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### The Avocado

IN

## Southern California

By F. W. POPENOE

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### The Avocado in Southern California

BY F. W. POPENOE PASADENA, CALIFORNIA

That the avocado will succeed in Southern California has been proved conclusively by the seedlings planted fifteen to twenty-five years ago which are now bearing, and by more recent experiments with budded trees; and the establishment of an avocado industry in the immediate future is assured. As to whether we shall proceed at once to the production of the best fruits or whether the loss of much money and time with the incident disappointment to all concerned shall be caused by the planting of inferior varieties is the vital question at this moment. It is to the solution of this problem that the earnest endeavor and careful efforts of all our nurserymen should be directed, and it is in the hope that some help may be given in eliminating wasteful efforts that this article is written.

For centuries the avocado has been grown in Mexico and other tropical countries, propagated only by seed. Like other fruit trees grown from seed, it comes true in but a very small percentage of cases. This has led to the existence of a wide range of varieties. All avocados so far fruited in California are these mere chance seedlings, most of them of indifferent value and not worth propagation on an extensive scale. There are many varieties of good size and flavor, fruiting in Mexico and other parts of the tropics, which will doubtless succeed here as well as the smaller and inferior ones. Some of these Mexican varieties are of such superior quality as to leave nothing to be desired.

It is therefore manifestly the part of wisdom for California planters of this fruit to proceed with intelligence and accept nothing but the best. Attracted by prospective large returns some investments of a doubtful character are already being made. There is really no excuse for this.

Investigation and care will lead anyone in the right path. There will be no demand for seedling or inferior fruits once a superior avocado is to be found plentifully in our markets. Nor need there be delay or groping in the dark for these superior varieties. At our very door lies a boundless experimental garden in which for centuries the avocado has been grown, where countless varieties have originated, and where now are growing hundreds of thousands of trees from among which we have only to select the best.

By taking advantage of this opportunity California can obtain in a comparatively short time the choicest varieties, which it would take years of time and a large expenditure of money to produce by the ordinary methods of plant breeding, carried on here.

The results presented in this preliminary paper on this subject have been worked up in the Biological Laboratory of Pomona College, and acknowledgments are here made for the facilities placed at my disposal there and the constant and kindly assistance extended to me.

#### TYPES GROWN IN CALIFORNIA

Broadly speaking, the avocados which have fruited here so far may be divided into two classes; those of Mexican origin, which include all the smooth and thin skinned varieties, and those of Guatemalan origin, which are easily distinguished by their very thick skins and rough exterior. This is not saying, of course, that all avocados can be divided into these two classes.



Figure 1. At left the parent tree of the Blake Avocado, growing at Pasadena, age eight years; this tree would be of good form if topped. At right, parent tree of the Walker Avocado growing at Hollywood, age fourteen years, the tree showing a very bad form for a cultivated Avocado.

Of the Mexican type many trees may be found scattered all over the southern end of the state, most of which have been grown from seed obtained from Monterey and other points in northern Mexico. The famous Chappelow tree is the oldest and best known of the lot.

Most of in color, bu LC Control Number

produce fruits of small size, dark purple are preferred by many to the large green



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fruits, it being the belief that they are richer and of better flavor than the larger varieties.

They are also somewhat hardier than the larger varieties and would probably be valuable in locations where the latter would not thrive.

For home use these varieties will always be desirable, but as a commercial fruit they are out of the question altogether. They are too thin skinned to stand shipment, and would probably not take at all in American markets in competition with the larger, thick skinned fruits.

A few varieties of Mexican origin and green in color are now grown here which are larger than the purple varieties, but these also are thin skinned and of little more value commercially than the purple ones, although the quality is all that could be desired in some cases. To be profitable commercially, the fruit will have to be thick and tough skinned, so as to stand shipment, and as yet no Mexican variety which has fruited here has this quality.

Outside of the Mexican varieties the only other type known to have successfully fruited here is the Guatemalan. The trees of this type are probably all descendants of the old Miller tree, the seed of which was brought from Guatemala and planted at Hollywood over twenty-five years ago. Numerous seedlings have been grown from this tree, several of which are now bearing. The Walker tree is the best known of these, and is the most prolific tree known here, its crop every year running into the thousands. From the behavior of these trees it seems certain that this type is admirably adapted to this climate, a fact of the greatest importance to the future of the industry here.

In his bulletin on the avocado, Collins speaks of the avocados of Guatemala as forming a very distinct group, the most peculiar characteristic of which is the unusual thickness and toughness of the skin, and he considers them the most promising of all types from a commercial standpoint. It is particularly fortunate, then, that this type has been tested here and its adaptability proved, for the way has been paved for the introduction of numerous forms of the type with practical assurance of success. Another noteworthy point in regard to this type is the fact that all of the local trees are spring bearers, this point alone making them of great value. Being spring bearers their blooming season is considerably later than the fall bearing Mexican sorts, so that danger of the crop being destroyed by late frosts is almost eliminated. Already we have several varieties of this type that are well worth growing, of which the Lyon is the most promising, it being the finest avocado yet produced in California, of good size and excellent quality. This variety has just come into bearing, and therefore is little known as yet, but its prolificacy and good qualities promise to place it in the lead of the local varieties. The trees of the Guatemalan type are easily distinguished from those of the Mexican type because more spreading, particularly when young, and the leaves are more lanceolate.

It has been the general impression that the South American type which is grown in Florida would not succeed here, but this remains to be proved.

Budded trees of many Florida varieties are being tested in Southern California, and the Bureau of Plant Industry expects to send out a large number this spring for trial. One large tree at Sherman which was worked over to the Trapp variety flowered this year for the first time, and numerous other trees are becoming old enough to bear and will be watched with interest for the next few years. This type is certainly more tender than the Mexican, but the past few winters have shown that some varieties at least will stand our average winter temperature without injury. Future experience will likely confirm the present belief that this type will succeed in many locations here.

Numerous seedlings of Hawaiian, Cuban, and West Indian varieties have been grown, but as yet these have not come into bearing. Budded trees will have to be tested before anything definite can be said of their adaptability.

It has been stated that the avocado would not succeed in the hot and dry

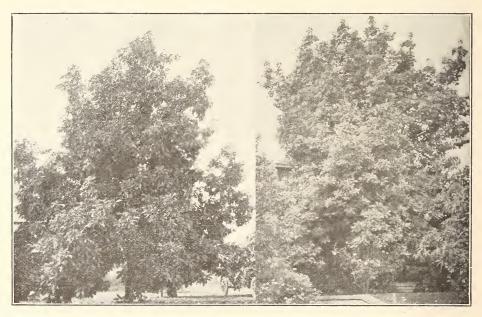


Figure 2. At left the parent tree of the Ganter Avocado growing at Whittier, Cal., age eight years; at right the parent tree of the White Avocado, growing at Santa Barbara, age twelve years.

interior parts of California. Trees are known to have grown without injury as far into the interior as Redlands and Riverside, and have fruited heavily at Pomona and San Fernando, and should be tried at Imperial.

#### PROPAGATION

By Seed. This is the simplest method, and the one most practiced in California up to the present time. The seeds of most varieties are obtainable during late summer and autumn, and should be planted as soon after removal from the fruit as possible. It has been found to hasten germination greatly if the seeds are buried in moist sand or sawdust for a period of two to four

weeks before planting. During this time they should be occasionally examined, and when they show signs of germinating they can be taken out and planted in pots. After this treatment they will start to grow very promptly and it has the added advantage that only seeds that are sure to grow are planted, and no labor is wasted. For most seeds a four inch pot is large enough. The seeds should be placed in the pot pointed end up, or in the case of the round seeded varieties, the end toward the stem of the fruit, and about one-fourth of the seed left exposed above the surface of the soil. A good rich soil is essential to the best development of the young plant, and should be kept thoroughly moist, but care should be exercised to avoid standing water in the pots, as this is fatal to either the seed or the young tree. While the young trees should be grown in a warm situation, the direct rays of the sun should be avoided. If the seeds have not been buried in moist sand before planting they will often be slow in germinating, especially if not grown under glass. Many of the seeds planted in the fall in a lath house do not come up until the following spring. After the young trees have made a growth of eight to twelve inches they should be shifted into larger pots or cans, if it is desired to carry them on in this way, or set out in the nursery to be grown until of suitable size to bud.

By Budding. It is only during the past season or two that much attention has been given to budding the avocado in California, although previously a few nursery-men most interested in this fruit had tried it. Having no experience of their own in the budding of this particular tree, most of those who have budded during the past year or two have simply applied the methods they would use for citrus fruits, while a few others have followed the instruction given in various publications by those who have experimented in Florida. In all cases the results have proved the budding of this fruit to be no more difficult than that of the citrus fruits, and when a little more experience has been acquired the operation will be performed with as much assurance of success as with the orange.

For commercial purposes plants are grown in pots until about twelve inches high, when they are set out in nursery rows three and one-half to four feet apart, and fourteen inches apart in the rows. Here they are grown and budded and allowed to remain until of saleable size, when the trees are balled, or transplanted into pots, and allowed to become established before being sold.

The method of budding is practically the same as used for the orange. In regard to such points as the best size of stock and buds, and season for carrying on the work, there has, however, been some uncertainty.

Experiments have been carried out locally on stocks ranging in diameter from about one-fourth of an inch to over one inch, with budwood of all sizes, from the young and tender tops to well matured wood of the previous season's growth. Results lead to the conclusion that for small stocks, such as will be obtained during the first summer's growth of the seedling tree, buds from young wood of the current season's growth are the only ones which will give good results. On older trees, mainly two-year-olds, the

buds from older wood seem to take better, but are liable to drop after taking, leaving a blind bud.

The experience of P. J. Wester, in charge of the avocado investigations of the Bureau of Plant Industry, is unquestionably the most valuable to be had on this subject. Under date of January 4, 1911, he writes me as follows: "In 1906 I published an article in the Florida Agriculturist that has been reproduced in many papers, but which does not now wholly represent my views on the subject. The stock should be the size of a lead pencil, in vigorous growing condition with sap flowing freely, and young budwood,

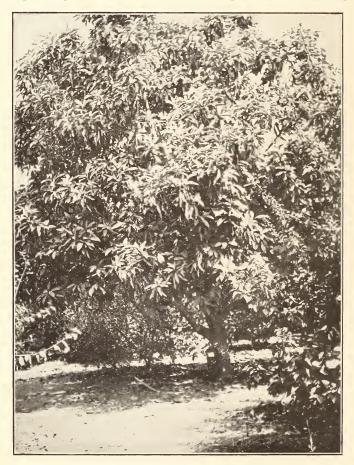


Figure 3. Parent tree of the Harmon Avocado, growing at Sherman, Cal. This tree is thirteen years old, and shows a fine orchard form for an Avocado.

i. e., that from the current year's growth, with well developed buds, used. Do not use old and hard budwood, as such buds after taking frequently drop. Cut the buds large, and cover entirely with waxed tape. The last point may not be so important in California's dry climate. Continued experimentation since I wrote the above mentioned paper shows that budding may be practiced any month of the year, provided the stock is in condition, though for nursery practice I would not bud in August, September, October or November."

Regarding the best season to bud, it seems to be the concensus of opinion here that October and November, which are mentioned by Mr. Wester as undesirable months, are as good a season as any, if not the best of the whole year. This is probably owing to the climatic conditions of Southern California being different from those of Florida.

Three weeks after insertion the buds will have taken and the trees should be lopped back to several inches above the bud. The buds will then start into growth, and when a growth of eight to twelve inches has been made the stock may be trimmed back to the bud.

Edgar Harman, of Sherman, has done considerable experimental budding and what he says will be of value to those contemplating doing this work. The seeds are started under glass and as soon as the plants are two inches high they are set in pots and placed in a protected place in the open. When they have grown to the diameter of three-eighths to one-half of an inch. they are budded. Mr. Harman considers that this operation can be performed successfully any month of the year except July and August. Young and tender budwood is used and the buds cut from three-fourths to one inch long. Waxed cloth is used for wrapping, and the buds are not wrapped very tightly. As soon as the buds swell, which should be in about three weeks, the top of the stock is lopped over at about the fourth leaf above the bud, and a little later on it is cut clear off. When the bud has started into growth the top is cut back to a level with the bud. The sap must be flowing freely at the time of budding to insure success.

C. P. Taft of Orange has probably had more experience in growing and budding the avocado than any other person in California. He says: "I am inclined to regard the months of October and November as the best for budding, though I think there is a short period in the spring when considerable success can be had. The buds I put in my three-year-old orchard last fall have done well and are making a fine growth. About 25% of the buds on stock in cans succeeded. Those put in during the warm summer months were an almost total failure."

In April, 1909, D. W. Coolidge of Pasadena budded about 150 two-year-old seedlings growing in the open ground at Hollywood. The buds were taken from well matured wood of the previous year's growth, and waxed cloth was used for wrapping. Fully 90% of these buds took, but quite a number dropped their buds after having taken. However, fully 75% of the buds inserted developed into trees. Mr. Coolidge has made several attempts to bud stock grown in cans, but with no success, probably because trees thus grown are not sufficiently vigorous.

William Chappelow of Monrovia, owner of the original Chappelow tree. states that he proceeds exactly as in budding citrus fruits, and has budded at all seasons of the year with about equal success.

Large avocado trees which are unproductive should be cut back and budded over to some good variety. The method is simple, and as described has been practiced very successfully by Mr. Harman. The large limbs are all cut back close to the trunk, and the cut ends covered with white lead to

prevent bleeding. In a short time numerous sprouts will make their appearance; all of these should be kept cut off but three or four of the most promising, selected on different sides of the tree so as to form a good head. In a short time they will be large enough to bud, and should be budded in the same way as small seedlings. The wraps must be loosened every four or five days, as the sprouts make a very rapid growth. After the buds have made a growth of several inches the stocks may be cut back and the buds allowed to develop into the new tree. In two years time a good sized head will be obtained.



Figure 4. Avocado tree of the Mexican type growing at Redlands, Cal., showing what the Avocado may become when not pruned or cut back.

The best material for budding tape is cheap cotton cloth which will tear easily. The method of preparing it is described by Mr. Wester as follows: "Rip up the cloth in strips of desired widths, say six inches, and roll these tightly on stout iron wire as long as the width of the strips. Several strips may be rolled on until the roll is one inch in diameter; tie a string around the roll at each end to prevent unrolling while being boiled in the wax. A

good wax is made by boiling together two pounds beeswax, two pounds rosin, and half a pound of good lard; when in boiling state put in the rolls of cloth and let them remain for fifteen minutes, when they are taken out and cooled before being stored away. The iron wire is more desirable than sticks of wood, as the weight of the wire will keep the roll below the surface of the boiling mass. Another advantage in using the wire is that if the sticks are not quite dry the water, as it is converted into steam, will cause the contents to boil over."

INARCHING has never been practiced in California, but J. L. Hickson, of Miami, Florida, a large and successful grower of the avocado, states that he propagates entirely by this method, as he considers it produces a stronger and better growth than budding. However this may be, the method is slow and laborious, and trees cannot be produced in sufficient quantities to make it commercially practicable here.

GRAFTING has been performed successfully in a few instances, but has not been attempted to any great extent as yet.

Cuttings have been very successfully rooted by being placed in clear sand in a lath house, but it is doubtful if this method of propagation produces as strong a plant as the others.

#### ORCHARD PLANTINGS

It is only within the last year or two that orchard plantings of the avocado have been made in Southern California, and then only in very small acreages, but the next few years will see the territory devoted to the culture of this fruit on a commercial scale greatly increased.

The trees may be planted at the same distance apart as orange trees, or if space is available at a somewhat greater distance. Budding seems to dwarf the tree, and budded trees will require much less room than seedlings. In either event the trees should not be allowed to grow to an unlimited size, but should be pruned like deciduous fruits, allowing only the strongest branches to develop and form the head of the tree, and all weak and undesirable growths cut out each year. The top should be kept cut back to facilitate picking the fruit, and not allowed to grow to an unlimited height as has been done with all the seedlings grown here.

Transplanting should be done in early spring, before the trees have started into new growth.

During the first year or two of its growth, the tree is more tender than when larger, and in locations subject to heavy frosts should be protected during the winter by some covering. Palm leaves are used for this purpose if they can be obtained in sufficient quantities, or a frame can be constructed of lath and covered with burlap or cheesecloth. The danger from frost, however, lies not so much in the possibility of injury to the trees themselves, as in the destruction of the crop through freezing of blossoms of early flowering varieties. To avoid this, late blooming varieties may be planted, such as those of the Guatemalan type, which bloom so late in the spring as practically to eliminate all danger from this source. It is only occasionally

that the Mexican varieties are caught, but as the crop is practically certain to be lost, if a very heavy frost occurs during the blooming season, the only safe way will be to plant late blooming varieties.

The tree requires about the same irrigation as the orange. Insufficient irrigation will result in small fruit.

In selecting varieties for planting on a commercial scale, there are a number of points which should be kept in mind. Fruits which ripen during midwinter will command the highest prices in the markets, and there will probably be the greatest demand for avocados at this season of the year. As



Figure 5. At left a Mexican seedling Avocado, eighteen menths from seed; at right a budded tree of the South American type, three years from the bud and grown in California.

to size of fruit, there is no advantage in having the very largest. While a two pound avocado is a regal fruit, for practical purposes one of half that size is better. Quality should be one of the most important factors in choosing a commercial fruit, and other desirable points are prolificness, a smooth, thick and leathery skin which will stand shipment, good keeping qualities, and a small seed, completely filling the cavity, as a loose seed pounds the walls in transit, causing early decay. We must, however, have still smaller varieties for cheaper trade, and summer varieties for local consumption, and we already have a good assortment of varieties to choose from for these purposes.

#### THE FUTURE OF THE AVOCADO IN SOUTHERN CALIFORNIA

It may seem a strong statement to say that within the next quarter of a century the avocado will rank with the orange as a commercial fruit in Southern California. But there is a strong foundation of fact underlying this statement and the reasons seem sufficient, indeed, to warrant the belief that it may become even more important.

First, the adaptability of the avocado to this climate has been proved beyond the possibility of a doubt. There are one hundred or more trees now in bearing, ranging in age from three to twenty-five years, scattered over the southern end of the state from the cool sea coast to the hot and dry interior. These trees embrace a number of widely different types, sizes and characters of fruits. This test of adaptability ought to be sufficient to satisfy the most skeptical.

Second, the food value of the fruit is the main basis for the above statement. It presents in a most easily digested and assimilated form as high as 12 to 18% of fat, which places the fruit in a class with the staple food products, instead of being a mere luxury as is the case with many fruits. The taste for the avocado is not always acquired upon first trial, but a few repetitions are usually sufficient to make any one extremely fond of it. The price is now prohibitive to most, and only a few have had opportunity to acquire the taste, but as the production becomes greater and the price lower, an almost unlimited demand will be created throughout the whole country. It is, of course, universally known as one of the most important staple fruits throughout the tropics and subtropics of the world.

Culture of the fruit in this country will be restricted to limited areas in Florida and Southern California, and consequently the danger of overproduction will be practically eliminated. As rapidly as price and production permit, the avocado will become an important and indispensable part of the daily food of the majority of the people of the United States.

#### LIST OF VARIETIES

known in California, arranged according to general characters and possible usage:

For winter fruiting: Lyon.

For late fall fruiting: White, Ganter.

For late summer and early fall fruiting: Harman, Fowler, Chappelow, Blake.

For spring fruiting: Walker, Miller.

Large varieties: Lyon, Miller.

Small to medium varieties: White, Walker, Harman, Ganter, Fowler, Chappelow, Blake.

Best varieties for shipping: Lyon, Walker, Miller.

Best varieties for local use only: Ganter, Chappelow. Fowler, Blake, Harman.

Most prolific varieties: Walker, Ganter, Lyon.

#### DESCRIPTION OF VARIETIES

The following list contains not only those varieties of local origin which have been named up to the present time but is a complete list of all the named varieties in cultivation of which it has been possible to obtain descriptions.

With the increasing number of varieties being propagated every year, it will be absolutely essential to any exact knowledge of this subject that the introducer of any variety shows sufficient differences between the new variety and all previously known ones to warrant giving it a name.

#### Better Known Varieties

#### PROVISIONAL KEY TO THE VARIETIES

This key is not to be considered as anything definite for the determination of varieties. It is merely intended to point out the distinguishing characters of the varieties described and supplement the descriptions.

A. Skin smooth. B. Towards base broadly rounded; general shape round to oblong. C. Skin thick. D. Roundish oblate to oblate pyriform; seed more or less loose in cavity ......TRAPP CC. Skin thin; shape oval to oblong. D. Averaging more oblong; flesh very rich and buttery; skin glossy; seed not compressed Fowler DD. Averaging more oval; flesh more watery, and not buttery; skin not BB. Towards base more or less tapering, pear shaped, or bottlenecked. C. Black, or dark or reddish purple when ripe. D. Slender pear shaped, or even banana-shaped. E. Skin thin; seed tight; becoming almost black when ripe......CHAPPELOW EE. Skin medium thick, seed loose; purple with scarlet streaks.....FAMILY DD. Stout pear-shaped; reddish purple; skin medium thick...........Wester CC. Red mottled with yellow; skin thick; seed tight in cavity.........CARDINAL CCC. Green principally when ripe, in ground color at least. DD. With a more or less distinct neck. E. Skin thick and tough. F. Weight up to 3.5 pounds......Pollock FF. Weight up to 1.5 pounds \_\_\_\_\_LANDON EE. Skin thin. F. Color clear green. G. Size small BLAKE GG. Size large OUALITY FF. Color green, washed with purple; size small.......WHITE

AA. Skin rough, usually thick.

- BB. Towards base more or less tapering, pear-shaped, or bottlenecked.
- C. Color deep, dark green; weight up to 1.3 pounds.
- CC. Color pale greenish yellow; weight up to 2 pounds......RICO

#### Trapp

(Figure 6A)

Form roundish oblate to oblate pyriform; size medium to large; cavity regular, small, shallow, with gradual slope, somewhat furrowed; stem stout;

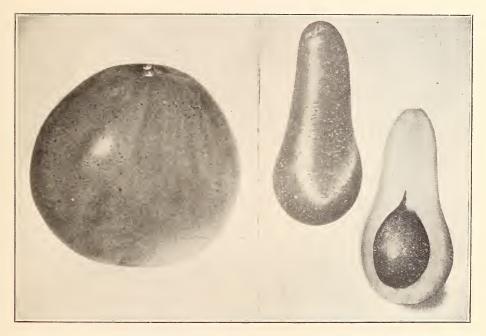


Figure 6. At left the Trapp Avocado and at right the Chappelow, as originally figured in Year Book U. S. Dept. Agriculture.

apex slightly depressed; surface smooth and undulating, with numerous brownish dots, some of which are indented; color pale green, with faint and indistinct pale yellow stripes; skin very thick and tough, separating readily from the flesh; flesh fairly thick, firm, but smooth and rather oily in texture, ranging from pale green near the skin to greenish yellow next the seed cavity; flavor mild, pleasant; seed large, oblate, with loose seed coats, and loose in the cavity, sometimes germinating in the fruit when allowed to remain late on the tree, though, so far as observed, without injury to either texture or flavor of flesh; quality very good; season from October 1 to January in South Florida, occasional specimens having remained on the tree in good condition until March.

The tree is reported to be a fairly vigorous grower and very productive.—1906 Yearbook U. S. Dept. of Agriculture.

#### Sinaloa

(Figures 7 and 8)

Form oval; size medium to large; stem stout; surface smooth, undulating; color light green with numerous large, irregular, brownish dots; skin thick

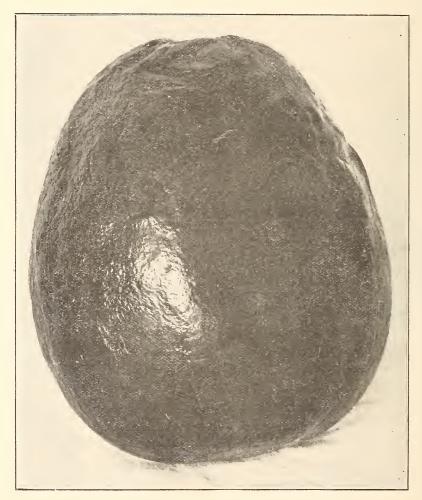


Figure 7. The Sinaloa Avocado, natural size.

and very tough; flesh rich yellow in color, shading to light green near the skin; texture smooth and very buttery; flavor very rich and nutty; quality very good; seed large, oblate, tight in cavity; season September to October. Originating in Mexico and now in our own plantations.

#### Fowler

Form oblong to oval; dimensions, length four and one-fourth inches, diameter three and one-fourth inches; apex a dot; base flattened slightly; cavity

regular, small and shallow, flaring; pedicel stout; surface smooth; color light green, with numerous small, rounded, yellowish dots; skin very thin, glossy, adhering closely to flesh; flesh yellow, changing to yellowish green near skin; texture smooth and buttery; flavor very rich and nutty; fibre slight; quality very good; seed medium large, oblong-conical, tight in cavity; season July to October at Pasadena, California.

Tree is of vigorous growth, upright, round topped, with abundant healthy foliage. Rather shy bearer. This is originally described here. A seedling of the Blake, and very similar to the Ganter.

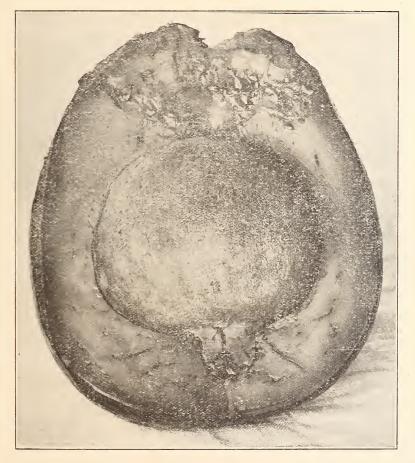


Figure 8. The Sinaloa Avocado.

#### Ganter

(Figure 9A)

Form oval to oblong; dimensions, length two and one-half to four inches, diameter one and three-fourths to two and three-fourths inches; apex slightly depressed; base flattened; cavity regular, small, rounded or flaring, slightly furrowed; pedicel very stout; surface smooth, undulating; color

light green, with numerous small, irregular yellowish green dots; skin thin and tender, adhering closely to the flesh; flesh yellowish cream color, changing to pale green near the skin; texture smooth but not very buttery; fibre very slight; flavor rich, nutty; quality very good; seed large, oblongconical, somewhat compressed, about 25% loose in the cavity; seed cavity medium large; season November to December at Whittier, California.

Tree is a vigorous grower and rather spreading in habit, with abundant healthy light green foliage. A very prolific bearer. Here first described. Very similar to the Fowler.

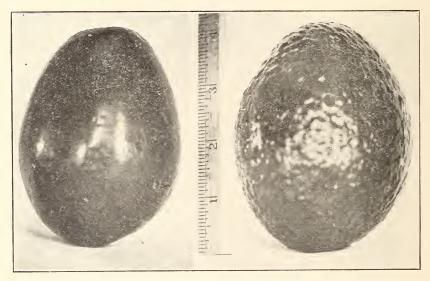


Figure 9. At left the Ganter Avocado, grown at Whittier; at right the Miller, grown at Hollywood.

#### Chappelow

(Figure 6B)

Form oblong, slender pyriform or "bottlenecked"; size medium to large for the Mexican type; cavity small, shallow and wrinkled; stem stout; surface undulating, smooth, glossy; color dull purple, with reddish brown dots; apex a mere dot, skin very thin, tender, adhering closely; flesh pale greenish yellow, buttery; seed large in proportion to size of fruit, roundish conical, filling internal cavity; flavor pleasant, though less rich than the best varieties of the West Indian type. Season July to October at Monrovia, California.

The tree is a vigorous, rather diffuse grower, with slender wood. It is productive, although being an early bloomer it is sometimes caught by frost.—1905 Yearbook, U. S. Dept. of Agriculture.

The fruits produced by the original tree show considerable variation in form, and Mr. Chappelow states that they are becoming larger as the tree grows older.

#### Family

A strong growing tree of spreading habits, being an abundant bloomer and moderate cropper. Blooms in late February and during March. Ripens fruit during July, August and September, and into October.

Shape of fruit variable, from pear-shaped to long-oblong, nearly banana-shaped; size, variable from 6 by  $3\frac{1}{2}$  to  $3\frac{1}{2}$  by  $1\frac{1}{2}$  inches; color purple, with scarlet streaks, very attractive; skin medium thick, smooth; stem large; meat yellow, free from fibre; flavor good, seed small, loose in cavity.—*Rolfs*.

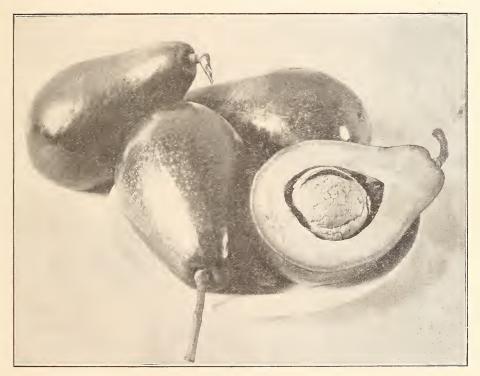


Figure 10. A common Cuban type of large purple Avocados, apparently the same as the Wester.

#### Wester

#### (Figure 10)

Form roundish or obliquely pyriform with short neck; average weight 650 grams; skin medium thick, smooth and glossy, adhering to meat; color reddish purple; meat greenish next to skin, rich yellow toward center of fruit; flavor good, rich and buttery; seed medium large, usually loose in cavity; season October.

This variety is of vigorous growth and very prolific.—Bureau of Plant Industry.

#### Cardinal

Form bottlenecked; skin thick, red, mottled with yellow; flavor very good, a trifle watery; seed small, filling cavity; season October in South Florida.—

Wester.

#### Harman

(Figure 11 A)

Form irregularly oval, slightly compressed, and flattened obliquely at the apex; dimensions, length three to four and one-half inches, diameter two to three and one-half inches; apex a dot; base tapering somewhat and slightly flattened; cavity regular, small, shallow, flaring, and somewhat furrowed, calyx persistent in the form of 6 divisions surrounding the stem base of fruit; pedicel stout, insertion usually one sided; surface smooth, glossy;

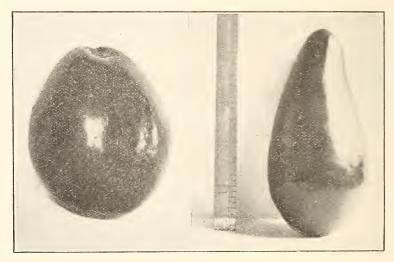


Figure 11. At left the Harman Avocado grown at Sherman, Cal.; at right the White Avocado grown at Santa Barbara.

color light green, washed with reddish purple, with numerous large, irregular greenish yellow dots; skin thin, adhering closely to the flesh; flesh greenish yellow, changing to yellowish green near the skin; texture smooth and very buttery; fibre practically none; flavor very rich and nutty; quality very good; seed very large, roundish conical, often loose in cavity; seed cavity very large; season October to November at Sherman, California.

Tree is upright, round-topped, and of fairly vigorous growth. Foliage rather scant, but healthy. Moderately prolific. This is the first description of this variety.

#### Pollock

Tree moderate grower, heavy bearer, profuse bloom, limbs rigid; blooms in February and March; ripens in September and October. Upright grower with strong central stem.

Fruit pear-shaped, being about six and one-half by four and one-half inches; weight up to three and one-half pounds; color greenish; rind medium; meat yellowish; flavor good; seed medium.—Rolfs.

#### Landon

Form broad pyriform or bottlenecked; size medium to large, average weight one and one-fourth pounds; surface smooth, undulating; color light green; skin thick and tough, separating readily from the flesh; flesh rich yellow, changing to yellowish green near the skin; texture very smooth and buttery; flavor rich and melting; quality very good; seed medium large, broadly conical, tight in the cavity; season September to October in South Florida.

#### Quality

Form bottlenecked; size large; color green; skin thin, smooth; quality very good; seed medium large, loose in cavity; prolific bearer; season September in South Florida.—Wester.

#### Blake

Form slender pyriform, bottlenecked; dimensions, length three and one-half to four and one-half inches, diameter one and three-quarters to two and one-fourth inches; apex slightly protruding to form a point; base very slightly flattened; cavity regular, small, very shallow and flaring; pedicel stout; surface smooth, slightly undulating; color light green with numerous small, round, greenish yellow dots; skin very thin, adhering closely to the flesh; flesh creamy yellow, changing to yellowish green near the skin; texture smooth and buttery; fibre very slight; flavor very rich and oily; quality very good; seed medium, conical, often loose in the cavity; seed cavity medium large to large; season September to October at Pasadena, California.

Tree upright, of fairly vigorous growth, with abundant, healthy, light green foliage. Moderately prolific. Here first described.

#### White

#### (Figure 11 B)

Form slender pyriform; dimensions, length four and three-quarters, diameter two and one-fourth inches; apex slightly protruding to form a point; base somewhat flattened; cavity regular, small, shallow, rounded, pedicel stout; surface smooth; glossy; color bright green, washed with purple, with numerous small, round, yellowish dots; skin thin and leathery, adhering closely to the flesh; flesh cream color, changing to pale green near skin; texture smooth; fibre objectionable; flavor rather watery; quality fairly good; seed conical, large, tight in cavity; seed cavity long, pointed, and wrinkled; season November to December at Santa Barbara, California.

Tree is upright, moderately vigorous, and a rather shy bearer. First described here.

#### Miller

#### (Figure 9B)

Form oval; dimensions, length four and one-half inches, diameter three and one-half inches; apex a slight point; base rounded; cavity regular, small

and shallow, flaring, furrowed; pedicel very stout, insertion usually one sided; surface very rough; color dark green, with numerous small, round, yellowish dots; skin very thick and tough, separating readily from the flesh; flesh yellowish cream color, changing to yellowish green near the skin; texture, smooth; fibre very slight; flavor fairly rich; quality good; seed large, roundish conical, tight in cavity; seed cavity large; season February to April at Hollywood, Los Angeles, Cal.

Tree is upright, vigorous, with abundant dark green foliage. Moderately prolific. Here described for the first time.

### Walker (Figure 12)

Form broad pyriform; dimensions, length four and one-fourth inches, diameter two and one-half inches; apex a dot; base rounded; cavity none; pedicel rather slender; surface very rough; color dark green, with numerous medium

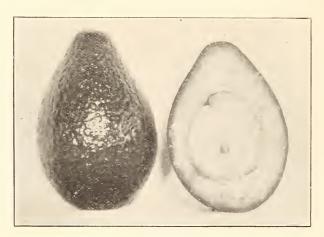


Figure 12. The Walker Avocado, one of the Guatemalan type, one-half natural size.

sized, round, yellowish green dots; skin very thick and tough, separating readily from the flesh; flesh cream color, tinged with green near the skin; texture smooth, but not buttery; flavor fair, rather watery; fibre objectionable; quality fair; seed large, broadly conical, tight in cavity; seed cavity large; season March to May at Hollywood, Los Angeles, Cal.

Tree is a vigorous grower, spreading in habit, with abundant, healthy, dark green foliage. Extremely prolific. A seedling of the Miller. Here first described.

#### Lyon

#### (Figure 13)

Form broad pyriform; dimensions, length five and one-half inches; diameter three and one-half inches; apex slightly depressed; cavity almost none; pedicel very stout, insertion usually one sided; surface rough, color dark green, with numerous small, irregular, yellowish or russet dots; skin very thick and tough.

separating readily from the flesh; flesh yellowish cream color, tinged with green near the skin; texture smooth and fairly buttery; flavor rich and nutty; fibre none; quality very good; seed large, broadly conical, tight in cavity; seed cavity medium large; season February to April at Hollywood, Los Angeles, Cal.

Tree is a vigorous grower, upright, with abundant, healthy foliage. Very prolific. This is the first description of this variety.

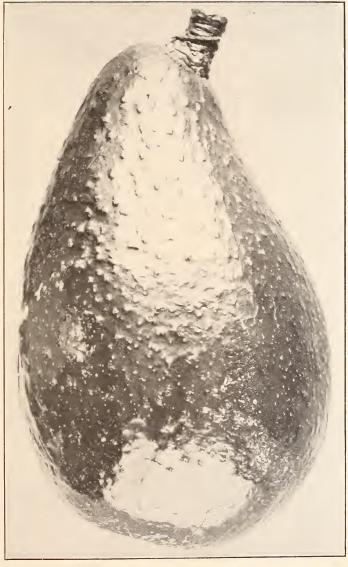


Figure 13. The Lyon Avocado, a fine example of the Guatemalan type. This specimen grown at Hollywood. Natural size.

#### Rico

Form rather oblong, thick necked, with oblique depressed flattening on opposite sides of both ends; average weight two pounds; skin rough; color pale greenish yellow; flesh pale yellow, with very little green near the skin; texture fine grained, firm; flavor very rich, nutty and buttery; season August to November in South Florida.—Cellon.

#### Insufficiently Known Varieties

#### Largo

Budwood from Mr. C. H. Matthews, who described the fruit as follows: "Egg shaped, very large, three and one-half to four pounds in weight; skin green, very thin; flavor very good; seed small; ripens in August and September."—Wester.

#### Johnstone

Budwood from Judge R. S. Johnstone, who gave the following description of the fruit: "Pear-shaped, but rather broad at basal end; skin smooth, thin; tlesh yellow, almond flavored; seed large; famous as the best avocado in the Bahamas. Ripens in August and September."—Wester.

#### Blackman

Form oblong; size medium large to large; color greenish red to chocolate; skin thick and leathery; flesh delicate yellow, soft and melting; seed tight in cavity, medium large; quality good; season September in South Florida.—Wester.

#### Cyrus

Form pear-shaped to round; skin smooth, yellowish, thin, quality good; seed loose in cavity; very prolific; season September to October in South Florida. (Analysis gave 17% fat.)—Wester.

#### Sterling

Skin thick; color dark bronze red; quality good; seed filling cavity, medium large; season October in South Florida.—Wester.

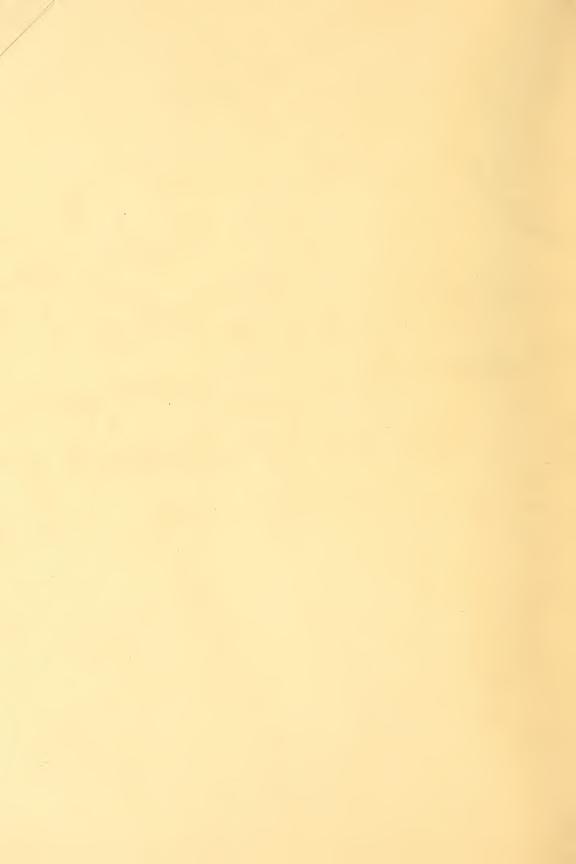
#### Baldwin

Tree a vigorous grower, with strong central stem; branches rather rigid; light bloomer, but heavy cropper. Blooms in February and March. Fruit at best in August; drops in September. Ripens uniformly. Shape of fruit approaching oblong, four by five and one-half inches, not regular; color green, with a few yellowish streaks; rind smooth, thin, stem small; meat deep cream, one-fourth green, firm, flavor excellent. Seeds are rather large, firm in cavity.—Rolfs.









# THE DEVELOPMENT

OF THE

### **AVOCADO INDUSTRY**

By F. W. POPENOE

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# The Development of the Avocado Industry

F. W. POPENOE, ALTADENA, CALIFORNIA

Within the past twelve months interest in growing the avocado has increased many fold. The feeling has now become general among well-informed orchardists and nurserymen that this fruit is destined to play an important part in the economic horticulture of Southern California; and many wise growers already foresee great promise for this new industry. The adaptability of the avocado to our climatic conditions has become convincingly apparent, and belief is growing into conviction that it is to rival the orange as a semi-tropic product. As a future food product it is unquestionably an important factor to be reckoned with. Economists who have the ability to grasp matters horticultural are figuring the avocado into the future food supply of the country at large as a competitor of meat, and are estimating its possibilities for replacing animal products with a wholesome and delicious vegetable food. As eminent and practical a horticulturist as Mr. Parker Earle, formerly president of the American Pomological society, is convinced of an immense future for the avocado. In a recent letter to the editor of the Pacific Garden, Mr. Earle says: "We cannot help wondering, as we look ahead for a hundred years, how people will live—what they will eat—when there are four hundred millions to be fed out of the land that now supports one hundred millions. With this great density of population, will there be room for producing much animal food in that time? Will it not become a necessity of existence to utilize all of the land in a way that will yield the greatest tonnage of human food?

"An acre of land can produce, let us say, one quarter of a ton of beef, or other animal food, per year. It can produce one ton, or possibly two tons, of food in wheat, or corn, or rice. It can produce five, ten, or possibly twenty tons of an incomplete food ration in the form of apples, or grapes, or bananas. And there may be from one to two tons or more of very rich food in the form of nutsnotably pecans—from one acre of land. But with avocados there would seem to be a possible yield of food of very high nutritive value in tonnage equal to apples with their low nutritive value." Mr. Earle goes on to state that if men can produce many tons of food of best value from an acre of land in trees that can only yield a fraction of a ton in the form of animal food, it is pretty certain that they are going to plant trees. The crowding of men together in dense population will compel this. "In primitive conditions men turned to animals for food. It was a state of savagery. We are outgrowing it. Very soon there will be no room for animals that are grown to be eaten. It is compulsory. It is nature'r way. We must get our food in greatest quantities from a minimum area of land. And we must have food containing the same elements that animals have been giving us. Among these substitutes does not the avocado offer itself as one of large possible importance?"

The one answer that can be made to Mr. Earle's inquiry is—it does.

#### Progress in Florida

Along both the lines of propagation and commercial planting Florida has so far been in the lead of California. The proximity of Cuba, where the avocado, or aguacate as it is called in all Spanish speaking countries, is commonly grown, and the fact that seedlings had been planted quite freely along the east coast in the earlier days, must have led horticulturists there to see the possibilities of this fruit, and have acted as a stimulus to the development of the industry. When, in 1901, it was successfully demonstrated that the avocado could be propagated by budding, considerable attention was at once directed to this fruit as a commercial possibility, and since then the progress of the industry has been steady.



Figure 58. Young avocado trees growing in nursery rows at Altadena, California, one year old and ready for budding.

One of the most important of the earlier commercial plantations, and in fact the first plantation of any extent, was that of Mr. S. B. Bliss of Miami. His orchard consists of twenty acres of the Trapp variety, planted six years ago, and now in bearing. The first crop of marketable fruit was produced last year, and though a heavy yield could not be expected from trees so young, the returns were satisfactory. Mr. Bliss is an experienced and careful grower, and has given intelligent consideration to the avocado as a commercial proposition both in Florida and in Southern California, and has great confidence in its extensive development.

Having had many years experience in both localities Mr. Bliss is well qualified to speak on the subject.

More recently than Mr. Bliss' plantation, considerably larger acreages of the avocado have been planted on the east coast, and planting is going on as rapidly as the budded trees can be supplied. As a considerable quantity of the fruit is now produced each year and shipped to northern markets, the Florida growers have learned a number of things regarding packing and shipping which will be of value to Californians.



Figure 59. A two year old head of the Trapp variety, top worked on an old seedling tree, at Sherman, California.

Mr. Joseph L. Hickson, of Miami, who grows the avocado extensively, writes under date of July 5, 1911, as follows: "We have never been able to supply our demands except for the varieties that mature in mid season (last half of August and first half of September). We are therefore growing and propagating more early and late varieties, Family and Trapp, respectively.



Figure 60. A fine type from Cuernavaca, Mexico. A thick skinned, purple, winter bearer.

"We have customers who place season orders with us for all the fruit we have at \$6 per case, f. o. b. Miami, which price we are very well satisfied with.

"We pack according to size, sometimes only 18 fruits to the case, but usually 36, 45 or 48. Our fruit went to all the eastern markets and to Chicago and Cincinnati.

"The propagation of the avocado is done exclusively by budding now, with a success equal to 95 per cent.



Figure 61. One of the first avocados planted in California, being one of three trees brought from Mexico and planted at Santa Barbara by the late Judge Ord in 1870. (Photo from Dr. Franceschi).

"This section of the state is extending its planting very considerably. Personally we believe there is more money to be made on the finer varieties of avocado and mango than there is with either oranges or grapefruit. The avocado does not require nearly so much care and attention, and so far is practically free from all insect pests, nor does it require the amount of fertilizer that a citrus tree does.

"The budded trees come into bearing the second or third year from the bud and in heavy bearing the fourth year. The budded trees show a tendency to be dwarfed."

From Mr. E. N. Reasoner, of the Royal Palm Nurseries, Oneco, I have the following under date of June 30, 1911: "The avocado is being planted extensively

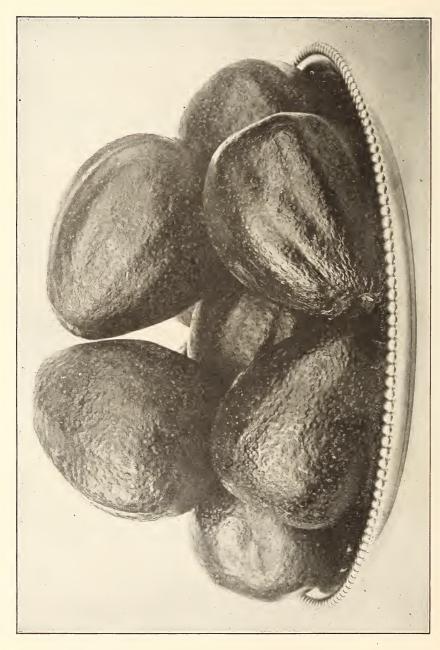


Figure 62. A thick skinned summer bearing type from Guadalajara, weighing about 14 ounces each.

by numerous people in both small and large lots; one man has 100 acres practically all to the Trapp variety, in fact the planting is more of this variety than of all others combined. There is a fine grove of 40 acres of Trapp, and two others of nearly 100 acres each, mixed avocados and mangos, of which the avocados are nearly all Trapp. The next important variety is Pollock.

"Budding is very successful, and a large percentage take. The buds are usually put in in spring, on trees of the preceding year's growth.

"Trees are being set about 18 or 20 feet apart. The trees are looking well and interest is high. The trees of sufficient age have a large crop of fruit this season."

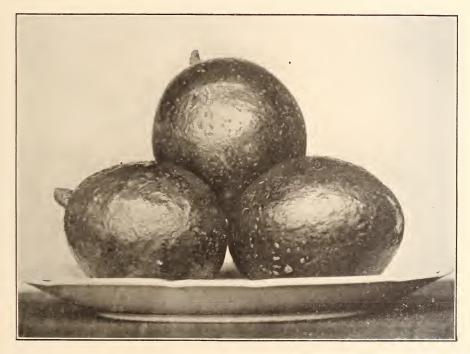


Figure 63. A desirable type grown in Mexico at an altitude of 6000 feet. A winter bearing, very thick skinned fruit of fine quality. It is now being propagated in California.

Mr. John B. Beach, of West Palm Beach, who propagates the avocado quite extensively, writes as follows under date of July 1, 1911: "After November first there is always a good demand in New York for avocados, with ever increasing prices as the season advances, and often they sell well in October. Owing to its lateness we prefer the Trapp for general market planting, though there are many other varieties which are being tested, but have not been cultivated long enough to be well known.

"Budding is most successful in late autumn and winter, from November 1 to April 1. Fifty to ninety per cent of the buds will 'take,' but more or less loss

will occur after that from eyes dropping off, and from fungus attacking young sprouts. This trouble may not be so bad with you. Very likely the beginning of your dry season will be the best time for budding on this account. Our rainy season is in summer, and then we suffer most from fungus.

"Budding is most simple. Use well developed eyes on young wood, the bigger the shoot the better provided it is of last growth, otherwise you will have trouble with buds failing to start, and eyes dropping. We start the seeds in six inch pots, budding and removing at the same time into 6x6x12-inch shingle boxes, at five to seven months from the seed. Allow six months in these boxes for the buds to grow, then plant out."

# California Plantings

The production of varieties suitable for commercial purposes here has so far been dependent upon chance seedlings, no systematic attempt to breed superior varieties having been made. The variation always exhibited by seedlings has resulted in the existence of numerous forms and types, a few superior to the average, but by far the greatest number inferior to or no better than the average. Realizing, however, the possibility of obtaining choice varieties by chance in this way, and varieties which would be especially well adapted to this climate, several experimental plantings have been made.

One of the largest of these is that of Mr. William A. Spinks, of Monrovia, who has obtained selected seeds from every available source and set out 150 seedling trees in orchard form. (See also the reference made below to his orchard planting of budded trees). Mr. Spinks' location is one of the most favorable in Southern California, and with this number of selected seedlings the possibility of obtaining something choice is certainly good.

Mr. Joseph Sexton, of Goleta, near Santa Barbara, has planted 140 seedlings, 100 of which were grown from selected Hawaiian seed and the balance from selected seeds from Mexico, Costa Rica, Guatemala, and Porto Rico. In addition to this plantation of his own, Mr. Sexton is planting for other parties in his vicinity over 600 Hawaiian seedlings, of his own raising, all of which will be allowed to grow as seedlings until they have had time to fruit. This extensive plantation of Hawaiian seedlings will form an admirable test of this type of avocado, and as the climate of Santa Barbara is notably mild, the possibilities of success are good.

These plantations have only recently been made and will require some time before the results will be known. Older than either of the foregoing is that of Mr. C. P. Taft, the well known horticulturist at Orange, whose work along various lines of experimental horticulture has been of great value to the state. Mr. Taft began planting avocados in a very small way seven or eight years ago. His orchard now consists of several acres of seedlings, may of which are producing fruit. So far Mr. Taft feels that he has not produced the ideal avocado, and is continuing his experimental work by selection of his most desirable seedlings rather than by securing buds from other countries.

Mr. E. S. Thacher of Nordhoff, another of the well informed and experienced horticulturists of Southern California, has been interested in the avocado for



Figure 64. A cluster of Hawaiian avocados, showing the typical Hawaiian fruit. Each of these fruits weighs from 15-24 ozs.

several years and now has a plantation of 120 seedlings just coming into bearing. Among those which are fruiting this year Mr. Thacher has one tree that at the time this is written, and before the fruits have matured, bears promise of being especially worthy of propagation.

Because of the impossibility of obtaining budded trees in sufficient quantity for orchard plantings, almost no plantations of budded trees have been made in Southern California up to the present time. Several parties, however, have made plantations of seedlings with the intention of budding the young trees to some desirable variety, and in this way saving considerable time. Probably the largest of these plantations is that of Mr. W. G. Davison, at La Habra. Mr. Davison has twenty acres set to Mexican seedlings and is now budding them to choice Mexican varieties.

Mr. William A. Spinks of Monrovia has a plantation of about 600 budded trees of various varieties, which is more in the way of an experimental planting, perhaps, than a commercial orchard. A few other plantings of seedlings have been made, with the intention of budding the trees as soon as it is possible to obtain budwood of choice varieties, but the majority of parties interested in the commercial production of avocados are waiting until they can obtain budded trees with which to make their plantings. Another year will see the work of planting orchards well under way, as the growing of budded stock is being given adequate attention. Among those engaged in this branch of the industry, the West India Gardens, a tropical nursery company at Altadena, has many thousand young Mexican seedlings in the field which are being worked to the choicest Mexican varieties. This company sent its own representative to Mexico to locate the trees bearing the most desirable fruits. The trees selected were marked, and budwood from them is now being sent up. As in the selection of this stock all points of desirability were considered, a choice lot of budded trees will be the result—a result which by the process of growing seedlings at home and selecting therefrom, it would have taken many years to bring about.

# Co-Operation of the Department of Agriculture

Realizing the possibilities of the avocado as a commercial proposition in Southern California, the United States Department of Agriculture has become interested in the development of the industry, and has recently sent out a large shipment of budded trees for trial. This shipment consisted of four sets of about eighty trees each, all budded, which were propagated at the Subtropical Laboratory of the Department at Miami, Florida. These four sets have been planted by co-operators in San Bernardino, Pasadena, Whittier and Altadena, so as to test them out under different climatic conditions. The set includes all of the standard Florida varieties, Trapp, Pollock, Mitchell, Baldwin, Family, Wester, Blackman and Peacock; one variety from the Bahamas called Largo, and unnamed varieties from Mexico, Guatemala, Cuba, California, Canary Islands, Florida and Hawaii. It is expected that when these trees come into bearing several choice varieties will be obtained, and it will also give an opportunity to thoroughly test out the Florida varieties under the different climatic conditions obtaining in Southern California.

# The Commercial Avocado

At the present moment the question of greatest importance to prospective avocado growers is "What are the best varieties for commercial purposes?"

We have as yet no standard varieties, and it will be well, therefore, before the industry becomes established, to consider the characteristics required in an avocado for commercial purposes, and to obtain only those that come nearest to the ideal in every respect. It would be dangerous, to say the least, to rush into such an extensive industry as this promises to become, without having thoroughly considered this question and having obtained the very best to be had for our plantings. Eventually the better varieties would come to the front anyway, and loss of time and disappointment will be avoided by giving careful thought to this matter in the beginning.

# 1. Season

It is the hope of those interested in the development of the avocado industry in California that it will be possible to obtain for this climate a set of varieties that will provide fruit of good quality continuously throughout the twelve months of the year. And it seems as though this desire is to be realized in the near future, for already we have mature fruit from September to June inclusive, which leaves only a small gap to be filled in. But these varieties we already have do not come up to our requirements in most respects, so that they are only of value to demonstrate what can be done in the way of extending the season. It will be a notable thing to have avocados in the market every month of the year, and will tend to greatly increase the consumption of the fruit. And when the avocado comes to be known and valued as a food product, there will be a steady demand for it throughout the twelve months of the year. At present, however, there is the greatest demand during the winter months, when other fruits are scarce. The Florida growers have almost ceased to plant anything but winter bearing varieties, not because there is no demand for the fruit in summer, but because at that season many small avocados are thrown on the markets of the east from the West Indies, and this fruit sells at such a low price that it is not profitable to compete with it. However, the greatest demand has always been during the winter months, when the markets of the country are not filled with other fruits, and it will doubtless be advisable for California planters to follow the precedent of the Florida growers to a great extent and plant mainly of winter and early spring bearing sorts.

# 2. Hardiness

While there are doubtless limited areas in Southern California where avocados from the West Indies and Hawaii will thrive, our limited experience leads to the belief that for general culture in California we must have hardier varieties than those localities ordinarily produce. Avocados from the Mexican highlands have proved to be hardy almost anywhere in Southern California, and suited to as large an area as the orange. There are many locations in Mexico where avocados are produced in quantity, where fully as low temperatures are experienced as are ever felt here. Indeed, it is stated by G. N. Collins, a well known authority, that he found in one locality in Mexico avocados growing and thriving where snow fell

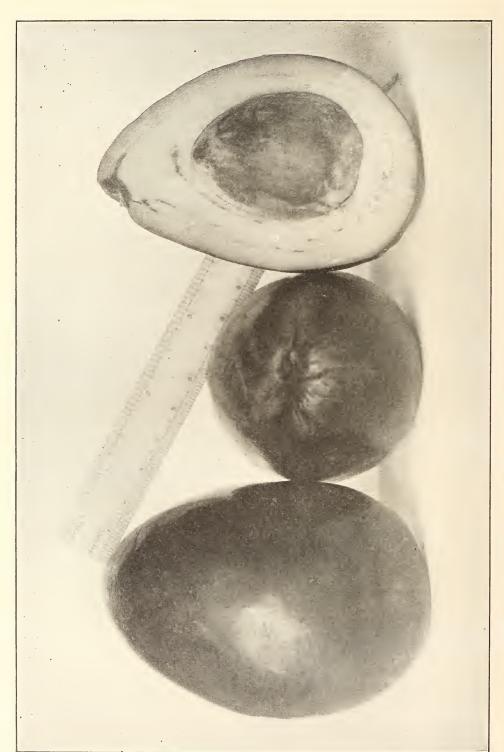


Figure 65. The common Mexican type of summer bearing, thin skinned, purple avocado.

every winter. If these hardier varieties were all small or inferior, we would of course prefer to take the chances with the more tender but superior ones, but there are many fine Mexican and Central American varieties which possess the requisite of hardiness in a very satisfactory degree.

# 3. YIELD

Through propagation by budding a great difficulty experienced with the seed-lings has been done away with, namely, the liability of the tree to bear sparsely or not at all. The orchardist does not, of course, want to plant a tree on which he cannot depend for a good crop. While the smaller types of avocados are almost invariably prolific bearers, the larger varieties when grown from seed are inclined to considerable variation in this respect. Through budding the prolific varieties may be propagated and all danger from this source done away with. The avocado is ordinarily a good bearer. It is not unusual for mature trees of the larger varieties to produce a crop of five hundred to one thousand fruits each season, and the small purple varieties are sometimes extraordinarily prolific, a single tree bearing as high as four thousand fruits in one season, in some instances. To make a variety profitable commercially it must, of course, be a fairly prolific bearer, and it should be ascertained to a certainty that this is the case before planting a tree.

### 4. Size

A mistaken idea which is held by many prospective avocado growers is that the larger the fruit the better. The experience of the Florida growers has proven conclusively that this is not the case when it comes to a question of marketing the fruit. A two or three-pound avocado is certainly a regal fruit, but will not prove half so profitable commercially as a smaller and consequently more prolific variety. From fifteen to twenty ounces would seem to be the most desirable size.

#### 5. Form

It has been found very desirable for shipping to have fruits of oval or round form. The necked varieties necessitate considerable more care in packing, and are much more liable to injury in transit. For local consumption, however, a pear shaped or "bottle-necked" fruit is as good as any other form.

# 6. Uniformity

To facilitate packing, the product should be uniform in size as well as in form, and this also improves the appearance of the fruit as it lies in market.

# 7. Color

The attractiveness of a fruit is affected considerably by its color. Locally the purple varieties have sold somewhat more readily than the green ones, and in Florida the dark crimson ones seem to be favored. But when the people are thoroughly familiar with the avocado the color will probably make little difference, unless some particular color or shade is found to denote a particularly good fruit.

### 8. SKIN

A skin sufficiently thick and tough to stand shipment to great distances is a prime essential. This is found in many of the Mexican varieties, and is partic-

ularly prominent in the Guatemalan type. Some varieties have a skin so thick and tough that it could almost be called a shell, while many of the Mexican varieties have a skin so thin and papery that the fruit when fully ripe will scarcely bear handling. A good tough skin will cut down the loss of fruit in transit to the minimum.

# 9. FLAVOR

As with all other fruits, there is considerable difference in the flavor and quality of avocados. This is, of course, a point which must be given first consideration, as a fruit of inferior quality would be undesirable in the extreme, even though it possessed all the other essential characteristics. Those containing the highest percentage of oil are naturally the most desirable from an economic standpoint, and having the highest percentage of fat they are ordinarily the finest flavored. Sometimes there will be found fibres or "strings," (fibro-vascular bundles) extending through the flesh from base to apex, and this is a very objectionable feature. It is, fortunately, rarely met with in the larger varieties.

# 10. Seed

The seed should be tight in the cavity. It has been found that in shipping loose seeded fruits, the seed in transit pounds the walls of its cavity and causes considerable injury to the flesh. This is a difficulty seldom met with in Mexican varieties, but often encountered in Florida. In size the seed should, of course, be as small as possible. In time a seedless variety will no doubt be developed, as has been done with the orange and other fruits.

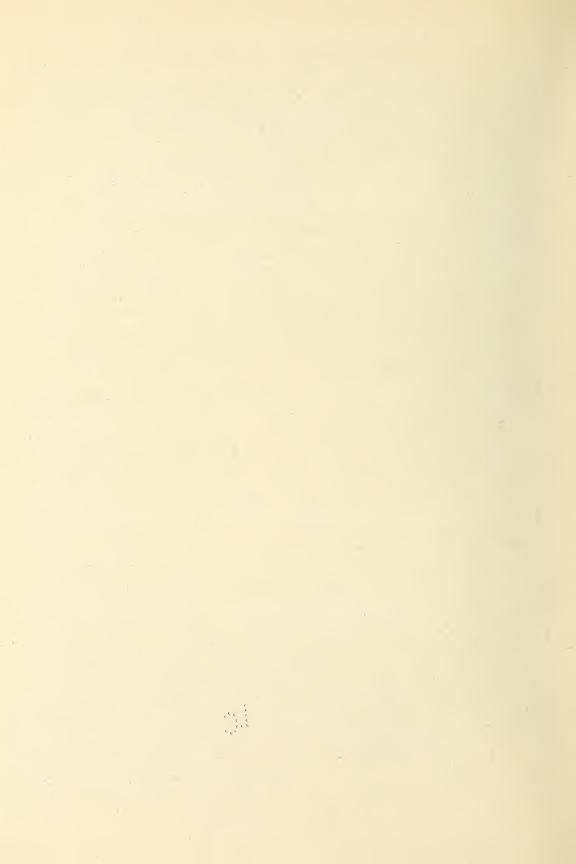




# THE MANGO IN SOUTHERN CALIFORNIA

By F. W. POPENOE

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# The Mango in Southern California

F. W. POPENOE WEST INDIA GARDENS, ALTADENA, CALIFORNIA

The mango, with which but few people of California are intimately familiar, is throughout the tropics where extensively grown, the fruit of first importance. While systematic cultivation on an extensive scale has been applied to it in comparatively few countries, in all parts of the tropics it is grown in the greatest profusion and valued about as those of temperate climates value the apple. To those who are familiar with its finer varieties it is held in the highest esteem, but it is a regrettable fact that in many localities it is found only in inferior seedling forms, and this is accountable for the misunderstanding which exists in the minds of some Americans in regard to this fruit.

In India the cultivation of the mango extends back to the remotest antiquity, and careful selection of seedlings has resulted in the production of the finest varieties now existing. These have been propagated to a limited extent by inarching, and the Indian mangos are now famed as the finest mangos in the world.

The fruit has been termed "the king of tropical fruits," or "the apple of the tropics." Its beautiful coloring and delicious flavor, together with its extensive use in all tropical countries, seem to warrant these appellations. In many countries it is one of the commonest of fruits, growing in a semi-wild state, and forms an important part of the diet of the natives during the season when it is to be obtained.

According to DeCandolle, the mango is a native of South Asia and the Malay Archipelago, but it has long ago spread from its native home to the most remote corners of the earth. In Florida it is now attracting attention as a commercial proposition, and plantings of considerable extent are being made. Through the introduction of some of the choicer Indian varieties, many of which have already produced fruit, the mango industry in Florida has become one of great promise.

Until late years the slow and laborious method of inarching had to be resorted to for the perpetuation of any desirable variety, but recently several methods of budding have been successfully practiced and by these means the production of trees of known varieties on a commercial scale has been made possible.

The value and esteem in which the mango is held are attested by an article on a recent number of the National Geographic Magazine, by no less an authority

than Mr. David Fairchild, in charge of the Agricultural Explorations of the U. S. Department of Agriculture, himself a man of wide experience in tropical countries and familiar with the mango in its native home. He states: "The mango is one of the really great fruits of the world. India, with its hundreds of millions of people, has for centuries held it sacred, and celebrates annual ceremonies in its honor. The great Mogul Akbar, who reigned in the sixteenth century, planted the famous Lak Bag, an orchard of a hundred thousand mangos, and some of these still remain alive. It is a fruit the importance of which Americans are at last beginning to recognize, notwithstanding the unfortunate discredit which some of the worthless seedling mangos of Mexico and the West Indies have given it in the minds of Americans generally.

"There are probably more varieties of mangos than there are of peaches. I have heard of one collection of five hundred different sorts in India. There are exquisitely flavored varieties no larger than a plum, and there are delicious sorts the fruits of which are six pounds in weight. In India, where the wage of a coolie is not over 10 cents a day, there are varieties which sell for \$6.60 a hundred and the commonest sorts bring over a cent apiece.

"The great mango trees of India are said to reach a height of seventy feet, and are so loaded down with fruit that over \$150 worth has been sold from a single tree.

"These fine varieties, practically as free from fiber as a freestone peach, can be eaten with a spoon as easily as a canteloupe. Trainloads of these are shipped from the mango-growing centers of India and distributed in the densely peopled cities of that great semitropical empire; and yet, notwithstanding the great importance of this fruit, the agricultural study of it from the new standpoint has scarcely been begun. I believe that it has never, for example, been tested on any but its own roots."

The mango has received only the slightest attention in California, but its inherent value and the fact that it has been proven to be a possibility for parts of the state have seemed to warrant the preparation of this preliminary paper on the subject.

# Its Present Status in California

So few mango trees have been planted in Southern California, and these have been of such a nondescript character, that no adequate trial can be said to have yet been made of this fruit. Not until superior forms are given a trial under a variety of conditions, and afforded every possible assistance to make them a success, will we definitely know what can be expected of the mango in this state; and yet the results with the few seedlings now in bearing have been so encouraging as to leave little room for doubt as to the future possibilities of this fruit in California.

In considering the behavior of, and results obtained from the trees which have fruited here it is important to take into consideration the fact that they have, almost without exception, been subjected to the most adverse conditions—conditions which would prove fatal in a year to the majority of our temperate fruits—and under these circumstances the behavior of some of these trees is truly re-

markable. Planted in poor soil in some instances and left to shift for themselves, getting no care whatever and no water except from the skies, how could they be expected to do their best? When subjected to such conditions it is little wonder that their growth has been stunted and unhealthy, and that many of them have failed to mature their fruit. The few trees which have had reasonable care



Figure 67. Seedling mango on old Miller place at Hollywood, California.

have done much better, and although they have shown that the growth of the tree will be much slower here than in tropical countries, and the large proportions attained by the mango further south will probably never be reached, yet good healthy growth has been made, fruit has been produced abundantly, and no diseases have appeared to affect the tree or fruit.

The cultivation of the mango in California probably dates back not more than thirty years. One of the earliest trees planted was that on the Jacob Miller place in Hollywood. The seed came from Guatemala City and the tree was set out in its present location almost thirty years ago. This tree has had the advantage of a very mild location, which though not favorable to the rapid growth of the tree or the perfection of its fruit, has enabled it to develop into a good sized tree without being cut back by the frost. The fruit produced is of little value, but the enormous productivity of the tree is surprising, it frequently carrying over a thousand fruits in one crop. Few of the fruits reach a mature size, however, and none ripen perfectly.

Other trees planted more recently are now in bearing, and being situated in several different localities their behavior may be taken as giving something of an indication of the situations in this part of the state best adapted to the culture of the mango. Many small seedlings planted in cool localities have succumbed to the frosts of winter, but in the milder locations or with some protection during the first few winters, several trees have attained sufficient size to withstand the frosts, and are now doing well, it being a well known fact that if afforded some protection for the first few winters the tree will withstand without injury frosts which would have been fatal to it in the young stage.

At Sierra Madre the mango has probably done best. This is probably due to the absence of severe frosts during the winter, coupled with the intense heat of such a location during the summer, Sierra Madre being directly at the foot of the mountains and receiving a large amount of reflected heat. Here two trees, planted quite a number of years ago and receiving practically no care, are bearing regularly and show that one of the principal requirements of the mango is a warm season of long duration, with high temperatures, for the fruits come much nearer ripening on the tree here than near the coast, where they are subjected to fogs during a great part of the summer and never experience the intense heat found further inland.

Two trees growing in the foothills near Sherman, and only a few miles from the ocean, are in a thrifty condition and bearing well, but also go to show that more heat than is experienced in such a location is necessary for the perfect ripening of the fruit. One of the trees is an inarched Red Number Eleven, sent out some years ago by the Department of Agriculture, and is of great interest on account of being, so far as known to me, the only inarched or grafted mango now bearing in California. This tree demonstrates very clearly some of the differences between a seedling and a grafted tree. It is a regular and prolific bearer, and the fruits are all of a uniform, normal development, a fact rare with the seedlings. If it could have been planted further inland there seems little doubt but that it would be producing first-class mangos, as it is only the lack of sufficient heat that prevents the fruit from ripening perfectly. It is never affected by frost, and one glance at the dark green, healthy state of its foliage is sufficient to satisfy the most skeptical as to the possibility of growing the mango in California.

A five year old seedling near Santa Ana has made a splendid growth and is producing regularly, although rather shyly. Not much can be said as yet as to the adaptability of this locality to the mango, but it would seem that it too lacks the necessary degree of heat during the summer months for the perfect ripening of the fruit, of this variety at least.

At Montecito, near Santa Barbara, there are several trees some sixteen or eighteen years old. These trees have never had a healthy look, and their growth has been stunted and their foliage yellow. From the appearance of other plants in the same vicinity it would seem that this was due more to the soil than to the climate. The trees bear regularly a fair crop of fruit, but it does not mature sufficiently to be of any value.



Figure 68. Seedling mango "No. 5" grown at Sherman, California.

Prof. C. V. Piper, Agricultural Explorer of the U. S. Department of Agriculture, writes as follows regarding the conditions at the Government Botanical Gardens, Saharanpur, India:

"Saharanpur is only a short distance from the Himalayan foothills, and the mercury commonly goes down to about 20 degrees in the winter. It is on this account that both tropical and temperate trees can be grown here successfully It is quite strange to see cherries, plums, pears and even apples growing along-side mangos, dates, guavas, etc. In a general way it is comparable to Chico so far as temperature is concerned, possibly a little hotter in summer, and hardly so cool in winter. Judging from this place, why won't mangos do well in California?"

It would seem that if there are varieties of the mango that will thrive in a locality similar in climatic conditions to Chico, California, which is in the northern part of the state and experiences much more severe winters than the orange growing districts of Southern California, then we can reasonably expect to successfully produce this fruit in the latter districts at least. It is interesting to note that many of the mangos which have proved successful in Florida, and are now under trial in California, were introduced to this country from the Saharan-pur. Surely, with varieties which will thrive in a locality experiencing temperatures of 20 degrees above zero every winter, and scarcely hotter in summer than Chico, our chances of success are great!

From this short survey of the behavior of the mango in different localities several conclusions are reached, which it is believed will hold good, although sufficient experience has not yet been had to make them positive. First, the mango, as far as can be judged with the varieties tried out here, is much better adapted to the milder and so called "frostless" localities of the interior than to the seacoast for the reason that near the ocean there is a lack of sufficient heat during the summer months to properly ripen the fruit. It seems reasonable to believe that sheltered locations in the hot interior valleys, such as the San Joaquin, Imperial and Coachella, as free from frost as possible, will produce first-class mangos.

Second, the growth of the tree will be stunted here, and the tree will never reach the proportions attained in tropical countries, although in time it may attain considerable size, especially in the hottest locations.

Third, if given protection for the first few winters the tree will withstand considerable frost, and will be hardy here in many localities at least.

Fourth, the dryness of our climate will not prohibit the production of choice mangos nor seriously interfere with growth in any way, provided ample moisture is supplied at the roots.

It is extremely improbable that the above conclusions will hold good in the case of all varieties, and in fact it could not be expected that they would. The question of variety will have much to do with the success of the mango here, but statements made by many of the greatest authorities on this subject would maintain the contention that a climate such as found in certain parts of Southern California is well adapted to the growth of this fruit.

While there are certain limitations in regard to climate, soil and rainfall, the question of variety must be of great importance in varying these limitations. The mango having become acclimatized in such widely distant localities and under such varying climatic conditions, it is reasonable to believe that a variety which has become adapted to one locality through years of acclimatization would not necessarily be a success in another one of widely differing character.

It is agreed that a dry season of considerable duration is desirable for the most successful culture of this fruit. On this point Collins [The Mango in Porto Rico (Bur. Plant Industry Bul. No. 28) p. 13] states: "It may be considered as proven that the mango will be prolific only in regions subject to a considerable dry season. \* \* \* \* In Mexico and Guatemala the mango was found at its

best only where severe dry seasons prevailed." It is argued that rains at the time of flowering interfere with pollination, and that without some artificial means of checking the growth, such as supplied by an extended dry season, the tree is not encouraged to produce fruit." In regard to climatic requirements Macmillan [Handbook of Tropical Gardening and Planting, p. 154] states, "A hot and rather dry climate and a rich, well drained soil suit it best."

Whether or not a high degree of humidity is at any time of the year necessary is perhaps open to question, but it would appear from the statement of Woodrow [The Mango: Its Culture and Varieties, p. 7] that it is not. He says: "The mango requires an abundance of moisture either in the atmosphere or at the root." Higgins [The Mango in Hawaii (Hawaii Ag. Exp. Station, Bul. 12) p. 8] says: "The mango is better suited to an irrigated region than to one of natural rainfall, because of the bad effects of rain at flowering time, and indeed throughout the life of the tree where the mango blight is known; and further, because it is a distinct advantage to be able to apply water when it is most needed and withhold it when it would do harm." And the behavior of the tree in Southern California and in parts of Mexico with extremely dry summers would argue that the necessary moisture can as well be supplied by irrigation as through the atmosphere.

The amount of frost that the tree will stand could scarcely help depending in a large measure on the variety, those which have become acclimatized in cool localities being naturally less susceptible to frost than those from strictly tropical countries. On this point Woodrow [The Mango: Its Culture and Varieties, p. 7] gives the experience in India as follows: "A few degrees of frost for a short time destroys the leaves and young branches, and an occasional blizzard giving 100F. below freezing point for a short time may destroy branches as thick as the forearm, but on these being pruned off the trees are little worse for the low temperature." It seems, therefore, that the tree will withstand quite low temperatures provided they are of not too long duration. But a high temperature is necessary during the fruiting season. On this point A. C. Hartless, superintendent of the Government Botanical Gardens, Saharanpur, India, states: "As regards the conditions under which the mango ripens its fruit, undoubtedly a high temperature is necessary, and moreover a dry one is preferred. The fruits ripen here from May to July and thus have the hottest and dryest time of the year in which to ripen. Generally there is during May a hot, dry wind that no doubt acts on the acids of the fruit."

It is not necessary that the fruit be ripened on the tree, and the practice of ripening it artificially is extensively used in India. Mr. Hartless says regarding this: "It is a common practice here to ripen the fruit artificially. This is done to save the expense of watching and protecting from predatory animals and birds. When the fruits attain the desired size they are taken off and packed in straw in closed boxes where they will ripen. In this way the taste may differ slightly from those ripened on the tree, but it is not uncommon for fruits on the same tree to differ materially in taste." Mr. H. C. Prinsen Geerligs of Java, writing in the International Sugar Journal, [From The Agricultural News, Barbados, Vol. VIII, No. 176, p. 21] says: "Mangos are usually picked when unripe. At that

time they are hard, acid and flavourless, but the after-ripening process renders them tender and full flavoured in a few days."

# Future Possibilities

A careful study of the behavior of the few bearing mango trees in Southern California will leave little room for doubt as to the future possibilities of this fruit here. Past experiments, while limited in extent, and confined chiefly to the seacoast belt, have been amply adequate to demonstrate that the mango will be, some day, a success in California.

But the varieties which have originated here, or been grown here thus far, are scarcely worthy of consideration for future planting on an extensive scale. In India, and other tropical countries, the mango has been grown for centuries and has reached a high state of development, and the existing varieties are so far ahead of anything that could be produced here by many years of breeding and selection that it behooves us not to waste time and effort experimenting along such lines, but to obtain at once for trial in different locations and under varying climatic conditions inarched or budded trees of a great number of the best varieties. By making such an experiment, we can determine without long delay what varieties or types are adapted to this climate, and obtain for cultivation here varieties much choicer than we could develop in many years.

This work has already been started by the Department of Agriculture. A set of inarched trees, comprising about forty of the choicest varieties from India, Ceylon, Philippines and other countries, has recently been sent to several locations in Southern California for trial. The list includes Alphonse, Ameeri, Amini, Bhadauria, Bhurdas, Bombay Yellow, Brindabani, Bulbulchasm, Cambodiana, Carabao, Chickna, Davey's Favourite, Divine, Ennuria, Faizan, Fernandez, Itamaraca, Jamshedi, Julie, Kachmahua, Kistapal, Langra, Langra Hardoi, Langra Large, Malda, Maller, Mulgoba, Mullgoa, Paheri, Punia, Rajabury, Salamar, Sharbati Black, Singapur, Stalkart, Sufaida, Surkha, Totapari, and White Alphonse. Notes regarding these will be found in the appended list of varieties.

By such experiments as this there is little doubt but that a number of choice varieties will be found that are adapted to this climate, and we will be enabled to proceed at once to the production of the finest forms of this valuable fruit.

The mango being so highly esteemed and extensively cultivated in tropical countries there seems no doubt but that the industry will reach large proportions here when choice varieties are found which are susceptible of rapid acclimatization.

# Propagation

It is a regrettable fact that up to the present time the mango has been propagated in California exclusively by seed. The entire lack of budded or grafted trees of desirable varieties from which to propagate and the inferiority of the local seedlings have not tended to stimulate attempts at asexual propagation of this fruit. A small number of seedlings has been grown by the nurserymen during the past few years, in order to supply the demand which has existed, but it is to

be hoped that in the future propagation in this way will be utilized only to supply the necessary stocks upon which to bud or graft superior varieties. As with nearly all other tree fruits, the mango does not come true from seed, and trees grown by this method are liable to prove inferior and disappointing in the majority of cases. With all the choice varieties now at our command it will be much more profitable to turn our attention at once to the asexual propagation of those found to be adapted to this climate, than to the development of new varieties through the selection of seedlings.

By Seed: Propagation from seed is most simple, and no difficulties are encountered in growing the mango in this way. It has been found advantageous to remove the husk from the seed before planting, as this not only hastens germination, but does away with loss of seeds from insects or fungous growths which find their way inside the husks. A high temperature favors prompt germination, and for this reason seeds are usually started in a greenhouse. They can be planted singly in 4-inch pots, a light, well drained soil being best suited to the development of the young plant.

INARCHING: The simplest method of asexual propagation, and the only one practiced until very recently, is that known as inarching, or grafting by approach. This is the method that has been in use in India for centuries, and by which the choice varieties for which that country is famous have been perpetuated. Inarching provides a simple means for the perpetuation of good varieties, and while somewhat tedious and not suited to the production of trees commercially, propagation in this way may be much more successfully practiced by the inexperienced than budding. The following description of the process from the Sugar Journal and Tropical Cultivator will be of great assistance to those contemplating doing this work:

"The best method of propagating good varieties of mangos is by means of inarching, which is a very simple process. It is performed usually between a large tree of superior variety growing in the ground and a seedling growing in a pot,—small, cheap flower pots about eight or nine inches deep and six inches diameter do well for the purpose. The soil should be good potting soil, with a fair proportion of manure. A single large mango stone should be planted in each pot. The seedlings are ready for inarching, if well grown, in ten months or so; if not well grown, they should be older. Two-year-old seedlings are very successfully inarched. The stem of the seedlings should be in each fairly thick, with the wood fairly developed,—near the root the stem will be somewhat thicker than an ordinary workingman's smallest finger. Any number of seedlings in pots can be inarched in one tree by erecting a stage (for their support) under the lower branches. The stem of the branch to be inarched should be about the same thickness as the seedling, and like the seedling, should be fairly developed wood. The juncture where the inarching is performed should be about six or eight inches from the root of the seedling and about a foot or so from the growing point of the branch, unless the branch is making new vigorous growth, in which case the distance will be more. A straight, well-shaped branch should be selected, so that the future grafted tree will be well proportioned. A slice of wood and bark

should be cut from the seedlings and from the branch, so that the inner bark of both can be made to touch accurately; the two wounded surfaces are bound securely with tape or bast fiber, and grafting clay applied to keep out air. The juncture of branch and seedling should extend for a length of about 3 inches, but at no point should the wound in either be deep; the slices should in fact be of almost uniform thickness throughout and not thick. Tenacious clay should not be used to cover the inarch, it soon cracks and admits air. One part of fresh cattle dung, mixed with two parts good soil, kneaded together with a little water, serves the purpose excellently. Inarching can be done in India at any season, but it is most successful when the trees are in active growth. It takes some time (several months) before the inarched juncture is perfectly joined by the new wood and bark cells. Meantime the seedlings in the pots must be carefully and regularly watered. When the juncture is complete the leading shoot of the seedling should be removed immediately above the inarch juncture and some days afterwards the branch of the tree may be severed immediately below the juncture.

"Trees for inarching should be in a sheltered situation, because if swayed much by the wind the pots or the platform are disturbed from their position.

"In planting out young grafts the pots should be broken if the young plant can not be removed without disturbing the earth on the roots. If the earth on the roots is much disturbed the plant will almost certainly die. They should be planted with plenty of manure in pits three feet deep and wide."—[From "The Mango in Porto Rico," by G. N. Collins, (Bulletin No. 28, Bureau of Plant Industry), p. 15]

Patch Budding: It would be almost impossible to propagate mango trees in sufficient quantities for large commercial plantings by the method of inarching as described above. With the recent development of interest in the extension of the mango industry, several methods of budding, which permit of the propagation of trees in commercial quantities, have been developed. And while these doubtless require considerable more skill and experience on the part of the operator than inarching, when the production of trees in quantity is desired, one of them will have to be resorted to. The first method of budding successfully practiced was that of patch budding, Mr. G. W. Oliver of the Department of Agriculture being the first one to succeed with it in this country. The method as practiced by him is described as follows: ["The Propagation of the Mango," by G. W. Oliver, in the Florists Exchange, New York, April 19, 1902, p. 461.]

"The method I wish to call attention to must be performed under certain conditions, the first and foremost of which is that the stock must be in active growth. The best time is when the new leaves are not far enough developed to show the bright green color. The bark is then most easily removed. Choose the thick part of the stem only a few inches above the surface of the ground; cut out a rectangular piece of bark about one and one-half inches in length, and from the variety to be propagated cut a similar piece with a bud in the center, not, however, from new wood, but from that which is at least two years old and which has lost its green color and assumed the grayish brown tint. Fit the section of bark, with bud attached, into the space formed by the removal of the bark from

the stock. If this piece of bark removed from the stock has a bud in the central part, the wood exposed to view will fit better with the section of bark to be applied. When the section has been put in place, with a small brush apply a light coating of liquid grafting wax in which there is a large quantity of resin, to the cut parts, and immediately tie firmly with thick pieces of raffia; then an 8-inch wide strip of strong wrapping paper wound round and round the stem a few inches above the bud, and tied above with a cord, completes the operation for the time being.

"If good material is selected and the operation carefully carried out at the proper time, there is no reason why a high percentage of successful unions should not be secured."

SHIELD BUDDING: In 1910 the Hawaii Agricultural Experiment Station issued a bulletin [Shield Budding the Mango (Bul. No. 20, Hawaii Ag. Ex. Station), Honolulu, 1910] by Mr. J. E. Higgins, describing a method of shield budding successfully practiced by him. Shield budding has several advantages over patch budding, the chief being that the buds can be set much more rapidly, and do not require skilled labor for the wrapping. If it can be successfully practiced here, it should be by far the most desirable method for nursery propagation. Mr. Higgins describes the process as follows:

"Budding by this method has been successfully performed on stocks from an inch to three inches in diameter. What the limitations are, on either side of these dimensions, is not known at present. Wood of this size, in seedling trees, may be from two to five years old. It is essential that the stocks be in a thrifty condition, and still more important that they should be in 'flush'. If not in this condition, the bark will not readily separate from the stock. It has been found that the best time is when the terminal buds are just opening. Unless the trees are watched carefully they will pass this stage before the flush is observed. When the young, brown leaves have appeared it is often too late to bud, and the operation must be postponed until the next flush.

"The budwood which has been most successfully used is that which has lost most of its leaves and is turning brown or gray in color. Such wood is usually about an inch in diameter. It is not necessary in this method of budding that the budwood shall be in a flushing condition, although it may be an advantage to have it so. It should, however, be healthy wood of normal growth.

"The incision should be made in the stock about six inches in length. At the lower end of this make an incision at right-angles to it, with the knife edge pointing upwards at an angle of about forty-five degrees with the stock, thus making a curved incision. Insert the sharpened end of the handle of the budding knife beneath the bark at the junction of these incisions, and push it gently upward, raising the bark so as to make a place for the bud. It is not necessary to push the handle far, but by gently prying, the bark may be separated from the stock, if the latter is in proper condition, without injuring the delicate cells against which the bud shield is to be placed.

"The bud is now to be removed from the budwood. With a rather heavier knife than is generally used for budding, in the right hand, and the budwood held firmly in the left, place the blade against the budwood with a very slight inclina-

tion, and cut so as to make as flat a surface as possible under the bud shield. This bud shield should be about three to three and one-half inches long, with the bud in the center. The small portion of wood, which will thus be taken off with the bud shield, may be removed if it slips readily. If not, it should be left in place. The lower end of the shield is taken between the thumb and finger and gently inserted in the incision prepared for it, pushing it up until it is held firmly in place by the surrounding bark.

"The stock must then be tied with raffia or some other soft, but strong, tying material so as to prevent drying out. The cut surfaces below the actual bud are usually covered with grafting wax, and the whole is then wrapped with a waxed cotton bandage, beginning at the lower part and winding spirally to the top, exposing only the actual bud. This method protects the bud and the wound from the access of water. The bud is shaded by a short piece of bandage hung over it and held in place by being laid under one of the upper strands of the spirally wound bandage.

"In about three or four weeks, if the bud remains green, the stock should be lopped at a point about seven inches above the bud. Care should be taken in thus cutting the stock partly off to avoid splitting downward. It should be made to split upward into that portion of the stock which is to be destroyed. This lopping will serve to force the bud into growth. Many other buds, on the sides of the stock, will start into growth before the new bud. These must all be cut off. It has not been found necessary to remove the tying and wrapping material until the bud has made two flushes, and often it is not necessary at all, since the raffia usually decays beneath the waxed cloth and the latter naturally expands with the growth of the stock. When the bud has started into growth the top of the tree may be cut off and destroyed. The stump remaining above the bud may be cut off with a sloping cut close to the bud, after the latter has made three or four flushes."

# Influence of Stock on Scion

Very few experiments have as yet been made to determine the influence of the stock on the scion, and it is to be hoped that this important subject will be more thoroughly investigated in the near future. The following statement, by Prof. Rolfs, demonstrates that the field is an interesting and important one:

"At the present time we know very little as to the influence of the stock on the scion in the various groups of mangos. In this connection I may say that I have two trees of the Totafari, one tree budded on the scion of an unknown variety, probably belonging to the Eleanor group. This small tree began to fruit before it had been set out three years, and has been a constant fruiter and heavy bearer ever since. At exactly the same time that this tree [Rolfs, P. H., 'The Mango in Florida' (Proc. Am. Pomological Society, 1911] was set out, a spring was taken from that tree and inarched on a large number eleven tree. This inarch has grown most remarkably and has made a good sized tree, but up to the present time has shown no tendency to produce bloom. One would naturally have expected that when this scion was inarched on the fruiting tree, the scion would

begin to fruit in a very short time. Likewise, I have another case in which a Cambodiana scion has been inarched on to a number eleven mango, and on another limb of the same tree a Pakiri has been inarched. The Cambodiana and Pakiri are of about equal growth. They compose now the entire top of a large mango tree. The Cambodiana has been a regular and constant fruiter, while the Pakiri has shown no tendency to bloom, although some Pakiri trees on what is probably Eleanor stock are blooming and fruiting abundantly. From the isolated instances, it would appear the number eleven proves to be an excellent stock for Cambodiana, but proves to be a poor stock for Pakiri and Totafari groups."

These results seem to indicate beyond the possibility of a doubt that the question of stock is of the utmost importance. It will be both profitable and necessary, therefore, when a choice variety is found adapted to Southern California, to experiment extensively and determine what stock is best suited to it. But the subject will require thorough investigation and experimentation before it is clearly understood.

# Varieties

While the following varieties do not by any means include all the mangos so far fruited in California, they may be considered as all which are worthy of notice or liable to be propagated, and hence the only varieties now grown here that it will be necessary to distinguish by name. With one exception, they have originated locally as seedlings. The exception is the variety Red Number Eleven, which, as described, is produced by an inarched tree sent out by the Department of Agriculture. The presence of this one inarched tree is of the greatest interest, and it has demonstrated a number of things which could not be determined by seedlings. Being of a variety whose habits are well known, its behavior can be taken as an accurate indicator of what the mango will do in Southern California, under such conditions as this tree has been grown. It has produced abundantly and regularly, and the fruit has been fully as large as that produced by the same variety in Florida or the West Indies. In addition the fruits are uniformly well developed, which is not the case with the fruits produced by any of the local seedlings. While the growth of the tree has been much slower than it would have been in a hotter country, it is in a healthy and vigorous condition, and is rarely affected by frost, although it has not been subjected to our average winter temperatures, perhaps, on account of being grown in a very mild locality. The locality in which it was grown being near the seacoast, it also lacks the intense summer heat found further inland, and this fact is accountable for the failure of the fruit to ripen perfectly, or even to as great a degree as at Sierra Madre. The cool nights and mild days have the effect of greatly retarding the development of the fruit, so that it reaches maturity just as the winter season is coming on and is unable to ripen for lack of heat. When picked and laid away for awhile, the fruits become soft and eatable but cannot be said to be up to the standard in this respect, by any means.

Most of the seedlings differ from this inarched tree in setting an enormous crop of fruit each year and then bringing only a few to maturity, probably the

earliest blossoms. The great difficulty experienced in many humid tropical countries, namely, the failure of the mango to set fruits, certainly will not be experienced here. But the cool winters check the growth of the tree, and it flowers much later than it normally would, and this results, of course, in making the fruits very late to mature. So that with the seedlings, as with Red Number Eleven, the fruits must be picked and laid away for a few days before softening up sufficiently to become eatable. Those fruits which have been grown farthest inland, and subjected to the greatest heat during the summer, always mature before those grown near the seacoast, and usually are in fact the only ones which mature at all.



Figure 69. The Fales mango. This tree should have been headed lower.

# Fales

(Figures 69, 70, 71, 72)

This variety originated at Sierra Madre, on the property formerly owned by W. L. Fales, by whom the tree was planted and for whom it has been named. It

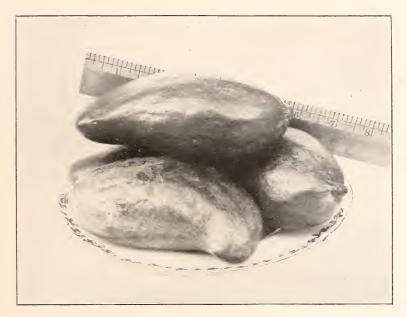


Figure 70. A plate of well developed specimens of the Fales mango.

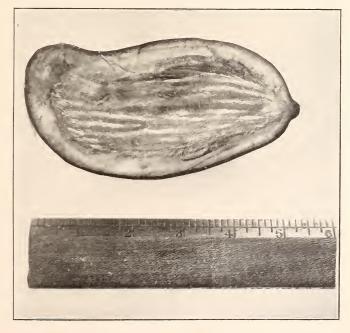


Figure 71. Longitudinal section of the Fales mango grown at Sierra Madre, California.

is probably the best of the local seedlings. This mango would seem to be one of the "Manila" type grown in Mexico, and it is probable that the seed was brought from some point in that republic, and was of that type. The tree has been subjected to the hardest possible usage, and under these conditions its behavior is truly remarkable. It is grown in a partially decomposed granite soil at the foot of the Sierra Madre mountains, and for a number of years has received practically no care whatever. And yet it bears regularly good crops of fruit,—fruit which will compare well in size with those of the Manila type produced in Mexico. If picked in December and laid away for a few days it ripens into a mango of very fair flavor and quality.

Description: General form long and slender, somewhat compressed, and terminating in a prominent curved beak; size large; weight ten ounces; dimensions, length five and one-half inches, width two and three-quarters inches, thickness two

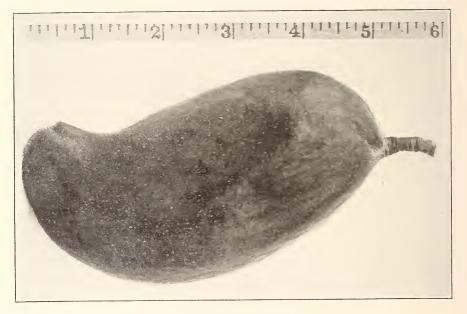


Figure 72. The Fales mango.

inches; base somewhat tapering, slightly extended where stem joins the fruit; apex very prominently curved and beaked, stigmatic point rather prominent and one-quarter inch above tip of beak; stem rather stout; fruits borne in clusters of two to six; surface somewhat undulating; bloom none; color greenish yellow, brightest at base and gradually shading downward to yellowish green at apex; dots numerous, small, rounded, some of them subcutaneous, dark brown, the subcutaneous ones light yellowish; skin medium thick, tough; flesh firm, orange yellow, juicy; fibre not very abundant, fine; seed very long, narrow, medium thick; flavor sweet, aromatic, very pleasant; quality fair to good; matures in December at Sierra Madre, but does not ripen perfectly on the tree.

Tree is upright, close headed, and a fairly prolific bearer. Here described for the first time.

# Sierra Madre

(Figures 73, 74)

This also originated at Sierra Madre, and was planted by Mr. Fales at the same time as the variety first described. It is inferior to the Fales, and is mainly noticeable for its habit of producing small sterile fruits, as mentioned below.

Description: General form reniform, long, somewhat compressed, very prominently beaked; size large; weight nine ounces; dimensions, length five inches, width two and one-half inches, thickness two inches; base tapering toward stem, slightly extended where stem joins fruit; apex very prominently curved and beaked, stigmatic point a mere dot; stem medium stout; surface somewhat undulating; color yellowish green, exposed side blushed with brownish orange; dots numerous, small, rounded, some of them subcutaneous, dark brown, the sub-

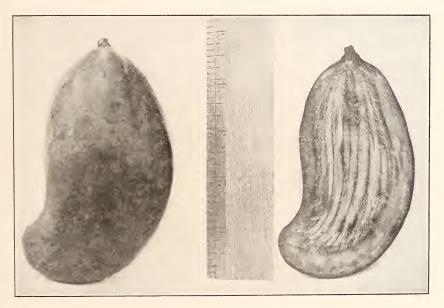


Figure 73. Normal type of the Sierra Madre mango, grown at Sierra Madre, California.

cutaneous ones light yellowish green; skin medium thick, tough; flesh light yellow, rather dry; fibre rather abundant; seed very large, oblong, rather thick; flavor subacid, strong; quality fair; matures in December at Sierra Madre, California, but does not ripen on the tree.

Tree upright, open headed, fairly prolific bearer. A peculiar thing about this variety is the fact that it produces a large number of small, sterile fruits, which ripen and fall to the ground in October. These sterile fruits are quite distinct in form from the normal type, are about two ounces in weight, and more highly colored than the normal fruits, being a dull orange yellow, overlaid with scarlet and bright orange around the base of the fruit. The seed is represented by a thin, empty husk. The flesh is light orange in color, contains considerable

coarse fiber, and is of a most delicious, sweet, spicy flavor. These sterile fruits are the only mangos known to me which mature in California during the warm season, and consequently have an opportunity to ripen perfectly under favorable conditions. They are really a choice little fruit, and far superior in flavor to any of the normal varieties which mature during the winter and do not ripen perfectly.

This is the first description of this variety.



Figure 74. The Sierra Madre mango. Small sterile form.

# Santa Ana

(Figure 75)

Originated near the city of Santa Ana, on the property now owned by Mr. Chas. Eells. It is a common type of mango and a fruit of fair quality, its chief drawback being that it is (so far, at least,) a shy bearer.

Description: General form reniform, rather broad, thick, terminating in a curved beak at apex; size medium; weight seven ounces; dimensions, length four and one-half inches, width two and one-half inches, thickness two inches; base very slightly tapering, more or less plaited; cavity none; apex extended into a prominent curved beak, stigmatic point depressed, one-quarter inch above tip of beak; stem medium stout, swollen where it joins the fruit; surface slightly undulating; bloom none; color yellowish green, blushed with maroon on exposed side; dots numerous, medium large, rounded, sometimes subcutaneous, russet, the subcutaneous ones yellowish green, lighter than skin; skin rather thick, tough; flesh light yellow, sometimes tinged with greenish; fibre fairly abundant, but fine; seed rather long, narrow, thick, reniform, small in proportion to size of fruit; flavor rather acid, quality fair; matures in December at Santa Ana, but does not ripen perfectly on the tree.

Tree is of vigorous growth, but a rather shy bearer, producing only about one dozen fruits this season.

This is the first description of this variety.

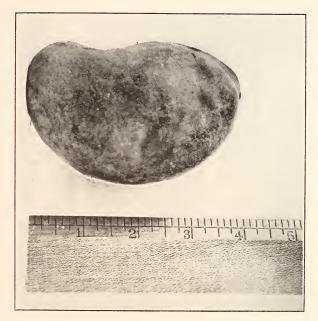


Figure 75. The Santa Ana mango, grown at Santa Ana, California.

# Red Number Eleven

(Figures 76, 77, 78, 79)

A red cheeked form of the well known Number Eleven, one of the most popular mangos in the West Indies. The fruit as here described is produced on the property of Ed. Harman, at Sherman, by an inarched tree sent out some years ago by the Department of Agriculture.

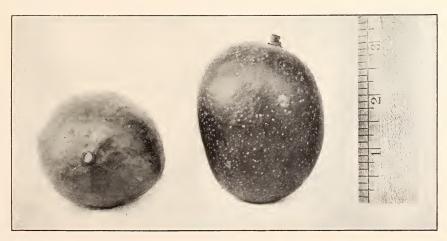


Figure 76. The Red Number Eleven mango as now grown at Sherman, California.

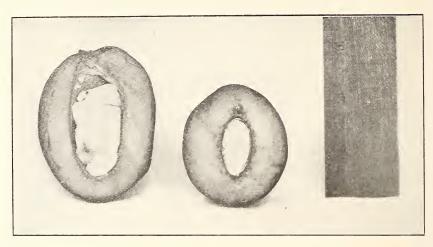


Figure 77. The Red Number Eleven mango as now grown at Sherman, California.

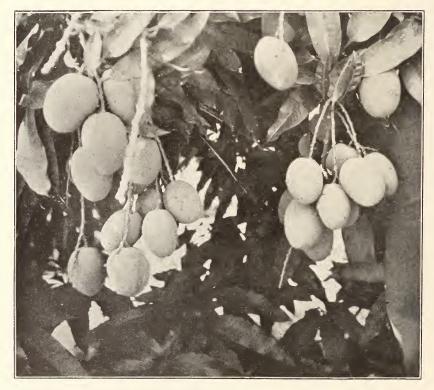


Figure 78. Clusters of fruit on inarched Red Number Eleven mango at Sherman, California.

Description: General form oblong, oblique, somewhat compressed; size small; weight four ounces; dimensions, length three and one-quarter inches, width two and one-quarter inches; thickness two inches; cavity very shallow, sometimes none, slightly plaited; apex rounded, not beaked, stigmatic point slightly depressed and one-half inch above longitudinal apex of fruit; stem rather slender; fruits borne in clusters of two to eight; surface slightly undulating; bloom none; color green, overlaid with magenta on exposed side; dots numerous, medium sized, irregular, russet; skin rather thin, tough; flesh deep yellow to orange yellow; rather dry; fibre slight; seed oblong, thick, very large in proportion to size of fruit; flavor subacid, spicy; quality fair to good; matures December-January at Sherman, California, but does not ripen perfectly on the tree.

Tree is rather spreading in habit, close-headed, of vigorous growth, and a prolific bearer.



Figure 79. The Red Number Eleven mango at Sherman, California. This tree shows a fine orchard form for the mango.

### CLASSIFICATION

Almost no attempt has ever been made to classify the immense number of mango varieties, either by a natural or artificial system. The one obstacle which has probably prevented this more than anything else is the extremely wide distribution of the fruit, making it an impossibility to gather all the varieties together in one place for study and comparison. There seems to be ample basis for a classification by natural characteristics, and if this could be done it would bring out vividly the relationship between many of the varieties, and establish the synonymy of many which are now considered as distinct, or known under different names in different countries. Few fruits are as widely grown as the mango, or exhibit as many variations, and this will make the task of gathering together and classifying the multitude of forms from all parts of the world a difficult one.

Prof. Rolfs has classified the mangos now grown in Florida into a number of distinct groups, based not only on a similarity of natural characteristics of certain fruits, but also on a similarity in growth and foliage of the trees. It is stated that persons naturally inclined to horticultural work will come to recognize these groups instinctively.

This grouping is as follows:

NO. 11 GROUP. Composed of a miscellaneous lot of seedlings distributed most largely along the east coast from the lower end of India River southward. The group, as far as Florida is concerned, originated in a shipment of about 1200 seeds of No. 11 sent [Rolfs, P. H., "The Mango in Florida" (Proc. Am. Pomological Society, 1911)] from Jamaica. The fruit weighs from three to twelve ounces, varies in color from crimson red to light orange, is quite fibrous, in general shape what has been called a modified kidney shape to almost round, and is the first group to ripen. The group contains two varieties, No. 11, which includes an assemblage of seedling trees, which seem to come more or less true from seed, and Roberts, a descendant from No. 11 which has been propagated by budding to some extent.

TURPENTINE GROUP. A miscellaneous lot of fruits, seeming to have come to Florida from various parts of the Antillean region. It is of so inferior grade that varieties have not been propagated.

CAMBODIANA GROUP. Considered by some botanists to be a distinct species from the other groups of India, and known under the name of Mangifera Cambodiana. It seems to be most common in the Malayan Peninsula and the Philippine Islands. In some instances the seed fails to develop and yet produces a good fruit, that is, the group seems to produce strains which are tending to become seedless. The characteristics of the group are a fruit of six to eight ounces in weight, deep lemon yellow color, weak fiber, much elongated form, and prominent stigmatic area. The varieties at present recognized are: Manila, an assemblage of seedlings that is to eastern Mexico what No. 11 is to the east coast of Florida; Philippine, an assemblage of seedlings grown in Cuba; Cambodiana, grown from seeds imported by U. S. Department of Agriculture; and Cecil, a very handsome variety originated at Miami, Florida.

PINEAPPLE GROUP. Composed largely of seedlings grown in Mexico, some of which have found their way into Florida. It is small in size, light orange or lemon yellow, streaked with red, fiber strong as in No. 11 group, shape distinct, shoulder not prominent, stigmatic area prominent. The varieties are: Pinna, seeds imported from Mexico; Totafari, received as inarched tree from India.

BOMBAY GROUP. This group has no distinct line of demarcation between it and the Eleanor group, which follows. Some of the varieties have come to Florida as seed from the Antilles, others have come from India as inarched trees. As a rule the fruit runs large; the ground color is dark lemon or bright orange in most cases, in some ripening with a distinct greenish color, or containing a considerable amount of red; fiber is rather weak; shape approximates as nearly spherical as any group of mangos; stigmatic area occurs well up on the fruit, where it is either prominent or slightly depressed. Varieties are: Bombay, a miscellaneous lot of seedlings from the Antilles; Indian, a variety of the Bombay group; Mulgoba, introduced by United States Department of Agriculture from India in the late eighties, in form of an inarched tree; Alphonse, derived from India; Bennet, derived from India.

ELEANOR GROUP. A miscellaneous lot of seedlings. Distinct from the Bombay group in color, and in coarseness of fiber. Varieties are: Eleanor, a rather handsome fruit; Apple, quite similar to Eleanor, but of apple-like flavor; Apricot smaller than two preceding, and of apricot-like flavor.

SOONDERSHA GROUP. Comprising a single variety, the only one of the group yet grown in Florida. Derived from India. The largest of the mangos that have been grown in Florida, color somewhat like Cambodiana group, lemon yellow with small dark colorations, fiber weak, season very late. The Soondersha is the only one of the group so far fruited in Florida.

## An Annotated List of Better-Known Mangos

Of the almost innumerable varieties of the mango, which have originated in all parts of the tropical world, extremely few have ever been completely described or figured in any publication. Several of the most famous Indian mangos have received considerable attention, but the great majority of varieties are scarcely known even by name outside of the locality in which they have originated. The following list is of necessity very fragmentary, and incomplete, and only contains varieties which have received the attention of horticulturists. One authority records having collected five hundred distinct sorts in India, but no description has ever been published of the majority of these, and there remain vast numbers whose existence has never been recorded.

This list has been compiled in the main from the following sources, but extracts have also been made from a number of articles which have appeared in periodical publications, and I am personally indebted to Mr. E. N. Reasoner of Oneco, Florida, for notes regarding many of the Indian varieties as fruited in that state.

Woodrow, The Mango: Its Culture and Varieties, Paisley, 1904.

Collins, The Mango in Porto Rico (Bureau of Plant Industry, Bulletin No. 28) Washington, 1903.

Higgins, The Mango in Hawaii, (Hawaii Agricultural Experiment Station Bulletin No. 12) Washington, 1906.

Macmillan, A Handbook of Tropical Gardening and Planting, Colombo, 1910. Jumelle, Les Cultures Coloniales, Paris, 1901.

Hartless, A Tabular List of Mangos grown at the Government Botanical Gardens, Saharanpur, U. P., India.

Yearbooks of the United States Department of Agriculture for 1901, 1907, 1908 and 1910.

Catalog of Government Botanical Gardens, Saharanpur, India, 1907.

Catalog of Tropical Fruit Trees, William Bros., Heneratgoda, Ceylon, 1907.

Catalog of Royal Palm Nurseries, Oneco, Florida, for 1911-12.

Inventories of Bureau of Plant Industry, U. S. Department of Agriculture.

And other publications.

Ada. A good sized, well flavored fruit.—William Bros., Ceylon.

Afonza, India. Weight eighteen ounces; size four and five-eighths by three and seven-eighths inches; skin greenish yellow with dark specks; pulp very pale yellow, very sweet, slightly wooly; left shoulder high; beak slight.—Woodrow.

Alphonse, India. Introduced under S. P. I. No. 8440. (Synonyms Alphonso, S. P. I. No. 9517, Alphonso, Alfonso, Alfonso, and Hafu, S. P. I. No. 8733). Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Weight twelve ounces; size four by three and one-quarter inches; skin greenish yellow, with reddish orange shoulder; pulp fine, dark cream colored, of the finest piquant and delicate flavor; beak none; left shoulder very slight. The keeping qualities of this mango are excellent, and it is generally admitted the best of all mangos. The name is applied to many distinct sorts of greatly varied merits, in the markets.—Woodrow.

A well known Bombay kind, tender in the United Provinces-Saharanpur.

This is the best Bombay mango, and is remarkable for its good shipping qualities. It can be picked while still green, laid or shipped in straw with plenty of air, and kept for six weeks. Even after ripe, fruits can be kept for a week or more. A much better shipper than Mulgoba, and more productive.—Fairchild.

Prolific bearer; medium size; quality good; color red and yellow; stone medium size; ripens mid season; good keeper; very fair flavor; tree tender.—Hartless, Saharanpur.

AMEERGOLA. Listed, but not described, by William Bros., Ceylon.

AMINI, India. Introduced under S. P. I. No. 7104. Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

General form long, about five and one-half inches. Skin medium thick, yellow and red. Flesh meaty, tender, juicy, sweet.—Reasoner, Florida.

Amini has produced fruit as free from adhesion as Fernandez, and of excellent flavor. The shape is more nearly what is desired in a market fruit, i. e., it approaches more nearly to the spherical than most others. It is a very thick and short variety, with no noticeable point at blossom end.—Beach, Florida.

Amiri or Amircola, India. (Syn. Ameeri, S. P. I. No. 8731). Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Weight ten ounces; size five and one-half by two and seven-eighths inches; crimson yellow on skin shading downward to green. Described as a very high class fruit by Mr. Mahaluxmivalla of Bombay.—Woodrow.

ANNURRUA. Listed, but not described, by William Bros., Ceylon.

Apple, Florida. Quite similar to the Eleanor. At its best has a decided apple flavor.—
Rolfs.

Apricot, Florida. Running somewhat smaller than either the Eleanor or the Apple. At its best has a decided flavor like the apricot.—Rolfs.

Arbuthnot, India. Introduced under S. P. I. No. 9504. Fruited in Florida.

A medium sized fruit, near the Bombay variety.—Saharanpur.

Prolific bearer; medium size; quality medium; color orange and green; stone medium size; mid season; good keeper; flesh firm; tree tender; slow grower.—Hartless, Saharanpur.

The fruits are rather long, weighing from eight to twelve ounces each, of excellent flavor and very little fiber.—Reasoner, Florida.

Aristide, Mauritius. Introduced under S. P. I. No. 27926. The best of our mangos.—Regnard.

Auguste, Mauritius. Introduced under S. P. I. No. 27853.

AUMINI. Listed, but not described, by William Bros., Ceylon.

Bada Mawa, India. Weight six ounces; size three and five-eighths by two and three-quarters inches; skin green, speckled pale green, and shaded yellow; pulp sweet and luscious, without piquancy.—Woodrow.

BADAMI, India. Introduced under S. P. I. No. 7103.

Badshaha, India. Weight fourteen ounces; size four and three-quarters by three and three-eighths inches; skin pale yellow, of agreeable flavor but woolly; beak small; shoulders yellow.—Woodrow.

Bahardura, India. A small fruit of fine flavor, ripens in August and September.—Saharanpur.

Baissac, Mauritius. Introduced under S. P. I. No. 27927.

Banchore of Alandi-Keir, Poona. India. Weight four and three-quarters ounces; size three by two and one-half inches; skin deep crimson on exposed side, dark cream on shaded side; pulp very fine, creamy, delightfully piquant; beak none; shoulders level.—Woodrow.

Banchore of Dhairey, Poona. India. Weight seven ounces; size three and one-third by two and three-quarters inches; skin green, speckled pale green and shaded yellow; pulp very sweet, and luscious, without piquancy.—Woodrow.

BANKA, India. A twisted variety, highly popular.—Woodrow.

Baramasi, India. (Synonymous with Baromeshe and Baransi). Fruits during several months of the year.—Saharanpur.

Baransi, India. Prolific bearer; fruit small; quality fair; color yellow and green; stone large; ripens late; keeps well; fruits twice a year, latest to fruit; rather fibrous; medium hardy; slow grower.—Hartless, Saharanpur.

BAROMESHE. Or all the year round.—William Bros., Ceylon.

Batasi, India. A very small fruit of delicious flavor and very rare, with fine fibre. Beak none, left shoulder slightly higher.—Woodrow.

Bath, India. Introduced under S. P. I. No. 7038.

Belkash. Listed, but not described, by William Bros., Ceylon.

Bennett Alphonse, which see.

Beresa. Listed, but not described, by William Bros., Ceylon.

BHADAYA. A late fruiting variety, ripens August to October, and one of the best as to flavor.—William Bros., Ceylon.

BHADAUREA OF BHADUREA, India. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Sparse bearer; size large; quality fair; color yellow and green; stone large; ripens late; poor keeper; texture fibrous; poor flavor; tree hardy; medium free grower.—Hartless, Saharanpur.

Bhao Kan. Listed, but not described, by William Bros., Ceylon.

BHOPALY, India. Weight fourteen ounces; size four by three and one-eighth inches; skin yellowish green; pulp deep yellow without fibre; flavor pleasing; beak none; shoulders level.—Woodrow.

BHUNGA, India. Weight eight ounces; size three and one-third by two and seven-eighths inches; skin yellow; pulp yellow, shaded dark yellow in center. Infested with mango weevil. Beak very slight; shoulders level.—Woodrow.

Bhurdas, India. Introduced under S. P. I. No. 9515. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Sparse bearer; medium size; quality medium; color yellow and green; stone large; ripens mid-season; good keeper; pineapple flavored; medium hardy and free grower.—Hartless, Saharanpur.

Bishor, India. Weight eighteen ounces; size five and three-eighths by four and one-half inches; skin yellowish with very small bright light yellow specks; pulp deep brownish towards stone, shading off to pale at the outside; slightly wooly, sweet and rich, without piquancy; beak scarcely perceptible; left shoulder slightly high.—Woodrow.

Bissaneth Mukho. Listed, but not described, by William Bros., Ceylon.

BLACK (or Green Gage). A delicious mango from Jamaica, where it is considered their best sort. Small to medium size; regular oblong; green, with numerous black spots on the skin; pulp with exceedingly fine fiber hardly noticed, of a yellow color, and spicy, sweet flavor.—Reasoner, Florida.

Bolo, India. Weight thirteen ounces; size four by three and one-half inches; skin yellow; pulp pale yellow, with a few strong, dark fibers near skin; beak and shoulders none.—Woodrow.

Bombay Bhuto or Bhuta Bombay. Listed, but not described, by William Bros., Ceylon.

Bombay Calcutta Garden, India. Prolific bearer; large size; second quality; color green and yellow; stone small; tree hardy; ripens midseason; keeps well; medium free grower; good flavor.—Hartless, Saharanpur.

Bombay Green, India. Introduced under S. P. I. No. 9507. Now under trial in Florida.

One of the best kinds for general planting, prolific bearer.—Saharanpur.

Prolific bearer; medium size; quality good; color green; stone medium size; hardy; ripens early; keeps well; medium free grower; soft fleshed.—Hartless, Saharanpur.

Bombay Jait. Listed, but not described, by William Bros., Ceylon.

Bombay Singa. Listed, but not described, by William Bros., Ceylon.

Bombay Surat. Listed, but not described, by William Bros., Ceylon.

Bombay White. Listed, but not described, by William Bros., Ceylon.

Bombay Yellow, India. Introduced under S. P. I. No. 9508. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

One of the best for general planting. A prolific bearer.—Saharanpur.

The best mango here. Fruit of medium size and yellowish when ripe.—Gollan, Saharanpur.

Prolific bearer; medium size; first quality; yellow and red in color; stone medium size; hardy; ripens mid season; keeps well; free grower; flesh firm; superior to Bombay Green.—Hartless, Saharanpur.

Borsha, India. Introduced under S. P. I. No. 8442.

Weight ten ounces; size four and one-eighth by two and five-eighths inches; skin bright green, with minute yellow spots and bright crimson on exposed side; beak very slight; left shoulder very high.—Woodrow.

Fruit weighs on an average ten ounces, ripens by first of July. Flesh is as dry as that of Mulgoba or Alphonse and can be cut like cheese. It is three to four weeks later in ripening than Alphonse and considered almost its equal in quality. One large tree of this variety is said to have often yielded over \$150.00 worth of fruit in a single crop. \* \* \* This variety is distinguished from Mulgoba by its young shoots, which are distinctly reddish in color.—Fairchild.

Bottle, India. Introduced under S. P. I. No. 8420.

A good market sort of Bombay. Green in color, ripening to reddish yellow. Flesh is yellowish in color and not stringy. The fruit is very long and slender, hence the name "bottle." The stone is small. The fruit ripens, as do most of the Bombay mangos, from April to May.—Fairchild.

Brindani, India. Introduced under S. P. I. No. 9506. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Medium sized, green colored fruit. Quality only fair. Gollan, Saharanpur.

Sparse bearer; size small; quality only fair; color green and yellow; stone large; tree tender; ripens midseason; keeps well; slow grower; juicy and of good flavor.—Hartless, Saharanpur.

Brojonath Dhur (or *Brojo Nath Dhar*). Listed, but not described, by William Bros., Ceylon.

Bulbulchasm, India. Introduced under E. P. I. No. 9519. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Sparse bearer; medium size; second quality; color green and yellow; tree hardy; stone medium; keeps well; ripens medium; free grower; ordinary—Hartless, Saharanpur.

Calcutta Amin, India. Introduced under S. P. I. Nos. 9520 and 10644. Now under trial in Florida.

A long fruit, hooked and pointed. Has a very thin stone. Flavor good.—Gollan, Saharanpur.

Sparse bearer; large size; second quality; color reddish; stone small; tree hardy; ripens medium; keeps well; medium free grower; ordinary.—Hartless, Saharanpur.

Cambodiana, India. Introduced under S. P. I. No. 8701. Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A very rapid grower, bearing medium to large fruit; early ripening, color yellow; shape long; rather more acid than most sorts if gathered before coloring, but when ripened on the tree is quite sweet. Very fine sort without any turpentine taste.—Reasoner, Florida.

Much like Totapari, but not so pointed. Free bearer.—Beach, Florida.

Carabao, Philippine Islands. Introduced under S. P. I. Nos. 24927 and 25659. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A variety of merit. It comes true from seed and by that method has been reproduced in that country (Philippines) for generations.—MacIntyre.

Cecil, Florida. Form oblong reniform, rather slender; size large; cavity regular, small, shallow, slope gradual; stem medium slender; fleshy where it joins the fruit; tip an inconspicuous beak, usually about half an inch from the longitudinal apex of the fruit; surface nearly smooth; color rich greenish or golden yellow, marbled lightly with brownish yellow; dots numerous, russet, sometimes subcutaneous, green or gray; bloom whitish; skin medium thick, tenacious; flesh yellow, tender, juicy, with but very little fiber; seed thin, oblong, large; flavor sweet or mild subacid, rich, aromatic, pleasant; quality good to very good; season June to August at Miami, Florida.

Tree is said to be a very vigorous grower, symmetrical in form, and a heavy bearer. The fruit begins to ripen at Miami about the first week in June.—1910 Yearbook, U. S. Dept. of Agriculture.

Originated at Miami, Florida.

CHICKNA, India. Introduced under S. P. I. Nos. 9521 and 10660. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A medium sized fruit, light yellow, of good flavor.—Gollan, Saharanpur.

Prolific bearer; small size; quality only fair; color reddish green; stone small; tree hardy; ripens medium; keeps well; free grower; ordinary.—Hartless, Saharanpur.

China of Guatemala. A very fine seedling race, common in the markets of Guatemala City, and considered the finest mango of that region. The form of the fruit is characteristic, being very thin and almost circular in outline, with a prominent blunt "nak" located some distance from the apex. The flesh is thick and remarkably free from fiber for a seedling, mild and aromatic, without suggesting turpentine.

This variety differs from others examined in having pronounced longitudinal ridges on the seed, which is thin and very broad. Like the Manila of Mexico, this form apparently comes true to seed. By some this form is called Mango de Brea. This name is, however, more appropriately applied to another form in which the fruit is more or less coated with a pitch-like exudation, brea meaning pitch.—Collins.

- China of Hawaii. Size very large, one of the largest mangos in Hawaii; form resembling the Strawberry mango, with a slightly depressed stem; color a shade of yellow on the unexposed side, and on the exposed side varying from orange to orange red; peeling qualities good; texture good; flesh abundant in proportion to the size of the seed, very bright in color like that of the Vanilla mango; flavor rather lacking in delicacy, though sweet. It would seem that this variety, the Vanilla, and the so-called Strawberry are all closely related. There is a similarity of flavor, form and odor of flesh. They differ in size and color of rind.—Higgins.
- CHITTORO. Listed, but not described, by William Bros., Ceylon.
- COBRIA, India. Weight six ounces; size two and three-quarters by two and three-quarters inches; skin smooth, yellowish green; pulp pale yellow, of fine flavor, no fiber; beak none; shoulders level.—Woodrow.
- Colleca, India. Weight ten ounces; size four and three-eighths by two and five-eighths inches; skin yellowish green; pulp shaded yellow, sweet, no fiber, a cooking fruit; beak very slight and broad; right shoulder slightly lower than the left one.—Woodrow.
- Costa, India. Weight eight and one-half ounces; size three and five-eighths by two and seven-eighths inches; skin yollowish green; pulp cream, of pleasant flavor; beak very slight; left shoulder very broad and slightly high.—Woodrow.
- Cowasjee Patel, India. Introduced under S. P. I. No. 7045. Synonymous with *Kavasji-Patel*, which see.
- CRESCENT, Hawaii. Size medium to large; form crescent shaped, with a tendency toward greatest enlargement on the exposed side, even when ripe. In ripening, the exposed side takes on tinges of yellow, and when fully ripe becomes a shade of orange yellow. Peeling qualities poor; texture very good, quite free from fiber; flavor excellent, sweet, and spicy; flesh light yellow with a slight tinge of green, except at the center close to the seed, where it is quite bright, approaching yellow-orange; seed very thin and long, resembling the fruit in outline, greatly reduced within the husk and showing a tendency toward seedlessness. This is one of the most desirable of the sweet seedling mangos.—Higgins.

Crassous, French West Indies. Oblong, clear green outside, very little fiber.—Jumelle. Cuiller, Mauritius. Introduced under S. P. I. No. 27854.

- Custodio, India. Weight twenty-eight ounces; size six by four and one-eighth inches; skin yellowish green; pulp pale yellow, no fiber; season begins in July. Beak slight; left shoulder very high.—Woodrow.
- Dalbed, India. Weight ten and one-half ounces; size four and three-eighths by two and seven-eighths inches; skin yellow, shaded with green; pulp deep yellow, very sweet, but very fibrous; fruit stalk insertion high; left shoulder higher than right; beak medium.—Woodrow.

DAMARIA, India.

- Dampara, Ceylon. Prolific; fruit small in size, of second quality, rather fibrous; skin yellow brown; seed small; ripens early and keeps fairly well. The tree is a free grower and is hardy. It is not much cultivated.—Dr. Drieberg.
- DAVEY'S FAVOURITE, India. Introduced under S. P. I. Nos. 9522 and 10661. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry. A long thin fruit, yellow shaded red. A fine fruited variety.—Saharanpur.

Sparse bearer; medium size; second quality; color green; stone medium size; tree tender; ripens mid season; keeps well; free grower; somewhat sour.—Hartless, Saharanpur.

- Davis No. 11, Hawaii. This is a seedling from the No. 11 mango, which has attained considerable fame in the West Indies and appears to come quite true to kind, as this variety is reported to do with a fair degree of accuracy. It was introduced by Mr. Henry Davis and has received his name to distinguish it from another and very inferior form which has been known locally as the "No. 11." Size medium; form short, rounded, much depressed at the stem end; color light green, turning to orange yellow in ripening; peeling qualities excellent; texture very good; flavor excellent; color of flesh very dark; seed small.—Higgins.
- Deorukhia, India. Weight seven ounces; size four by two and one-half inches; skin clear orange; pulp deep yellow; very fine flavor; habit upright, vigorous; a first class mango; left shoulder slightly raised, right shoulder depressed; beak very slight.—Woodrow.
- DILPASSAND, India. A very small leaved variety, described as of excellent flavor.—Woodrow.
- Diniz, India. Weight eleven ounces; size three and five-eighths by three inches; skin dark green; pulp yellow, very soft, creamy, sweet, without piquancy; shoulders level; beak very slight.—Woodrow.
- DIVINE, French West Indies. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Elongated, slightly flattened, light brown pulp; no fiber. Strong turpentine flavor. A close relative of the Chinese mango.—Jumelle.

D'Joao, India. Weight thirteen ounces; size four and one-half by three and one-half inches; left shoulder high and broad; beak none. A popular fruit.—Woodrow.

Dofasli. Listed, but not described, by William Bros., Ceylon.

Dophala. Listed, but not described, by William Bros., Ceylon.

D'OR, French West Indies. Introduced under S. P. I. No. 28085. Fruited in Florida.

Douglas Bennett's Alphonse, India. Introduced under S. P. I. Nos. 8419 and 8727. (Synonyms, Bennett and Bennett's Alphonse). Fruited in Florida.

In size it is three by four inches, and in color a golden yellow when ripe. The flesh is quite without stringiness, stone small, and flavor, according to Mr. Bennett, the best in the world. It is a large leaved variety and forms a good sized tree, but is of scraggly growth.—Fairchild.

Considered one of the best yet fruited in Florida. Medium sized, highly colored, very prolific.—Reasoner, Florida.

Fruit nearly round, with short, blunt, curved point at blossom end, obliquely impressed on one side. Pale greenish yellow in color, occasionally shaded with pink on

exposed side. Weight eight to twelve ounces. Skin firm and tough, flesh pale yellow, melting and juicy, slightly acid with pleasant aromatic flavor. Seed medium small and thin. Fiber very short and coarse, tree strong grower.—Cellon, Florida.

Its fruit is smaller than Mulgoba, running from eight to twelve ounces, while the former runs from twelve to sixteen. In flavor and aroma as well as other qualities it is equal to Mulgoba, differing enough to make some prefer one, some the other, according to individual taste. So far as it has been tested it appears to be more prolific than the former, and we presume as good a shipper, though it has not yet had the test of time to determine. This is the only one of the famous Alphonse type that has fruited with us yet.—Beach, Florida.

Dulce, India. Weight twelve ounces; size four and three-eighths by three and one-quarter inches; skin pale greenish yellow; sweet piquant, no fiber; shoulders level; beak slight.—Woodrow.

DUN OF TWICE BEARING. Listed, but not described, by William Bros., Ceylon.

Durma, India. A round yellowish mango about eight ounces to one pound in weight. It has an exquisite vanilla flavor.—C. Maries, Woodrow.

ELEANOR, Florida. A rather handsome fruit which gives a name to a group. It has considerable of a reddish blush, over the yellow ground color.—Rolfs.

Ensurea, India. (Sometimes spelled *Ennuria*). Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A very large fruiting variety.—Saharanpur.

Sparse bearer; large size; first quality; color yellow and green; seed long and thin; tree tender; ripens medium; does not keep well; slow grower; flesh firm and good flavored.—Hartless, Saharanpur.

Medium sized, oblong, highly colored, exquisitely flavored, mid season in ripening. Has a very little fiber.—Reasoner, Florida.

FAIZAN, India. Introduced under S. P. I. No. 9523. (Sometimes spelled Fizan). Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A large long fruit, brownish green, flavor good.—Gollan, Saharanpur.

Sparse bearer; medium size; second quality; yellow and green; stone small; tree hardy; ripens medium, keeps well; free grower; very good flavor.—Hartless, Saharanpur.

FAJRI LONG and FAJRI ROUND. See Fijri Long and Fijri Round.

FAQIRWALA, India. Introduced under S. P. I. No. 9526. Fruit superior.—Saharanpur.

Sparse bearer; fruit large; first quality; color yellow; stone medium sized; tree hardy; ripens late; keeps well; free grower; very good.—Hartless, Saharanpur.

Fernandez, India. Introduced under S. P. I. No. 7039. Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Weight six ounces; size three and one-eighth by two and one-half inches; skin on exposed side bright red, with small yellow specks, gradually shading downward, and on sheltered side to yellowish green; pulp bright yellow, fiber very slightly wooly; flavor very fine, sweet and piquant; shoulders both low; beak scarcely perceptible. A very superior sort.—Woodrow.

Fernandez is a small fruit, with a bright red cheek, and small seed. It is the only one of the imported sorts so far that has a distinct sub-acid flavor. Some specimens are so absolutely free from fiber that by making an incision around the center of the fruit, the bottom half of the pulp with the skin can be slipped off from the seed, like a freestone peach. It has very distinctive foliage, and is further distinguished from all others by a whitish bloom which covers the new bark so long as it remains green, disappearing only when the latter turns brown with age.—Beach, Florida.

- Fernandino, India. Weight nine and one-half ounces; size three and seven-eighths by two and seven-eighths inches; skin bright crimson on the upper half, shading to pale yellow at the lower end; pulp very pale yellow, sweet and of piquant flavor, but wooly; left shoulder level, right shoulder low; beak none.—Woodrow.
- Fernandino II, India. Weight ten ounces; size four and three-eighths by three and three-eighths inches; skin green; pulp white, a cooking mango of special value; left shoulder level, right shoulder low; beak none.—Woodrow.
- FIFINE-GABRIELLE, French West Indies. Listed, but not described, by Jumelle.
- Fijri Long, India. Introduced under S. P. I. Nos. 9524 and 10646. (Sometimes spelled Fajri Long). Now under trial in Florida.

A large, longish fruit, ripens late. Dark green when ripe.—Gollan, Saharanpur.

Sparse bearer; large fruit; second quality; green in color; stone medium size; tree hardy; ripens late; keeps well; medium free grower; very fair.—Hartless, Saharanpur.

FIJRI ROUND, India. Introduced under S. P. I. Nos. 9525 and 10647. (Sometimes spelled Fajri Round). Now under trial in Florida.

Similar to Fijri Long, but roundish shape.—Saharanpur.

Sparse bearer; large size; second quality; green in color; stone medium size; tree hardy; ripens late; keeps well; medium free grower; very fair.—Hartless, Saharanpur.

- Frederico, India. Weight eight ounces; size three and one-half by two and seven-eighths inches; no fiber. Gathered while green. A valuable preserving fruit. Left shoulder level; right shoulder slightly lower; beak slight.—Woodrow.
- FRENCH, Hawaii. Sometimes locally known under this name, a term whose significance is uncertain. It might well be called the Wine, because of its exceedingly beautiful wine-colored rind, which takes a very high polish if gently rubbed with a soft cloth. Size medium to large; form oblong, rounded; texture fair; peeling qualities good; flavor rather too strong for the average taste.—Higgins.
- FREYCINET, French West Indies. Rosy outside, reddish pulp, without fiber.—Jumelle.
- Friel, Hawaii. Size small; form resembling on side view the Davis No. 11, but viewed from the back it shows a rather gradual narrowing toward the stigmatic end; stigmatic point depressed; forming a small hole where there is often an elevation; stem very slightly depressed; color on the exposed side orange yellow when fully ripe, the unexposed side lighter, mingled with green; peeling qualities fair; texture fair; flavor fair; color of flesh light. Both this and the Walnut would probably be considerably changed by cultivation. They are now much neglected.—Higgins.
- Furtado, India. Weight eleven and one-half ounces; size four by three and one-eighth inches; skin smooth, green, becoming rich yellow green; pulp deep orange, puffy, rather coarse; left shoulder high and broad, right shoulder level; beak none.—Woodrow.
- FURTADO II, India. Weight eight ounces; size three and one-third by three inches; skin yellow and green in blotches; pulp dark yellow; flavor rather high; left shoulder slightly high; right shoulder slightly low; beak very distinct, one-quarter inch.—Woodrow.
- Fusli Bewa, India. (Syn. Fuzli, of William Bros., Ceylon). Is said by Maries to bring 1 rupee each. August is its season.—Woodrow.
- GADA MAR, India. Introduced under S. P. I. No. 7107.
- Gardya, India. Weight eighteen ounces; size four and one-half by three and seven-eighths inches; skin greenish yellow, pulp pale yellow, of piquant flavor, slightly fibrous; shoulders nearly level; beak slight but distinct.—Woodrow.
- GANCHIR. Most renowned.—William Bros., Ceylon.
- GENERAL GORDON. See Gordon.

Goa, India. (Syn. with Goa Alphonse). Now under trial in Florida.

Weight seven ounces; size three and one-eighth by two and seven-eighths inches; skin pale yellow; pulp very soft, sweet; left shoulder high, right shoulder low; beak none.—Woodrow.

Gola, India. Introduced under S. P. I. Nos. 9527 and 10662. Now under trial in Florida.

A variety with small round yellow fruit. Flavor superior.—Saharanpur.

Sparse bearer; medium size; second quality; color green and yellow; stone medium size; tree hardy; ripens late; keeps well; free grower; juicy, of good flavor.—Hartless, Saharanpur.

Golapkhash. Listed, but not described, by William Bros., Ceylon.

Gollan, India. Our own importation from Saharanpur, named in honor of the late Superintendent of Government Gardens there. Fruit large, oblong, weighing from twelve to twenty-four ounces each; pale yellow in color. Small quantity of fiber; flavor excellent.—Reasoner, Florida.

Gopal Bhog, India. Introduced under S. P. I. No. 9509. (Synonyms, Gopal Bhog, Gopalbogh, Gopal Bhoga and Gopalbhogy). Fruited in Florida

A superior variety coming into market at the end of June. Weight six ounces.—Woodrow.

Prolific bearer; medium size; first quality; color green and yellow; stone medium size; tree hardy; ripens medium; keeps well; free grower; pleasant aroma.—Hartless, Saharanpur.

GOPAL DHOBA. Listed, but not described, by William Bros., Ceylon.

GORADYA, India. Weight twelve ounces; size four and one-eighth by three and seven-eighths inches; skin very rough, with large obtuse projections; pulp sweet but wooly; left shoulder high, right shoulder low; beak indistinguishable.—Woodrow.

Gordon, West Indies. (Syn. General Gordon). Fruited in Florida.

This is probably the smallest fruit in our collection, averaging around six ounces. Short, kidney shaped, flavor delicious, high color, quite prolific.—Reasoner, Florida.

This variety is rather dwarf in habits, which renders it suitable for cultivation where space is limited or protection is necessary. Introduced by the U. S. Dept. of Agriculture from Trinidad, West Indies. Fruit long, yellow, shaded on exposed side with carmine; pulp fine, rich and melting, with pleasant aroma, and scanty fiber, confined mostly to the thin edges of the seed. The trees come into bearing while very young.—Cellon, Florida.

Green Gage. Synonymous with Black, which see.

Green Flesh, Hawaii. Size small, form resembling the common Hawaiian Sweet; color a bright green with traces of yellow and brown on the exposed surface; peeling qualities good; texture poor; flavor sour and unpleasant; seed long, thin.—Higgins.

HADEN, Florida. Originated from a seedling planted by the late Captain J. A. Haden at Coconut Grove, Florida, whose name it bears, and is apparently of the East Indian type.

Size medium to large; shape oblong, nearly round, only slightly impressed on one side at blossom end, which is nearly the same size in circumference as the stem end, making it of convenient shape for packing; color rich golden yellow, washed over the greater portion of the surface with rich crimson and scarlet; skin smooth, tough and of firm substance, medium thin; flesh golden yellow color; flavor rich, aromatic and spicy; seed medium small, fiber short and coarse, extending only from the thin edge of the seed; quality best; season July. The fruit can be easily separated in halves and the seed extracted without leaving any fiber in the pulp, which can be eaten from the fruit with a spoon.—Cellon, Florida.

HAFT. Synonymous with Alphonse, which see..

HASTINGS. Listed, but not described, by William Bros., Ceylon.

Hathijhul, India. Introduced under S. P. I. No. 9258. (Sometimes spelled *Hathi Jhul*, S. P. I. No. 10648). Now under trial in Florida.

A variety with a very superior flavored fruit, one of the best. Λ very large fruit.
—Saharanpur.

Moderate bearer; fruit large; second quality; green and yellow; stone small; tree hardy; ripens late; keeps well; free grower; the largest fruiting kind, and of good quality.—Hartless, Saharanpur.

- HAWAHAN SWEET, Hawaii. (So called). This was the first variety to be introduced in the islands, having come probably from Mexico. It is now found everywhere in Hawaii where mangos are grown. Size medium; stem depressed; color light green with slight brownish tints before ripening, the green changing to yellow and the brown to pink as ripening proceeds; flavor good when well grown; juices abundant; texture fibrous; seed large; tree a free bearer.—Higgins.
- Heart, Ceylon. This is also called the *Bombay* and is the commonest variety found on the market. Prolific; fruit medium in size, not much longer than broad, of second quality; skin golden yellow; seed of medium size; ripens early and is a fair keeper. The tree is a free grower and is hardy.—Dr. Drieberg.
- Herbert No. 9, Hawaii. The seed from which this variety was grown was introduced at the same time as the No. 9, and was supposedly identical, being planted under the same number. The fruit, however, is very distinct, but bears a close resemblance to No. 9. The writer has designated it in honor of Mr. Allan Herbert, who planted the tree. Size rather smaller than No. 9; form resembling that variety, but with the peculiar "S" shape, still more marked; color dark yellow when ripe, with a very beautiful bright red on exposed side, thus making it very distinct and one of the most attractive mangos. In other respects it is similar to No. 9, but is apparently more subject to blight.—Higgins.

Himsagar. Listed, but not described, by William Bros., Ceylon.

Honey, Ceylon. A small roundish fruit, of sweet flavor.-Macmillan.

INERMA, India. A Durbhanga variety of great size. Reported four pounds in weight.—
Woodrow.

ITAMARACA, Brazil. Introduced under S. P. I. No. 23426. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A small yellow mango with a thin skin, without fiber, and with a very delicate flavor, bringing a high price in the market. Occurs in Pernambuco. (Bello)—Bureau of Plant Industry.

Jaffna, Cevlon. Introduced under S. P. I. Nos. 8411 and 8680.

Large oval fruit of excellent quality when well grown; probably equal to "Alphonso" of India.—Macmillan.

A long fruited, medium sized mango, green in color. The seed is fairly large, flesh golden yellow. It is edible before fully ripe. A vigorous grower and a good bearer. This is the best market mango in Ceylon, and is the one generally planted about the villages.—Fairchild.

The favorite variety here. Prolific; fruit medium in size, twice as long as broad, of first quality; skin green; seed of medium size; ripens early and is a fair keeper. The tree is a fairly free grower and is hardy.—Dr. Drieberg, Ceylon.

Jalibandha. Synonymous with Maldo, which see.

Jamshedi, India. Introduced under S. P. I. No. 8734. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Skin thick, tough, shrivelled, blotched yellow and green, intruded at apex (almost like an apple). Tip rounded; beak short and strong; pulp yellow with a brownish tinge, free from fiber; flavor strong, excellent, distinct. (R. K. Bhide)—Woodrow.

JAPAN. Listed, but not described, by William Bros., Ceylon.

JAVA. Listed, but not described, by William Bros., Ceylon.

JAVA of Hawaii. Synonymous with Kauai Chutney, which see.

JEEPRIA, India. Weight twelve ounces; size four and three-eighths by three and one-eighth inches; skin green when brought to market, pulp pure white, a good cooking sort; both shoulders low; beak none.—Woodrow.

Jobos, Porto Rico. A common form in the San Juan market in the early part of the season. A very poor kind, considered to be the wild or unimproved form. It is green in color, with a large seed, and very stringy meat, frequently ripening unevenly and having a strong turpentine flavor. In form it is slightly asymmetrical, stem not depressed.—Collins.

Johnson. Listed, but not described, by William Bros., Ceylon.

Jose, Mauritius. Introduced under S. P. I. No. 27855.

Josephine, French West Indies. Listed, but not described, by Jumelle.

Julie, French West Indies. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry. Listed, but not described, by Jumelle.

Kabutria, India. Weight seven ounces; size four and three-eighths by two and one-half inches; skin greenish yellow, red on shoulder; pulp deep yellow, without fiber, of rich piquant flavor; shoulders nearly level; beak small but distinct.—Woodrow.

Каснамитна, India. The fruit of this variety is sweet and eatable when in a green, unripe state.—Saharanpur.

Prolific bearer; fruit small; first quality; red and green in color; stone medium size; tree hardy; ripens early; keeps well; free grower; very sweet even when unripe.—Hartless, Saharanpur.

Kachmahua, India. Introduced under S. P. I. Nos. 9527 and 10649. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Kaelia, India. Weight fourteen ounces; size three and seven-eighths by three and one-eighth inches; skin greenish yellow; pulp deep yellow; flavor luscious; fibres few; left shoulder high, right shoulder low; beak very slight.—Woodrow.

Kagdi-Alphonse, India. Weight ten onnces; size three and seven-eighths by three and one-eighth inches; skin greenish yellow, suffused with crimson; pulp deep yellow, fine, creamy; left shoulder from the stalk falling slightly, then rising; right shoulder gently falling; beak none. A thick-skinned Alphonse mango.—Woodrow.

KAKARIA, India. Introduced under S. P. I. Nos. 9530 and 10650.

A large fruited, dark green mango. Good flavor.—Saharanpur.

Prolific bearer; fruit small; second quality; color yellow and red; stone medium; tree hardy; ripens mid season; keeps well; free grower; good flavor.—Hartless, Saharanpur.

Kala, India. Introduced under S. P. I. Nos. 9531 and 10666.

A longish shaped fruit. Free of stringiness. Pale green, good.—Saharanpur.

Sparse bearer; medium size; second quality; color dark green; stone medium; tree hardy; ripens mid season; keeps well; free grower; juicy and nicely flavored.—Hartless, Saharanpur.

KALA ALPHONSE, India. Introduced under S. P. I. No. 7041. (Syn. Kala-Alfoos).

Weight fourteen ounces; size four and five-eighths by three and three-eighths inches; skin dark green with red on shoulder; pulp fine, dark yellow, creamy; flavor luscious; no fiber; left shoulder level, right shoulder low; beak very slight, obtuse.—Woodrow.

Kalla, India. Weight nine ounces; size four by three and one-fourth inches; skin dark green, slightly yellow on shoulder; pulp pale yellow, very sweet; left shoulder high, right shoulder low; beak distinct, small.—Woodrow.

KANCHAMITHA (PANCHANANDA). Listed, but not described, by William Bros., Ceylon.

KAPAT BHANGA. Listed, but not described, by William Bros., Ceylon.

KAUAI CHUTNEY, Hawaii. Also known as the Java, etc. It is improperly called a chutneym as it lacks the characteristics of that group. (See explanatory note under Lemon Chutney). Size large; form thick at the shoulders and almost round, while it tapers rapidly to a point at the stigmatic end; color varying from lemon yellow to saffron where exposed and when thoroughly ripe more or less dotted with red spots which have a gray center where the epidermis is ruptured; peeling qualities fair; flesh rather brighter yellow than is found in the No. 9; texture exceedingly good for a seedling, there being no fiber except close to the seed; flavor very good; a distinguishing characteristic of this form is the large size of the leaves.—Higgins.

Kavasji Patel, India. (Sometimes spelled Cowasjee Patel).

Weight twenty-one ounces; size five and one-fourth by three and three-fourths inches. Gathered green, with white pulp, for cooking. A fine large cooking sort. Both shoulders falling; beak prominent.—Woodrow.

Khajya, India. Sparse bearer; medium size; first quality; color yellow and red; stone small; tree tender; ripens late; keeps well; medium free grower; fair in flavor.—Hartless, Saharanpur.

KHAPARIAH, India. Introduced under S. P. I. Nos. 9510 and 10641. (Also spelled Khaparia and Kahpariah).

Medium size; medium sparse bearer; third quality; color green and yellow; stone small; tree hardy; ripens medium; keeps well; free grower; fair in flavor.—Hartless, Saharanpur.

Khatkia, India. A longish, hooked, pointed fruit. Color yellow, shaded red.—Saharanpur. Weight seven ounces; size four and one-half by two and five-eighths inches; skin doubtful; pulp sweet and piquant, but stringy; both shoulders low; beak depressed. A popular mango, to be sucked.—Woodrow.

Khetubasek. Listed, but not described, by William Bros., Ceylon.

Kheershapottee, India. Probably synonymous with Khirsapati.

KHIJURA GOORKA. Very sweet.—William Bros., Ceylon.

KHIRPOOLI. Listed, but not described, by William Bros., Ceylon.

Khirsapati, India. Now under trial in Florida. Listed, but not described, by William Bros., Ceylon.

Khoont, India. Weight eight ounces; size three and three-fourths by three and one-eighth inches; skin dull red and yellow, blotchy; pulp very fine, creamy, dark yellow, but puffy. A very fine fruit, but with an unattractive color.—Woodrow.

Khrishnakali. Listed, but not described, by William Bros., Ceylon.

Kissen Bhoga (or Kissenbhog.) Now under trial in Florida. Listed, but not described, by William Bros., Ceylon.

Kistaphal, India. Introduced under S. P. I. Nos. 9536 and 10656. (Sometimes spelled Kistaphal, a Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A large fruit. Flesh highly colored and of good flavor.—Saharanpur.

Sparse bearer; medium size; second quality; color yellow and red; stone small; tree tender; ripens late; keeps well; medium free grower; good.—Hartless, Saharanpur.

Krishna Bhog, India. Introduced under S. P. I. 9532. (Sometimes spelled Khrishna Bhog).

Sparse bearer; large size; second quality; color yellow and green; stone medium size; tree tender; ripens late; keeps well; slow grower; good.—Hartless, Saharanpur.

Kumrajali. Listed, but not described, by William Bros., Ceylon.

Kumukht, India. Described by Maries, has a rough skin, a large beak, eight ounces in weight, and has a fine flavor.—Woodrow.

Kutna, India. A favorite variety.—Saharanpur.

Sparse bearer; medium size; second quality; color yellow; stone medium size; tree hardy; ripens late; keeps well; slow grower; fair.—Hartless, Saharanpur.

Lamba Bhadra, India. Introduced under S. P. I. No. 9537. Fruited in Florida.

Sparse bearer; fruit large; first quality; color green and yellow; stone large; tree hardy; ripens mid season; keeps well; free grower; nicely flavored.—Hartless, Saharanpur.

Fruited in Florida for first time in 1911, and said by Reasoner to be so inferior as to be worthless.

Langra, India. Introduced under S. P. I. No. 9511. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Weight six and one-half ounces; size three and five-eighths by two and five-eighths inches; skin very thin, green, with a yellowish tinge when ripe; pulp creamy, and of delicious flavor; no fiber and small stone; both shoulders falling; beak very small. This is *Maldah*, described in Botanical Magazine, t. 4510.—Woodrow.

Prolific bearer; medium sized fruit; first quality; color green; stone small; tree medium hardy; ripens mid season; does not keep well; free grower; fine flavored.—Hartless, Saharanpur.

LANGRA BENARSI, India. One of our introductions from India which bore in 1910 for the first time. Promises to be very prolific and is a strong grower. The fruit is the largest we have ever seen, weighing up to three pounds one ounce each. Very little fiber, flavor rich and spicy. Fruit is yellow or greenish when ripe.—Reasoner, Florida.

LANGRA HARDOI, India. Introduced under S. P. I. Nos. 9538 and 10651. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A thin seeded variety of good flavor, ripens late. Medium sized fruit, pale yellow, flesh very rich.—Saharanpur.

Prolific bearer; medium size; second quality; green in color; stone medium size; tree hardy; ripens medium; keeps well; free grower; similar to Langra, but more stringy.—Hartless, Saharanpur.

LANGRA LARGE, India. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Sparse bearer; medium size; second quality; green in color; stone medium size; tree hardy; ripens medium; keeps well; free grower; similar to Langra, but more stringy.—Hartless, Saharanpur.

Largo, Porto Rico. A form common on the south side of the island and at Mayaguez. Long, nearly straight, stem not depressed, green in color. The flesh is very firm, moderately thick, and with very few fibers. At Yauco slightly shorter specimens were called "Mangotina," a name used very loosely in all markets, this form selling for ten for one cent. The flavor is fine, though the taste of turpentine is pronounced, and to those who do not object to this feature it will appeal as one of the best of the Porto Rican forms.—Collins.

Latania. A creeping variety.—William Bros., Ceylon.

LATE MULCARRI, India. Fruited in Florida. Fruit small to medium, yellow, highly flavored, usually late to ripen, contains but little fiber. Prolific.—Reasoner, Florida.

LATHROP. Introduced by the Division of Seed and Plant Introduction, U. S. Dept. of Agriculture, and fruited in Florida for the first time in 1911. Said by Reasoner to be so inferior as to be worthless.

Lemon Chutney, Hawaii. Size large for this class; color, a light lemon yellow, dotted with lighter yellow after the manner of the chutneys; peeling qualities good; texture good; flavor good; seed medium size.—Higgins.

Explanatory Note: The term chutney should be used as the name of a class rather than of a variety, and does not signify a mango used chiefly for the manufacture of chutney, as might be supposed. The flavor of the members of this class is characteristic, and though not so sweet as most of the other varieties, it is nevertheless very agreeable and more esteemed by many than any of the sweeter kinds. There is a delightful acidity and spicy character, with a pleasant aroma and usually a characteristic odor in all parts of the plant. The difference between the forms is sometimes very slight, but in other cases it is well marked. They are sometimes separated into so-called acid chutneys and sweet chutneys, but it is quite probable that most of the forms classed as sweet chutneys are really the result of crosses between acid chutneys and some of the sweet mangos.—Higgins.

Lerrua, India. A variety described by Maries, chiefly valued for its fine coloring, orange and red and green in stripes and blotches.—Woodrow.

Long Manila, Hawaii. Size medium to large; form long, narrow; color light yellow; texture good; flavor very good; seed thin, flat. It appears to be the same as that known in Porto Rico under the name Manila.

It will be observed that the term Manila is applied to several varieties grown in these islands, and means very little except that the original of the variety is supposed to have come from Manila.—Higgins.

Lyon, Philippines. Introduced under S. P. I. Nos. 27835 to 27838.

Grown from S. P. I. No. 25940, which was introduced under the class name of Pahutan.—Bureau of Plant Industry. See *Pahutan*.

Madras, India. Now under trial in Florida. Prolific bearer; small size; second quality; color greenish red; stone medium; not very hardy in the United Provinces; ripens medium; keeps well; free grower; fairly good.—Hartless, Saharanpur.

Malda, India. (Syn. Jalibandha). Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Prolific bearer; large size; third quality; yellowish green in color; stone medium; very hardy; early ripening; does not keep well; medium free grower; very large; insipid in taste.—Hartless, Saharanpur.

Synonymous with Langra (which see).—Woodrow.

Maharajah. Introduced under S. P. I. No. 27848. Now under trial in Florida.

Fruit roundish oblique, flattened, four and one-eighth by three and three-sixteenths by two and seven-eighths; cavity shallow, with a distinct suture extending two inches from stem; beak medium, about one inch from end of fruit; surface moderately smooth, some fine undulations; color, greenish yellow, shading to rich yellow; dots very numerous, yellow; skin thick, tenacious; flesh rich yellow, tender, but very fibrous; flavor sweet, pleasant quality, if fiber was not so abundant would be good; seed flat, oval, covered with a dense coat of fiber; medium size, three by one and eleven-sixteenths by seven-eighths inch.—W. A. Taylor.

Maison Rouge, Mauritius. Introduced under S. P. I. No. 27928.

Malcoa. Listed, but not described, by William Bros., Ceylon.

Maliabad. Listed, but not described, by William Bros., Ceylon.

Maller, India. Introduced under S. P. I. No. 23747. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Maneckjee Rustomjee. Listed, but not described, by William Bros., Ceylon.

MANGALORE, India. Introduced under S. P. I. No. 27849. Now under trial in Florida.

Fruit oblong, flattened, four and one-sixteenth by three and five-eighths by two and five-eighths inches; cavity shallow, small furrows without suture; stem very slender, with bracts; beak small, one-sixteenth inch above general surface, seven-eighths inch from end center; surface moderately smooth; color yellow, with marblings of

green; dots numerous, yellow; skin thick, tenacious; flesh deep yellow, tender except for fiber, juicy; flavor mild subacid; quality good; seed flat, oval, three and one-half by two and one-eighth by seven-eighths inch.—W. A. Taylor.

Mango. Porto Rico. A large, rather straight form, with a very square base, somewhat resembling Largo, but slightly more symmetrical and thicker. Large quantities were seen in the San Juan market on June 22, a month later none were to be found. The flesh was fairly thick and of good quality.

This name may possibly be a contraction of *mangon*, which would not be at all inapplicable, as this is one of the largest Porto Rican forms. Stahl gives *mango* as the common name of *Mangifera indica* in Porto Rico.—Collins.

- MANGOSTEEN, Hawaii. Improperly so-called. Size small; form rounded, unlike most mangos; color green with a dull red on the exposed side before ripening, but turning to a very beautiful bright red, thus making it one of the most ornamental of the mangos; flavor poor; seed very large. It is very subject to mango blight.—Higgins.
- MANGOTINA, Porto Rico. A very small yellow form, with one side red. Similar to Mayaguez, seen at San Juan, but longer, with rounder base and stigmatic point nearer the apex.—Collins.
- Manilla of Mexico. A Mexican race, almost entirely free from fiber, and of mild, pleasant flavor. The skin is uniformly light yellow and thin; the flesh is also light colored and firm. The seed is very thin and small in proportion to the amount of flesh.

This is really a high grade mango, not unlike the *Mulgoba* in flavor. Its shipping qualities have not been tested, but perfectly ripe fruits purchased in Mexican markets kept in good condition for several days. This mango was very popular in the City of Mexico about the end of June. It was sold in all the markets and hawked on the streets, the price usually being four cents apiece Mexican. The uniformity of the fruit as it appeared in different markets, taken with the absence of asexual methods of propagation in Mexico, would argue that it is a form that comes true from seed.

The name of this race suggests that it came from the Philippine Islands, and indeed it is not impossible that it was brought to Mexico from those islands by one of the Spanish galleons that during the seventeenth century plied regularly between the Philippines and Mexico.

A form resembling this in Guam is there commonly supposed to have come from the Philippines, but as ships only touched at Guam on the return voyage from Mexico, the fruit must have reached Guam by way of America, and would naturally have become established in both countries. Possibly a further confirmation is to be found in the occurrence of the same or a very similar form in Cuba, known as the Philippine mango.—Collins.

- Manila of Hawaii. This is sometimes spoken of as the Double-Pointed Manila. Size very large; form roundish with stigmatic point giving rise to descriptive name; color light green tinged with yellow, approaching orange yellow when fully ripe; peeling qualities good; texture very good, with no fibers except close to the seed; flavor good, sweet, juicy; color of flesh yellow orange; seed thin.—Higgins.
- MARTIN, French West Indies. Beautiful yellow, sometimes almost rose colored, slight turpentine flavor.—Jumelle.
- Mayaguez, Porto Rico. A small yellow form, with comparatively large seed, but with good flavor, soft flesh, and few fibers. This form, for sale in the San Juan markets, is considered one of the finest. It has very little of the turpentine taste, but its flavor did not appear to be better than that of several others, while its small size and thin flesh make it seem on the whole inferior. In shape it is asymmetrical, with depressed stem. The color in the early part of the season is a uniform yellow, later many specimens were seen with one side red.—Collins.
- Mazagon, India. Introduced under S. P. I. No. 7042. Now under trial in Florida.

Mekongensis. Now under trial in Florida.

Melocoton, Porto Rico. A small yellow and red form seen at Yauco, said to have come from a grafted stock brought from Martinique. Base very square, stem slightly depressed, skin thin, meat with few fibers, mild in flavor.—Collins.

Moanalua Long Red, Hawaii. This is in all probability a cross between some form of chutney and the sweet mango. The seeds which produced this tree and several others of the more normal type of chutney in the same locality are said to have come from a single parent tree on the island of Maui. The variety is so named because the tree producing this rather peculiar form is located at the Moanalua gardens. Size large; form long and pointed; color before ripening green on the unexposed surface, with a dull red on the exposed side, which brightens to a red orange in ripening, a rather unusual color for a chutney; peeling qualities fair; texture fair; flavor lacking somewhat in the character of the chutneys; color of flesh rather dark; seed medium.— Higgins.

See explanatory note under Lemon Chutney.

Mohanbhoga. Listed, but not described, by William Bros., Ceylon.

Mohan Thacoor. Listed, but not described, by William Bros., Cevlon.

Moradabadi Amin, India. Introduced under S. P. I. No. 9541.

Flavor superior.—Saharanpur.

Morla, India. Weight eight ounces; size three and five-eighths by three and one-eighth inches; skin yellowish green, reddish on shoulder; pulp very sweet, slightly fibrous; left shoulder broad, gently rising, right shoulder falling; beak small, sharp. A good keeping sort.—Woodrow.

Mulgora, India. Introduced in 1889 by Division of Pomology, U. S. Dept. of Agriculture. First fruited in Florida in 1898, being the first of the Indian varieties to fruit in this country. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Weight twenty ounces; size five by four and seven-eighths inches; skin yellow and green, blotched; pulp pale yellow, no fiber, flavor piquant and sweet; stalk scar very prominent; left shoulder level, right shoulder falling; beak large, sharp. Plants of this variety were sent to Florida in 1889 by the writer and have given much satisfaction.—Woodrow.

Form roundish, oblique, reniform; size large, weighing from three-fourths pound to one pound; surface smooth and undulating; color yellow, beautifully blushed with red and faintly dotted with numerous brown dots; skin thin, tough, tenacious; seed reniform, oval, rather large; fiber scanty, fine, and tender; flesh rich apricot yellow, very tender, melting and juicy, sweet, rich, fragrant; quality very good.

The Mulgoba surpasses in flavor and quality the seedlings previously grown, but its most distinctly marked features of superiority are the tenderness of the flesh and absence of objectionable fiber and strong turpentine flavor common to most of the seedlings grown in this country. The tree is a strong symmetrical grower, and appears to be abundantly productive.—1901 Yearbook U. S. Dept. of Agriculture.

Mullgoa, India. Introduced under S. P. I. No. 7102. Fruited in Florida.

Fruit large (twelve to sixteen ounces), almost round, fiberless, and of good flavor.

—Reasoner, Florida.

Mussarata, India. Weight fifteen ounces; size four and one-fourth by three and three-eighths inches; skin, exposed side yellow, shaded side green; pulp cream colored, fine rich flavor; left shoulder high, right shoulder rising slightly; beak none.—Woodrow.

Najibabadi Amin, India. Introduced under S. P. I. No. 9542. Now under trial in Florida. Flavor superior.—Saharanpur.

Sparse bearer; small fruit; second quality; color yellowish red; stone medium; tree hardy; ripens mid season; keeps well; free grower; fairly good.—Hartless, Saharanpur.

- NAJI HAHADI AMIN, India. Introduced under S. P. I. No. 10668. (Same as Najibabadi Amin.)
  - A medium sized, dark green fruit, ripens late-Saharanpur.
- NARALYA, India. Weight ten and one-half ounces; size four by three and one-fourth inches; pulp pale yellow, slightly fibrous; flavor piquant; left shoulder very high and broad, right shoulder broad, falling; beak very small.—Woodrow.
- NARAYAN ROPRA, India. Weight ten ounces; size three and three-fourths by three and fiveeighths inches; skin green with yellow shading near the stalk; pulp deep yellow, of fine flavor, but fibrous; shoulders both falling, or level; beak small.—Woodrow.
- NASPATI, India. A variety with a pear shaped fruit. Not a good bearer.—Saharanpur.

  Sparse bearer; medium size; first quality; pale yellow in color; stone small; tree hardy; ripens late; keeps well; slow grower; good flavored.—Hartless, Saharanpur.
- NAVAB, India. Sparse bearer; small size; second quality; brown in color; stone medium; tree hardy; ripens medium; keeps well; slow grower; good kind.—Hartless, Saharanpur.
- NAWAB BHOGA. Listed, but not described, by William Bros., Ceylon.
- Nawsharwani, India. Weight about sixteen ounces; size four and seven-eighths by four and one-eighth inches; both shoulders high; beak sharp.—Woodrow.
- NECTARINE, Hawaii. Locally known under this name. Size small; form short, rounded, rather heaviest on the dorsal side and about equal in length and breadth; color dark, dull green, acquiring slight yellow tinge in ripening; flavor peculiar, attractive, having a slight biting taste, supposed by some to resemble the nectarine. The flesh is characteristic, being the most highly colored the writer has seen in any variety of mango.— Higgins.
- Nowshari, India. Weight about twenty ounces; size four and seven-eighths by four and one-eighth inches; skin shaded yellow on shoulders, darker downward. A fine large mange, of which definite information is wanting.—Woodrow.
- Nucka, India. Introduced under S. P. I. Nos. 9544 and 10659. Now under trial in Florida. A long, hooked, pointed fruit, slightly fibrous, but flavor good.—Saharanpur. Sparse bearer; fruit small; second quality; color brown; medium size stone; tree hardy; keeps well; slow grower; good.—Hartless, Saharanpur.
- No. 5, Hawaii. Locally known under this name. This was among the introductions of Mr. Marsden. It very closely resembles the common Hawaiian Sweet mango, but is rather broader at stigmatic end. Color, flavor, peeling qualities and texture are also much like those of the latter.—Higgins.
- No. 7, Hawaii. Locally known under this name. This variety was introduced, together with No. 9 and others, by Mr. Marsden. Size rather small, form exceedingly variable, great differences being noticeable on the same tree; color a dull, somewhat dingy shade of yellow orange, overlaid with a beautiful orange red on the exposed side; peeling qualities poor; texture inclined to be fibrous; flavor peculiar and not very pleasing; flesh dark; seed of medium size.—Higgins.
- No. 9, Hawaii. This variety, now quite common in Hawaii, was introduced about twenty years ago under this name by Mr. Joseph Marsden, who at the same time added several other forms to the local collection. Form resembling the letter S, stem prominent; size from three and one-half to four and one-half inches long, and two and three-eighths to two and seven-eighths inches broad, and from two to two and one-half inches thick; color before fruit is mature, green, turning to pale yellow when ripe, with a slight blush of pink on the upper end of exposed side; peeling qualities very good; texture variable but most specimens rather fibrous; flavor sweet but watery; flesh light yellow; seed small; tree an abundant bearer. The fruit appears to be quite resistant to the attacks of the mango blight.—Higgins.

No. 11, Mauritius. This variety, the original stock of which was among the first mangos introduced into Jamaica by Captain Marshall, in 1782, is still the most popular variety in the island. It is a fine fruit, though somewhat stringy, and is said to come true to seed. Mr. Hart identifies this variety with the Reine Amelie of Martinique. As Martinique received a large part of its early introduced plants from Mauritius, the source of this variety in Jamaica, this identification doubtless means identity of origin, and the fact that these distinct strains are still identifiable would argue great constancy for this variety. Budded stock of this variety is also grown in Florida.—Collins.

A variety from Jamaica, but originally from the East. A spicy-flavored sort, with almost unobjectionable fiber (very fine), and of good, large size. The shape is slightly oblong; round, not flat, and in color usually a yellow or green, but we have one tree, out of nearly three dozen bearing specimens, which has a highly colored red cheek, rendering it a valuable market sort. (See Red No. 11).—Reasoner, Florida.

OGEE, India. Weight thirty-one ounces; size seven and one-eighth by four and one-eighth inches; skin golden; pulp sweet, free from turpentine, but not luscious; stone comparatively small, left shoulder falling gently, right shoulder falling abruptly; beak small but distinct.—Woodrow.

Paheri, India. Introduced under S. P. I. No. 8730. Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Iudustry.

Fruited in Florida in 1910 for the first time. One of the finest sorts grown in India. General form is roundish, about three and five-eighths by three and three-eighths inches. Skin thick, yellow and green when ripe, touched with garnet red on sunny side, very attractive. Flesh yellow, tender and juicy, very aromatic. Of high quality.—Reasoner, Florida.

From India. Size medium; color yellow, blushed with red and pink on side exposed to light; shape nearly round, slightly flattened and obliquely impressed on one side, with a point protusion at blossom point; skin medium thin, of firm substance; flesh rich golden yellow color, fine grain, tender; flavor rich and melting, highly aromatic and spicy. The fruits can be easily separated in halves without leaving any fiber in the pulp, which can be eaten from the fruit with a spoon.—Cellon, Florida.

Pahutan, Philippines. Introduced under S. P. I. No. 25940. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

From my viewpoint this is the best, not horticulturally, other than being a vigorous grower, early fruiter, and enormously prolific. Its very serious defects,—small size, scanty flesh, and excessively large seed,—are from my point of view fully offset by a smoothness, sweetness, juicyness, and flavor unapproached by any other. I have eaten the famous Alphonso mango in Calcutta and do not consider it ace high with Pahutan. Pahutan further has a very thick rind. This, while still further diminishing its scanty flesh, probably adds to its shipping qualities.—Lyon.

Pairi, India. Probably a synonym for Pyrie, which see.

PAKRIA, India. Introduced under S. P. I. No. 8444.

Weight seven ounces; size four by two and five-eighths inches; skin pale yellow; pulp pale yellow, of delicious flavor without fiber; both shoulders falling; beak none. The leaves are of medium size, pale green, and acute at the base.—Woodrow.

PANCH SERA, India. Very large fruit.—William Bros., Ceylon.

Pandria, India. Weight nine ounces; size three and one-fourth by three and one-eighth inches; skin greenish yellow; pulp sweet but wooly; both shoulders falling; beak none.—

Parnasse, French West Indies. Oval, flattened; light green skin; fiberless, delicious.— Jumelle. PARROT, Ceylon. Medium sized, oblong fruit; with a distinct beak. Piquant and pleasant flavor.—Macmillan.

Fairly prolific; fruit medium to small, of second quality; skin dark green; seed of medium size; ripens late and is a fair keeper. The tree is a free grower and is hardy. This variety has a slight turpentine flavor and is not very common.—Dr. Drieberg, Ceylon.

Peach, Hawaii. This variety has some local reputation under this name. The original tree of the variety, at least in these islands, is in the Henry Davis homestead in Honolulu. Size medium; form resembling the Samoan; color before ripening bright green overlaid with dull red on exposed side, the red brightening and the green becoming yellow during the ripening process; peeling qualities fair; texture good, quite free from fiber except near the seed; flavor very good, abounding in sweet juice; color of flesh almost as light as that of No. 9; seed long and of medium thickness.—Higgins.

Pere Louis, French West Indies. Introduced under S. P. I. No. 3707. Fruited in Florida. It is not large, weighing but seven or eight ounces, but it has a very distinct and delicate flavor, is almost absolutely free from fiber, and the meat is soft and custardy and can be eaten with a teaspoon. In this Mr. Gale has a prize, as it is one of the most delicate, highly flavored and aromatic of the family of mangos, and is a valuable addition to the varieties being grown in Florida.—The Homeseeker.

Perrime. Florida. The fruit is very fragrant when ripe; size medium to large; plump oblong, obliquely impressed on one side; color greenish yellow, with greater portion of the surface a bright carmine fading to delicate pink tints; skin thin but firm; flesh pale yellow color, fine grained, tender, melting and juicy; flavor very delicately aromatic; seed very small and thin, fiber fine and short, only on edges of seed. Tree a good grower and prolific bearer.—Cellon, Florida.

Peterpasand, India. Introduced under S. P. I. No. 7101.

Peters, West Indies. (Syn. Peters No. 1, S. P. I. No. 3706). Fruited in Florida.

Form roundish oblong, heavily shouldered at base and plump at apex; size medium; stem rather stout, inserted in a small, shallow cavity; apex swollen, with a broad, strong beak an inch or more from the extremity of the fruit; surface moderately smooth; color greenish yellow, blushed, striped and splashed with light and dark red; dots numerous, yellow; bloom bluish white; skin moderately thick, tenacious; seed small, oblong, thin, adhering tenaciously; flesh thick, yellow, meaty, tender and juicy, with but little fiber; flavor sweet, aromatic, rich; quality good to very good; season July 15 to August 1 in Manatee Co., Florida.

The tree is described as of broad, spreading habit.—1908 Yearbook U. S. Dept. of Agriculture.

PHILLIPS No. 9, Hawaii. This is the form of the No. 9 distinct from the ordinary form and from that described as Herbert No. 9. Size smaller than either of the other varieties to which it is related; form decidedly like No. 9, but with the stem end drawn out into a protuberance from one-fourth to one-half inch long; color similar on the unexposed side to No. 9, on the exposed side a dull red before the fruit is ripe, turning in ripening to a tint of orange red; peeling qualities excellent; texture fair; flavor fully equal, if not superior to its allied forms.—Higgins.

PIA POSHA, India. Weight fourteen ounces; size five and three-eighths by three and one-eighth inches; skin rich cream colored, suffused pale crimson on the exposed side; pulp pale yellow, very sweet, and agreeably flavored but stringy; both shoulders falling equally; beak large. A very showy fruit with a delightful fragrance.—Woodrow.

Pico, Philippines. Introduced under S. P. I. No. 24170. Now under trial in Florida.

A variety of merit. It comes true from seed and by that method has been reproduced in that country (Philippines) for generations.—MacIntyre.

PINA, Porto Rico. A short, thick form found in the San Juan market before the middle of June, green, slightly asymmetrical, with rather oblique base, stem depressed. The meat is thick, of good texture and flavor.—Collins.

PINEAPPLE, Hawaii. A tree producing fruit known by this name locally is found on the Punchbowl slopes near Alapai street, Honolulu. It has received this name because of a resemblance in flavor, fancied or otherwise, to that of the pineapple. Size small; form resembling the Davis No. 11; color yellow splashed with red about the stem end; peeling qualities excellent; texture fair; flavor very fine; color of flesh light, approaching orange yellow; seed large. This is a pretty mango and well suited for home use, but its large seed and its texture are against it.—Higgins.

PIRIE, India. Introduced under S. P. I. No. 8421. (Syn. Pyrie).

A green, pointed shaped variety from the Cooper estate at Goregon. Said by the owner, an inspector in the Bombay markets, to be, next to the Alphonse, the best of the Bombay mangos. The seed is larger than that of Alphonse and the flavor excellent. Has the undesirable quality of being a poor keeper, losing its flavor quickly after ripe.—Fairchild.

Pirt, India. Weight five and one-half ounces; size three and five-eighths by two and five-eighths inches; skin green and golden.—Woodrow.

Pointed Chutney, Hawaii. (See explanatory note under Lemon Chutney). Size medium; form rather long, tapering to a sharp point; color yellow; peeling qualities good; texture fair, many specimens found with peculiar white lumps in the flesh, which, however, are not thought to be normal but due to the work of mealy bugs in large numbers on the exterior of the fruit throughout its time of growth; flavor decidedly acid; color of flesh very light just beneath the skin, ripening from the center outward with the outer layer quite firm, while the interior has become softened, a character found in many of the chutneys; seed of medium size, resembling the outline of the fruit; tree a vigorous grower and heavy cropper.—Higgins.

Роотоо. Listed, but not described, by William Bros., Ceylon.

Punia, India. Introduced under S. P. I. No. 10655. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A medium sized, stringy kind. Flavor very good.—Saharanpur.

Prolific bearer; small size; first quality; color reddish yellow; stone small; tree tender; ripens late; keeps well; slow grower; lemon scented.—Hartless, Saharanpur.

PYAREKHAS. Listed, but not described, by William Bros., Ceylon.

PYASEE, India. Introduced under S. P. I. Nos. 9545 and 10663.

A medium sized fruit of subacid flavor. Good.—Saharanpur.

Sparse bearer; medium sized; third quality; color yellowish brown; stone medium; tree tender; ripens mid season; keeps well; medium grower; somewhat sour at times.—Hartless, Saharanpur.

Pyrie, India. Weight eight ounces; size three and three-fourths by three inches; skin varying from red on the shoulder to pale yellow at the beak, very brightly colored; pulp soft, creamy, of delicious delicate flavor; stalk scar prominent; beak large. A first class sort.—Woodrow.

Ragu, India. Size five and seven-eighths by two and one-eighth inches; skin yellow; pulp deep yellow; flavor distinct and agreeable; no fiber; both shoulders falling; large depression in place of beak.—Woodrow.

RAINBOW, Hawaii. Known to a limited number of people under this name, the one tree of the variety known to the writer being in the Henry Davis homestead at Punahou, Honolulu. Size medium; form resembling that of the so-called French or Wine mango; color light green on the unexposed side before ripening, the exposed side being overlaid with dull red which brightens in ripening to orange red in dots or stripes, much

brighter red than in the French; peeling qualities good; texture fair; flesh light yellow; flavor good, resembling No. 7.—Higgins.

Rajia, India. Weight seven ounces; size three and one-eighth by two and one-half inches; skin yellowish green, tinged red on shoulder; pulp deep yellow, of rich sweet flavor, and no fiber; left shoulder level, right shoulder falling; beak none.—Woodrow.

RAJPURY, India. Introduced under S. P. I. No. 7105. Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry. (Also spelled *Rajpuri*, *Rajabury*, and *Rajapurri*).

Average size about ten ounces in weight, a trifle elongated, flavor rich and buttery. Both flavor and aroma distinct from any other mango; very attractive and very prolific.—Reasoner, Florida.

This is a fruit averaging from eleven to twelve ounces, and while it is practically free from fiber and of a delicate texture and flavor, its remarkable characteristic is its perfume, which is entirely different from any other mango yet grown in this section. This perfume, fascinating and delicate as it is, is hard to describe, and this mango, like many others that are being propagated here, is bound to become of great value, as it promises to be a prolific bearer and a great favorite.—The Homesecker.

It weighs from seven to fourteen ounces, seventy-five per cent. of all the fruit weighing from ten to eleven ounces, and is more nearly globular in shape than any other of our mangos. It has a fine aroma and flavor, which are distinct and peculiar to itself, preferred by many to Mulgoba or Alphonse. Yellow, with delicate pink cheek where exposed to the sun. As nearly spherical in shape as a mango ever is.—Beach, Florida.

RASPBURY, India. Introduced under S. P. I. No. 7106.

RASPURI. Listed, but not described, by William Bros., Ceylon.

RAYNAUD, French West Indies. Native of the Indian archipelago. Small, round, light colored outside, flesh whitish and aromatic.—Jumelle.

Redondo, Porto Rico. A large, thick-meated form, common in the Ponce market. In form it is quite symmetrical, with a decidedly depressed stem. In color it varies from green to red, the difference being in some instances so marked as to suggest a distinct type. The color seemed the only difference, however, and the market people insisted that the green and the red might come from the same tree. The flesh is very juicy, moderately free from fiber, and of a very good flavor.—Collins.

Red No. 11, West Indias. A West Indian descendant of a fine Indian sort, having high color, but is small and somewhat fibrous.—Reasoner, Florida.

Reine Amelie, French West Indies. Skin very thin, slightly spotted, easily separated from the pulp.—Jumelle.

ROBERTS, Florida. This is a descendant from No. 11 and has been propagated by budding to some extent. It is distinctly to be preferred to the usual run of No. 11's, being highly colored and having less fiber.—Rolfs.

Romani, India. Introduced under S. P. I. No. 10658. A medium sized fruit, subacid, of very fine flavor.—Saharanpur.

Roos, India. Introduced under S. P. I. No. 7043.

Rosa, Porto Rico. A nearly spherical form, seen at Yauco, yellow in color, with one side a beautiful red. The skin is very thin, the meat comparatively free from fiber, very mild and pleasant, without a trace of turpentine flavor.—Collins.

RUNTRA. Listed, but not described, by William Bros., Ceylon.

Rupee, Ceylon. Introduced under S. P. I. No. 8412. The largest fruited mango grown in Ceylon. It is called the *Rupee*, or two shilling mango, because of the price paid for a single fruit. Its origin is unknown. It is very large, sometimes five inches long, nearly globular, light green in color when ripe. A shy bearer. Skin tender and easily

bruised, rendering the fruit a poor shipper. Flesh is golden yellow. Seed small in proportion to size of fruit. A rare variety even in Ceylon. Flesh free from stringiness and flavor delicious, but only when perfectly ripened on the tree. The tree is not very robust, and Dr. Drieberg does not recommend the variety for general planting.—Fairchild.

Very large and somewhat round, pulp luscious and free from fiber; similar to *Inerma* of Bombay.—Macmillan.

This is also called the *Two Shilling*. It is a sparse bearer; fruit the largest of the local (Ceylon) varieties, of first quality; skin pale green; seed small compared to size of fruit; ripens late and is not a good keeper. The tree is not a free grower and is tender. This variety is scarce and expensive. Requires very careful ripening.—Dr. Drieberg.

Russer, Hawaii. Introduced under S. P. I. No. 12930.

RYOTYA, India. Weight eight ounces; size three and three-eighths by two and three-fourths inches; skin bright crimson on exposed side, creamy on shaded side; pulp creamy yellow, of extra fine quality, and no fiber; both shoulders falling equally; no beak; exactly obovate. A really fine fruit, handsome and prolific.—Woodrow.

SA PACHAND. Listed, but not described, by William Bros., Ceylon.

SAFAIDA. Listed, but not described, by William Bros., Ceylon.

SAFEDA. Listed, but not described, by William Bros., Ceylon.

SAFFRON, Hawaii. Size medium; form rather short, resembling Wooten Chutney; peeling qualities fair; color rich saffron; texture good; flavor good. The original tree of this variety in the islands is a seedling growing at Kalihi. It is one of the most esteemed of the local seedlings.—Higgins.

Saharanpur No. 1. Listed, but not described, by Reasoner Bros., Florida.

Saint Aime, India. Weight fifteen ounces; size four by four inches; skin greenish yellow; pulp deep orange, of coarse grain but rich flavor; left shoulder high and broad, right shoulder low and broad; beak none.—Woodrow.

SALAMAR, India. Introduced under S. P. I. No. 9535. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Salgada, India. Weight twenty-four ounces; size five and one-fourth by four and one-half inches; skin greenish yellow on shoulder, shading downward to yellow; very sweet and agreeably flavored; right shoulder very high, left shoulder level, then descending.—Woodrow.

Salgadina, India. Weight seven ounces; size three and three-eighths by two and three-fourths inches; skin rich crimson, shading to yellow; pulp deep yellow; left shoulder level, right shoulder falling; beak none.—Woodrow.

Salibunda, India. Introduced under S. P. I. Nos. 9513 and 10642.

A distinct variety, a large fruit, subacid flavor, color greenish yellow.—Saharanpur. Prolific bearer; small size; second quality; yellowish red; stone medium; tree hardy; ripens medium; keeps well; medium vigorous grower; good.—Hartless, Saharanpur.

Samar Chist, India. Introduced under S. P. I. No. 9534.

Samoan, Hawaii. So called by Mr. Allan Herbert, who introduced the seed from Samoa. Size medium; form oblong; color pale yellow with a bright tinge on the exposed cheek, occasionally striped; peeling qualities fair; texture good for a seedling, the fibers being very fine; flesh light yellow just under the rind, slightly darker within; flavor sweet, with abundant juice.—Higgins.

Sandersha, India. Fruited in Florida. (Synonyms Sandershah, Sandershaw, Soondershah S. P. I. No. 7108, and Sundershah S. P. I. No. 10665).

A long fruit, stringy, flavor peculiar and only liked by some people.—Saharanpur.

Prolific bearer; size small; third quality; color green; stone large; tree hardy; ripens mid season; does not keep well; free grower; fair.—Hartless, Saharanpur.

So far as known the latest to ripen. Fruit long, yellow, of the very largest size, sometimes weighing two pounds. Somewhat acid.—Reasoner, Florida.

Form long, compressed, and rather slender, tapering toward stem and terminating in a distinct curved beak at the apex; size very large, averaging around twenty ounces in weight, and occasionally attaining a weight of two pounds; stem stout, apex prominent, curved and beaked; surface smooth; color clear yellow, with faint pinkish blush in the sun; dots numerous, small, russeted; skin moderately thick; seed long, curved, thin, small in proportion to size of fruit and thickness of flesh; flesh rich reddish yellow, juicy and tender, almost entirely free from fiber; flavor sprightly and refreshing in the fresh state, though with rather less aroma than Mulgoba. Its higher acidity will doubtless render it more acceptable for serving in sliced form than are most of the mangos thus far obtainable in our markets. Season very late, ripening in the latter part of August at Miami, Florida.—1907 Yearbook U. S. Dept. of Agriculture.

Sanduria, India. Introduced under S. P. I. Nos. 9547 and 10667. Now under trial in Florida.

A small long shaped fruit. Stringy but of fine flavor.—Saharanpur.

Prolific bearer; small size; second quality; color red; stone medium; ripens mid season; keeps well; medium grower; good.—Hartless, Saharanpur.

Sans-Pareille, French West Indies. Largest of all, but of mediocre quality.—Jumelle.

SARI. Listed, but not described, by William Bros., Ceylon.

Sarikhas. Listed, but not described, by William Bros., Ceylon.

Seed-Mango, Ceylon. A small oval fruit, with scanty juicy pulp of a distinct piquant flavor.—Macmillan.

Shah-Passand, India. Is a much esteemed variety said to be the same as Malda, and two pounds in weight, and of irregular shape.—Woodrow.

Sharbati Brown, India. Introduced under S. P. I. No. 9548. Now under trial in Florida. Prolific bearer; small size; second quality; color brown; stone medium; tree hardy; ripens early; keeps well; medium grower; good.—Hartless, Saharanpur.

Sharbati Black, India. Introduced under S. P. I. Nos. 9547 and 10669. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Prolific bearer; small size; second quality; color black; stone medium; not hardy in United Provinces; ripens early; keeps well; medium grower; good.—Hartless. Saharanpur.

SHENDRIA, India. Weight seven ounces; size four and one-eighth by two and three-sevenths inches; skin deep yellow, spotted and flushed with carmine; pulp very fine, creamy, and rich in flavor, with a few fibers near the skin; left shoulder rising slightly, right shoulder falling abruptly; beak none.—Woodrow.

Shrawani Alphonse, India. Weight fourteen ounces; size four and seven-eighths by three and three-fourths inches; skin yellow; pulp deep yellow of fine flavor; stone large; left shoulder very broad and rising slightly, right shoulder falling; beak marked by an abrupt contraction.—Woodrow.

SINGAPUR, India. Introduced under S. P. I. No. 9550. Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A small fruited variety of Bombay mango, flavor excellent.—Saharanpur.

Sparse bearer; medium size; second quality; color yellow; stone medium; tree hardy; ripens medium; keeps well; slow grower; taste resembles a loquat.—Hartless, Saharanpur.

Fruited for the first time in 1911, and proved to be all that was claimed for it by our Indian correspondent. The skin is green and golden yellow, finely mottled, thick and strong, with a grayish-blue bloom, clean and free from spotting. The flavor is distinct, rich and sweet, with characteristic true mango flavor. The fruits are remarkably uniform in shape, meaty, thick and solid, perfect, weighing from fourteen to twenty ounces each, and we judge will be a remarkably good shipper. The seed is medium and flat.—Reasoner, Florida.

SITALOHOGA. Listed, but not described, by William Bros., Ceylon.

Society's. Listed, but not described, by William Bros., Ceylon.

STALKART, India. Introduced under S. P. I. No. 9514. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A small fruited variety of Bombay mango, flavor excellent.—Saharanpur.

Prolific bearer; medium size; first quality; color yellowish red; stone medium; tree hardy; ripens early; keeps well; free grower; resembles the Bombay.—Hartless, Saharanpur.

Strawberry of India. Introduced under S. P. I. Nos. 9515 and 10643. Fruited in Florida.

Medium sized, with a strawberry flavor. A longish, hooked, pointed fruit. Flavor good.—Saharanpur.

Fruited in 1910 for first time. Fruit small, of delicious flavor. Contains some fiber. A medium strong grower.—Reasoner, Florida.

Sparse bearer; small size; second quality; color yellowish red; stone medium; tree tender; ripens medium; keeps well; free grower; strawberry flavored.—Hartless, Saharanpur.

STRAWBERRY of Hawaii. Size large; form roundish, uniform; color before ripening very light green overlaid on exposed side with dull red, which brightens on ripening; flavor very good; flesh light in color; seed medium.—Higgins.

Sucretino, India. Weight twelve ounces; size four by three and one-fourth inches; skin slightly yellowish at top but deepening to green at base; pulp sweet, with an agreeable subacid flavor; both shoulders falling; beak, place slightly depressed.—Woodrow.

Sufaida No. 1, India. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Prolific bearer; size large; first quality; color green; stone large; tree tender; ripens late; keeps well; slow grower; very good flavored; flesh firm.—Hartless, Saharanpur.

Sufaida No. 2, India. Prolific bearer; size large; second quality; color green; stone large; tree tender; ripens late; keeps well; medium free grower; fairly good.—Hartless, Saharanpur.

SUMMER APPLE, Hawaii. In size and form this closely resembles the Davis No. 11, but it is very unlike it in other respects. Color a very light green and yellow, slightly orange tinted on the exposed side, and dotted with orange red; texture fair; flavor very poor; color of flesh rather light; seed medium size.—Higgins.

Sunhara, India. Introduced under S. P. I. No. 9551.

Surkha, India. Introudced under S. P. I. Nos. 9552 and 10652. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

A stringy kind, but of good flavor.—Saharanpur.

Prolific bearer; medium size; first quality; yellowish red; stone medium; tree hardy; ripens late; keeps well; moderate grower; good.—Hartless, Saharanpur.

Surkhya, India. Weight four ounces; size three and one-eighth by two and three-eighths inches; skin rich creamy yellow, with crimson speckled shoulders; pulp pale cream colored, not fibrous, but of cloying flavor; left shoulder rising, right shoulder falling abruptly; beak none. A very showy fruit produced in great abundance.—Woodrow.

TAMANCHA, India. Introduced under S. P. I. Nos. 9553 and 10653.

A large fruit, greenish yellow, flavor good.—Saharanpur.

Sparse bearer; size small; second quality; color yellowish red; stone medium; tree tender; keeps well; ripens medium; free grower; sweet.—Hartless, Saharanpur.

Thurston, Ceylon. Introduced under S. P. I. No. 8413.

Fruit is of medium size, short, and somewhat globular. The stone is of medium size and the skin is dark green when ripe. It ripens well off the tree. It is a vigorous grower, has a sweet flavor, and according to Dr. Drieberg is acid when not fully ripe. The flesh is greenish in color near the skin and slightly fibrous.—Fairchild.

Toashaik. Listed, but not described, by William Bros., Ceylon.

TOTAPARI, India. (Synonym *Totafari*). Introduced under S. P. I. No. 8732. Fruited in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

Skin very smooth, altogether yellow, moderately tough, pulp concolorous with skin. Slightly fibrous, flavor excellent. It measures four and seven-eighths by two and seven-eighths inches. Both shoulders fall equally, beak small but distinct (Bhide).—Woodrow.

A good midseason sort, resembling Sandersha, but only about half the size. Bears when very small.—Reasoner, Florida.

This has proven to be a good fruit. It is about the size of *Bennet*, but has not the same aroma or flavor, still it is very desirable and a valuable acquisition. Weight eight to ten ounces. Rather long and pointed at blossom end, much like *Sundersha* on a smaller scale. A free bearer.—Beach, Florida.

Vanilla, Hawaii. Size medium to large; form approaching roundness, with the stigmatic point more or less prominent; color quite uniform when ripe, passing through shades of yellow to those of orange yellow when ripening; peeling qualities good; texture fair to good; flavor rather too pronounced, with a slight bitter principle close to the seed; color of flesh orange; seed medium to large.—Higgins.

WALNUT, Hawaii. Size small to very small; some specimens being not much larger than a walnut; form rounded, but not full on the stigmatic side, the stigmatic point being almost obliterated; color a shade of yellow on the unexposed side, the exposed side blushed with red and orange at the stem end; peeling qualities fair; flavor fair; texture fair; seed large. It is valuable chiefly as a curiosity.—Higgins.

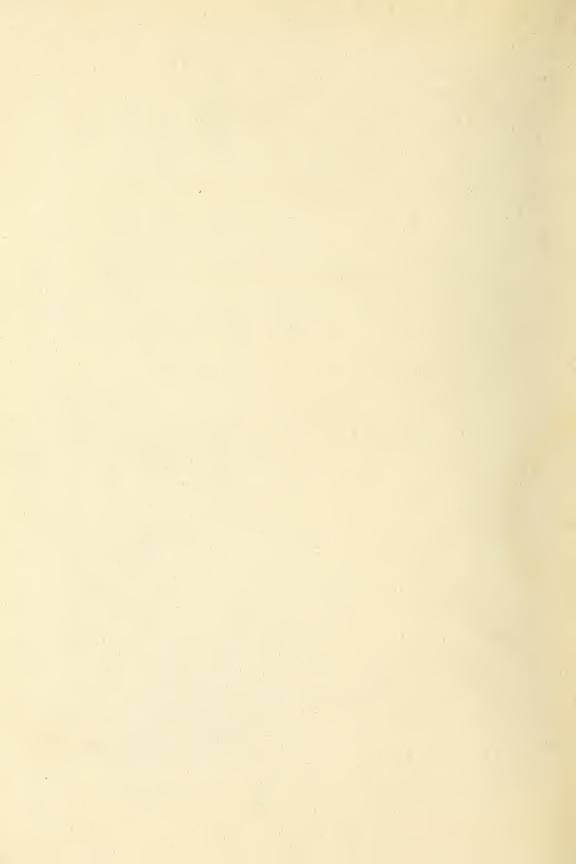
WHITE ALPHONSE (or Safeda Alfoos), India. Introduced under S. P. I. No. 22970. Now under trial in Florida. Sent to California for trial, in 1911, by Bureau of Plant Industry.

The Advocate of India has this to say of the White Alphonse mango: "We have at this moment on the office table a specimen of mango which has been sent us,—the like of which has never before been grown. It is a White Alphonse, perfect in shape, with a beautiful satin skin and a subtle aroma which faithfully indicates the delicate flavor of its golden pulp. It is a triumph in every respect, with the smallest stone for its size. Yet it is gigantic in weight and proportions. A good specimen of our Golden Alphonse, so far our best mango, does not weigh more than about four ounces. The White Alphonse just fails to tip the beam at the weight of two and one-half pounds." Michael.—Bureau of Plant Industry.

WOOTTEN CHUTNEY, Hawaii. See explanatory note under Lemon Chutney.

This name has been given to the variety because the only tree of the kind known is growing on the residence property of Mr. Harry Wootten in Honolulu. Size medium to large; color when ripe a shade between orange yellow and yellow orange, with tinges of pink and red at stem end; peeling qualities fair; texture very good; flavor excellent; seed rather small for the size of the fruit. An important characteristic of this variety is that while still solid it has a very beautiful color as if ripe, making it a desirable market form. It is one of the best of this class of mangos.—Higgins.





## A BASIS

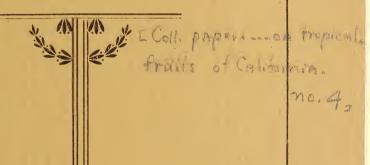
FOR THE

## Future Classification

OF THE

# Mango

F. W. POPENOE Washington, D. C.



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Collected papers





## A Basis for the Future Classification of the Mango

F. W. Popenoe, Washington, D. C.

When a fruit attains commercial importance and is cultivated on an extensive scale there arises an urgent need for detailed information respecting varieties, and for nomenclatural accuracy. If the growers themselves do not recognize this need, it is sure to be impressed upon them by an exacting and discriminating market, always prompt to demand that the product meet certain clearly defined requirements.

While it may be said that the tropical fruits have been the last to require attention of this nature, because of the unimportant part they have played in commercial horticulture, with increased transportation facilities they are coming more and more into prominence, avocados, mangos, and cherimoyas being no longer rare on the fruit stands of large cities, while the banana and the pineapple years ago became standard products.

Vegetative, or asexual, propagation, arising from the desire to perpetuate a choice form originating as a chance seedling is usually the first step toward the recognition of the importance of the question of varieties. In the last quarter of a century a number of tropical fruits, previously grown exclusively as seedlings and not considered important, have come under the influence of modern horticultural science, and through the aid of vegetative propagation have been raised to the level of valuable horticultural products. The vegetative propagation of the mango in India, however, dates back some hundreds of years; hence, the existence and importance of varieties has long been recognized. The Hindus, being a fruit loving people, have increased their varieties until they now number several hundred, and either consciously or unconsciously wrought great improvement in the fruit over its wild forms; but, with the characteristic inertia of the Orient, they have paid little attention to the systematic culture of the fruit, and less to its systematic study, though one could not expect much in this latter line. The Arab date growers of Baghdad, however, know vastly more about the dates of the entire Arabian peninsula than does the average Hindu about the mangos of the Indian peninsula.

### Ancient Practices.

The Indian has been satisfied to go on multiplying the number of varieties indefinitely, perpetuating by the laborious method of inarching C

every seedling that struck his fancy, and tacking a name on to it. In other mango growing countries inarching is not yet practiced, or has been introduced only recently, comparatively speaking, yet the natives invariably distinguish many seedling types or varieties by name.

In India, in the Philippines, in Australia, in Hawaii, and especially in tropical and subtropical America, mango culture is coming under the influence of modern scientific methods. Every year sees several contributions to the literature on the subject, and a great increase of interest in it on the part of horticulturists, both amateur and professional. New methods of propagation are being perfected, cultural problems are being solved, and planting is going on at a rapid rate. The mango promises, in fact, to become an important commercial fruit wherever it can be grown; its present importance in India testifies to its vast possibilities elsewhere.

With all this interest and activity comes an increasing need for accurate information on all that pertains to mango culture. The work done in the past few years has scarcely made an impression on the field and there remains much to be accomplished before the subject will be placed upon a thoroughly scientific basis. One of the most important, and as yet, almost untouched fields is the systematic study of varieties,—their nomenclature and classification. India offers the greatest opportunities for work along this line, since the majority of the world's named varieties are to be found in that country. Quite recently the work of systematizing these varieties has been undertaken by a few energetic horticulturists, among whom should be mentioned in particular A. C. Hartless, Superintendent of the Government Botanical Gardens at Saharanpur, and the near future will surely see the accomplishment of some important results. There exists, however, a need for uniformity in this work, and to this end the writer ventures to offer the following suggestions:

#### Nomenclature.

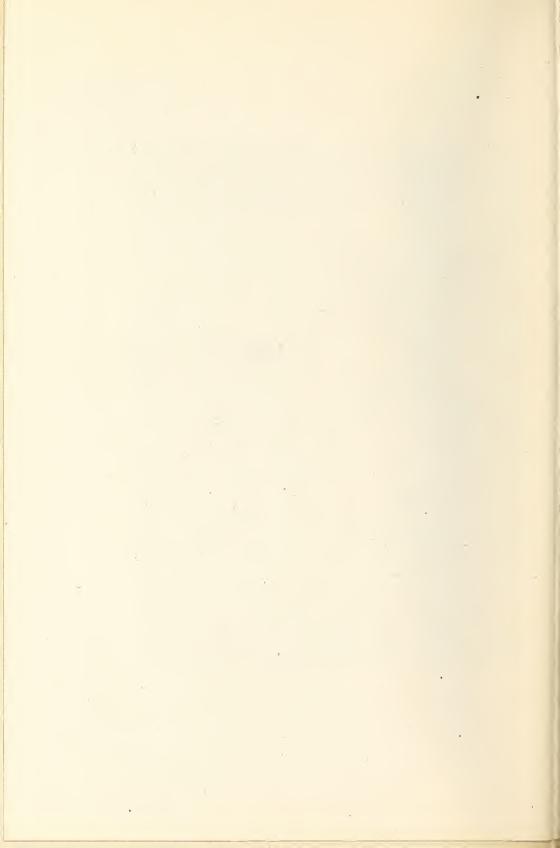
In view of the present confusion of mango names it seems almost useless to expect that the subject can ever be thoroughly straightened out; yet much can be done to improve conditions as they exist at present, and there is certainly no reason why the most important varieties should not be established under their correct names and with a uniform orthography, in so far, at least, as European and American horticulturists are concerned. As regards India, a concerted effort on the part of English horticulturists connected with the various botanic gardens and experiment stations could accomplish a great deal, as the few scattered efforts of the past have clearly demonstrated.

Without doubt there is no end of cases where certain varieties exist in different localities under different names. One authority states that Pairi of Bombay is grown in Hyderabad under the name of Goabunder, and in Chittu under the name of Badami. Whether these three are actually synonymous or not, they are, in all probability, very similar in general characteristics, or this confusion would not have arisen. Obviously, the



INFLORESCENCE OF THE MANGO.

Insert shows one flower enlarged. It can easily be seen that there is only one functioned stamen, the other four being abortive.



thing required is to have accurate descriptions and illustrations of each on record, when a comparison would soon show up any differences that exist.

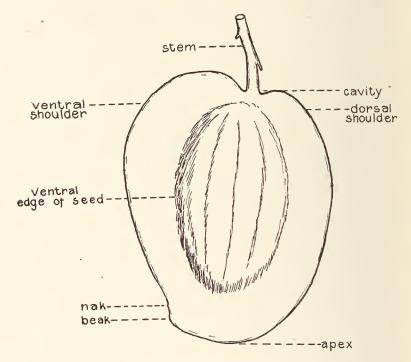
A pomological variety has been defined as "a group of plants propagated vegetatively from one original plant producing fruit of a distinctive appearance, texture, flavor or aroma, by which characteristics it may be distinguished from fruit or other trees of the same species. Some of the botanical characters of the plant may also be distinct from those of other plants of the same species." There are, doubtless, many instances where two mangos sufficiently distinct to be classed as separate varieties are grown under one and the same name. When this is the case, the two should be distinguished by the addition of an identifying term. This has already been done by some writers; as an instance may be mentioned the "Banchore of Alandi Keir" and "Banchore of Dhairey" of Woodrow.

As regards the form of mango names one cannot do better than adhere to the Code of Nomenclature of the American Pomological Society, which specifies that in choosing names for new varieties the following points shall be borne in mind: distinctiveness, simplicity, ease of spelling and pronunciation, and indication of origin or parentage. Varietal names must consist of a single word, and the use of a number, either singly or attached to another word, is tolerated only as a temporary expedient; the use of such terms as seedling or hybrid is not admissible, neither is the use of a possessive noun. Thus a qualifying word would have to be substituted for the numeral in such a name as "Fernandino No. 2," the addition of a second word being allowable in such an instance, while "Phillip's" and "Society's" would have to be changed to "Phillip" and "Society."

### Troublesome Spelling.

The orthography of mango names has always given a deal of trouble, probably because many of the names are of vernacular origin, and have been spelled by each individual according to his own ideas on the subject. In India and other oriental countries, the investigator unfamiliar with the native language can arrive at a close approximation to the true name by getting an educated native to pronounce it for him several times, slowly and distinctly, and then writing down these sounds, giving consonants their English value, but vowels the value they bear in Italian and other continental languages. Every letter should be pronounced and no unnecessary ones inserted; thus there will no longer be perpetrated such monstrosities as Kheershapottee for Khirsapati and Killeemookoo for Kilimuku, or varied spellings of the same word, such as "Pairi," "Pirie," "Peary," "Pyrie" and "Paheri." For scientific purposes, however, the only satisfactory solution of the problem is to have the names written in the native character by an educated man, and then transliterated into English spelling on the system laid down by the International Congress of Orientalists at Geneva in 1894 and since adopted by practically all governments and scientific bodies; a system whose principle is that mentioned above for the guidance of the ordinary investigator.

New varieties of the mango are constantly being produced in every mango growing region, and the names of many of them sooner or later find their way into print. If in publishing these names the authors are careful to make them simple, distinctive, easily spelled and easily pronounced, mango nomenclature will in the future look after itself; as for those five or six hundred varietal names already published, their revision should be undertaken by every one having occasion to mention any of them in print. It is not too late to begin this work: pomologically the mango is just beginning



Essential Features of Mango.

Diagram showing the points to which particular attention should be paid in making taxonomic descriptions.

to receive attention, and this is the time to take up those basic questions which mean so much to the future of the mango culture.

## Description.

. In describing a variety, the General Form of the fruit should be stated first. It may be reniform, subreniform, oval, oblong, elliptical, spherical, etc. Often it is asymmetrical. Frequently a combination of two or more terms is needed; indeed, some mangos are of such peculiar form

as almost to defy accurate description. In cross section the fruit is usually round, oval or elliptical.

Size. As the mango is so little known pomologically, each individual usually has his own ideas as to what constitutes a small, medium, or large fruit, hence the use of such terms is not always satisfactory. They should in any event be supplemented by the dimensions and weight. The dimensions necessary are length, breadth, and thickness, breadth is taken dorsoventrally, it being an easy matter to determine the ventral surface of the fruit by the location of the "nak," or stigmatic area, which is always to the ventral side of the apex. Care must be exercised to get each measurement in one plane only.

The stem must be described with regard to its insertion,—square or oblique. One should also mention its length, and whether it is stout or slender.

The base is commonly rounded, flattened, or tapering. The "shoulders" form an important character, and are distinguished as ventral and dorsal. They should be described as to prominence; often one is entirely wanting, sometimes both. Rarely are they equal in prominence.

The depression around the insertion of the stem forms the cavity. It is sometimes wanting, the base of the fruit being extended where it joins the stem. It should be described as to form, depth, breadth, and markings. The form may be obtuse, acute, or acuminate, and while usually regular, is sometimes furrowed or plaited more or less deeply; the depth may be shallow, medium deep, or deep; breadth from narrow to broad; the markings, if any, are in the nature of russeting or distinctive coloring.

The apex is commonly obtuse, rounded, or acute; sometimes more or less prominently hooked or "beaked." The stigmatic point is situated close to the apex on the ventral side of the fruit and is known as the "nak," a Hindustani term probably first published by Maries. It may consist in a slight prominence or a slight depression; its height or depth should be stated, together with its distance from the longitudinal apex of the fruit.

The surface should be described as to smoothness, and next as to color. By color is meant the ground color of the skin, aside from the color of the dots or the blush sometimes present on the cheek, which should be described separately. The dots, most of which are usually subcutaneous, should be described as to size, color, form, and abundance. The color and thickness of the bloom should also be stated.

The **skin** should be mentioned as regards thickness, texture, and adhesion to the flesh.

The flesh should be described as to color, texture, aroma, and juiciness. One should also mention whether it is scant or abundant. The amount of fiber present should be stated, as well as its coarseness or fineness. In some varieties the fibers are confined to the ventral edge of the seed and do not extend any great distance into the flesh.

The flavor is a point often difficult of description. Nevertheless, a fairly accurate idea may usually be given by the use of such terms as acid, subacid, sweet, aromatic, spicy, mild, rich, melting, etc.

Quality. A careful attempt should be made to estimate the general quality of the fruit, which is usually described by the use of such terms as poor, good, or excellent.

The form and size of the seed should be carefully described, and the weight, as well as longitudinal, transverse, and lateral dimensions given. Further, in the light of the recent important discoveries regarding the embryony of the mango, it should be stated whether the seed is monoembryonic or polyembryonic.

The season is usually described as early, mid-season, or late, but it is well to add the exact period during which, in each particular region, the fruit can be picked, also its keeping and shipping qualities.

There are usually a few remarks regarding the fruit which will suggest themselves, and which have not been provided for in the general description. These should be noted down, following which the characteristics of growth and productiveness should be fully described. Under this head will be included any peculiarities of growth or foliage, resistance to cold and disease, and those most important of points, precocity and regularity of bearing, as well as the average size of the crop.

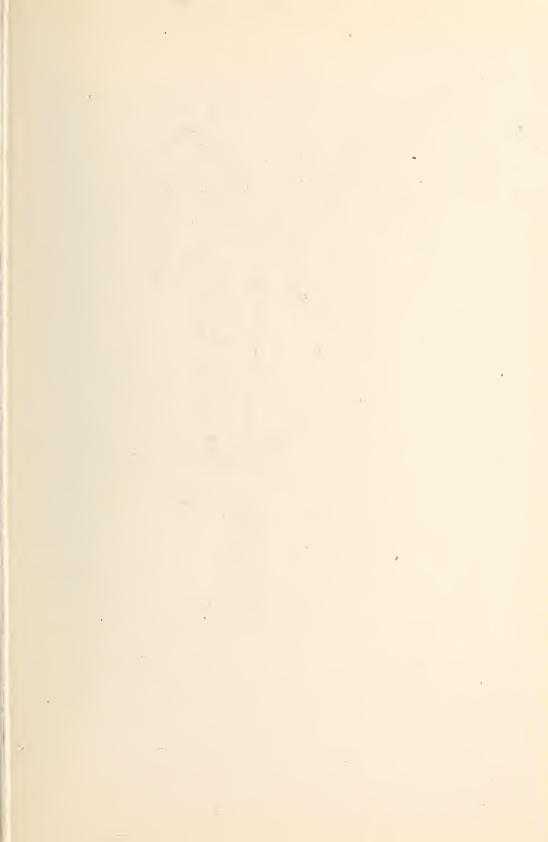
The importance of accurate illustrations to accompany the description of each variety cannot be overestimated. If photographic apparatus is not available, careful drawings will suffice. One drawing should show the general outline of the fruit, another a longitudinal section with the seed in place, and a third the seed alone, viewed longitudinally.

Photographs are by far the most satisfactory illustrations. With a camera of fairly good size a composite photograph may be taken, showing the fruit in several positions and including every detail. The external appearance should be shown by longitudinal and basal views, though in the case of a flat, compressed variety a view of the ventral surface may be more satisfactory than a basal one. A seed should be included, or better, two of them, washed free of all pulp but with the fibers left intact, and one viewed edgewise, so as to show the thickness, the other showing its length and breadth. A scale or tape line, marked in inches or centimeters, should always be placed in one side of the photograph to show the comparative size.

#### Classification.

An accurate and systematic classification of varieties is at present one of the greatest desiderata in connection with mango culture. There seems to be ample basis for a classification by natural characteristics, in which, could all named varieties be included, their relationships would be vividly brought out, and the synonomy established of many considered distinct.

The principal obstacle confronting such a work is the widespread distribution of the mango, making it impossible to gather together all varieties for study and comparison. There is no reason, however, why a classificatory system could not be formed which could be applied by each pomologist to the varieties of his particular region, when a collaboration of the various investigators would bring together the fragments and produce the desired





A POLYEMBRYONIC MANGO.

Instead of sending up a single shoot from the pollinated ovum, the seed produces seven by vegetative means.

result. At present our knowledge of the mango is so elementary that no satisfactory system of classification can be drawn up, the subject requiring much more study and investigation than have so far been given it.

Recent investigations seem to indicate that all mangos can be divided into two classes, monoembryonic and polyembryonic, which in a classification might form the first great division. The Indian mangos as a rule appear to be monoembryonic, while those in the Philippine Islands, as well as some now grown in Florida, Mexico, and the West Indies, are polyembryonic. The polyembryonic varieties have the characteristic of reproducing themselves fairly true to type when grown from seed, by some authorities believed to be due to the fact that the embryos are adventitious and not formed from the germ cells in the ovary, i. e., they are not the product of the fertilization of the ovule, as is the single plant produced from the seed of the monoembryonic type, whose progeny is variable.

Following this division into two primary classes might come the subdivision of each into distinct races or types. Indian horticulturists already recognize a number of more or less distinct types, such as the Langras and Maldas, each of which includes a number of closely related varieties, having in common certain characteristics which prove their affinity. Maries divided the mangos of his acquaintance into four classes,—Bombays, Maldas, Langras, and Budayas; Rolfs divided the mangos of Florida into seven groups; while Wester has found three distinct types in the Philippines. Many so-called varieties are in reality races or types embracing a number of very closely allied forms.

#### A Key For Classification.

It would be an easy matter, by means of a key taking into consideration the distinguishing characteristics of each type, to determine the affinities of any variety which appeared, and quickly place it in its proper division. A comparison with the other members of the type, again by means of a key, would determine the right of the variety to be considered distinct.

The great practical importance of such a work as this, especially the placing on record of complete descriptions and accurate illustrations of every variety, will be easily understood. With mango culture coming to the front as it is at present, particularly in the Western Hemisphere, there is great need of accurate information for the guidance of planters, so that laying all scientific interest in the subject aside, the practical value of the work alone is sufficient to justify an effort on the part of mango enthusiasts throughout the world. India, with her undisputed preeminence as a mango country, should be the first to take in hand the systematic study of the "King of Tropical Fruits," but the work should be carried on simultaneously in all parts of the mango-growing world.

There is, at present, a dearth of literature on the mango, though a number of valuable publications have appeared within the last few years. The following are some of the principal ones, and will be of interest to every student of the subject: The Mango: Its Culture and Varieties, by G. Marshall Woodrow (Paisley, 1904); The Mango, by P. J. Wester (Bul. No.

18, Bureau of Agriculture, Manila, Philippine Islands, 1911); The Mango in Hawaii, by J. E. Higgins (Bul. No. 12, Hawaii Agricultural Experiment Station, Washington, 1906); The Mango in Southern California, by F. W. Popenoe (Pomona College Journal of Economic Botany, Vol. 1, No. 4, Claremont, California, 1911); The Mango in Porto Rico, by G. N. Collins (Bul. No. 26, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, 1903).

Much important information will also be found in the Yearbooks of the U. S. Department of Agriculture for 1901, 1907, 1908, and 1910; in Watt's Dictionary of the Economic Products of India; Macmillan's Handbook of Tropical Gardening and Planting (Colombo, 1910); Jumelle's Les Cultures Coloniales (Paris, 1901); and in back volumes of the Tropical Agriculturist (Colombo, Ceylon); The Queensland Agricultural Journal (Dept. of Agriculture and Stock, Brisbane); The Agricultural News (Imperial Dept. of Agriculture, Barbados); the Bulletin of the Department of Agriculture, Jamaica; the Journal of the Royal Horticultural Society, and other publications.

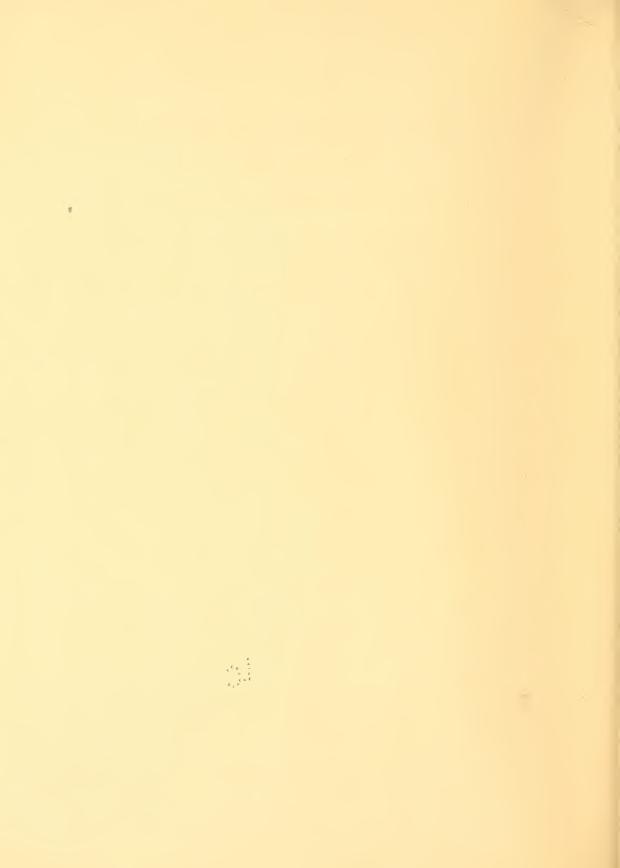




# The Cherimoya in California

By F. W. POPENOE

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# The Cherimoya in California

# With Notes on Some Other Anonaceous Fruits

F. W. POPENOE
WEST INDIA GARDENS, ALTADENA, CALIFORNIA

The Cherimoya has not yet assumed an important place among the cultivated fruits of California. This cannot be attributed to any fault in the fruit itself, since in its better varieties it is one of the finest known to horticulture. Neither can it be said that the climate and soil of Southern California are not adapted to it, as forty years of cultivation have shown the tree to be hardy here, and fruits of fine quality have been produced.

The real cause of this regrettable state of affairs is not hard to determine. It does not lie deep below the surface, but is plainly apparent upon investigation. The fact is, we have been perpetuating only inferior seedlings. Thus the fault lies with our horticulturists and not with California or the fruit.

Had the precaution been taken to propagate from the best of our local seedlings, to say nothing of introducing better varieties, we would have many good Cherimoya orchards in our state at this time. Had the most desirable varieties been searched out from the countries to the south of us, or from other parts of the world wherein our own climatic conditions are paralleled, it is not assuming too much to say that the Cherimoya would now be regarded as one of the important fruits of this region. In other parts of the world where it has reached a high state of perfection, as in Madeira and the Canary Islands, it has become an important product, and vineyards are being replaced by Cherimoya orchards.

Where grown to perfection the Cherimoya is classed as one of the three finest fruits of the world, the other two being the Pineapple and the Mangosteen,—a royal trio indeed! A fully ripe Cherimoya is so delicious that it is safe to say not one out of a hundred on first tasting it would be other than delighted; in fact, this was exactly the case at a recent flower show at Pasadena, where a number of fine Cherimoyas from Mexico were exhibited and visitors permitted to sample them. In flavor and character the flesh may be likened to a delicious sherbert or ice cream. When prepared as it is in the tropics—thoroughly chilled on ice—there are few desserts that equal it.

On the great central plateau of Mexico, under climatic conditions almost identical with those of Southern California, it is not uncommon to find trees bearing two or three hundred of these delicious fruits. Why, then, should not the attention of our horticulturists be more earnestly addressed to the reproduction of such conditions here?

That so little is known in California of this superb fruit—its culture, its value, and its possibilities for this state—has seemed to warrant the preparation of this preliminary paper on the subject.

# History and Cultivation in California

As far as is definitely known, the Cherimoya was first introduced to California in 1871, by the late Judge R. B. Ord of Santa Barbara. Dr. Franceschi, who has investigated the subject thoroughly, is unable to learn of any earlier introduction than this, and although it would seem natural that the early Mexican settlers should have brought this fruit with them, such does not seem to have been the case.

From the trees brought from Mexico by Judge Ord, many seedlings have been raised and planted in Santa Barbara and vicinity. Further south, some of



Figure 119. A fifteen-year-old seedling Cherimoya in the A. Z. Taft grove at Hollywood, California, showing what the tree will do in California under proper cultivation.

the first trees planted were on the Jacob Miller place in the Cahuenga valley, just outside of Hollywood, where the Cherimoya grows to perfection and is found in larger numbers than in any other locality in the state. The early impetus here given it has resulted in it being quite common in the gardens of Hollywood, and along the slopes of the valley to the west. Certainly it could not be more at home anywhere than it is here, the tree reaching a large size, and the fruit ripening perfectly. While it fruits well at Santa Barbara and in many other localities, there seems to be something peculiarly suited to it in the conditions of soil and climate of the foothill regions.

The superior hardiness of the Cherimoya has made it one of the most widely planted of the lesser-known subtropical fruits. The number of mature specimens is not more than a few hundred, but their wide distribution and success go to prove the adaptability of the tree to an extensive area in this state. Of these seedlings scattered throughout the gardens of Southern California, practically all have been successful so far as growth is concerned, but a large percentage are scantily productive. A study of the habits of the tree shows this to be nothing unusual and not due to anything unfavorable in our climate or soil. The Cherimoya is never enormously productive. But there are occasional seedlings much more prolific than the average, and this is the case in California as well as other countries.



Figure 120. A seven-year-old budded tree of the Golden Russet Cherimoya grown by C. P. Taft at Orange, California.

Cultivation on a commercial scale has been undertaken in but few instances, and with unsatisfactory results in practically all of them, the trees failing to produce sufficiently to make their culture profitable. For this difficulty a single, and exceedingly simple, remedy suggests itself—asexual propagation—making possible the perpetuation of productive and otherwise desirable seedlings, true to type. This is already practiced in other countries, and here to a very limited extent.

The largest grove of Cherimoyas in California is that owned by A. Z. Taft of Hollywood, consisting of some eighty fifteen-year-old seedlings. No finer specimens could be desired than some of these, but the majority of them are deplorably unproductive,—if the five best trees were taken out, a bushel of fruit

could not be gathered from the lot. One tree alone, more prolific than the others, produces about one-fourth as many fruits as the remaining trees taken together. It is easily seen that such a grove does not pay for the care bestowed upon it, but if worked over to a prolific variety it could be transformed into a very profitable holding.

It has been questioned by some whether the climate of California will produce a Cherimoya of the best quality. This query arises from the fact that many of the fruits produced here are of poor flavor. The explanation is that seeds from inferior fruits have been planted, and a lot of degenerate seedlings produced. Experience leaves no doubt on this point, since some of the fruits grown here are all that could be desired in flavor and quality.

# Botanical Description

The genus Anona comprises about sixty species, indigenous to tropical America and Africa. Several members of the genus are cultivated for their fruit, notably the Sugar Apple (A. squamosa), the Sour Sop (A. muricata), and the Custard Apple (A. reticulata).

The Cherimoya, Anona Cherimolia Miller, while not so widely cultivated as the above mentioned species, is nevertheless one of the most noteworthy and valuable. It is a small tree, fifteen to twenty-five feet in height, much branched and spreading, with grayish bark, the branches rounded and the young growth scurfy-pubescent.

Leaves alternate, ovate, acuminate, sometimes obtuse, bright green and sparsely hairy above, grayish-pubescent beneath; petiole five-eighths inch long. Flowers solitary, axillary, small and very fragrant, peduncle short. Calvx composed of three small, valvate sepals. Petals six, arranged in two series: the three exterior valvate, fleshy, greenish outside and whitish within, oblong-linear, keeled on the inner side; the three interior minute, sometimes wanting. Stamens indefinite, inserted on the hemispherical receptacle. Carpels, also indefinite, distinct but cohering loosely among themselves and containing a single ovule; style oblong. Fruit compound, made up of the individual fruits (berries) derived from the separate carpels, sunk in and united with the fleshy receptacle, sometimes eight inches in length, conical, ovate, or globose, frequently irregular, greenish, brownish or yellowish in color; the surface sometimes smooth, but frequently covered or partially covered with more or less prominent protuberances, one arising from each pentagonal carpellary area. Seeds three-eighths to three-fourths inch in length, oblong or oval, more or less compressed, brown, containing the characteristic ruminated endosperm.

The Natural Order Anonaceae, to which the Cherimoya belongs, includes 46 genera and 620 species, according to Dr. Willis, the majority being found within the tropics, both in the old world and the new world. The order includes numerous fruit-producing shrubs and trees, of which may be mentioned in particular, besides the genus Anona, Rollinia orthopetala and R. emarginata, natives of South America and among the finest of the anonaceous fruits; Asimina triloba, the "Papaw" of eastern and central United States; and several species of

Uvaria, natives of Mexico and southern Asia. The Ylang-Ylang (Cananga odorata), a native of southern Asia, from which a perfume is distilled, is also a member of the order.

### Origin

DeCandolle, in his monumental work "Origin of Cultivated Plants," discusses this subject at length, and states in conclusion, "I consider it most probable that the species is indigenous in Ecuador, and perhaps in the neighboring part of Peru." This statement was based mainly upon the opinions of early botanists who had collected in South America. That he was not certain in his conclusion is plainly expressed in the conclusion itself, but until recently his verdict has been generally accepted as correct. Some few, however, have held to the belief that the species is indigenous in Mexico and Central America as well as Peru and



Figure 121. A prolific Cherimoya tree at the C. W. Mitchell residence in Sierra Madre, California.

Ecuador, and recent researches by Prof. Gabriel Alcocer of the Mexican National Museum seem to prove that it is exclusively Central American, having been introduced to South America from Guatemala. In a Spanish work entitled "Historia del Nuevo Mundo," it appears that the author, P. Bernabe Cobo, while traveling from Peru to Mexico in the year 1629, found the Cherimoya in Guatemala City, and was so pleased with it that he despatched some seeds to his friends in Peru, where it was unknown at that time. Upon returning there thirteen years later,

he found that a number of trees had been raised and were in bearing, but the fruit was still scarce and sold in the markets from eight to twelve reales each. It was more than one hundred years later that the first Cherimoya seeds found their way to Europe, and having come from Peru it was naturally supposed that the tree was a native of that country. Later, when European botanists found the tree in an apparently wild state in the mountains of Peru and Ecuador, this belief was more firmly established, but it is plainly apparent that the tree might have become naturalized in the two hundred years that had elapsed since its introduction, even to such an extent as to lead to the belief that it was native. Prof. Alcocer points out that the work, "Historia del Nuevo Mundo," was unknown to DeCandolle, and he also presents much other evidence in favor of a Central American origin, with the result that little room is left for doubt.



Figure 122. Fruits of Cherimoya on a young tree at Hollywood, California.

#### Common Names

In Mexico the common name of this fruit is spelled "Chirimoya." Evidently a different spelling is used in Peru, giving rise to the specific name *Cherimolia* and the English adaptations "Cherimoya" and "Cherimoyer," the latter most commonly used in the British colonies. Though the fruit came to California from Mexico, the spelling "Cherimoya" has been generally adopted by horticulturists in this state and will, in all probability, eventually supersede all others.

Some authorities have termed all members of the genus *Anona* "Custard Apple" individually and collectively, it is extremely undesirable that the Cherimoya be known under this name, which properly belongs to the West Indian *Anona reticulata*, a fruit similar to the Cherimoya in many characteristics.

but greatly inferior in quality. The listing of the Cherimoya under the name "Custard Apple" has already led to much confusion among nurserymen and horticulturists in this state, some, knowing that this name was applied to A. reticulata going so far as to list this species and A. Cherimolia as synonymous. Furthermore, the Cherimoya suffers a certain loss of prestige through this confusion—sufficient in itself to merit careful discrimination on the part of all those describing or listing it.

# Climatic Requirements

That the Cherimoya is not highly successful in strictly tropical countries is conclusively shown by the fact that even when it has been grown for some time in such regions and is comparatively well known, it is not held in high esteem. It is reported that it succeeds in some parts of Ceylon, and is popular with the



Figure 123. A Cherimoya tree in the A. Z. Taft grove at Hollywood, California, probably one of the finest specimens in the State.

natives. Obviously it is not at its best or it would call for a greater degree of enthusiasm. In Jamaica it is only a success in the coolest and dryest parts of the island. Writers in other parts of the West Indies, and in Reunion, have remarked that it is not as fine a fruit as some other members of the genus.

But a glance at its popularity in the Mexican highlands, Madeira, the Canary Islands, and Peru shows a contrary state of affairs. It has reached a degree of perfection never attained in tropical lowlands, and is esteemed as one of the finest of all fruits.

The great central plateau of Mexico may be taken as an example of climatic conditions best suited to this fruit, since it is there found in perfection, and has been cultivated from the remotest antiquity. Comparatively high temperatures accompanied by a very low degree of humidity are the rule during the dry season, the winters being cool and the annual precipitation not great—a climate very similar on the whole to that of Southern California. And indeed it is not necessary to search elsewhere to determine the requirements of this fruit, since forty years' successful cultivation in this state has proved them to be fulfilled here to a very satisfactory degree. Two factors which seem to be particularly important are freedom from excessive humidity or precipitation, and cool (but not frosty) weather at the time of ripening.



Figure 124. Trunk of Cherimoya tree shown in Figure 123, almost a foot and a half in diameter.

Prof. Foex, in "Algunas Anonaceas Frutales de Mexico" (Bulletin No. 9 of the Estacion Agricola Central, Oaxaca), says: "Of the Anonas grown in Mexico the Cherimoya is the most resistant to cold, and suffers most from excessive heat. 
\* \* When grown in a region of moderate temperatures it is considered the best of all the Anonas; grown in a hot climate it is not superior to Anona squamosa."

The hardiness of the tree has been so thoroughly tested in this state as to leave no room for dispute, and it can be relied upon to succeed in locations suited to citrus fruits, with the same amount of protection. The same provision must be made as with the citrus fruits, however, that some localities will produce finer fruit than others. And it must be recognized and remembered that varieties intro-

duced from other countries will not necessarily be successful here—if from climates widely different from our own—without undergoing a process of acclimatization.

# Propagation

Although the majority of Cherimoyas in this state are seedlings, the tree can be readily budded. It is only through this or some other asexual means of propagation that desirable forms originated as chance seedlings can be perpetuated, and Cherimova culture on a commercial scale made profitable.



Figure 125. Parent tree of the Mammillaris Cherimoya, at Altadena, California, on the property now owned by A. C. Calkins.

Seeds are sometimes obtainable in the fall, but more frequently during early spring. If a glass-house or hot-bed is available they may be planted at any time, but if no artificial heat can be supplied it is best to defer planting until the advent of warm weather, usually in April or early in May. For germinating the seeds an excellent medium is a mixture of two-thirds silver sand and one-third old redwood sawdust; lacking this, any light, well-drained soil can be used with



Figure 126. Showing one of the very best types of Cherimoya, this being five inches in length and weighing a pound and a half.

good results. The seeds should be covered to a depth of half an inch, and if conditions are favorable they will germinate within four or five weeks. The young plants should be potted off when they have attained a height of three or four inches, using pots of a diameter not less than two and a half inches. The plants are not particular as to soil, it only being necessary that it is light and porous.

Budding is best done in early spring, shortly after the sap has begun to flow. In some seasons this will be as early as the first of March, but more frequently late in March or early in April. The trees should be watched and the work begun as soon as it is found the bark will slip readily.

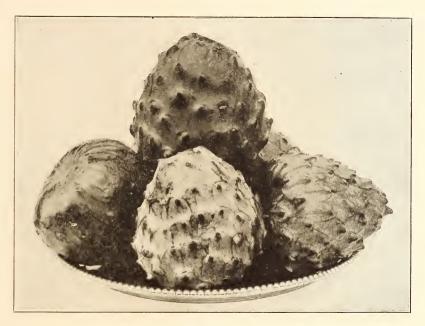


Figure 127. A plate of Cherimoyas as grown at an altitude of 7000 feet in the highlands of Mexico.

The most advantageous method of budding the Cherimoya is that known as shield budding, the operation being practically the same as with the citrus fruits. Mr. C. P. Taft of Orange obtained excellent results from his first attempt, but later found that even though the work was done under favorable conditions the buds would sometimes fail to grow. The stocks used by Mr. Taft have been seedling Cherimoyas; in Florida Mr. Wester has budded on Anona glabra, A. squamosa, and A. reticulata, finding A. glabra the most vigorous and satisfactory. It is not certain that this species will be equally satisfactory in California, however.

The stocks should be from three-eighths to one-half inch in diameter—seedlings of this size being usually from a year to a year and a half old. Wood from which the leaves have dropped and of about a year's growth is the most desirable for budwood, and Mr. Wester advises cutting the buds not less than an inch and a quarter in length. If cut smaller than this, on account of the rapid callousing and thick bark of the Anonas, the buds have difficulty in starting and are choked out. Insert the buds exactly as in budding citrus fruits, and tie with waxed tape. At the end of three or four weeks they should be unwrapped, and if alive, the tree should be lopped back and the bud rewrapped loosely, leaving the "eye" exposed so that it may start into growth. The buds of the Cherimoya are sunk into the bark tissues, and there is not the danger of their dropping and leaving a "blind" bud that there is with the avocado.

In Madeira and the Canary Islands grafting is extensively practiced. Dr. Trabut, in the Bulletin Agricole de l'Algerie et de la Tunisie, advises grafting as being much more successful than budding. Two-year-old seedlings are used, the operation itself being a simple cleft-graft.



Figure 128. Showing a collection of the different types of seedling Cherimoyas occurring in Southern California—these from one grove at Hollywood.

#### Culture

Experience in California has shown that the Cherimoya thrives under the same treatment accorded the Citrus fruits. The seedlings grow to much larger size than any of the Citrus trees, however, and should be planted at least twenty-five feet apart. Budded trees will probably require less room, as budding dwarfs the tree to a certain extent.

The tree has proved to be about as hardy as the orange—though this must be largely a matter of variety—and is semi-deciduous in nature, the extent being dependant upon the severity of the climate.

Whether seedling or budded, the tree ordinarily comes into bearing about the fourth year. The fact that large trees are quite frequently unproductive, though blooming profusely, has led to a series of investigations by P. J. Wester of the U. S. Dept. of Agriculture, which throw considerable light on the matter, although there is still much to be learned. Mr. Wester found that the flowers of the Cherimoya were unable to fertilize themselves because of the pistils maturing before the stamens, and consequently not receptive to the pollen when

it was liberated, thus necessitating the assistance of some outside agency for fertilization. The pollination of the mature pistils with pollen from another flower was attributed to insects. Mr. Wester believed the sterility of the Cherimoya in Florida to be due to a scarcity of flowers and an insufficient number of insects to assist in pollinating them. He further states that "the extraordinary productivity of a few individual trees suggests a change in regard to the pollination of the flowers of these trees, possibly due to synacmy and self-pollination."

In Madeira and the Canary Islands the cultivation of the Cherimoya is carried on systematically, the trees being pruned and manure regularly supplied.



Figure 129. Showing what the Cherimoya may be in Southern California. A fine specimen from Hollywood, weighing 18 ounces.

# Diseases

In California no diseases affecting the Cherimoya have been observed; if they are present, they do not seriously interfere with growth, and have not been of sufficient importance to become evident. In other countries, however, the tree seems to be subject to certain fungus diseases, probably unknown here. Jumelle (Les Cultures Coloniales, p. 176) remarks: "It is well to replace the trees when they commence to get old, as they are subject to the attacks of a blight."

In a paper read before the Cuban National Horticultural Society, and published in the Society's report for 1910, H. A. Van Hermann says: "The cultivation of Anonas for commercial purposes will need some careful attention. The fruit when young is affected by both fungi and insects, which disfigure it. Spraying may be necessary to grow perfect fruits in some localities."

Mr. R. H. Johnston of the hacienda "La Queseria" in the state of Jalisco, Mexico, reports that many of the trees, which are given practically no cultivation in that vicinity, are subject to a serious disease somewhat similar to the pear canker.

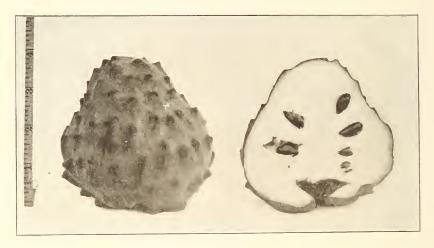


Figure 130. The Mammillaris Cherimoya as grown at Altadena, California.

#### Insect Pests

Even though in close proximity to infested citrus and other trees, none of the local Cherimoyas appear to be bothered by any insect pests. But it is evident that the species is not immune from the attacks of pernicious insects. The Bulletin Agricole de l'Algerie et de la Tunisie for March 15, 1908, contains an account of the Cherimoya in Algeria by Dr. L. Trabut, in which he states that old trees are nearly always infested with the "Cochenille blanche" (Mealy Bug) requiring stringent combative measures. Fumigation is advised, the work to be done during the winter months. In Southern California, the work of Essig and others has shown that the Mealy Bug can be most effectively handled by the use of carbolic emulsion.

Throughout the warmer parts of America there are small chalcid flies related to the wheat joint-worm and the grape-seed chalcid which infest the seeds of anonaceous fruits particularly those of *Anona squamosa*. These are so widely distributed that they will be practically certain to appear eventually in Southern

California. All seed from southern sources should be carefully examined on being received.

#### Season

In this state the main season for Cherimoyas is March and April, although in favorable weather a few fruits may mature in the fall. The entire crop does not ripen at one time, the fruits maturing individually and extending the season over six or eight weeks.

The fruit does not ripen on the tree, and must be picked when mature—to avoid its dropping to the ground and becoming bruised—and laid away for three or four days before it is in condition for eating. That it is difficult for some to judge when the fruit should be picked is evidenced by the fact that mature, and sometimes half-grown, fruits are often found in the markets. These immature fruits are easily distinguished by their becoming dark brown upon softening, accompanied by a hardness of the surface that is never present in the ripe fruit.

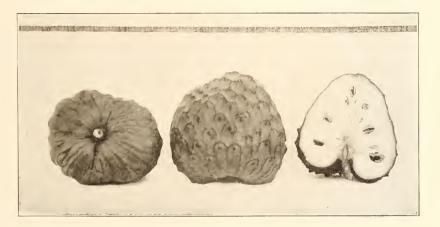


Figure 131. The Golden Russet Cherimoya as grown at Orange, California.

When fully ripe and ready to pick, the fruit assumes a yellowish tinge, more pronounced in some varieties than in others, and yields slightly to pressure of the thumb.

In certain states of Mexico Cherimoyas are obtainable throughout the year. The season has not been greatly extended by seedling variation in California, since fruit can not be obtained in quantity for more than three months. Doubtless by introducing varieties from other countries it would be possible to greatly prolong the period.

Unfavorable weather at the time of ripening has a pronounced effect on the flavor and size of the fruit, both suffering considerably in severe seasons.

# Shipping

That the Cherimoya could be successfully shipped to any part of the country without difficulty is shown by the fact that numerous shipments to this state from southern Mexico have arrived in excellent condition, even though no care was

used in packing. After picking, the fruits do not soften up sufficiently to be easily bruised within three or four days, and this time can be greatly extended by refrigeration. With the selection of the toughest-skinned varieties for this purpose, there should be no difficulty in placing the Cherimoya on the markets of any part of the country.

A more complete treatment of this subject will be found in Prof. Foex' bulletin "Algunas Anonaceas Frutales de Mexico," already referred to.

# Nature and Extent of Seedling Variation

Notwithstanding some statements to the effect that the Cherimoya comes true from seed, the variation exhibited by the seedlings in Southern California, many of which have sprung from a common parent, demonstrates conclusively that asexual propagation must be resorted to in order to perpetuate a variety absolutely true to type. Although the distinct departures from the parent type which are frequently shown by seedlings of some other cultivated fruits do not appear to exist in this species, in variation of seedlings, and particularly in variation of fruits on the same tree, it is peculiar and extraordinary.

As observed among the local trees, the most important characteristics in which variation is shown, and the extent of variation in each, are briefly as follows:

#### A. VARIATIONS AFFECTING THE TREE.

1. Productiveness. A large percentage of seedlings are so unproductive as to be of no value. Many produce moderately, and an occasional tree is so exceptionally productive (comparatively speaking) as to make it of great value for propagation, provided it is otherwise desirable. These productive trees are quite frequently isolated specimens, showing that the difference is not due to cross fertilization, or an abundance of pollen supplied by other trees. Mr. Wester suggests that the flowers of these trees may be self-fertile, as opposed to the majority of Cherimoyas which are dependent on insects for pollination. Whether this be the case or not, it is certain that the bearing habits of a tree are perpetuated by asexual propagation, and thus all danger of trees turning out to be shy bearers can be eliminated.

It is quite possible that the productiveness of many of the local trees could be increased through better attention to culture, since many of them have been subjected to severe neglect.

2. Foliage. On one plantation in the Cahuenga valley there are a few trees whose leaves are uniformly two or three times the ordinary size, being eight to ten inches in length and five to six inches in breadth. It is not rare for seedlings to show this variation, and the fruits produced by such trees do not appear to differ from the ordinary in any respect.

#### B. VARIATIONS AFFECTING THE FRUIT.

1. Surface. In respect to surface, the local seedlings may be broadly divided into two classes; those with more or less prominent protuberances over the greater portion of the surface, and those without protuberances, in which the

surface is smooth and the carpellary areas are defined by raised lines, or in which the carpellary areas are individually concave. There are, of course, many forms intermediate between these two, and extreme forms of each. While both smooth and rough fruits are sometimes produced by the same tree, and some trees produce fruits which are covered with protuberances when young but become smooth at maturity, there are many which uniformly produce fruits of one type. Thus in the Mammillaris variety the mammiform protuberances are present on all specimens, and in the Golden Russet the protuberances near the base, which disappear towards the apex and are replaced by concavity of the carpellary areas, are characteristics which are almost always present.

2. Size. In this respect the Cherimoya is extraordinary, it being possible to find mature fruits all the way from an inch to six inches in diameter on many trees, whether seedling or budded. Ordinarily, only a small percentage of the fruits



Figure 132. On the left a view in the huerta of Herman Evers, at Mazatlan, Mexico, showing a young Cherimoya in bearing; on the right, a large tree near Colima, Mexico, photographed during the winter season and showing the deciduous nature of the tree in cold climates.

attain large size, although some trees are more uniform in this respect than others.

- 3. Form. The commonest form is conical or oblong-conical, but some varieties are normally cordate and there are many seedlings among whose fruits it would be difficult to determine a normal form. Rarely is there a tree whose fruits are all of uniform shape. Even among perfect specimens there is considerable variation, and many malformed fruits are produced, due, without doubt, to imperfect fertilization of the flowers.
- 4. Color. Although commonly a dull green, there is considerable variation in coloring, some varieties being light russet at maturity. Since any other color than green is only assumed in favorable weather, it is evident that coloring is largely a matter of weather conditions, becoming most pronounced in the hottest seasons.

- 5. Seeds. Among the seeds of different varieties there are no great differences. The average number of seeds, while greater in fruits of some varieties than others, is largely a matter of the individual specimen. Slight differences in the form of the seeds are frequently noticeable.
- 6. Quality. It is natural that some seedlings should produce fruits of inferior quality. Occasionally a very superior one is found.

#### Varieties

In general characteristics of fruit many of the local seedlings are practically identical; furthermore, as has already been noted, the variation existing among fruits on the same tree is great. This makes it impracticable to distinguish between any large number of varieties, and renders difficult the describing of a variety in such a way that every fruit produced will answer to the description, without entering at length into the range of variation exhibited within the variety.

When the most prolific and desirable of the local trees come to be propagated by budding or grafting, and are offered by the nurserymen, it will be essential that each one be given a name and that accurate descriptions and illustrations be placed on record for the guidance of prospective planters. As yet only two named varieties have been offered. Both these are desirable, but it is highly probable that much finer forms will be introduced within the next few years from other countries where this fruit has been given more attention that it has here. In Madeira, seedling selection has resulted in the production of varieties weighing as much as sixteen pounds, and with very few seeds. Choice forms, adapted to varied conditions of soil and climate and bearing at different seasons of the year, have been produced in several countries, and it will be much more expedient to direct our efforts toward obtaining as many of these as possible, rather than to the production of superior varieties through seedling selection,—necessarily a slow and laborious process at best.

#### Mammillaris

This variety originated as a seedling at Altadena, California, on the property now owned by A. C. Calkins. In flavor it is greatly superior to the majority of local seedlings, and its exceptionally tough skin renders it of value for shipping. Although not a fruit of large size, it must be ranked as one of the best which have originated locally.

Description—Form distinctly conical, more uniformly so than with most other varieties; size medium; weight up to one pound; length up to four and a half inches; width up to four inches; base flattened; cavity shallow, broad, flaring, regular; apex rather pointed; stem short and very stout; surface covered with more or less prominent conical protuberances, one arising from each carpellary area over the entire fruit; color dull green; skin thick and very tough; flesh clear white, soft, fine grained; seeds rather short and blunt, plump, not very numerous; flavor very aromatic and rich, strongly resembling the pineapple; quality excellent; season February-March at Altadena, California.

Tree upright; growth close, moderately vigorous; productiveness very good; seems to be hardier than many other Cherimoyas. This is the first description of this variety.

#### Golden Russet

A variety of obscure origin, received in the form of two budded trees from London, England, by Mr. Burgess of Villa Park, California, some years ago. It was under this name when received. It has been propagated by C. P. Taft of Orange, who has a number of budded trees in bearing. A very good variety, but as produced at Orange it is inferior in flavor to Mammillaris.

Description—Form normally oblong-conical, but extremely variable; size medium large; weight up to a pound and a half; length up to seven inches; width up to five inches; base flattened; cavity deep, rather narrow, rounded, regular; apex rounded, broad; stem short and stout; surface near base giving rise to a rounded and not very prominent protuberance from each carpellary area, toward apex the protuberances disappear and the carpellary areas are concave; color light green, usually shaded with, or varying to, golden russet; skin rather thin, tender; flesh white, of good texture; seeds oblong, slightly compressed, not very numerous; flavor resembling the pineapple but not so rich as in Mammillaris; quality good; season February-April, occasional specimens ripening in the fall, at Orange, California.

Tree upright, broad topped; growth vigorous, rather open; productiveness fairly good.

# OTHER SPECIES OF ANONA FRUITED IN CALIFORNIA Anona macrocarpa

Considered by some authorities to be a horticultural form of A. Cherimolia, but believed by Dr. Franceschi, who introduced it to California, to be distinct.

The most marked characteristic of the species is the large size of the leaves, which causes Dr. Franceschi to note that it might better be called macrophylla, the fruits being proportionately not so large, although larger than the ordinary Cherimoya, and of excellent quality. The seeds are distinct from those of A. Cherimolia. It is believed to have originated in Orotava, Teneriffe, and has proved hardy at Santa Barbara.

#### Anona reniformis

Also introduced by Dr. Franceschi, who describes it as of dwarf habit and more spreading than the Cherimoya, with smaller and more coriaceous leaves. The flowers are very fragrant, and are produced in great profusion over a longer period than with other species. A sparse bearer, the fruits reniform, of small size, and indifferent quality. Not authentic, but for its distinctiveness in foliage, in fruit, and particularly in seeds, considered by Dr. Franceschi to rank as a distinct species.

#### Anona suavissima

Also considered a horticultural form of A. Cherimolia by some authorities. It was described about 1820 by Prof. Tenore, Director of the Botanic Garden at

Naples, Italy, from whence it was introduced to California by Dr. Franceschi. Similar to A. Cherimolia in most characteristics, but quite distinct in its seeds. The fruit is of indifferent quality.

# ANONACEOUS FRUITS INTRODUCED TO CALIFORNIA

The most important members of the genus Anona, and several members of other genera of the Anonaceae, have all been introduced to California, but so far as known, none of them have yet attained sufficient size to produce fruit except the Cherimoya and the three doubtful species Anona macrocarpa, A. reniformis and A. suavissima. The following list includes all others known to have been introduced, some being of such recent introduction that they have not yet been tried out in the open, others, like the Sour Sop (Anona muricata) and the Sugar Apple (A. squamosa) have been repeatedly planted in various locations, only to succumb to the cool winters. It may yet be possible to fruit them by obtaining the hardiest types and planting them in the most favored locations.

# Anona Cherimolia Mill., var. pyriformis

Indigenous to Chile.

Described as being hardier than most other Cherimoyas, and bearing pearshaped fruits of large size and excellent quality. Recently introduced by the Bureau of Plant Industry.

# Anona glabra Linn.

(A. laurifolia Dunal)

Southern Florida, Mexico, and the West Indies.

Known as "Anona" in Mexico; "Cachiman Creme" in the French West Indies; "Pond Apple" in Florida and the British West Indies.

A vigorous tree up to thirty feet in height, the trunk up to two feet in diameter. Leaves ovate-lanceolate, deep green above, pale green beneath, glabrous, coriaceous, persistent.

Fruit ovate-conical in shape, flattened at the base and rounded at the apex, two and a half to five inches long. Skin yellow or brownish yellow, sometimes reddish. Seeds conical, few. Pulp of a buttery consistency, very sweet, sometimes cloying.

Prof. Foex says this is the commonest anonaceous fruit on the markets of Mexico City, with the exception of the Cherimoya. It ripens throughout the year in the Mexican states of Chiapas, Guerrero, Jalisco, Michoacan, Oaxaca and Vera Cruz; from January to June in Puebla and other central states; from July to December in those states along the Pacific coast.

Although esteemed by the Mexicans, this fruit is not highly valued in Florida, where it is found in both fresh and salt water swamps. While it is found in Mexico at considerable altitudes it is not as hardy as the Cherimoya. Introduced to California by Dr. Franceschi. Only small plants are to be found as yet.

# Anona montana MacFayden

Porto Rico, and other islands of the West Indies.

A small tree, bearing a sub-globose, muricate fruit, of little value. Introduced to Florida by Bureau of Plant Industry for trial as a stock for other Anonas.

Seeds sent to California in 1911 by Bureau of Plant Industry. Young plants raised by Dr. Franceschi were all killed during the first winter.

#### Anona muricata Linn.

(A. asiatica Linn.)

Cuba, Santo Domingo, Jamaica and several of the smaller islands of the West Indies, according to DeCandolle.

Known as "Cabeza de Negro," "Catucho," "Guanabano," and "Anona Amarilla" in Mexico; "Corossolier," "Cachiman Epineux," and "Sappadille" in the French colonies; "Sour Sop" in Florida and the British colonies.



Figure 133. A grove of Cherimoyas in the hacienda of "La Queseria," at the foot of the volcano of Colima, in Mexico, showing the conditions under which the Cherimoya frequently exists in that country.

A tree of about the same size as the Cherimoya. The leaves are ovatelanceolate, acuminate, and glabrous. The foliage possesses a peculiar and distinctive fragrance.

Fruit very large (sometimes as much as ten pounds in weight), oblong, conical, or oval, and dark green in color. The skin is covered with short, pointed, recurved protuberances or weak spines. Pulp soft and juicy, but frequently fibrous or wooly and tasting of turpentine. Seeds slightly larger than those of the Cherimoya. The juice is acid or subacid, of pineapple flavor, and is widely used in the West Indies and other parts of the tropics for the preparation of a refreshing drink. The fruit matures throughout the year.

In many parts of the tropics choice varieties have been obtained, prolific and of fine flavor. It is well known that there is a great difference in quality in the produce of different trees.

The Sour Sop is one of the tenderest species of *Anona*, and is not known to have ever become established in California, although plants have been imported from Florida at numerous different times. Dr. Franceschi has raised seed from different sources, but with poor success. An importation from Paraguay in 1911, however, appears to be more robust and hardier, and may result in plants becoming established here. It is only by obtaining the hardiest varieties and planting them in the most favored localities that anything can ever be expected of this species.

# Anona palustris Linn.

West Indies and South America, from Cuba to Rio Janeiro.

Known as "Corcho" in Mexico; "Pomme de Serpent" in the French West Indies; "Alligator Apple" and "Cork Wood" in the British West Indies.

An arborescent shrub, 10 to 15 feet high, the leaves ovate-elliptic or oblong, with short narrow point or sometimes bluntish, smooth on both sides, rather thick. The wood is sometimes used in place of cork.

Fruit two inches in diameter, yellow, somewhat roughened and scaly. Said to be narcotic, and for this reason not much used. Grows in swamps and along the seashore.

Of not much value as a fruit, but used in Florida as a stock for other Anonas. The difference in climatic conditions makes it doubtful if it will prove of value for this purpose here. Introduced from Florida in 1910 by Dr. Franceschi.

#### Anona reticulata Linn.

West Indies and tropical America.

Known as "Anona," "Ananhtzapotl," "Anona Colorada," and "Llama" in Mexico; "Cachiman," "Cachiman Coeur de Boeuf," "Corossol Reticule," "Corossol Sauvage," and "Mamilier" in the French colonies; "Custard Apple" in Florida; "Custard Apple" and "Bullock's Heart" in the British colonies.

One of the largest members of the genus, growing up to twenty-five feet in height. Leaves oblong-lanceolate, glabrous above, slightly pubescent and reddish below.

The fruit is described by Dunal as ovate-globose in form, but is better described by Prof. Foex as "the shape of an enormous strawberry." In color it is reddish brown or brownish yellow. The skin is not covered with protuberances or scales, the carpellary areas being defined by more or less distinct reticulations. The pulp is grayish or pinkish, and adheres to the rather numerous seeds. In flavor the Custard Apple is similar, but inferior, to the Cherimoya.

Prof. Foex remarks that by selection and crossing it would be possible to obtain varieties with pulp not adhering to the seeds, and of superior flavor and texture.

This species is common in the warmer parts of Mexico and in the West Indies. It is cultivated quite widely and has become naturalized in some places in southern Asia and western Africa. In Florida it has been grown for many years.

This species and A. Cherimolia have been greatly confused by California nurserymen and horticulturists in general, probably because of the fact that the Cherimoya has been commonly called "Custard Apple" in this state, and because the two species are somewhat similar, although they are entirely distinct in foliage and readily distinguishable by this means. A. Cherimolia has been listed under the name A. reticulata by some nurserymen, and others have listed the two as synonyms; but the plants disseminated have been of the species Cherimolia probably without exception.

Not as hardy as the Cherimoya, but might succeed in favored locations in this state. No plants of any size are known.

# Anona squamosa Linn.

(A. cinerea Dunal)

According to DeCandolle, this species is indigenous to tropical America, and the West Indies in particular.



Figure 134. Another small grove of Cherimoyas in the hacienda "La Queseria."

Note the similarity of the country to the dry foothill regions of Southern California.

Known as "Anono," "Chirimoyo," "Saramuyo," "Texaltzapotl," and "Anona Blanca" in Mexico; "Pomme Canelle" and "Attier" in the French colonies; "Sugar Apple" and "Sweet Sop" in Florida and the British West Indies; "Custard Apple" in British India.

An arborescent shrub or a small tree, ten to fifteen feet in height. Trunk ashen gray, branches light gray. Deciduous in climates having a more or less marked dry or winter season. The foliage is strongly scented, and is sometimes used as an insecticide.

The fruit is normally round or conical, about the size of a small orange, and greenish in color. The surface is covered with prominent rounded protuberances, imbricated like the scales of a pine cone. The pulp is creamy, very sweet, and surrounds the rather numerous, medium sized, seeds.

The Sugar Apple is one of the finest of the Anonas, and is widely grown in tropical countries, in some of which it has become naturalized. It is ordinarily a more prolific and regular bearer than other species.

It has been planted in Southern California, but has not become established, having proved too tender for this climate. By obtaining the hardiest varieties from the Mexican highlands it may be possible to successfully grow it in favored localities. Dr. Franceschi believes it was first planted in this state about 20 years ago, having come from Florida.

#### Asimina triloba Dunal

United States, as far north as New York, and west to Michigan and Kansas; Mexico, south to the state of Jalisco.

Known as "Papaw" in the United States; "Anonillo" in Mexico.

A tree thirty to forty feet in height. The leaves obovate or oblong, acute, six to twelve inches long. Flowers 2 inches broad, purplish red.

Fruit oblong, two to six inches in length. Skin yellowish green, covered with a whitish bloom. The fruit greatly resembles the banana in its lack of acid and its fine grained pulp, but is of a peculiar and distinctive flavor. The pulp is light yellow in color, and contains two rows of seeds extending the length of the fruit.

The Papaw is occasionally found in cultivation, and has proved hardy as far north as Ontario. It is the hardiest of the anonaceous fruits, and the only one found in cold climates. Among the wild trees seedlings of superior quality are occasionally found, and the fruit could doubtless be greatly improved by selection. It offers a wide field for hybridization with other less hardy anonaceous fruits, and should also prove of value as a stock upon which to graft the more tender Anonas and Rollinias.

The Papaw was planted at Goleta, Santa Barbara County, many years ago by Joseph Sexton, one of California's pioneer nurserymen, but failed to establish itself. Repeated attempts to grow it were made, but with no success, due, as Mr. Sexton believes, to the hot and dry summers. Further attempts to grow it should be made, especially in cool and moist mountain canyons, where it should feel at home. Its greatest value probably lies, however, in the possibility of obtaining hybrids with other anonaceous fruits, or as a stock for them.

# Rollinia emarginata Schlecht.

Brazil, Paraguay, and the northern part of Argentina.

"Aratacu-quatu." This is a small bush growing here in the open campo in almost any soil. The fruit is large and the best class of all, according to my thinking.—T. R. Gwynn.

Recently introduced, under S. P. I. No. 27610.

# Rollinia orthopetala A. DC.

Paraguay, Brazil and Argentina. "Biriba."

A tree, thirty to forty feet in height. Leaves oblong, acuminate, acute at the base, corolla one inch in diameter, greenish yellow.

Fruit size of an infant's head, greenish yellow. The flesh white and sweet.

Described by Prof. C. F. Baker as "the finest anonaceous fruit of tropical America."

"This is, as Prof. Baker wrote, the finest anonaceous fruit of tropical America. It is the only one of those which I have tasted that I liked, and on first trial I immediately pronounced it delicious. The seeds are embedded in a large quantity of pulp, which is of a custard-like consistency and of a very agreeable acidulous taste. I do not know what fruit it resembles most in taste."—Fischer.

Introduced under S. P. I. Nos. 22512 and 27609. Rather tender, but may succeed in favored localities, where it is now being tested.





# TROPICAL AND SUBTROPICAL FRUITS IN CALIFORNIA

ВΥ

F. W. POPENOE, F.R.H.S.

ALTADENA, CALIFORNIA, U.S.A.

of California no. 6

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# TROPICAL AND SUBTROPICAL FRUITS IN CALIFORNIA.

By F. W. Popenoe, F.R.H.S., ALTADENA, CALIFORNIA, U.S.A.

CALIFORNIA has been known for many years for its oranges and lemons, its prunes and apricots, and many other fruits which it grows on an extensive scale. The last quarter of a century, however, has witnessed a great increase of interest in the cultivation of other exotic fruits, especially those of a tropical or subtropical nature. Several of comparatively recent introduction are already taking a position among the commercial products of the State; others, while perhaps marketed in a small way, are grown more for the interest they possess, and to

increase the variety of fruits placed upon the home table.

One of the most remarkable features of California is its wide diversity of climatic conditions, embracing comparatively humid, frost-free localities near the sea-coast, arid but frost-free locations in the foothill regions several miles back from the ocean, and interior valleys whose climatic conditions are little different from those of the Sahara, as well as the cooler portions of the State where the temperate fruits are grown to perfection, and mountain slopes where Conifers flourish up to the point of perpetual snow. Obviously, such a range permits the cultivation of nearly all fruits except the most delicate of the equatorial belt, the absence of uniformly high temperatures throughout the year prohibiting the successful cultivation of such species as the durian, mangosteen, and rambutan. And while our horticulturists have been somewhat slow in following up their advantage, they are at last awakening to a realization of their strategic position, and pushing forward in all directions.

Every quarter of the globe has been laid under contribution to furnish its most interesting and valuable fruits to California. Many of these introductions have not yet passed beyond the experimental stage, having been too recently imported to have produced fruit yet or to have fully proved their adaptability to our climate and soil, but they, nevertheless, show promise of eventually becoming valuable additions to our economic flora. The following species, for many of which we are indebted to Dr. F. Franceschi of Santa Barbara, whose twenty years' work of introduction and acclimatization has added many beautiful and valuable plants to Californian gardens, are some of the most interesting of this class:

Achras Sapota Linn., Antidesma Bunius Spreng., Britoa acida Berg, Byrsonima crassifolia H. B. & K., Calodendrum capensis Thunb., Castanospermum australe A. Cunn. & Fraser, Clausena Wampi Oliver, Coccoloba caracasana Meissn., Crataegus mexicana Moc. & Sesse, Cupania sapida Voigt (properly Blighia sapida Kön.), Eugenia alba s Roxb. (properly E. javanica Lam.), E. brasiliensis Lam., E. cauliflora Berg, E. costaricensis Berg, E. edulis Vell., E. littoralis Planch., E. Luma Berg (properly E. apiculata DC.), E. Mato Griseb., E. pungens Berg, E. pyriformis Cambess., E. Uvalha Cambess., Ficus Pseudo-Carica Miq., Flacourtia Ramontchi L'Hérit., Greigia sphacelata Regel, Lucuma mammosa Gaertn., Malpighia mexicana A. Juss., Melicocca bijuga Linn., Myrtus Arayan H. B. & K., Nephelium Lit-chi Cambess., N. Longana Cambess., Passiflora ligularis A. Juss., Psidium cuneifolium Tenore, P. Friedrichsthalianum Niedenzu, P. laurifolium Berg, P. littorale Raddi, P. montanum Sw., Rollinia emarginata Schlecht., R. orthopetala A. DC., Strychnos spinosa Lam., Vangueria edulis Vahl (properly V. madagascariensis J. F. Gmel.), V. infausta Burch., Vitellaria multiflora Radlk. (properly Lucuma multiflora A. DC.), Xylosma Salzmanni Eichl.

Leaving these out of consideration, the following list describes the ctual situation with regard to those which have become so well established as to be offered by the trade:—

#### THE AVOCADO (Persea gratissima Gaertn.).

During the last few years the Avocado has attracted so much attention in California that it is rapidly assuming a position of importance among commercial fruits. Although introduced about 1870, it was scarcely known until after 1900, and only seedlings were grown until four years ago. Since it does not come true to variety when grown from seed, it was recognized that cultivation on a commercial scale would only be made possible through vegetative propagation. Budded trees are now being produced, and many have been planted.

The exact area in which the Avocado can be grown has not yet been determined, but it has been found to do well in the Citrus belt and coastal regions of the southern part of the State. Since its success elsewhere depends largely upon obtaining hardier and more drought-resistant types, a definit search has been made for such types in Mexico, with the result that varieties have been secured that will, without doubt, greatly extend the area in which the fruit can be profitably grown.

Most of the trees now in bearing are of Mexican or Guatemalan prigin. The type from Guatemala (fig. 131) appears to be the most desirable for commercial purposes, on account of its thick, woody skin, which permits the fruit to be shipped to distant markets. The smaller, thin-skinned type from Mexico (fig. 133), considered a distinct species, *P. drymifolia* Cham. & Schlecht., by some botanists, is not so valuable commercially, but is a favourite for home use. Of both these types there are numerous named varieties, some of the most prominent being 'Taft,' 'Lyon,' 'Murrieta,' and 'Chappelow.'

Propagation by shield budding is somewhat more difficult than with Citrus fruits, probably because it is not, as yet, so well understood, but several nurserymen are producing budded trees in large numbers. Grafting, when done under glass, is also successful and is

practised to a limited extent. Seedling stocks are ready for budding at the age of six or seven months, when grown under favourable conditions, and are worked in spring or summer.

Avocados command fancy prices in the markets, single fruits fetching as high as \$1.25 in the winter season, although the average price for a good specimen, about a pound in weight, is 50 or 60 cents. The two types bear at different times of the year, and this, with the variation in season of the different varieties, permits the fruit to be in market for about ten out of the twelve months.

#### THE CHERIMOYA (Anona Cherimolia Mill.).

Although introduced at about the same time as the Avocado, the Cherimoya (figs. 132, 135) has not yet become commercially popular. This can only be attributed to the fact that propagation by seed has resulted in a large majority of the trees being inferior or worthless Several small seedling orchards have been planted and later grubbed out because the trees did not produce enough fruit to make their culture profitable. Budding is now being practised, and prolific and otherwise desirable varieties are being planted. The cool climate of the coastal regions of southern California seems to be especially suited to this fruit.

As yet only two named varieties are known; of one, the 'Golden Russet,' a small plantation of budded trees is now in bearing. There is no disputing the fact that the Cherimoya, in its finer varieties, is one of the most delicious of all fruits, consequently the future of Cherimoya culture, now that propagation by budding has placed it on a sound basis, looks very bright.

#### THE DATE (Phoenix dactylifera Linn.).

Experiments carried out by the Department of Agriculture and by various private growers have demonstrated that the date palm is admirably adapted to the Imperial and Coachella valleys, in the southern end of the State, where climatic conditions are practically those of the Sahara. Palms have been in bearing for some years, and through the importation of offshoots and planting of seedlings an industry is being rapidly developed. Nearly 25,000 offshoots have been imported, about 9000 having come from the Persian Gulf region and the remainder from North Africa. Varieties from practically all the principal date-growing regions of the world have been planted experimentally, and an accurate idea gained as to their adaptability. The 'Manakhîr' from Tunis, 'Deglet Nur' from Algeria (fig. 136), and 'Maktum,' 'Khustawi,' and 'Khadrawi' from Mesopotamia have proved to be among the best.

# THE MANGO (Mangifera indica Linn.).

The progress of the Mango (fig. 137) in this State has been retarded by the planting of worthless seedlings, and by neglect of many of the trees. In a few localities fruits of good size and flavour have been produced, demonstrating, at least, that Mango culture is not an impossibility here. Locations in the foothill regions, which experience a high degree of heat throughout the summer, have proved to be best suited to the Mango, the climate along the coast being too cool during the summer to ripen the fruit perfectly.

The Department of Agriculture is now conducting co-operative experiments in several localities thought to be suited to Mango culture, about forty varieties being on trial. Many of these were introduced from Saharanpur, Bombay, and other sections of India famous for their Mangos, and are the best Indian varieties.

#### THE LOQUAT (Eriobotrya japonica Lindl.).

The Loquat has been grown in this State for forty years, with considerable attention recently given to its improvement. Seven or eight named varieties are now offered by the trade. The climate in some parts of the State seems particularly suited to it, and the fruit develops to large size.

Loquat culture is most prominent in Orange county, the largest single plantation being about forty acres in extent. Early in the season the fruit sells at 10 to 15 cents a pound, and many tons are marketed each year.

Propagation is by budding, seedling Loquats being generally used as stocks. When budded on quince the trees are dwarfed.

The best varieties of local origin are 'Advance,' 'Premier,' and 'Champagne.' A variety introduced from Japan some years ago under the name of 'Giant,' but seemingly synonymous with 'Tanaka,' is later in ripening than the local varieties, but of large size and excellent quality.

# THE GUAVAS (genus Psidium).

The only species at all common is *P. Cattleianum* Sabine, which goes under the name of Strawberry Guava, and is found in backyards and gardens throughout the southern part of the State. The fruit is a favourite for jelly-making, and is widely sold in the markets. A yellow-fruited form of this species, *P. lucidum* of horticulture, is much less common, but fully as valuable.

P. Guajava Linn., of which there are here, as elsewhere, a number of more or less distinct varieties, is not infrequently seen, and is hardy enough to be successfully grown in many localities. It is difficult to explain why it has not become more popular, since the fruit is preferable

for jelly-making to that of the Strawberry Guava.

Several other species are occasionally seen. One somewhat similar in general appearance to *P. Cattleianum* was introduced from Florida under the name of *P. Araça* Raddi, and is likely to become popular, as the fruit is of good size and flavour. Another species introduced from Florida is listed as *P. guineense* Sw., but it is certainly not this species, and is so similar in every characteristic to *P. Guajava* that it can probably be referred to a horticultural form of that species.

THE WHITE SAPOTE (Casimiroa edulis La Llave).

This was the first tropical fruit planted in California, having been introduced by the early Mexican settlers (fig. 138). It has never become very popular, and is not commonly cultivated, the greatest drawback being that seedling trees require nine or ten years to come into bearing, and are even then very uncertain as to the size and quality of fruit they will produce. Attempts at asexual propagation are now being made, in order to perpetuate choice varieties originated as chance seedlings. So far only seedlings have fruited, and it is not known that any of their fruit has ever been placed on the market.

THE FEIJOA, OR PINEAPPLE GUAVA (Feijoa Sellowiana Berg).

Although recently introduced, the Feijoa (fig. 134) is already widely planted and is becoming more popular every year. Its hardiness permits it to be grown almost anywhere in California, although it does not seem to thrive in the extremely hot interior valleys.

Most of the plants now growing in the State have been propagated from seed, but to perpetuate choice forms it is necessary to resort to vegetative propagation. Cuttings are not difficult to root, and grafting is successful; layering is the easiest method, but is too slow ever to be popular.

Three named varieties have been established, of which the best is probably the 'André,' the plants grown here having been propagated from the specimen in the garden of the late Edouard André, at Golfe-Juan, on the Riviera.

# THE ROSE APPLE (Eugenia Jambos Linn.).

This species has proved to be quite hardy in southern California, but is planted more for its ornamental value than for its fruit. There is much difference among the plants, some producing larger, more highly coloured and highly perfumed fruits than others, perhaps due in some measure, but not entirely, to the care bestowed upon them.

E. uniflora Linn. (E. Michelii Lam.), another member of the genus of economic value, is not up to the present time a success as a fruiting plant. Although it is apparently at home in this climate, the plants produce too sparingly to be of any value. The same appears to be true of E. Jambolana Lam.

# THE JUJUBE (Zizyphus sativa Gaertn.).

For the interior arid valleys the Jujube is proving of value, and, through the introduction of the choice Asiatic forms recently secured by the Department of Agriculture, it seems likely to become of real importance. Practically all those which have been grown up to the present time are inferior seedlings.

### THE PASSION FRUIT (Passiflora edulis Sims).

The abundance of better fruits with which Californians are supplied has prevented the passion fruit from becoming popular. It is hardy, and not infrequently seen in gardens, but the fruit is rarely used.

#### THE NATAL PLUM (Carissa grandiflora A. DC.).

This shrub bears too sparsely to make it of economic importance, but its ornamental value has stimulated planting to such an extent that it is occasionally seen in gardens and collections of exotics. There seems to be considerable variation among the different plants in regard to productiveness as well as size of fruit, and taking advantage of this it should be possible to secure, through asexual propagation, varieties that will be worthy of general cultivation.

#### THE POMEGRANATE (Punica Granatum Linn.).

The Pomegranate is produced commercially in a small way, the demand for the fruit being limited. The shrub succeeds best, and is most commonly grown, in the interior valleys. The inferiority of the varieties cultivated in the State has led to an attempt to secure superior ones; among those which have been introduced the variety 'Wonderful' has proved to be choice, and is now offered by the trade.

#### THE JAPANESE PERSIMMON (Diospyros Kaki Linn.).

This fruit is becoming quite popular, and is proving correspondingly remunerative to the growers. The varieties most extensively grown are 'Tane Nashi' and 'Hachiya.' From one grove of six acres over 15 tons of fruit were picked last season, which sold at 10 to 12 cents a pound.

# THE PINEAPPLE (Ananas sativus Schult.).

At several different times attempts have been made to grow pineapples commercially in southern California, but these have always resulted unsuccessfully, since an excessive amount of care and expense was required in the production of the fruit, and it could not be sold at a profitable figure in competition with the imported product.

Pineapples require more heat than is found on the sea-coast to develop to large size and perfect maturity, consequently they are more successfully grown in the foothill regions some miles back from the ocean. 'Red Spanish' and 'Smooth Cayenne' are about the only varieties cultivated, and these are rare.

# THE TREE TOMATO (Cyphomandra betacea Sendt.).

This plant is occasionally seen in gardens, but the fruit is usually allowed to fall to the ground and go to waste. Its easy culture has made it more widely planted than would otherwise have been the case, but as a fruit it is in no likelihood of becoming very popular.

# THE KEI APPLE (Aberia caffra Harv. & Sond.).

As grown in California this is a fruit of little value, and in addition bears very sparsely except in rare instances. It has proved to be quite hardy, and seems to be of considerable value as a hedge plant, but its cultivation is not being extended very rapidly.



Fig. 131.—Avocado of the Guatemala type.



Fig. 132.—Cherimoyas of different types grown in Southern California.



Fig. 133.—Fruits and Foliage of the Mexican type of Avocado.



Fig. 134.—Fruits and Foliage of Feijoa Sellowiana.



FIG. 135.—CHERIMOYA TREE, FIFTEEN YEARS OLD, AT HOLLYWOOD, CALIFORNIA.



Fig. 136.—Plantation of "Deglet Nur" Dates at Heber, California.



Fig. 137.—Young Mango Tree in Bearing at Los Angeles, California.

#### THE PAPAYA (Carica Papaya Linn.).

The Papaya is one of the tropical fruits which Californians seem most anxious to grow, and many seedlings are annually planted. Most of these succumb during the cold rains of winter, but in favoured locations, with well-drained soil, the plants sometimes reach maturity and bear fruit. Old plants exist at Hollywood which bear regularly, but the summers are not hot enough in this locality to mature the fruit perfectly. Further inland, in locations practically free from frost, better success is attained. The whole subject, however, is in an experimental stage as yet.

#### THE KAFFIR PLUM (Harpephyllum caffrum Bern. ex Krauss).

This South African tree, introduced about eight years ago, is chiefly valuable as an ornament. Although it has fruited in several localities, it does not produce regularly or abundantly, and the fruit itself is of little value. It seems hardy enough for ordinary locations, and has been planted to a small extent as a street tree.

#### THE CERIMAN (Monstera deliciosa Liebm.).

Fairly common as an ornamental plant in ferneries and pergolas, its fruit does not ordinarily ripen sufficiently to be eatable, although it is freely produced and attains good size.

#### THE BANANA (Musa sapientum Linn.).

In favoured locations in southern California good bananas have been produced, one grower at Santa Barbara even going so far as to cultivate a small commercial plantation for several years. The banana is one of the commonest ornamental plants to be seen in dooryards and gardens but in ordinary locations the fruit does not ripen perfectly and is of no value. In addition, the varieties cultivated are practically all inferior ones.

# THE CHINESE RAISIN (Hovenia dulcis Thunb.).

Although usually listed as a fruit, this species as grown in California has no economic value whatever, and, although offered by several nurserymen, is rarely planted.

# THE QUEENSLAND NUT (Macadamia ternifolia F. v. M.).

The drought-resisting qualities of this tree make it of value for semi-arid regions, while its ornamental appearance commends it for culture in every garden. While very few trees are yet in bearing in the State, several thousand young plants have been disseminated by the nurserymen within the last few years, and the tree promises to become popular, not only for the home garden or orchard, but commercially as well.

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THE CAROB (Ceratonia siliqua Linn.).

The Carob is grown here almost exclusively as an ornamental tree, the inferiority of the local varieties, as well as the abundance of better fruits, preventing it from becoming of any economic value. While not common, it is rather frequently seen in gardens, and is sometimes used as a street tree.

THE MELON SHRUB (Solanum muricatum Ait.).

This is one of those fruits whose chief recommendation is the ease of its culture. Some profess a liking for the fruit, but as a general rule the plant is grown as a curiosity and the fruit is allowed to rot on the ground. It is rarely seen in Californian gardens.



Fig. 138.—A White Sapote at Santa Barbara, probably the first tropical tree planted in California.

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