II — BOTANICA

THE GENUS ERYTHROXYLUM IN COLOMBIA

by

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INTRODUCTION

OBJECTIVE

This work was undertaken in an effort to establish a guide to the genus **Erythroxylum** in Colombia for field investigators.

In order to facilitate the identification of these species there has been enclosed a key, followed by a detailed description of each species. An outline map of Colombia is included on which are plotted the locations where the various species have been collected in hopes that it will simplify the field collector's identification of, or search for, a specific **Erythroxylum.**

TOPOGRAPHY AND CLIMATE OF COLOMBIA

The Republic of Colombia is located on the northwestern corner of South America and has extensive coasts on both the Atlantic and the Pacific Oceans. Colombia is further described by A. Dugand (5) as lying within 12° 30' north and 4° 13' south of the Equator, from the Caribbean Sea to the Amazon River. The climate is tropical over the greater part of Colombia, but the country is crossed by three ranges of the Andean Cordillera which are separated from each other by large valleys descending to the torrid zone. These ranges cause considerable

(*) This work was submitted to the Faculty of Colombian College of the George Washington University as a thesis in partial satisfaction of the requirements for the degree of Master of Arts in 1952.

diversity in climatic conditions according to elevation, with a corresponding zonation in the vegetation.

The coastal lowlands up to an altitude of 350 meters, and the plains of the Orinoco and the Amazon basins, as well as the low-lying plains of the interior to about 500 meters above the sea, have a mean temperature ranging from 27° to 30° C. The highlands to an altitude of 1000 meters have a mean temperature ranging from 23° to 26° C. From this elevation to about 1500 meters the mean temperature ranges from 20° to 22° C. Between the 1500 meter level and the 2000 meter level the mean temperature ranges from 17° to 19° C. Gradually the temperature decreases until at 4500 to 4800 meters above the sea the freezing point is reached, this being approximately the lower limits of the perpetual snow on the higher mountains.

The temperature of any given locality in Colombia shows comparatively small fluctuations throughout the year, and rarely exceeds 8° C. above or below the mean. The seasons are marked, not by an increase of cold or heat but by rainfall. Three types of seasonal distribution of rain can be distinguished. North of latitude 8° N. the seasons are characterized by a wet season of six to nine months duration and a distinct dry season. South of the latitude 8° N. and east of the Cordillera the seasons are characterized by two wet seasons of about three months duration alternating with dry seasons, or at least considerably less rainy periods of equal duration. The regions lying west of the Cordillera are characterized by one wet season with no well defined dry periods.

DISTRIBUTION

The ERYTHROXYLACEAE is a pan-tropical family, the numerous species of which inhabit all four continents having areas in the tropical zone. The greater concentration of species is in tropical South America and the Antilles. Approximately forty species are to be found in Africa and three in Australia. Certain species exceed the Tropic of Cancer by 3° N., being found in the Bahamas, and others exceed the Tropic of Capricorn by approximately 10° S., being found in Uruguay.

Relatively little can be said about the distribution of this family in Colombia due to the fact that there have been inadequate collections in this country from which to draw

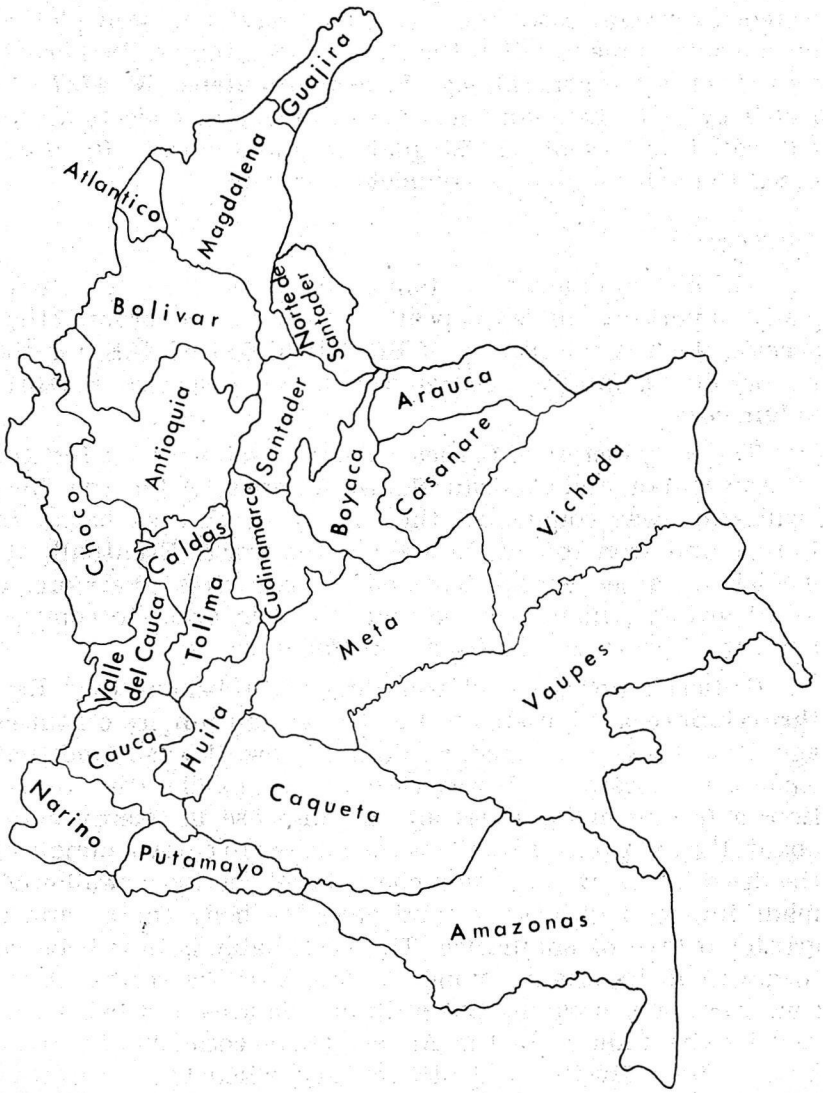

Fig. 29. Index-map to Departments of Colombia.
Mapa de los departamentos de Colombia (1952).

conclusions. Several outline maps have been included in this paper on which are plotted the locations, in cases where known, where the various species of Colombia have been collected. In several cases these locations have not been plotted on the outline maps. Often the location as given on the herbarium sheet is too general, e.g., **E. novogranatense** Nº 4737 collected by F. C. Lehmann has for the place of collection, "In cultivated valleys of the Magdalena and Cauca". In other cases the information is completely lacking.

HISTORY

The history of any plant family which contains an economically important species appears to be centered around that species. Such is the history of ERYTHROXYLACEAE, for the history of this family is centered around one species, **Erythroxylum coca.**

The early history of **E. coca** concerns itself with the Indians of Amazonian and Andean South America. After the Inca civilization was conquered, the history of **E. coca** began in Europe and soon spread throughout the world. Eventually its medicinal values were discovered. **E. coca** has, therefore, a world history which must be understood in order to comprehend the history of this species in Colombia.

Gutierrez-Noriega and von Hagen (9) believe that **Erythroxylum coca** originated in the Amazonian jungles centuries ago. How it was discovered, we do not know. It was found that when the leaves were chewed with lime an exhilarating sensation, a feeling of lightness and an increase in energy came about. It was "good custom" for the natives to carry a bundle of the dried leaves, which, when chewed and the juice swallowed, made hunger less insistent and gave the body energy and a greater degree of endurance. The coca habit is now believed to have had its origin among the tribes of the central Amazon, eventually breaking out of its jungle area and being carried by the Indians to the Andes. There coca chewing took a fierce hold. By the fifteenth century, when the Inca civilization burst out in its full glory, the coca leaf had already become an Indian institution. Because of the strange sensations which came about as a reslut of chewing the leaf, it was called a "divine plant" and its use was limited to the members

Fig. 30. Cultivated field of. E. coca. (Photo E.P. Killip and A.C. Smith, May 10-11, 1929 near Río Apurímac in the Department of Ayacucho, Perú).

Plantación de coca cerca al río Apurímac.

of the Inca aristocracy. The coca plant was cultivated on plantations which bordered the cities and towns of the Inca empire. Some of the present coca plantations in South America are so ancient that they date back to pre-Inca times. (See Figure Nº 5.) It is believed that the coca habit is at least as old as the Inca empire. The leaves of this "divine plant" have been found in graves which date back to the ninth century A. D.; the leaves being found in the same small woven bags as carried by modern addicts. In these graves is also found the same lime (llipta) used in chewing today.

According to Wilgus (18) the Inca civilization was conquered in 1533 by Francisco Pizarro, the illegitimate son of a Spanish army officer, who garroted Atahualpa, the Inca emperor, in the public square of Cajamarca, and thus brought about the end of the Inca empire. Gutierrez-Noriega and von Hagen (9) say that under the shock of the Spanish conquest the Inca society degenerated and opened to the Indians many things they had been denied under the Inca rule. One of these was the chewing of coca "and the habit spread like wind-blown fire."

According to O. E. Schulz (16), the coca plant was made known in Europe through Clusius who translated into Latin (**"Simplicium Medicamentorum Historia"** - 1582) a Spanish work written in 1580 by Nicholas Monardes, a doctor of Seville. In **"Clusii Libri Exoticorum"** which contained Monardes' paper, it was noted that, according to Petrus Cieça, the Indians chew the leaf continuously from early morning until late evening without swallowing it. O. E. Schulz (16) says that coca leaves served as a medium of exchange for clothes, food, salt, and many other necessities. The-much traveled Pedro Cieza de Leon, who, acording to Gutierrez-Noriega and von Hagen (9), penned the finest of the conquest chronicles, wrote, "there are some persons in Spain who are rich from the produce of this coca, having traded with it, sold and resold it to the Indian markets."

J. F. Macbride (14) says that botanical specimens were first brought to Europe by the French botanist Joseph de Jussieu who had observed its daily use by many of the inhabitants of the Andes.

LaWall (12) points out that the early commentators appar-

ently did not appreciate the medicinal and stimulating properties of the active principal of the coca leaf. They often wrote of "the curious custom of the natives of carrying a small leaf in the mouth while traveling." Joseph D'Acosta, a Jesuit missionary, described the coca leaf as "a delicate and royal leaf" and Markham said that, "of all narcotics used by man, coca is the least injurious and the most soothing and invigorating." Dr. Abraham Cowley in 1662 said in regard to the sustaining qualities of the coca leaf as used by the natives: "Each leaf is fruit, and such substantial fare No fruit beside to rival it will dare."

According to Holmes (10), Gaedeke in 1855 was the first person to obtain a crystalline alkaloid from the leaves of **Erythroxylum coca.** Gaedeke named this alkaloid erythroxyline.

According to Leake (13), Albert Neimann, in 1858, isolated cocaine from coca leaves while working in the laboratory of Friedrich Woehler, and both Neimann and Woehler described the numbing effect of the alkaloid on the tongue without recognizing the significance of the fact.

Holmes (10) says that in 1865 W. Lossen further examined the crystalline alkaloid commonly found in the coca leaf and the name of the alkaloid was then changed from erythroxyline to cocaine.

It was about the year 1876 that the anesthetic values of cocaine attracted serious notice. At this time the experiments of Professor Christison directed attention to the fact that cocaine did possess the power of exciting and sustaining the vital functions, and that its use brought about an anesthetic action which lessened the sense of fatigue and hunger.

According to Leake (13), cocaine remained a medical curiosity for many years and in 1880 a British medical commission reported that cocaine had no medical value, being at the best merely a poor substitute for caffein. In the same year Von Anrep published a careful pharmacological study wherein the local anesthetic properties of the alkaloid were suggested.

Dr. Carl Koller noted the benumbing effect of cocaine on the tongue and it occurred to him that here might be the agent for which he was seeking in connection with eye anesthesia. He conducted experiments on animals and on normal humans in Vienna and was convinced of his findings. He made

his first report to the German Opthalmological Society at Heidelberg on September 15, 1884 and later published a paper on the subject in **"Wiener Medizinisch Wochenschrift"**. This paper was immediately translated and printed in important medical publications abroad, and within a year Dr. Koller's new procedure was used over the world.

Dr. Koller is usually recognized as being the first person to put cocaine to anesthetic use. However, according to Leake (13), Dr. Roy L. Moodie said that the aboriginal inhabitants of the highlands of South America were acquainted with the anesthetic properties of cocaine. Dr. Moodie believed that these inhabitants performed operations on one another and that the operator chewed some of the leaves, the juice from which he could drop upon the wound of the patient if the pain was too severe. In this manner cocaine may have been used as an anesthetic by the Indians of South America prior to its introduction to white man.

Alexander Wood, who, in 1853, introduced the hypodermic syringe, added much to the development of the anesthetic values of cocaine, for without this device the administration of cocaine or its derivatives would be difficult.

By 1885 Dr. James L. Corning of New York had already demonstrated hypodermic and spinal anesthesia with the use of cocaine solutions.

Gutierrez-Noriega and von Hagen (9) state, "Statistics regarding the present-day chewing of the coca leaf and its accompanying scourge, the cocaine habit, as released by the United Nations Committee on Narcotics, are sufficiently terrifying." Bolivia produces 5,000,000 pounds of coca leaves annually, a million pounds of which are shipped to Argentina to be used by harvest hands who chew the leaf while gathering in the crops. Bolivia consumes the remaining 4,000,000 pounds of coca leaves and, at times, finds it necessary to import additional tonnage from Peru. Coca production is now so important an element in Bolivian economy that the government admits in answering a United Nations questionnaire that the loss of the plant or a curtailment of its production would bring about a serious problem to Bolivia and Argentina.

"Peru, the center of coca production and consumption, is faced with an enormous sociological issue arising out of

coca chewing." Of Peru's 7,000,000 inhabitants, more than 3,000,000 are coca chewers (coqueros).

Gutierrez-Noriega and von Hagen further state that coca claims more addicts than any other narcotic-yielding plant "15,000,000 South Americans, mostly Indians and cholos, ranging geographically over half the continent from Argentina to Colombia, are addicted to the cocaine-yielding leaf."

In Bolivia and Peru much of the work and physical activity is geared to the coca leaf. According to Gutierrez-Noriega and von Hagen, no work of any kind can be started in the Central Andes of Peru without the daily ration of coca leaves.

Dr. Ramon Ferreyra (8), professor of Systematic Botany at the University of San Marcos, says that the Indians of the higher elevations who chew coca are able to carry exceedingly heavy loads over abnormally great distances. While Dr. Ferreyra was on a collecting trip, several of the Indians attached to the party found **E. coca** growing wild. He says that they were highly excited and that they removed the leaves with great care so as to cause no injury to the foliage buds. At various periods during the year, according to Dr. Ferreyra, a good botanical specimen of **E. coca** is very hard to collect because the Indians have stripped the foliage from the plants.

According to Culbreth (3), the coca plant is frequently propagated by stem cuttings. (See Figure Nº 31.) The leaves are picked when they are bright green on the dorsal surface and yellow-green on the ventral surface. The pickers are very careful to avoid breaking or injuring the young leafbuds that form next year's crop. (See Figure Nº 32.) The leaves are removed in baskets, spread on unroofed floors, and dried for a few hours in the sun. (See Figure Nº 33.) They are then placed in a coca-house in loose piles for a period ranging from two to three days. They are exposed to the sun again for a short time to drive off additional moisture and then are compressed into bales or tin-lined boxes. Prepared in this manner, the coca leaves are ready to be exported or shipped to the markets where they may be purchased.

Gutierrez-Noriega and von Hagen (9) describe the use of coca leaves by the natives as follows: The coca leaves are masticated with lime or the alkaline ashes of certain plants. The saliva serves as the extracting agent of the coca alkaloids. The

addition of lime or alkaline ashes is sometimes explained as being necessary to extract the alkaloid; however, this is not entirely true, but there is a higher percentage of the alkaloid extracted if either the lime or the alkaline ash is used in conjunction with the coca leaf. "The daily dose of dried coca leaves chewed by addicts varies between 10 and 100 grams with 20 grams as a mean value." Upon chemical analysis of the expectorated remains of coca leaves it was found that, "as a mean value, 86 per cent of the total alkaloids contained in coca leaves are extracted and absorbed during a period of coca chewing."

TAXONOMY

O. E. Schulz (16) says that the genus **Erythroxylum** was founded by Patrick Browne in his work **"The Civil and Natural History of Jamaica"** (1756); however, several species of **Erythroxylum** had been distinguished before that time. Prior to the founding of the genus **Erythroxylum** by Patrick Browne, **Erythroxylum areolatum** had been illustrated by Sloane (17), and Plukenet had described **Erythroxylum monogynum** in his **"Amalthemum Botanicum"** (1705) as polynomials. Patrick Browne distinguished two species. One was called **Erythroxylum areolatum** by Linnaeus in 1759. The other, according to O. E. Schulz (16), certainly belonged to **Erythroxylum suave** var. **jamaicense.**

In 1763 Jacquin described and illustrated **Erythroxylum carthagenense** and **Erythroxylum havanense.** Although only three species were previously known, an uncertainty began pertaining to the specific limits due to the habital similarity of the plants, and Linnaeus joined **Erythroxylum carthagenense** with **Erythroxylum areolatum.**

Lamark published six new species in 1786, among them the famous **Erythroxylum coca.** The others are from collections of Commerson and Sonnerat and are components of the Mascarenes and Madagascar floras.

In 1788 Swartz described **Erythroxylum squamatum** of the West Indies.

In 1789 Cavanilles gave his **"Eighth Botanical Dissertation"** which contained description of **Erythroxylum macrophyllum, ferrugineum, rufum** and **ovatum.**

In 1795 Roxburgh published a description of **Erythroxylum monogynum** of the East Indies.

In 1821 Kunth published descriptions of **Erythroxylum hondense, cumanense, mexicanum, orinocense, popayanense** and **lucidum.** He made a separate genus **Sethia** from **Erythroxylum monogynum** which has a simple style and three-parted stigma and erected the family ERYTHROXYLACEAE. According to Engler and Prantl (7), the genus **Erythroxylum** had been classified in various families prior to this time. Bentham and Hooker (2), as well as Baillon (1), had classified this genus as a tribe of the LINACEAE, while Jussieu, Martius and

Fig. 31. Propagation of E. coca by stem cuttings. (Picture obtained from Dr. C. Vargas C.)

Propagación de coca por estacas.

Eichler (6) believed it to be more closely related to the MALPIGHIACEAE.

De Candolle (4), (1824), gave a summary of the previously known species and added **Erythroxylum brevipes, ligustrinum, lineolatum** and **rigidulum.** He separated the ERYTHROXYLACEAE from the MALPIGHIACEAE on the basis of the appendaged petal, the abortively one-locular fruit and "the peculiar habit of the ERYTHROXYLACEAE." De Candolle divided the genus **Erythroxylum** into two sections: PENNINERVIA (without longitudinal lines on the leaves) and AREOLATA (with longitudinal lines on the leaves). The first section he divided into three parts: (1) Pedicel solitary in the leaf axil; (2) Pedicels two to four in the leaf axil; (3) Pedicels numerous in the leaf axil. He retained the genus **Sethia.**

O. E. Schulz (16) states that the treatment of the ERYTHROXYLACEAE in the **"Flora Brasiliae Meridionalis"** of Saint-Hilaire (1829) was very important since Saint-Hilaire emphasized the importance of the inflorescence and the ligule of the petals and correctly reduced the genus **Sethia.**

O. E. Schulz (16) further states that the first great work primarily on ERYTHROXYLACEAE is that of Martius (1840), and that the treatment is valuable in many respects. However, Martius did not recognize heterostyly but believed that some of the floral organs might be now longer, now shorter, and that no systematic value should be attached to them. O. E. Schulz says that in Martius' introduction to the systematic part of his work, he notes that the distinctions between species had given him great trouble and that the specific characters in tropical genera are so unstable that one can scarcely compare them with the plants of cooler climates.

O. E. Schulz (16) indicates that the treatment of the ERYTHROXYLACEAE in the **"Flora Brasiliensis"** by Peyritsch (1878) was a notable contribution. Peyritsch (15) recognized heterostyly and, since he had rich collections at his disposal, he was able to make a large number of new species.

O. E. Schulz (16) mentions the unpublished works of three Russian botanists. In 1936-39 the academician Bongard described the Brazilian species of **Erythroxylum.** Although the manuscript was apparently completed, it never came to press. During the years 1835-55 Fischer and C. A. Meyer tried to

include the Brazilian species of **Erythroxylum** in a general treatment, but this work remains uncompleted.

In 1862 the genus **Aneulophus** was erected by Bentham and Hooker (2). This genus contained one species when it was erected and no additions have been made to it.

O. E. Schulz (16), in the year 1907, recognized the two genera of the ERYTHROXYLACEAE (1) **Erythroxylum** and (2) **Aneulophus,** a genus consisting of one species which is found in Africa. He divided the genus **Erythroxylum** into nineteen sections, the major divisions of which were made on stipule characters. Further divisions were made on floral characters, fruit-shape and leaf characters.

Some of the characters used by O. E. Schulz have been

Fig. 32. Harvesting the leaves of E. coca (Picture obtained from Dr. C. Vargas C.)

Cosecha de hojas de coca.

confusing. The divisions which depended on the texture of the leaf were, in many cases, of little value since this character may vary with the age of the plant, or may be influenced by the environment. The fact that dried specimens have been used in the preparation of the present paper instead of fresh specimens has, without doubt, added to confusion in places where leaf texture is used as a major division, since a leaf which had been fleshy in the field may appear coriaceous when the specimen is pressed and dried. The fact that the interpretations of leaf textures vary from individual to individual should be brought to mind at this point. The stipule, floral and fruit characters used by O. E. Schulz caused little confusion and, on the whole, were quite clearly defined.

One hundred ninety-three species composed the genus **Erythroxylum** at the time of the publication of the work of O. E. Schulz in 1907.

In 1926 Hutchinson (11) classified the ERYTHROXYLACEAE with the MALPIGHIALES and said that this order contained advanced and specialized groups from the TILIALES, with special types of indumentums and fruits, plus the fact that the stamens are often connate and the anthers are two-celled.

Fifty-one species and varieties of **Erythroxylum** have been proposed since the time of Schulz's publication in 1907; however, there has been no taxonomic treatment of the entire genus subsequent to that year.

NOMENCLATURE

Often the generic name with which this paper deals has been spelled "Erythroxylon." As has been stated earlier in this paper, the genus was first described by Patrick Browne in 1756, the name then being spelled "Erythroxylum," a hybrid of Greek and Latin. Later Linnaeus changed the spelling of the generic name to "Erythroxylon," a pure Latin form. The spelling of the generic name by Patrick Browne in his description of the genus is the accepted form in accordance with the rules of nomenclature; hence "Erythroxylum" is the correct spelling.

METHODS

All of the specimens examined for the writing of the present paper were necessarily herbarium specimens. In order to make a more accurate study, the stipules and flowers, where they were available, were soaked in a warm detergent to make their components more pliable and more easily seen. The soaking treatment also restores much of the shape and size which has been reduced in many cases due to the drying of the specimen.

LIBRARIES AND SOURCES

The herbaria consulted were the U. S. National Herbarium,

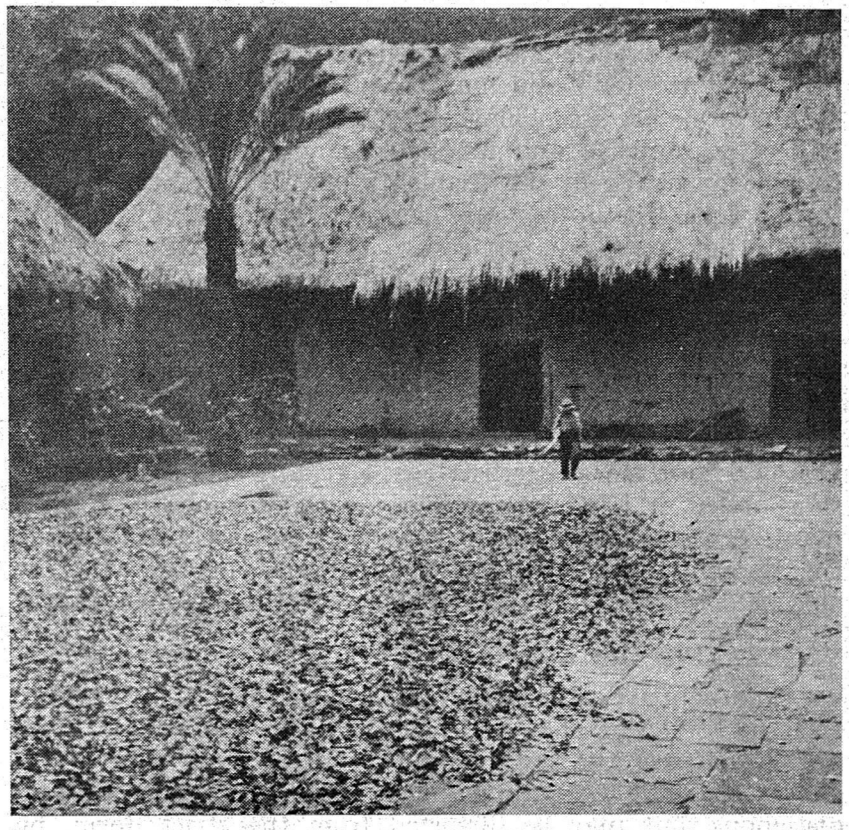

Fig. 33. Drying the leaves of E. coca (Picture obtained from Dr. C. Vargas C.).

Secado de hojas de coca.

the Gray Herbarium and the herbarium of the Chicago Natural History Museum.

The libraries consulted were The George Washington University Library, the library of the Smithsonian Institution, the Department of Agriculture's library and The Library of Congress.

The pictures of **E. coca** were obtained from Dr. A. C. Smith and Dr. C. Vargas C.

FLORAL STRUCTURE

The flowers are small and are frequently white, yellow-white or green-white. They may be borne singly or in clusters in the axils of leaves or branchlets. The pedicels are apically enlarged and five-angled with two, rarely four, basal bracts. The flowers are actinomorphic and hermaphroditic. The calyx persists in the fruit and may be cut from one-fourth to the base. The petals are oblong, or nearly so, obviously ligulate, and often obtusish and unguiculate. The stamens are ten, biseriately arranged, the filaments more or less connate to form a tube. The anthers are cordate, two-celled and longitudinally dehiscent. The styles are three, the ovary superior, frequently truncate, with only one cell becoming fertile. The stigmas are clavate or depressed-capitate, the depressed-capitate condition being the only one found in Colombia. The fruit is drupaceous and red at maturity with one, rarely two, pendulous ovules. The embryo is straight and endosperm may or may not be present.

The flowers are heterostylous; i.e., any species may have short-styled or long-styled flowers, with only one type on a plant. The stamens of the short-styled flowers are equal while the stamens of the long-styled flower are unequal with the episepalous stamens being longer than the epipetalous stamens.

VEGETATIVE ORGANS

The genus **Erythroxylum** consists of densely branching trees or spreading shrubs. In most cases, for example in **E. novogranatense**, the thick trunk produces rather stout branches just above the ground. The twigs are numerous and distichous, but may be distorted from the strict form by turning and twisting, for example **E. distortum** (not reported from Colombia). In **E. Engleri** (not reported from Colombia),

the twigs are so close together that they are almost opposite or verticillate. In cross section the central trunk and branches are round, while the younger shoots are more or less compressed. In many species the final division consists of short branchlets terminated with a rosette of leaves. Thorn-like short branches termed brachycladi are often reflexed, for example in **E. rigidulum.**

Many species of **Erythroxylum** have their branchlets covered with distichous scales. These scales are particularly characteristic and are variously called scales, epidermal scales, cataphylla, or ramenta, the latter term being more commonly used. They are most abundant at the base of new shoots, but occasion-

Fig. 34. Kubeo Indians chewing coca around coca-pot, Cuduyarí River. Kubeo name: pa-too. (Photo Dr. R.E. Schultes).

Indios cubeos masticando coca alrededor de la vasija coquera. Río Cuduyarí, Vaupés. **Patú** (pa-too) es el nombre kubeo de la coca.

ally are found between the leaves. Generally, the ramenta have a three-sided form. Their base may half-surround the stem, while their margins may overlap the base of the next ramenta above. The abaxial side has two parallel keels which are often excurrent as long mucros. Between these two keels is a furrow, through the lower part of which runs a fine mid-rib. This mid-rib is prolonged at times into a slender point which, however, is shorter than the mucronate extensions of the keels; thus the ramenta may appear three-pointed. In the furrow on the abaxial side of the ramenta there is often found an organ which resembles a stout awn and is termed an arista. The arista is frequently lacking or very short in the lower scales, while in the higher ones it reaches its full length, for example, **E. amplifolium** (not reported from Colombia). O. E. Schulz (16) states that the arista is a rudimentary, rolled-up leaf whose development is checked at an early stage and which quickly falls off. O. E. Schulz further states that the morphological comparison of the arista and its associated ramenta with the foliage leaf and its associated stipule leads to an interpretation of the ramenta as a bladeless stipular structure.

The texture of the ramenta is variable. Often they are firm and woody, often thin and membranaceous. Not infrequently they are finely striate with nerves running parallel to the keel and anastomosing but slightly. The apex and margins are transparent and membranaceous. In many species the transparent-membranaceous areas extend into cilia which are sometimes very dense and become a woolly indument, for example **E. barbatum** (not reported from Colombia). In other cases the apex or keel is ciliate. The function of these closely ranked ramenta appears to be protection to both vegetative and floral organs. The flower buds may occur in their axils and develop before the full unrolling of the foliage leaves.

According to O. E. Schulz (16) some of the ramenta on certain species slowly transform into stipules, which, as a rule, show the same structure. In only a few species, apparently none in Colombia, are the ramenta larger and of a different shape than the stipules, for example, **E. Kapplerianum** (not reported from Colombia). In **E. strobilaceum** (not reported from Colombia) there is an unusual situation where the ramenta are deciduous while the stipules persist. Usually both

organs persist on the shoot so that after the fall of the leaves the branchlet has a scaly covering. However, in some species they both may fall together before the foliage has completely unrolled. Since no observations of living plants were made in the present study some of these facts cannot be verified and conclusions pertaining to these facts have been taken from O. E. Schulz's work.

Characteristically the leaves have a short, often red petiole. It is convex on the underside, but usually channeled

Fig. 35. Toasting ccca leaves preparatory to pulverising. Kubeo Indians, Cuduyarí River, Vaupés, Colombia. Photo Dr. R.S. Schultes).

Indios cubeos del río Cuduyarí, Vaupés, tostando hojas de coca para pulverizarlas.

above, rarely flat. The leaf blade is usually entire and in many species resembles the tropical type. The texture and size of the leaves show great variation from species to species, for example, **E. macrocnemum** (not reported from Colombia) has a blade 400 mm. long, while the blade of **E. minutifolium** (not reported from Colombia) is 3.5-6 mm. long. The mid-nerve is usually thick at the base and generally tapers so that it is much thinner at the apex. It ends in a very short mucro, which is often reduced to a callous-like point. The lateral nerves are usually much thinner than the mid-nerve, from which, varying with the species, they diverge at angles of different degrees.

There occur characteristically in many species, especially on the underside of the leaf, two longitudinal lines or creases, which begin at the base of the mid-nerve, swing upward in a shallow curve, and unite again at the apex. The area between these lines is called the areolum and it has additional venation and sometimes a glaucous coat. These lines were observed by Nicholas Monardes in 1580 and by Patrick Browne in 1756. In the earlier time these lines were called nerves. However, according to O. E. Schulz (16), Nevinny has proved that they are not nerves, but a condition brought about by the involute type of venation.

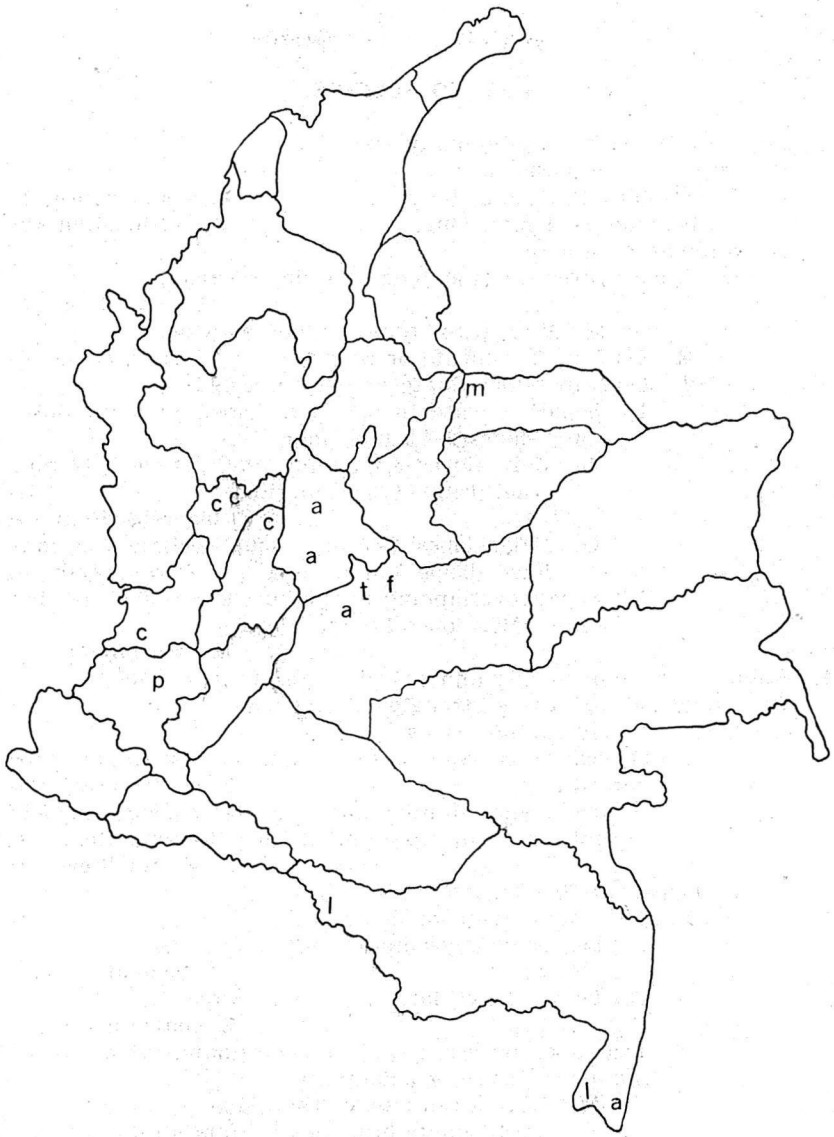

Fig. 36. Map of locations where those species with obviously longitudinally striate stipules have been collected.

Distribución de las especies de **Erythroxylum** provistas de estípulas longitudinalmente estriadas: **amazonicum, citrifolium, floribundum, lucidum, macrophyllum, testaceum.**

KEY TO SPECIES

A. Stipules obviously longitudinally striate.
  B. Stipules 2-setulose.
    C. Stipules 2.5-3 mm. long. **E. popayanense** (1)
    C. Stipules 8-14 mm. long. **E. lucidum** (2)
  B. Stipules 3-setulose.
    D. Leaves three times as long as wide or longer. **E. citrifolium** (3)
    D. Leaves less than three times as long as wide.
      E. Leaf-apex truncate or round. **E. testaceum** (4)
      E. Leaf-apex acuminate or obtuse-cuspidate.
        F. Sepals valvate in the bud, leaves oblong-elliptic, calyx-lobes 2-4.5 mm. long.
          G. Calyx-lobes 3.5-4 mm. long, petiole 7-12 mm. long, drupe 8-8..5 mm. long. **E. macrophyllum** (5)
          G. Calyx-lobes 2-3 mm. long, petiole 5-9 mm. long, drupe 7 mm. long. **E. floribundum** (6)
        F. Sepals overlapping in the bud, leaves slightly obovate, calyx-lobes 1-2 mm. long. **E. amazonicum** (7)

A. Stipules striate or weakly and obscurely striate in **E. Ulei**.
  H. Under side of leaves strongly bilinneated.
    I. Leaves 116-157 mm. long.
      J. Leaves lanceolate, apex acuminate, staminal tube subentire. **E. cuatrecasasii** (8)
      J. Leaves oblong-elliptic, apex generally acute, seldom abruptly acuminate, staminal tube 10-crenulate. **E. gracilipes** (9)
    I. Leaves 25-97 mm. long.
      K. Leaf-apex acute or acuminate.
        L. Leaves oblong-elliptic, 14-32 mm. wide. **E. acutum** (10)
        L. Leaves lanceolate, 21-44 mm. wide. **E. cuatrecasasii** (8)
      K. Leaf-apex obtuse, round or emarginate, often apiculate, never acute or acuminate.
        M. Ultimate branches thorn-like.
          N. Ultimate branches 3-7 mm. in diameter at base, staminal tube subentire. **E. rigidulum** (11)
          N. Ultimate branches 1-2.5 mm. in diameter at the base, staminal tube 10-crenulate. **E. carthagenense** (12)

M. Ultimate branches elongate, not thorn-like.
O. Pedicel 1 mm. long. **E. densum** (13)
O. Pedicel 1.5-7.5 mm. long.
P. Staminal tube subentire, endosperm 4-angled.
Q. Stipule 2-setulose, petiole 1.5-2.5 mm. long, calyx-lobes 0.75 mm. long, drupe 3-3.5 mm. in diiameter. **E. cataractarum** (14)
Q. Stipule asetulose, petiole 3-6 mm. long, calyx-lobes 1.2 mm. long, drupe 4.4-6.5 mm. in diameter. **E. novogranatense** (15)
P. Staminal tube 10-crenulate, endosperm 3-angled, stipule briefly 2-setulose, petiole 2-5 mm. long, calyx-lobes 1 mm. long, drupe 3.5-4 mm. in diameter. **E. coca** (16)

H. Under side of leaves plain, i.e., not bilineated.
R. Stipules 2 setulose.
S. Leaves 72-173 mm. long, 26-60 mm. wide, cuspidate, mucronate. **E. acrobeles** (17)
S. Leaves 25-77 mm. long, 15-37 mm. wide, truncate, emarginate, acute or broadly so, never cuspidate.
T. Staminal tube minutely 10-crenulate, apex of ovary round or subtruncate. **E. cumanense** (18)
T. Staminal tube subentire, apex of ovary acute. **E. havanense** (19)
R. Stipules 3-setulose.
U. Leaf-apex acute, obtuse or broadly cuspidate.
V. Leaf apex generally acute, staminal tube subentire, stipules 1.5-2 mm. long, weakly longitudinally striate. **E. Ulei** (20)
V. Leaf apex generally obtuse to broadly cuspidate, staminal tube 10-crenulate, stipules 2-3 mm. long. **E. venosum** (21)
U. Leaf-apex rouded or emarginate.
W. Pedicels 1.5-6 mm. long.
X. Calyx ¾ divided, ovary ovoid, staminal tube 10-20-crenulate, petiole 2-5 mm. long. **E. orinocense** (22)
X. Calyx ½ divided, ovary obovoid, staminal tube 10-crenulate, petiole 1.5-3 mm. long. **E. hondense** (23)
W. Pedicels 7-11 mm. long, calyx ¾ divided, ovary ovoid, staminal tube 10-crenulate, petiole 3-6 mm. long. **E. haughtii** (24)

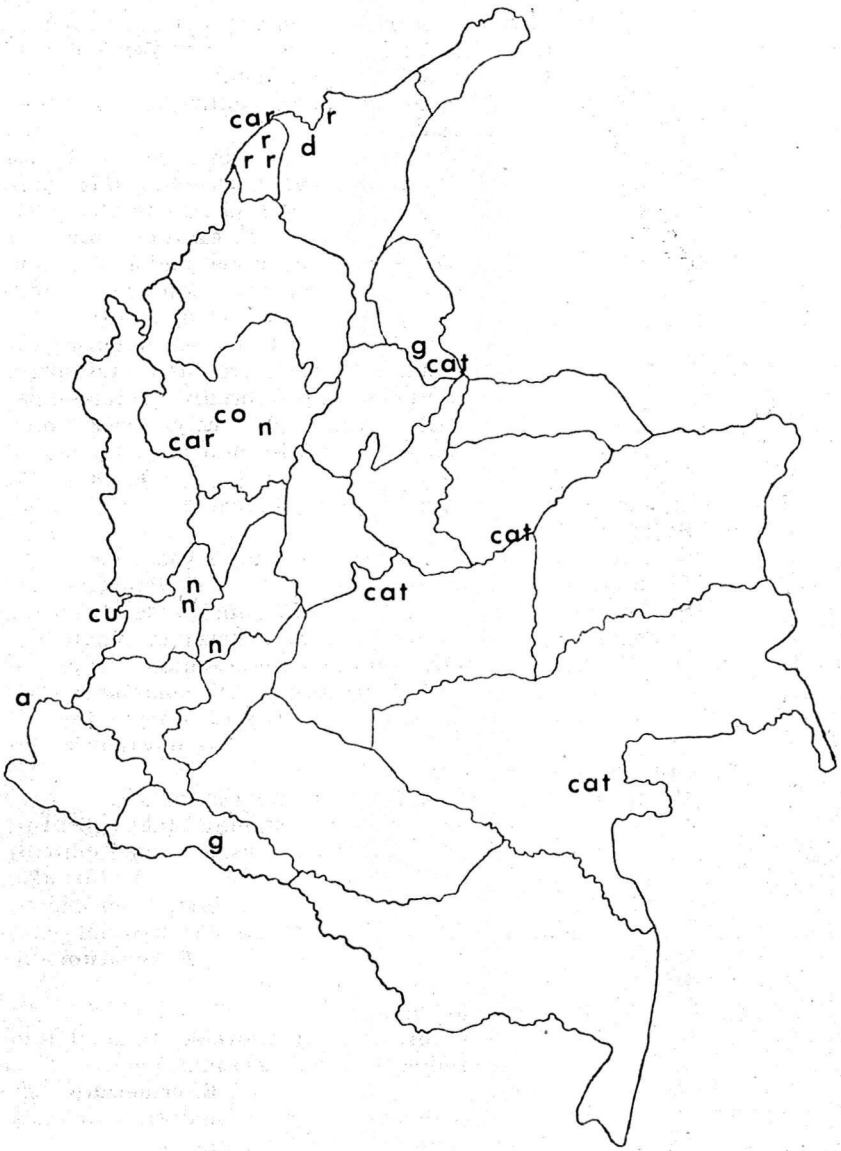

Fig. 37. Map of locations where those species with bilineated leaves have been collected.

Distribución de las especies de **Erythroxylum** con hojas bilineadas: **acutum** (a), **carthagenense** (car), **cataractarum** (cat), **coca** (co), **cuatrecasasii** (cu), **densum** (d), **gracilipes** (g), **novogranatense** (n), **rigidulum** (r).

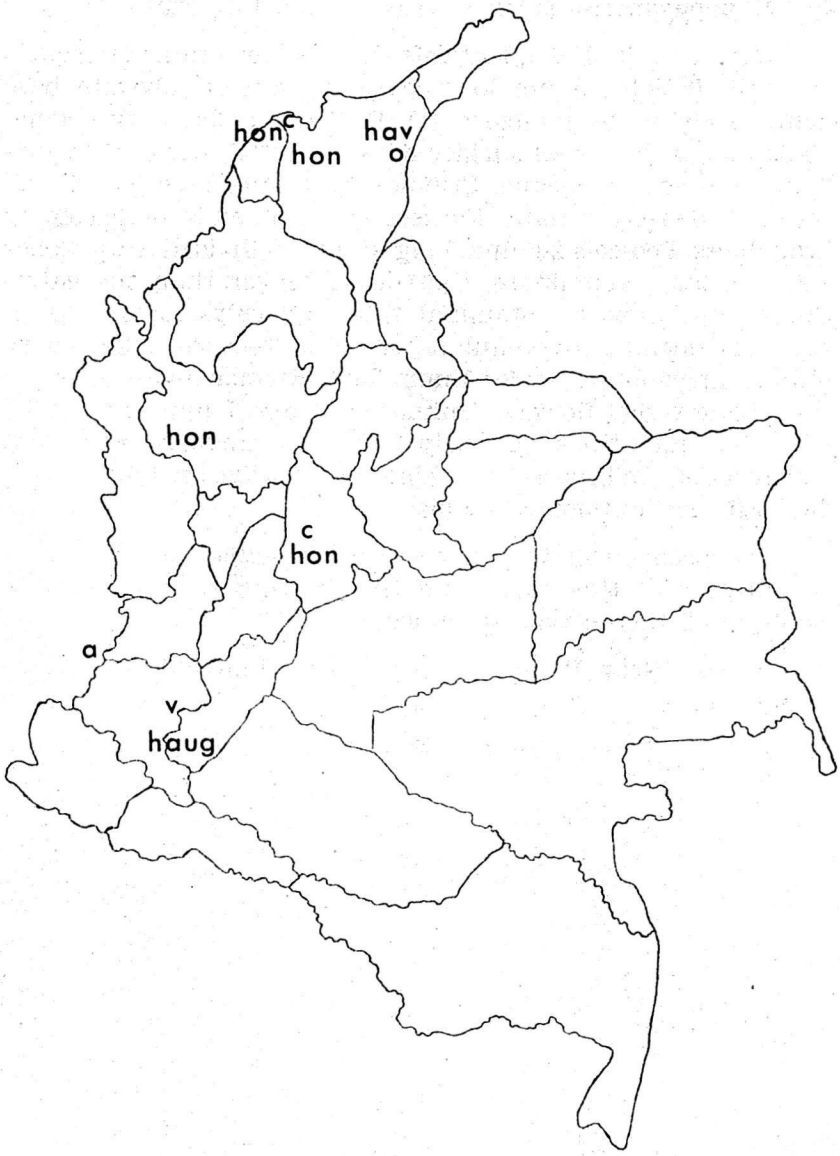

Fig. 38. Map of locations where those species with neither obviously longitudinally striate stipules nor bilineated leaves have been collected.

Distribución de las especies de **Erythroxylum** que carecen de estípulas estriadas y de hojas bilineadas: **acrobeles** (a), **cumanense** (c), **haughtii** (haug), **havanense** (hav), **hondense** (hon), **orinocense** (o), **venosum** (v).

1. **E. popayanense** H. B. K. Nov. Gen. 5:138. 1821.

Cortex dark brown, lenticels shiny. Older branches recurved, scaly. Petiole 2.5 mm. long, leaves obovate or subovate, base acute, apex acute, punctate (O. E. Schulz), 34-42 mm. long, 19-22 mm. wide, dorsal surface dark brown, shiny, ventral surface ferruginous, opaque. Stipules 2.5-3 mm. long, shortly 2-setulose, densely striate. Flowers ca. 3 in axils of leaves or branchlets. Pedicels 2-6 mm. long. Calyx ½ divided, calyx-lobes 1.2 mm. long, acuminate, the corolla longer than the calyx. Short-styled flowers: Staminal tube and calyx equal, staminal tube opening 10-crenulate, stamens 3-4 mm. long, ovary elliptic, apex obtuse, styles 1 mm. long, stigmas depressed-capitate. Long-styled flowers: Unknown. Drupe 7 mm. long, 3-3.5 wide, 2-2.5 mm. thick, obliquely ovate, acute, empty locules not conspicuous. Embryo 4-5 mm. long, 3 mm. wide, ca. 1 mm. thick. General distribution: Colombia.

No specimen of this species was available for use in the preparation of this paper and the drawing is made from a photograph of the type specimen.

Cauca: Near Popayán, July, 1801, **Humboldt and Bonpland s. n.**

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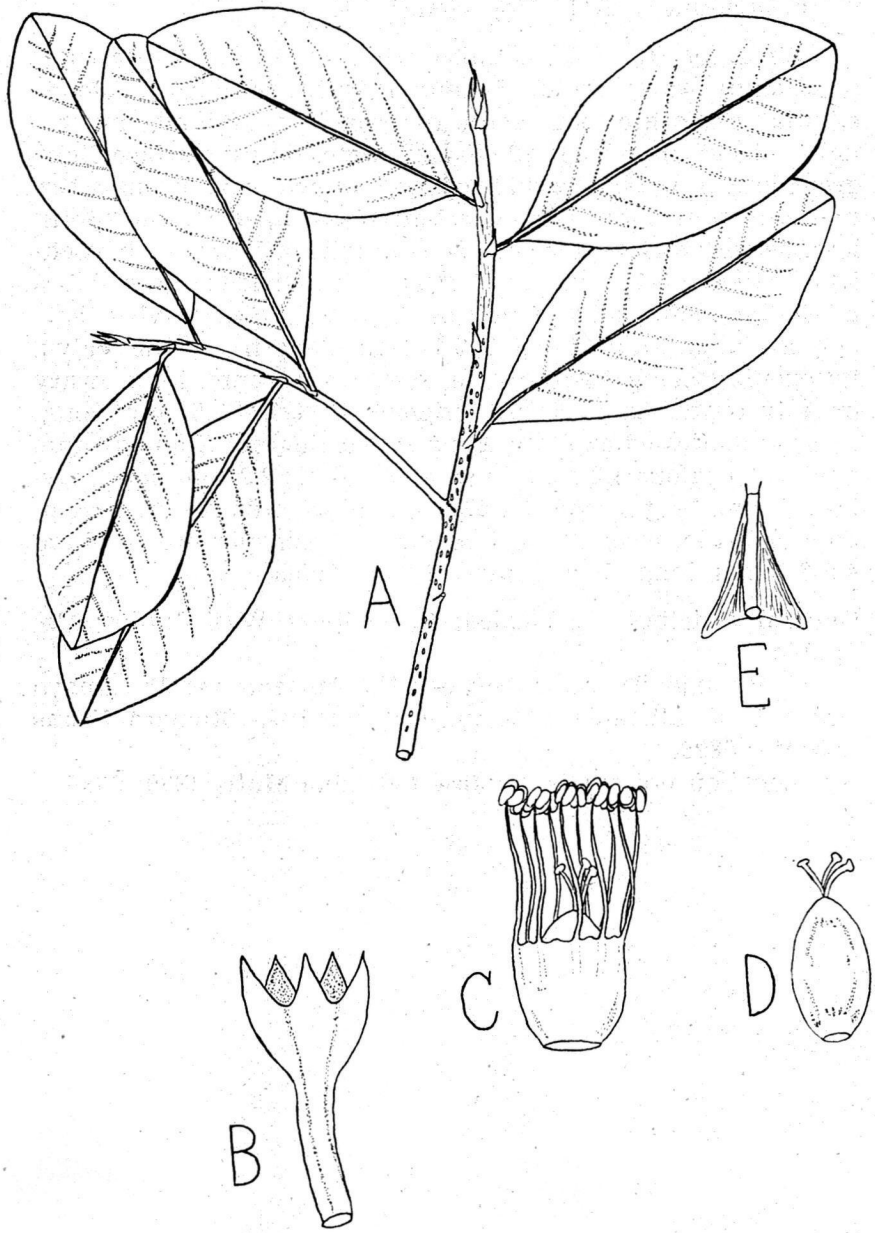

Fig. 39. 1. **E. popayanense.** Habit x 1.6; others x 6. (Explanation of figures, page 552).

2. **E. lucidum** H. B. K. Nov. Gen. 5:138. 1821.

Shrub or tree 2-6 m. tall. Cortex grey-brown or ferruginous, shiny, warty. Petiole 5-8 mm. long, leaves elliptic, oblong-elliptic or obovate, base acute or broadly acuminate, mucronate, 68-140 mm. long, 29-65 mm. wide, dorsal surface light green-brown, ventral surface opaque, brown or glaucous. Stipules 8-14 mm. long, narrowly lanceolate, apex acute, 2-setulose, densely striate. Flowers 7-11 in axils of leaves or branchlets. Pedicels 1-10 mm. long. Calyx ¾ divided, calyx-lobes 2.5-4.5 mm. long, suborbicular or broadly so. Short-styled flowers: Staminal tube short, 1/6-1/2 the length of the calyx, its opening being 10-crenulate, stamens 4-5 mm. long, ovary broadly ovate, apex obtuse, trigonous, styles 1.5 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.2 mm. long, epipetalous 2.2 mm. long, styles 3.2 mm. long. Drupe 5-7.5 long, 4 mm. in diameter, subglobose or ovate, terete, empty locules not conspicuous. Embryo 4.5-6.5 mm. long, 3 mm. wide, 2 mm. thick.

General distribution: Mexico; Costa-Rica; West Indies; Colombia.

Amazonas: Trapecio, between the Amazon and Putumayo water-sheds, alt. above 100 m., October 1945, **Richard Evans Schultes 6892.**

Location not available: **José Celestino Mutis 2399; 2386.**

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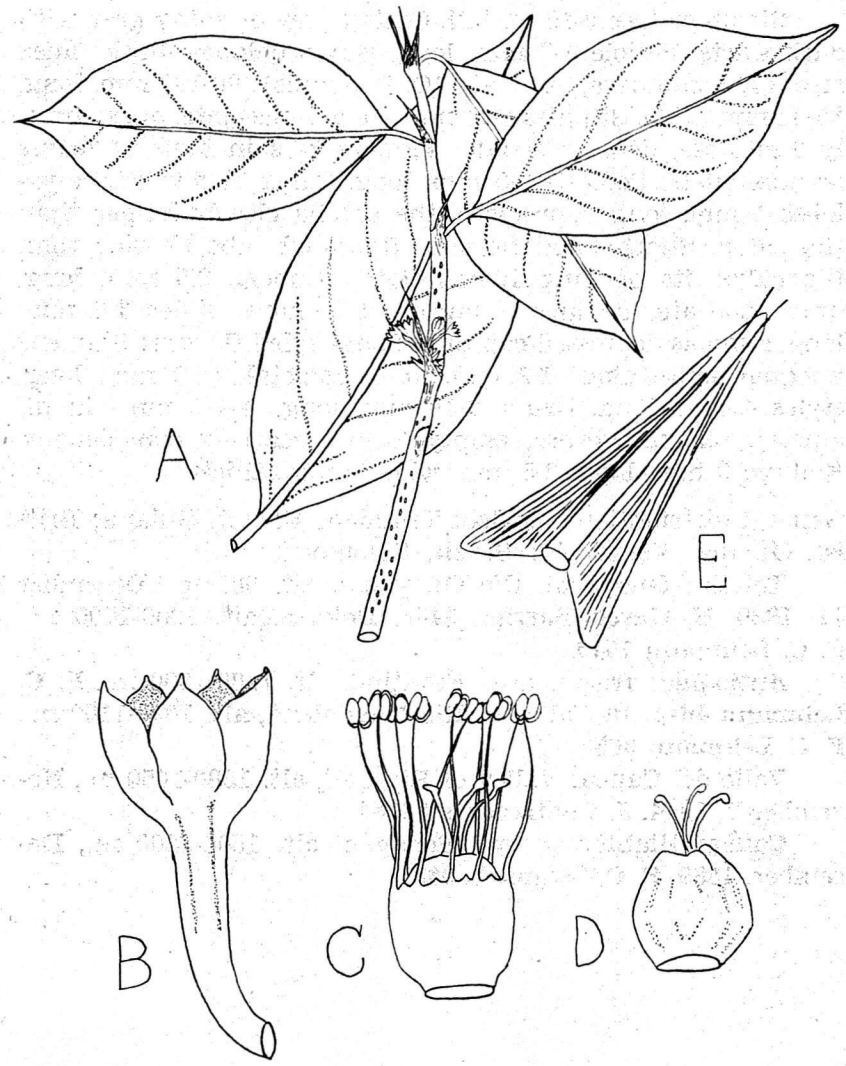

Fig. 40. 2. **E. lucidum.** Habit x 0.6; others x 6.

3. **E. citrifolium** St. Hil. Fl. Bras. Merid. 2:67. 1829.
E. gomphioides Planch. and Lind. in Ann. Sc. Nat. ser. 4. 18:339. 1862.

Shrub or tree 2-10 m. tall. Cortex grey or shiny grey with dark warts. Petiole 4-7 mm. long, leaves oblong-elliptic, apex strongly acuminate, punctate (O. E. Schulz), 90-190 mm. long, 35-54 mm. wide. Stipules 4-14 mm. long, lanceolate, apex shortly 3-setulose, densely striate. Flowers 3-12 in axils of leaves or branchlets. Pedicels 2-5 mm. long. Calyx ¾ divided, calyx-lobes 1 mm. long, lanceolate, the corolla clearly longer than the calyx. Short-styled flowers: Staminal tube shorter than the calyx, its opening 10-crenulate, stamens 3.5 mm. long, ovary obovate, its apex truncate, trigonous, styles 1.5 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.2 mm. long, epipetalous 2 mm. long, styles 4 mm. long. Drupe 9-10 mm. long, 4-4.5 mm. in diameter, oblong, obtuse, empty locules scarcely conspicuous. Embryo 8 mm. long, 3.5 mm. wide, 2 mm. thick.

General distribution: Mexico; Trinidad; French Guiana; British Guiana; Venezuela; Brazil; Colombia.

Tolima: Guayabal, Río Guayabal, alt. 680 m., December 11, 1939, **H. García-Barriga 8406.** Dolores, alt. 1000-1700 m., **F. C. Lehmann 7543.**

Antioquia: Iracal, near Frontino, alt. 1500-1800 m., **F. C. Lehmann 4644.** In Valley of Rio Magdalena, alt. 1000-1100 m., **F. C. Lehmann 5655.**

Valle del Cauca: Valley of Rio Cali, alt. 1580-1650 m., November 7, 1944, **J. Cuatrecasas 18784.**

Cauca: Highlands near Popayán, alt. 1500-2000 m., December, 1889. **F. C. Lehmann 9084.**

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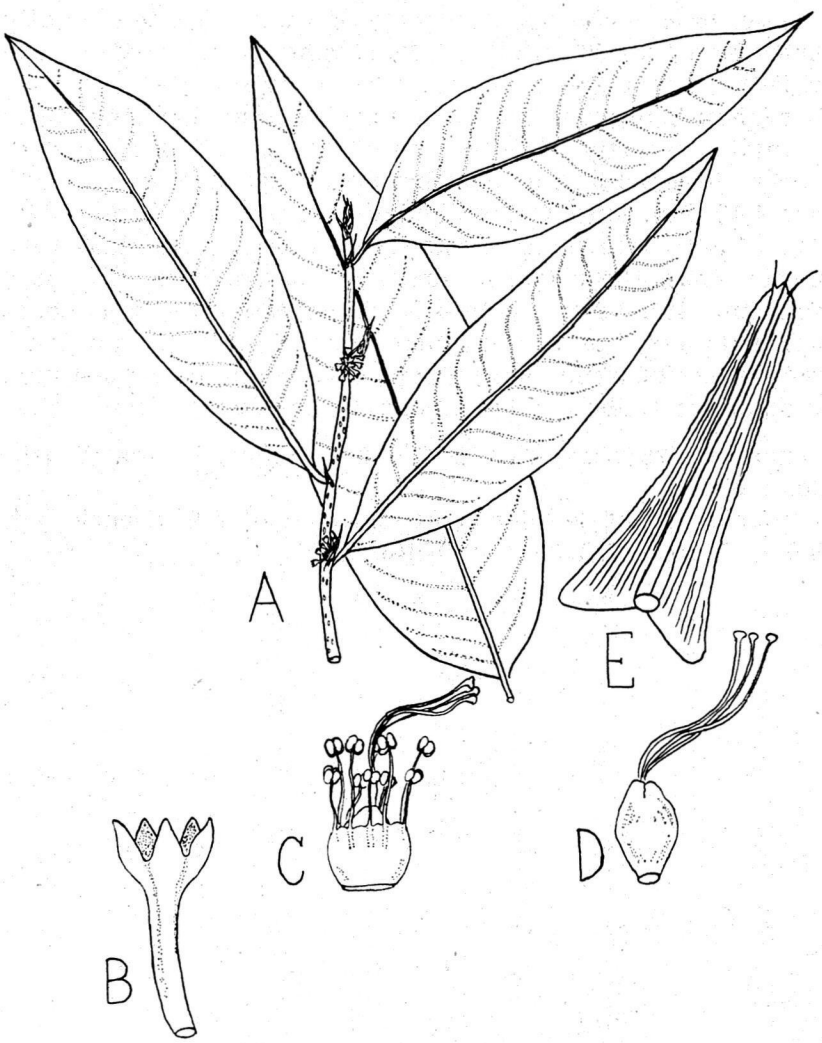

Fig. 41. 3. E. citrifolium. Habit x 0.6; others x 6.

4. **E. testaceum** Peyr. in Fl. Brasil. 12. 1:170. 1878.

Shrub or tree 1-4 m. tall. Cortex whitish, warty. Petiole 1.5-3 mm. long, leaves generally obovate, seldom oblong or elliptic, base acute, apex truncate or rounded, often slightly emarginate, 30-100 mm. long, 19-74 mm. wide, dorsal surface whitish or dull green, ventral surface dull white or purple-ferruginous. Stipules 2-4 mm., rarely 6 mm. long, narrowly triangular, shortly 3-setulose, striate. Flowers 8-50 in axils of leaves, flowers 1-3 in axils of branchlets (O. E. Schulz). Pedicels 4-10 mm. long. Calyx divided nearly to the base, calyx-lobes 1.5-2.5 mm. long. Short-styled flowers: Staminal tube shorter than the calyx, its opening 10-crenulate; stamens 4 mm. long; styles 2 mm. long; stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.5-2 mm. long, epipetalous 2.2-3 mm. long. Drupe 4.5-8.5 mm. long, 2.5-4 mm. in diameter. Embryo 4-6 mm. long, 2.5 mm. wide, 2 mm. thick.

General distribution: British Guiana; French Guiana; Brazil; Colombia.

Meta: About 20 kilometers southeast of Villavicencio, alt. 500 m., March 17, 1939, **E. P. Killip 34300.**

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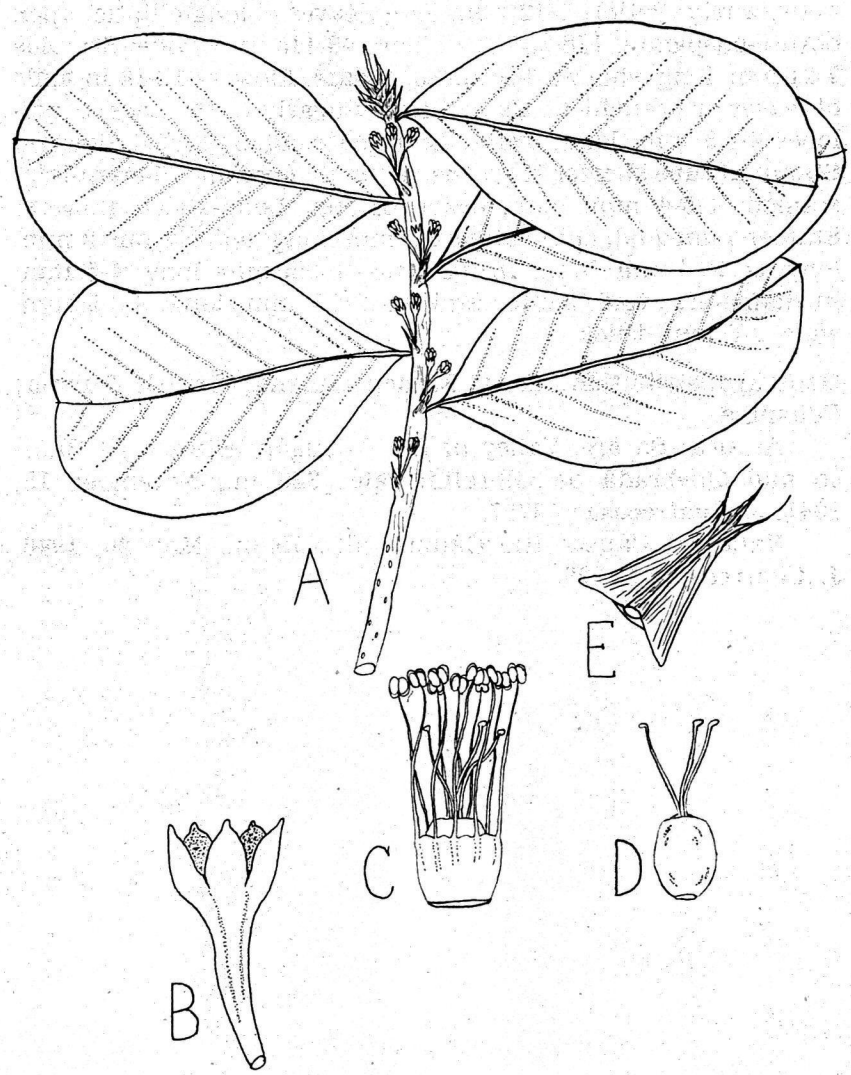

Fig. 42. 4. **E. testaceum.** Habit x 1.6; others x 6.

5. **E. macrophyllum** Cav. Diss. 8:401, pl. 227. 1789.

Shrub or tree 2-6 m. tall. Cortex grey-brown or ferruginous, warty. Petiole 7-12 mm. long, leaves oblong-elliptic, apex obtuse-cuspidate, 128-232 mm. long, 48-115 mm. wide. Stipules 7-21 mm. long, shortly 3-setulose, striate. Flowers 12-18 in axils of leaves or branchlets. Calyx divided nearly to the base, calyx-lobes 4-4.5 mm. long, ovate, acuminate. Short-styled flowers: Staminal tube shorter than the calyx, its opening 10-crenulate, stamens 3.5-4 mm. long, ovary oblong. Long-styled flowers: Stamens unequal, episepalous 1.5 mm. long, epipetalous 2 mm. long, style 4 mm. long. Drupe large, 8-9.5 mm. long, 4-5 mm. in diameter, ovoid, acute. Embryo 8-8.5 mm. long, 4-4.5 mm. wide, 1.5 mm. thick.

General distribution: Peru; French Guiana; British Guiana; Colombia.

Arauca: Sarare, Valley of Rio Cubugón between El Blanco and Quebrada de Gibraltar, alt., 320 m., November 15, 1941, **J. Cuatrecasas 13207.**

Valle del Cauca: Rio Calima, alt., 10 m., May 26, 1946, **J. Cuatrecasas 21329.**

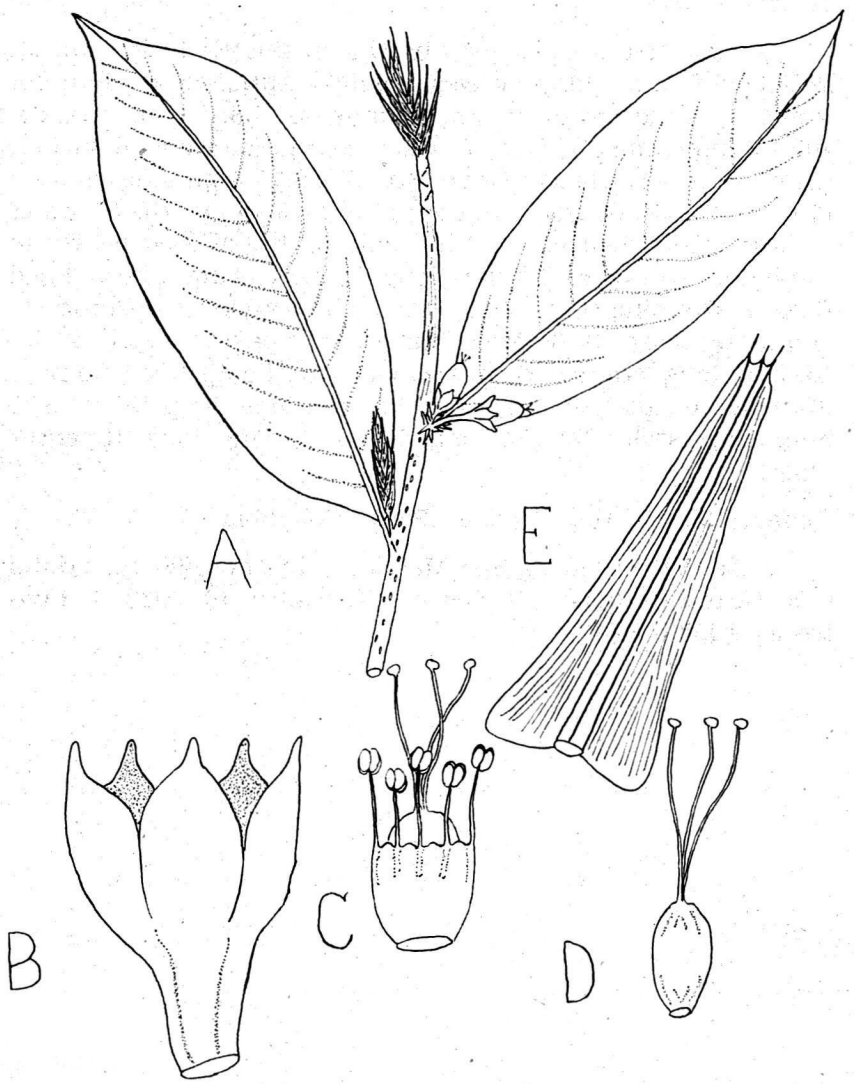

Fig. 43. 5. **E. macrophyllum.** Habit x 0.6; others x 6.

6. **E. floribundum** Mart. Beitr. Kenntn. Gatt. Erithrox. in Abhandl. Akad. München 3. 2:398. 1843.

E. laurinum Triana and Planch. in Ann. Sc. Nat. ser. 4. 18:339. 1862.

Robust tree. Cortex grey-brown or shiny whitish, warty. Petiole 5-9 mm. long, leaves oblong-elliptic, base acute or rounded, apex more or less acuminate, hardly mucronate, 100-230 mm. long, 37-88 mm. wide, ferruginous, dorsal surface shiny, ventral surface opaque. Stipules 9-15 mm. long, lanceolate, 3-setulose, densely striate. Flowers 15-40 in axils of leaves or branchlets. Pedicels 2-7 mm. long. Calyx divided nearly to the base, calyx-lobes 2-3 mm. long, broadly ovate. Short-styled flowers: Staminal tube shorter than the calyx, its opening 10-crenulate, stamens 3 mm. long, ovary apex truncate, styles 1.5 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.75 mm. long, epipetalous 2.25 mm. long, styles 3 mm. long. Drupe 7 mm. long (Spencer Moore).

General distribution: Brazil; Peru; Colombia.

Meta: Villavicencio, San Martín Plains, alt. 400 m., **Triana s. n.** Near El Parrao, alt. 500 m., November 10, 1938, **J. Cuatrecasas 4582; 5676.**

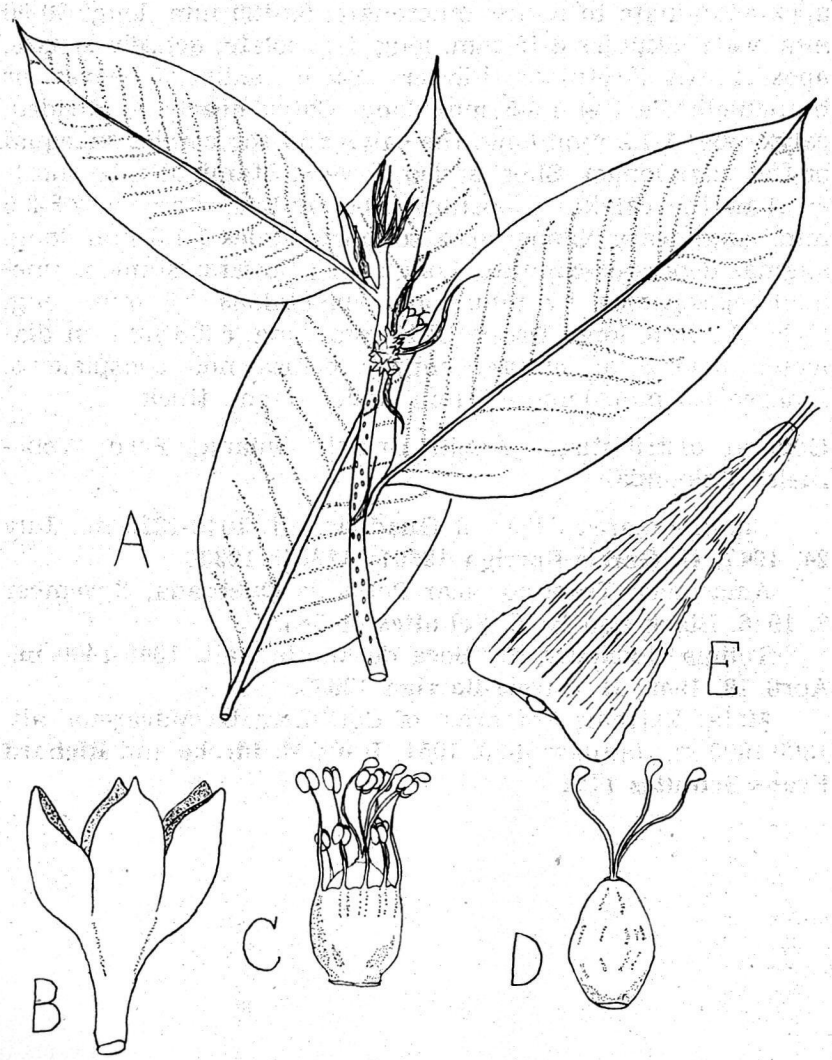

Fig. 44. 6. **E. floribundum.** Habit x 0.6; others x 6.

7. **E. amazonicum** Peyr. in Fl. Brasil. 12:pt. 1:167. 1878.

Tree 3.6-7.5 m. tall. Cortex grey-brown, warty. Petiole 2.5-5 mm. long, leaves somewhat obovate, base narrowly cuneate, apex acuminate to obtuse-mucronate, 60-120 mm. long, 30-60 mm. wide. Stipules 6-15 mm. long, lanceolate, densely striate, apex shortly 3-setulose. Flowers 3-9 in axils of leaves or branchlets. Pedicel 1.5-5 mm. long. Calyx nearly ½ divided, calyx-lobes 1-1.2 mm. long, the calyx and the corolla subequal or the calyx longer. Short-styled flowers: Staminal tube shorter than the calyx, its opening 10-crenulate, stamens 2.5-3.5 mm. long, ovary oblong, apex rounded, styles 1-1.3 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.2 mm. long, epipetalous 1.5 mm. long, styles 2-3 mm. long. Drupe 12-16 mm. long, 5.5-6 mm. in diameter, oblong or obtuse, empty locules not conspicuous. Embryo 9.5 mm. long, 4.5 mm. wide, 2 mm. thick.

General distribution: Brazil; British Guiana; Peru; Venezuela; Colombia.

Cundinamarca: West of Guaduas, alt. 1040-1320 m., July 24, 1947, **H. García-Barriga 12307; 12334; 12336.**

Amazonas: Trapecio, near Porto da Quebrada, November 8, 1946, **Black** and **R. E. Schultes 46-385.**

Tolima: Icononzo to "Boca de Monte", alt. 1340-1400 m., April 18, 1946, **H. García-Barriga 12032.**

Meta: Extreme Northeast of Cordillera La Macarena, alt. 1300-1900 m., January 6-20, 1951, **Jesús M. Idrobo** and **Richard Evans Schultes 1121.**

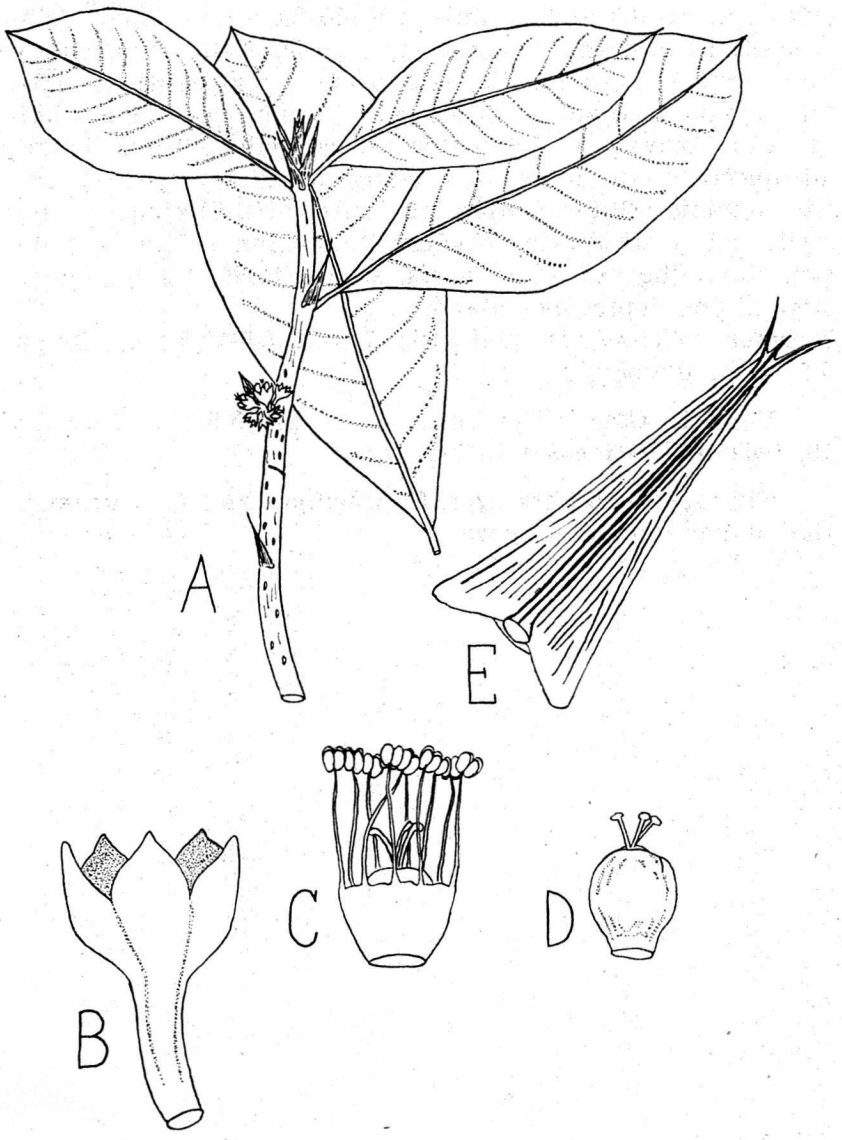

Fig. 45. 7. **E. amazonicum.** Habit x 0.6; others x 6.

8. **E. cuatrecasassi** Gentner, Journ. Wash. Acad. Sc. 47:6. 1957.

Arbor 8 m. alta; cortice obscure purpureo-brunneo, verruculoso, lenticellis dilute rubris; petiolo 3-6.5 mm. longo, foliis lanceolatis, basi acutis, apice acuminatis, 79-148 mm. longis, 21-44 mm. latis, bilineatis; stipulis non persistentibus, 1.5-2 mm. longis, triangulatis, asetulosis; floribus uno vel plurimis in axillis foliorum vel ramentorum; pedicellis 4-9 mm. longis, ad apicem versus incrassatis, 5-angulatis; calyce ad ¾ partito, laminis 1-2 mm. longis, late lanceolatis. Floribus brachystylis: calyce superante urceolum stamineum, orificio subintegro, staminibus 1.5 mm. longis, stylis liberis, 1 mm. longis, stigmatibus depresso-capitatis.
Floribus dolichostylis: non visis. Drupa 8.5-10.5 mm. longa, 3.5-4 mm. diametro.

Valle del Cauca: Río Yurumanguí, alt. 5-50 m., February 19, 1944, **J. Cuatrecasas 15736.**

This species differs from **E. gracilipes** and **E. acutum** in that it has lanceolate leaves.

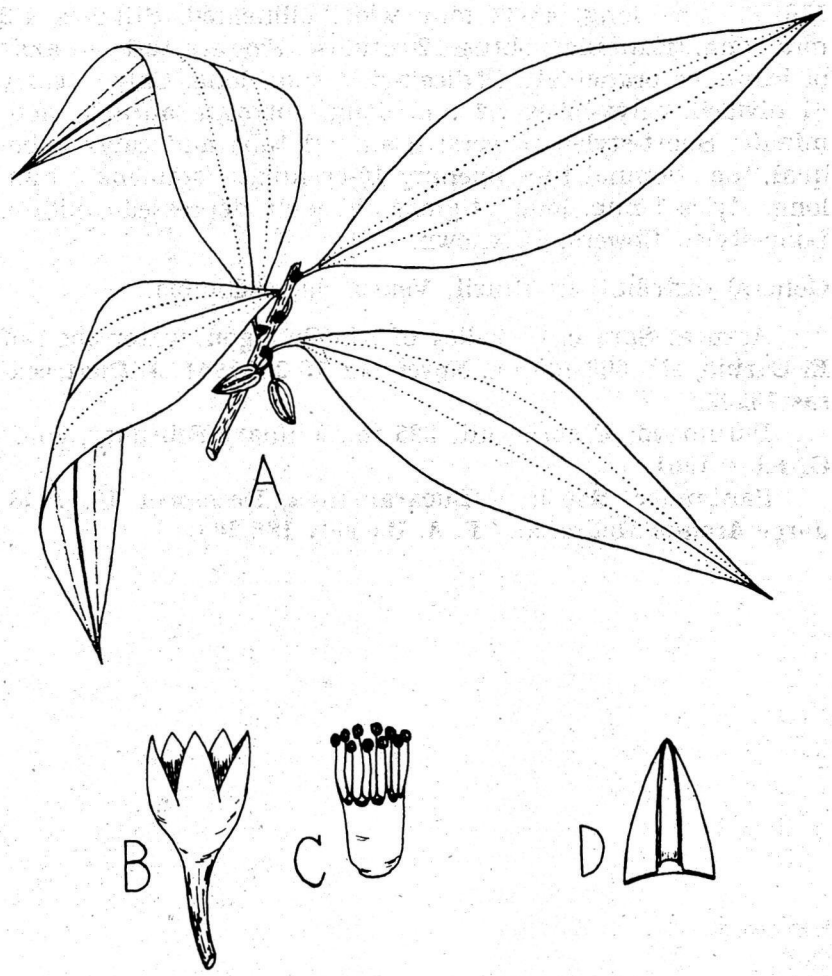

Fig. 46. 8. **E. cuatrecasasii.** Habit x 0.6; other x 6.

9. **E. gracilipes** Peyr. in Fl. Brasil. 12. 1:159. 1878.

Shrub. Cortex purple-brown, shiny, warty, in older areas somewhat grey. Petiole 5-8 mm. long, leaves oblong-elliptic, base acute, apex acute or abruptly acuminate, mucronate, 116-185 mm. long, 43-62 mm. wide, bilineated. Stipules 1-2 mm. long, triangular, obtuse, 2-setulose. Flowers 12-16 in axils of leaves or branchlets. Pedicels 5-10 mm. long. Calyx nearly ¾ divided, calyx-lobes 1.2 mm. long, subovate abrupty acuminate. Short-styled flowers: Staminal tube and calyx subequal, the staminal tube opening 10-crenulate, stamens 3 mm. long, styles 1 mm. long, stigmas obliquely depressed-capitate. Long-styled flowers: Unknown.

General distribution: Brazil; Venezuela; Colombia.

Arauca: Sarare, in Valley of Río Cubugón, water shed of El Cariño, alt. 500-700 m., November 18-20, 1941, **J. Cuatrecasas 13303.**

Putumayo: Umbría, alt. 325 m., January-February, 1931, **G. Klug 1961.**

Santander: South of Bucaramanga, December 16, 1948, **Jorge Araque Molina** and **F. A. Barkely 18S.306.**

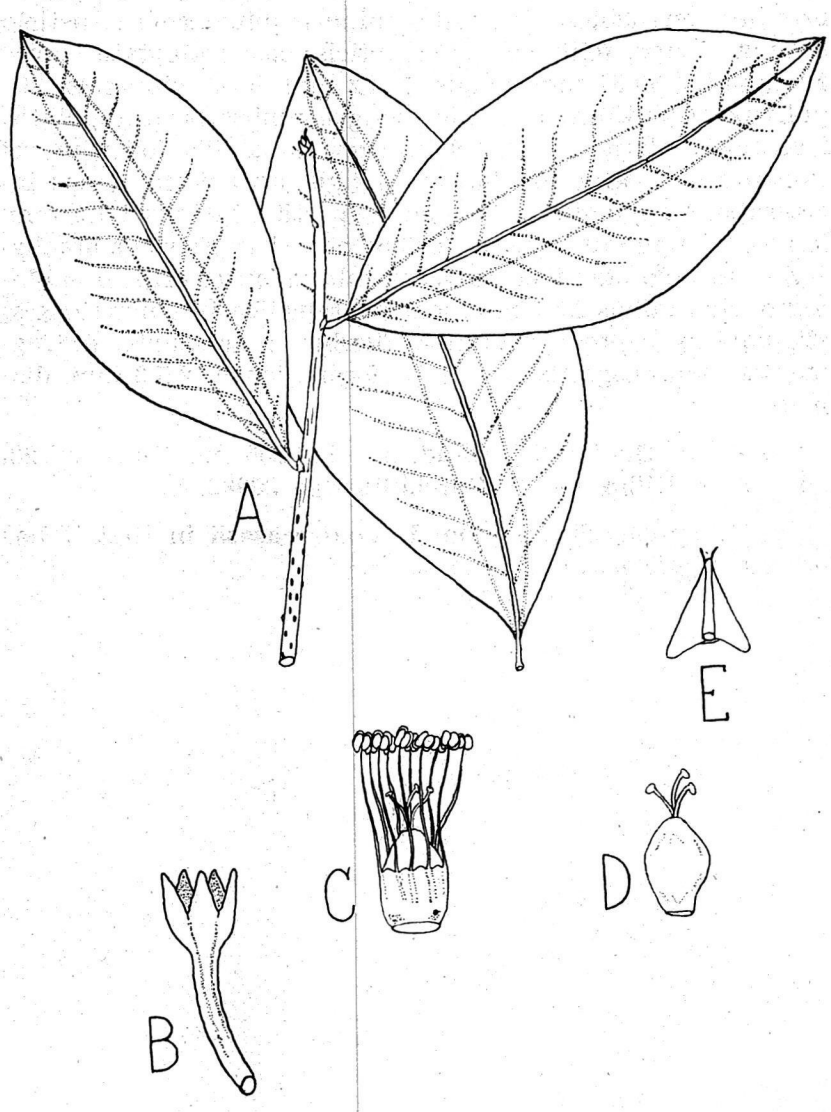

Fig. 47. 9. **E. gracilipes.** Habit x 0.6; others x 6.

10. **E. acutum** Gentner, Journ. Wash. Acad. Sc. 47:6. 1957.

Frutex vel arbor 3-4 m. alta; cortice obscure purpureo-brunneo, verruculoso, lenticellis minutis dilute rubris; petiolo 3-7 mm. longo, foliis oblongo-ellipticis, basi rotundatis, apice acuminatis, 30-81 mm. longis, 14-32 mm. latis, bilineatis; stipulis persistentibus, 1-1.5 mm. longis, fimbratis, triangulatis, 3-setulosis; floribus uno vel plurimis in axillis foliorum vel ramentorum; pedicellis 4-6 mm. longis, ad apicem versus incrassatis, 5-angulatis; calyce ad ½ partito, laciniis 1-1.5 mm. longis, triangulatis, acutis; floribus non visis. Floribus brachystylis: urceolo stamineo calycem subaequante, orificio subintegro; staminibus 2.5-3 mm. longis; stylis liberis, 2 mm. longis; stigmatibus depresso-capitatis; floribus brachystylis e fragmentis solum cognitis. Drupa 7.5-9 mm. longa, 2.5-3 mm. diametro.

Nariño: Gorgonilla Island, alt. 130-200 m., February 28, 1939, **E. P. Killip** and **H. García-Barriga 33082.**

This species differs from **E. cuatrecasasii** in that it has oblong-elliptic leaves.

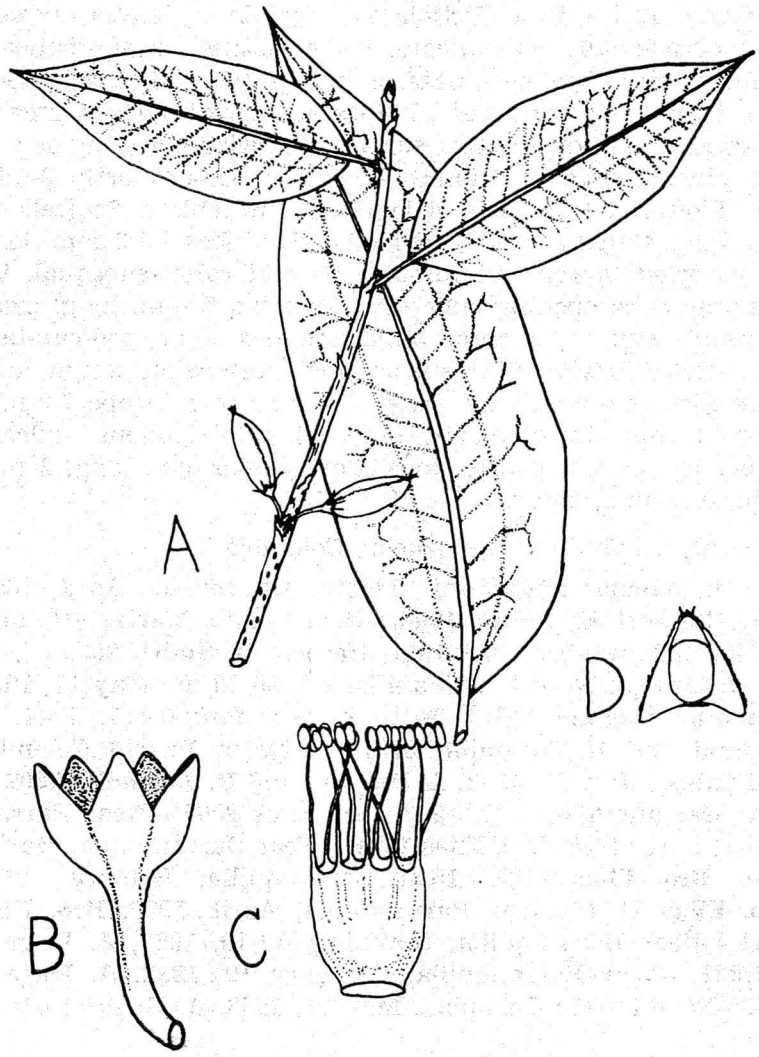

Fig. 48. 10. **E. acutum.** Habit x 0.6; others x 6.

11. **E. rigidulum** DC. Prodr. 1:575. 1824.

Tree or shrub 1-6.5 m. tall. Cortex purple-brown, warty, warts shiny white. Ultimate branches thorn-like, 3-7 mm. in diameter at the base. Petiole 2-4 mm. long, leaves obovate, base occasionally subcuneate, often obtuse or subtruncate, rounded, slightly emarginate, punctate (O. E. Schulz), 40-80 mm. long. 21-45 mm. wide, bilineated, dorsal surface grey or yellowgreen, shiny, ventral surface yellowish-glaucous or subferruginous, opaque. Stipules 1-1.5 mm. long, shortly 2-setulose. Flowers 3-9 in axils of leaves or branchlets. Pedicels 2-5 mm. long. Calyx about ¾ divided, calyx-lobes 1-1.2 mm. long. Short-styled flowers: Staminal tube and calyx subequal, the staminal tube opening subentire, stamens 5 mm. long, ovary ellipsoid, styles 1.5 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 2 mm. long, epipetalous 4.5 mm. long, styles 3.5 mm. long. Drupe 7-9 mm. long, 4 mm. in diameter, ellipsoid, subtrigonous, sulcate, empty locules not conspicuous. Embryo 6.5 mm. long, 2 mm. wide, 0.75 mm. thick.

General distribution: Venezuela; Colombia.

Magdalena: Near Santa Marta, alt. 150 m., April, 1898-1901, **Herbert H. Smith 1708.**—Near Santa Marta, alt. near sea level, November, 1898-1901, **Herbert H. Smith 865.**

Atlántico: Near Barranquilla, alt. 50-80 m., May 11, 1937, **Armando Dugand 1070.**—Near Salgar, January 7, 1941, **A. Dugand** and **R. Jaramillo 2734.**—Between Puerto Colombia and Salgar, July 23, 1943, **A. Dugand and R. Jaramillo 3202.**—Near Barranquilla, July, 1933, **Bro. Elías 1065.**—Near Barranquilla, April, 1933, **Bro. Elías 1064.**—Near Barranquilla, March, 1934, **Bro. Elías 1187.**—Near Barranquilla, January, 1934, **Bro. Elías 1164.**—Near Barranquilla, April, 1936, **Bro. Elías 1441.**—Near Barranquilla, November 12-19, 1932, **A. Dugand 247;221.**—Near Barranquilla, February 19, 1932, **A. Dugand 364.**—Near Puerto Colombia, May 21, 1933, **A. Dugand 416.**

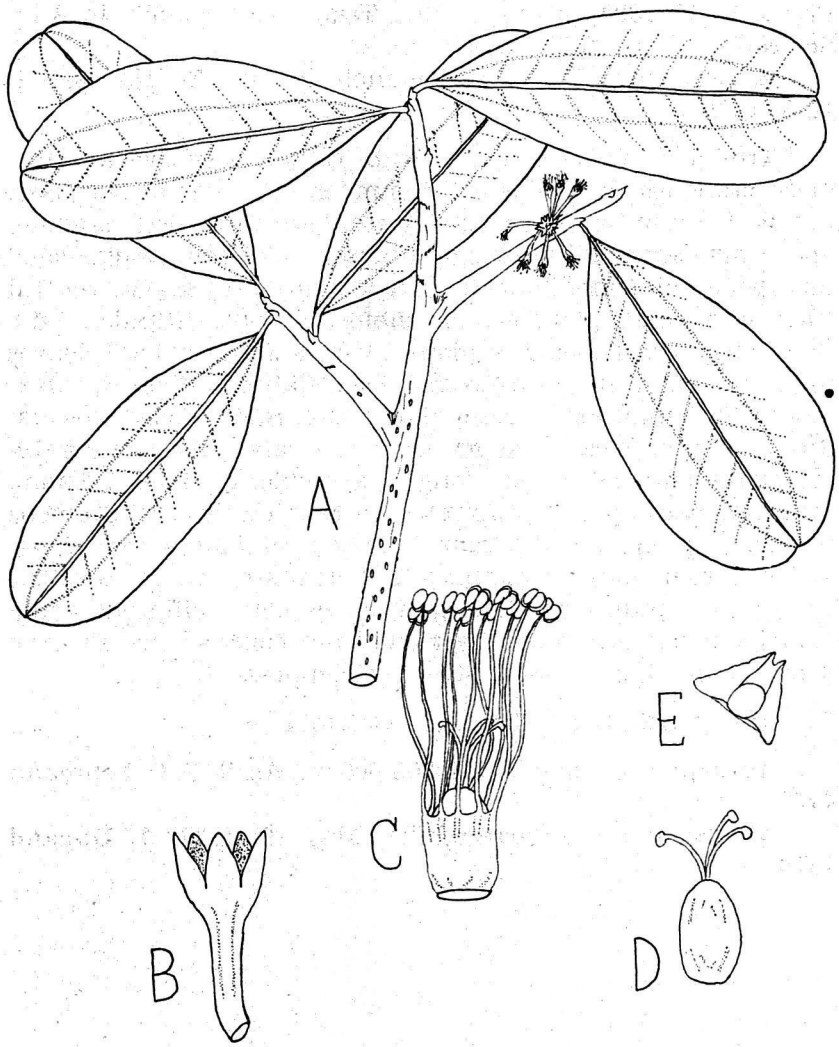

Fig. 49. 11. **E. rigidulum.** Habit x 1.6; others x 6.

12. **E. carthagenense** Jacq. Enum. Pl. Carib. 21. 1760.

E. areolatum L. Syst. Nat. ed. 13. 2:315. 1770, and DC. Prodr. 1:575. 1824, pro parte, and Triana and Planch. in Ann. Sc. Nat. ser. 4. 18:337. 1862.

E. coca sensu Triana and Planch. in Ann. Sc. Nat. ser. 4. 18:3. 1862.

Tree 5 m. tall, rarely a shrub. Cortex grey, warty. Ultimate branches thorn-like, 1-2.5 mm. in diameter at the base. Petiole 3-5 mm. long, leaves obovate, base more or less acute, apex rounded or slightly emarginate, 48-79 mm. long, 29-46 mm. wide, bilineated, dorsal surface shiny grey-green, ventral surface opaque, glaucous or subferruginous. Stipules 1-1.5 mm. long, triangular, 2-setulose. Flowers 3-6 in axils of leaves or branchlets. Pedicel 1.5-2.5 mm. long. Calyx ½ divided, calyx-lobes 0.75-1 mm. long, triangular, acute. Short-styled flowers: Staminal tube clearly longer than the calyx, its opening 10-crenulate, stamens 3 mm. long, ovary oblong, styles 1-2 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.5 mm. long, epipetalous 2 mm. long, styles 3 mm. long, sometimes 2/3 connate (O. E. Schulz). Drupe 10-11 mm. long, 4-4.5 mm. in diameter, ellipsoid, acute subtrigonous, sulcate, empty locules not conspicuous. Embryo 6 mm. long, 1 mm. wide, strongly compressed.

General distribution: Trinidad; Colombia.

Antioquia: Antioquia, alt. 500-600 m., April, **F. C. Lehmann 4736.**

Atlántico: Near Barranquilla, May 10, 1937, **A. Dugand 1070.**

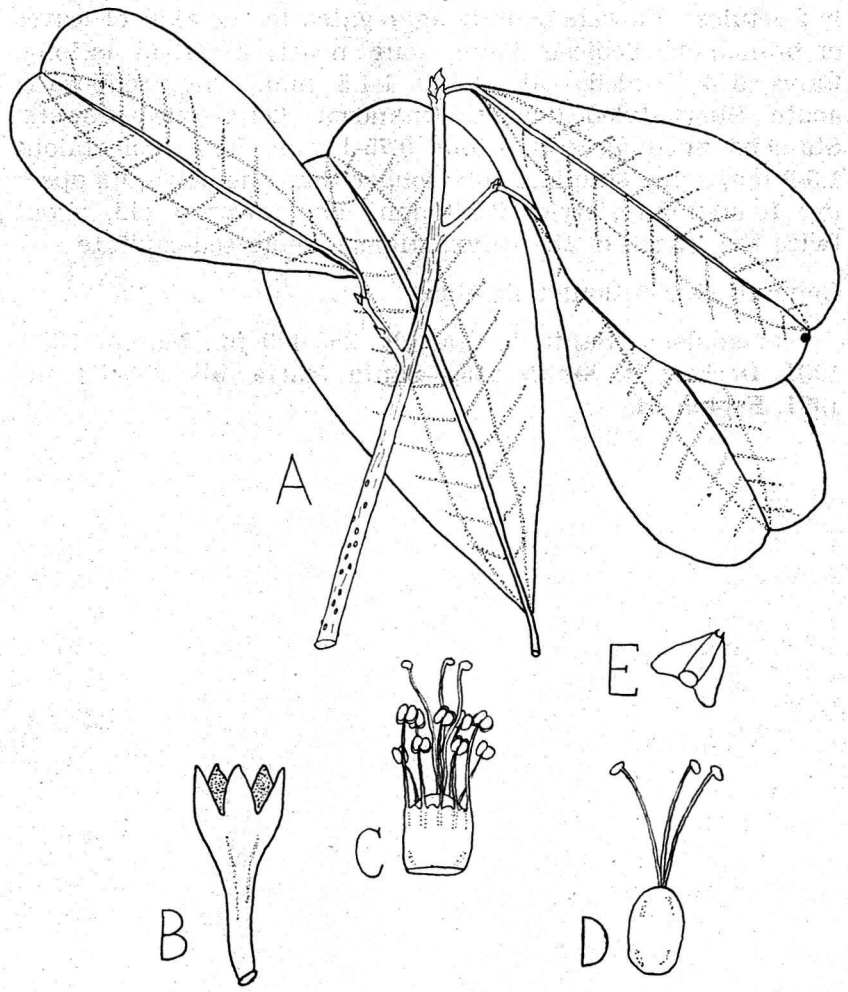

Fig. 50. 12. **E. carthagenense.** Habit x 1.6; others x 6.

13. **E. densum** Rusby Desc. So. Am. Pl. 33. 1920.

Tree 8 m. tall. Cortex grey-white, warty. Petioles 3-6 mm. long, leaves elliptic or slightly obovate, 30-70 mm. long, 20-50 mm. wide, mostly mucronate. Stipules 1.5-2.5 mm. long, shortly 2-setulose. Flowers densely aggregated in the axils of leaves or branchlets. Pedicels 1 mm. long, nearly as broad as long. Calyx 3/4 divided, calyx-lobes 1-1.5 mm. long, semiovate, acute. Short-styled flowers: Unknown. Long-styled flowers: Stamens unequal, episepalous 0.75-1 mm. long, epipetalous 1.5-2 mm. long, staminal tube longer than the calyx, its opening 10-crenulate, styles 2.5-3 mm. long, ovary ovoid, about twice the length of the calyx, stigmas depressed-capitate.

General distribution: Colombia.

• Magdalena: Santa Marta, alt. 250-450 m., March, 1898-1901, **Herbert H. Smith 845.**—Santa Marta, alt. 250-450 m., 1931, **Espina 64.**

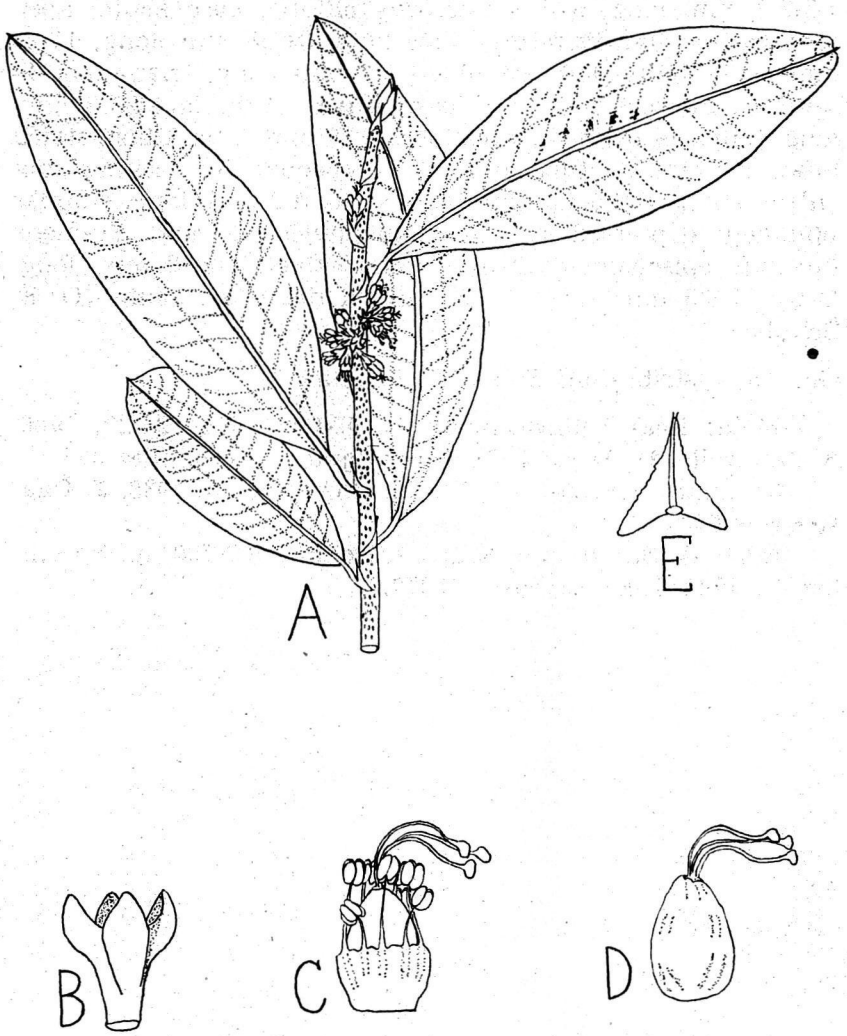

Fig. 51. 13. E. densum. Habit x 1.6; others x 6.

14. **E. cataractarum** Spruce ex. Peyr. in Fl. Brasil. 12:pt. 1:149. 1878.

Shrub 1-3 m. tall. Cortex purple-brown, warty. Petiole 1.5-2.5 mm. long, leaves narrowly elliptic, base acute, apex rounded or slightly retuse-mucronate, 31-58 mm. long, 11-23 mm. wide, bilineated. Stipules 1.5-3 mm. long, triangular, 2-setulose. Flowers 3-15 in axils of leaves. Pedicels 4.5-7.5 mm. long. Calyx ½ divided, calyx-lobes 0.75 mm. long. Short-styled flowers: Staminal tube and calyx subequal, its opening subentire, stamens 3.5-5.5 mm. long, styles 1.2 mm. long, stigmas obliquely depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.2 mm. long, epipetalous 2 mm. long. Drupe 7-9.5 mm. long, 3-3.5 mm. in diameter, acute (O. E. Schulz).

General distribution: Brazil; Colombia.

Meta: Near Villavicencio, alt. 450 m., July 24-28, 1946, **R. Jaramillo, D. Mesa, J. M. Idrobo** and **A. Fernández 363.**

Casanare: Orocué, alt. 140 m., November 3, 1938, **J. Cuatrecasas 4337.**

Norte de Santander: Near Sarare, alt. 500-700 m., November 18, 1941, **J. Cuatrecasas 13277.**

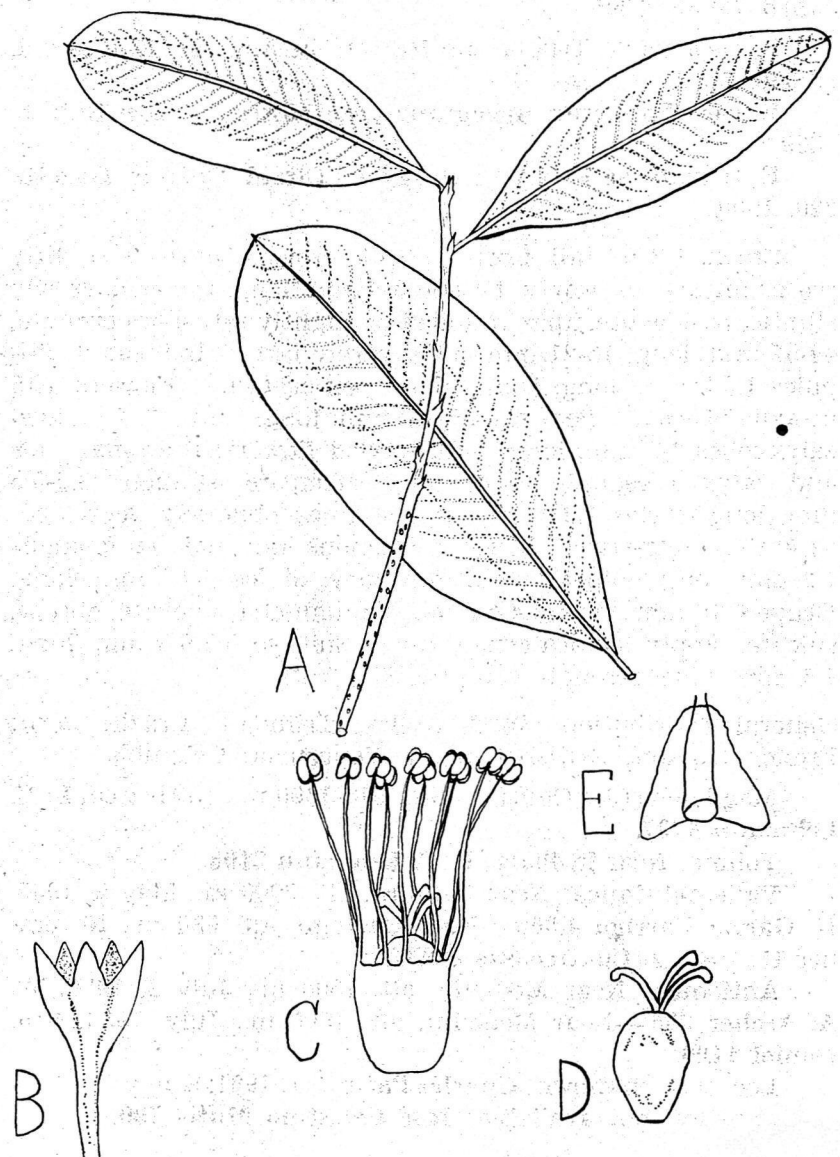

Fig. 52. 14. E. cataractarum. Habit x 1.6; others x 6.

15. **E. novogranatense** (Morris) Hieronymus in Engler's Bot. Jahrb. 20:35. 1895.

E. coca sensu Triana and Planch. in Ann. Sc. Nat. ser. 4. 18:336. 1862.

E. coca Lam. var. **novogranatense** Morris in Kew Bull. 5. 1889.

E. truxillense Rusby in Druggists Circul. Chemic. Gazette 220. 1900.

Shrub 1-3 m. tall. Cortex purple-brown. Lenticels slightly red or micaceous, warty. Petiole 3-6 mm. long, leaves narrowly elliptic, base acute, apex rounded or slightly retuse-mucronate, 44-52 mm. long, 15-21 mm. wide, rarely larger, bilineated. Stipules 1.5-3 mm. long, triangular, apex asetulose. Flowers 3-15 in axils of leaves. Pedicels 4.5-7.5 mm. long. Calyx 3/4 divided calyx-lobes 1.2 mm. long. Short-styled flowers: Staminal tube and calyx subequal, its opening subentire, stamens 3.5-5.5 mm. long, styles 1.2 mm. long, stigmas obliquely depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.2 mm. long, epipetalous 2 mm. long, styles 2-2.5 mm. long. Drupe 6-10 mm. long, 4.4-6.5 mm. in diameter, obovate, obtuse, sulcate, empty locules conspicuous. Embryo 5.5-6.5 mm. long, 1.5 mm. wide, strongly compressed.

General distribution: West Indies; Trinidad; Brazil; Peru; French Guiana; British Guiana; Venezuela; Colombia.

Magdalena (?): Cauca Valley, alt. 1500 m., cultivated, **F. C. Lehmann 4737.**

Tolima: Near la Plata, **F. C. Lehmann 2108.**

Valle del Cauca: Near Palmira, alt. 2000 m., May 2, 1935, **H. García Barriga 4.306.**—Near Cartago, alt. 980 m., November 15, 1946, **J. Cuatrecasas 22837.**

Antioquia: Near Medellín, alt. 1500 m., July 2, 1930, **W. A. Archer 336.**—Near Medellín, alt. 1500 m., July, 1939, **Bro. Daniel 1100.**

Location unknown: **Charles Patin** (?), 1901, s. n.

Location not available: **José Celestino Mutis 790.**

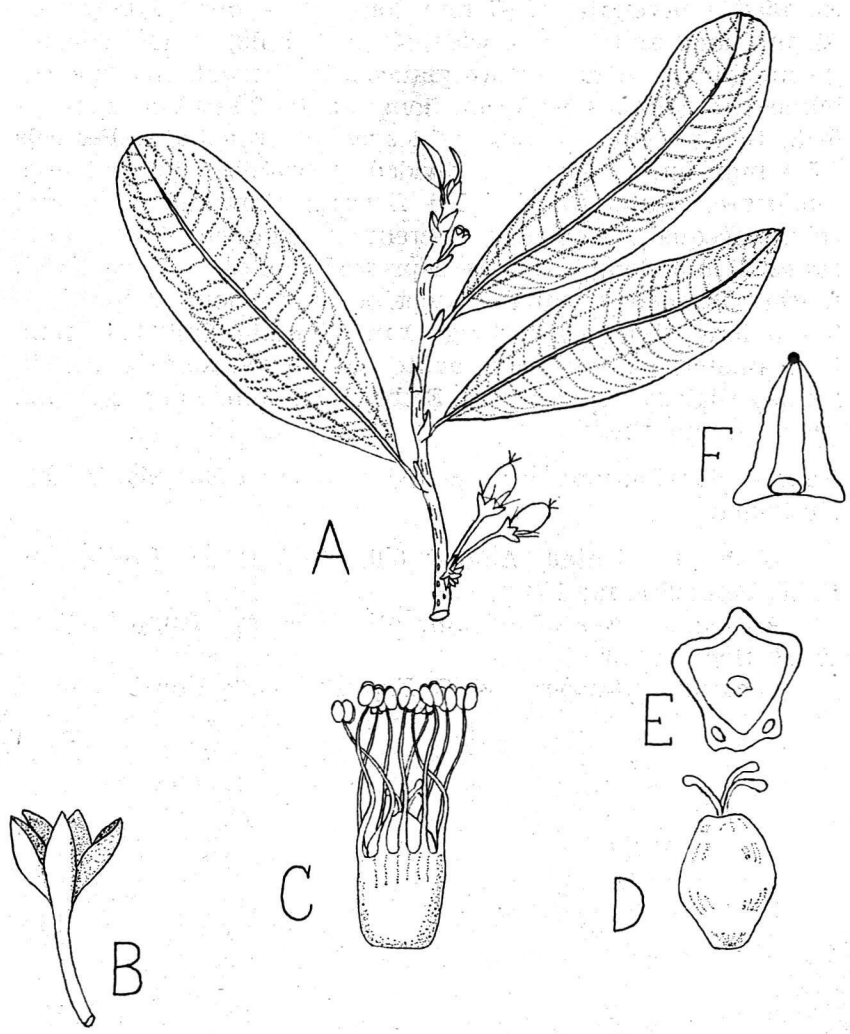

Fig. 53. 15. **E. novogranatense.** Habit x 1.6; others x 6.

16. **E. coca** Lam. Encycl. Meth. Bot. 2:393. 1786.

Shrub 1-2 m. tall. Cortex red-brown, warty. Petiole 2-5 mm. long, leaves elliptic or obovate, base acute, apex acute, rarely rounded, mucronate, 44-97 mm. long, 20-44 mm. wide, rarely 35 mm. long and 10 mm. wide (O. E. Schulz), dorsal surface green, shiny, ventral surface glaucous or ferruginous, opaque, bilineated. Stipules 3-3.5 mm. long, acute, 2-setulose. Flowers 6-12, rarely more, in axils of leaves or branchlets. Pedicels 3.5-4 mm. long. Calyx 3/4 divided, calyx-lobes 1 mm. long, semiovate, acute. Short-styled flowers: Staminal tube and calyx subequal, its opening 10-crenulate, stamens 4 mm. long, styles 2 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 2 mm. long, epipetalous 3 mm. long, styles 4 mm. long. Drupe 7-8 mm. long, 3.5-4 mm. in diameter, oblong-ovate, acute, trigonous, sulcate, empty locules slightly conspicuous. Embryo 5.5 mm. long, 1.5 mm. wide, 0.4 mm. thick.

General distribution: Perú; Bolivia; Brasil; Colombia. Widely cultivated.

Huila: Cultivated, August 8-9, 1917, H. H. Rusby and F. W. Pennell s. n.; 1134.

Antioquia: Near Medellín, alt. 1560 m., August, 1945, W. H. Hodge 6710.

Location unknown: "W. C. Exp. 1893 collections", s. n.

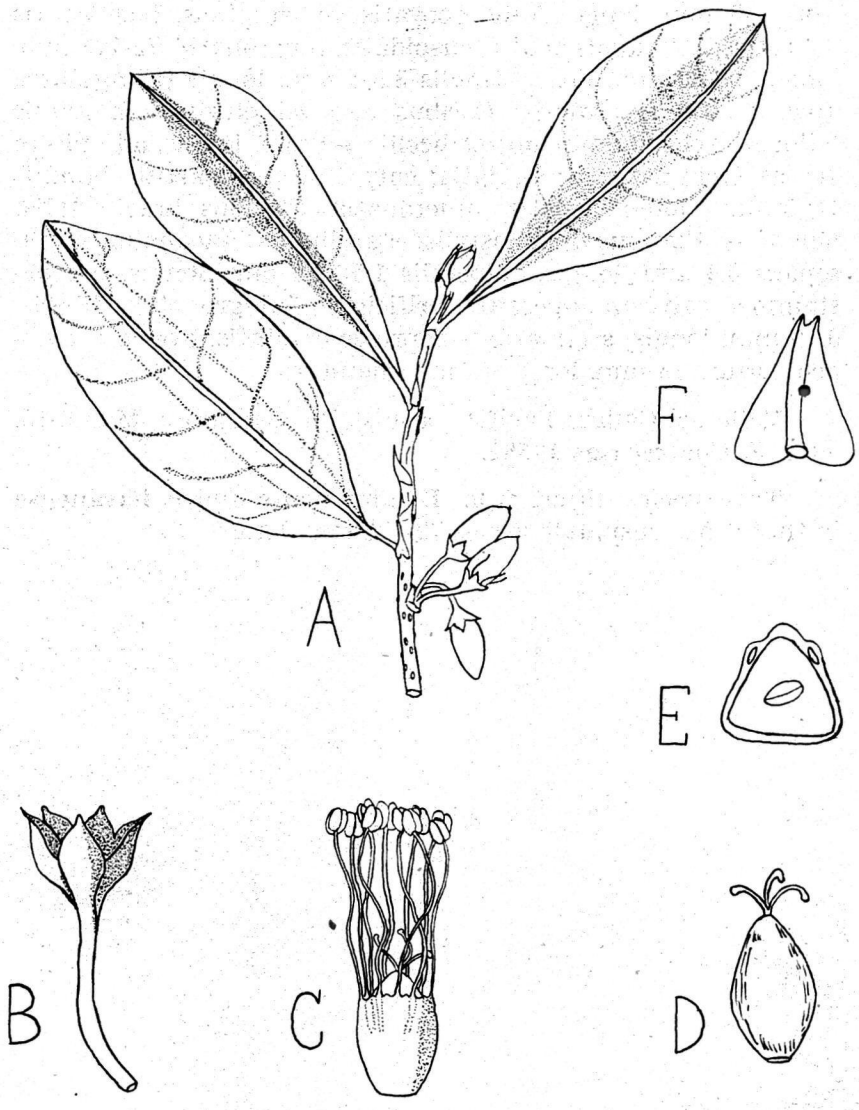

Fig. 54. 16. **E. coca.** Habit x 1.6; others x 6.

17. **E. acrobeles** Gentner. Journ. Wash. Acad. Sc. 47: 6. 1957.

Frutex parvus, cortice griseo-brunneo, verruculoso; petiolo 3-5 mm. longo, foliis obovatis vel ellipticis, basi acutis vel rotundatis, apice acutis, cuspidatis, mucronatis, 72-173 mm. longis, 26-60 mm. latis; stipulis 3.5-5 mm. longis triangulatis, apice acutis, 2-setulosis; floribus uno vel plurimis in axillis foliorum vel ramentorum; pedicellis 4-9 mm. longis, ad apicem versus incrassatis, 5-angulatis; calyce ad 1/2 partito, laminis 1-1.5 mm. longis, ovatis, mucronatis. Floribus brachystylis: non visis. Floribus dolichostylis: staminibus inaequalibus, episepalis 0.4 mm. longis, epipetalis 1.5-1.75 mm. longis, urceolo stamineo calycem superante, orificio subintegro, stylis liberis, 0.75 mm. longis, stigmatibus depresso-capitatis, ovario obovoideo. Drupa 13 mm. longa, 7 mm. diametro.

Valle del Cauca: Pacific coast at Río Cajambre, May 5-15, 1944, **J. Cuatrecasas 17581.**

This species differs from **E. cumanense** and **E havanense** in that it has cuspidate leaves 72-173 mm. long.

ERRATAS ADVERTIDAS DEL VOLUMEN I

Pág.	Renglón	Dice	Debe decir
Nos. 1 y 2:			
39	27	Concierte al tema	Concierne al tema
	32	legado el día	llegado el día
48	3	se extrade de la	se extrae de la
49	38	La suma del % de has. cultivadas es inferior a 100	(así en el original)
69	6	dichos menestees	dichos menesteres
76	9	amarillento	amarillento
78	39	seg5n	según
133	24	Flores olorosas 70	Flores olorosas 76
Nº 3:			
242	6	humanoss	humanos
370	7-32	No coinciden el total con los sumandos de las columnas **Nº de paquetes y total gramos**	(así en el original)
Nº 4:			
449	25	números más frecuente	número más frecuente
453	4	parejas sacaron sacaron	parejas sacaron
455	23	guarcero	garcero

INDICE DEL VOLUMEN I

CONTENIDO

íntegro; estípulas 1.5-2 mm. de largo, débilmente estriadas longitudinalmente. **E. ulei** (20)

V. Apice foliar generalmente obtuso o hasta anchamente cuspidado; tubo estaminal 10-crenulado; estípulas 2-3 mm. de largo. **E. venosum** (21)

U. Apice foliar redondeado o emarginado.

W. Pedicelos 1.5-6 mm. de largo.

X. Cáliz hendido en ¾; ovario ovoide; tubo estaminal 10-20 crenulado; pecíolo 2-5 mm. largo. **E. orinocense** (22)

X. Cáliz hendido hasta la mitad, ovario obovoide; tubo estaminal 10-crenulado; pecíolo 1.5-3 mm. largo. **E. hondense** (23)

W. Pedicelos 7-11 mm. de largo; cáliz hendido en ¾; ovario ovoideo; tubo estaminal 10-crenulado; pecíolo 3-6 mm. largo. **E. haughtii** (24)

Termina el trabajo con la descripción de las 24 especies enumeradas, indicándose las localidades de colección y los nombres de los colectores.

Nota. En la tesis original (1952) figuraron como especies nuevas las números 8, 10, 17 y 24 (descripciones en latín), que al ser publicadas en 1957 perdieron aquel carácter. — **V. M. Patiño.**

J. Hojas oblongo-elípticas con ápice generalmente agudo, raramente súbitamente acuminado; tubo estaminal 10-crenulado. **E. gracilipes** (9)

I. Hojas 25-97 mm. de largo.

K. Apice foliar agudo o acuminado.

L. Hojas oblongo-elípticas, 14-32 mm. de ancho. **E. acutum** (10)

L. Hojas lanceoladas, 21-44 mm. de ancho. **E. cuatrecasasasii** (8)

K. Apice foliar obtuso, redondeado o emarginado, a menudo apiculado, nunca agudo o acuminado.

M. Ramillas últimas en forma de espina.

N. Ramillas últimas de 3-7 mm. diámetro en la base; tubo estaminal subíntegro. **E. rigidulum** (11)

N. Ramillas últimas de 1-2.5 mm. diámetro en la base; tubo estaminal 10-crenulado. **E. carthagenense** (12)

M. Ramillas últimas alargadas, no espinosas.

O. Pedicelo 1 mm. largo. **E. densum** (13)

O. Pedicelo 1.5-7.5 mm. largo.

P. Tubo estaminal subíntegro; endosperma cuadrangular.

Q. Estípulas 2-ciliadas; pecíolo 1.5-2.5 mm.; lóbulos calicinales 0.75 mm. de largo; drupa 3-3.5 mm. diámetro. **E. cataractarum** (14)

Q. Estípulas sin cilios; pecíolo 3-6 mm.; lóbulos calicinales 1-2 mm. de largo; drupa 4.4-6.5 mm. diámetro. **E. novogranatense** (15)

P. Tubo estaminal 10-crenulado; endosperma triangular; estípulas brevemente 2-ciliadas; pecíolo 2-5 mm.; lóbulos calicinales 1 mm. de largo; drupa 3.5-4 mm. diámetro. **E. coca** (16)

H. Envés de las hojas sin las dos líneas longitudinales.

R. Estípulas 2-ciliadas.

S. Hojas 72-173 mm. de largo, 26-60 mm. de ancho, cuspidadas, mucronadas. **E. acrobeles** (17)

S. Hojas 25-75 mm. de largo, 15-37 mm. de ancho, truncadas, emarginadas, agudas o subagudas, nunca cuspidadas.

T. Tubo estaminal menudamente 10-crenulado; ápice del ovario redondeado o subtruncado. **E. cumanense** (18)

T. Tubo estaminal subíntegro; ápice del ovario agudo. **E. havanense** (19)

R. Estípulas 3-ciliadas.

U. Apice foliar agudo, obtuso o anchamente cuspidado.

V. Apice foliar generalmente agudo; tubo estaminal sub-

METODOS.

Como el estudio se basó exclusivamente en ejemplares de herbario, para hacerlo más cuidadoso, las estípulas y flores, cuando se pudieron obtener, fueron ablandadas con un detergente caliente, para provocar tumefacción, y revelar mejor la forma y tamaño de las partes.

BIBLIOTECAS Y FUENTES.

Se consultaron los herbarios Nacional de los Estados Unidos, el Herbario de Gray y el del Museo de Historia Natural de Chicago.

Las consultas se hicieron en las bibliotecas de la Universidad George Washington, del Instituto Smithsoniano, del Departamento de Agricultura y la del Congreso.

Las fotografías de **E. coca** fueron suministradas por los doctores A. C. Smith y C. Vargas C..

ESTRUCTURA FLORAL Y ORGANOS VEGETATIVOS.

Se dan precisiones anatómicas sobre estos aspectos.

CLAVE DE LAS ESPECIES DE ERYTHROXYLUM EN COLOMBIA

A. Estípulas claramente estriadas longitudinalmente.
  B. Estípulas 2-ciliadas.
    C. Estípulas 2.5-3 mm. de largo. **E. popayanense** (1)
    C. Estípulas 8-14 mm. de largo. **E. lucidum** (2)
  B. Estípulas 3-ciliadas.
    D. Hojas por lo menos tres veces más largas que anchas. **E. citrifolium** (3)
    D. Hojas menos de tres veces más largas que anchas.
      E. Apices de las hojas truncado o redondeado. **E. testaceum** (4)
      E. Apice de las hojas acuminado u obtuso-cuspidado.
        F. Sépalos valvados en el capullo; hojas oblongo-elípticas; lóbulos calicinales 2-4,5 mm. de largo.
          G. Lóbulos calicinales 3.5-4 mm. largo; pecíolo 7-12 mm. largo; drupa 8-8.5 mm. larga. **E. macrophyllum** (5)
          G. Lóbulos calicinales 2-3 mm. largo; pecíolo 5-9 mm. largo, drupa 7 mm. larga. **E. floribundum** (6)
        F. Sépalos imbricados en el capullo; hojas ligeramente obovadas; lóbulos calicinales 1-2 mm. de largo. **E. amazonicum** (7)

A. Estípulas no estriadas (oscuramente estriadas en **E. ulei**).
  H. Envés de las hojas con dos líneas longitudinales muy conspicuas.
    I. Hojas 116-157 mm. de largo.
      J. Hojas lanceoladas con ápice acuminado; tubo estaminal subíntegro. **E. cuatrecasasasii** (8)

bre de 1884, y posteriormente publicó un artículo sobre lo mismo en el "Wiener Medizinisch Wochenschrift". Este último fue inmediatamente traducido y publicado en importantes publicaciones médicas donde quiera, y en un año el procedimiento del doctor Koller se usó en todo el mundo.

Con la introducción en 1853 de la jeringa hipodérmica por Alexander Wood, se facilitó el aprovechamiento de las propiedades anestésicas de la cocaína, pues sin aquél invento, la administración del alcaloide y de sus derivados habría sido más difícil.

Hacia 1885 el Dr. James L. Corning de Nueva York había hecho demostraciones de anestesia hipodérmica y espinal, con el uso de soluciones de cocaína.

Según Gutiérrez Noriega y von Hagen, los datos sobre consumo de coca y el hábito del cocainismo, son inquietantes. Bolivia produce cinco millones de libras de hojas anualmente, de las cuales consume cuatro y el resto se envía a la Argentina para trabajadores que van de los Andes a labores agrícolas. A veces tiene que importar del Perú. Tan importante es la coca como provento fiscal en Bolivia, que si la producción mermara, habría graves problemas económicos.

Perú, con una población de 7 millones de habitantes, tiene más de 3 millones de coqueros. Gutiérrez Noriega y von Hagen concluyen diciendo: "15.000.000 de suramericanos, principalmente indios y cholos, extendiéndose geográficamente sobre la mitad del subcontinente, desde Argentina hasta Colombia, son adictos a la hoja cocaínica".

En varias áreas andinas, el trabajo en los campos no puede hacerse si los indígenas no disponen de la hoja, que les enmascara la sensación de hambre y disminuye el cansancio. A veces se hace difícil la colección de muestras botánicas completas de la planta, pues todas las hojas producidas son cuidadosamente cosechadas para aprovecharlas.

Con frecuencia se propaga la coca por esquejes. Viene luego una descripción de la cosecha de las hojas y del secamiento para el expendio.

Se describe la manera de utilizar las hojas. Se calcula en unos 20 gramos de hoja por día el consumo de un coquero. Se estima en 86% el total de alcaloides extraídos y absorbidos por período de masticación en los Andes.

TAXONOMIA.

Siguen datos históricos sobre el género **Erythroxylum,** desde el punto de vista de la descripción botánica y del estatus taxonómico. 193 especies componían el género en 1907 cuando O. E. Schulz publicó una monografía. Desde entonces se han propuesto 51 especies y variedades más; sin embargo, desde 1907 no ha habido un nuevo tratamiento del género en su totalidad.

NOMENCLATURA.

Se concluye que el correcto deletreo no es **Erythroxylon,** como ha sido usado por varios autores, sino **Erythroxylum.**

ron el uso de la coca para las clases dirigentes y promovieron el cultivo de la planta. Se han hallado relictos de esta "planta divina", como se la empezó a considerar, en tumbas del siglo noveno antes de la era cristiana, en bolsas muy semejantes a las usadas hoy en día entre los indígenas, y también la llipta o sustancia calcárea asociada.

Después de la conquista española del imperio incaico en 1531, el hábito se expandió entre las clases populares, con una rapidez sorprendente.

De acuerdo con O.E. Schulz, la planta de la coca fue conocida en Europa al través del botánico francés Clusius, que tradujo al latín (1582) una "Historia de los Medicamentos Simples", del médico español Nicolás Monardes, escrita en 1580. Este a su vez, se basa en los informes del cronista Pedro Cieza de León, según el cual los indios masticaban continuamente durante el día unas hojas, sin tragarlas. Estas hojas servían como signo de cambio por telas, alimentos, sal y otros artículos.

J. F. Macbride dice que los especímenes botánicos fueron llevados inicialmente a Europa por el botánico José de Jussieu, quien había observado el uso diario de las hojas por los pueblos andinos.

LaWall anota que aparentemente los primeros comentadores no apreciaron las propiedades medicinales y estimulantes del componente principal de las hojas de la coca. Cita pasajes de José de Acosta, Markham y Cowley.

Según Holmes, Gaedeke en 1855 fue el primero que obtuvo un alcaloide cristalino de las hojas de **E. coca,** denominándolo erythroxylina.

De acuerdo con Leake, Alberto Neimann, en 1858 aisló cocaína a partir de las hojas de la coca, cuando trabajaba en el laboratorio de Friedrich Wohler; ambos describieron el entorpecimiento de la lengua causado por el alcaloide, pero no reconocieron el significado del hallazgo. Holmes dice que en 1865 W. Lossen examinó el alcaloide cristalino de la coca, y cambió el nombre de erythroxylina en cocaína.

Hacia 1876 las propiedades anestesiantes de la cocaína llamaron la atención, cuando el profesor Christison comprobó que ella posee el poder de excitar y corroborar las funciones vitales, y que su uso tiene una acción anestesiante, que atenúa las sensaciones de fatiga y de hambre.

Según Leake, la cocaína permaneció como una curiosidad médica por muchos años. En 1880 una comisión médica británica conceptuó que no tenía valor medicinal alguno, siendo cuando más un modesto sustituto de la cafeína. En el mismo año Von Anrep publicó un cuidadoso estudio farmacológico, en el cual se sugirieron las propiedades del alcaloide para la anestesia local.

El doctor Carl Koller notó el efecto de la cocaína para adormecer la lengua, y esto lo condujo a creer que sería el buen agente que andaba buscando en conexión con la anestesia ocular. Llevó a cabo experimentos en Viena con animales y con humanos, hasta que tuvo la convicción del hallazgo. Hizo su primer informe sobre esto a la Sociedad Alemana de Oftalmología de Heidelberg el 15 de septiem-

RESUMEN

EL GENERO ERYTHROXYLUM EN COLOMBIA

Por **Walter A. Gentner.**

Tesis para optar en 1952 el grado de Magister en Artes, en la Universidad George Washington.

OBJETIVOS.

Se incluye una clave, seguida de una descripción detallada de cada especie. En mapas de Colombia se señalan, cuando están indicadas, las localidades de colección de las muestras.

OROGRAFIA Y CLIMA DE COLOMBIA.

Resumen que se omite, pues todos los colombianos están al tanto de las características de su territorio.

DISTRIBUCION.

La de las Erythroxyláceas es una familia pantropical, cuyas numerosas especies habitan los cuatro continentes que tienen áreas en la zona tropical. La mayor concentración de especies se halla en Sur América tropical y en las Antillas. Unas 40 especies se pueden encontrar en Africa y 3 en Australia. Algunas especies sobrepasan el Trópico de Cáncer en 3°N, hallándose en las Bahamas, mientras otras lo hacen en unos 10°S del Trópico de Capricornio, encontrándose en Uruguay.

Relativamente poco es lo que puede afirmarse sobre la distribución de esta familia en Colombia, debido a que las insuficientes colecciones botánicas hechas en ese país no permiten sacar conclusiones. En este trabajo se incluyen algunos mapas donde se señalan las localidades, cuando se conocen, en que han sido halladas varias especies en Colombia.

HISTORIA.

Como ocurre con otras familias botánicas, la historia de las Erythroxyláceas se centra alrededor de una sola especie cultivada, en este caso **Erythroxylum coca.**

Originalmente confinado a la cuenca amazónica y a los Andes, después de la conquista del imperio incaico, el conocimiento de la coca se dispersó en Europa y luego en todo el mundo. Con posterioridad se descubrieron las propiedades medicinales.

Aunque no se sabe cómo ocurrió, Gutiérrez Noriega y von Hagen creen que **E. coca** fue descubierta hace muchos siglos en la selva amazónica. Se puso de manifiesto que cuando se masticaban las hojas, en asocio con cal, sobrevenía una sensación agradable de ligereza y un aumento de la energía corporal. Se creó el hábito de cargar hojas para masticar en los viajes, con el objeto de atenuar la sensación del hambre. Este hábito se extendió del Amazonas a los Andes, alcanzando su máximo apogeo en el siglo XV entre los soberanos incas, que reserva-

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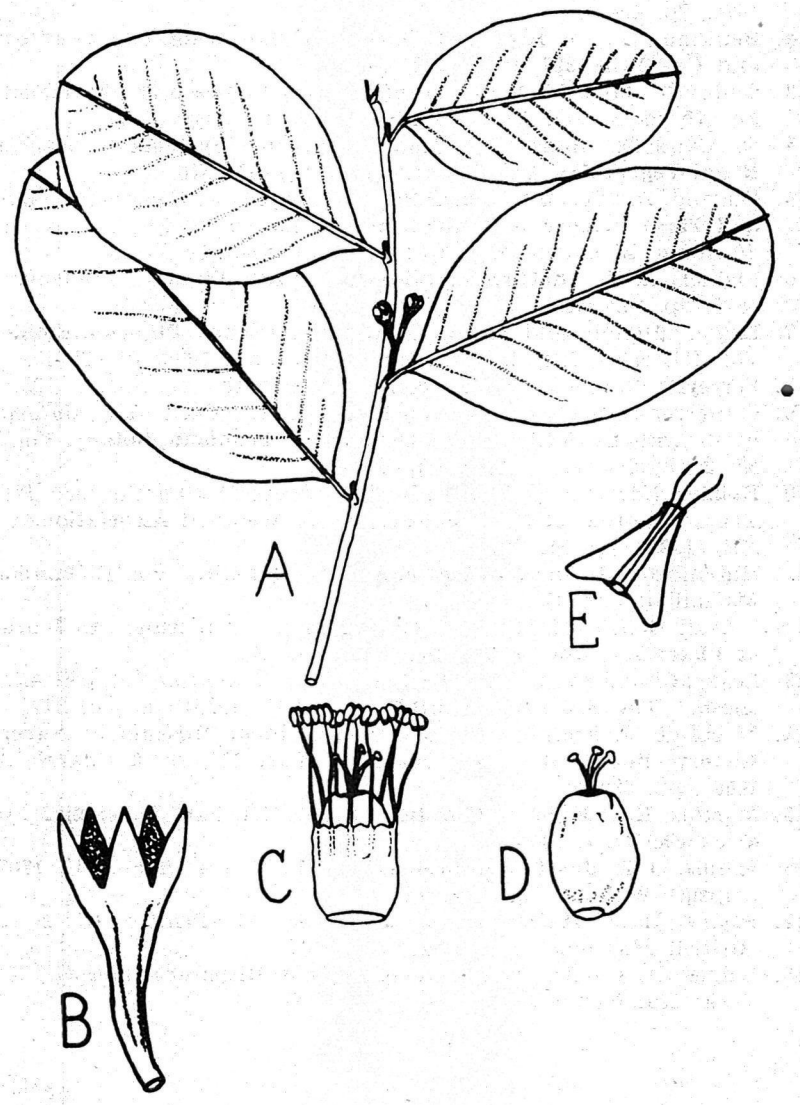

Fig. 62. 24. **E. haughtii.** Habit x 0.6; others x 6.

24. **E. haughtii** Gentner, Journ. Wash. Acad. Sc. 47:6. 1957.

Frutex ultra 2 m. alta; cortice griseo-brunneo, verruculoso, lenticellis dilute rubris, ramulis recurvatis, compressis; petiolo 3-6 mm. longo, foliis ovatis vel ellipticis, basi apiceque rotundatis, 22-57 mm. longis, 23-32 mm. latis; stipulis persistentibus, 1.5-2 mm. longis, fimbriatis, triangulatis, 3-setulosis; floribus 1-4 in axillis foliorum vel ramentorum; pedicellis 7-11 mm. longis, graciliter obconicis, 5-angulatis; calyce ad ¾ partito, laciniis 1.5-2 mm. longis, late lanceolatis; petalis 2.5-3 mm. longis, laminis 2.5-3 mm. longis, ligula laminum ad ¾ aequante. Floribus brachystylis: urceolo stamineo calycem subaequante, orificio 10-crenulato; staminibus 2.5 mm. longis, stylis liberis, 1 mm. longis, stigmatibus depresso-capitatis, ovario ovoideo. Floribus dolichostylis: non visis. Drupa non visi.

Cauca: Near Mercaderes, alt. 1100 m., October 27, 1946, **Oscar Haught 5143.**

This species differs from **E. orinocense** and **E. hondense** in that its pedicels are 7-11 mm. long.

EXPLANATION OF FIGURES

A = Habit of plant.
B = Calyx and pedicel.
C = Androecium and gynoecium.
D = Gynoecium.
E = Stipules, except in figs. 53 and 54.
E in figs. 53 and 54 = section of drupe.
F in figs. 53 and 54 = stipules.

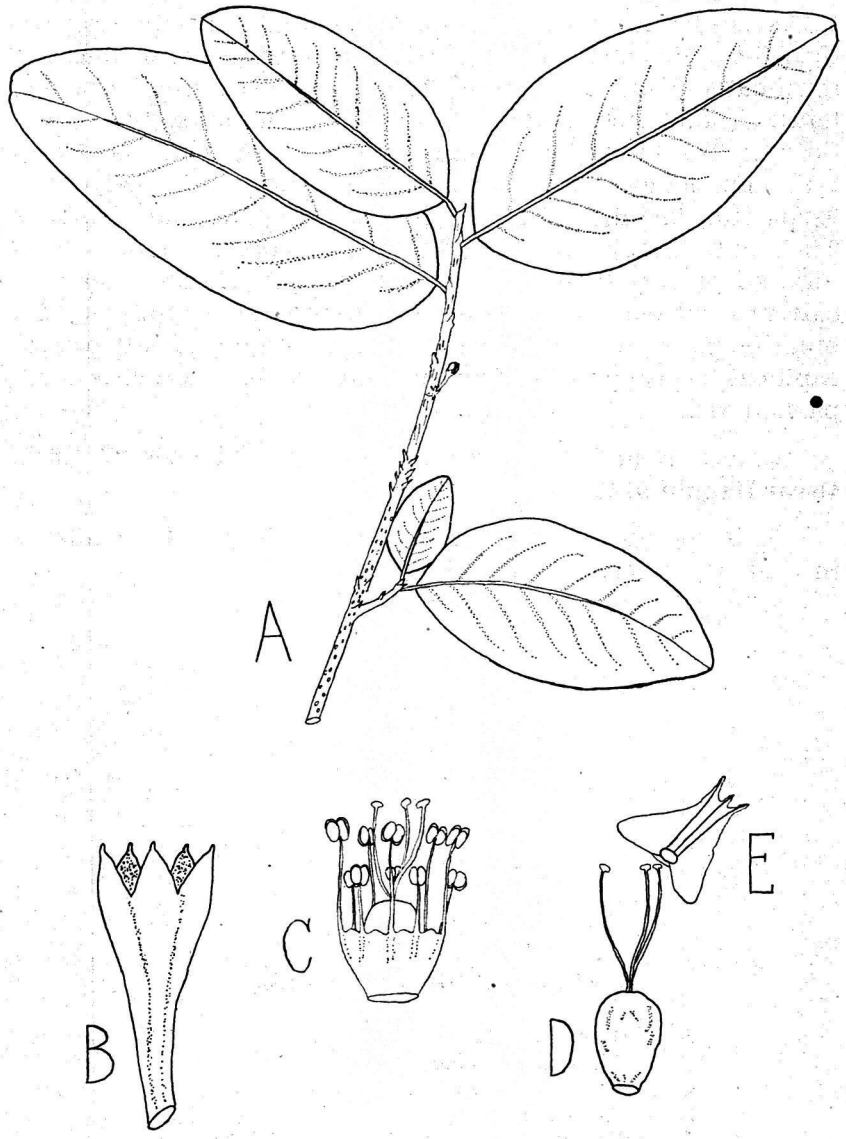

Fig. 61. 23. E. hondense. Habit x 0.6; others x 6.

23. **E. hondense** H. B. K. Nov. Gen. 5:136. 1821.

Shrub or tree 3-6 m. tall. Cortex grey-white, warty. Petiole 1.5-3 mm. long, leaves elliptic or obovate, base more or less acute, apex rounded or slightly emarginate, 30-113 mm. long, 17-49 mm. wide, dorsal surface shiny, pale green, ventral surface opaque, glaucous or subferruginous. Stipules 1.5-2 mm. long, triangular, obtuse, shortly 3-setulose. Flowers 1-3 in axils of leaves or branchlets. Pedicels 1.5-6 mm. long. Calyx ½ divided, calyx-lobes 1-1.2 mm. long, semiovate, acute. Short-styled flowers: Staminal tube and calyx subequal, staminal tube opening 10-crenulate, stamens 3.5-4 mm. long, ovary narrowly obovate, slightly longer than the staminal tube, styles 1.5 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1-1.4 mm. long, epipetalous 1.5-2 mm. long, styles 2.5-3 mm. long, ovary obovate. Drupe 8 mm. long, ca., 3.5 mm. in diameter, ovate, terete, not sulcate, empty locules not conspicuous. Embryo 6 mm. long, 3 mm. wide, 2.5 mm. thick.

General distribution: Peru; Colombia.

Magdalena: Santa Marta, alt. 150-200 m., June 1898-1901, **Herbert H. Smith 2399.**

Cundinamarca: Quebrada Camargo, north of Apulo, alt. 460-480 m., May 5, 1944, **E. P. Killip, A. Dugand,** and **R. Jaramillo 38217.**—Near Honda, alt. about 300 m., 1801, **Humboldt 1695.** (This is the type specimen which the author has not been able to see.)

Atlántico: Puerto Colombia, alt. 50-100 m., July 8, 1934, **A. Dugand 628.**

Antioquia: Antioquia, alt. 400-600 m., April, 1889, **F. C. Lehmann 4637.**

Location unknown: **Lehmann Nº B. T. 798.**

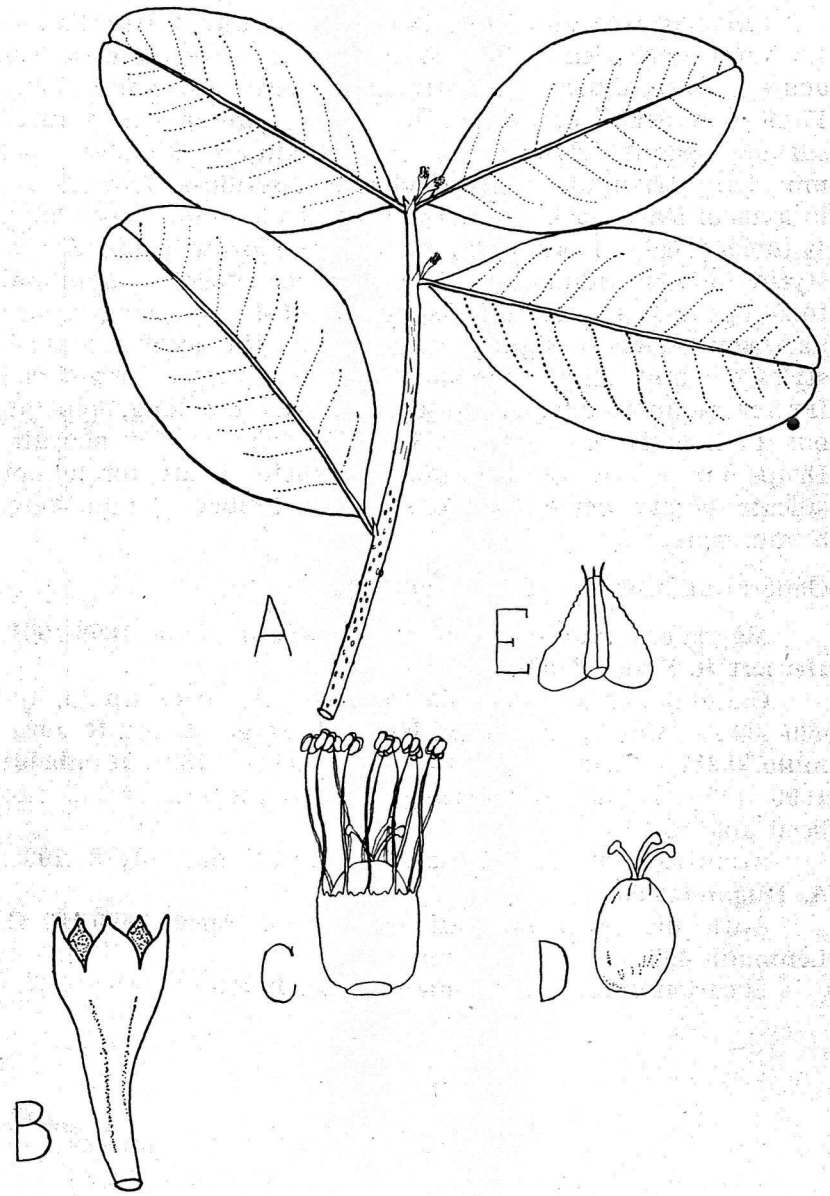

Fig. 60. 22. E. orinocense. Habit x 0.6; others x 6.

22. **E. orinocense** H. B. K. Nov. Gen. 5:137. 1821.

Tree 5-6.5 m. tall. Cortex grey, warty. Petiole 2-5 mm. long, leaves elliptic, base rounded, apex frequently slightly emarginate, 47-80 mm. long, 23-44 mm. wide, dorsal surface ferruginous. Stipules 1-3 mm. long, triangular, apex round, briefly 3-setulose. Flowers ca. 3 in axils of branchlets. Pedicels 3-3.5 mm. long. Short-styled flowers: Staminal tube slightly longer than the calyx, its opening 10-20-crenulate, stamens 3 mm. long, styles 1 mm. long, stigmas obliquely depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.2 mm. long, epipetalous 2 mm. long, styles 2.8 mm. long, ovary ovoid. Drupe 9 mm. long, 3 mm. wide, 2.5 mm. thick, ellipsoid, acute, sulcate, empty locules scarcely conspicuous. Embryo 7 mm. long, 2.5 mm. wide, 0.75 mm. thick.

General distribution: Venezuela; Colombia.

Magdalena: Dry hill near San Juan de Cesar, alt. 400 m., June 10, 1944, **Oscar Haught 4195.**—Near Santa Marta, 1931, **Espina 82**; 30.—Near Santa Marta, alt. 300 m., April 1898-1901, **Herbert H. Smith 788.**

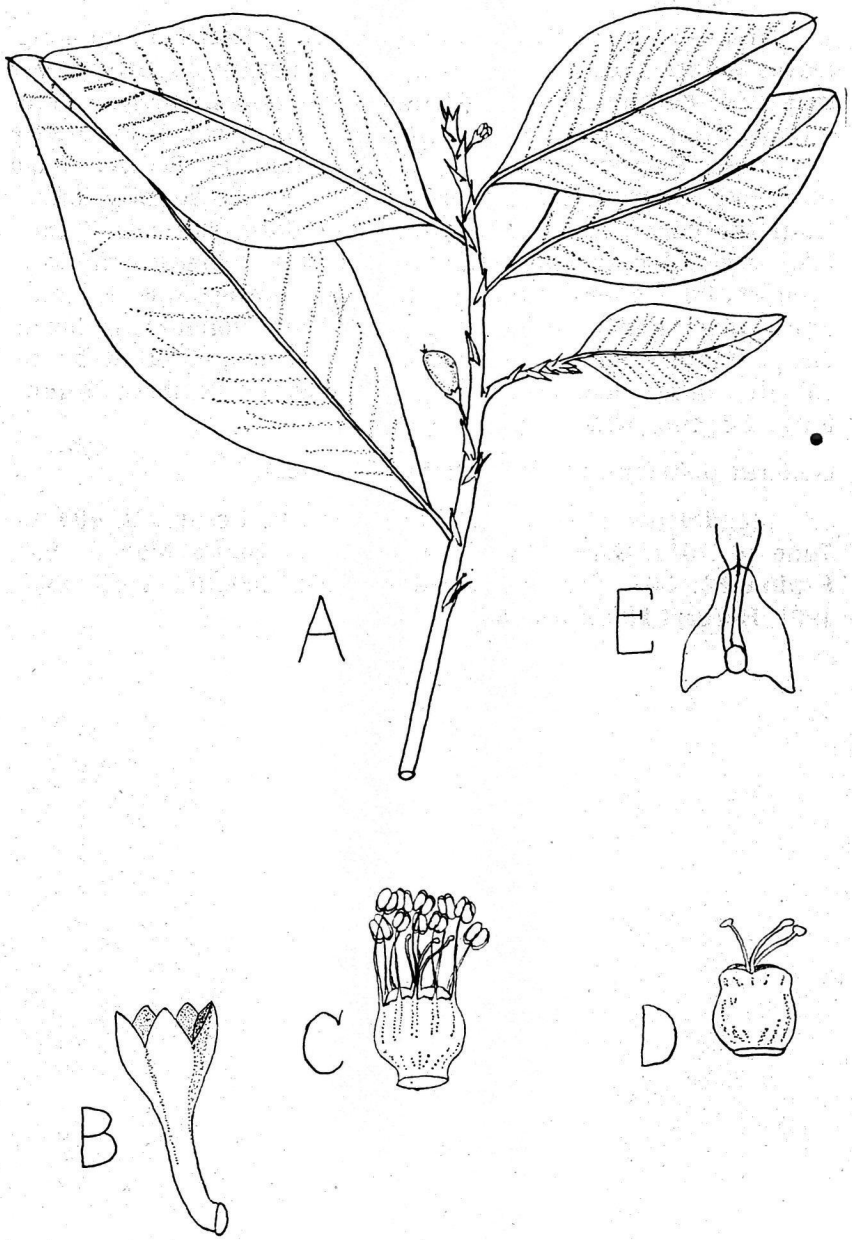

Fig. 59. 21. E. venosum. Habit x 1.6; others x 6.

21. **E. venosum** Rusby, Mem. N. Y. Bot. Gard. 7:370. 1927.

Shrub or tree 1-4 m. tall. Cortex grey-brown, warty. Petioles 2-4 mm. long, leaves elliptic-ovoid, base acute, apex obtuse, often broadly cuspidate, slightly mucronate, 30-60 mm. long, 15-30 mm. wide. Stipules 2-3 mm. long, triangular, 3-setulose. Flowers 1-2 in axils of leaves or branchlets. Pedicels about 3 mm. long (Rusby). Calyx ½ divided, calyx-lobes 1 mm. long. Short-styled flowers: Unknown. Long-styled flowers: Staminal tube longer than the calyx, its opening 10-crenulate, stamens unequal, episepalous 1.7 mm. long, epipetalous 2 mm. long. Ovary subglobose, styles 1.2 mm. long. Drupe 7-11 mm. long, 3-6 mm. in diameter.

General distribution: Brazil; Colombia.

• Valle del Cauca: North of Palmira, alt. 1050 m., December 28, 1938 January 5, 1939, **Hernando García-Barriga 6357.**— Near Palmira, alt. 1100 m., April 25, 1940, **Adalberto Figueroa 869.**

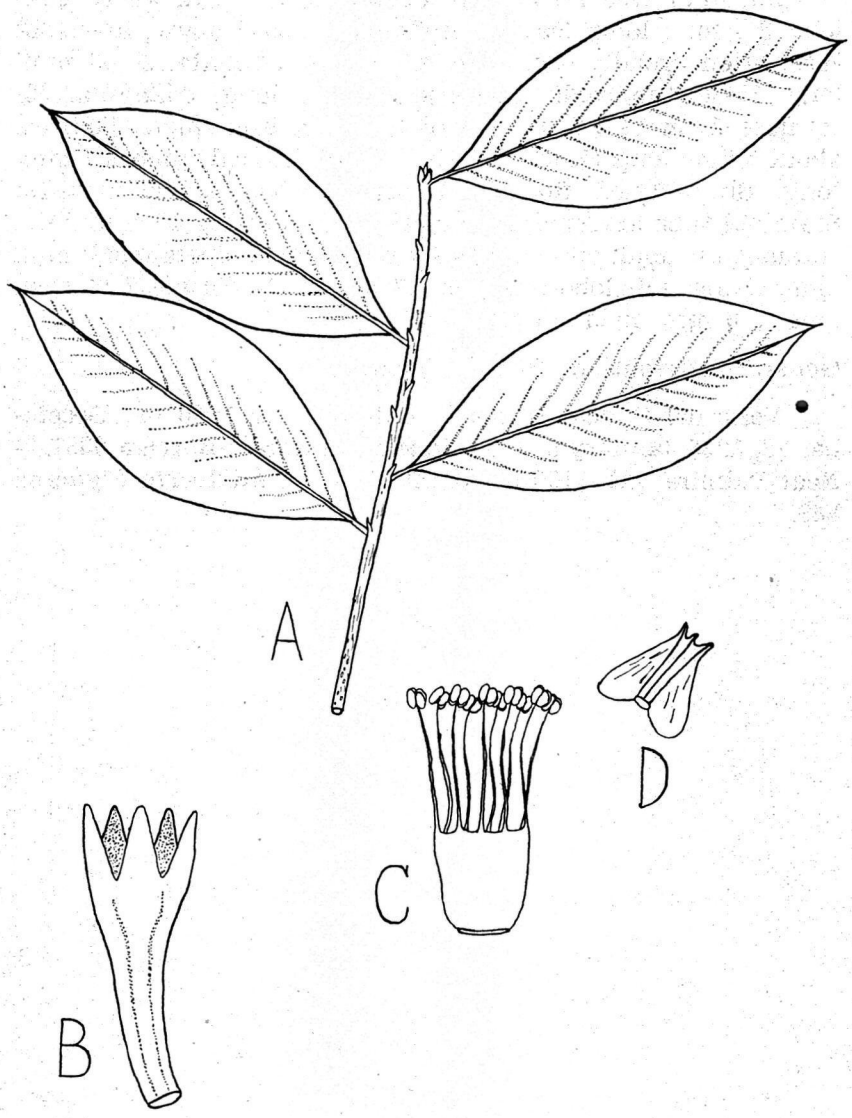

Fig. 58. 20. **E. ulei.** Habit x 1.6; others x 6.

20. **E. ulei** O. E. Schulz in Engler's Pflanzr. 4: Fam. 134:62. 1907.

E. popayanense Triana and Planch. in Ann. Sc. Nat. ser. 4. 18:338. 1862.

Shrub 1-3 m. tall. Cortex brown, warty. Petiole 2-3 mm. long, leaves narrowly ovate, base more or less acute, apex acute, mucronate, 34-82 mm. long, 16-39 mm. wide, dorsal surface grey-green, shiny, ventral surface ferruginous, opaque. Stipules 1.5-2 mm. long, triangular, apex shortly 3-setulose, obscurely striate. Flowers 1-3 in axils of leaves or branchlets. Pedicels 1-4 mm. long. Calyx nearly ¾ divided, calyx-lobes 1.5 mm. long. Short-styled flowers: Staminal tube slightly shorter than the calyx, its opening subentire, stamens 3.2 mm. long, styles 1 mm. long, stigmas depressed-capitate. Long-styled flowers: Styles 3 mm. long. Drupe 7.5 mm. long, 3.5 mm. in diameter, ovate, terete, acute, empty locules scarcely conspicuous. Embryo 5.5 mm. long, 2 mm. wide, 1.5 mm. thick. (O. E. Schulz gives no additional data for the long-styled flowers and no specimen of this type was available.)

General distribution: Peru; Colombia.

Location not available: **José Celestino Mutis 2564; 2517; 2563.**

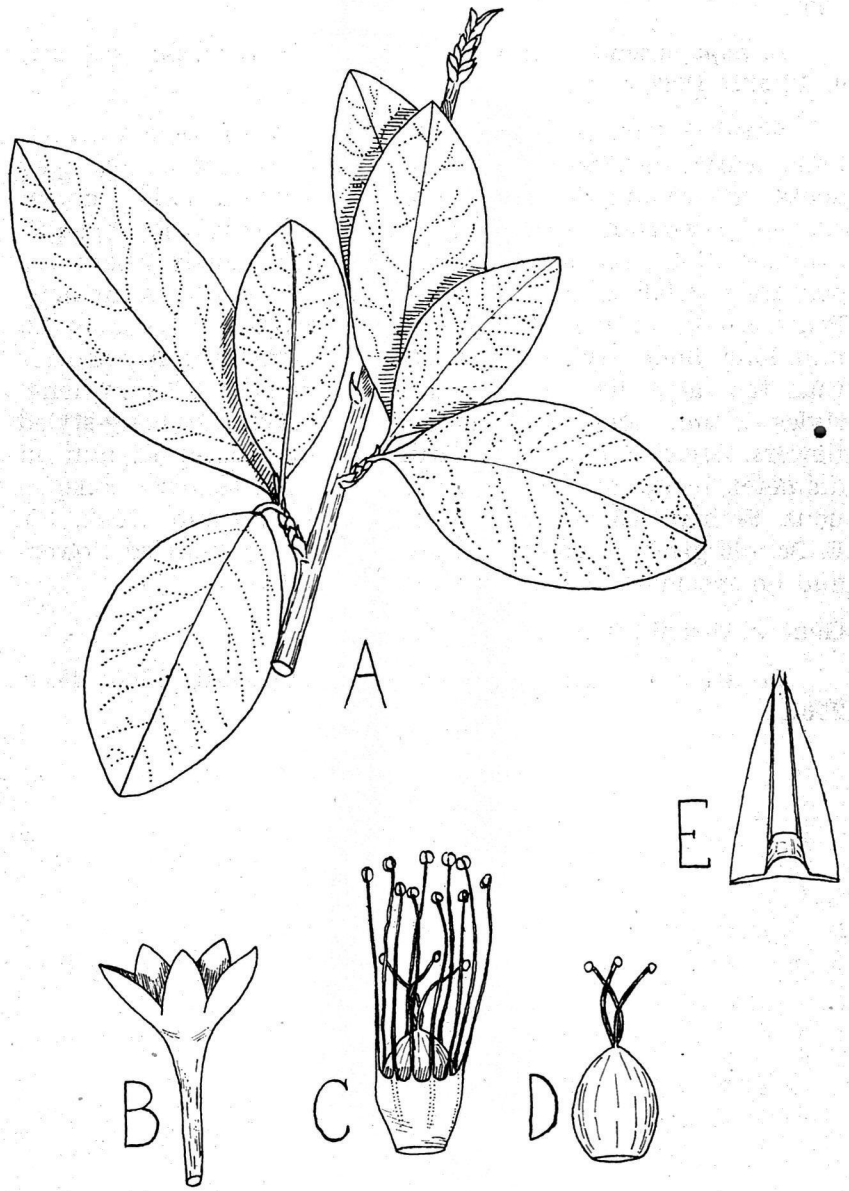

Fig. 57. 19. **E. havanense.** Habit x 1.6; others x 6.

19. **E. havanense** Jacq. Pl. Carib. 21. 1760.

Shrub or tree 1.2-6 m. tall. Cortex shiny grey, warty. Petiole 2.5-3 mm. long, leaves elliptic or subovate, base narrowly cuneate, apex acute or broadly so, rarely slightly emarginate, 25-77 mm. long, 15-36 mm. wide, dorsal surface grey-green, hardly shiny, ventral surface glaucous or ferruginous. Stipules 2-3 mm. long, apex acute, 2-setulose. Flowers 3-8 in axils of leaves or branchlets. Pedicels 4.5-6.5 mm. long. Calyx ¾ divided, calyx-lobes 1-1.5 mm. long, strongly lanceolate. Petals 3-3.5 mm. long. Short-styled flowers: Staminal tube shorter than the calyx, its opening subentire, stamens 4.5 mm. long, ovary subglobose, its apex truncate, styles 1.8 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens subequal, ca. 2.5 mm. long, styles 3.5 mm. long. Drupe 4.5-7 mm. long, 2.5-3.5 mm. in diameter, oblong-ovate, obtuse, slightly furrowed, subtrigonous, empty locules not conspicuous. Embryo 5-6 mm. long, nearly 1 mm. wide, 0.33 mm. thick.

General distribution: West Indies; Costa Rica; Venezuela; Colombia.

Magdalena: Molino, alt. 200 m., May 5, 1944, **Oscar Haught 4136.**

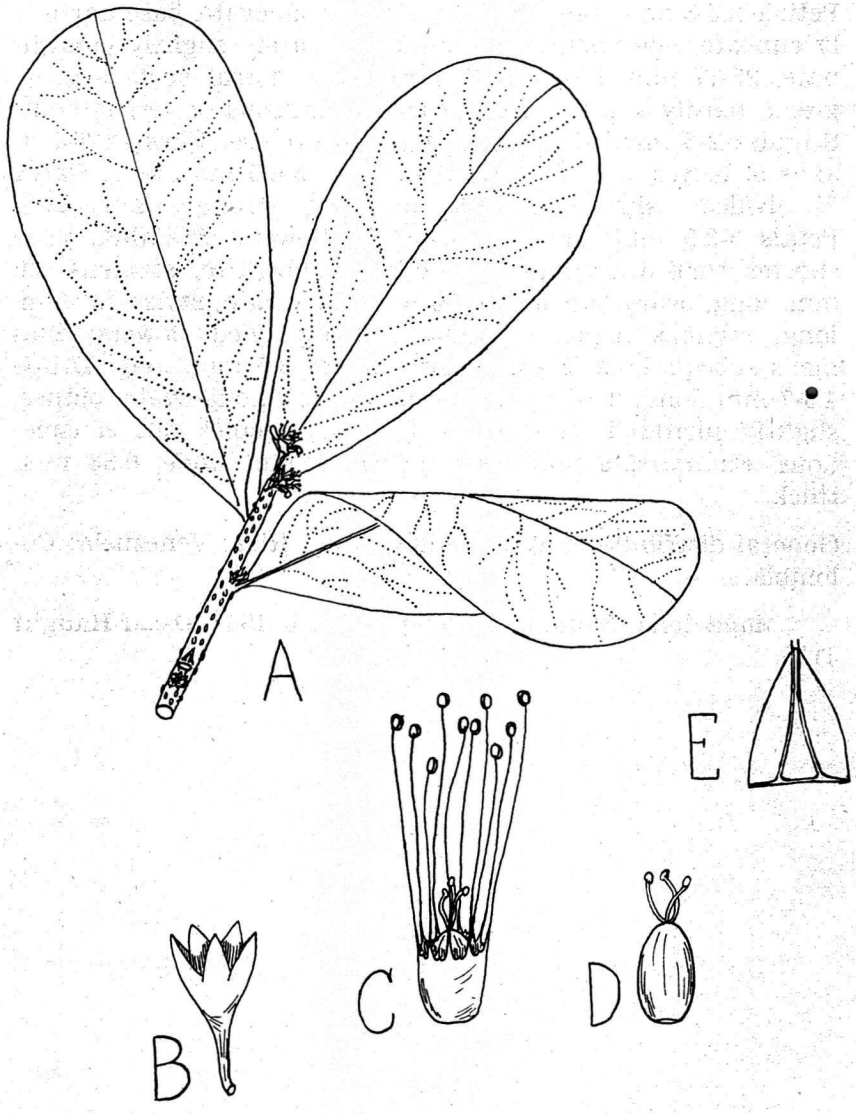

Fig. 56. 18. **E. cumanense.** Habit x 1.6; others x 6.

18. **E. cumanense** H. B. K. Nov. gen. 5:137. 1821.

Shrub. Cortex grey, warty. Petiole 1-2 mm., rarely 3 mm. long, leaves oblong-obovate, base narrowly cuneate, apex truncate or slightly emarginate-mucronate, 26-68 mm. long, 15-37 mm. wide, dorsal surface shiny, ventral surface glaucous or ferruginous, opaque. Stipules 1.5-2.5 mm. long, triangular, apex acute, 2-setulose. Flowers 3-5 in axils of leaves or branchlets Pedicels 2-6 mm. long. Calyx ¾ divided, calyx-lobes 1-1.5 mm. long, strongly lanceolate. Short-styled flowers: Staminal tube shorter than the calyx, its opening minutely 10-crenulate, stamens 4.5 mm. long, ovary oblong-elliptic, styles 1.8 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, ca., 2.5 mm. long, styles 3.5 mm. long. Drupe 5-8 mm. long, 3-4 mm. in diameter, oblong-ovate, obtuse, slightly furrowed, subtrigonous, empty locules not conspicuous. Embryo 5-6 mm. long, nearly 1 mm. wide, 0.33 mm. thick.

General distribution: Trinidad; French Guiana; British Guiana; Venezuela; Colombia.

Magdalena: Sabanilla, at the mouth of the Río Magdalena, alt. 30 m., March, 1898-1901, **Herbert H. Smith 1709.**

Cundinamarca: Near Honda, 1906; 1919, **Bro. Ariste-Joseph A444; A380.**

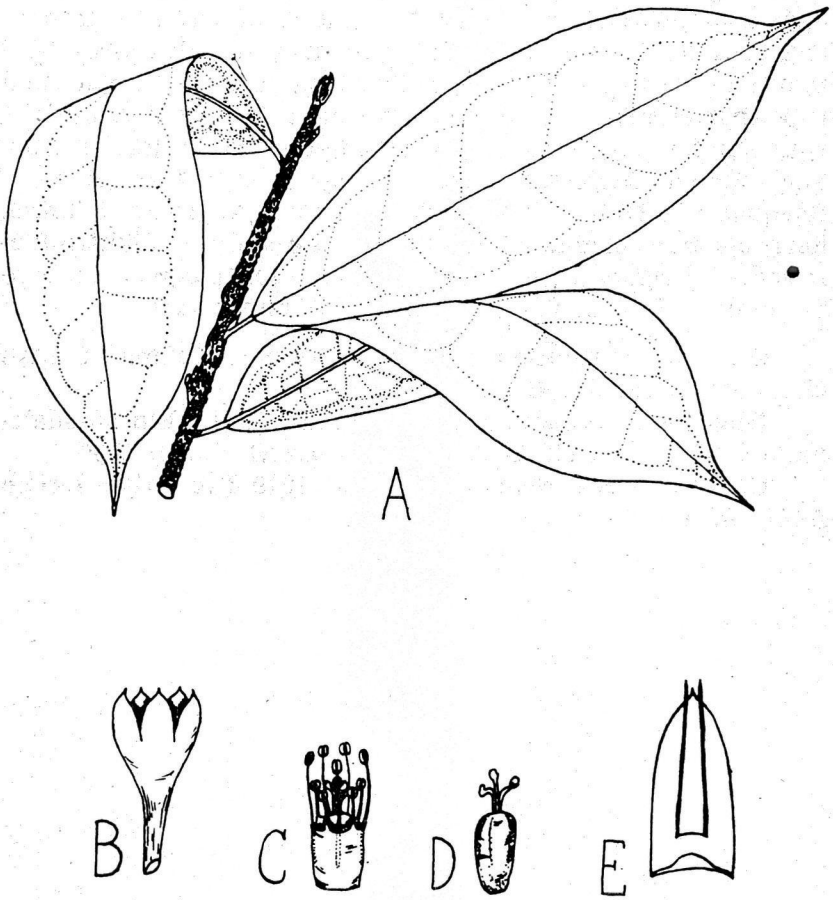

Fig. 55. 17. **E. acrobeles.** Habit x 0.6; others x 6.

18. **E. cumanense** H. B. K. Nov. gen. 5:137. 1821.

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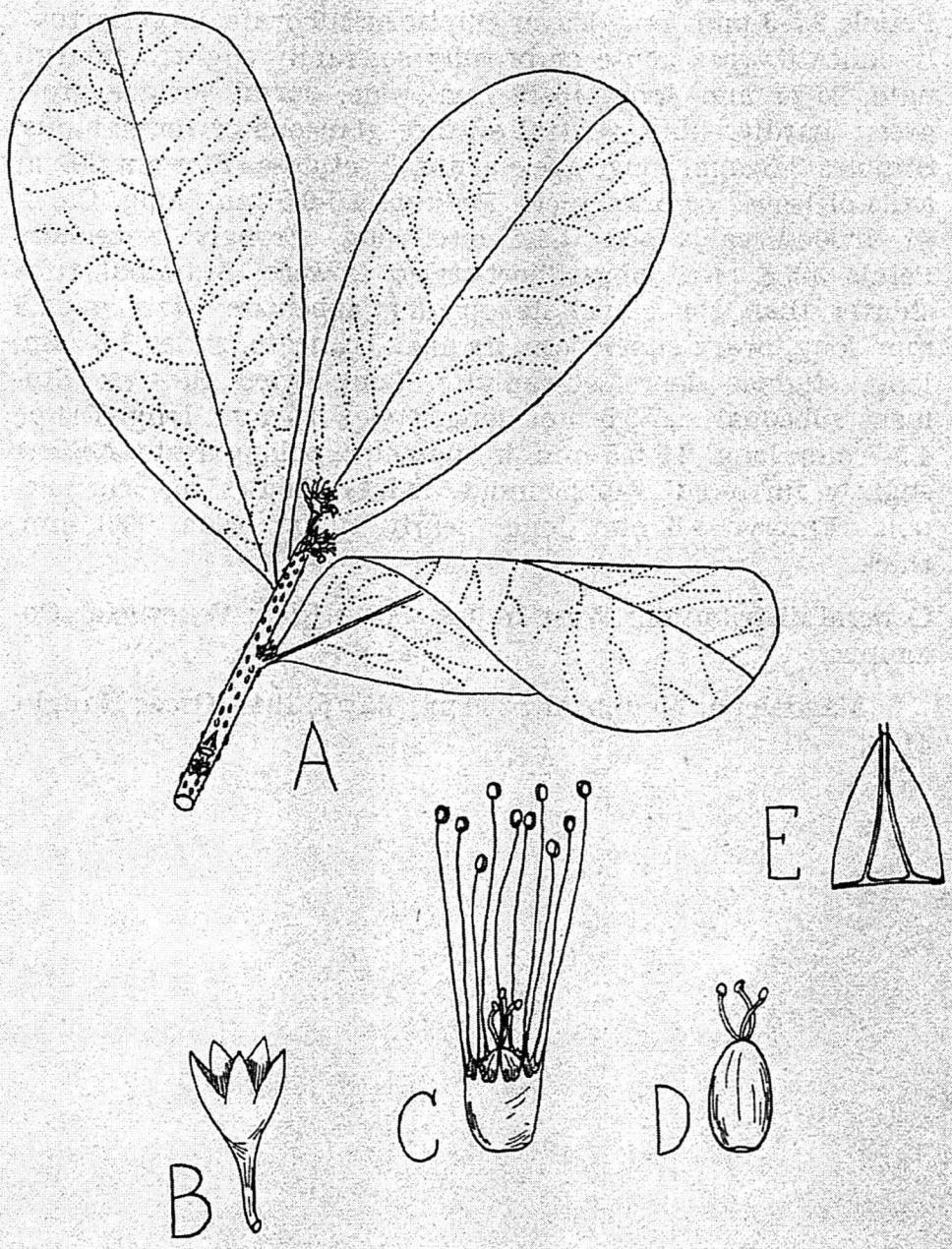

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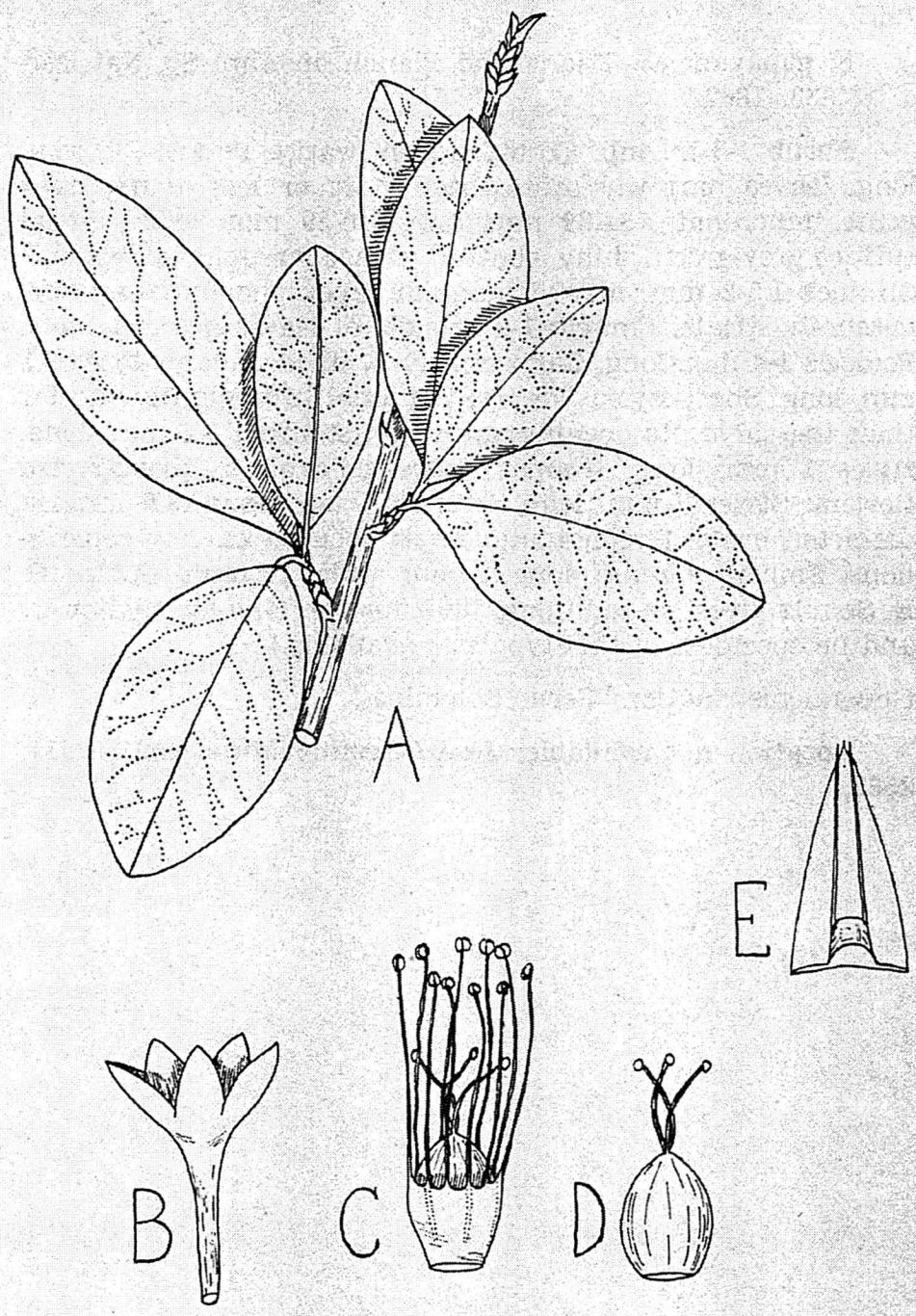

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General distribution: Peru; Colombia.

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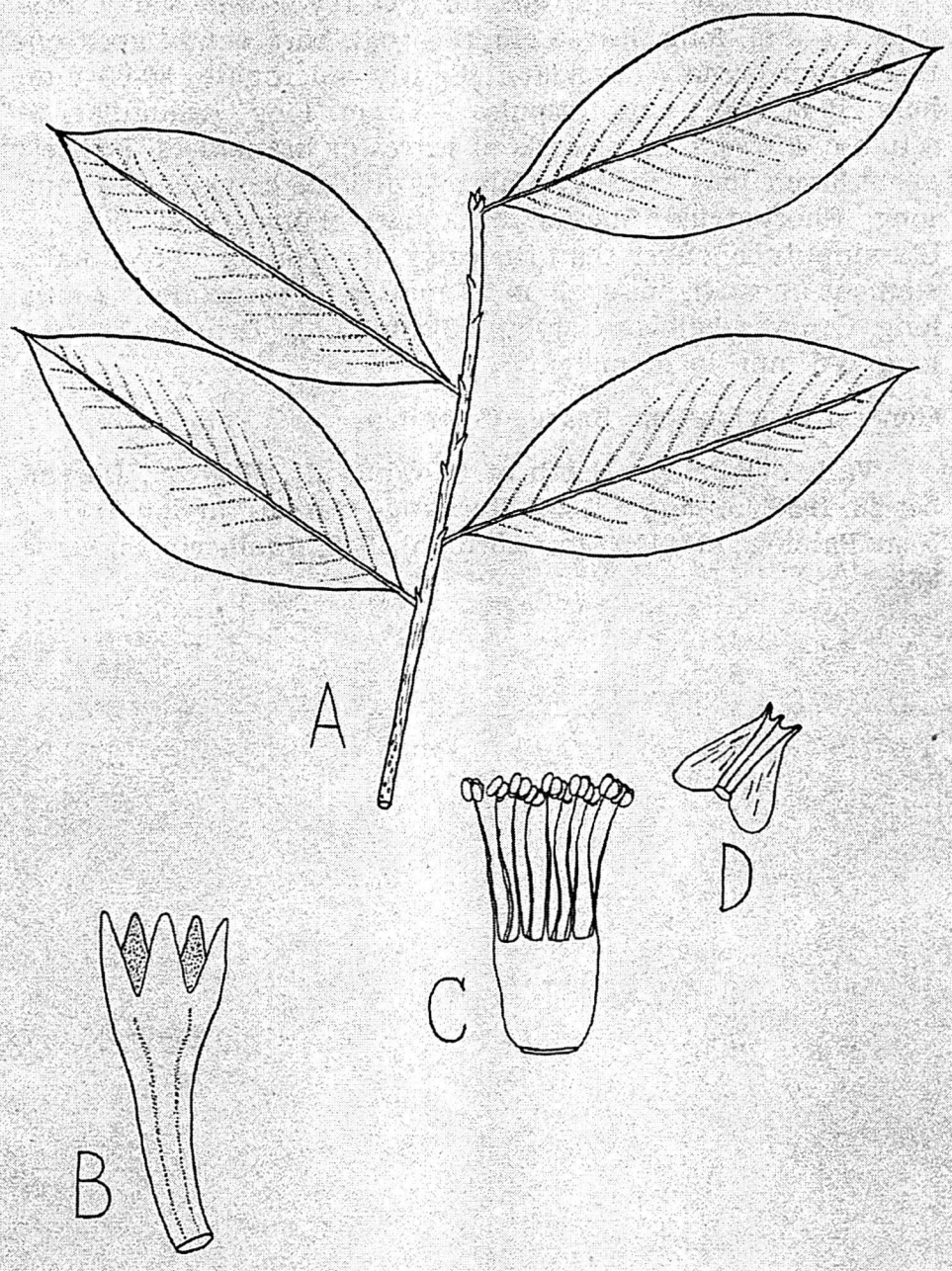

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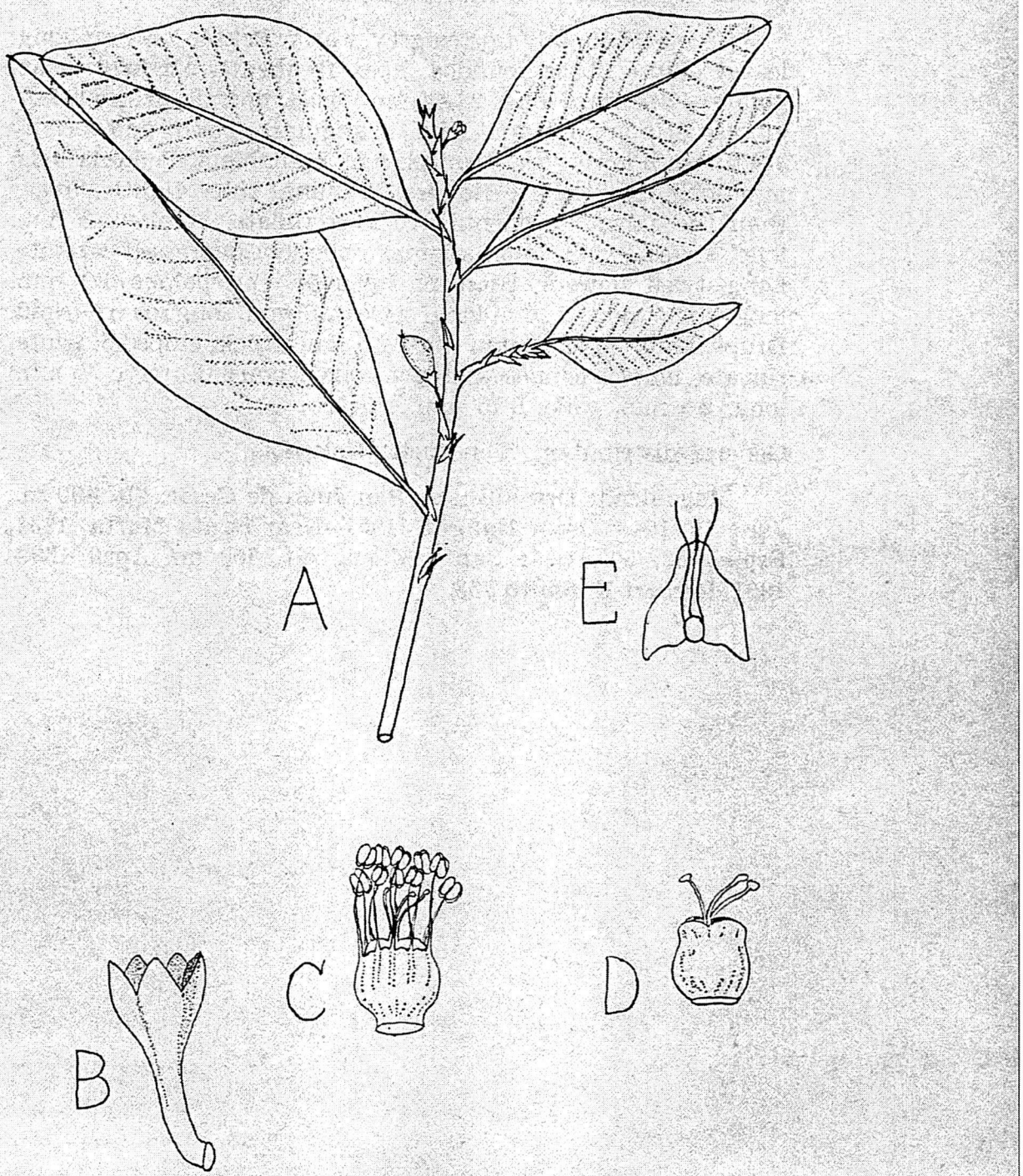

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Tree 5-6.5 m. tall. Cortex grey, warty. Petiole 2-5 mm. long, leaves elliptic, base rounded, apex frequently slightly emarginate, 47-80 mm. long, 23-44 mm. wide, dorsal surface ferruginous. Stipules 1-3 mm. long, triangular, apex round, briefly 3-setulose. Flowers ca. 3 in axils of branchlets. Pedicels 3-3.5 mm. long. Short-styled flowers: Staminal tube slightly longer than the calyx, its opening 10-20-crenulate, stamens 3 mm. long, styles 1 mm. long, stigmas obliquely depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1.2 mm. long, epipetalous 2 mm. long, styles 2.8 mm. long, ovary ovoid. Drupe 9 mm. long, 3 mm. wide, 2.5 mm. thick, ellipsoid, acute, sulcate, empty locules scarcely conspicuous. Embryo 7 mm. long, 2.5 mm. wide, 0.75 mm. thick.

General distribution: Venezuela; Colombia.

Magdalena: Dry hill near San Juan de Cesar, alt. 400 m., June 10, 1944, **Oscar Haught 4195**.—Near Santa Marta, 1931, **Espina 82**; 30.—Near Santa Marta, alt. 300 m., April 1898-1901, **Herbert H. Smith 788.**

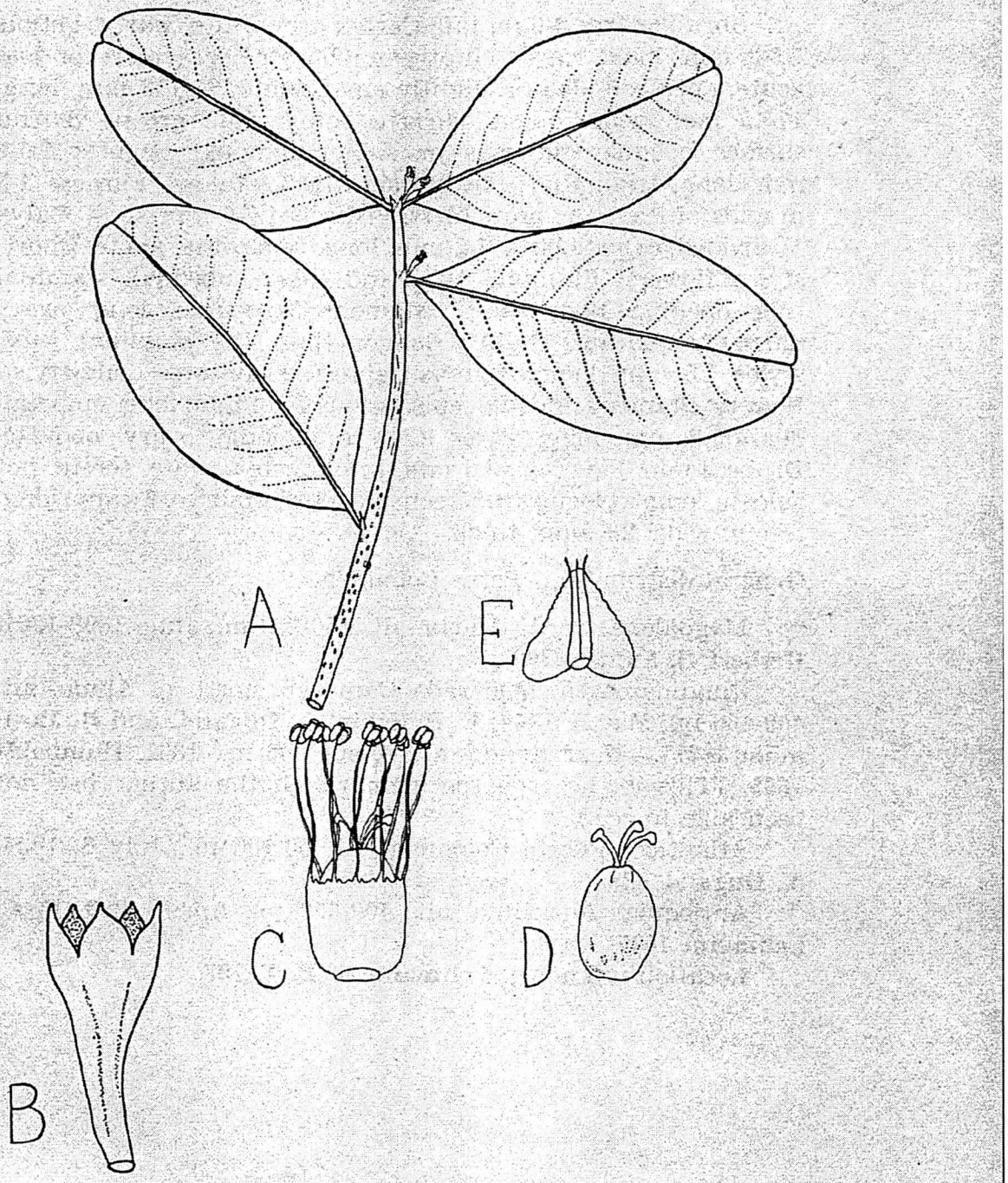

Fig. 60. 22. E. orinocense. Habit x 0.6; others x 6.

23. **E. hondense** H. B. K. Nov. Gen. 5:136. 1821.

Shrub or tree 3-6 m. tall. Cortex grey-white, warty. Petiole 1.5-3 mm. long, leaves elliptic or obovate, base more or less acute, apex rounded or slightly emarginate, 30-113 mm. long, 17-49 mm. wide, dorsal surface shiny, pale green, ventral surface opaque, glaucous or subferruginous. Stipules 1.5-2 mm. long, triangular, obtuse, shortly 3-setulose. Flowers 1-3 in axils of leaves or branchlets. Pedicels 1.5-6 mm. long. Calyx ½ divided, calyx-lobes 1-1.2 mm. long, semiovate, acute. Short-styled flowers: Staminal tube and calyx subequal, staminal tube opening 10-crenulate, stamens 3.5-4 mm. long, ovary narrowly obovate, slightly longer than the staminal tube, styles 1.5 mm. long, stigmas depressed-capitate. Long-styled flowers: Stamens unequal, episepalous 1-1.4 mm. long, epipetalous 1.5-2 mm. long, styles 2.5-3 mm. long, ovary obovate. Drupe 8 mm. long, ca., 3.5 mm. in diameter, ovate, terete, not sulcate, empty locules not conspicuous. Embryo 6 mm. long, 3 mm. wide, 2.5 mm. thick.

General distribution: Peru; Colombia.

Magdalena: Santa Marta, alt. 150-200 m., June 1898-1901, **Herbert H. Smith 2399.**

Cundinamarca: Quebrada Camargo, north of Apulo, alt. 460-480 m., May 5, 1944, **E. P. Killip, A. Dugand,** and **R. Jaramillo 38217.**—Near Honda, alt. about 300 m., 1801, **Humboldt 1695.** (This is the type specimen which the author has not been able to see.)

Atlántico: Puerto Colombia, alt. 50-100 m., July 8, 1934, **A. Dugand 628.**

Antioquia: Antioquia, alt. 400-600 m., April, 1889, **F. C. Lehmann 4637.**

Location unknown: **Lehmann Nº B. T. 798.**

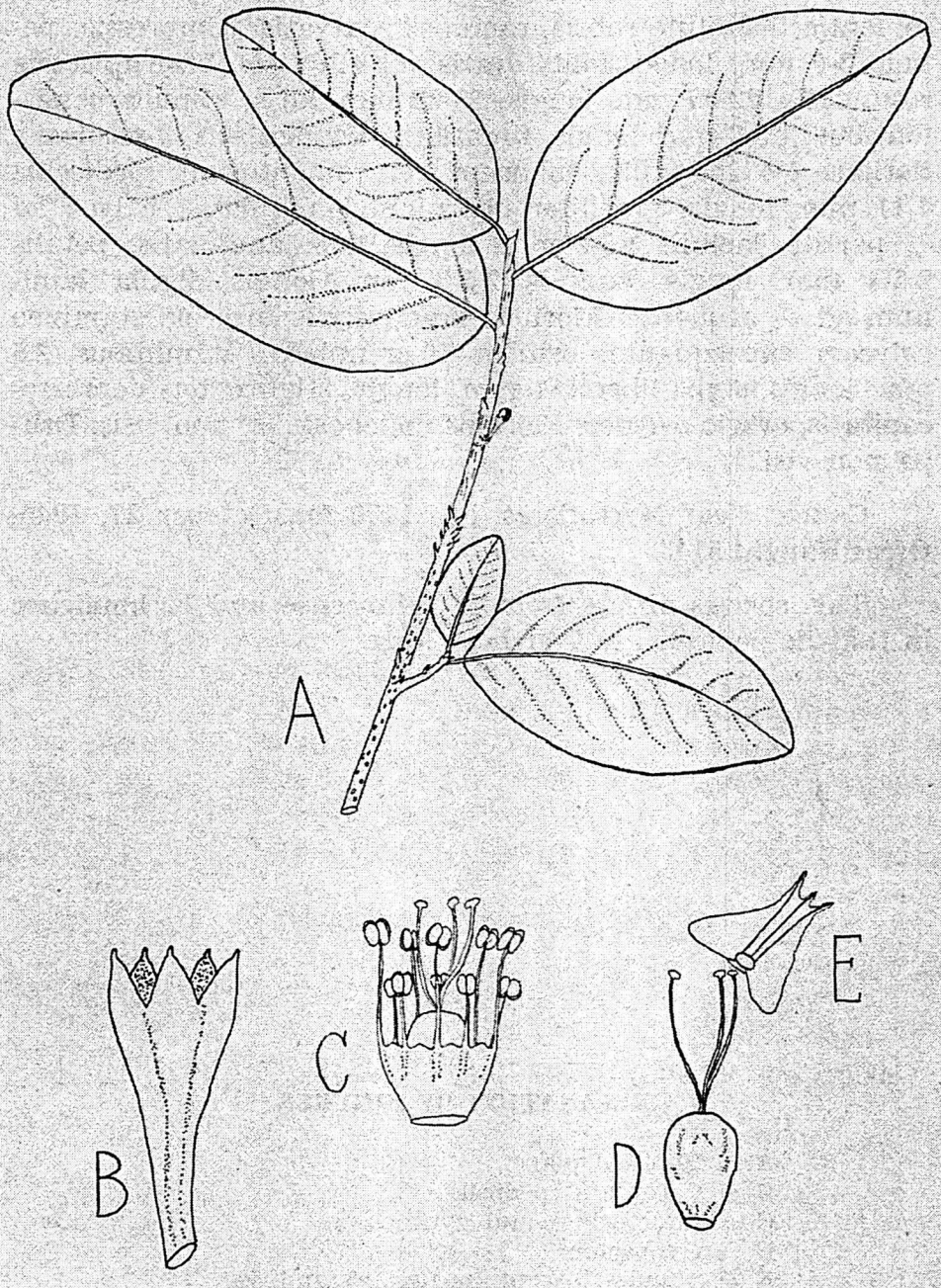

Fig. 61. 23. E. hondense. Habit x 0.6; others x 6.

24. **E. haughtii** Gentner, Journ. Wash. Acad. Sc. 47:6. 1957.

Frutex ultra 2 m. alta; cortice griseo-brunneo, verruculoso, lenticellis dilute rubris, ramulis recurvatis, compressis; petiolo 3-6 mm. longo, foliis ovatis vel ellipticis, basi apiceque rotundatis, 22-57 mm. longis, 23-32 mm. latis; stipulis persistentibus, 1.5-2 mm. longis, fimbriatis, triangulatis, 3-setulosis; floribus 1-4 in axillis foliorum vel ramentorum; pedicellis 7-11 mm. longis, graciliter obconicis, 5-angulatis; calyce ad ¾ partito, laciniis 1.5-2 mm. longis, late lanceolatis; petalis 2.5-3 mm. longis, laminis 2.5-3 mm. longis, ligula laminum ad ¾ aequante. Floribus brachystylis: urceolo stamineo calycem subaequante, orificio 10-crenulato; staminibus 2.5 mm. longis, stylis liberis, 1 mm. longis, stigmatibus depresso-capitatis, ovario ovoideo. Floribus dolichostylis: non visis. Drupa non visi.

Cauca: Near Mercaderes, alt. 1100 m., October 27, 1946, **Oscar Haught 5143.**

This species differs from **E. orinocense** and **E. hondense** in that its pedicels are 7-11 mm. long.

EXPLANATION OF FIGURES

A = Habit of plant.
B = Calyx and pedicel.
C = Androecium and gynoecium.
D = Gynoecium.
E = Stipules, except in figs. 53 and 54.
E in figs. 53 and 54 = section of drupe.
F in figs. 53 and 54 = stipules.

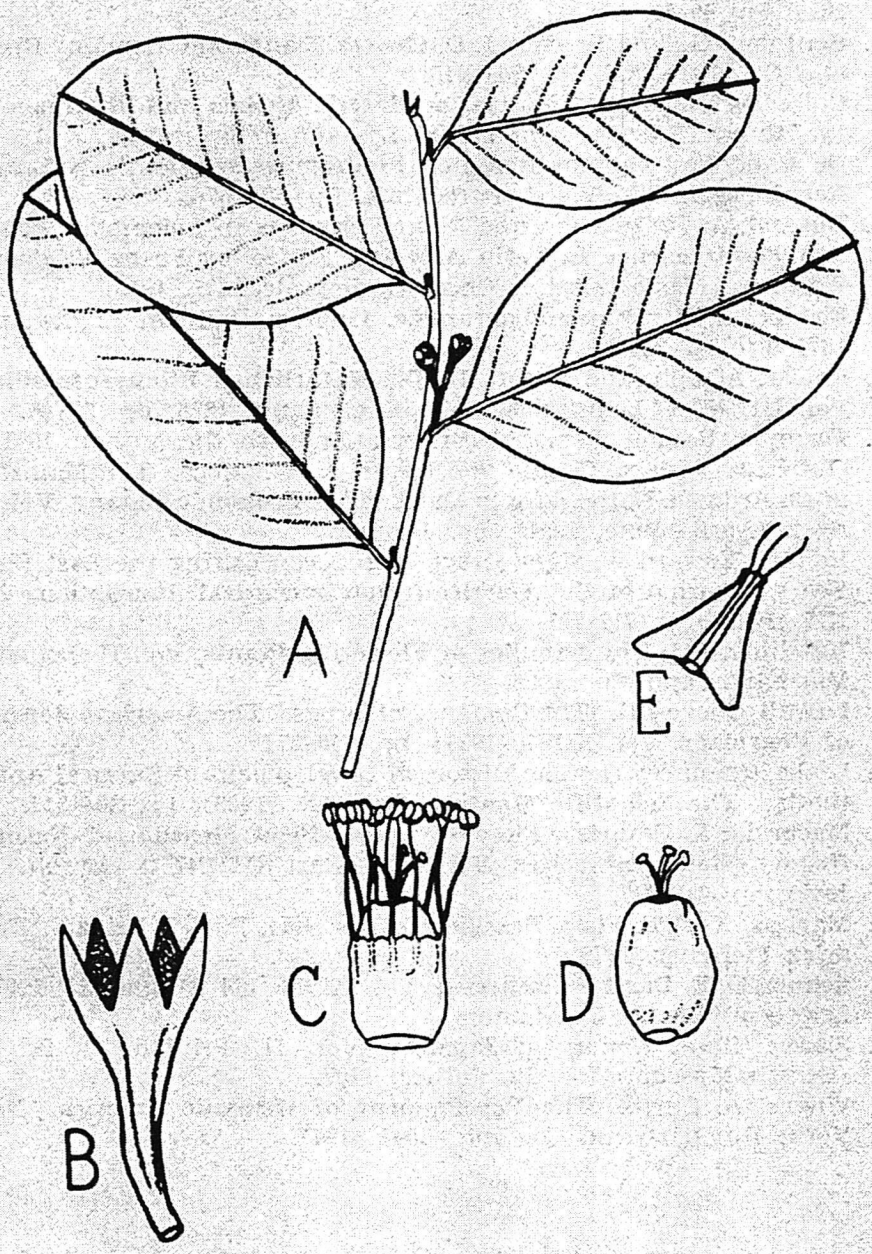

Fig. 62. 24. E. haughtii. Habit x 0.6; others x 6.

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RESUMEN

EL GENERO ERYTHROXYLUM EN COLOMBIA

Por **Walter A. Gentner.**

Tesis para optar en 1952 el grado de Magister en Artes, en la Universidad George Washington.

OBJETIVOS.

Se incluye una clave, seguida de una descripción detallada de cada especie. En mapas de Colombia se señalan, cuando están indicadas, las localidades de colección de las muestras.

OROGRAFIA Y CLIMA DE COLOMBIA.

Resumen que se omite, pues todos los colombianos están al tanto de las características de su territorio.

DISTRIBUCION.

La de las Erythroxyláceas es una familia pantropical, cuyas numerosas especies habitan los cuatro continentes que tienen áreas en la zona tropical. La mayor concentración de especies se halla en Sur América tropical y en las Antillas. Unas 40 especies se pueden encontrar en Africa y 3 en Australia. Algunas especies sobrepasan el Trópico de Cáncer en 3°N, hallándose en las Bahamas, mientras otras lo hacen en unos 10°S del Trópico de Capricornio, encontrándose en Uruguay.

Relativamente poco es lo que puede afirmarse sobre la distribución de esta familia en Colombia, debido a que las insuficientes colecciones botánicas hechas en ese país no permiten sacar conclusiones. En este trabajo se incluyen algunos mapas donde se señalan las localidades, cuando se conocen, en que han sido halladas varias especies en Colombia.

HISTORIA.

Como ocurre con otras familias botánicas, la historia de las Erythroxyláceas se centra alrededor de una sola especie cultivada, en este caso **Erythroxylum coca.**

Originalmente confinado a la cuenca amazónica y a los Andes, después de la conquista del imperio incaico, el conocimiento de la coca se dispersó en Europa y luego en todo el mundo. Con posterioridad se descubrieron las propiedades medicinales.

Aunque no se sabe cómo ocurrió, Gutiérrez Noriega y von Hagen creen que **E. coca** fue descubierta hace muchos siglos en la selva amazónica. Se puso de manifiesto que cuando se masticaban las hojas, en asocio con cal, sobrevenía una sensación agradable de ligereza y un aumento de la energía corporal. Se creó el hábito de cargar hojas para masticar en los viajes, con el objeto de atenuar la sensación del hambre. Este hábito se extendió del Amazonas a los Andes, alcanzando su máximo apogeo en el siglo XV entre los soberanos incas, que reserva-

ron el uso de la coca para las clases dirigentes y promovieron el cultivo de la planta. Se han hallado relictos de esta "planta divina", como se la empezó a considerar, en tumbas del siglo noveno antes de la era cristiana, en bolsas muy semejantes a las usadas hoy en día entre los indígenas, y también la llipta o sustancia calcárea asociada.

Después de la conquista española del imperio incaico en 1531, el hábito se expandió entre las clases populares, con una rapidez sorprendente.

De acuerdo con O.E. Schulz, la planta de la coca fue conocida en Europa al través del botánico francés Clusius, que tradujo al latín (1582) una "Historia de los Medicamentos Simples", del médico español Nicolás Monardes, escrita en 1580. Este a su vez, se basa en los informes del cronista Pedro Cieza de León, según el cual los indios masticaban continuamente durante el día unas hojas, sin tragarlas. Estas hojas servían como signo de cambio por telas, alimentos, sal y otros artículos.

J. F. Macbride dice que los especímenes botánicos fueron llevados inicialmente a Europa por el botánico José de Jussieu, quien había observado el uso diario de las hojas por los pueblos andinos.

LaWall anota que aparentemente los primeros comentadores no apreciaron las propiedades medicinales y estimulantes del componente principal de las hojas de la coca. Cita pasajes de José de Acosta, Markham y Cowley.

Según Holmes, Gaedeke en 1855 fue el primero que obtuvo un alcaloide cristalino de las hojas de **E. coca**, denominándolo erythroxylina.

De acuerdo con Leake, Alberto Neimann, en 1858 aisló cocaína a partir de las hojas de la coca, cuando trabajaba en el laboratorio de Friedrich Wohler; ambos describieron el entorpecimiento de la lengua causado por el alcaloide, pero no reconocieron el significado del hallazgo. Holmes dice que en 1865 W. Lossen examinó el alcaloide cristalino de la coca, y cambió el nombre de erythroxylina en cocaína.

Hacia 1876 las propiedades anestesiantes de la cocaína llamaron la atención, cuando el profesor Christison comprobó que ella posee el poder de excitar y corroborar las funciones vitales, y que su uso tiene una acción anestesiante, que atenúa las sensaciones de fatiga y de hambre.

Según Leake, la cocaína permaneció como una curiosidad médica por muchos años. En 1880 una comisión médica británica conceptuó que no tenía valor medicinal alguno, siendo cuando más un modesto sustituto de la cafeína. En el mismo año Von Anrep publicó un cuidadoso estudio farmacológico, en el cual se sugirieron las propiedades del alcaloide para la anestesia local.

El doctor Carl Koller notó el efecto de la cocaína para adormecer la lengua, y esto lo condujo a creer que sería el buen agente que andaba buscando en conexión con la anestesia ocular. Llevó a cabo experimentos en Viena con animales y con humanos, hasta que tuvo la convicción del hallazgo. Hizo su primer informe sobre esto a la Sociedad Alemana de Oftalmología de Heidelberg el 15 de septiem-

bre de 1884, y posteriormente publicó un artículo sobre lo mismo en el "Wiener Medizinisch Wochenschrift". Este último fue inmediatamente traducido y publicado en importantes publicaciones médicas donde quiera, y en un año el procedimiento del doctor Koller se usó en todo el mundo.

Con la introducción en 1853 de la jeringa hipodérmica por Alexander Wood, se facilitó el aprovechamiento de las propiedades anestésicas de la cocaína, pues sin aquél invento, la administración del alcaloide y de sus derivados habría sido más difícil.

Hacia 1885 el Dr. James L. Corning de Nueva York había hecho demostraciones de anestesia hipodérmica y espinal, con el uso de soluciones de cocaína.

Según Gutiérrez Noriega y von Hagen, los datos sobre consumo de coca y el hábito del cocainismo, son inquietantes. Bolivia produce cinco millones de libras de hojas anualmente, de las cuales consume cuatro y el resto se envía a la Argentina para trabajadores que van de los Andes a labores agrícolas. A veces tiene que importar del Perú. Tan importante es la coca como provento fiscal en Bolivia, que si la producción mermara, habría graves problemas económicos.

Perú, con una población de 7 millones de habitantes, tiene más de 3 millones de coqueros. Gutiérrez Noriega y von Hagen concluyen diciendo: "15.000.000 de suramericanos, principalmente indios y cholos, extendiéndose geográficamente sobre la mitad del subcontinente, desde Argentina hasta Colombia, son adictos a la hoja cocaínica".

En varias áreas andinas, el trabajo en los campos no puede hacerse si los indígenas no disponen de la hoja, que les enmascara la sensación de hambre y disminuye el cansancio. A veces se hace difícil la colección de muestras botánicas completas de la planta, pues todas las hojas producidas son cuidadosamente cosechadas para aprovecharlas.

Con frecuencia se propaga la coca por esquejes. Viene luego una descripción de la cosecha de las hojas y del secamiento para el expendio.

Se describe la manera de utilizar las hojas. Se calcula en unos 20 gramos de hoja por día el consumo de un coquero. Se estima en 86% el total de alcaloides extraídos y absorbidos por período de masticación en los Andes.

TAXONOMIA.

Siguen datos históricos sobre el género **Erythroxylum,** desde el punto de vista de la descripción botánica y del estatus taxonómico. 193 especies componían el género en 1907 cuando O. E. Schulz publicó una monografía. Desde entonces se han propuesto 51 especies y variedades más; sin embargo, desde 1907 no ha habido un nuevo tratamiento del género en su totalidad.

NOMENCLATURA.

Se concluye que el correcto deletreo no es **Erythroxylon,** como ha sido usado por varios autores, sino **Erythroxylum.**

METODOS.

Como el estudio se basó exclusivamente en ejemplares de herbario, para hacerlo más cuidadoso, las estípulas y flores, cuando se pudieron obtener, fueron ablandadas con un detergente caliente, para provocar tumefacción, y revelar mejor la forma y tamaño de las partes.

BIBLIOTECAS Y FUENTES.

Se consultaron los herbarios Nacional de los Estados Unidos, el Herbario de Gray y el del Museo de Historia Natural de Chicago.

Las consultas se hicieron en las bibliotecas de la Universidad George Washington, del Instituto Smithsoniano, del Departamento de Agricultura y la del Congreso.

Las fotografías de **E. coca** fueron suministradas por los doctores A. C. Smith y C. Vargas C..

ESTRUCTURA FLORAL Y ORGANOS VEGETATIVOS.

Se dan precisiones anatómicas sobre estos aspectos.

CLAVE DE LAS ESPECIES DE ERYTHROXYLUM EN COLOMBIA

A. Estípulas claramente estriadas longitudinalmente.
  B. Estípulas 2-ciliadas.
    C. Estípulas 2.5-3 mm. de largo. **E. popayanense** (1)
    C. Estípulas 8-14 mm. de largo. **E. lucidum** (2)
  B. Estípulas 3-ciliadas.
    D. Hojas por lo menos tres veces más largas que anchas. **E. citrifolium** (3)
    D. Hojas menos de tres veces más largas que anchas.
      E. Apices de las hojas truncado o redondeado. **E. testaceum** (4)
      E. Apice de las hojas acuminado u obtuso-cuspidado.
        F. Sépalos valvados en el capullo; hojas oblongo-elípticas; lóbulos calicinales 2-4,5 mm. de largo.
          G. Lóbulos calicinales 3.5-4 mm. largo; pecíolo 7-12 mm. largo; drupa 8-8.5 mm. larga. **E. macrophyllum** (5)
          G. Lóbulos calicinales 2-3 mm. largo; pecíolo 5-9 mm. largo, drupa 7 mm. larga. **E. floribundum** (6)
        F. Sépalos imbricados en el capullo; hojas ligeramente obovadas; lóbulos calicinales 1-2 mm. de largo. **E. amazonicum** (7)

A. Estípulas no estriadas (oscuramente estriadas en **E. ulei**).
  H. Envés de las hojas con dos líneas longitudinales muy conspicuas.
    I. Hojas 116-157 mm. de largo.
      J. Hojas lanceoladas con ápice acuminado; tubo estaminal subíntegro. **E. cuatrecasasasii** (8)

J. Hojas oblongo-elípticas con ápice generalmente agudo, raramente súbitamente acuminado; tubo estaminal 10-crenulado. **E. gracilipes** (9)

I. Hojas 25-97 mm. de largo.
K. Apice foliar agudo o acuminado.
L. Hojas oblongo-elípticas, 14-32 mm. de ancho. **E. acutum** (10)

L. Hojas lanceoladas, 21-44 mm. de ancho. **E. cuatrecasasasii** (8)

K. Apice foliar obtuso, redondeado o emarginado, a menudo apiculado, nunca agudo o acuminado.
M. Ramillas últimas en forma de espina.
N. Ramillas últimas de 3-7 mm. diámetro en la base; tubo estaminal subíntegro. **E. rigidulum** (11)

N. Ramillas últimas de 1-2.5 mm. diámetro en la base; tubo estaminal 10-crenulado. **E. carthagenense** (12)

M. Ramillas últimas alargadas, no espinosas.
O. Pedicelo 1 mm. largo. **E. densum** (13)

O. Pedicelo 1.5-7.5 mm. largo.
P. Tubo estaminal subíntegro; endosperma cuadrangular.
Q. Estípulas 2-ciliadas; peciolo 1.5-2.5 mm.; lóbulos calicinales 0.75 mm. de largo; drupa 3-3.5 mm. diámetro. **E. cataractarum** (14)

Q. Estípulas sin cilios; peciolo 3-6 mm.; lóbulos calicinales 1-2 mm. de largo; drupa 4.4-6.5 mm. diámetro. **E. novogranatense** (15)

P. Tubo estaminal 10-crenulado; endosperma triangular; estípulas brevemente 2-ciliadas; peciolo 2-5 mm.; lóbulos calicinales 1 mm. de largo; drupa 3.5-4 mm. diámetro. **E. coca** (16)

H. Envés de las hojas sin las dos líneas longitudinales.
R. Estípulas 2-ciliadas.
S. Hojas 72-173 mm. de largo, 26-60 mm. de ancho, cuspidadas, mucronadas. **E. acrobeles** (17)

S. Hojas 25-75 mm. de largo, 15-37 mm. de ancho, truncadas, emarginadas, agudas o subagudas, nunca cuspidadas.
T. Tubo estaminal menudamente 10-crenulado; ápice del ovario redondeado o subtruncado. **E. cumanense** (18)

T. Tubo estaminal subíntegro; ápice del ovario agudo. **E. havanense** (19)

R. Estípulas 3-ciliadas.
U. Apice foliar agudo, obtuso o anchamente cuspidado.
V. Apice foliar generalmente agudo; tubo estaminal sub-

íntegro; estípulas 1.5-2 mm. de largo, débilmente estriadas longitudinalmente. **E. ulei** (20)

V. Apice foliar generalmente obtuso o hasta anchamente cuspidado: tubo estaminal 10-crenulado; estípulas 2-3 mm. de largo. **E. venosum** (21)

U. Apice foliar redondeado o emarginado.

W. Pedicelos 1.5-6 mm. de largo.

X. Cáliz hendido en ¾; ovario ovoide; tubo estaminal 10-20 crenulado; pecíolo 2-5 mm. largo. **E. orinocense** (22)

X. Cáliz hendido hasta la mitad, ovario obovoide; tubo estaminal 10-crenulado; pecíolo 1.5-3 mm. largo. **E. hondense** (23)

W. Pedicelos 7-11 mm. de largo; cáliz hendido en ¾; ovario ovoideo; tubo estaminal 10-crenulado; pecíolo 3-6 mm. largo. **E. haughtii** (24)

Termina el trabajo con la descripción de las 24 especies enumeradas, indicándose las localidades de colección y los nombres de los colectores.

Nota. En la tesis original (1952) figuraron como especies nuevas las números 8, 10, 17 y 24 (descripciones en latín), que al ser publicadas en 1957 perdieron aquel carácter. — **V. M. Patiño.**