

# ECONOMIC FRUIT-BEARING PLANTS OF ECUADOR

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## INTRODUCTION.

With a fertile coastal plain lying exactly under the Equator, with cool, semiarid highland valleys and plains whose climate is subtropical in character, and with moist cultivated slopes scarcely below the snow line, Ecuador is enabled to grow an extremely wide range of fruits. Although these advantages have scarcely been exploited commercially as yet, a large number of exotic fruit-bearing plants have become established in the Republic, and there are numerous indigenous species of economic importance.

Upon the littoral are to be found the cosmopolitan fruits of the Tropics, such as the mango, the orange, and the banana. In addition to these, a number of Asiatic species, including the mangosteen, the lychee, and the breadfruit, have been planted in the vicinity of Guayaquil, where they have proved altogether successful.

In the fertile highland valleys, and on the plateaus of moderate elevation,—those of Cuenca, Ambato, Quito, and Ibarra, for example—the apple, peach, pear, and other fruits of the Temperate Zone are abundantly cultivated. Alongside them are to be seen such native species as the chirimoya (*Annona cherimola*), the mora de Castilla or Andes berry (*Rubus glaucus*), and the chamburo (*Carica candamarcensis*).

Toward the upper limit of cultivation, on the cold bleak *páramos* or rolling plains, where drizzling rains fall nearly every day in the year, the mortiño or Andean blueberry (*Vaccinium floribundum*) grows in great profusion, while several wild blackberries and raspberries, the tacsos (*Passiflora* spp.), and other native plants yield fruits of interest and value. Many of these Andean fruits are unfamiliar to horticulturists of other regions and several of them have not even received botanical attention. Two species of *Carica* included in the present paper, both cultivated in the highlands of Ecuador, were named and described by the Swedish botanist Heilborn in 1921, while one *Passiflora*, two species of *Disterigma*, and two of *Macleania* have been named from material collected during the course

of the investigations that have furnished the data for the present paper. Of the genus *Inga*, and of numerous other genera, there are interesting species in Ecuador that have yet to be studied and described.

It will readily be seen, therefore, that much remains to be learned on the subject of Ecuadorian fruits. Little has been published in past years. The well-known work of Teodoro Wolf, *Ecuador*, contains interesting notes, gathered at first hand, concerning a number of species, but very few details are included. The classic and delightful work of Father Juan de Velasco, *Historia del Reino de Quito*, written in 1789, is replete with interesting accounts of Ecuadorian plants and animals; yet it can not be considered of great practical value at the present day. Luis Cordero, one time President of the Republic and a devoted student of horticulture, has brought together many interesting facts concerning the fruits of the Cuenca region in his *Enumeración de Plantas*, published in 1911. The work, unfortunately, is not botanically sound.

It is hoped that the present paper will serve to place on record more facts concerning Ecuadorian fruits than have been brought together elsewhere. The data herein set forth were collected during an eight months' exploration of the Republic, conducted on behalf of the United States Department of Agriculture with the object of determining in what manner a mutually beneficial exchange of seeds and plants might be established between the United States and Ecuador. In the course of this work numerous overland trips were made, and the inter-Andean region from the Colombian frontier to that of Peru was examined carefully. A journey was made along the coast, from Esmeraldas southward to Machala, followed by a trip from the latter point to Loja. Unfortunately, it was not possible to visit the vast plains and forests of eastern Ecuador—the region known as El Oriente; but in view of the fact that this part of the Republic is inhabited only by a few Indians, and that it is known to contain relatively few useful fruits that are not found elsewhere, the omission may not be so important as might at first appear. A sojourn of 10 days in the vicinity of Baños, on the Pastaza River in Tungurahua Province, furnished an opportunity to obtain a few data on this little-known region.

Except in those instances in which the identity of the species was beyond question, the botanical names herein used are based upon herbarium material collected at the time the notes on the geographical distribution, common names, and uses of the fruits were made. It should be remembered, of course, that a single common name may be applied, in different regions, to several plants quite distinct botanically. The confusion in the use of the names *chamburo* and *chil-*

*huacán* for species of *Carica* is noteworthy. In order to eliminate as far as possible, the danger of drawing incorrect inferences, an effort has been made to show the precise region in which a given name is applied to a given species.

It is not to be assumed that the species discussed in this paper are cultivated or found growing wild only in the regions mentioned under each heading. On the contrary, most of them occur in numerous other parts of the country, but for purposes of accuracy it has seemed best to list only those places in which the species under consideration were actually seen. Stress may well be placed upon the importance of observing the elevation at which species grow in a country such as Ecuador. Altitude plays so important a part in controlling climate throughout the Tropics that the first thing to be noted concerning any plant is its altitudinal range.

I am indebted to Sidney F. Blake and Donald C. Peattie of the Bureau of Plant Industry for determining the specimens collected in Ecuador. I also wish to express my hearty appreciation of many courtesies received at the hands of Hon. Charles S. Hartman, formerly American minister at Quito and Dr. F. W. Goding, American consul general at Guayaquil, and my thanks to Prof. Abelardo Pachano, of Ambato, and Sr. José Felix Tamayo, of Ibarra, for much assistance in gathering data on Ecuadorian fruits.

### PHOENICACEAE.

#### *Cocos nucifera* L.

*Coco*; along the coast, and toward the interior, up to elevations of about 1,500 meters, occasionally 1,800 meters. Above the latter elevation it is rarely seen.

Although the coconut is abundant along the Ecuadorian littoral, few commercial plantings have been made. The largest grove is probably that belonging to the heirs of Alejandro Ganto, near Bahía de Caraquez.

#### *Jubaea chilensis* (Molina) Baill.

*Jubaea spectabilis* H. B. K.

*Coco de Chile* at Ambato, where it occurs only in a very few gardens; *coco chileno* at Otavalo, where there are two fine specimens. The latter name, as well as *coquito de Chile*, is used at Loja, where there are a number of plants, the fruits being sometimes sold in the market.

This palm has a very stout trunk and stiff pinnate leaves 3 to 4.5 meters in length. The fruit, which is produced in large racemes, is top-shaped, about 4 cm. long, and deep yellow. The kernel is eaten.

This species, which has probably been introduced into Ecuador from Chile, is seen only in the highlands. It is not abundantly cultivated.

#### *Guilielma speciosa* Mart.

*Chontaduro* (correctly *chontaruru*) on both the eastern and western slopes of the Andes, below elevations of 1,200 meters, extending down onto the coastal plain. It is said to occur in great abundance along the Río Cayapas, in northwestern Ecuador, and in the eastern part of the Republic, popularly known as the Oriente.

This valuable food plant has been much used by the Indians of northern South America since pre-Columbian times. It is a handsome tree, the slender trunk reach-

ing an ultimate height of about 12 meters, effectively armed with long black spines. The leaves are pinnate, very graceful in appearance, and 2.5 to 3.5 meters in length. The fruits, which are borne in racemes containing in some instances as many as 2,000, are top-shaped, 3 to 5 cm. long, and orange brown in color; they have deep yellow, farinaceous flesh, in which is embedded the single bony seed. To render them palatable they must be boiled, after which they have the flavor and consistency of roasted chestnuts.

This species is very close to *G. utilis* Oerst., the *pejibaye* of Costa Rica, if, indeed, further study does not show them to be identical.

## BROMELIACEAE.

### *Ananas sativus* Schult. f.

*Piña* in all parts of Ecuador; commonly cultivated from sea level up to elevations of 1,800 meters, and marketed in all the principal towns of the country.

The pineapples of Guayaquil are famous for their exquisite flavor. They are produced mainly in the vicinity of Milagro, some 30 kilometers east of the port, and are of a variety that appears either to be Smooth Cayenne or very close to it. The commercial cultivation of this variety is rather important and capable of great extension, although for exporting to Peru and Chile (which is at present the ambition of cultivators) a pineapple with better shipping qualities would be preferable.

There are, in various parts of the country, several varieties of this fruit, but no other is equal to the Guayaquil pineapple in quality. The worthy Padre Juan de Velasco, writing in 1789, said: "There are two varieties, one with yellow flesh and little juice, the other, called *cambray*, white, and much more delicate; but both are of equal fragrance and sweetness." Probably his *cambray* is the variety now grown at Milagro, but no longer known by that name, the name *cambray* being now applied to a rather uncommon form, with large fruits, and yellowish flesh of very fair quality, not so sweet as the Guayaquil variety (to use a name not locally applied, but one by which this pineapple has become more or less known in other countries).

The pineapples of northern Ecuador, e. g. the Chota Valley, are small, oblong, with yellow flesh of sweet and pleasant flavor but of woody texture. Occasionally the Guayaquil variety is seen in that part of the country, where it is known as *piña de leche*. At elevations of 2,100 meters in the Province of Imbabura the latter variety does not become sweet, as at Guayaquil, and is in fact inferior in quality to the small yellow pineapple. This yellow pineapple is rather common in the lower regions of the Sierra, between elevations of 1,500 and 2,300 meters.

## MUSACEAE.

### *Musa paradisiaca* L.

*Plátano* throughout the Republic. Cultivated in the coastal lowlands, and thence upward to altitudes of about 2,100 meters.

The plantain is one of the principal food plants of the lowlands, and is abundant in the markets of nearly all the highland towns, being carried to them from nearby regions of lower elevation. The historian Gonzales Suárez asserts, without saying on what grounds, that this was one of the food plants of the pre-Columbian inhabitants of Ecuador.

### *Musa paradisiaca sapientum* (L.) Kuntze.

*Guineo* and *banano* throughout the country. Cultivated extensively in the Province of Guayas, whence the fruit is exported to Peru and Chile. Elsewhere it is grown for local consumption, and for near-by markets. The upper limit of its cultivation is about 2,300 meters.

Numerous varieties of the banana are cultivated in Ecuador. Those known as *seda*, *morado*, and *de oro* are among the commonest. No study has been made of these, to determine their relationships with the varieties of other countries. As in other parts of tropical America, the banana is one of the important food plants in regions of low or moderate elevation, and it is carried in considerable quantities from the coast to the markets of Quito.

### JUGLANDACEAE.

**Juglans honorei** Dode.

PLATE 34.

*Tocte*, applied to the fruit, and sometimes to the tree; the latter is also called *nogal*. Found at altitudes between 1,800 and 3,000 meters; abundantly grown in nearly every highland town.

Luis Cordero says of this tree in the Azuay and Cañar, "It is most useful, since it furnishes, aside from its graceful fruit and its fine, solid, and beautiful wood, a tonic of probable efficacy, made by boiling the leaves." The plant is much used by the Indians of Imbabura in the preparation of dyes. It is very abundant at Ambato, but can scarcely be termed a cultivated species in this region, since it is not generally planted in gardens, being allowed to grow up about the edges of fields and *huer-tas*. The nuts are 2.5 to 4 cm. in diameter, with a very thick, bony shell, deeply corrugated on the surface, and a kernel of rich and pleasant flavor. Recently the species has been cultivated at Ambato as a stock plant on which to graft *Juglans regia*.

At Ibarra the tree is very abundant, and the nuts are commonly sold in the market. They are used to prepare a famous sweetmeat, the *nogada* of Ibarra, made from brown or white sugar, milk, and walnut meats. At Otavalo the tree is abundant, as also in the southern part of Ecuador at Loja and Cuenca.

**Juglans regia** L.

*Nuez* (the tree, *nogal*) at Ambato, where it is cultivated commercially on a small scale. There are a few trees at Otavalo and Ibarra, in Imbabura Province, and a few in the southern Provinces of Azuay and Cañar.

This, the English walnut of other countries, or more correctly the Persian walnut, is grown successfully at Ambato. Most of the trees are seedlings, and their fruit is rather small, though of excellent quality. The introduction of choice varieties is to be desired.

At Ambato there are two trees that appear to be hybrids between this species and the indigenous black walnut (*J. honorei*). One is found in the town itself, the other at La Viña, a few miles from Ambato on the railroad to Pelileo. The one at La Viña is a large and very handsome tree, more than double the size of *J. regia*, as the latter grows in Ecuador. Both produce nuts which appear to be intermediate in character between those of the two supposed parent species.

### MORACEAE.

**Morus nigra** L.

*Mora* in all the provinces of the Sierra, from Imbabura to Loja, where it is occasionally cultivated. The leaves are ovate, acuminate, and serrate, 10 to 15 cm. long. The fruit is sometimes sold in the market of Ambato, but in general is not much used in Ecuador.

This is the common black mulberry of southern Europe, introduced by the Spaniards into numerous parts of tropical America.

**Artocarpus communis** Forst.

*Árbol de pan* (the tree) and *fruta de pan* (the fruit), on the coast. It is grown principally in the Province of Guayas, and even here does not become a product of much commercial importance. It has been planted in a few of the warmer inter-Andean valleys.

The breadfruit tree is one of the handsomest to be seen within the Tropics, and for this reason it is often planted for ornamental purposes. It attains 12 to 15 meters in height; its glossy, deep green leaves are entire toward the base, three to nine-lobed toward the upper end, and often 30 cm. in length. The staminate flowers grow in dense, yellow, club-shaped catkins; the pistillate, which are borne upon the same tree, are grouped together to form a large prickly head upon a spongy receptacle. The ripe fruit, which is composed of the matured ovaries of the pistillate flowers, is round or oval in form, commonly 10 to 20 cm. in length, greenish brown at maturity or at times almost yellow. The pulp is somewhat fibrous, yellowish white in the fully ripe fruit, and starchy in character. It is cooked before being eaten.

The best varieties of the breadfruit are seedless, and can be propagated only by cuttings or suckers. The tree is a native of the Malayan Archipelago, and was introduced into the tropical regions of America by the British Government in 1792.

#### *Ficus carica* L.

*Higo* and *breva*, the latter name being applied to fruits of the first crop, the former to those of the second or main crop, throughout the highlands, where it is cultivated at Ibarra, Otavalo, Quito, Ambato, Cuenca, Loja, and elsewhere. It is very successful as a fruit-bearing tree, and its cultivation might profitably be extended, in certain regions, to place it upon a commercial basis. There are as yet no commercial plantations in Ecuador.

Two sorts of figs, both doubtless brought from Spain in colonial days, are cultivated in Ecuador: one is black fruited, the other white or, properly, green. There is much confusion in regard to the application of the names *higo* and *breva*. By some Ecuadorians the largest fruits of the black fig are called *brevas*, and all others *higos*. Properly speaking, there are *higos* and *brevas* of both varieties, the name depending only upon the time of ripening. Luis Cordero says: "The fig \* \* \* grows and fruits well in protected sections of both provinces (Azuay and Cañar), especially in Gualaceo and Paute. The earliest fruits are called *brevas*, because of the promptness of their ripening; the later and smaller ones are properly called *higos*. The green variety, which is called 'higo blanco', was brought from the north only a short time ago. It is cultivated with success, and is highly appreciated for its sweetness of flavor and delicacy of texture."

### ANNONACEAE.

#### *Annona cherimola* Mill.

*Chirimoya* (Quichua: *chiri*, cold, and *muyu*, seed); throughout the Sierra. In some of the towns of the coast this name is incorrectly applied to *Annona squamosa*.

Alphonse DeCandolle wrote concerning the origin of the *chirimoya*, "I consider it most probable that the species is indigenous in Ecuador, and perhaps in the neighboring part of Peru." Teodoro Wolf (p. 439) reported having found it "in a wild state, and forming small groves, in the mountains of Loja Province, for example, between Loja and Malacatos, at altitudes of 1,800 to 2,000 meters." Following the indication of Wolf, I have visited the Province of Loja and have personally observed the tree in such abundance, and in such an evidently spontaneous state, that no doubt is left in my own mind regarding its indigenous character.<sup>1</sup> The *chirimoya* is certainly an Ecuadorian species, probably entitled to be considered the finest fruit which that country has produced.

Aside from the considerable groves of wild trees, found throughout the southern part of Loja Province at elevations between 1,400 and 2,000 meters, the species is

<sup>1</sup> See Wilson Popenoe, The Native Home of the *Chirimoya*, *Journal of Heredity* 12: 331-336. 1921.



cultivated abundantly in all those regions of the sierra where climatic conditions are favorable. Luis Cordero says regarding Cañar and the Azuay, "This tree yields one of our best fruits, the sweet and fragrant chirimoya, justly appreciated in the markets. It is produced by our valleys of moderate temperatures, such as Paute and Gualaceo." It is occasionally seen in the *huertas* of Ambato, where it is not, however, altogether successful as a fruit-bearing tree, the climate of this region being too cool for it. At Baños, Tungurahua, at an elevation of 1,800 meters, it is cultivated rather commonly. The markets of Quito are abundantly supplied with fruits of excellent quality from the valley of the Río Guailabamba, a few miles north of the city. There are a few trees in Otavalo, in the Province of Imbabura, these fairly thrifty, and there are many in the gardens of Ibarra. Much of the fruit sold in the latter town, however, is brought from the haciendas situated in the Chota Valley.

The chirimoya is a small, erect or somewhat spreading tree, rarely growing to a height of more than 7.5 meters. The leaves are ovate to ovate-lanceolate, commonly 10 to 15 cm. long, sparsely hairy above, and velvety-tomentose below. The fragrant, greenish white flowers are 2.5 cm. in length, solitary or sometimes two or three together, on short nodding peduncles in the leaf axils. The fruit is commonly heart-shaped, conical, oval, or somewhat irregular in form, and from 100 grams to 2 kilograms in weight. The surface is smooth in some varieties, in others covered with small conical protuberances; it is light green, with the skin thin and delicate. The flesh is white, melting, and of subacid, delicate flavor, suggesting that of the pineapple and the banana; in it are embedded numerous brown seeds the size and shape of a common bean.

Little attention is given to the cultivation of this fruit in Ecuador, the trees all being propagated by means of seed. Very rarely they are planted in orchard form. The fruit is a favorite in the markets, and is carried to the coast from the inter-Andean regions where it is produced.

#### *Annona muricata* L.

*Guanábana*, on the coast, where it is commonly cultivated. It is occasionally grown in some of the hot inter-Andean valleys of moderate elevation, such as the valley of the Chota, in the northern part of Ecuador. It is rarely grown at elevations higher than 1,200 meters.

The soursop, as the species is called in English, is a small tree, slender in habit and rarely more than 6 meters high. The leaves are obovate to elliptic, 6 to 15 cm. long, leathery, glossy above, and glabrous on the lower surface. The flowers are large, and the fruit is the largest of the anonas; specimens weighing 2 kilograms are common. It is ovoid, heart-shaped, or conical, dark green, with many short fleshy spines on the surface. The flesh is white, somewhat cottony in texture, juicy, and of a highly aromatic flavor, somewhat resembling that of the pineapple. The seeds are much like those of the chirimoya. The soursop is native in tropical America.

#### *Annona reticulata* L.

*Anona* in the coastal lowlands, where it is cultivated rather commonly. It is rarely seen at elevations above 1,500 meters.

This is the bullock-heart or custard-apple of English-speaking countries, inferior in quality to several other species of *Annona*, but nevertheless common in many parts of the Tropics. The tree is commonly 6 to 7.5 meters high. The leaves are oblong-lanceolate to lanceolate, 10 to 15 cm. in length, and glabrate. The flowers, which are borne in small clusters upon the new branchlets, are about 2.5 cm. long. The fruit is commonly heart-shaped, but it may be conical, oval, or irregular in form. It weighs from 100 grams to more than a kilogram; the surface is smooth, usually reddish yellow or reddish brown in the ripe fruit, and divided by impressed lines into 5 or 6-angled areas. The flesh, which contains numerous brown seeds the size of

a small bean, is milk-white, granular near the thin skin, and sweet, even insipid in flavor. Like most of the other species of *Annona*, this is a native of tropical America.

***Annona squamosa* L.**

*Chirimoya*, in the vicinity of Guayaquil, to which city the fruits are brought in considerable quantities from the Island of Puna. The common name properly belongs to *Annona cherimola*, and its application to *A. squamosa* has resulted in confusing the two species in the minds of many Ecuadorians.

The sugar-apple, as this species is called in English, is a smaller tree than most other species of *Annona*, its maximum height being about 5 meters. The leaves are lanceolate or oblong-lanceolate in outline, 5 to 10 cm. long, pale green on both surfaces, and nearly glabrous; they closely resemble those of *A. reticulata* except in their smaller size. The flowers, which are produced singly or in clusters of two to four, also resemble those of *A. reticulata*. The fruit, however, is of very different appearance from that of the last-named species; it is round, heart-shaped, ovoid or conical, 5 to 7.5 cm. in diameter, and yellowish green. The surface is tuberculate and covered with a whitish bloom. The pulp is white, custard-like, and of a pleasantly acidulous flavor. The seeds are much like those of other species. When grown in a hot, dry climate, this is often a fruit of excellent quality, never equal, however, to a good specimen of the true chirimoya in richness of flavor. It is a native of tropical America.

### LAURACEAE.

***Persea americana* Mill.**

*Persea gratissima* Gaertn. f.

*Aguate*, in all parts of the country; also called *palta* in some parts of Loja Province. This species, the common avocado of tropical lowlands, is grown abundantly in the Province of Guayas and less commonly elsewhere in the coastal lowlands. There are many trees in the valley of the Río Chota, in northern Ecuador, at 1,500 meters altitude, and numerous others in the central and southern portions of Loja Province, at altitudes of 1,200 to 1,500 meters. It was not seen at elevations above 1,800 meters.

This tree, the West Indian avocado of North American horticulturists, is distinguished from the highland or Mexican avocado (*P. americana drymifolia*) by its foliage, which, when crushed, has none of the aniselike odor characteristic of the latter; and by its fruit, which has a thick, leathery skin, in place of a thin, membranous one.

There is a famous tree in the town of Esmeraldas, which yields avocados a kilogram in weight and of excellent quality. Some good fruits are produced in the Province of Guayas, also; but in general it may be said that the avocados of this race which are grown in Ecuador are inferior to the best from Cuba and Florida.

***Persea americana drymifolia* (Cham. & Schlecht.) Blake.**

PLATE 35.

*Aguate*, in all parts of the country where it is known. It is cultivated abundantly in the Chota Valley of northern Ecuador, at altitudes of 1,500 to 2,100 meters; at Ibarra (2,200 meters) and Otavalo (2,600 meters); in the Guailabamba Valley, north of Quito, at 1,800 to 2,100 meters; at Quito (2,900 meters), though it is not common there; at Ambato (2,600 meters), and from this point down the Ambato River (later called the Patate and then the Pastaza) to the town of Baños (1,800 meters); at Cuenca (2,600 meters) and Loja (2,200 meters), and in numerous other places throughout the highlands. It is not grown in the coastal lowlands.

This variety, the Mexican avocado of North American horticulturists, is distinguished from the West Indian or lowland avocado (*P. americana*) by the aniselike odor which the leaves give off when crushed, and by the thin membranous skin of the fruit.



Most of the seedlings cultivated in the Ecuadorian highlands are inferior in quality. Those of Ambato and the Patate Valley are mostly small-fruited, as also those of the Guailabamba Valley, which supplies the Quito markets with avocados. In the Chota Valley, contributing to the Ibarra market, there are some unusually choice forms of this avocado, some of the fruits weighing as much as a half a kilogram and being of excellent quality, with small seeds.

### GROSSULARIACEAE.

#### *Ribes punctatum* Ruiz & Pav.

*Grosella*, in the province of Carchi, where it occurs at altitudes between 3,400 and 3,700 meters. It is not cultivated, but grows in ravines of the *páramo* or cold, moist region.

This Andean currant is a shrub reaching 2 meters in height; leaves broadly ovate, subcrenate, sometimes slightly lobed, truncate at the base, and about 2.5 cm. in length. The round, orange-yellow fruits, rarely more than 6 mm. in diameter, are borne on axillary racemes about 5 cm. long. They are subacid, and not very agreeable in flavor, and are little used by the inhabitants of the region in which they grow.

### MALACEAE.

#### *Osteomeles obtusifolia* (Pers.) Kunth.

*Quiqui*, in the Province of Loja, where it is common at elevations of 2,100 to 2,400 meters. It is not cultivated, and is not much esteemed as a fruit-bearing species.

The plant, which grows along the edges of ravines and among scrub, is an arborescent shrub reaching a height of 4.5 meters. It is armed with long sharp thorns, and its leaves are oblong-elliptic, blunt or acute at the apex, dentate, commonly 2.5 cm. in length. The fruits, which are produced in small terminal clusters, are globose to oblate, deep red, and up to a centimeter in diameter. Within the thin skin is a small quantity of yellowish, mealy flesh surrounding the several hard seeds. The flavor of the fruit is subacid and slightly acrid, resembling that of the haw (*Crataegus*).

#### *Cydonia oblonga* Mill.

##### *Cydonia vulgaris* Pers.

*Membrillo* throughout the inter-Andean region; cultivated rather commonly in many of the highland towns, from the Carchi to Loja. Two varieties of the quince are grown at Ambato, one producing fruits rather elongate in form, and sweet, the other round and somewhat acrid fruits. Quinces are abundant in the Ambato market during the first few months of the year.

The quince is successfully cultivated in the Ecuadorian highlands, but it is nowhere a product of much commercial importance, though there are a few small commercial plantations near Ambato. Propagation is by means of cuttings and root-suckers.

#### *Pyrus communis* L.

*Pera* at Ambato and Cuenca, and in a few other regions of the highlands.

The cultivation in Ecuador of superior varieties of the pear dates from recent years. A small form, known as *pera nacional* or *pera común*, was probably introduced in colonial times, and is extensively cultivated in the vicinity of Ambato, whence the fruits are carried to Quito, Guayaquil, and many other cities. Propagation is by suckers, which spring up abundantly beneath the trees. The fruit is pyriform, 2.5 to 4 cm. long (occasionally larger), yellow and firm even when fully ripe. The flesh is white, rather mealy, not very juicy, and of a mild, pleasant flavor. Seeds are rarely produced.

Luis Cordero states that several European pears, such as Louise Bonne de Jersey, Duchesse d'Angouleme, and Beurre de Nantes, have been planted at Cuenca, but their cultivation in that region has not yet assumed commercial importance. At Ambato there are a number of varieties, known variously as *pera de manteca*, *pera de botella*, *pera de azúcar*, and so on, most of them being sold in the market under the name *pera de manteca*. There is no record of the introduction of these forms, and, although they are probably well-known European varieties, none of them has been identified with certainty. They are usually propagated by grafting on suckers of the *pera común*.

**Malus baccata** (L.) Moench.

*Pyrus baccata* L.

*Manzanita de Chile* at Ambato, where it is rarely grown, having been introduced only in recent years. As indicated by the common name, it probably came to Ecuador from Chile.

Two varieties of the crabapple have been seen at Ambato. One is broadly oval to spherical in form, about 4 cm. in length, the surface yellow, overspread on one side with orange-scarlet, and the flesh yellowish white. The other is oblate, about 4 cm. in diameter, the surface yellow, streaked and splashed with bright red on one side, the flesh pale yellowish white.

**Malus sylvestris** Mill.

*Pyrus malus* L.

*Manzana* throughout the country. The principal commercial centers of apple culture are at Ambato and Cuenca, but there are trees in many of the highland towns from Ibarra to Loja. In many places they are not very successful.

This fruit was probably introduced into Ecuador in colonial days, but it is only in recent years that good varieties have been planted. The types formerly grown, undoubtedly seedlings in many instances, are grouped together under the name *manzana común*, and yield small, hard fruits of inferior quality. The following three varieties are the best that are commercially cultivated.

**AZOTADA.** An apple much resembling Red Astrakhan. It is distinctly oblate in form, flattened, with a rather shallow cavity and rounded to broadly pointed at the apex, with a furrowed, moderately deep basin. The length of the fruit is about 5 cm., the breadth about 7.5 cm. The surface is somewhat irregular, the ground color light green or yellowish green, freely streaked and splashed with red, particularly toward the apex. The core is large and open, the flesh white, rather tough, very juicy, and of subacid flavor, the quality not above fair. It is used mainly as a cooking apple, and in the north would be classed as a cider apple. It ripens in February at Ambato, the season therefore being rather early. The origin of the variety is uncertain, but it has been cultivated at Ambato longer than any other named variety.

**BALSOSA.** In form and quality this variety resembles Bellefleur. It is a large apple, often as much as 10 cm. in length, oblong to oval-conic, usually with three or four protuberances or bosses at the apical end. The cavity is rather deep and rounded, and the basin is deep, broad, and slightly furrowed. The surface is pale yellow, one cheek overspread with dull crimson-scarlet. The flesh is white, crisp, of firm texture, fairly juicy, and of mild, subacid flavor. For eating out of hand it is a fairly good fruit, when fully ripe. The season at Ambato is February and March. The origin of the variety is uncertain, but it has probably been brought to Ambato from Europe within the last 50 years.

**EMILIA.** This is the best eating apple commercially grown in Ecuador at the present time, and the most highly esteemed in the markets, where it sells for two to four times the price brought by *Balsosa* and *Azotada*. It is oblate, flattened at both ends, and somewhat narrower at the apex than at the base. Commonly it is about 7.5 cm. in diameter, but occasionally it reaches 12.5 or even 15 cm. The cavity is

shallow and flaring, the basin broad, rather deep, and slightly fluted. The flesh is white, melting, very juicy, and of very pleasant flavor, with plenty of sweetness, a piquant taste, and a delicate aroma. The ripening season is slightly later than that of *Balsosa*. This variety was introduced from Europe in 1883 or 1884 by Don Emilio Teran; its correct varietal name has been lost, and it is now called *Emilia*, after the introducer.

*Emilia* and other varieties of apples (a few of North American origin have recently been planted in Ambato) are grafted on young plants of the *manzana común*, propagated as suckers from old trees. Nearly all of the apples (as well as peaches and pears) marketed in the Ambato region are picked too green. They are then brought into the public market place, roughly handled, pinched by all prospective purchasers, and perhaps kept until the bruised spots have all turned brown. As a result, it is difficult to obtain an apple, peach, or pear in prime condition for eating. Because of its greater value, more care is used in handling *Emilia*, however, and fruits of this variety can sometimes be purchased in good condition at Guayaquil and Quito.

***Eriobotrya japonica* (Thunb.) Lindl.**

*Nispero del Japón* in the highlands, where it is occasionally seen in the gardens of Ibarra, Quito, Ambato, Cuenca, Loja, and other towns, but where it is not as yet much cultivated as a fruit-bearing tree. Also grown occasionally in the coastal lowlands. As an ornamental it is highly esteemed.

The climate of the highland towns is in many instances too cool for the loquat fruit to develop satisfactorily, but by planting the tree at elevations of 1,800 to 2,100 meters in regions with fairly dry climates better success would probably be obtained. However, no good varieties have as yet been introduced into Ecuador; the fruits produced by the seedlings cultivated in Loja, Cuenca, and elsewhere are small and sour.

The loquat is a tree reaching 6 to 7.5 meters in height, with elliptic-lanceolate, remotely toothed leaves 15 to 25 cm. long. The small white flowers, which are borne in woolly panicles 10 to 20 cm. long, are followed by yellow or orange fruits varying from globose to pyriform, 2.5 to 7.5 cm. long, with firm, juicy flesh enclosing one to several ovoid, light brown seeds about a centimeter long. In flavor the fruit suggests the cherry. The species is a native of eastern Asia.

***Crataegus stipulosa* (H. B. K.) Steud.**

*Huagra-manzana* in the Province of Pichincha, where it is a common wild tree; *manzanita* in the Province of Azuay, where it is abundant in the region of Cuenca.

The plant, which grows wild along some of the inter-Andean ravines and is also cultivated in several regions, becomes a slender tree, usually not more than 6 meters high. It has elliptic-lanceolate leaves 5 to 7.5 cm. long, and produces during the months from March to May yellow globose fruits about 2.5 cm. in diameter. These are identical in character with the *tejocotes* of Mexico and the *manzanilla* of Guatemala. The flesh is whitish, mealy, and rather dry, and of pleasant flavor, suggesting that of the apple; the seeds are large and rough on the surface. The fruits are often sold in the markets of Quito and Cuenca.

## ROSACEAE.

***Fragaria chiloensis* (L.) Duchesne.**

PLATES 36, 37.

*Frutilla* at Ambato; *fresa* in Imbabura Province, where a few plants are to be seen at Otavalo and at the Hacienda Cusin. Luis Cordero says, regarding its occurrence in the southern provinces of Azuay and Cañar: "It is cultivated in a few gardens, though it does not fruit so well as in the sandy regions of Tungurahua Province." That it has been cultivated at Ambato since a remote day is evidenced by the following passage, taken from Padre Velasco: "*Frutilla*, erroneously so-called, is the strawberry of Quito, since it is so large that one fruit is equal to two or three of the

European. It bears every day in the year, and although it is common in several Provinces in no other is it produced in such abundance and perfection as in that of Tungurahua."

This remarkable fruit more recently attracted the attention of Robert Spruce, the English naturalist, who wrote: "In the equatorial Andes the Province of Ambato is famed for its strawberries, which equal in size and flavor some of our best varieties, and are to be seen exposed for sale in the market place of Ambato every day in the year. They are cultivated at an altitude of from 2,100 to 2,700 meters, but the best are grown a little way out of Ambato, as you go towards Guayaquil, on the slopes of Guachi (lat.  $1\frac{1}{2}$  deg. S.) at near 2,700 meters, and in a mean temperature of  $60^{\circ}$ , where, however, the thermometer does sometimes descend, perhaps half a dozen times in the year, to the freezing point in the early morning, but scarcely ever on two successive days."

It is only in the region of Guachi that this species is commercially cultivated in Ecuador. This settlement, distant about 8 kilometers from Ambato, lies at an altitude varying from 2,900 to 3,000 meters, and is a series of rolling hills, almost devoid of trees, with a soil which can be characterized as a very loose, fine, sandy loam of volcanic origin. The strawberry plantations cover an area of at least 60 acres. The plants are never irrigated, and the rainfall here is probably not more than 40 cm. per annum. Three times a year the fields are cleaned of weeds with a heavy hoe, this being the only cultural attention they receive. The plants do not grow to large size. When irrigated they make luxuriant growth, but do not yield abundantly nor is the fruit large or sweet. The fruit is picked once a week throughout the year. There are, however, three seasons when the most abundant yield is obtained, these being in February, in August, and in December. The method of handling the fruit is primitive; it is carried to Ambato in kerosene boxes, holding about 12 to 15 kilograms; and is there sorted and packed in baskets for shipment by train to Quito and Guayaquil.

In form this strawberry is less variable than most of the varieties grown in the United States. It is oblong-conical in outline, sometimes oblong-ovoid, and from 2.5 to 5 cm. in length. When fully ripe it is light red, with the flesh pinkish white, meaty, juicy, and of mild, sweet flavor. In quality the fruit is not so good as the finest North American and European strawberries, but it can be shipped much more successfully than the latter, because of its firm texture.<sup>2</sup>

#### ***Fragaria vesca* L.**

*Fresa* in the southern provinces, and as far north as Quito; *frutilla* in Imbabura Province. It grows wild upon the mountain sides between 2,100 and 3,000 meters altitude at various places in Loja and Tungurahua provinces, and probably elsewhere. It is occasionally cultivated in gardens throughout the inter-Andean region.

This species is believed to have come to Ecuador from Europe, probably along with the seed of barley or some other European grain. It has, however, assumed the appearance of an indigenous plant in several parts of the Republic and still more noticeably so in the Department of Cundinamarca, Colombia. In Ecuador the fruit is not esteemed and is, in fact, rarely used, the species being cultivated in gardens more as an ornamental than as a fruit-bearing plant. In Colombia, however, the fruit is much liked, and is commonly sold in the markets of Bogotá. The largest specimens are about a centimeter in length, broadly oval to round, bright red, of delicate texture and aromatic flavor, though sometimes possessing an unpleasant bitterness. When cooked they yield an excellent preserve, and it is in this form that they are most commonly served in Bogotá.

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<sup>2</sup> For a more extensive treatment of this species see Wilson Popenoe, The Frutilla, or Chilean Strawberry, *Journal of Heredity*, 12: 457-466. 1921.

**Rubus glaucus** Benth.

PLATE 38.

*Mora de Castilla* at Ambato, where it is cultivated commercially on a small scale; at Quito, where it is not common; at Otavalo, where it is found in many gardens, this town being famous for its *moras*; at Ibarra, where it is fairly abundant; and in several other highland towns, at altitudes between 2,100 and 3,000 meters.

This excellent fruit,<sup>3</sup> native to the mountainous regions of Ecuador (as well as several other tropical American countries), has received a certain amount of cultural attention in several parts of the country, with the result that horticultural varieties have originated. At Ambato there are two—one, the common sort, with dark maroon-colored fruits, and the other with light-red fruits, somewhat more delicate in flavor than the common form. The plant is half-climbing in habit, and a vigorous grower. It covers arbors and fences, or can be trained to bush form, making a clump 3 meters in diameter and about 3 meters high. The stems are round, and covered with a thick whitish bloom; the leaves are trifoliolate, with the leaflets ovate-lanceolate, long-acuminate, serrate, about 7.5 cm. in length, light green above and glaucous beneath. The flowers are produced in terminal racemes sometimes 30 cm. in length; they are white, and nearly 2.5 cm. in diameter. The fruits are oblong to oblong-oval in outline, often more than 2.5 cm. in length, composed of a large number of small drupelets closely set together. The seeds are not so large as to be troublesome in eating the fruit. The flavor resembles that of some of the northern raspberries. It is rich, aromatic, pleasantly subacid, and very agreeable when the fruit is fully ripe. Although excellent when eaten with sugar and cream, the fruit of this species is more commonly used in Ecuador to prepare a sweet conserve or a syrup made in Otavalo, called *jarope de mora*, from which a *refresco* is made.

**Rubus adenotrichos** Schlecht.

PLATE 39.

*Mora* and *mora común* in central and northern Ecuador, where it is a common wild plant at elevations between 2,300 and 3,700 meters.

This is a very vigorous plant, forming large clumps up to 5 or 5.5 meters high, the stout canes thickly furnished with short, stiff, maroon-colored hairs. The leaflets are ovate-acuminate to oblong-acuminate, finely serrate, 7.5 to 10 cm. long. The white flowers are produced in large loose panicles sometimes more than 30 cm. in length, and are followed by an abundance of ovoid, deep purple fruits commonly about 2 cm. long. The drupelets are numerous and crowded closely together; the seeds are moderately large, but not very troublesome when the fruit is eaten. The flavor is practically the same as that of the cultivated blackberry of the North, and the quality is good. Because of its productiveness and the excellent quality and flavor of its fruit this species seems worthy of horticultural attention.

An albino form was collected at La Rinconada, in the Province of Carchi, where it is known as *mora blanca*. This is somewhat less robust than the typical form of the species. The fruits differ only in color and flavor, being cream-yellow and sweet.

**Rubus floribundus** H. B. K.

*Mora* in the Provinces of Azuay, Cañar, and Loja, where it appears to be indigenous. Luis Cordero, who incorrectly identifies this as *Rubus fruticosus*, says of it: "This is the common *mora*, abundant in the hedges which surround our farms and in many other situations throughout the region of mild climate. It is also called *zarzamora*. It produces very good fruits, and is the great protector of our cultivated fields, because of its profusion of intertwined stems, and more particularly because of the sharpness of its thorns."

This species reaches about 4.5 meters in height, and is half-shrubby. The canes are somewhat angular in cross section, finely pubescent, and light green. The leaves are composed of five oblong-elliptic, acuminate, finely serrate leaflets, very sparsely

<sup>3</sup> See Wilson Popenoe, The Andes Berry, Journal of Heredity, 12: 387-393. 1921.

pubescent on the lower surface and glabrate above. The flowers are white to light pink, nearly 2.5 cm. broad, and are produced in stiff terminal racemes up to 30 cm. long. The fruit is a blackberry of oblong-oval form, about 2 cm. long, the drupelets rather small and closely crowded together. The seeds are not unduly large nor hard, and the fruit is, on the whole, one of very fair quality. It is not much used.

**Rubus roseus** Poir.

PLATE 40.

*Huagra-mora* upon the slopes of the Volcano Tungurahua, where it occurs abundantly as a wild plant at altitudes of 2,700 to 3,700 meters; *mora de rocoto* in the Province of Carchi, where it is found at altitudes of 3,000 to 3,700 meters. It also occurs in the Province of Loja, at about 2,700 meters altitude, in the Cordillera de Zamora.

The plant is not a large grower. It forms clumps about 1.5 meters high, or sometimes scrambles over other plants, its canes reaching 2.5 meters in length. The leaves are trifoliolate, with glossy, oval to oblong-acute, serrate leaflets, often having a maroon tinge. The rosy purple flowers, about 4 cm. broad, are borne in clusters of only a few; they are followed by oval or conical fruits 2.5 to 4 cm. long, crimson, juicy, and of pleasant flavor. The seeds are not objectionably large nor hard. The individual drupelets of which each fruit is formed are medium sized—about like those of the cultivated raspberries, which the species also suggests in flavor and general character of fruit. The plant is not very productive.

**Rubus urticaefolius** Poir.

*Mora*, the common wild blackberry of Baños, Tungurahua Province, where it grows abundantly along roadsides, in fences, and about cultivated places. The plant is rather conspicuous because of the whitish undersurface of the leaves.

This species is a fairly strong grower, sending up canes to a length of 3 or 3.5 meters. It is half-climbing in habit. The leaves are palmately compound, the leaflets ovate-acute, very finely serrate, sparsely hairy above, velvety-pubescent and glaucous below. The racemes are slender, commonly 10 to 20 cm. in length, and the flowers are small and white. The fruits also are small, being rarely more than 6 mm. long; they are broadly oval, each composed of numerous very small drupelets, the seeds soft. The berries are sweet and of very agreeable flavor, but their small size is against them and they are little used by the people of Baños.

### AMYGDALACEAE.

**Prunus serotina** Ehrh.

PLATE 41.

*Capulí* throughout the highlands, where it is much more abundant in some sections than in others. Beginning in the north, it is frequent in the Province of Carchi, but not really abundant. The same is true of the Ibarra section. Toward Otavalo it occurs in greater profusion, and around the shores of Lake San Pablo it is very abundant. In Pichincha Province it is, again, less conspicuous, though not by any means wanting. From Latacunga to Riobamba it is one of the few trees that grow upon the sandy plains, and it here attains greater economic importance, perhaps, than in any other portion of the Republic. In the Azuay, however, it is nearly as abundant and important, and in certain parts of this province, as in that of Cañar, it assumes an indigenous appearance. In Loja it is not rare, but is not sufficiently common to play a very important rôle in the life of the people. Its range in general is between 1,800 and 3,400 meters elevation.

It has generally been considered by botanists that this species is indigenous in Ecuador, but there is little evidence to substantiate this belief. It is thoroughly naturalized in several regions, but it is known in all of them under a name taken from the Nahuatl tongue of Mexico; and history records its introduction from Mexico into other parts of South America after the Conquest. It is most probable that the species was not known south of Central America in pre-Columbian times.



The *capuli* is a stout tree up to 12 or 14 meters in height, with oblong-lanceolate to lanceolate, finely serrate leaves from 7.5 to 12.5 cm. long. The flowers, which are produced in slender racemes 7.5 to 20 cm. long, are white, and about 2 cm. broad. The fruits resemble the European cherry in appearance; they are oblate or nearly spherical, 1 to 2 cm. in diameter, deep purplish maroon when fully ripe, with a thin, tender skin surrounding the greenish flesh and the single hard seed. The flavor and quality of the fruit, as also the size, vary greatly. As commonly seen, the *capuli* is not over a centimeter in diameter, and its flavor is slightly bitter. In several regions there are, however, superior forms that are worthy of vegetative propagation. Some of the best are those of Cuenca and Ambato. At Catiglata, near the latter town, there is a famous tree whose fruit is large, very juicy, and as sweet and pleasant as the best European cherries.

The botany of this interesting and valuable fruit tree has long been in confusion. Recently Blake<sup>4</sup> has gone over the material available in the herbaria at Washington and has reached the conclusion that the *capuli* or *capulin*, grown from Mexico to Peru and Chile, is a cultivated southern form of the northern black cherry, *Prunus serotina* Ehrh., which occurs as a wild plant from Nova Scotia to Mexico. Other botanists have considered it to be distinct, and it is often mentioned in literature under the name *Prunus salicifolia* H. B. K. or *Prunus capuli* Cav.

***Prunus cerasifera myrobalana* (L.) C. Schneid.**

*Mirabel* at Ambato, where it is more extensively grown than any other species of plum, though it will probably be supplanted in the near future by better ones. Elsewhere in Ecuador it is seen very rarely.

The myrobalan plum was brought from Europe in early colonial days, and is successful under the conditions obtaining in the region of Ambato. The trees grow to large size and produce their popular fruits in great abundance. Propagation is mostly by suckers, less commonly by seed, and rarely by cuttings. The species is often used as a stock plant on which to graft the so-called Reina Claudia plum.

The fruit, which ripens in December and January, earlier than that of the other plums now cultivated in the Ambato region, is round to broadly oval in outline, up to 2.5 cm. in length, bright red when fully ripe, with soft, juicy flesh of pleasant flavor, but is inferior in quality to that of the grafted varieties now being planted.

***Prunus armeniaca* L.**

*Albaricoque* in those parts of the country where it is known. The apricot is cultivated commercially in two regions, at Ambato and in the vicinity of Cuenca. Regarding its behavior in this latter region, Luis Cordero says: "This handsome fruit tree succeeds perfectly in our haciendas of rather warm climate, especially in the fertile and beautiful valleys of Paute and Gualaceo. Rare is the year in which the fruit is not abundant, and for this reason the well-known boxes of apricots preserved in syrup, so highly esteemed in other parts of the country, are never wanting." Outside the Cuenca and Ambato regions, there are occasional trees to be seen at Loja and northward in Imbabura Province.

The ripening season at Ambato is in January and February. Propagation is commonly by seed, and occasionally by grafting on peach, apricot, and plum. The varieties grown in Ecuador—mostly seedling forms—are almost invariably small-fruited and considerably inferior to the best North American and European apricots.

***Prunus* spp.**

*Ciruela*, of which several forms are cultivated commercially in the vicinity of Ambato. Elsewhere in the highlands they are seen occasionally, as at Otavalo and especially in the region of Cuenca.

<sup>4</sup>See Popenoe and Pachano, The Capulin Cherry, *Journal of Heredity*, 13: 51-62. 1922.

The variety called the *Reina Claudia* at Ambato is properly the Chabot or Bailey plum (*P. salicina* Lindl.) of the United States, according to Professor Pachano, who states that it was introduced into Ecuador about 15 years ago. Its cultivation is assuming commercial importance very rapidly, the fruits meeting a ready sale at excellent prices. The variety is propagated by grafting on peach, on *mirabel*, and sometimes on the Damasco plum.

The variety Wickson (*P. salicina* × *simonii*), introduced in recent years by the Quinta Normal de Agricultura at Ambato, is also becoming popular in Tungurahua Province, where it produces its excellent fruits in abundance. The tree has not proved to be a strong grower, however.

The *ciruela morada* or *damasco* of Ambato, doubtless introduced in colonial times, is a slender, compressed, very sweet fruit, probably of the Damson group, *Prunus domestica inistitia* L. It is propagated by suckers.

#### **Amygdalus persica L.**

*Prunus persica* Stokes.

*Durazno* in all parts of the country where it is cultivated, though this name is properly limited to the clingstone varieties; the freestones are variously called *guaytambo*, *melocotón*, *abridor*, and *prisco*.

Among the fruits brought by the Spaniards to the inter-Andean region of Ecuador, the peach is to-day the most extensively cultivated. It is especially abundant in the Provinces of Tungurahua and the Azuay, where there are many seedling forms of excellent quality. In all Provinces of the Sierra it is cultivated more or less commonly, its approximate range being from 1,500 to 3,000 meters.

Since about 40 years ago, grafting has been practiced at Ambato. The forms now cultivated in that region, according to Professor Pachano, may be classified as follows:

#### **Duraznos (true peaches):**

1. Duraznos (clingstones); white-fleshed (termed "de leche"), yellow-fleshed, and red-fleshed (termed "sanguineos").
2. Abridores (freestones); white-fleshed, yellow-fleshed, and reddish-fleshed.

#### **Peladillos (nectarines):**

1. Clingstones (peladillos).
2. Freestones (nectarines).

The clingstone *duraznos* of Ambato are sometimes of good size, attaining 7.5 cm. in length. As a general rule they have rather hard flesh, and are better for cooking or preserving than for eating out of hand. For the latter purpose some of the small white freestones are excellent. These are commonly from 5 to 6.5 cm. in length, with milk white flesh of delicate texture and aromatic flavor.

Since peaches are commonly propagated by seed at Ambato (as well as elsewhere in Ecuador), there are practically as many varieties as there are trees. An occasional one is good enough to merit vegetative propagation.

The clingstone forms are the commonest in all parts of the country. At Ibarra and elsewhere in northern Ecuador freestones are practically unknown. The same is true of Loja Province. Some of the seedlings grown near Gualaceo, in the Azuay, are of excellent quality. Luis Cordero says of the peach in Azuay and Cañar, "It is profusely cultivated in all our regions of moderate temperature, since its fruit is among the most highly appreciated in the markets. We possess several varieties, the best being the *prisco* and the *abridores*."

While the cultivation of the peach, like that of most other fruits, has not yet received scientific study in Ecuador (with the exception of a few instances), there is no doubt that it is capable of forming the basis of a considerable and profitable industry. Besides large areas of land suitable for the production of good peaches, Ecuador possesses good seedling varieties, especially valuable because better adapted to the

peculiarities of the climate than are forms introduced from abroad. It would not be difficult to search out some of these seedlings and establish them, by means of vegetative propagation, as named varieties. This will have to be done, and more care will have to be given to marketing the fruit than at present, before peach culture in Ecuador will be put upon a really profitable basis.

***Amygdalus communis* L.**

*Prunus amygdalus* Stokes.

*Almendra*, in the provinces of Azuay, Cañar, Tungurahua, and Pichincha, where occasional trees are to be seen.

There are a number of almond trees in Ambato, but they do not bear regularly or abundantly. Luis Cordero says of its behavior in the region of Cuenca: "There are people who cultivate it, and who have obtained a few almonds, but it has never become widely distributed, in spite of its manifest usefulness; for, while it flowers profusely, it appears that fertilization is not satisfactorily accomplished, and most of the flowers fall to the ground without setting fruits." While Cordero is probably not correct in considering the failure of this species to be due to defective pollination, it is evident that the tree does not find its environment congenial, and there are no facts to warrant the belief that almond culture can ever become commercially important in Ecuador.

**MIMOSACEAE.**

***Inga* spp.**

*Guaba* or *huaba* in many highland towns of moderate elevation, such as Ibarra (2,200 meters), Ambato (2,600 meters), Cuenca (2,600 meters), and Loja (2,200 meters).

Trees reaching about 9 meters in height, with pinnate leaves 20 to 30 cm. long, and small white flowers in axillary clusters. The fruits are flattened pods up to 15 cm. long. They contain several large seeds surrounded by white, translucent, jelly-like pulp of a sweet, perfumed taste, much liked by Ecuadorians of all classes.

Numerous species, both wild and cultivated, are found from sea level up to 1,800 or 2,100 meters elevation, and under cultivation they sometimes ascend to 2,700 meters. Various common names, such as *guaba de bejuco*, *guaba de mono*, and *guaba machetona* are applied to them; the Quichua name is *pacay*. The genus is a difficult one, some of the Ecuadorian species probably being as yet undescribed.

**CAESALPINIACEAE.**

***Tamarindus indica* L.**

*Tamarindo* on the coastal lowlands, where it is a common tree. It is rarely seen at elevations higher than 1,200 meters.

The tamarind, a handsome tree which reaches 18 meters in height, has pale green, abruptly pinnate leaves composed of 10 to 20 pairs of obtuse oblong leaflets, each about a centimeter long. The pale yellow flowers, borne in small lax racemes, are about 2.5 cm. broad, and are followed by flattened cinnamon-brown pods, 7.5 to 20 cm. long. These have a thin, brittle outer shell, within which are the brown, acid pulp and several obovate, flattened seeds. Although considered indigenous in tropical Africa, the tamarind has long been cultivated throughout the Tropics. Its fruit is used to prepare refreshing drinks and to season food.

**OXALIDACEAE.**

***Averrhoa carambola* L.**

*Carambola*; cultivated at the Hacienda Payo (near Naranjito, in Guayas Province), which is probably the only place in Ecuador where it has been planted. It succeeds well under the conditions of climate and soil which obtain in the Ecuadorian lowlands.

This Asiatic fruit tree, which grows to a height of 9 meters, has compound leaves with two to five pairs of ovate or ovate-lanceolate leaflets, 4 to 7.5 cm. long, light green and glabrous above, glaucous beneath. The small white or purplish flowers are borne in small racemes from both the young and old branches. The fruit is oval or elliptic in outline, translucent yellow or pale golden brown in color, 7.5 to 12.5 cm. long, and 3, 4, or 5-ribbed longitudinally, so that a cross section is star-shaped. It contains a clear watery pulp, astringent when green and tasting like green gooseberries, but pleasantly acid when ripe, with an aroma suggesting that of the quince. The seeds are small and very few, or sometimes wanting altogether. The fruit is sometimes eaten out of hand, but more often is prepared in conjunction with meats or other food.

### RUTACEAE.

#### *Citrus sinensis* (L.) Osbeck.

*Naranja dulce*; cultivated principally in the coastal lowlands and in the warm valleys of the inter-Andean region, such as those of Guailabamba and Chota. It is occasionally seen at Ambato (2,600 meters), but the fruit there produced is not of good quality. At Ibarra, also, it is occasionally cultivated, though the fruits are not so sweet as those of lower elevations. Some of the best oranges grown in the highlands are found in the Guailabamba Valley. The product of the region along the river Daule, in Guayas Province, is famous for its quality. The oranges of the coast are in general sweeter than those of the highlands, but not so richly flavored.

The orange is one of the important fruits of Ecuador. The trees are nearly all seedlings, there being only a few grafted specimens, introduced in recent years. The product is of about the same quality as that of other Latin-American countries, in many of which the orange is one of the most popular of fruits. In size and general character the best Ecuadorian oranges resemble the Valencia or Hart's Late of the United States; but they usually have more seeds, and the "rag" is more troublesome in eating the fruit.

#### *Citrus nobilis deliciosa* (Ten.) Swingle.

*Mandarina* throughout the country. At Ambato the mandarin orange is the most successful of the citrus family. It is fairly common in the better gardens of the town, and the fruit appears in the market, often, however, from haciendas farther down the river. The tree remains small, due to the cool climate of this region, and the fruits are scarcely as large as a good Dancy tangerine; commonly they are about 5 cm. in diameter, with thin skin, rather tough and abundant "rag," and numerous seeds, but the flesh contains abundant juice of rich flavor. At Ibarra it is occasionally seen, but it is not a common fruit in this region; the same is true of Cuenca and Loja, in southern Ecuador. On the coast it is cultivated successfully, though to a limited extent.

#### *Citrus aurantifolia* (Christm.) Swingle.

*Limón sutil* in the lowlands, and in the warmer inter-Andean valleys, up to elevations of about 1,800 meters. This, the sour lime of English-speaking countries, replaces the lemon in Ecuador, just as it does in tropical America generally. It is used extensively for the preparation of refreshing drinks, and in cookery.

#### *Citrus aurantium* L.

*Naranja agria* in the vicinity of Ambato, at Ibarra, and commonly throughout the lowland region of the Republic.

The sour orange is sometimes employed as a stock plant on which to graft sweet oranges, though propagation by this means is not extensively practiced in Ecuador. Its fruits, which are the size of ordinary sweet oranges, have a sour and bitter taste and are not highly esteemed. They have various culinary uses, but can scarcely be eaten out of hand.

**Citrus grandis** (L) Osbeck.

*Toronja*, on the littoral, and occasionally in the warm inter-Andean valleys up to elevations of about 1,500 meters.

Good varieties of the grapefruit are scarce in Ecuador. The seedling forms known under the name *toronja* are comparable to the shaddocks of the West Indies, and are little esteemed. They are used principally for the preparation of sweetmeats, and trees are rarely seen in any part of the Republic.

**Citrus limetta** Risso.

*Lima* in the valleys of Guailabamba and Chota, and elsewhere throughout the Republic up to elevations of about 2,000 meters. Occasional trees are seen at Ambato, Otavalo, and Ibarra.

The sweet lime, popular throughout most parts of tropical America, resembles an oblate lemon in appearance, and has very juicy flesh of a sweet and somewhat insipid flavor. It is considered refreshing in hot climates, and is relished in the same manner as is the orange in the United States.

**Citrus limonia** Osbeck.

*Limón real*; occasionally seen in gardens at Ambato, Otavalo, Ibarra, and elsewhere in the highlands, and on the coast. Nowhere in Ecuador is it a fruit of any economic importance.

The true lemon, highly esteemed in southern Europe and in the United States, does not usually produce fruits of excellent quality in tropical America. In all this region its place is filled by the sour lime (*C. aurantifolia*).

**Citrus medica** L.

*Cidra*; occasional in gardens near Ambato, Ibarra, and elsewhere. The citron is rarely seen in Ecuador, and its fruit is not much used.

**MALPIGHIACEAE.****Bunchosia armeniaca** (Cav.) DC.

*Ciruella verde* and *ciruella silvestre*, throughout the inter-Andean region, at elevations of approximately 1,500 to 2,400 meters. The plant is considered to be indigenous in the Pastaza Valley below Baños. It is commonly cultivated in the latter town (elevation 1,800 meters), and is occasionally seen in the gardens of Ambato, but the climate of the latter region is slightly too cool for it. At Loja it is well known, as also at Ibarra and Otavalo, Province of Imbabura. As a fruit-bearing plant, however, it is nowhere esteemed very highly, and it possesses no commercial importance.

This handsome species attains a maximum height of about 4.5 meters and is therefore an arborescent shrub rather than a tree. The glossy, deep green leaves are elliptic-acuminate and 7.5 to 15 cm. long; the small yellow flowers are produced in short axillary racemes. The light green fruits are round or nearly so, 2.5 to 4 cm. in diameter. Within the thin, delicate skin is a mass of cream-colored, very sweet pulp, in which are embedded one or two large seeds. The flavor is rather cloying, and the pulp not very abundant.

**ANACARDIACEAE.****Mangifera indica** L.

*Mango* in all those sections of the Republic where it is grown. On the coast it is one of the commonest fruit trees; in the highlands it is rarely seen, but is said to be grown in the Yunguilla Valley, near Cuenca, and in a few other places. It is not successfully cultivated at elevations greater than 2,000 or 2,100 meters.

This well-known Indian fruit tree, doubtless introduced into Ecuador during colonial times, is represented only by inferior seedling forms similar to those of most

other tropical American countries. Grafted mangos have probably not been produced in Ecuador as yet, with the exception of a few at the Hacienda Payo, near Naranjito, in the Province of Guayas.

**Anacardium occidentale L.**

*Marañón* on the coast, where it is fairly well known, though not so abundant as in many parts of Central America and the West Indies.

The *marañón*, in English commonly termed cashew, is a native of tropical America. The tree is somewhat spreading in habit, and reaches a height of 6 to 9 meters. The young growth has an attractive reddish color; the leaves are oblong, 10 to 15 cm. in length; the flowers small, pinkish, and produced in large terminal racemes. The fruit (usually termed the cashew nut) is kidney-shaped, about 2.5 cm. long, and attached to the end of the fleshy peduncle (termed cashew apple), which is 5 to 7.5 cm. long, yellow or bright red in color, very juicy, and of strongly aromatic odor and flavor. Both the fleshy peduncle and the nut or true fruit are eaten, the latter only after roasting to remove the caustic and volatile oil which it contains.

**Spondias cytherea Sonner.**

*Spondias dulcis* Forst.

*Manzana de oro* (from the West Indian name, golden apple) in the Province of Guayas, where there are a few trees. The fruit is not known in the markets of the Republic.

The tree is erect, stately, up to 18 meters in height, with compound leaves 20 to 30 cm. long, composed of 11 to 23 oval to oblong, remotely serrate, acuminate leaflets about 7.5 cm. in length. The small whitish flowers are produced in loose panicles 20 to 30 cm. long. The fruit is oval to obovoid, 5 to 7.5 cm. long, orange-yellow, with a thin but tough skin, yellow, juicy flesh, and a large oval seed covered with stiff spines or bristles. The flavor of the fruit suggests that of the apple, but is sometimes unpleasantly resinous or pungent. This species, native to some of the islands of Oceania, is widely cultivated throughout the Tropics.

**Spondias mombin L.**

*Spondias lutea* L.

*Jobo* (sometimes *hobo*) and *ciruela amarilla* in the coastal lowlands, where it is abundant. Its fruit is not much used.

The *jobo* is a tall, stately tree, sometimes attaining 15 meters in height. The leaves are 20 to 30 cm. long, and composed of 7 to 17 ovate-lanceolate, serrulate leaflets about 7.5 to 10 cm. in length. The yellowish white flowers are borne in loose panicles 15 to 30 cm. long, and are followed by clusters of ovoid, bright yellow fruits, each about 2.5 cm. in length, with a thin skin, soft juicy flesh, and a large rough stone. The flavor is rather pungent, for which reason the fruit is not liked by everyone. It is eaten out of hand.

**Spondias purpurea L.**

*Ciruela* and *ciruela colorada* in the Province of Guayas and elsewhere in the coastal lowlands, where it is a common tree; *hobo* in the Chota Valley of northern Ecuador, where it is cultivated on a very limited scale. It grows readily from large cuttings, which may be put in as fence posts. For this reason it is much used to form hedges and fences.

The tree is small, often spreading in habit, and reaches a maximum height of about 7.5 meters. The leaves are 12 to 20 cm. long, composed of 16 to 21 oblong-elliptic, oblique, subserrate leaflets about 2.5 cm. in length. The purplish maroon flowers are produced in small unbranched panicles commonly under 2.5 cm. long. The fruits, borne singly or in clusters of two or three, are oval to round, from 2.5 to 5 cm. in length, yellow to deep red, with a thin but tough skin surrounding yellow, juicy flesh and a rough, oblong, hard seed, usually more than a centimeter long.



The species is a native of tropical America. The fruit, which is often seen in the markets, is usually eaten out of hand.

### SAPINDACEAE.

#### **Melicoccus bijugatus** Jacq.

*Melicocca bijuga* L.

*Mamoncillo*; cultivated at the Hacienda Payo, near Naranjito, in Guayas Province. Not noted elsewhere in Ecuador, though it is adapted to cultivation throughout the coastal lowlands.

The tree, which grows slowly, is erect, shapely, and 9 to 12 meters high. The leaves are compound, with two pairs of elliptic-lanceolate, acute, glabrous leaflets, the lower pair about half the size of the upper. The small flowers, which are produced in short panicles, are followed by clusters of smooth round fruits the size of plums. The outer covering of these fruits is thick and leathery, and green on the surface; it incloses a large round seed surrounded by soft, yellowish, translucent, juicy pulp. The flavor is sometimes sweet and pleasant, again rather acid, especially if the fruit is not fully ripe. The native home of the *mamoncillo* is in northern South America.

#### **Litchi chinensis** Sonner.

*Nephelium litchi* Cambess.

*Lychee*, at the Hacienda Payo (near Naranjito, Province of Guayas), which is probably the only place in Ecuador where it has been cultivated.

The lychee, one of the most valuable of Asiatic fruits, is produced by a tree 7.5 to 10 meters in height, with compound leaves formed of two to four pairs of elliptic-oblong to lanceolate, sharply acute, glabrous leaflets 5 to 7.5 cm. long. The flowers are small and unattractive and are borne in terminal panicles sometimes 30 cm. in length. The fruits are borne in loose clusters of 2 or 3 to 20, and are oval to ovate in form, about 3 cm. in diameter, with a hard, brittle outer covering which is rough and divided into scalelike areas on the surface. Within is the white, translucent, firm and juicy flesh, inclosing a single round, glossy seed the size of a large bean. The flavor is subacid, somewhat suggestive of the sweet cherry. While the lychee has not yet fruited at Payo, there are two trees of fruiting size at that place, and there is little doubt that the climate and soil of the Ecuadorian lowlands are adapted to the successful cultivation of this species.

#### **Nephelium lappaceum** L.

*Rambutan* at the Hacienda Payo, near Naranjito, in Guayas Province. It is probably not grown elsewhere in Ecuador at the present time.

This excellent Malayan fruit is produced by an erect, rather slender tree which reaches 9 or 10 meters in height. Its leaves are compound, with five to seven pairs of elliptic to oblong, glabrate leaflets about 10 cm. in length. The flowers are produced in loose axillary and terminal panicles, and are small, pubescent, and devoid of petals. The fruits are oval, about 5 cm. long, crimson, and covered with soft fleshy spines about a centimeter long. The outer covering is thin and leathery; when this is torn off, the white, translucent, juicy flesh is exposed. Within this is a large, oblong, somewhat flattened seed to which the flesh adheres closely. The rambutan is eaten out of hand, and its cultivation could be extended to advantage in Ecuador, since it seems to succeed admirably in the coastal lowlands.

#### **Blighia sapida** Koen.

*Seso vegetal* in Spanish, *akee* in English. This is an African plant, cultivated rather commonly in certain of the West Indian islands, but almost unknown in Ecuador. There are a few bearing trees in gardens and haciendas of the Province

of Guayas. This species is essentially tropical in its requirements, and probably will not succeed in Ecuador when planted at elevations greater than 1,500 meters.

The akee is an erect, handsome tree attaining 10 to 12 meters in height. The leaves are abruptly pinnate, with three to five pairs of obovate-oblong leaflets, the upper ones 10 to 15 cm. in length, the lower ones much shorter. The small flowers are borne in short axillary racemes. The fruit is a curious-looking capsule, about 7.5 cm. long, triangular in outline, and varying from straw-colored to magenta-red. When ripe it opens along three sutures, exposing three round, shining seeds with a whitish fleshy body at the base of each. This fleshy substance, which in appearance strikingly suggests the brain of a small animal, is firm and oily in texture, and is eaten when fried or cooked in some other manner.

### VITACEAE.

#### *Vitis vinifera* L.

*Uva* throughout the sierra; it is grown mainly in the Malacatos Valley of Loja Province; in the Patate Valley of Tungurahua Province; and in the Chota Valley, which separates Imbabura and Carchi Provinces. All these regions have hot, dry climates and sandy soils favorable to the grape. They lie at elevations between 1,500 and 2,700 meters.

In colonial times the grape was cultivated by the Jesuits on their hacienda near Pimampiro, in the Chota Valley, and history records that a small quantity of wine was there manufactured. The varieties usually cultivated in Ecuador were introduced during the colonial period and are inferior in quality, being comparable to the Mission grape of California. In recent years more than 20 European varieties have been introduced from Chile by the Quinta Normal de Agricultura at Ambato, and it is probable that some of these will prove suited to the climate and soil of the Ecuadorian highlands, and will, at the same time, be of better quality than the varieties now cultivated. The greatest enemy of the grape in Ecuador is mildew; this often destroys the crop, and renders grape culture somewhat precarious in most parts of the country. Occasional grapevines are seen in many of the highland towns, but commercial plantations are limited to the regions mentioned.

### BOMBACACEAE.

#### *Matisia cordata* Humb. & Bonpl.

*Sapote* in the provinces of the littoral, where it is a common fruit tree. It is abundant also in the Cauca and Magdalena Valleys of Colombia under this same name, the use of which has confused the species, in the minds of local botanists, with the sapote or zapote of Central America, *Calocarpum mammosum*.

This tree, which is cultivated from sea level up to elevations of about 1,200 meters, is erect in habit, and reaches an ultimate height of about 12 meters. Its leaves are cordate in outline, from 15 to 30 cm. in length, and are clustered toward the ends of the stiff branchlets. The short-stalked flowers, produced abundantly along the smaller branches, are cream-colored, about 2.5 cm. in length, with the stamens and pistil protruding conspicuously beyond the corolla. The fruit, which is about 10 cm. long, is elliptic and extended at the apical end to form a conspicuous rounded point. It is brownish green and pubescent, and has a thick leathery skin, within which are two or three seeds surrounded by soft orange-yellow flesh of sweet and pleasant taste.

Although this is one of the common fruit trees of the Ecuadorian lowlands, it is not well known in most other parts of tropical America. It can not be considered a fruit of great value.

## CLUSIACEAE.

**Mammea americana** L.

*Mamey de Cartagena*, and occasionally *mata-serrano* in the provinces of the coast, where it is a rather common fruit tree.

The mamey, as it is termed in English as well as Spanish, is a handsome, erect tree reaching 18 meters in height. The leaves are oblong-obovate, 10 to 20 cm. long, thick, dark green, and glossy. The flowers, which are solitary or clustered in the axils of the young branches, are white and about 2.5 cm. broad. The fruit is round or oblate, 10 to 15 cm. in diameter, the rind russet-brown and nearly 3 mm. thick. The flesh, which commonly adheres closely to the one to four large seeds, is bright yellow and has a pleasant flavor suggestive of that of the apricot, for which reason the mamey is sometimes called "Santo Domingo apricot." It is not much esteemed for eating out of hand, but yields an excellent *dulce* or conserve. The species is considered to be native to the West Indies and northern South America.

**Rheedia madruno** (H. B. K.) Planch. & Triana.

*Madroño*, in the Province of Guayas (where it is a common garden tree) and probably elsewhere on the coast; it is also abundant in the Cauca Valley of Colombia, under the same common name.

This handsome tree is of erect, slender, pyramidal habit. It is conspicuous because of the deep green color of its foliage; the leaves are oblong-elliptic, shortly acuminate, 10 to 20 cm. long and 5 to 7.5 cm. broad, dark green above, somewhat lighter beneath. The small flowers are followed by yellow fruits 7.5 cm. long, oval to elliptic with a slender point at the apex, and tapering toward the stem; the surface is very rough, the skin thick and leathery, and the flesh whitish, translucent, juicy, and of a pleasant subacid, somewhat aromatic flavor. The seeds are large, oblong, and commonly two in number. The fruit, which is sometimes seen in the markets, is usually eaten out of hand.

**Garcinia mangostana** L.

*Mangostán* at the Hacienda Payo, near Naranjito, in Guayas Province, which is the only place in Ecuador where it is found, and probably the only spot in which this tree has been successfully grown on the west coast of South America.

The mangosteen, one of the finest fruits of the Asiatic tropics, is produced by a tree which reaches about 9 meters in height, and has elliptic, acuminate leaves, 15 to 25 cm. long, glossy, and of thick, leathery texture. The species is polygamous, staminate flowers and hermaphrodite or perfect flowers being produced separately upon the same tree. The red-purple fruit is about the size and shape of a mandarin orange, and has a large green calyx at its base. Within its thick, tough rind is a cavity in which lie four to eight snow-white segments of delicate pulp, having an acidulous, very agreeable flavor difficult of description. Many fruits are seedless; in others there are one or two oblong, flattened seeds. The ripening season at Payo is in April and May, with a few fruits remaining on the trees until July. There are a dozen fine trees at this place, all about 15 years old and in bearing. Because of its delicate root system, this is considered one of the most difficult to cultivate of all the tropical fruit trees. The behavior of the trees at Payo, however, proves that the species is well adapted to the Ecuadorian littoral region.

## PASSIFLORACEAE.

**Passiflora maliformis** L.

*Granadilla de hueso* in northern Ecuador, where it is cultivated in the Valley of the Rio Chota; it is also known under this same name in the Cauca Valley of Colombia.

This is a vigorous climber much resembling the *granadilla de Quijos* in foliage, the light green leaves being ovate-cordate and about 7.5 cm. in length. The flowers

have a conspicuous whitish green calyx, and the corona is white, marked with purplish blue. The fruits are round, rarely more than 5 cm. in diameter, with a thin shell, yellowish green on the surface and whitish within. Though not 3 mm. thick, this shell is so hard that it is broken with difficulty. Within are the numerous small black seeds, surrounded by juicy pulp of pale, orange-yellow color and rather acid, highly aromatic flavor.

**Passiflora popenovii** Killip.

PLATE 42.

*Granadilla de Quijos* on the eastern slopes of the Andes, where it is said to be indigenous as well as cultivated. It is a rare species, not seen in the highlands nor on the Pacific coast. Teodoro Wolf says of it: "From the mountains of Canelos the Indians bring to the markets of Baños and Riobamba a delicious fruit, called the *granadilla de Quijos*, which is the best of all the passifloras that grow in our territory." At Baños (Tungurahua Province, elevation 1,800 meters) it is now cultivated, though not abundantly.

The plant is a vigorous climber, with leaves 7.5 to 12.5 cm. long, ovate-elliptic and acuminate, glabrous, and light green. The flowers are produced in profusion upon slender peduncles arising from the leaf axils; the large calyx is deep rose-colored, while the remainder of the flower is white and purplish blue, the corona being marked with the latter color. The fragrance of the flowers is pronounced and agreeable. The fruit was described by Padre Velasco, in 1789, as follows: "It is larger and somewhat longer than that of *P. ligularis*, with a thick skin, not brittle, which is green on the surface and white within. The pulp which surrounds the seeds is sweet, of exquisite taste and delicious fragrance." Other species than the one here described are sometimes called *granadilla de Quijos* in various parts of Ecuador.

**Passiflora quadrangularis** L.

*Badea* in northern Ecuador, *tumbo* in the southern part of the Republic. It is cultivated abundantly in the coastal lowlands, and up to elevations of 1,800 meters. Above this it is rare but is found occasionally at elevations as high as that of Ibarra, 2,200 meters. It does not grow at Ambato, but is cultivated in the town of Loja, whose elevation is approximately the same as that of Ibarra.

The giant granadilla, as this plant is called in English, is the largest-fruited species of its genus. It is a coarse, strong climber, with four-angled stems and ovate or round-ovate, cordate leaves 15 to 20 cm. long. The flowers are white and purple, about 7 cm. in diameter, while the roughly oblong fruits are sometimes 30 cm. in length. The surface is dull yellow or orange-yellow, and the skin thin and delicate; within the latter is a zone of crisp, white flesh about 2.5 cm. in thickness, surrounding a cavity in which lie the numerous small, black seeds, each enveloped in whitish, translucent pulp. There is usually a quantity of juice within the cavity, and this, together with the pulp which surrounds the seeds, is used to prepare an excellent *refresco*.

**Passiflora ligularis** Juss.

PLATE 43.

*Granadilla* throughout the country. It is cultivated mainly at elevations between 2,200 and 2,700 meters. At Ibarra it is quite successful, and it is fairly so at Otavalo (2,600 meters). At Ambato it is common, while close by, at Baños (1,800 meters), it has run wild. It is grown at Cuenca and also at Loja, and is, in fact, a common fruit in the markets of nearly all parts of the country, being carried to Guayaquil and other coast towns.

The plant is a vigorous climber, scrambling over trees and buildings of considerable size. The leaves are cordate, acuminate, and commonly about 15 cm. long. The flowers are solitary, 5 cm. broad, with the petals and sepals greenish, and the corona white with zones of red-purple. The fruit is oval or elliptic, 5 to 7.5 cm. long, orange-brown, with a thick, brittle shell enclosing small black seeds, each sur-

rounded by white, translucent, juicy pulp. The flavor is acidulous, and slightly perfumed. This species, a native of tropical America and known in English as "sweet granadilla," is one of the best of its genus.

***Passiflora tripartita* (Juss.) Poir.**

*Tacso* at Baños, Tungurahua Province (elevation 1,800 meters), where it is occasionally seen in gardens, whence the fruit is sometimes carried to the market of Ambato.

This species is somewhat less vigorous in habit than *P. mollissima*, being a slender climber, reaching to 5 or 6 meters, with 3-lobed leaves 9 to 10 cm. long, the finely serrate lobes 7.5 to 9 cm. long by 1 to 2 cm. broad, glabrate above and sparsely and softly pubescent beneath. The light pink flowers are about 5 cm. broad, with a slender corolla tube about 10 cm. long. The fruit is oblong, tapering slightly toward the stem, about 7.5 cm. long, deep yellow when ripe, often blushed with red on one side. The small seeds are surrounded by deep orange-colored, juicy pulp very similar to that of *P. mollissima* in flavor and quality, and used in the same ways.

***Passiflora psilantha* (Sodirol) Killip.**

*Gullan* in the vicinity of Cuenca (elevation 2,600 meters), where it is commonly cultivated in dooryards and gardens.

This species is very close to *P. mollissima*, from which it differs most conspicuously in the pubescence of the foliage. The plant is a vigorous climber, reaching to 6 or 7 meters. The leaves are 3-lobed, the lobes serrate, acute, 2.5 cm. or more in breadth, glabrate above and sparsely hairy on the lower surface. The pink flower is 5 cm. broad, with a slender corolla tube about 10 cm. long. The fruit is similar to that of *P. mollissima*. There is a white-flowered form, occasionally seen in Cuenca.

***Passiflora pinnatistipula* Cav.**

*Tacso* at El Angel, Province of Carchi (elevation 3,000 meters); also at Ambato, where it is common, but not so extensively cultivated as *P. mollissima*, nor is the fruit often sold in the market. In the Department of Cundinamarca, Colombia, it is known as *gulupa*.

This species is a strong climber of much the same habit as *P. mollissima*, from which, however, it can easily be distinguished in foliage, flowers, and fruit. The leaves are much more deeply lobed than those of the latter species, the lobes being nearly 7.5 cm. long by less than 2.5 cm. broad, and very sparsely serrate; they are dark green and glabrous on the upper surface, whitish and velvety-pubescent below. The flower is more attractive than that of *P. mollissima*, being of a deeper and livelier shade of pink; it has a corolla tube about 5 cm. long. The greenish yellow fruit is round, 5 cm. in diameter, with a somewhat brittle shell, and many seeds, each surrounded by translucent colorless pulp of sweet but rather insipid taste.

***Passiflora mollissima* (H. B. K.) Bailey.**

PLATE 44.

*Tacso* in northern and central Ecuador, where it is commonly cultivated, especially in the towns of Ambato and Ibarra. Its approximate range extends from 1,800 to 3,000 meters.

The plant is a vigorous climber, with 3-lobed leaves varying from 7.5 to 10 cm. in length, the finely serrate lobes 5 to 6 cm. long by 2.5 to 4 cm. broad, densely and finely pubescent above, and velvety-pubescent below. The handsome pink flowers, 5 to 7.5 cm. across, have a corolla tube 7.5 to 10 cm. in length; they are followed by cream-yellow, oblong, finely pubescent fruit, 7.5 to 12.5 cm. long. Within the thick, leathery skin are numerous small, elliptic, compressed, black seeds, each surrounded by deep orange-colored, juicy pulp of pungent subacid flavor. In the Department of Cundinamarca, Colombia, this species is very popular under the name *curuba de Castilla*. The fruits, in that country as well as in Ecuador, are commonly sold in the markets, and are eaten out of hand, or used to prepare refreshing drinks. They also make an excellent flavoring for ice cream.



Another species, *P. mixta* L. f., occurs wild throughout the highlands from Carchi to Loja. It is closely similar to *P. mollissima* in general appearance, but the fruits are not of such good quality as those of the last named. It is not seen in cultivation.

### CARICACEAE.

#### *Carica papaya* L.

*Papaya*, in all parts of the Republic from sea level up to elevations of about 1,800 meters.

Excellent varieties of this well-known tropical fruit are cultivated in the Ecuadorian lowlands. Fruits 3 to 3.5 kilograms in weight are not uncommon, and the quality of some of them is superior to that of the papayas cultivated in many other countries.

#### *Carica candamarcensis* Hook. f.

PLATE 45.

*Chilhuacán* in the gardens of Imbabura Province, where it is quite common; this name is used also at Quito, where the species is fairly well known. In Tungurahua Province it is termed *chamburo*, while in Azuay it is known as *siglolón*, *siglalón*, or *sigloalón*, and occasionally as *chiblacán*; in both these provinces it is abundantly cultivated. In Loja it is more frequently seen as a wild than as a cultivated plant, and is called *chamburo*. Its zone is approximately between 1,800 and 3,000 meters.

This species, which reaches a height of 4.5 to 6 meters, usually has a trunk stouter than that of the papaya, though the leaves strongly resemble those of the latter in size and character. It is irregularly dioecious, at least when brought under cultivation. At Ambato plants are seen bearing principally staminate flowers, but carrying at the same time a good number of fruits that are apparently normal in form and size. Many plants produce pistillate flowers only. The fruits, which are commonly sold in the markets of the inter-Andean region, are elliptic, sharply pointed at the apex, and deeply 5-sutured. By means of this last characteristic they can easily be distinguished from those of *C. chrysopetala*. They are deep orange when fully ripe, and possess a fragrance quite distinct from that of the papaya. The flesh is about a centimeter in thickness; it is usually eaten after cooking, being most popular in the form of a sweet conserve or *dulce*. The numerous seeds, quite distinct from those of the papaya in appearance, are embedded in a gelatinous, translucent, edible pulp which fills the central cavity of the fruit. The species is probably indigenous in the Andes of northern South America. In the vicinity of Bogotá, Colombia, it is abundantly cultivated, and it is seen also in numerous other parts of that republic.

#### *Carica pentagona* Heilborn.

PLATE 46.

*Babaco* throughout the inter-Andean region, where it is cultivated in many places, from Loja Province northward to El Carchi. It was seen only in cultivation, between 1,800 and 3,000 meters altitude. Flowers other than purely pistillate ones have not been found on any of the numerous plants examined.

This is the most remarkable and valuable of the several interesting species of *Carica* cultivated in Ecuador. Because of its large fruits, from which an excellent sauce can be made, because of the relatively low temperatures which the plant can withstand, and because of its habit of producing seedless fruits, the *babaco* is worthy of attention in other countries. It is a smaller plant than *C. candamarcensis*, *C. chrysopetala*, and the papaya; it rarely reaches a greater height than 3 meters, and the stem is commonly rather slender, especially when the plants are set close together in commercial plantations, as is done at Ambato. The leaves are glabrous like those of *C. chrysopetala*, but with fewer and broader lobes. The fruits are commonly about 30 cm. in length, and 7.5 to 12.5 cm. in diameter; they are truncate at the base and sharply acute at the apex, resembling in form those of *C. chrysopetala*. Unlike the



latter, however, they are in transverse outline conspicuously 5-angled, with hollowed sides. The flesh is about a centimeter in thickness, nearly white, distinctly fragrant and very acid in flavor. It is eaten only after cooking. The large cavity in the center of the fruit contains a quantity of white, cottony substance and, occasionally, a few seeds. The latter are perhaps produced when the flowers are fertilized with pollen from other species of *Carica*.

The plant is propagated only by cuttings, and has not been observed in a wild state. It is said that its introduction into southern Ecuador (the Azuay and Loja) has been effected in recent years; plants are believed to have been carried to these regions from Ambato.

O. Heilborn<sup>6</sup> has published the only detailed treatment of Ecuadorian *Caricas*. In the paper cited he describes two new species, *C. chrysopetala* and *C. pentagona*, and treats also of *C. candamarcensis* and *C. papaya*. The genus *Carica* is a difficult one, not yet exhaustively studied, and there are probably numerous undescribed species still to be found in the Andes.

***Carica chrysopetala* Heilborn.**

PLATE 47.

*Higacho* at Baños, Province of Tungurahua, where it is common in gardens. It appears not to be grown in Ambato. In the Provinces of Pichincha and Imbabura it is called *chamburo*, and is fairly abundant in the larger towns such as Quito, Otavalo, and Ibarra. In the Azuay it is called *chamburo*, and in Loja *toronchi*; in the former province it is fairly abundant, but in the latter, with the exception of the northern portion, it is little known.

This plant is of about the same size as *C. candamarcensis*, and in general resembles the latter in appearance, though it can easily be distinguished by the leaves; those of *C. candamarcensis* are pubescent beneath, while those of *C. chrysopetala* are glabrous or nearly so on both surfaces. The fruits of the last-named are also quite distinct from those of *C. candamarcensis*; they are narrowly oblong, truncate at the base and acute at the apex, and commonly 10 to 15 cm. in length. When ripe, they are greenish yellow or deep yellow; the flesh is thin, even more aromatic than that of *C. candamarcensis*, and used only when cooked to form a *dulce* of pleasing aromatic flavor. The species is probably indigenous somewhere in the Ecuadorian Andes; it was not observed in Cundinamarca or elsewhere in central Colombia.

## CACTACEAE.

***Opuntia bonplandii* Pfeiff.**

*Tuna*; in dooryards and rocky waste places about towns and villages throughout the highlands.

With this species are often found other cacti native to Ecuador, and several that may have been introduced from other countries. *Opuntia dobbieana* Britt. & Rose, and *O. soederstromiana* Britt. & Rose are two native species, both of which yield fruits inferior in quality to those of *O. bonplandii*. All these species are called *tuna*; some have red fruits, others yellow. The better kinds are highly prized and often sold in the markets.

***Hylocereus polyrhizus* (Weber) Britt. & Rose.**

*Pitajaya* or *pitahaya*; wild and half-cultivated in the lowlands along the littoral, where it climbs upon walls and trunks of trees, or scrambles over bushes and rocks.

This cactus, with slender 3-angled branches, yields a globular to oblong fruit 12.5 to 18 cm. in length, having a thick, red skin, bearing large leaflike scales. The pulp is white or sometimes pinkish, sweet, and pleasantly flavored. It is used in making *refrescos*, or eaten out of hand.

<sup>6</sup> Arch. Bot. 17<sup>12</sup>: 1-16. 1921.

## MYRTACEAE.

**Myrtus foliosa** H. B. K.

*Arrayán* at Ibarra, Otavalo, Quito, Ambato, and in other towns of the highlands, between 2,100 and 3,000 meters elevation.

This plant, cultivated more as an ornamental than as a fruit-bearing tree, is erect, slender in habit, and ultimately about 6 meters high. The leaves are obovate, 1 to 2.5 cm. long, thick, glossy, deep green above and light green beneath. The flowers, which are produced singly or in clusters of two or three in the leaf axils, are white and about a centimeter broad. The fruit is broadly obovoid to spherical, dark purple, and crowned at the apex by the persistent calyx. It varies from 1 to 2.5 cm. in length, and is soft and delicate in texture; the thin skin is easily broken, exposing the whitish, juicy pulp that surrounds the single irregularly oval, compressed seed. The flavor is mildly subacid and pleasant, somewhat suggestive of that of the grape. The fruit is usually eaten out of hand.

**Psidium friedrichsthalianum** (Berg) Niedenzu.

*Guayaba del Chocó* in the Province of Guayas, where it is occasionally cultivated. A few specimens were seen in northern Ecuador, and many in the Cauca and Magdalena valleys of Colombia, where the species is called *guayaba agria*.

This guava reaches a height of about 7.5 meters, forming a small and attractive tree. The young branches are wiry, quadrangular, and reddish. The leaves are elliptic to oval, 5 to 10 cm. long, almost glossy on the upper surface and puberulent on the lower. The fragrant white flowers, produced singly on slender peduncles, are about 2.5 cm. broad. The few-seeded fruit is round or oval, 4 to 6 cm. long, sulphur-yellow, with soft white flesh of acid taste, lacking the musky odor which characterizes the common guava. It is too sour for eating out of hand, but is used in Costa Rica (where it is known as *cas*) to prepare a popular *refresco*, and it can also be used for jellies. The species is probably indigenous in Central America and the northern part of South America.

**Psidium guajava** L.

*Guayaba* throughout the country. It is one of the commonest fruit-bearing plants in nearly all regions lying between sea level and 2,300 meters elevation.

The common guava is an arborescent shrub or small tree, sometimes growing to 9 meters. The young branchlets are quadrangular, and the leaves oblong-elliptic to oval, 7.5 to 15 cm. long, finely pubescent beneath, with the venation conspicuously impressed on the upper surface. The white flowers, about 2.5 cm. broad, are solitary or several together upon a slender axillary peduncle. The fruit is round, ovoid, or pyriform, 2.5 to 10 cm. long, commonly yellow, with flesh varying from white to deep pink or salmon red. Numerous small hard seeds are embedded in the flesh toward the center of the fruit. The flavor is sweet, musky, and very distinctive. The fruit is eaten out of hand, or used to prepare various sorts of jellies and preserves. The native home of this species is tropical America.

**Psidium guineense** Swartz.

*Guayabilla* and *allpa guayaba* at Baños, Tungurahua (1,800 meters), where it is a common wild plant, growing along roadsides and in the edges of cultivated fields, in some places becoming a weed.

This species, of little economic value, is a slender shrub reaching 1 to 1.5 meters in height. The young branchlets are compressed-cylindrical and finely hairy. The leaves are oblong-oval, 7.5 to 12.5 cm. in length, with the lower surfaces pubescent. The flowers, of which one to three are borne upon a slender peduncle, resemble those of *P. guajava*. The fruit is round or nearly so, 2.5 to 4 cm. in diameter, greenish yellow and rather hard when ripe, with whitish flesh containing numerous small seeds. The flavor is rather acid and not so musky as that of *P. guajava*.

**Caryophyllus jambos** (L.) Stokes.*Eugenia jambos* L.

*Pomaroosa* in the coastal lowlands, and in numerous towns of the sierra which lie at elevations not exceeding 2,300 meters. It is esteemed more as an ornamental than as a fruit-bearing tree.

The rose-apple grows to 7.5 or 8 meters in height and is shapely and attractive in appearance. The leaves are oblong-lanceolate, 12 to 20 cm. long, thick and glossy, with the new growth wine-colored. The large flowers are greenish white, with a conspicuous cluster of long stamens; the fruit is round or oval, 2.5 to 5 cm. in length, whitish green to apricot-yellow in color, with the large round seed (sometimes two hemispherical ones) loose in the seed cavity. The odor and flavor of the fruit are those of the rose, but the texture of the flesh is such that it is not pleasant to eat in quantity. The fruit is sometimes prepared in crystallized form, when it becomes more palatable than it is as a fresh product. The native home of the species is in the East Indies.

**PUNICACEAE.****Punica granatum** L.

*Granada* in all those regions where it is cultivated. It is found on the coast, in the Province of Guayas and elsewhere, and in many of the towns of the inter-Andean region, such as Ambato, Ibarra, and Cuenca. It is of little economic importance anywhere in Ecuador, being cultivated as an ornamental rather than as a fruit-bearing plant.

The well-known pomegranate, probably a native of Persia, was introduced into Ecuador during colonial times. It is a shrub 4.5 to 6 meters high, with lanceolate to oblong, obtuse leaves about 7.5 cm. long. The handsome orange-red flowers are axillary and solitary or in small clusters toward the ends of the branchlets. The fruit is globose or flattened, obscurely 6-sided, the size of an orange or sometimes larger. It has a smooth, leathery, brownish red to yellow skin which encloses the numerous seeds, each surrounded by reddish, juicy pulp of delightful subacid flavor, and used for making *refrescos* as well as eating out of hand.

**VACCINIACEAE.****Englerodoxa alata** Hörold.

*Pera silvestre* and sometimes *manzanilla* in Tungurahua Province, where it occurs abundantly upon the slopes of the volcano of the same name, at elevations of 3,700 to 3,800 meters. It is not cultivated.

This species, of very little economic importance, is a slender, somewhat wiry shrub, reaching a maximum height of 3 meters. Its leaves are thick and stiff, elliptic to broadly elliptic, entire, and about 2.5 cm. long. The bright crimson flowers, which are 4 cm. in length, are borne in small terminal clusters, and are followed by light red, globose fruits, longitudinally 5-ribbed and about a centimeter in length. These are soft and juicy, and contain a number of minute seeds; in flavor they are thought to suggest the pear, whence the common name usually applied to them.

**Disterigma margaricoccum** Blake.

*Chirimote*; one of the characteristic plants of the higher slopes of the Volcano Tungurahua, occurring in great abundance at elevations between 3,400 and 4,000 meters. It is never seen in cultivation.

This beautiful plant is a compact, shapely bush reaching 1.5 meters in height. Its leaves, which are sessile and produced abundantly on the slender stems, are lanceolate and about a centimeter in length. The flowers are tubular, slightly contracted at the mouth, a centimeter in length, and of rich rose-pink color. They are followed

by round fruits which suggest large pearls in appearance, being translucent white, up to one centimeter in diameter. These fruits are crowned at the apex by four sharply pointed calyx segments; they are tender and crisp, with abundant juice and a few minute seeds. The flavor is pleasantly subacid and very refreshing. Although not an article of commerce they are gratefully eaten by the traveler who chances to pass through the zone in which they grow.

***Disterigma popenoei* Blake.**

*Tira*, in the Cordillera de Zamora, Loja Province, where it occurs abundantly at elevations between 2,400 and 2,700 meters. It is not cultivated.

This is a shrub about 2 meters high, with elliptic-acute, entire, rather stiff leaves about 2.5 cm. long. The white tubular flowers, about 6 mm. long, are produced abundantly in the leaf axils, and are followed by translucent white berries scarcely 5 mm. in diameter. These have much the same flavor as the *chirimote* of Tungurahua Province, but are not quite so good; they have soft, juicy, acidulous pulp in which a few minute seeds are embedded. The plant occurs in cool and very moist regions, and is of little economic importance.

***Macleania ecuadorensis* Hörold.**

*Hualicón* on the slopes of the Volcano Tungurahua, at elevations of 2,400 to 3,000 meters, and probably in other parts of the Republic. It is not cultivated.

This is a slender shrub rarely more than 3 meters high, with thick, stiff, oblong-elliptic to broadly oval leaves 7.5 to 12.5 cm. in length. The rose-pink, waxy, tubular flowers, about 2.5 cm. long, are borne in crowded axillary clusters, and are followed by globose fruits about 1 cm. in diameter, purplish black, soft and delicate in texture, with a thin skin and juicy pulp in which are embedded several minute seeds. The flavor is sweet and agreeable. While not an article of commerce, the fruits are eaten by those who live in the regions where they grow.

***Macleania laurina* Blake.**

*Chaqui-lulu* and *hualicón* in the vicinity of El Angel, Province of Carchi, where it occurs abundantly at elevations of 3,000 to 3,700 meters. It is not cultivated.

Viewed from a horticultural standpoint, this species is very similar to the *hualicón* (*M. ecuadorensis* Hörold) of Tungurahua Province. Its leaves are oblong-lanceolate to ovate, acute, and 5 to 12.5 cm. in length. The rose-pink, tubular, waxy flowers are borne in dense axillary clusters, and are followed by round, dark purple fruits, a centimeter in diameter, containing an abundance of slightly acidulous juice of pleasant flavor.

***Macleania popenoei* Blake.**

*Joyapa* in the Province of Loja, where it occurs abundantly, as a wild species, in the Cordillera de Zamora at elevations between 2,400 and 2,700 meters. Like the other *joyapas*, it prefers a moist, cool climate. It is not cultivated, but the fruit is sometimes gathered from wild plants and eaten out of hand.

This is a shrub, sometimes half-climbing in habit, and reaching about 3 meters in height. Its leaves are variable in form; commonly they are elliptic-lanceolate, elliptic, or ovate-elliptic, sharply acute, thick and somewhat stiff in texture, and from 5 to 10 cm. in length. The reddish, tubular flowers about a centimeter long are produced in dense axillary clusters. They are followed by round fruits a centimeter in diameter, which are soft, juicy, and sweet to the taste.

Several other species of *Macleania* occur in the Ecuadorian highlands and yield fruits which are eaten, though not highly esteemed. The names *joyapa* and *salapa* are usually applied to them.

***Vaccinium floribundum* H. B. K.**

PLATE 48.

*Mortiño*; very abundant as an indigenous plant throughout the sierra at elevations between 3,000 and 3,700 meters. It is not cultivated, but the fruit is brought into

the markets of Andean villages. In some parts of the country its ripening season, March to August, is the occasion for picnics in the *campo*, the inhabitants of the towns and villages betaking themselves to the places in which this plant grows abundantly, to pick and eat the fruit.

The *mortiño* is a slender, handsome shrub about 2 meters in height, with very small, elliptic to ovate, acute, finely serrate leaves closely crowded on the stems, and small, bell-shaped, deep pink flowers produced in great abundance. The very glaucous blue fruit is roundish, up to about 8 mm. in diameter, juicy, subacid, and pleasant to the taste, and containing several very small seeds. It greatly resembles some of the blueberries of the United States, and could probably be developed by cultivation into a more valuable fruit than it is to-day. In northern Ecuador it is believed that the fruits produced by low, spreading plants are better than those of the tall ones.

### SAPOTACEAE.

#### *Achras zapota* L.

*Nispero* on the coast, where it is fairly common. It is rarely seen above elevations of 1,200 meters.

A stately tree, reaching 15 or 18 meters in height, native to southern Mexico and Central America, where it is usually called *chicosapote*. Leaves entire or emarginate, ovate-elliptic to elliptic-lanceolate, thick, stiff, and shining, commonly 5 to 12.5 cm. long. The small, whitish flowers are produced in the leaf axils toward the ends of the branchlets. The fruit is round, oval, or conical, and 5 to 9 cm. in diameter; the thin, brown, somewhat scurfy skin encloses yellow-brown, soft flesh of very pleasant flavor, in which are imbedded several hard, obovate, flattened, shining black seeds about 2 cm. long.

From this tree much of the *chicle* used in the manufacture of chewing-gum is obtained, the principal center of production being southern Mexico and northern Guatemala. The fruit is known as *sapodilla* in Florida and *naseberry* in Jamaica; it is highly esteemed in many parts of tropical America, and also in certain oriental countries. The seedling forms grown in Ecuador are not, as a rule, of superior quality; larger and finer fruits are grown in southern Florida and Cuba.

#### *Lucuma obovata* H. B. K.

*Lucma* (sometimes *lugma* and *lugma*) at Loja, where it is fairly common; at the village of Baños, near Cuenca; and at Baños in Tungurahua Province. It does not seem to be known in northern Ecuador, but is probably cultivated in the Oriente, or eastern part of the county, where it may perhaps be indigenous.

This is a little-known and not very highly esteemed fruit. The tree reaches 12 meters in height, and when well grown it has a round, dense crown of very attractive appearance. The leaves, which are clustered toward the ends of the branchlets, are obovate, oval, or elliptic, subacute at the base and rounded to acute at the apex, commonly 12.5 to 25 cm. long, deep green, with the margins entire. The small flowers are produced in great abundance upon the younger branches; they are 2 cm. long, the corolla tubular, deeply 5-toothed, and pale green. The fruit is round to broadly oval, occasionally pointed at the apical end, commonly 7.5 to 10 cm. in diameter. The surface is deep brownish green, heavily marked or overspread with russet. The skin is very thin and easily broken. The flesh is deep yellow, quite firm even in the fully ripe fruit, and of very sweet, typically sapotaceous flavor. The seeds are commonly two, broadly oval, about 3 cm. long, brown and glossy except on the flattened ventral surface, which is white and rough.

#### *Pouteria caimito* (Ruiz & Pav.) Radlk.

*Cauje* in the provinces of the littoral, where it is a common tree, especially in the Province of Guayas.

This plant, known in Brazil as *abiu* and in the Cauca Valley of Colombia (where it is rare) as *caimo*, reaches a height of about 6 meters. Its leaves are obovate to lanceolate, 10 to 20 cm. long, glabrous, and bright green. The fruit is elliptic to round, 5 to 10 cm. long, bright yellow, with a thick, tough skin. Surrounding the two or three large seeds is the translucent, whitish flesh, somewhat jellylike in consistency and of a sweet, pleasant flavor resembling that of the caimito or star-apple. The species is perhaps indigenous in eastern Ecuador, its native home, according to De Candolle, being along the headwaters of the Amazon. The fruit is held in considerable esteem by Ecuadorians, and often appears in the markets of Guayaquil during March and April.

**Chrysophyllum cainito L.**

*Caimito* in the coastal lowlands, where it is a common tree.

The star-apple, as this species is called in English is an unusually handsome tree, attaining 12 to 15 meters in height. The leaves are oval or oblong, about 10 cm. in length, deep green and glossy above, and typically golden-brown, with a satin-like sheen beneath. The flowers are small and inconspicuous, purple-white in color. The fruit is round or oblate, 5 to 10 cm. in diameter, smooth, somewhat glossy, either dull purple or light green. The flesh is soft and melting, but not very juicy; it incloses three to five ovate-elliptic, hard, flattened dark brown seeds. The flavor of the fruit is suggestive of that of the other members of this family, such as the *nispero* and the *cauje*. The species is considered to be native to the West Indies and Central America.

**Calocarpum mammosum (L.) Pierre.**

*Lucuma mammosa* Gaertn. f.

*Mamey colorado* in the coastal lowlands, where it is a common fruit tree. In many parts of tropical America it is known as *zapote*, but this name is applied in Ecuador to the fruit of *Matisia cordata*.

The sapote (to use the correct English name) is a large Central American tree, sometimes attaining 20 meters in height. The leaves, which are clustered toward the ends of the stout branchlets, are obovate to oblanceolate, and 10 to 25 cm. long. The small flowers are produced in great numbers along the branchlets. The fruit is elliptic or oval, commonly 7.5 to 15 cm. long, russet-brown, with the skin thick, woody, and scurfy on the surface. The flesh is firm, salmon-red, and finely granular. Its flavor is very sweet and, in many varieties, somewhat suggestive of the squash. The seed is large, elliptic, hard, brown, and shining except on the ventral surface, which is whitish and somewhat rough.

**OLEACEAE.**

**Olea europaea L.**

*Olivo* (the fruit, *aceituna*); occasionally seen at Ibarra, Quito, Ambato, Cuenca, and elsewhere in the highlands, but nowhere cultivated on a commercial scale. Luis Cordero says it grows and fruits fairly well in the valleys of Paute, Gualaceo, Chuquipata, and others of southern Ecuador. In the region of Ambato it does not fruit abundantly, and this seems, in fact, to be true of the species in all those sections of the country where it has been planted.

Olives are imported into Ecuador from California and southern Europe. It would be more favorable for the country to produce them, were this practicable; but past experience with the tree is not very encouraging. Possibly there are certain regions in which it will fruit with sufficient regularity to make its culture commercially profitable. The subject is, at least, worth further study. In the dryer parts of the inter-Andean region, at elevations of 2,000 to 3,000 meters, it grows vigorously.



## VERBENACEAE.

*Vitex gigantea* H. B. K.

*Pechichi* in the Province of Guayas, and elsewhere in the coastal lowlands, where it is rather abundant. The fruit is sold in the markets of Guayaquil during December and January.

The *pechichi* is a tree up to 10 meters high, with palmately compound leaves, composed of elliptic to obovate-elliptic acuminate leaflets, 5 to 15 cm. in length and sparsely pubescent on both surfaces. The small purplish flowers are followed by oval fruits of the size and appearance of ripe olives; they have a thin, almost black skin, juicy brown flesh, and a single elliptic stone of rather large size. The flavor is rather bitter, and not apt to be appreciated by those unaccustomed to it. The tree can not be considered of much economic importance or value.

## SOLANACEAE.

*Physalis peruviana* L.

*Uvilla* at Ambato, where it grows spontaneously along roadsides, and where also it is cultivated in a small way. The same name is used in Imbabura and Carchi provinces, northern Ecuador, and in the southern provinces, in all of which it is found.

This, the ground-cherry or husk-cherry of northern gardens, is a plant about 60 cm. high, with yellow flowers followed by globose yellow fruits a centimeter in diameter, each surrounded by a dry husk, and having a thin skin which incloses numerous small seeds and a quantity of soft, juicy pulp. When eaten out of hand these fruits are rather insipid, but they are cooked with sugar to form an excellent conserve. The *uvilla* is not of much importance in any part of Ecuador.

*Solanum muricatum* Ait.

*Pepino* throughout the inter-Andean region, where it is commonly grown between altitudes of 1,200 and 2,700 meters.

Several good varieties of this Andean fruit are cultivated in Ecuador; the best one probably is the round yellow pepino of the Chota Valley. The latter is commercially cultivated on a small scale, as is also the long, green-fruited form of the region near Ibarra.

The *pepino* is a half-shrubby plant reaching about 60 cm. in height, with trifoliolate leaves, linear-lanceolate to oblong-lanceolate leaflets, and clusters of bluish flowers suggesting those of the potato. Its fruits vary from round to long and slender, and from 5 to 20 cm. in length. They are commonly greenish yellow, with markings of purplish red, but they may also be yellow or light green. Commonly they are seedless; sometimes they contain small seeds like those of the eggplant. The flesh is very juicy, crisp, and of a refreshing subacid flavor suggesting that of the cantaloupe. The plant, which bears fruit during three years, begins to yield five months after planting, producing a crop every three or four months. Sometimes it is attacked by *Phytophthora infestans*, according to Professor Pachano, who has studied this disease at Ambato.

*Solanum quitoense* Lam.

PLATE 49.

*Naranjilla* throughout the sierra, where it is cultivated at altitudes between 1,500 and 2,600 meters. It succeeds best at 1,500 to 1,800 meters. At Baños, Tungurahua, it is grown on a commercial scale, and the fruit is shipped to Guayaquil, Quito, and other cities. The highest point at which it has been observed is Otavalo (2,600 meters).

The *naranjilla* is a soft-wooded, sparsely branched plant, stiffly erect and reaching about 1.5 meters in height. The stout stems, as well as the leaves, flower buds, and fruits are covered with soft, simple or stellate hairs; on the young leaves and the

flower buds these are light purple, while on the older parts they are almost white. The leaves, which are borne upon stout terete petioles up to 15 cm. in length, are oblong-ovate, 30 to 45 cm. in length, clasping at the base and acute or shortly acuminate at the apex, with the margins sinuate; they are deep green above and light green (with a purplish tinge) beneath, soft, with the midrib and primary lateral nerves conspicuous on both surfaces, but most prominently so beneath.

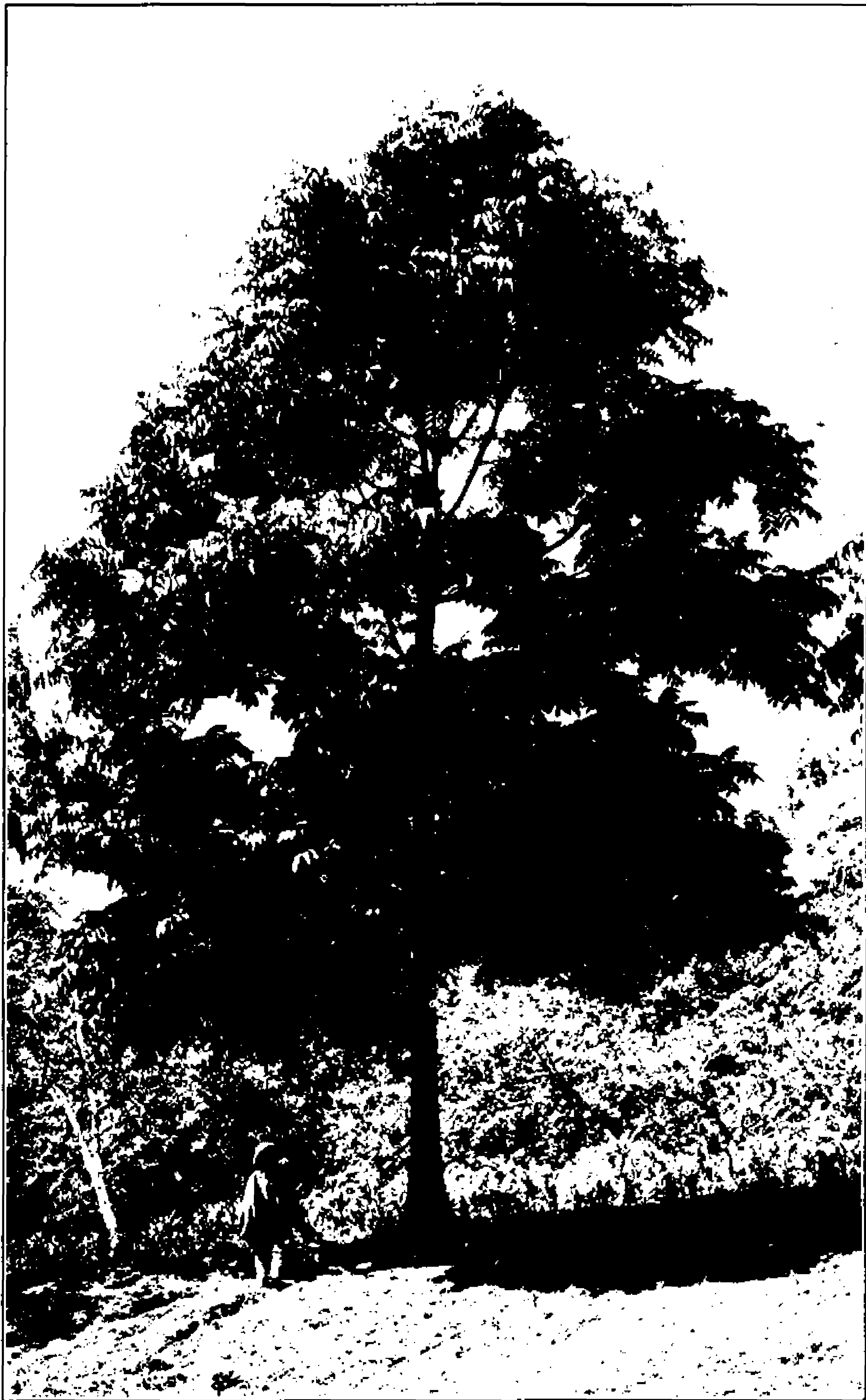
The flowers are borne in short axillary cymes; they are white, star-shaped, about 4 cm. broad, with five large yellow stamens in the center. The fruits, which are produced upon very short stalks, are round or round-ovate, about 5 cm. in diameter, and bright orange-colored when fully ripe. The coarse hairs with which the surface is covered are easily brushed off; it is the custom to remove them in this manner before the fruits are taken to market. The skin is thick and leathery; it incloses translucent, greenish or yellowish pulp in which are embedded numerous seeds similar to those of the tomato. The pulp is extremely juicy, and of a refreshing subacid flavor which renders it suitable for preparing drinks and water ices.

***Cyphomandra betacea* (Cav.) Sendt.**

*Tomate de árbol* throughout the highlands, where it is abundantly cultivated.

The tree-tomato is highly esteemed in many parts of the inter-Andean region; it is, in fact, one of the most popular fruits in many sections. It is grown principally between elevations of 1,500 and 3,000 meters; at Baños, Tungurahua (1,800 meters) it is one of the commonest fruit-bearing plants to be seen in the gardens of the town; at Ambato (2,600 meters) it is found in many dooryards, and the fruit appears commonly in the market; at Otavalo and Ibarra (Imbabura Province) it is fairly well known, and is more abundant in the former (2,600 meters) than in the latter (2,200 meters). In Loja (2,200 meters) and in Cuenca (2,600 meters) it is abundantly cultivated, and the fruit is sold in the markets.

The tree-tomato, as it is called in English, is a half-woody shrub reaching to a height of 3 meters, usually a miniature tree in form. The leaves are cordate-ovate, often 15 to 20 cm. long; small, pinkish flowers are produced in the leaf axils in small clusters. The fruits are oval to elliptic, commonly 5 cm. in length, and orange-red. In character of flesh and seeds they resemble the common tomato, which they suggest also in flavor. They are usually prepared for eating by stewing in sirup, to form a *dulce* or conserve.



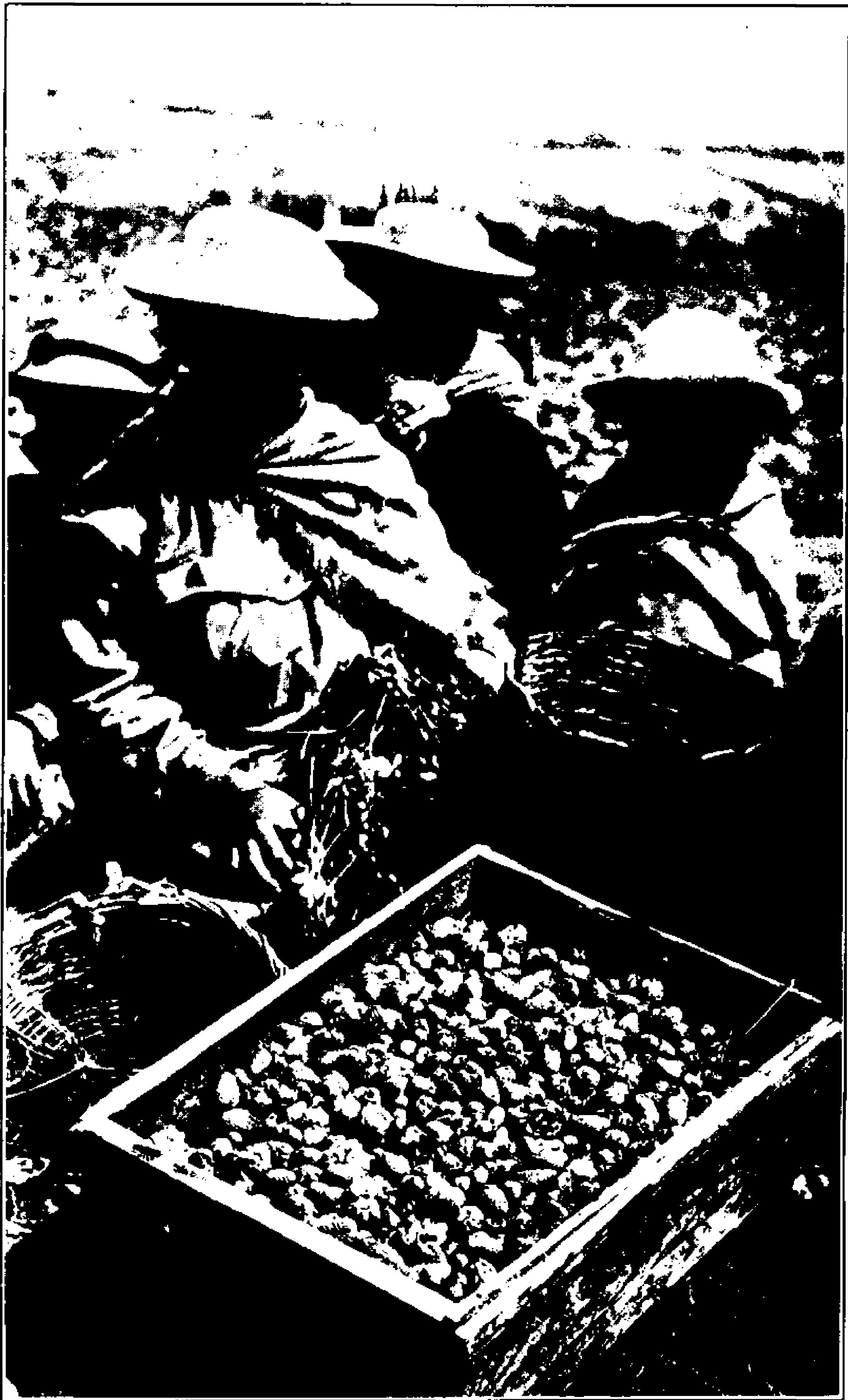
**JUGLANS HONOREI DODE.**

The native black walnut of Ecuador, commonly called tocte by the Indians. Photographed near the city of Ambato.



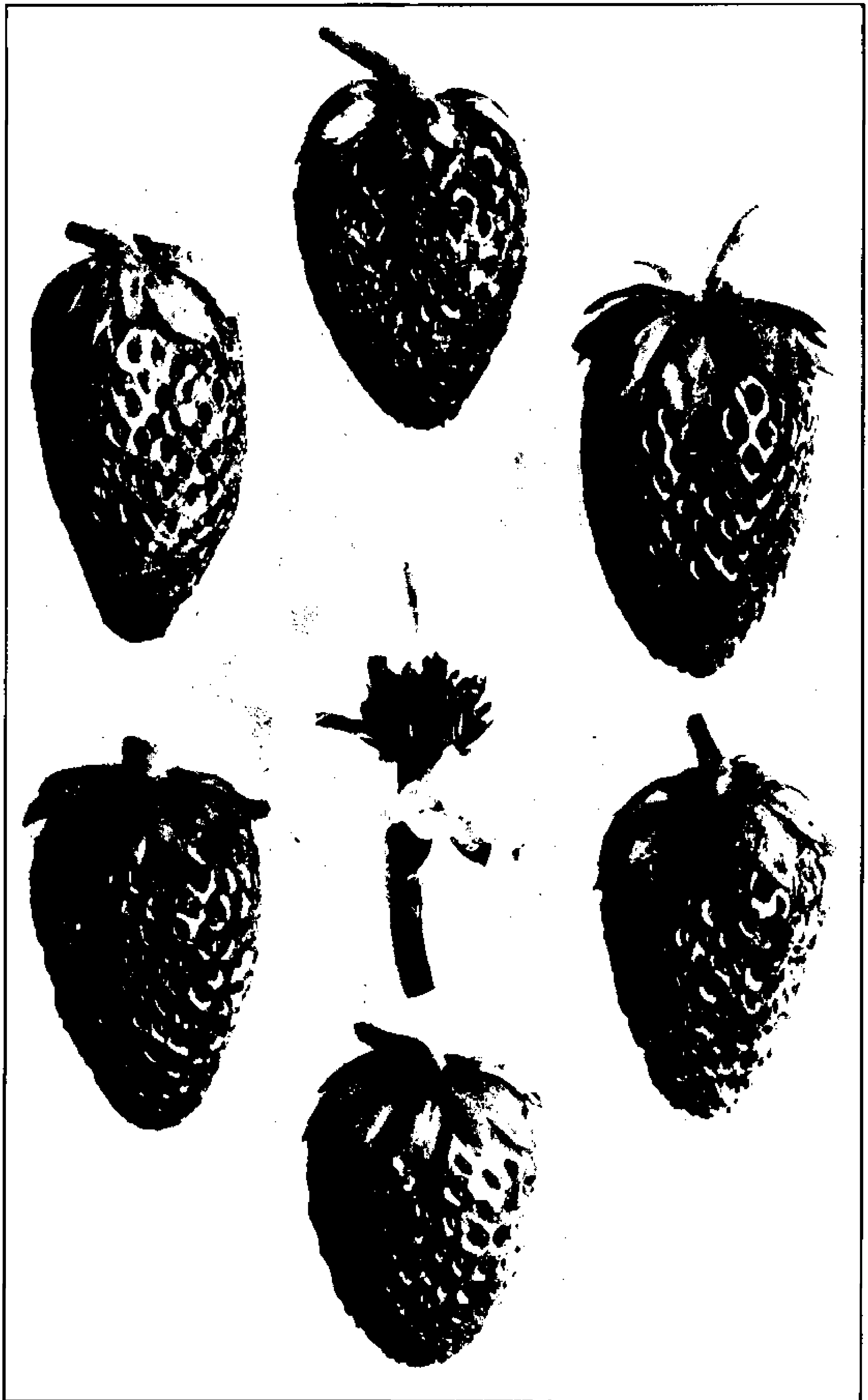
*PERSEA AMERICANA DRYMIFOLIA* (CHAM. & SCHLECHT.) BLAKE.

This enormous avocado tree of the Mexican race stands on the lower slopes of the  
Batale Valley, not far from the city of Ampaté.



**FRAGARIA CHILOENSIS DUCH.**

Strawberry pickers in a field at Guachi, near Ambato. Considerable areas are here devoted to the cultivation of the Chilean strawberry.



**FRAGARIA CHILOENSIS DUCH.**

Fruits and flowers of the Chilean strawberry, as grown at Guachi, near Ambato.  
(Natural size.)





**RUBUS GLAUCUS BENTH.**

The Andes berry, known as mora de Castilla in Ecuador and Colombia; photographed at Ambato. — *Natura*, 23.



**RUBUS ADENOTRICHOS SCHLECHT.**

This blueberry grows throughout the E. and W. highlands. Its fruits are at once green and of most excellent flavor. It is at least 1000 ft. above the sea level. Photo taken at the R. and W. Highlands, P. V. and C. G. C. C.



**RUBUS ROSEUS POIR.**

A large-fruited red raspberry growing at high elevations in Ecuador. Photographed at Baños, Province of Tungurahua. (Natural size.)



**PRUNUS SEROTINA EHRH.**

Fruit clusters and foliage from the Goza es tree, a choice variety of the kapali, grown at Cat glata, in the suburbs of Ambato. (Natural size.)



**PASSIFLORA POPENOVII KILLIP.**

A rare species from the eastern slopes of the Ecuadorian Andes, where it is called granadilla de Quijos. Photographed in a garden at Baños, Province of Tungurahua.



**PASSIFLORA LIGULARIS JUSS.**

The common granadilla of tropical American highlands, from southern Mexico to Peru. Photographed at Ambato. (Natural size.)





**PASSIFLORA MOLLISSIMA H. B. K. BAILEY.**

The common taste of the Equatorial highlands called curupa. Colombia. Photographed at Bogotá, Colombia.



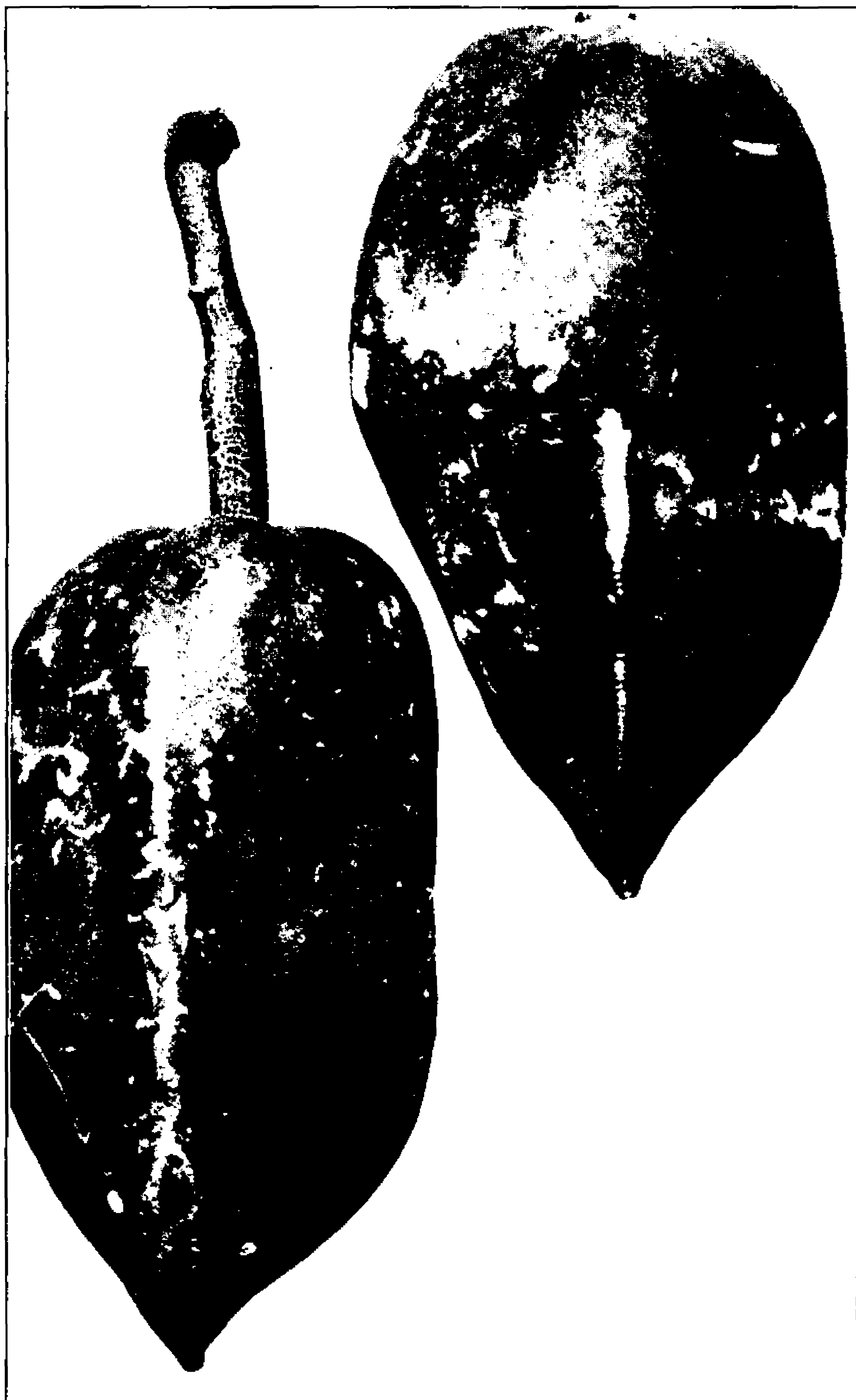
**CARICA CANDAMARCENSIS HOOK. F.**

A mature plant of the small-fruited hardy papaya found throughout the northern Andean region in Ecuador known usually as chilhuacán and camburo. Photographed at Nemocón, Cundinamarca, Colombia.



**CARICA PENTAGONA HEILBORN.**

The babaco of Ecuador, fruiting in a garden at Ambato.



**CARICA CHRYSOPETALA HEILBORN.**

Fruits of the higacho, from a cultivated plant at Baños, Province of Tungurahua.  
(Natural size.)



**VACCINIUM FLORIBUNDUM H. B. K.**

The mortiño, or Andean blueberry, a characteristic plant of the cold, moist plains of the high Andes. (Photographed at La Rinconada, Province of Carachí. (Natural size.)



**SOLANUM QUITOENSE LAM.**

Fruits of the naranjilla; photographed at Baños, Province of Tungurahua (Natural size.) The coarse hairs are brushed off before the fruits are taken to market.