tenace alboque, cortice laevigato vel saepe subrugoso, cinereo-nigro, comparate crasso; ramulorum cortice tenuissime papyraceo, sicco, rufo-fusco. Ramis glaberrimus, bene cicatricosis. Folia lanceolato-elliptica, petiolata (petioli 1.5 - 3 cm. longis), apice acuta vel saepe aliquid acuminata, basi conspicue glandulosa, cuneato-rotundata, margine integra, leviter revoluta, cum plus minusve quatuordecim venis lateralibus non elevatis, secundum costam medium angulatim (90°) plicata, in statu adulta plerumque 9 - 12 cm. longa, 4.5 - 6 cm. lata, sed saepe aliquid majora coriacea in sicco fragilia; supra atroviridia, valde nitida, in sicco fusco-viridia; infra viridia pallida, subnitida in hic inde subtus ceraceo-glandulosa, sicco flava. Inflorescentiae ♂ graciles, erectae, subpaniculatim ramosa 6 - 15 cm. longae, axibus sparse puberulentis. Flores flavi vel flavo-virides; tria ♂ in axilla bracteolae parvae, triangulares, 1.5 mm. x 0.5 mm., perianthio subcampanulato, circiter 1 mm. longo, 1 mm. lato; staminibus tria, 2 - 2.5 mm. longis. Fructus sex-partitus, lignosus in maturitate; epicarpio firme coriaceo, 1 mm. crasso, atroviridi sed in maturitate fusco-rufescente; mesocarpio lignoso, usque ad 2 mm. crasso; capsula elongato-ovoidea, brevissime pedunculata vel subsessilia, apice brevissime rostrata, rostro usque ad 3 mm. longo, 16 (rareiter 18) mm. longa, 12 - 14 mm. in diametro; capsulae valvae usualiter plus minusve 14-15 mm. longae, crepitantes. Semina ovoidea, atrofusca, nitida, sine maculis, apice late rotundata, usque ad 7 - 8 mm. longa, 4 - 5 mm. in diametro; arillo carnoso, flavo-fusco, 1 mm. x 2 mm.

COLOMBIA: VAUPÉS: Upper Apaporis Basin - Río Macaya, Cerro Chiribiquete, alt. about 1200 feet above the forest floor, 2100 feet above sea-level. Sandstone formation. "In slope forest on dry sandstone ledge near top of mountain. In association with *Clusia* spp. and *Miconia paradoxa*. Tree 20-25 feet tall, basal diameter 7 inches. Latex abundant, thick, white. Flowers small, yellow or yellowish green. Bark grey-brown or grey-black, smooth or sometimes roughish. Fruits greenish, ripening red-brown, ligneous, explosive, 6-parted, with beak 1/8th inch long. "May 15-16, 1943, R. E. Schultes 5456 (TYPE in Econ. Herb. Oakes Ames; DUPLICATE TYPE in Herb. Nac. Colomb.).

Same locality: May 15-16, 1943, R. E. Schultes 5464, 5466, 5484; - July 24, 1943, R. E. Schultes 5623; - January 18, 1944, R. E. Schultes 5736. All these collections were made from shrubs or small bushes 4 to 12 feet tall; in R. E. Schultes 5736 the fruits were reddening to a dull purplish red hue.

Other localities: VAUPÉS: Upper Apaporis Basin, río Ajajú, Cerro Macuje, alt. about 200 feet above the forest floor; on lower ledge; sandstone formation; "Bushy treelet from 8 to 15 feet tall; floral axes yellow; male flowers greenish yellow", June 1-6, 1943, R. E. Schultes 5551; - CAQUETÁ: Upper Apaporis Basin, río Ajajú, Cerro del Gigante, alt. about 600 feet above the forest floor; sandstone formation; "Bush. Fruit capsules woody", June 12, 1943, R. E. Schultes 5595.

Senefeldera chiribiquetensis is apparently closely related to no species described from north-western South America. It is remarkable because of its small size and xerophytic nature. Another species with three stamens, *Senefeldera triandra* Pax & Hoffm., is endemic to the Acre region of Brazil; its vegetative characters (ex descr.) are



Senefeldera chiribiquetensis Schultes & Croizat.
Close-up of fruiting specimen. Type locality: Cerro
Chiribiquete.

(Foto Schultes)

not even suggestive of this new species however. Pittier's *Senefeldera testiculata* of Zulia, Venezuela, has seven stamens and has a "glándula testiculada en la base de la costilla foliar".

On the several mountains of the Upper Apaporis Basin, *Senefeldera chiribiquetensis* is a dominant part of the vegetation. The top of Cerro Chiribiquete is very densely grown with this species. The greatest density, however, was found on the lower ledge surrounding the base of Cerro de la Campana. Here, the bush occurs in thick stands to the complete exclusion of other plants with the single exception of *Hevea viridis* var. *toxicodendroides*. These stands, averaging between 8.000 and 10.000 individuals per hectare, are so thick that one is covered with white sticky latex as he breaks and cuts his way through the brush.

An analysis of the dried leaves, twigs, and bark of a complete plant of *Senefeldera chiribiquetensis* from the type locality, made by the Bureau of Plant Industry in Washington, D. C., is herewith published with the permission of the Rubber Development Corporation:

<i>Analysis of Plant Specimen:</i>	<i>Leaves</i>	<i>Stems</i>	<i>Bark</i>
Acetone extract (resins)	13.10	10.72	19.49
Benzol extract (rubber)	0.56	0.44	0.76
Insolubles (calculated)	86.34	88.84	79.25

Benzol extracted rubber from leaves and stems was fair; bark was good in quality.

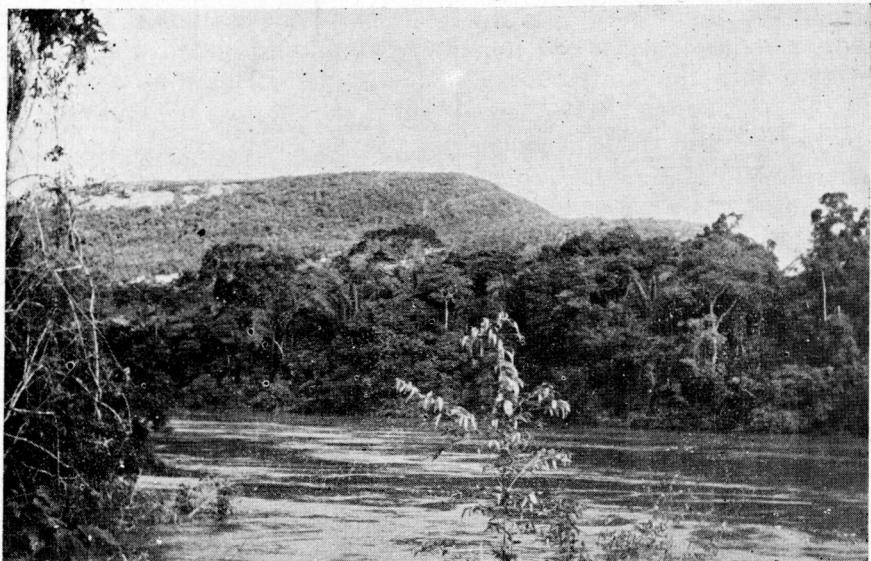
Notes on the Ecology of some isolated sandstone hills of the Vaupés Region.

Scattered in various parts of the Comisaría del Vaupés and in adjoining areas of the Comisaría del Caquetá and of Brazil, are small sandstone ridges or mountains, each of which, apparently, has a flora extraordinarily distinct from that of the surrounding Amazonian forest. It also seems that each of these isolated mountains, usually removed from one another by several hundred kilometers, has a flora which is endemic to a certain extent. We do not as yet know enough about the specific composition of the vegetation of these mountains to state that this is a certainty, but preliminary examination of collections from far-separated mountains of the Vaupés by Cuatrecasas, Allen, Schultes and Gutiérrez, would seem to indicate a relatively high degree of endemism.

In the upper reaches of the Apaporis drainage there is a very extensive series of sandstone mountains standing isolated without connection with the nearest similar mountains or ridges at Araracuara on the río Caquetá (to the south), those at San José del Guaviare (to the north), and Cerro Isibucurí on the río Cananari (to the east). These mountains create ecological conditions certainly conductive to endemism. They are of two forms: 1) long, tilted sandstone ridges or ledges with a sharp cliff on the northern side, often with jutting benches or shelves near the base, and gradually sloping to the south or southwestward; 2) more or less eroded, rounded, knob-like or dome-like masses surrounded at the base by rather extensive flat sandstone benches or shelves. In the Upper Apaporis Basin, the best example of the former is the Cerro Chiribiquete; of the latter, the series of mountains which are collectively known as Cerros de la Campana.

In the Upper Apaporis Basin, the mountains appear to be of about the same altitude: between 800 and 1200 feet above the forest floor, which is itself approximately 900 or 1000 feet above sea level. They are composed of a white or reddish quartzite sandstone. On the official map of Colombia (Oficina de Longitudes, 1939), Cerros Chiribiquete and Campana are approximately correctly located; the former at the confluence of the Macaya and Ajajú Rivers, the latter on the left (northern) bank of the Ajajú some 25 to 30 kilometers upstream from the confluence. There are other mountains, equally as large and important, which are not indicated on any map of Colombia; these are Cerro Camarote, between the Macaya and Itilla or Itiya Rivers; Cerro Macuje, Cerro de la Iglesia, and Cerro del Gigante on the right (southern) bank of the Ajajú; and Cerro del Castillo on the same bank of the Apaporis River, immediately below the confluence of the Ajajú and Macaya.

All these mountains are nearly devoid of soil on the top except in the frequent crevices or on the slopes protected somewhat by overhanging crags. The tops of the ridges are usually pure sandstone ledges, and plants are forced to grow with their roots twisted and gnarled into cracks where rock-decomposition probably supplies minute quantities of sand. In low basins on these flat ridges, there are often small pools accumulating stagnant rainwater which cannot leave the depression except by evaporation. In these basins, small amounts of a sort of white quick-sand accumulate. Otherwise, the tops of the mountains are bare rock. Yet, it is surprising to find that there are



The northwesternmost tip of Cerro Chiribiquete taken from the Macaya River at the Cachivera (Raudal) del Diablo. The flat top of this end of the mountain is the locality of *Hevea viridis* var. *toxicodendroides*, *Senefeldera chiribiquetensis* and *Ficus chiribiquetensis*.

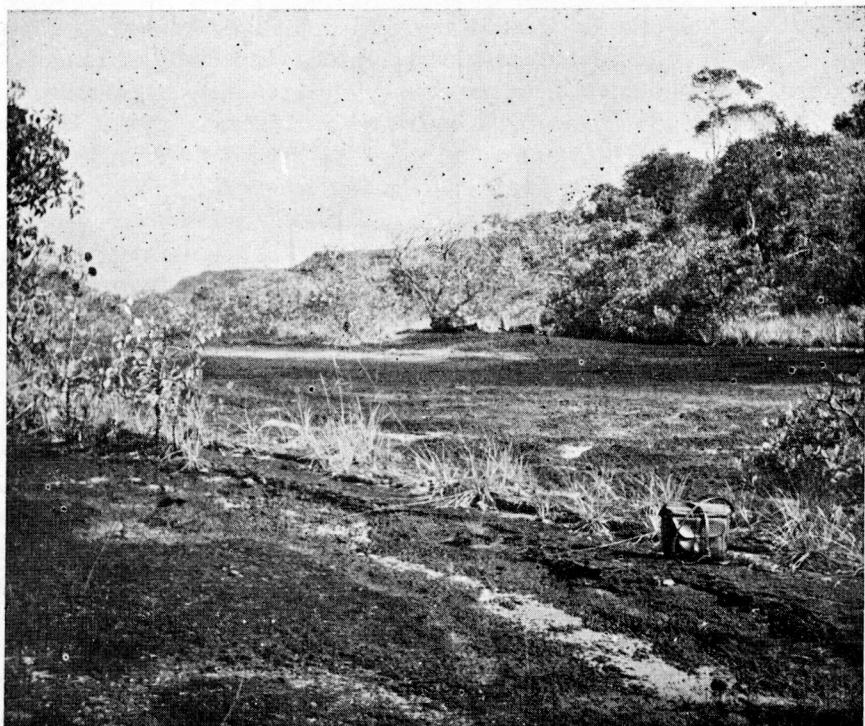
(Foto Schultes)

really very few spots devoid of vegetation. Everywhere, except on the shaded and protected slopes where a fair-sized forest usually covers the residual soil, the vegetation is of a strongly xerophytic nature. The typical vegetation consists of bushes and scandent shrubs: several species of *Clusia*, a bushy *Ternstroemia*, two or three species of *Miconia* (the most characteristic plant on the top of Cerro Chiribiquete is *Miconia paradoxa* Triana), the shrubby *Bombax coriaceum* Mart. & Zucc. (see CALDASIA 8 (1943) 298 and 10 (1944) 435), an occasional treelet of the recently described *Ficus chiribiquetensis* Dugand (see CALDASIA 9: 375. 1944), a species of red-flowering *Calliandra*, an as yet unidentified bushy Composite with very coriaceous leaves, an undescribed, bushy species of *Vochysia*, and what seems to be shrubby species of the Velloziaceae, as well as the recently described novelty, *Hevea viridis* var. *toxicodendroides* (see CALDASIA 11: 25. 1944) and *Senefeldera chiribiquetensis*, described in this paper. In appropriate places, where a bit sand and moisture gather, there is a typical vegetation of herbaceous species of grasses and sedges, primitive ferns (*Ac-*

tinostachys, *Schizea*, *Trichomanes*, etc.), bromeliads (the most abundant of which is *Navia acaulis* Mart.), orchids (especially of the genera *Catasetum*, *Elleanthus*, *Epidendrum*, *Pleurothallis*, *Schomburgkia*, and *Sobralia*), numerous juncaceous and xyridaceous species, a surprising collection of Burmanniaceae (of the genera *Apteria*, *Burmannia*, and *Dictyostegia*), several species of *Utricularia* and *Polygala*, a large collection of Eriocaulaceae (*Paepalanthus*, especially *P. fasciculatus* (Rottb.) Koern.), and other interesting plants such as the bright yellow gentianaceous root-parasite *Leiphaimos*.

That the dominant shrub-flora of the various mountains tops is not constant has definitely been established. Even in the series of mountains of the Upper Apaporis Basin, the shrub-flora of Cerro Chiribiquete, for example, differs markedly from that of Cerro de la Campana, whilst both of these differ from the nearby Cerro de la Iglesia and Cerro del Castillo. These mountains, although they have much in common with other sandstone ridges of the Vaupés region, are noticeably distinct. Mr. Paul H. Allen, Field Technician of the Rubber Development Corporation, has recently made an extremely interesting collection of the xerophytic flora of the top of the low Cerro Yapóbodá near the Caño Cuduyari, an affluent of the lower Vaupés River. This ridge has *Hevea viridis* var. *toxicodendroides* Schultes & Vinton but lacks *Senefeldera chiribiquetensis* Schultes & Croizat, one of the most common shrubs on Chiribiquete and Campana; it has one species of *Clusia* which is different from any of the three on Chiribiquete; it lacks the very characteristic *Miconia paradoxa* Triana. But, on the other hand, Cerro Yapóbodá supports *Astrocaryum acaule* Mart., an unidentified *Mauritia*, a species of *Mauritiella*, and several species of the *Cassia* group, all growing in the cracks and fissures of the dry sandstone top of the ridge; these are all apparently absent from Cerro Chiribiquete and the neighbouring hills of the Upper Apaporis. Furthermore, I found *Hevea viridis* var. *toxicodendroides* on the sandy "savana" at the base of Cerro Circasia on the Vaupés River, but not many of the species of Circasia are found on Chiribiquete. Noticeable in the xerophytic flora at Circasia are three very interesting species of *Clusia* (all different from those of Chiribiquete), a species of *Mauritia*, a species of *Mauritiella* and *Parascheelea anchistropetalala* Dugand.

It may be of interest to enlarge upon the statement that the conditions on these mountains are of a xerophytic nature. Represent-



A view the top of Cerro Chiribiquete showing the almost complete dearth of soil. The dominant shrubs in the background are *Miconia paradoxa*, *Clusia* spp., and *Bom-
bax coriaceum*.

(Foto Schultes)

ing elevated and isolated islands in the vast, flat Amazonian jungle, these mountains naturally receive approximately the same rainfall as the rain-forest of the intervening *planada*. Carefull observation has convinced me that very little of this rainfall remains for any period of time on the flat sandstone extensions of the hills. Immediately after a cloudburst, the numerous and often picturesque cascades which drain these ridges swell tremendously and are heard for great distances as the excess of water pours down to the creeks below, which in turn empty into the rivers of the Apaporis drainage. The force of these cloudbursts is the chief factor in preventing the accumulation of soil and sand. In protected spots, soil and sand have accumulated, and, in these places, a low forest vegetation has taken hold. In the small depressions or basins on the bare rock ledges, accumulations of



A view showing the sparse, xerophytic vegetation on the summit of Cerro Chiribique-
te. In the background, there is an exceptionally tall individual of *Hevea viridis*
var. *toxicodendroides*.

(Foto Schultes)

sand and organic material are being built up because the rains cannot sweep these places clean. The soil moisture follows rather closely the occurrence of organic matter. Where the surface is level or sloping from 1 to 10%, the soil retains water apparently for considerable periods of time. In some places, there are seepages which appear to be rather constant in the wet seasons, but these disappear completely during the dry months. Curiously enough, even the plants which exhibit a predilection for these moist places are of a xerophytic type. It

is probable, then, that even with a good and fairly constant source of water, there exists a condition of physiological drought due to acidity or other factors.

The only other source of moisture on the tops of these mountains is fog. Every afternoon (especially in the rainy season) at about 4: 30, a curtain of dense fog descends picturesquely, blotting the mountains completely from view. This curtain is not dispersed until about 8: 30 the following morning. The fog is a heavy mist. I spent several nights camped out on Cerro Chiribiquete and Cerro de la Campana and found that this fog completely drenches everything as thoroughly as would a light rain-storm. Shortly after the dispersal of the fog in the morning, however, the intensity of light and radiation becomes extremely excessive, and the vegetation has no protection or relief until late in the afternoon. It is obvious, therefore, that in exposed sites only xerophytically adapted species can possibly survive.

In this discussion, it should be noted that the term *xerophytic* has been employed, and purposely so, in a broad sense. The term which should be used to define with ecological precision the conditions on these mountains is *chersophytic*, which refers to a local condition of dryness due to shallowness of soil or similar phenomena. It would also be possible to employ the term *psammophytic* in reference to some of the ecological conditions of drought found on Cerro Chiribiquete when the dryness is due to the inability of the sandy or gravelly soil to retain water. It is clear that the problems of ecology which are encountered in studying the floras of these sandstone mountains are interestingly complex and must await much more botanical exploration before they can be critically appreciated.