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MINOR THESIS

LEADING FRUITS OF THE
LOWER GANGETIC VALLEY

Indu B. De Majumdar

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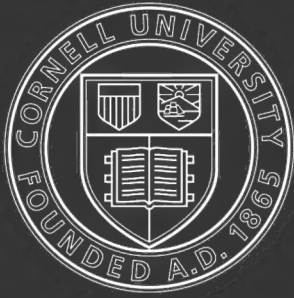
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A Monograph
on
THE LEADING FRUITS OF THE LOWER GANGETIC VALLEY

Minor Thesis
in the Department of Horticulture
For the Degree of Master of Science in Agriculture

Indu Bhushan De Majumdar

College of Agriculture

Cornell University

June, 1906

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The present monograph is the outcome of one year's study in the Department of Horticulture of the College of Agriculture of Cornell University. I beg leave to acknowledge my indebtedness to Professor John Craig who not only suggested to me the idea of devoting my time to the studies of the fruits of my country but also gave me kind guidance and wise advice from time to time during the pursuit of my studies.

INTRODUCTION

India consists of three separate and well defined tracts. The first includes the lofty Himalaya Mountains, which shut it out from the rest of Asia and forms an overruling factor in the physical geography of Northern India. The second region stretches southwards from the base of the Himalayas, and comprises the plains of the great rivers which issue from them. The third region slopes upward again from the edge of the river plains, and consists of a high three-sided tableland.

The second of these three regions, viz. the wide plains watered by the Himalayan rivers extend from the Bay of Bengal on the east to the Afghan frontier and Arabian sea on the west, and contains the richest and densely crowded provinces of the country. This vast level tract is watered by three distinct river systems, the Indus, the Ganges and the Brahmaputra. The present monograph covers only a small part of the second region, the Lower Gangetic Valley, including Calcutta, the metropolis of India. The original idea was to cover all the fruits of India but the limits of this thesis and the shortness of time rendered it impossible to do so.

India has been called the epitome of the whole world. A country having its length from north to south and its greatest breadth from east to west both equal to 1900 miles, thus covering an area equal to the whole of Europe minus Russia, and extending from the 8th to the 35th degree north latitude, that is to say, from the hottest regions of the equator to far

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within the temperate zone, India grows almost all the fruits and vegetables that are found anywhere else in the world.

By the Lower Gangetic Valley has not been meant any fruit growing region distinctly characteristic from the others ; in fact no well defined classification of the regions of India on the basis of fruit growing have yet been made. The fruits occurring in this valley cover almost all the leading tropical and subtropical fruits of India and excludes mainly the apples, peach and other fruits of temperate regions growing in the colder parts of India. The following tables of the temperature and rainfall of Calcutta will give a rough idea of the climate of the fruit growing area under consideration.

	Rainfall	Maximum temperature	Mean temperature	Minimum temperature
January	.44 in.	83° F.	65.1° F.	52° F.
February	.97	91	70.9	54
March	1.31	99	79.0	64
April	2.37	103	84.4	69
May	5.48	100	84.8	69
June	11.77	98	84.5	73
July	12.96	93	83.	76
August	13.94	92	82.4	75
September	9.92	93	82.4	75
October	5.42	91	80.1	68
November	.60	86	72.5	57
December	.32	81	64.9	52
Yearly average	65.50		77.9	

The following table gives the temperature of the soil of Calcutta at the surface and at the depth of 3 feet.

	Mean temperature at the surface	Mean temperature at a depth of 3 ft.
January	64.4° F.	72.5° F.
February	71.2	74.1
March	82.7	78.4
April	91.3	84.5
May	90.4	87.1
June	87.5	87.2
July	86.2	86.4
August	85.9	86.1
September	86.	89.1
October	83.2	85.2
November	73.3	81.
December	64.8	75.1
Yearly mean temperature	80.6	82.

In conclusion it may be said that there is no one book in which all these tropical and subtropical fruits have been treated at length. The facts lie scattered in different books, bulletins, ledgers and journals. I have tried to bring together these scattered facts and treat the subject in a systematic manner. But in doing so I have not been able to consult all the literature that has been written on the subject. My information is derived only from the books and reports that are to be found in the Cornell University Library and a few

others that have come within my reach from other sources. The following are the references which I have mainly consulted.

Tropical Agriculture, by P. L. Simmonds

Handbook of Indian Agriculture, by N. G. Mukerji

Indian Handbook of Gardening, by G. Speede

Flora of British India, by Sir J. D. Hooker

Origin of Cultivated Plants, by Alphonse De Candolle

Oranges and Lemons of India and Ceylon, by E. Bonavia

Handbook of Indian Botany, by Oliver

A Selection of Rare and Curious Fruits Indigenous to
Ceylon, by J. W. Bennett

The Nursery Book, by L. H. Bailey

The Cyclopedia of American Horticulture, edited by
L. H. Bailey

The Agricultural Ledgers and Journals of India

The Bulletins of the United States Department of
Agriculture and of the Division of Pomology

The Bulletins of the California and the Florida
Experiment Station

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CHAPTER I

Inventory of Fruits

Rutaceae

Orange, *Citrus Aurantium*
Citron, *Citrus Medica*
Lemon, *Citrus Limonum*
Lime, *Citrus Acida*
Sweet Lime, *Citrus Limetta*
Shaddock, *Citrus Decumana*
Bengal Quince, *Aegle Marmelos*
Wood Apple, *Feronia Elephantum*

Palmaceae

Cocoanut palm, *Cocos Nucifera*
Palmyra palm, *Borassus Flabelliformis*
Sugar Date, *Phoenix Dactylifera*

Anacardiaceae

Mango, *Mangifera Indica*
Cashew nut, *Anacardicum occidentale*
Hog plum, *Spondias Mangifera*

Myrtaceae

Rose apple, *Eugenia Jambos*

Malay apple, *Eugenia Malaccensis*

Guava, *Psidium Guyava*

Anonaceae

Custard apple, *Anona Squamosa*

Netted Custard apple, *Anona Reticulata*

Cucurbitaceae

Water melon, *Citrulus Vulgaris*

Muskmelon, *Cucumis melo*

Cucumber, *Cucurbita sativa*

Miscellaneous

Pineapple, *Ananas sativus*

Banana, *Musa Sapientum* (Musaceae)

Papaw, *Carica Papya* (Passiflorae)

Ponegranate, *Punica Gravatum* (Lyth

Litchi, *Nephelium Litchi*

Jack fruit, *Artocarpus Integrifolia* (Urticaceae)

Jujube, *Zizyphus Jujuba* (Rhmaceae)

Native olive, *Elaeocarpus Serratus* (Tiliaceae)

Tamarind, *Tamarindus Indica* (Leguminosae)

• Tropical almond, *Terminalia Catappa* (Combrataceae)

Averrhoa *Carambola* (Geraniaceae)

Rozelle, *Hibiscus Sabdariffa* (Malvaceae)

CHAPTER II

Rutaceae

Orange, *Citrus Aurantium* (Linn.)

Description and Habitat

Arboreous, rarely shrubby, young shoots glabrous greenish white, leaflet elliptic or ovate acute obtuse or acuminate, petiole often broadly winged, flowers pure white bisexual, fruit globose, generally white oblate not mamillate.

Hot valleys along the foot of the Himalayas, from Garwhal eastward to Sikkim, and in the Khasia Mountains.

A small slender tree, flowering in the rains and fruiting after them, growing in the very bottoms of valleys where it is according to Hooker, indigenous. The fruit there is somewhat flattened or nearly globose, about 2 inches diameter, high colored, and uneatable, being mawkish and bitter. The following are the principal cultivated varieties.

Varieties

Variety 1. *Aurantium* proper ; petiole naked or winged, pulp sweet yellow, rarely red--the sweet orange ; origin, China and Cochin China ; cultivated for less than two thousand years.

Variety 2. Bigardia. Petiole usually winged, flowers larger and more strongly scented ; rind very aromatic, pulp bitter. Wight and Arnott describe its oil vesicles as concave, in contradistinction to *C. Auranticum*, in which they are convex. This variety does not seem to be cultivated in India, except in gardens,-- the Bitter or Seville orange ; origin east of India, cultivated for more than two thousand years.

Variety 3. Bergamia; flowers small, very sweet scented, fruit globose or pyriform, rind smooth pale yellow, pulp acidulous with pleasant aroma. Rarely cultivated in India,-- the Bergamotte orange.

Cultivation of Oranges in the Khasia Hills, Assam, India

In the Khasia Hill, in one large connected piece of about 1,000 acres lie the groves of Shalla that supply a great part of Eastern as well as Western Bengal with oranges. One may walk for a good hour or two, always under the shade of orange trees, without reaching the limits of cultivation, and when, as in December and January, every tree is laden with ripe fruit, no sight can be more enjoyable. "I have been through the Sorrento gardens," says a horticulturist visitor, "but this beats Sorrento, and the Neapolitan orange growers would find some difficulty in selecting out of their entire plains, a piece at all approaching this."

The plantations commence from the plains and rise to an elevation of about 1,500 feet above the sea-level. Above these low hills and not far away, is the table land of Cherrapunji (elevation 4,500 feet), which enjoys the unenviable distinction of having the heaviest rainfall in the world. Orange trees are common enough in other parts of the district at an elevation of even 5,000 feet, but there the tree does not thrive so well as in the hot steamy climate of the lower hills; it takes a longer time to come into bearing, and the fruit is of inferior quality.

From their peculiar situation the gardens here have natural advantages which are seldom possessed by gardens elsewhere in the world. They are situated between a net work of small hill streams which overflow their banks during heavy downpours. Every part of the garden goes under water, not

infrequently five or six feet deep, or more, but the flood subsides within a few hours. Being situated on river sides, the soil naturally retains some moisture, even in the dry season, hence artificial irrigation is unnecessary.

The houses of the watchmen are raised on stout posts of jack wood, driven in deep. The house proper is fifteen feet above the level of the ground. During the flood, the pigs, dogs, fowls and goats take refuge on a lower platform, beneath the house proper.

The orange is said to do best on limestone soil. The fruit grown at Ty'na, where the soil rests on limestone, is reported to be the best grown in the district. The bulk of the crop is, however, grown on soils derived from siliceous rocks containing very little lime.

In the Shalla groves there are trees of considerable age that have lived out at least three generations of men. These old trees are great fruit bearers, some yield 1,000 oranges. Whatever may be their age, they never grow to a greater girth than three feet (about one foot diameter), or to a greater height than 20 feet.

Orange trees are invariably raised from seed in the Khasi Hills. The seed fruits are taken from trees selected for their good quality. They are plucked when fully ripe. After being pressed out of the pulp, the seeds are tested by immersion in water; those which sink are taken and those which float are rejected. The selected seeds are thoroughly washed and dried in the sun for two or three days. The seed must be

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burned. The burning kills everything at the time, except the trees that are left standing. But in March, as soon as some rain has fallen, grass and other deep rooted weeds shoot up, and are dug out. Nothing more is required to prepare the ground for receiving the plants. The land receives no cultivation whatever ; in fact the rocky nature of the ground makes any kind of cultivation impossible, and there is danger of the soil, if loosened, being washed away by the torrential rainfall to which the sides are exposed. The usual plan is first to plant out the clearing with plantain trees. These are planted in March, and begin to bear in fifteen to eighteen months after planting. The plantain clumps are allowed to remain on the ground for three years, at the end of which they cease to be productive and are dug out. In the meantime orange and useful trees are planted at intervals among the plantain trees. Before the time for removing the latter arrives, the other trees will establish themselves and cease to be in need of shade. The only treatment that the ground receives after it has been planted out is occasional weeding. Ordinarily, there are two cleanings during the year, one taking place in May after the spring rains which bring on a thick growth of weeds, and the other in October at the close of the rainy season.

The aspect of the land is matter of some moment to an orange garden. A garden with a northern aspect is shaded from the sun for a great part of the day. On such land, the fruits ripen late, remain longer on the trees and are not so sweet as those of a garden facing south which receives the full

sunshine. Late ripening is rather an advantage in point of the price obtained for the fruits.

Orange seedlings are ordinarily transplanted when two or three years old. The time for transplanting is May and June. Holes are dug at suitable intervals with a crowbar, or a thick pointed stick, and the plants are placed in them in a slanting position. No manure is used at the time of transplanting or at any other stage of growth. No fixed distance is observed in planting the trees, the ground being so uneven and full of rocks that planting at regular intervals is out of the question. Generally speaking, orange trees are planted about ten feet apart, but are often planted closer.

By the end of the rains, a number of leading shoots will have grown from the base of the plant. These are more vigorous and grow faster than the old stem which remains, more or less stunted, and often dies down altogether. At the end of two or three years the parent stem is pruned off, and one or two of the most promising shoots are preserved, and the rest cut off. The tree throws out a number of main branches a short distance above the ground. These ascend at an acute angle to the axis of the tree, and as they grow up almost vertically, they give to the tree a compact pyramidal shape not unlike that of a pear tree. The tree receives no further pruning till it comes into bearing.

Orange trees begin to bear from eight to ten years from the time of sowing the seed, sometimes twelve years or more in unfavorable localities.

The way the oranges are gathered in the Khasia Hills is this. A man with a net bag open at the mouth by a canering, and slung on the back by a strap passing over the right shoulder and chest climbs a bamboo ladder, plucks the oranges and puts them into the bag. Before descending with the hatchet knife sticking in his belt, all the dead and unproductive wood, and the twigs where they appear too thick are thinned out to admit light into the heart of the tree. Mosses and parasite growths are removed at the same time. The orange trees receive no other handling than the above when they come into bearing. They are never systematically pruned, or thinned, and are allowed to retain just what fruit they set, and yet the crop turns out wanting neither in size, flavor, nor abundance. Contrast with this the elaborate summer and winter pruning of the French and Genoese gardens, and the systematic cultivation of the gardens of Florida and California.

Heavy rain in April when the trees are in blossom is very injurious. Much damage is also caused at times by hailstones destroying the blossoms and young fruits.

Khasia oranges can be preserved in good condition for many months by placing them on a bamboo trellis suspended from the roof of the house with the wind blowing through. The fruits must be sound, fully ripe and very carefully plucked, so as not to be bruised or injured in any way. They are placed thinly in the trellis, no two fruits being allowed to touch each other. From time to time the fruits are turned over, and those which appear unsound are thrown away. Treated

in this manner, the fruits remain good for many months, almost till the next orange season comes round. The skin looks dry, but the pulp remains juicy and sweet ; in fact, it gains in sweetness by keeping.

Cultivation of Oranges in the United States

Propagation

Orange stocks are grown from seeds, which are cleaned and stratified in sand or other material, until sowing time. The seeds are not allowed to become hard and dry. Some prefer to let the seeds sprout in the sand and then sow them in the nursery, but they must be carefully handled. The seeds are usually sown in seed beds, and the seedlings are transplanted the next autumn or spring into nursery rows. Care must always be exercised in handling orange plants, as they are often impatient of transplanting. Oranges grow readily from cuttings, although cuttage is not often practiced. Layers are sometimes made.

The named varieties are shield budded upon other stocks. Grafting can be practiced, but it is often unsatisfactory. The nursery stocks are commonly budded in the spring, after having grown in the rows one year, which is two years from the sowing of the seed. If thorn-bearing varieties are to be propagated, a thorn with a bud in its axil is often cut with the bud, to serve as a handle in place of the leaf stalk, which is used in summer budding. Many stocks are used for the orange. The leading ones are sweet or common orange

(*Citrus Aurantium*), sour orange (*C. Aurantium*, var. *Bigardia*), pomelo (*Citrus Decumana*), Otahelie orange, trifoliate orange (*Citrus*, or *Aegle trifoliata*), and various lemons, as the "French" or Florida Rough and the Chinese.

Experiments in California have shown that the sweet orange root is a persistent surface feeder, having almost its entire root system above a depth of eighteen inches and rising to within eight inches of the surface. The stock produces an abundance of fibrous roots that concentrate near the surface, just beneath the reach of the plough and cultivator, thus making the tree too susceptible to draught.

On the other hand, the root of the sour orange penetrates to a depth of nine feet or more, sometimes having numerous laterals near the surface, and sometimes having fewer but more sharply descending laterals. Both a deep root system and broadly extending laterals, not too near the surface, are essential to the ideal stock. There would seem to be room for some selection among sour stocks so as to obtain these qualities in the highest possible degree. Though the sour stock does not appear to bring stocks into full bearing as soon as do the sweet orange and the pomelo stocks, the value of the sour stock in other directions may compensate for this defect, and in localities when the sweet stock fails, the sour stock may be advantageously used. The sour stock is obtained from wild seeds, this variety having extensively run wild in Florida from early times.

The pomelo laterals are found at a somewhat greater depth

than the laterals of the sweet orange and it produces more fibrous roots than do either of the other stocks, and consequently the tree is a ravenous feeder. It is resistant to a certain extent to the form of gum disease that attacks the roots of citrus trees. On the whole, the pomelo is deservedly becoming the favorite stock in Southern California. In practice it has succeeded better at the station than has the sour stock, which seems to lack uniformity of root growth, sometimes having few laterals, in which case the crops are small. The pomelo seedlings have made the greatest growth in the nursery.

The trifoliate and Otaheite stocks are used for dwarfing or for small growing sorts, as many of the Japanese varieties. The trifoliate orange is also one of the hardiest of the orange stocks.

Old orange trees can be top-budded with ease. It is advisable to cut them back a year before the operation is performed, in order to secure young shoots in which to bud.

The Rowell method of propagating the orange, named after its inventor, is given here as the process is almost startling in novelty, and yet very simple. Cuttings $1/4$ to $1/2$ inch in diameter and 10 or 12 inches long, are taken from any healthy citrus tree, and buds of any desired variety are put in them. This is done in the house or barn, and as the cuttings are budded they are placed in boxes and lightly covered with soil. There they remain until wanted for planting. The cuttings will form roots, but the buds will remain dormant until the

cuttings are transplanted, whether that be three weeks or three years.

When planting in grove form, the cuttings are placed in a vertical position if seedling trees are to be imitated, or in an almost horizontal position if it be the grower's intention to plant close and produce small trees ; and when the object is to dwarf the trees, the cuttings are almost inverted. In either case, the cutting is entirely covered with soil, except the portion occupied by the bud, which is protected by a small cylinder of zinc, two or three inches long, which is fitted to the cutting and protrudes through the soil, giving light and air to the bud. This is removed, however, when the bud attains a height of 10 or 12 inches, and the soil is then drawn up around the bud. The subsequent cultivation is the same as with trees propagated in the usual way. Mr. Rowell's three year old grove in Florida produced by this method yielded its first crop over 300 oranges to the tree in some instances.

Methods of Planting Orchards in California

The land chosen for the site of an orange grove should be surveyed and well graded wherever necessary, so that water will flow from every part of the tract from the main pipes or ditches. It ought to be thoroughly worked, at least a foot deep, ploughing twice and harrowing well ; a subsoil attachment can be used to loosen the soil several inches below the bottom of the plough furrows. The orange tree requires a warm, rich, and well-drained soil, which receives the best of

cultivation. The water system must be under complete control, so that waste and over irrigation can be avoided. The soils of the orange sections vary considerably in respect to the percentage of sand, decomposed granite, limestone, or red oxide of iron which is claimed to give high color to the fruit, but all are suited to irrigation and have a porous well-drained subsoil.

(1) The Ordinary Transplanting Method. The almost universal method of moving young orange trees from the nursery is to cut off a large part of the top, leaving short stubs of branches, and even from these the leaves are sometimes stripped. This, of course, is to balance the loss of a large part of the root system at the time of transplanting and to lessen evaporation. Twenty or thirty gallons of water are usually given to each tree at the time of planting. If the leaves do not fall after the trees have been planted a short time, but show a disposition to turn yellow, they should be removed.

(2) The Reed System of Transplanting. Much better results are obtained by the method adopted by one Mr. Reed of California. According to his method vigorous trees are selected in the nursery, and are well watered before removal. The longer branches are but slightly cut back, leaving most of the foliage on. The trees are then lifted with large balls of earth, and are taken directly to the plantation, where holes two feet deep and two and a half feet wide have been prepared, into which they are placed, and the earth is well filled in around each ball, not firmed, but settled with water, so that

the trees will stand at the same height as they did at the nursery. No planting should be done unless there is irrigation water available at the time. After the ground has been soaked for several feet on all sides of the newly set trees, thorough cultivation should follow, as soon as the land is in a proper condition. Under any system of transplanting this is good practice.

A small amount of fertilizer is applied soon after planting, for the young roots to use when they first start out from the balls. A pure bat guano, with a high percentage of nitrogen, about three-fourths of a pound to the tree, has been found to give the best results ; but any commercial fertilizer rich in nitrogen, or animal fertilizer, if placed properly and kept moist, answers well. It is applied in trenches each side of the ball, at right angles with the irrigation furrows, and reaching to them. They may be made by ploughing a deep furrow and deepening with a shovel to ten or twelve inches. The material is carefully distributed and slightly mixed with earth at the bottom of the furrows ; the water from the irrigating furrows keeping this always moist, it is available as soon as reached by the rootlets. This also tends to deep rooting. Thorough irrigation should follow planting every twelve or fifteen days during the first summer. The whole space between the rows should be thoroughly and deeply wet--not merely a narrow strip on each side of the rows. Roots have been found to grow during the first summer over six feet from the tree, and these should be well supplied with moisture at all times.

The advantage claimed for the Reed method is that it retains the top of the tree, and makes use of it immediately. This retention of nearly all the leaves and branches enables trees under proper conditions to produce a much more vigorous growth than under the ordinary system of severe pruning, when moved from the nursery. The best of care is essential to success in this method. If trees are to receive poor or only ordinary treatment after being set in the orchard, the common method of severe pruning is best. Mr. Reed himself prunes back any trees that show lack of vigor after being transplanted, watered, and fertilized.

The good start given to trees by the Reed method is shown in their size, vigor, and productiveness for an indefinite time, and it is also claimed that a crop of oranges is obtained, without injury to the trees, one year earlier than if they were planted by the usual method. Trees thus planted (on the Reed system) produced over one hundred boxes of oranges per tree three years from the time of planting. Ten acres of trees five years old produced 2,500 boxes. There was no appreciable injury done the young trees on account of the early bearing, for they continued to make a sturdy growth while maturing the crop of fruit. Trees planted in the usual way one year before, on adjoining land that is similar in character, although receiving good care from the start, were not as large as those of Mr. Reed, though apparently thrifty.

(3) The "Post-hole" Method. There is another new system of planting orange trees that is being used at the Southern

California Substation, but practical work has not been carried on long enough to demonstrate its real value. In this method, holes are bored with a post-hole auger in the bottoms of the regular sized tree hole, to a depth of five or six feet. They are filled up to the point at which the bottom of the tree rests with peat or well prepared compost, thus affording good drainage. The roots, it is thought, will follow this rich soil downward, and thus establish a deeper root system. In selecting a soil for any "post-hole" planting, it is very important to remember that young orange roots are easily injured by alkali or strong fertilizers, and care should be taken to avoid an injurious compost or one that prevents free drainage.

Pruning and Shaping Trees

The tendency of young trees of several varieties of oranges to assume a drooping habit when making a vigorous growth is due to the fact that the soft shoots are unable to support the weight of the large, heavy leaves. The remedy lies in pinching back the shoots which will then begin to straighten up.

Even trees that have been long in bearing will be benefited by pinching back every **branch** that takes too vigorous an upward growth. This pinching process is especially necessary with trees from one to five years old.

Pruning Bearing Trees. The advantage of an upright tree over a drooping one is considerable when it becomes loaded

with fruit. The crop is borne with less breakage of limbs, and not so much fruit is injured by the wind. After they are in full bearing, there seems to be no pruning that will promote the health of the trees or improve the crop, other than cutting out limbs that project abruptly from the side, or those that make a sudden skyward growth, and the constant trimming out of dead or stunted wood that is found on the inside of the trees.

If too close, the branches of a tree should be thinned out from the inside until the sunlight has had free access. This does not make any noticeable difference in the appearance of the tree, but makes it bear fruit on the inside. Such fruit is safe from sunburn and frost, and packs as "fancy" grade. By early attention to pruning, the trees need never be allowed to grow too close in the centre.

Renewal of Tops. There are some groves of old orange trees that do not respond to the best treatment that the owners can give them. Under such circumstances the most effective way to stimulate new life and vigor is sometimes to remove the entire top, leaving enough of each of the main limbs to distribute equally the suckers that will afterwards make the new top of the tree. An old orange tree will rapidly produce a new top, even when cut back to a mere stump. It is soon in a condition to bear again at its full capacity. When the roots are healthy and the soil is properly cultivated and fertilized, the orange tree appears able to produce several generations of tops on one stock. But it will generally be

found that the trouble with old, non-productive trees lies in the root system, or in the management of soil or in both. Thorough investigation of roots and soils should be made before any severe cutting or pruning of top is resorted to.

Except as noted above, all trees should be trained low for protection against frost, heat and wind, and to aid the gathering of fruit. Heavily laden branches are generally propped to prevent breaking down, as the loss from dropping and splitting is so great that the trees cannot be safely lightened by thinning of fruit when small.

Citron, *Citrus medica* (Linn.)

Description and habitat

Young shoots glabrous purple, leaflets glabrous, flowers often unisexual, petals generally more or less pink, fruit globose ovoid or oblong, often mamillate at the apex.

Valleys along the foot of the Himalayas from Garwhal to Sikkim, ascending to 4,000 feet, the Khasia Mts.; Garrow Mts.; Chittagong, Western Ghats and Satpura range in Central India.

A shrub or small tree, flowering and fruiting at most seasons, growing when Hooker found it on steep hillsides (in Sikkim). Leaflet 3-6 inches, elliptic ovate or ovate lanceolate ; petiole naked or winged. Flowers 5-10 in a raceme, small or middle sized. Stamens 20-40. The following are the principal varieties, of which Hooker found one truly wild in Sikkim, with an oblong leaflet 4 in. long, margined petiole,

pink flowers 1 in. long, narrowly ellipsoid, rough fruit 7 in. long, of which the upper 2 in. are contracted into a long conical mamilla, the rind is very thick, and the pulp pale yellow. The petals pass into stamens, which would suggest its not being indigenous, but Hooker did not doubt its being so when he gathered it, mainly on dry sunny slopes totally unsuited for any kind of cultivation, where it formed large bushes.

Varieties

Variety 1. *Medica proper* ; leaflet oblong ; petiole short, margined or not ; flowers usually numerous, fruit large, oblong or obovoid, mamilla obtuse, rind usually warted, thick, tender, aromatic, pulp scanty subacid--the citron (Bengali-Jambir); origin India, cultivated for more than two thousand years.

Variety 2. *Limonum* ; leaflet ovate, petiole margined or winged, fruit middle sized ovoid yellow, mamillate, rind thin, pulp abundant, acid--the lemon (Bengali-Gora lemboo): origin India, cultivated for more than two thousand years.

Variety 3. *Acida* ; leaflet elliptic oblong, petiole many times shorter than the leaflet, linear or obovate, racemes short, flowers small, petals usually 4, fruit usually small globose or ovoid, with a thick or thin rind, pulp pale, sharply acid. The large fruited sorts of this appear to assume the form of the citron, and the small to approach the West Indian lime, which is however described as a bush with

white flowers;-the sour lime of India (Bengali-Kagji, and Patilimboo)

Variety 4. Limetta ; leaves and flowers as in var. acida, fruit globose, 3-5 in. diameter, rind thin, smooth, juice abundant sweet not aromatic,-- the sweet lime of India. (Bengali Sharbatilimboo.)

The citron and the lime are usually propagated by seeds or by layers ; the latter as the most expeditious being generally preferred. Some varieties are budded upon strong seedlings. The named sorts of lemon are budded upon either orange or lemon stocks. Orange stocks are probably most generally preferred, as they are adapted to a great variety of soils, and vigorous trees nearly always result. The budding is performed in the same manner as upon the orange. Stocks for budding upon are sometimes grown from cuttings.

The lime is rather slow in fruiting, frequently going to the fourth or fifth year without showing blossom, whilst the lemon will yield fruit in the second year.

Pomelo, *Citrus Decumana* (Linn.). Synonyms--grape fruit, shaddock.

Origin

Pacific Islands to the east of Java, cultivated for more than two thousand years.

Description and Habitat

Young shoots pubescent, leaflet large ovate-oblong, frequently emarginate, pubescent beneath, petiole broadly winged, flowers large white, stamens 16-24, fruit large pale globose or pyriform, rind thick, pulp pale, sweet or acrid.

Commonly cultivated in India. A native of the Malaya and Polynesian Islands.

A tree 30-40 ft., leaflets 6-9 in. Fruit often very large, pulp yellow pink or crimson, sweet or acrid, vesicles distinct.

Nomenclature

The word has been variously spelled pummelo, pumalo, pumelo, pumelow, etc., but pomelo is the spelling recognized by the United States Department of Agriculture, the American Pomological Society and other distinguished bodies.

In regard to the origin of the name Bonava in his "Oranges and Lemons of India and Ceylon" makes the following remark : "The word pummelo is, of course, a corruption of the Dutch **Pompelmoes** through Pummeluose, by first making it Pummelos and then turning it into the singular "Pummelo." To the French the fruit is known by the name of **Pompelouse**. Rumphius in 1750 applied the Dutch name **pompelmoes** to the fruit. Pomelo is considered by some to be a contraction of pomum melo, the melon apple.

Commercially in America the fruit is known as grape fruit. This appellation was given because the fruit is so frequently

borne in grape like clusters of from three or four to a dozen and a half.

Shaddock, variously spelled Shaddoc, chaddock and chadec, was an English sea captain, who, according to Miller, carried a variety of Citrus Decumana to the West Indies, and from him it took the name Shaddock, by which it has since been commonly known and referred to by different writers.

The fruit now designated by the name Shaddock, considered horticulturally, is entirely distinct from the pomelo, but, botanically considered, the two cannot be separated; they belong to one species. The term Shaddock is more properly applied to the large, pyriform, or necked varieties. Also the fruit of the Shaddock is much the larger, often weighing fifteen pounds or more, the tree is smaller, the leaves on full grown trees are somewhat larger.

Fertilizer Requirements

The following analyses and measurements, etc., of the pomelo were made by the Florida Experiment Station. Six varieties were taken and in each case the analysis was made from ten fruits, which were well developed and fully ripe.

The average weight in grams varied from 430.92 grams (15.2 oz.) to 742.77 gms. (26.2 oz.), the diameter from 3.00 to 3.75 inches, number of seeds from 37.3 to 67.2, the pulp from 65.16 to 74.72 per cent, the rind from 20.93 to 31.82 per cent, the seeds from 3.02 to 4.35 per cent.

The percentage of phosphoric acid in the pulp varied in

the six varieties from .033 to .050, potash from .195 to .226, nitrogen from .055 to .101.

The percentage of phosphoric acid in the rind varied from .029 to .043, potash from .240 to .350, nitrogen from .073 to .108. The percentage of phosphoric acid in the seed varied from .270 to .360, potash from .430 to .460, and nitrogen from .850 to 1.130.

In every instance the percentage of phosphoric acid, potash and nitrogen was highest in the seed. The percentage of phosphoric acid was in almost every instance higher in the pulp than in the rind, while the percentage of potash was always higher in the rind than in the pulp. The percentage of nitrogen was higher in the rind than in the pulp, except in one variety, and even there the excess was very slight, .003 of one per cent.

The total percentage of phosphoric acid, potash and nitrogen in all the parts of the fruit, pulp, rind and seed combined were as follows:

The phosphoric acid varied in the six varieties from .040 per cent to .056 per cent, the potash from .213 per cent to .251 per cent, and the nitrogen from .085 per cent to .119 per cent. The average percentages in the six varieties were as follows : .050 per cent phosphoric acid, .237 per cent potash and .110 per cent nitrogen.

To make practical application of the above analyses we will assume that the average weight of a box of pomelos is 80 pounds and find the amounts of the three important plant

constituents removed by ten boxes of fruit, 800 pounds. In ten boxes there will be taken from the grove and subsequently sold in the market .40 pounds of phosphoric acid, 1.90 pounds of potash and .88 pounds of nitrogen. Now, if each tree bears ten boxes of fruit, these amounts must be supplied to make fruit alone, to say nothing of the amounts required to make wood growth.

Suppose we select as our fertilizing materials acid phosphate, containing 14 per cent available phosphoric acid, high grade sulphate of potash, containing 50 per cent available potash, and nitrate of soda, containing 15 per cent nitrogen. Of these materials then will be required as follows : acid phosphate, 2.85 pounds ; high grade sulphate of potash, 3.8 pounds ; and nitrate of soda, 5.86 pounds. This gives in all 12.51 pounds of fertilizer.

Of these amounts a certain portion is gathered from the soil, but in giving the weights as above no allowance has been made for the materials obtained from this source. It is deemed best to supply these amounts for the fruit and make the necessary deduction from the amounts required to make wood growth. On the other hand no increase has been made to counterbalance the losses from leaching, etc. All these things have to be taken into account.

Uses

The pomelo is much esteemed as a dessert fruit, and has the reputation of being an excellent digestive. It contains sugar and citric acid, with much essential oil in the peel.

Propagation

In Jamaica this fruit tree is propagated from seeds, or by budding on the rough lemon stock. It grows in company with the orange, and requires the same treatment, it is not, however, so liable to disease as the orange, nor is it so much affected by scale and other troublesome insects.

Culture

In no place in the world has the culture of the pomelo reached such perfection as in Florida, where it is an important commercial fruit. Its cultivation as a market fruit has been extended from Florida to California and Jamaica, and it is perhaps only in these localities as yet, where any of the varieties of pomelo are grown on a commercial scale.

In Florida the pomelo is, in general, cultivated and manured the same as the orange. They are ordinarily planted about 30 feet apart. It is usually budded either on its own stock or on that of the sweet orange or sour orange. Many growers think that it gives best results when budded on its own stock, and this is very extensively practiced in Florida.

Uses and Commercial Products of the Citrous Fruits

The juice of the fruits, the orangeade, limeade and lemonade, are good quenchers of thirst. Even water alone, whether iced or uniced, is no remedy for thirst in the hot weather. It is not known, however, how the lemon juice acts, whether by constricting the vessels which feed the sweat

glands, or by other ways. Citric acid can be manufactured from their juice, both for pharmaceutical purposes and for aerated waters. The so-called aerated lemonades in India are in most cases, if not in all, really tartarades, or, perhaps, sulphurades, they being much cheaper than citric acid. The citric acid can be manufactured even from sour oranges, and sour citrus of any kind with sufficient juice in it. The citrus are also used in perfumery. When orange flowers are macerated in a fatty matter, by what is called "enfleurage," eight kilogrammes are required to enflower one kilogramme of grease, divided over thirty-two infusions. This pomatum is then digested in rectified spirits, which takes up the essential oil, and forms extract of orange flowers. This scent is so fine that it cannot be recognized from that of the flower. From it "Sweet Pea," "Magnolia," and other scents are made up. If orange flowers are distilled with water, the Otto or "Oil of Neroli," is produced. This appears originally to be dedicated to the memory of the Emperor Nero. He is stated to have had perfumed showers come down from the roof of his dining hall. The finest otto is considered that which is extracted from the flowers of Citrus Aurantium (Portugal or sweet orange). It is called "Neroli Petale," or "Neroli Douce," Sweet Neroli. The next quality is that from the flowers of the Citrus Bigardia or Seville Orange. It is called "Neroli Bigarade," or bitter Neroli. Another otto is distilled from the leaves and young unripe fruit of different varieties of citrus. It is called "Petit Grain," from the little oil specks in the

leaves. The Nerolis are largely used for "Hungary Water" and "Eau de Cologne" and "Petit Grain" for scenting soap. Of the latter there are various kinds according to the kind of leaf from which it is distilled. All kinds of citrus leaves and flowers will yield, more or less, an otto by distillation. Orange flower water can be used for the skin, the hands, and the eyes as a lotion. Its use for confectionery and for mixing with nauseous medicines is well known. It is also a good carminative.

The orange and lemon peels are rasped by a little machine called "Ecuelle," or by a large but similar machine. The latter is a sort of barrel or drum with spikes inside. In this large machine 100 or more lemons are rasped at one time. The rasped rind is then pressed in hair bags, and the oil is afterwards allowed to stand and deposit impurities. It should be kept cool and in the dark, as the mucilage in it is said to cause decomposition and to spoil the essential oil. The best way to get rid of this mucilage is to shake the oil well with warm water, and then allow it to stand, and when clear decant it close to the water. The expressed oil of the lemon is the finest, and has an intense odor of lemons. This oil is called "Citron Zeste" while that distilled from the rind is not of the finest quality, but probably keeps better, and is called "Essence of Lemon."

The acid pulp of the lemon, after rasping off the rind, is pressed for citric acid.

The otto of the citrus peel has many uses in perfumery,

and is the leading ingredient in "Lisbon water" and "Eau de Portugal."

No tree is so profitable to the flower farmer as the orange. The leaves of the orange tree yield an otto worth (in 1879) three shillings an ounce ; the flower an otto, worth ten shillings an ounce. The flower, by "enfleurage," yields a fat worth ten shillings a pound, and the rind, an otto, worth twelve to sixteen shillings per pound. Moreover, if the fruit cannot be sold by the score in the market, cut up and mixed with bran it makes a capital food for cattle.

The plains of India, in the opinion of Bonavia are not very favorable for obtaining a large quantity of otto from any plant. The hot dry atmosphere appears to dissipate a good deal of the essential oil of flowers and seeds, such as oriander, etc. Therefore, the orange flowers, would have to be collected before sunrise in the morning, otherwise a cooler climate would be preferred for extracting otto profitably--such as the Himalayan Hills, where the citrus can be grown without being destroyed by frost in winter. In Kumaon many kinds of citrus grow to perfection, also in Buxa, Assam, and the Khasia Hills.

Besides the extraction of essential oils from the citrus rind, the latter can be made into "candied peel" for purposes of confectionery. A combination of citric acid, flavored with lemon oil, perhaps enters into the composition of lemon drops. The Seville orange is used for making marmalade.

One of the best citrus preserves is the lemon jelly. The cit~~on~~ peel also is preserved in syrup in India and the pulp of

some kinds that are not bitter candied.

. The imported candied peel from Europe has an unpleasant turpentine flavor, and is always very hard. This is because the essential oil of the rind loses its charming aroma by keeping any length of time, however well bottled. It cannot be imagined how different the fresh, soft and aromatic candied peels are from the state hard peels imported at a high price from Europe. Tons of marmalades and jams are annually imported from Europe, while all could be made in India of a nicer and fresher flavor.

In the genus citrus we have also a remedial agent of much potency for intermittent fevers and their consequences, the disorganization of the blood, enlarged spleen, etc.

The Seville orange, besides making the candied peel and best marmalade, is used for making tincture of orange peel, which is mixed with nauseous medicines, to disguise their revolting taste. It is also used for flavoring the liquor.

Lemons are also made into pickles by the people of India.

There is yet another use, and a very important one, for sweet oranges. A most excellent wine can be made from the juice of the orange, and after the troubles caused by the phyloxea, for a time a large proportion of the sherry of commerce was "orange wine."

Bengal Quince, *Aegle Marmelos*Description and Habitat

The Bengal Quince grows on a moderate sized tree, the fruit is nutritious and fragrant, its cells twelve in number, containing a tenacious transparent gluten, considered very wholesome, and esteemed an useful laxative.

Throughout India, in dry hilly places, from the Jhelum to , Assam, and southwards to Travancor ; wild or cultivated ascending to 4,000 feet in the Western Himalaya.

A small deciduous glabrous tree ; spines 1 in., straight, strong, axillary, leaflets 3-5, ovate, lanceolate, lateral sessile, terminal long-petioled. Flower 1 1/4 in. diameter, greenish white, sweet scented ; pedicles and calyx pubescent. Filaments sometimes fascicled. Fruit 2-5 in. diameter, globose oblong or pyriform, rind grey or yellow ; pulp sweet, thick, orange colored. A species or variety with oblong fruit is grown in Burmah.

Although heavy and solid, the fruit floats in water. The rind is pale green, and when ripe of a yellowish brown studded with large and small oil cells. The interior surface is studded with open mouthed cells, which pour their gummy secretion into the interior of the carpal, and fill it bathing the seed. The gum is a sticky astringent substance, soluble in water. The gum cells are more numerous towards the circumferential side of the carp 1, which is also the case with citrus juice vesicles. Bonavia looks upon these gum sacs as the homologues of the citrus juice vesicles. The rim

projects beyond the inner surface of the carpels, and a little more might make them closed sacks. All the rest of the fruit is occupied by a yellow spongy substance, and which appears to be the homologue of the white pith which is on the inside of the orange and lemon peel. In the case of the Aegle Mamelos the pithy matter has forced itself between the pulp carpels-- squeezing and separating them, and invading also the center of the fruit. In fact it is the principal part of the fruit, while in the citrus the pulp vesicles with their enclosing pod membrane form the principal part of the fruit. By their excessive growth they have, in the citrus kept the pulp carpels close together, and so have prevented the pith from invading the center also. In this case the pithy substance could only grow externally by expanding the rind, and so creating the thick skins of the pomelo, citron and others.

Propagation is affected by scales.

The Bengal Quince requires little or no cultivation, though it prefers a rich loam.

Wood apple, Feromia Elephantum. Synonym--Elephant apple

Description and Habitat

Throughout India, in dry situations, from the Panjab eastward to and southward to Ceylon, ascending to 1500 feet in the Himalayas.

A small deciduous glabrous tree, head ovoid. Leaves smelling of aniseed ; spines strong, straight, axillary. Leaflets 5-7, cuneate or obovate, tip crenate. Flowers $1\frac{1}{2}$

in. diameter, dull red, ♂ and ♀ often in the same panicle ; peduncle and pedicels pubescent. Fruit 2 1/2 in. diameter, pulp edible.

The tree is handsome in appearance.

The fruit is hardshelled, the pulp has a strong terebinthine odor, seldom liked at first, but generally considered wholesome.

Propagation

Propagation is effected by cuttings, which strike freely.

Soil

A sandy loam is preferable rather rich than otherwise.

CHAPTER II

Palmaceae

Palms

The number of known species of palms is over one thousand.. Although chiefly natives of tropical regions, there are many extra-tropical members of this princely order, several of which furnish useful products of commerce, such as the dwarf palm (*Chamaerops humilis*). There is scarcely any family of trees that are more generally useful in tropical climates than the palm tribe. Numerous races depend almost entirely upon the palms for many important products ; wood and leaves for habitation, bark and leaves for fabric and cordage, buds and fruit for food, and sap for sugar and spirit.

Cocoanut palm, *Cocos Nucifera*

Origin

Malay Archipelago (?), Polynesia (?); cultivated for how many thousands of years not determined,

Description

Much appreciated in the unripe state for the sake of its refreshing liquor ; the shell being then soft, and the kernel but just forming in a pulpy state has rather an agreeable

flavor, and is less unwholesome than when it hardens.

The cocoanut is a superior fruit resulting from the ovary alone, two of the three cells of which are clearly obliterated, or, rather, rudimentary from their origin, so that the fruit is one-celled, and one seeded : the triangular form of the fruit still indicates its tricarPELLARY character. A transverse section through the entire fruit shows a thick outer layer of the pericarp, fibrous in texture and a thin bony inner layer (the shell). The cavity of this inner layer (endocarp) is occupied by the seed. The seed is hollow, consisting of a uniform layer of solid albumen closely applied over the inner surface of the endocarp, with a portion (the milk) unconsolidated in the cavity, and a minute embryo occupies a little cell in the albumen at the base of the nut.

Culture

The nuts are buried in nursery rows, and the young trees are transplanted. A more common practice is to remove the buried nuts, when they begin to sprout, to the place in which the tree is to stand. A nut is then placed in a hole some two feet deep, which is gradually filled in as the plant grows. In from six to eight years the tree begins to bear.

The cocoanut palm is one of the most useful trees of tropical regions ; all its parts are utilized, but its fruit is the most important product. In preparing plantations, the nuts for sprouting should be chosen from those thoroughly ripe, having full, large eyes, and such as have been gathered

from trees past the middle age--not, however, from aged ones-- and from clusters containing few fruits.

The nuts for seed should not, on being gathered, be allowed to fall to the earth, but be lowered in a basket or fastened to a rope. If let fall the polished cover to the fibres will be injured and collect damp about the nut, or the shell inside may be cracked, and the water disturbed. If the nuts are allowed to dry on the tree before gathering, the plants are liable to be lost, not having water inside to cherish the growth of the sprout (before the actual roots shoot into the soil).

The seed nuts after being gathered, should be carefully kept for not less than a month before they are planted (in order that some of the moisture be absorbed, and the hard outer skin or rind be rendered dry and water proof). If the seed be immediately planted, the outer pod with the containing fibres will rot, and there will be no sprout. On the other hand, should a longer time intervene between gathering and planting seed than prescribed, the capsule of the fruit will fall off, and consequently the exposure to damp and rain will affect the eyes. The seeds should be planted on an elevated plot or bed of land, where water will not stagnate. If placed in flower pots with good soil and sand in them, no damage will be done by white ants, and very few will fail to germinate. If, however, they are placed on a hard soil which the roots cannot penetrate, and exposed to the sun, the water inside will dry up, damage will be done by ants, and those few that throw out shoots will be weak, and on transplanting, the

roots will break, and the sprouts be severed from the nuts. If, on the other hand, they are deposited on uneven ground or too moist soils, both the fibrous covering and the eyes will rot, and the seeds come to grief.

Nurseries should be somewhat exposed to the influence of the sun, though not too much heat ; plants thus grown will, even though deficient in stature, be strong, and when transplanted will not fail nor suffer from heat. Should plants, however, have but little sun, no great harm is done ; but if they be grown entirely under cover, insects will infest them, the stems will be long, tapering, and weak, the fronds will be often unable to sustain their own weight, and when transplanted, each successive hot season will affect the trees.

The planting of the nuts should take place from January to April, and also in August, provided the rains are not heavy, and then the planter may expect fruitful trees to be produced when grown ; but nurseries formed during the heavy monsoon will generally fail, or produce trees which will yield small nuts. Too much moisture of every kind is injurious to plants.

The seed beds, when the plants are to be nursed, should be well dug to about two feet deep, and all stones, roots of trees, etc., removed ; the cocoanuts should then be laid along flat on their side in the soil, in such a way that all but two inches of them be buried, the interval between the nuts being about a foot at least. Should the spaces be too great, the plants will have too many roots, and the sun will not be shaded

from them by the fronds, which will be shown by the pale green of the leaf. But should the nuts be placed too close to each other, the young shoots will be then meagre and quickly spindle up ; the roots too will twist together and be broken when the plants are taken up to be transplanted. Though manuring is of little use before they have taken root, yet in order to prevent white ants, etc., a mixture of salt and ashes, or ashes alone should be put into the trenches made in the beds for receiving the cocoanut. Sand alone, or salt with ashes, sand, and paddy husk, form another mixture to be placed between the earth of the bed and the nuts, which latter should be covered with the compost. Black salt, ashes made from the cocoanut husk and fronds, with sea sand is the best mixture. If this precaution be not used, many of the nuts will be injured and the plants grow pale and weak.

The next care is to water the nursery, which should be done only every second or fourth day according to the dryness of the weather, simply keeping the soil moist ; for if the ground is too damp, rot is engendered, but if too dry, the cocoanut water inside the nuts will evaporate and the shoots dry up. A careful observance of these instructions will cause the shoots to sprout generally within six months from the time they are placed in the ground.

Some place the cocoanuts intended for seed, tied together in pairs by a strip of the covering on the cadjan, over the roof tree of the dwelling house, or on branches of jack trees, freely exposing them to sun, dew and rain. But when the

shoots are a few inches long, they are taken down and placed in a nursery till transplanted. Such plants are seldom lost, and make no great delay in yielding fruit. Once the tender shoots begin to appear, no great care is necessary for manuring, but the greatest attention should be given that no cattle or insect, etc., injure the shoot itself, else the slightest blow or abrasion will cause a want of vigor ; but on the other hand, some suppose that unless either ashes alone, or mixed with salt and sand, or these separately, be applied to the plants, every month, a want of color will be visible in the opening leaves, or ants and other destructive insects will be fostered.

Plants are removed for transplanting generally in the second or third month, sometimes even in the ninth month, but rarely so late as the fifth month ; but in ordinary cases, if they be transplanted six months after the shoot makes its first appearance, their safe growth and vigor may be looked for. In low-lying lands, however, it is preferable to have plants of one year's growth, though they are more difficult in managing. The only benefit to be expected in transplanting older plants is that the planter looks for an earlier return, and in planting these on the banks of the rivers or low lands formed from the wash of the monsoons, the crops will not be deficient.

Plants left too long in the nursery, and then removed are apt to have the fibrous supports at the foot of the fronds decay, so that these hang down, wither, and dry up, and new fronds and leaves do not make their appearance for four or more months,

and these generally die prematurely. Some of the planters give it as their opinion that the transplanting may be effected from January to May, and again in August, October and November (i.e. omitting the wet months). Perhaps, however, the general rule should be, that in low, damp situations planting may be effected during the hot season, in salt marshes and on hill sides during the monsoon. It is said that those trees planted from January to June will yield fruit for eight months in the year, and those planted in October for six months, while those planted in June and July in the heavy rains will scarcely be fruitful at all. Different places and soils require different seasons for this operation, to be learned only from experience or observation of neighboring gardens. Soils suitable for a cocoanut plantation are variously described as below, particularly observing that stony grounds, or those overlying rocky foundations, are to be avoided :

1. Soils mixed with sand, either dark-colored or river-washed.
2. Where sand is mixed with clay, ferruginous earth, or black mould.
3. Clayey soils where the understrata consists of sand.
4. Sand clay, even when mixed with gravel and pebbles.
5. The sea shore, banks of backwaters, rivers, banks, and paddy fields.
6. Alluvium of rivers and backwaters, provided a yard and a half of land is to be generally seen above water level.

7. Marshy land even in brackish soils (but not where salt is formed in crystals by evaporation).

8. All level lands exposed to the sea breeze where the soil is good, as the valleys between hills, tanks and ditches which have been filled up.

9. Lastly, even the floors of ruined houses well worked up, and any places much frequented by cattle and human beings, on account of the ashes and salts of ammonia from the urine, etc., deposited day by day in the soil.

Sunlight is most beneficial to the cocoanut tree ; it increases the number of successive fronds and the crops of fruit, while if much shade is caused by trees of other kinds, there is a tendency in the lower part of the cocoanut stem to thicken, while the upper part grows thin and attenuated, with fronds at considerable intervals and little fruit.

Exposure to regular breezes is also beneficial, for the constant movement of the tree tops have a tendency to strengthen and enliven the whole race. The difference is easily seen by comparison with those in sheltered positions. The holes or pits into which the plants are to be transplanted should be twelve yards distant on backwaters, but where a deep alluvial soil is found, eight or ten yards are enough. These distances are necessary, otherwise the trees, not having room to expand their tops, repel each other, and grow in diagonal positions, and are easily blown down or overset. Too close a neighborhood also tends to draw up the trees into long, feeble stems, shoots, fronds, and small fruit. In a level, loose soil the

hole should be a cube, of a yard and a half, on hill sides 2 to 2 1/2 yards, but in low grounds half or three-quarters of a yard deep with one yard square is sufficient. If the pits are not wide and sufficiently deep, the roots soon appear above the surface of the surrounding ground, and the hold upon the earth is weak, nor is sufficient nourishment obtained, and the monsoon storms quickly overturn the tree where the soil is marshy, though the hole need only be large enough to contain the seed and roots, and in a cold clayed ground the holes are filled with sand and the plants deposited in it. Again, in low marshes, banks or terraces should be thrown up and consolidated previous to planting. If in any of these cases plants of two or three years old are used, the pits must be at least 2 1/2 yards every way. The pits should be dug from two to six months before planting, and then prepared first by having heaps of fuel and weeds burned in them, and subsequently by manuring. The fresh earth is supposed to be full of ants and worms, and itself injurious to the new plant, and to hinder growth ; on the contrary, there are some planters who deny this statement and think the burning and manuring not to be necessary. In low situated plantations new holes may be preferred and quick planting. No time should be lost in the removal from the nursery to the pits, indeed the day should not pass--in which case within the month new **roots and fronds** may be looked for ; but where this proves impracticable, if the plants are kept cool and in shade, four to six or eight **days** have been known to intervene, but followed by very great

loss in the number of successful trees. Inside the pits smaller ones should be made and filled with salt and ashes mixed with mould, into which the young plants are to be planted, with the nuts just covered with this compost. Some shade must be afforded, and care taken that the plants be not shaken or removed from their first position, and occasionally water should be sprinkled over them. The compost must be used when there is a small proportion of sand in the soil. Ashes will suffice on the seashore, and sand in marshy and loamy soils. The roots of a plant under a year which are broken (but according to many planters all found on the nuts in the nursery) should have their ends cut, as new ones are supposed to be hastened by the process. Turmeric and arrow root are often planted in the same pits with the cocoanut, as they are supposed in some way to repel white ants, rats, etc. After the plants are in, little sheds with twigs and branches should be made to protect them for the next six months from too great heat of noonday sun, this prevents withering of the leaves or any check to growth of the roots.

On dry soils the plants ought to be watered twice a day for the first month, once a day will suffice for the next five, or until the monsoon showers come on, and once every two or three days during the dry seasons of three following years, according to circumstances. On hillsides it is usual to water during the hot weather, even till the first buds appear; and on sandy plains on the seacoast, when the trees are in

full bearing, eight or ten feet of bamboo (with the divisions at the joints broken to form a pipe) is often driven down by the side of the coconut tree, and cool water from weed-covered tanks is poured down to refresh the roots and lower soil. The soil round the young plant is often kept damp by a bed of leaves, particularly such as will not be eaten by white ants. If the soil is naturally poor or of a hungry nature, salt, ashes, paddy husks, goat's dung, and dry manures may be applied for the first year, but in after seasons, fresh ashes, decayed fish, carrion, or other refuse is preferable, also oil-cake.

If the soil at the foot becomes too rich, the roots become subject to the attack of larvae and ultimately the tree drops down piece meal to the ground. It would appear that the fear of this evil is the reason why ashes alone are recommended by so many cultivators.

As soon as the new fronds have divided into the long side leaflets or lost their connected form, which is at the end of the first year, the soil should be dug up and ashes applied about once a month. When the tree is two years old, and henceforward at the commencement of every monsoon in May and June, the whole of the soil, a yard or two round the stem, must be opened out and ashes with dry manure applied and left open to the air ; and in October, when the rains have ceased, this freshened earth should be replaced and levelled. As the tree gets older and the depression at the foot is gradually filled up, it may not in after years be necessary to dig so

deep as for the earlier growths. If the opening out of the roots and manuring be thus annually attended to, the tendency to form a sort of bulb on the surface and throw roots above the soil will be checked ; the old worn out roots are cut away, strong roots from other trees and all weeds are removed. Cattle are the most destructive the first two years, in eating off the ends of the fronds and stripping the leaflets ; if the plants suffer often in this way, the growth is entirely stopped ; sometimes the new leaf spike is pulled out, and the tree dies. Should the heart of the stem and top not be injured, the tree will still remain an unsightly object, and often entirely profitless and barren.

From the time that the leaflets become fully developed and distinct from each other, till the period that the spathes (or covers to the flower) make their appearance, the fronds should be shaken and weighed or pressed downwards each month, so as to keep them from each other and make them spread, and careful examination should be made lest rats, beetles, or worms have made nests upon the head, or bored into the cabbage heart of the palm, and this often. Some planters sprinkle ashes and salts in March and October about the spike shoots to keep insects, particularly red ants, away. The dried fronds, old spathes, fruit and blossom stalks, and ragged fibres should be removed at stated periods of perhaps a month, or as often as the nuts may hereafter be gathered.

Distinct leaflets will begin to show themselves at the end of the first year. and be completed at the end of the second,

Missing Page

The most productive months are from January to June, that is for ripe nuts, the heat bringing quickly to maturity.

When the roots of the trees can reach water and the soil is alluvial, a tree in full vigor will bear eight, ten, or a dozen of peduncles flourishing in the course of five or six weeks ; in other and higher lands not more than six. In favorable localities each peduncle will bear from five to fifteen nuts, so that the yield of a tree can be safely put down at more than a hundred in the year. These ripen successively, and there may thus be seen at the same time flowers and fruit.

The trunk often attains a height of 90 feet, with a diameter of three feet at the base and one foot at the summit.

One hundred cocoanuts perfectly grown and carefully dried will, it is generally calculated, yield when pressed ten to thirteen edangalies (each containing 92 cubic inches) of oil (40 nuts to an imperial gallon). Inferior cocoanuts will vary from three to nine edangalies ; fruit taken from trees on salt marshes have the least oil.

When the trees begin to show the fruit on shoot, or spathe, it is often thought advisable to extract the juices for toddy, and not allow the blossoms to be grown ; but this only in the monsoon, and for that reason only. This is supposed to render the future fruit bunches more numerous and give the sap a tendency to flow. In some places trees are never allowed to bear fruit, but toddy is always extracted. Drawing toddy for a few months is thought to check the habit in some trees of dropping immature fruit, and again of preventing injurious

animals and insects from infesting plantations, the frequent visits of the men to the trees being a check to their forming nests and otherwise remaining hid in the tree tops.

While certain of the fruit shoots are cut for toddy the others will still produce cocoanuts, as well as those previously developed ; but if three or four be used for this purpose, the others will dry away or be of very little use. Even when a spathe is partly used for toddy and left, provided the part containing the buds remains undestroyed, a few fruits may be produced on that stalk.

Gathering some of the tender cocoanuts from the earlier branches will develop the succeeding bunches greatly, and strengthen the whole tree very materially. It is not, however, recommended to cut the fruit stems or stalks out before they are matured and dry, as it causes the tree to bleed and lose its most valuable juices ; hence in order to prevent the possibility of injury to the tree, owners should permit none but mature fruit to be taken.

The number of fronds which dry and fall off from a tree is eight or ten in the course of the year, principally in the hot season. It is usual to cut these off, but if done too early, those next the one cut are affected and fade ; hence only those turning brown should be removed, and leaving a small portion of the footstalk on the tree. It must be remembered that the drooping leaves are intended to protect the tree stem from the burning sun.

Trees growing in the most fertile soils will live for a

century, others less favored from sixty to eighty years only ; the former will yield their fruit commencing at the tenth year, and with rare intervals continue until their sixtieth year, and then gradually decrease in fruitfulness till they decay.

Although its real locality is bordered by the tropics and the tree is an inhabitant of the coast regions, it grows in India up to Lucknow, 26° 51' N., and is cultivated far in the interior of the peninsula, yet in the first case it does not fruit, and in the second it becomes stunted and languishes.

Uses

From the fruit of the cocoanut palm is obtained many an article of luxury and trade. The husk or thick green external pellicles stripped off the shell is spun into cables, ropes and yarn of every dimension and size, from a single pack thread to a cable for a first rate man-of-war ; and it is preferable for ship's use, as it is elastic and becomes as hard as iron when tarred and soaked in salt water, but it is more unwieldy for stowage than hemp rope.

The albumen or kernel produces oil by boiling it in water, after it has been pounded or rasped. Grated, a sweet milk, used as a substitute for cow's or goat's milk, is obtained, and by various preparations, jelly, copra, butter, candies, and sugar are produced, and, by fermentation, vinegar. The oil it yields is used at table, and is equal in quality to oil of almond when fresh ; but it soon becomes rancid and in this

state is employed to burn in lamps. A soap is also manufactured from it, which, with the exception of one prepared from the coa atoo (*Agave Americana*), is the only one known soluble in salt water. The kernel is used as a fattening substance in the dairy, aviary, etc., and there is no description of animal, graminivorous, carnivorous or herbivorous that does not feed on it with avidity. It is wholesome food for man, beast and bird.

The milk of the cocoanut effervesces with an acid extract, and the acid precipitates in a greyish hue, which becomes of a rich, violet color by the addition of a fixed alkali. It is with this that most cottons are dyed. This emulsion mixed with quicklime causes the alkali to become rose-colored. Dyers use this milk with great advantage in dyeing black linens, silks and cotton stuffs.

The nut when it is gathered young contains an opaline water, which is quite clear, if filtered, and is utilized for drinking. In countries where potable water is not obtained, only the milk or water of the cocoanut is drunk ; it is an agreeable, nutritious and healthy beverage. The gelatinous albumen when young is easily detached from the shell with a spoon, and may be eaten with satisfaction. As it ripens the albumen hardens and becomes almost horny, and the oil increase, although in this state it is still edible, but indigestible, and only eaten associated with other food. The following shows the composition of a young cocoanut and a ripe

cocoanut :

	Young nut	Ripe nut
Husk and shell	1.760	.816
Kernel	.090	.434
Water	,300	.250

Cocoanut oil, copra or copperah, the dry albuminous pulp, contains 54.3 per cent of oil dried at 100° it yields 66 per cent.

Palmyra palm, *Borassus Flabelli formis*

Description

The spadix bearing the fruits is generally simple, and covered with a single sheath or spathe, as in the areca, catecha, and cocoanut palms, but it is sometimes compound, and bearing two bunches of fruit in a compound spathe. The fruits are with beautiful regularity arranged round the spadix in three ways, and whichever way examined are found in nearly opposite pairs. Each spadix bears from ten to twenty fruits, and one of these spadices, with the fruit ripe, would be nearly as much as a man could carry. Each palm bears seven or eight of these spadices, so that a tree often bears about one hundred and fifty fruits in one season; each fruit is about the size of a young child's head. The fruits when young are pretty distinctly three cornered, but when old the pulp round the nut swells so as to give the fruit the appearance of a perfect globe.

The ripe fruits or drupes contain two or three nuts imbedded in a mass of soft yellow pulp, intermixed with dark, straw colored fibre or core. Those nuts are oblong and a good deal flattened, and covered with a mass of short fibre which adheres to them. Besides this fibre they are covered with a thick, tough shell, very difficult of fracture.

Uses

The fronds are fan leaved, armed with spines radiating from a common centre, and the stripes serrated at their edges. The fan part is about four feet in diameter. It answers as a kind of umbrella when held by the stem over one's head. The spines are cut off, and the middle is formed into large fans, called vissaries and punkahs. These are lacquered for sale, or used plain, as may suit the taste of the purchaser, but one never sees a Buddhist priest in Ceylon without one of the smaller part, or a fan of some kind or other ; of which some are heartshaped, others circular, with handles of carved ivory.

The leaves of this tree as well as those of the plantain and the banana are sometimes used instead of paper by the people. Narrow strips of the leaf are braided into sieves, hats and caps, baskets, mats and bags ; the baskets are used for drawing water as well as other purposes, and the bags not only for carrying rice, salt, etc., in small quantities, but for storing grain, being made very large and strong, while the mats are necessary for the people, not only to sit, eat and

sleep on, but for drying various kinds of fruit, treading out grains and many other purposes. On the stem of the leaf is a very hard and strong covering, like that of the bamboo or rattan, which, slit off, is formed into coarse, strong ropes.

Each tree has from twenty-five to forty fresh green leaves upon it at a time, and of these the people frequently cut off twelve or fifteen annually, or a greater number once in two years, to be devoted to various purposes, as well as to enable the fruit to ripen and increase in size. When the leaves are intended for thatch, or for making fences, they are placed flat on the ground in layers over each other, and often with weights upon them to assist in the process of flattening them. The thatch formed of these does not last more than two years, nor is it so handsome as that made from the plaited cocoanut leaves. The leaves make very close and elegant fences.

Toddy. At the season when the inflorescence begins to appear, when the spathes have had time to burst, the "toddy drawer" is at work in the palmyra groves. The spathe is cut off near the top, and an earthen pitcher tied on to the stump. The sap runs into this pitcher, which is emptied and replaced every morning after the stump has been again cut, and this process is repeated until the supply of the sap has been completely exhausted. Powdered lime which has the property of preventing fermentation, is sprinkled on the outside of the earthen vessel in which the sap is collected. An expert climber can draw toddy from about forty trees in a few hours.

Toddy serves extensively as yeast to the bakers ; large quantities of it are also converted into vinegar, used for pickling limes and other substances ; but by far the largest quantity is boiled down for jaggery or sugar.

The usual process of making jaggery is to boil the unfermented toddy until it becomes a thick syrup. A small quantity of scraped cocoanut kernel is thrown in that it may be ascertained by the feel if the syrup has reached the proper consistency, and then it is poured into small baskets of palmyra leaf, where it cools and hardens into jaggery. To make vellum or crystallized jaggery, which is extensively used as a medicine, the process is nearly the same as for the common sugar, only the syrup is not boiled for so long a period.

The pot which contains it is covered and put aside for some months, at the end of which period the crystals are formed in abundance. Amongst a variety of purposes to which it is put, is that of being mixed with the white of eggs, and with lime from burnt coral or shells. The result is a tenacious mortar, capable of receiving so beautiful a polish, that it can with difficulty be distinguished from the finest white marble.

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In the Madras Presidency of India and Ceylon a large quantity of sugar and jaggery is made from the sap. In Bengal, however, the juice of the date palm, which is so much more abundant in saccharine matter, is preferred for the manufacture of sugar ; though it is not apparent why in parts of the country where the palmyra palm abounds and the people do

not drink toddy, its vinous sap is not utilized in the same way as in Madras and Ceylon.

Timber. A full-grown palmyra palm is from 60 to 70 feet high, its trunk at the bottom is about 5 1/2 feet in circumference. The trees have to arrive at a considerable age before they are of use for timber ; when a hundred years old they are excellent. The wood near the circumference when of sufficient age, is remarkably hard, black, heavy and durable, and universally used for rafters in pent-roofed houses, for which purpose Roxburgh states it is the best wood in India. The center is soft and spongy, containing little else than a coarse kind of farinaceous matter, intermixed with some soft, white, woody fibres, and is cut out, as the black exterior hard part only is employed. For house building and various domestic purposes, the timber is the most generally used of the palm tube. Pillars and posts for the verandas of the houses are made from it. Trunks split into halves, with the heart scooped out, are used as spouts for various purposes, but more especially for carrying away the water from the eaves of houses. The dark outside wood of very old trees is used to some extent in Europe for umbrella handles, walking canes, paper rulers, fancy boxes, wafer stamps, and other articles.

Kelingoes. In Ceylon the nuts are collected and buried in heaps in the ground. When dug up after the space of three months, the young shoots called "Kelingoes," supply the inhabitants with a nourishing aliment. In size, color and

shape they resemble a parsnip, and look like a cold potato. In its fresh state it will keep good for a couple of months, and when well dried in the sun, for a whole year.

In this state they are called "odials." When reduced to flour or meal, the favorite cool or gruel is made of it.

Punatoo. In Ceylon the pulp of the fruit is preserved for use in the following manner. The ripe fruits are put into baskets containing water, and are then squeezed by the hand till the pulp forms a jelly. Layers of this jelly are spread on palmyra leaf mats to dry on stages. Layer after layer is deposited to the number of about fifteen. These are left in the sun about a fortnight or three weeks, only covered at night, and protected from the dew and rain. The best sort is called "Pimatos," and the tough withery kind made from the remaining fruits gathered at the end of the season, which is much in favor. Punatoo is sold by the mat at 3 s. to 6 s. each, and is the chief food of the Islanders of Ceylon, and of the poorer classes of Southern India, for several months of the year.

Sugar Date, *Phoenix Dactylifera*

Description and Habitat

Low or dioecious palms. Leaves pinnate ; leaflets lanceolate or ensiform, sides induplicate ; spadices usually several, interfoliar, erect or drooping in fruit, branched ; spathe basilar, complete, coriaceous ; flowers small, yellowish, coriaceous. Male flower, calyx angular, 3-toothed ; petals 3, obliquely ovate, valvate ; stamens 6 (3-9, filaments

subulate, anthers erect, dorsified ; pistillate, minute or 0. Female flowers globose, calyx of the male, accrescent ; petals rounded, imbricate ; staminate 6, or 6-toothed cup ; carpels 3, free, stigmas sessile, uncinata ; ovules erect. Fruit oblong, terete, 1-seeded, stigma terminal, pericarp fleshy, endocarp membranous, seed oblong, ventrally grooved ; albumen equable or subtruncate, embryo dorsal or subbasilar. Species 10 or 11, African and Asiatic.

Cultivated throughout the plains of India and Burma.

Wild in the Indus basin.

Trunk 25-40 ft., clothed with the persistent bases of petioles. Leaves 10-15 ft., quite glabrous ; spathe 12-15 in., scurfy, petiole short ; spadices erect, fruiting, inclined with spreading branches ; branches of male filiform ; male fl. 1/2 to 1/3 in. long. Fruiting peduncle short, 6 in. or more. Fruit orange yellow, seed rounded at both ends, pale brown. Very near *P. dactylifera* of Africa, the true Date, and possibly the original of that plant.

Origin of *P. Dactylifera*. Western Asia and Africa, from the Euphrates to the Canaries, cultivated for more than four thousand years.

Culture and Use

The ground chosen for date cultivation is the higher ground, that which is too high for rice to grow well, and the rent paid for such ground is at least three times that for rice land. High and low land, are however equally suitable for date cultivation. In fact, date trees should be grown in

small hollows where the rain water would collect and play round them, but too much of it would kill them. Planting should be done three yards apart each way. Pits in which they are planted should be manured at the end of each season and the ground ploughed up before and after the rainy season until they are fairly well grown up. Each palm before it enters into its full adult stage throws up about 50 to 20 shoots which may be detached and transplanted. One per cent of male trees for fecundating purposes would be quite enough. But male and female trees should be grown indiscriminately where obtaining juice is the only object. If after planting the trees are left untouched for seven years, good healthy trees may be expected. When the tree is ripe the process of tapping begins, and it is continued each year thereafter. There are in the date palm two series, or stories, as it were, of leaves ; the crown leaves, which rise straight out from the top of the trunk, being, so to speak, a continuation of it ; and the lateral leaves, which spring out of the side of the top part of the trunk. When the rainy season is completely passed, and there is no more fear of rain, the cultivator cuts off the leaves for one-half of the circumference, and thus leaves bare a surface measuring about ten or twelve inches each way. This surface is at first a brilliant white, but becomes by exposure quite brown, and puts on the appearance of coarse matting. The surface thus laid bare is not the woody fiber of the tree, but is a bark formed of many thin layers, and it is these layers which thus change their color and texture.

After the tree has remained for a few days thus exposed, the tapping is performed by making a cut into this exposed surface, in the shape of a very broad V, about three inches across and $1/2$ to $1/2$ inch deep. Then the surface inside the angle of the V is cut down, so that a triangular surface is cut into the tree. From this surface exudation of the sap takes place, and caught by the sides of the V, it runs down to the angle, where a bamboo sluice of the size of a lead pencil is inserted into the tree to catch the dropping sap and carry it out as by a spout.

The tapping is arranged throughout the season, by periods of six days each. On the first evening a cut is made as just described and the juice is allowed to run during the night. The juice so flowing is the strongest and best, and is called "jiran" juice. In the morning the juice collected in a pool hanging beneath the bamboo spout is removed and the heat of the sun causes the exuding juice to ferment over and shut up the pores in the tree, so in the evening the new cut is made, not nearly so deep as the last, but rather a mere paring, and for the second night the juice is allowed to run. This juice is termed "do-kat," and is not quite so abundant or so good as the "jiran." The third night no new cutting is made but the exuding surface is merely made quite clean, and the juice which runs this third night is called "jharna." It is less abundant and less rich than the do-kat, and towards the end of the season when it is getting hot, it is even unfit for sugar manufacture, the molasses made from it (and also from day

jharna" being sold simply as "droppings." These three nights are the periods of activity in the tree, and after these three it is allowed to remain for three nights at rest, when the same process again begins. Of course, every tree in the same grove does not run in the same cycle. Some are at their first, some at their second night and so on ; and thus the owner is always busy.

Since every sixth day a new cut is made over the previous one, it follows that the tree gets more and more hewed into as the season progresses, and towards the end of the season, the exuding surface may be, and often is, as much as 4 inches below the surface. The cuts are during the whole of one season made about the same place, but in alternate seasons, alternate sides of the tree are used for the tapping ; and as each season's cutting is thus above the previous season's, and on the opposite side, the stem of the tree has, if looked at from the side, a curious zigzag appearance. The age of a tree can, of course, be counted up by enumerating the notches and adding 6 or 7, the number of years passed before the first year's notch. When they are 46 years old they are worth little as produce-bearing trees.

As to the produce of one tree, one may expect from a good tree a regular average of 5 (about 2 gallon) per night (excluding the quiescent nights). The colder and clearer the weather the more copious and rick the produce. In the beginning of November tapping has begun. In December and

January the juice flows best, beginning sometimes as early as three p.m., and it dwindles away as the warm days of March come. If the cultivator begins too early, he will lose in quality and quantity as much as he will gain by extending the tapping season. But high prices begin in October, and there are not many who can resist the temptation of running into the market with their premature produce.

So much then for tapping. The next process is the boiling, and this cultivator does for himself, and usually within the limits of the grove. Without boiling, the juice speedily ferments and becomes useless ; but once boiled down into molasses, it may be kept for very long periods. The juice is, therefore, boiled at once in large pots placed on a perforated dome, beneath which a strong wood fire is kept burning, the pared leaves of the trees being used among other fuel. The juice, which was at first brilliant and liquid, becomes now a dark brown, half viscid, half solid mass, which is called "gur" (molasses), and when it is still warm, it is easily poured from the boiling pan into the earthen pots in which it is ordinarily kept.

As it takes from seven to ten seers of juice to produce one seer of molasses, we can calculate the amount of molasses which an ordinarily good tree can produce in a season. We may count four and a half months for the tapping season, or about 67 tapping nights. These at 5 seers each produce 335 seers of juice, which will give about 40 seers of molasses.

An acre of grove containing 300 trees will, therefore, produce Rs 600 to Rs 675 (200 to 225 dollars) worth of molasses if all the trees are in good bearing.

A cultivator, after boiling down his juice into molasses, does not ordinarily do more ; it is then sold to the refiners and by them manufactured into sugar.

CHAPTER IV

Anacardiaceae

Mango, *Mangifera Indica* (Linn.)

Origin

India, cultivated perhaps more than 4,000 years.

Description and Habitat

Leaves oblong or linear oblong or elliptic or obovate-lanceolate, obtuse acute or acuminate, panicle usually tomentose, petals 5 with 3 ridges, stamens 1, fertile and 4 reduced to short capitate subulate filaments, style subterminal.

Tropical Himalaya, altitude 1-3,000 ft. from Kumaon to Bhokara Hills and valleys of Behar, the Khasia Mts., Burma, Oudh and Western Peninsula from Kandeish southwards. Distribution, cultivated as far west as Muscat, in all Eastern tropical Asia, and generally in the tropics.

A large tree, glabrous except the panicle, branches widely spreading. Leaves 6-16 in., very variable in breadth, crowded at the ends of the branches, acute, acuminate or obtuse, shining, nerved, quite entire, margins often undulate, petiole 1-4 in., swollen at the base. Panicles a foot and more, pubescent, rarely glabrate; bracts elliptic, concave. Flowers yellow odorous, subsessile, rarely pedicelled, male and

female flowers on the same panicle. Sepals ovate, oblong, concave. Petals twice as long, ovate, ridges 3-5, orange. Disk fleshy, 5-lobed ; stamen, 1 inserted upon the disc ; filament subulate ; anther purple, ovary glabrous.

The fruit is a drupe, large (2-6") and kidney shaped, the skin being smooth rather soft, pale green, yellow or half red and resinous. The shell of the seed is rough and fibrous ; the kernel is shaped like a bean. In some poor varieties of mango the pulp is so full of fibre that the fruit is sucked rather than eaten and beginners say that it tastes like a ball of cotton soaked in turpentine, but the improved kinds are not unpleasantly fibrous.

It is often difficult to say whether so common a tree is wild or not in a given locality, but there seems to be little doubt that it is indigenous in the localities enumerated above. Amongst the varieties, those with an almost glabrous panicle from the Western peninsula look the most unlike the ordinary cultivated form. There are said to be 130 or more varieties cultivated in India, where the mango is most esteemed.

In the U.S.D.A. Bul. 1, Division of Pomology, mention is made of the following popular Indian varieties of mango :

(1) Alphonso, (2) Arbuthnot, (3) Arracan--one of the sorts grown in the gardens of the agri-horticultural society, Calcutta-- (4) August, (5) Archal , (6) Bombay--one of the finest of the Indian varieties--(This variety and the Malda are the two most popular varieties, in favor with every one who tastes them, while some of the other varieties are delicious to some

people and to others unendurable.) (7) Bhadouria, (8) Bindabunnee, (9) Bhutovia, (10) Bell, (11) Bataree, (12) Chuckcukeea, (13) Desi Bhadouria (very late in ripening which the name signifies ; valued only on this account), (14) Dodol (the largest Indian variety, the fruit weighing over 2 pounds, usually the size of a shaddock), (15) Davis, (16) Feroghabunnee, (17) Gopal Bhog (deep amber and orange color when ripe), (18) Goa India, (19)Heenghia, (20) Kysapatee, (21) Langera, (22) Lucknow, (23) Malda (Syn., Large Malda) (size medium, color olive green, deep orange color inside, about the finest of all), (24) Mazageng (the fruit of this variety is said to be so delicious that guards are placed over the trees during the fruiting season), (25) Moorshebad, (26) Madras, (27) Madame, (28) Nagroo, (30) Peter (size medium, shape almost round, with a projecting heel on one side ; color dull russet, with reddish tinge), (31) Pathema. (32) Singapore (large, color greenish yellow), (33) Soondershaw (perhaps identical with Soondooria), (34) Soondooria, (35) Safaida, (36) Tarse.

Uses

The stone kernels of the mango fruit yield a starch which can be used for bread making, i.e., after the kernels have been pounded and washed with hot water. The fruits can be utilized if they cannot be sold fresh. The strained juice is spread out thin in the sun and preserved in the form of thin cakes. In the tropics the mango is a staple article of food during the hot months. The ripe fruits are eaten raw, either

plain or sliced with wine, sugar and nutmeg. The unripe fruits are made into jellies, preserves, tarts and pickles. A wine is made by adding vinegar to the juice of mangoes. Various domestic animals are also fond of the fruit. As to quality, mango is ranked by some next to the finest pineapples and the mangosteen.

Propagation

Propagation may be effected by seed, but it is a slow process, and necessarily uncertain, as no dependence can be placed on the quality of the fruit. The best way, therefore, is to graft from an approved tree, on a stock raised from seed, of which every garden should always possess a good supply, ready to receive grafts. Dr. Mac Fadyen in his "Flora of Jamaica" points out, that in that island, "in order to obtain a good variety the only plan is to employ the seed of the desired sort;" a method so fraught with doubt, that its continuance is much to be wondered at. The reason, however, that this author gives against grafting is that the bark abounds with so much resinous gum that all scions fail. The species must differ widely from those in India, since failures very seldom occur there in grafting mangoes.

The stocks are obtained by seeds. The seeds usually have more than one embryo, sometimes as many as ten. Each embryo will produce a distinct plant. The embryos may be separated before planting, but it is preferable to separate the young plantlets soon after germination, before they grow

together as they are apt to do. The seeds germinate better if the hard shell is removed before planting. Seeds retain their vitality but a few days, and if to be shipped for sowing they should be enclosed in wax. Seedlings begin to bear from the third to the sixth year.

Inarching or grafting by approach, is the method commonly practiced in India in connection with mangoes. It consists in bringing a second year's seedling of an easily propagated and inferior plant in a pot to the tree from which the scion is to be obtained, and placing it in such a position (on a platform, or within the embrace of a bamboo split at the top, for instance), that the portion of the tree of the superior kind (scion) which it is desired to propagate, can be brought into direct contact with it. A thin slice is then taken off one side of the stock about 2 or 3 inches in length, and a corresponding slice is taken off the branch of the scion, the two branches being of the same diameter. The cut surfaces being placed together, it is seen that the inner barks on both sides of the cuts join, the two being firmly tied with soft cloth. The graft is not waxed but kept moist by water constantly dropping on it. When union has taken place the scion is severed very carefully from the parent tree and the young plant is ready for removing.

Culture

After the graft is planted out, it requires little attention beyond keeping the ground clear from weeds, and rubbing

Off the leaf buds that appear within two feet from the ground, unless it be determined to train the tree in espalier form, which although seldom attempted, is well worthy of trial, as possessing many advantages over other modes of culture. In this latter case the young shoots must be laid in the form required, and all superfluous ones taken off ; as a standard, it is only requisite to preserve an even stem and a regular well-formed head. In the third year the first blossoms will appear on the extremity of the shoots, and the trees will yield a regular crop from the fifth year. From that period the trees must be dug round every year in the month of December or January, and a good supply of manure bestowed on the roots, especially at their extremities, for which purpose the earth from the bed of a river or the bottom of a tank is the best ; and as soon as the blossoms appear a trench should be opened round the tree, at a distance of four or five feet from the trunk, which must be filled with water every morning until the fruit begins to ripen.

Cashewnut, *Anacardium Occidentale*. . . Synonyms, Monkey Jambo, Acajon of Tournefort.

Origin

Tropical America, cultivated how many centuries not known.

Description and Habitat

Leaves obovate or obovate oblong glabrous, obtuse retuse or rounded at the tip, base rounded or cuneate.

Hotter parts of India, especially near the sea. Naturalized from America

A small tree ; trunk short, thick, crooked. Leaves 4-8 by 3-5 in., hard ; nerves about 10 pair, nearly horizontal, petiole $\frac{1}{4}$ to $\frac{1}{2}$ in. Panicles 6-10 in. pubescent ; branches long, naked to the tips where the flowers are collected ; bracts lanceolate, gibbous, hoary. Flowers $\frac{1}{3}$ in. diameter, yellow with pink stripes. Stamens usually 9, all fertile, one larger than the rest. Fruit 1 in., on a pyriform fleshy receptacle 2-3 in. long.

The tree is indigenous to Ceylon and is only to be seen in a wild state, although very worthy of being cultivated for the valuable properties it possesses. Its astringent bark contains a great proportion of tannin, and yields a beautifully transparent gum in large masses from its trunk and branches.

The fruit has an unpleasant smell, similar to that of garlic ; it is juicy and of rather a spongy nature. The apples that are not exposed to the sun are smaller and quite yellow, without the slightest tinge of red ; their juice is a powerful acid but custom soon reconciles one to its use, notwithstanding the temporary contraction of the skin of the mouth consequent upon eating the fruit.

Some of the old Dutch families at Ceylon manufacture a superior wine and spirit from the cashew apple, and they prefer it as a liquor, but not for diluting with water to the best brandy. . . . Its juice stains linen, and may be used for marking it, and by the application of a solution of lime

upon the writing after it is dried, the color becomes black. The kernel of the nut forms part of every dessert at European tables ; it is eaten both in a green and dry state. The Ceylonese roast the nut, in order to get rid of the hard acrid pellicle that envelopes it. The nut shell contains a powerful oil, which might be usefully employed in a variety of purposes, and particularly as a varnish to wood where the white ant abounds ; for that insect will never attack anything besmeared with cashew oil.

The tree grows to the height of eighteen or twenty feet, and spreads much at the top ; but its timber is of little value ; the leaves are glossy and thickly set. The gum exudes in such large drops that insects are very often caught in its progress, and are soon covered with gum, which upon becoming hard, may be polished. These specimens are very often imposed upon purchasers in Ceylon as amber.

Hogplum, *Spondias Mangifera* (Willd.)

Description and Habitat

Leaflets, 4-6 pairs, 2-9 in., oblong, acuminate, quite entire ; panicle 1-2 ft., drupe ovoid, stone rough and fibrous.

Throughout India from the Indus eastward and southward to Malacca and Ceylon, ascending to 5,000 ft. in the Himalaya.

Wild and cultivated. Distribution, Tropical Asia.

A small tree, everywhere glabrous. Leaves 1-1 1/2 ft., petiole slender ; leaflets 2-9 by 1-4 in., shortly petiolate, shining, more or less oblique, nerves 10-30 on each side,

horizontal, joined by a strong intramarginal one. Panicles large, spreading, sparingly branched. Flowers $1/4$ in. diameter, scattered, uni or bi-sexual. Calyx 5-toothed. Petals oblong, greenish white. Disk broad, 10-toothed. Filaments short subulate. Drupe $1\ 1/2$ -2 in. long, yellow, smooth ; flesh very austere ; stone cavernous, usually with 1 (1-3) perfect seed.

The fruit is acid and is eaten cooked by the people of India.

Propagation

Propagation is effected by cuttings or suckers which root freely, and any soil is good for this tree, though it thrives best in a sandy peat, requiring no after culture when once planted.

CHAPTER V

Myrtaceae

Rose apple, *Eugenia Jambos* (Linn.)

Origin

Malay Archipelago, Cochin China, Burmah, Northeast of India. Cultivated for more than four thousand years.

Description and Habitat

Leaves narrowly lanceolate, acuminate, attenuated at the base into a short petiole, coriaceous, midribs stout, nerves prominent below and uniting within the margin in a distinct and continuous one, racemes short, terminal ; flowers large, white ; calyx tube turbinate ; berry subglobose and crowned with the four persistent calyx lobes.

Indigenous in the Sikkim Terai (Brandis); Burmah,

Pegu (McClelland); Penang (Wallich).

Distribution, Yunan to Australia (said to be naturalized at Hong Kong).

A moderate sized tree ; branchlets compressed or ~~sub-4-~~gonous. Leaves variable in length, 1 1/2-2 in. broad, nerves reticulate beneath ; midrib stout ; petiole short and stout ; 1/4 in. or less. Calyx tube produced above the ovary, lobes round, berries 1-2 in. diameter.

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Leaves 9-12 by 3 1/2 in., glossy on both surfaces, dots inconspicuous ; nerves indistinct above, the primary ones few, prominent beneath and uniting more or less distinctly within the margin, sometimes in double looping ; petiole stout, channelled above, 1/2 to 1/2 in. Flowers large and handsome. Calyx tube 3/4 in., lobes unequal, rounded, with membranous edges, the large pair 3/8 in. long. Petals large, suborbicular, glandular. Stamens numerous about 1 in. in length. Style long, persistent, nearly equalling the stamens. In a cultivated specimen from Chittagong the leaves are distinctly pellucid-penetrant, with large glands.

The fruit is of white color, pear shaped and of a highly polished surface. It is juicy, cooling, and of an agreeable vinous flavor and smell, the latter partaking but in a very slight degree, of the rose perfume by the *Eugenia Jambos*, or Rose apple. It forms part of the usual dessert at European tables ; it is also stewed or baked after the manner of pears in Europe, and occasionally preserved as a sweet meat. In order to give it a pink or deeper red color, to resemble baked beans, Ceylonese cooks employ the petals of the shoe flower (*Hybiscus rosa Sinensis*, var. *duplex*). The large bats called flying foxes (*Vespertilis vampyrus*, L.) are extremely partial to the fruit ; and if the Ceylonese did not in some measure provide against their night attacks, by stretching lines from branch to branch, and suspending a bell therefrom, these animals which generally fly in flocks, would devour the produce of a large tree in the course of a night. The tree attains the

height of 20 ft. and is conical in outline, but its timber is not held in estimation. When in full bloom, the bright pink stamens of its blossoms afford a delightful contrast to the brilliant green of the foliage, and give it a splendid appearance. It may then be known at a considerable distance by the color of the ground around its base ; for this to the extent of twelve or fourteen feet in circumference, is commonly of a uniform red, from the fallen stamens, for days together.

Culture

The tree grows almost wild and needs no particular cultivation.

Guava, *Psidium Guyava* (Linn.)

Description and Habitat

A small tree pubescent on the young branches. Leaves on very short petioles, ovate or oblong, and usually acuminate, 3-4 in. long, glabrous or nearly so above, softly pubescent beneath and with the principal nerves prominent. Peduncles axillary, 1/2 in., 1-3 flowered ; buds ovoid in the adnate part, the free part also ovoid but larger and more or less pointed. Petals broad, 1/2 in. in diameter. Fruit globose or pear-shaped. "Indigenous in Mexico and possibly in other parts of tropical America, cultivated and naturalized in most tropical countries. In India the Guava is cultivated almost everywhere except in the northwestern corner of the Punjab.

It often runs wild, but there is no ground for supposing that the Guava is indigenous in India. Wood compact, close-grained, takes a beautiful polish."

Variety *pyriferum*, Linn. peduncles one flowered,
fruit pyriform.

Variety *poniferum*, Linn. peduncles usually 2 to 3
flowered, fruit globose or ovoid.

The guava is an esteemed fruit both for the dessert and for jelly.

Propagation

It is propagated by seeds and the young plants when about six inches in height are transplanted.

Soil

A good garden mould is all that the guava requires ; occasionally in the cold season, it is manured by putting the soil from the bottom of tanks around the root.

Culture

The trees require frequent pruning, as they are apt to grow very straggling. They are abundant bearers and begin to give fruit in the third year after they are sown.

CHAPTER VI

Anonaceae

Custard apple, *Anona Squamosa* (Linn.). Synonym, Sweet sop.

Origin

West Indian Islands, cultivated for how many centuries not known.

Description and Habitat.

Leaves oblong obtuse or acuminate glaucous beneath and pubescent when young, fruit tubercled.

Naturalized especially in the Western Peninsula. Distribution, Tropical America.

A small tree. Leaves 2-3 by $3/4$ -1 $1/2$ in., membranous, usually obtuse, base-acute. Flowers solitage 1 in. long, pubescent. Petals 3, narrow, oblong. Fruit fleshy, areolate.

The outside skin is thick, and divided into many compartments, the pulp is sweet, luscious, and filled with small black, elongated seeds.

Propagation is effected by seeds.

Netted Custard Apple, *Anona Reticulata*. Synonyms,
Bullock's Heart.

Origin

West Indian Islands, cultivated for how many centuries not known.

Description and habitat

Leaves oblong or oblong lanceolate, quite glabrous, smooth or roughish beneath, fruit smooth, lightly areolate.--Linn.

Naturalized in Bengal and elsewhere. Distribution, Tropical America.

A small tree. Leaves 5-8 by 1 1/2-2 in., base acute ; petiole 1/2 in. Flowers 2-3 together on lateral peduncles. Outer petals as in *A. Squamosa* ; inner very small, narrow oblong. Fruit subglobose, roughish outside, with pentagonal areole.

Soil

Grows almost wild in a soil impregnated with salt, but requires a wet subsoil.

CHAPTER VII

Cucurbitaceae

Watermelon, *Citrulus vulgaris* (Schrad.)

Description and Habitat

Leaves deeply divided on but moderately lobed, glabrous or somewhat hairy, hardly scabrid, fruit often 10 in. diameter, sometimes much smaller.

Throughout India, cultivated. Distribution, In all warm countries of the world cultivated.

The fruit is very refreshing.

Propagation

Propagation is by seed sown where the plants are to fruit, for though many people transplant them, the plants are never so healthy, or the vines so strong, as when they remain where sown, seed should not be too new, as, if less than two years old it is apt to run too much to vine, and to produce only male flowers. The seed must be put in from the beginning of February to the middle of April.

Soil

The soil can hardly be too sandy, but it should be manured thickly with a compost of two parts old well-rotted cow

dung, one part stable manure, and one part sand, dug into the soil to a depth of not more than six inches ; a layer of about two inches of sand being laid over the bed. Some of the finest melons ever seen have been grown on sand, which had been left on inundation, in which holes were dug down to the soil wherein the seeds were planted, the vines being trained on the sand, whereby fields of some hundreds of acres were made productive after having been considered lost to the cultivator. Before sowing the seed the beds should be moistened, and the seeds put in holes not less than six (eight is better) feet apart, at a depth of an inch and a half.

Culture

When the seed leaves fall off, or wither, the plants must be thinned, so as not to leave more than four plants in each hole, As the shoots advance they should be pinned down at intervals with small wooden pegs to prevent their interference with each other, or being blown about by the wind, and the earth must be brought up about the stems. Such shoots as produce only male blossoms must be cut out. When the fruit blossoms open, it is advisable to assist the setting of the fruit by impregnating them with the male blossoms. As the fruit increases to the size of an egg, it should have a tile or potsherd placed under it to protect it from any dampness in the earth, or the late sown melons had better be raised on a low trellis, to prevent their being injured by the rain ; during the whole time of their growth the plants should be watered

daily ; the fruit ripens from the middle of April to the middle of June.

Muskmelon, *Cucumis melo* (Linn.)

Description and Habitat

Leaves orbicular-reniform, 5-angular or lobed, lobes neither deep nor acute scabrid on both surface and also often with soft hairs, petals $5/8$ in., fruit glabrous or somewhat hairy not spinous nor tuberculate.

Throughout India, cultivated. Distribution, cultivated in most hot countries.

Stems scabrous. Leaves 3 in. diameter ; petiole 2 in. Female peduncle sometimes 2 in. Fruit spherical, ovoid elongate or contorted.

Soil

Cucumbers will thrive in any good soil not extremely heavy nor sandy. Good maize or wheat land, if in gardening condition with respect to tilth and drainage, will answer or for the earliest crop, a situation with a more pronouncedly sandy soil may serve best.

Seeds are planted 6 to 12 in the hill (having enough to provide against the ravages of the insects), the hills being 4 by 6 feet apart.

Cucumbers for pickling should be gathered when quite small. In fact, their value as pickles seem to stand pretty much in inverse ratio to their size. Vines on which fruits

are allowed to ripen cease bearing almost immediately. The young fruits may be successfully preserved in brine, from which they are soaked out in fresh water as wanted, and put into vinegar, which they readily absorb.

Cucumber, *Cucumis Sativus* (Linn.)

Description and Habitat

Leaves ovate, 5-angular or slightly lobed, lobes acute hispidulous on both surfaces and also often with soft hairs, petals $5/8$ in., fruit glabrous, sometimes tuberculated, commonly elongate.

Throughout India, cultivated. Distribution, In all warm and warm temperate countries, cultivated ; where wild unknown.

Stems scabrous. Leaves 3-5 in. diameter ; petiole 2-3 in. Female peduncle sometimes 2 in. Young ovary muricate with rigid prickles. Fruit commonly cylindric, 12 by $1\ 1/2$ in.

Variety *Sikkimensis*, fruit 15 by 7 in., clavate with 5 placentas. Cultivated in Nepal and Sikkim.

Muskmelons thrive best in a light and quick warm soil. The hot, bright climate suits them well.

In warm countries the melon is propagated by seeds planted in the field where the crop is to mature. The seed is dropped in hills of well-enriched soil, three to five to each hill, and covered with about 2 inches of soil. In some parts of the United States a method is followed which is a good one for

extending the picking season over a long period. The first planting is 3 1/2 by 5 feet, and two to four weeks later more seeds are sown between the hills, thus prolonging picking season in the same patch.

CHAPTER VIII

Miscellaneous

Pineapple, *Ananus Sativus*

The following terms are used more or less generally in the United States in connection with the pineapple industry.

Rattoons. When a bud occurs in the underground portion of a pineapple stem it produces roots by the time it gets to be 12 to 15 inches high. These make strong, vigorous plants, and are left in the field undisturbed unless too many occur together.

Suckers. Plants produced from buds that originate from a portion of the stem above ground. These are nourished from the plain plant and are late in producing their own roots if they remain attached to the parent plant. They are the usual commercial commodity. In buying pineapple plants, suckers are understood unless otherwise stated.

Slips. These are plants that originate from buds produced at the base of the fruit. There is great variation as to the number of slips produced by different varieties and by different specimens of the same variety. Slips usually remain on the plant after the crop has been gathered, and often grow to be 8 to 12 inches long by winter. In the common varieties

only the largest slips are used, but in the high priced varieties all slips are saved and planted.

Crown Slips. These are plants that originate at the upper end of the fruit. In some of the varieties, the crown is wanting and a tuft of crown slips is produced instead. Crown slips are utilized only in the high-priced varieties.

Crowns. The tuft of short leaves at the apex of the fruit. It takes these a year longer to mature a crop than it does large suckers, so they are not employed extensively.

Pine. The ordinary abbreviation for pineapple both on the plantation and on the market.

Sanded, or sanding. Referring to sand being blown into the buds of newly set plants.

Shed. A structure which produces half shade, used to equalize the extremes of temperature.

Tanglewort. A pathological condition in which the roots or part of them are wound tightly around the stem of the plant.

Climate

A climate with a temperature never reaching the freezing point and with a dry atmosphere is necessary for the production of pineapples. A matured leaf will lie upon a table in the dry room of a dwelling for two months without decaying or drying up, but it will rot in less than two weeks if it be placed in an atmosphere saturated with moisture. Pineapple plants may be shipped from the Hawaiian Islands to Florida if they be kept dry.

The pineapple does not flourish in the extremely hot portions of the globe. Its largest acreage is confined to the tropical islands or to the sea coast. The best pineapple regions in the world have a mean temperature of from 75 to 88° and have the smallest annual variation.

Soil

The crop can be grown upon land that will produce ordinary vegetables, but the soil must be of a loose and open nature and not allowed to become water-soaked. Free drainage of soil is more important for pineapple growing than fertility and humus. The soil prepared by the gardeners who grow this crop under glass illustrates this point. Their standard formula is about as follows : two parts decomposed fibrous loam, one part well decayed manure, another part one-half inch bones and pounded oyster shells.

Propagation

Suckers are planted for the main crop of the common varieties. Slips and crowns take too long to mature a crop to be utilized excepting when suckers are not to be obtained. Well matured suckers will produce a crop in fourteen to eighteen months from time of setting out.

It is desirable to strip off the lower leaves of the suckers and to trim the butt end. Not to strip off these leaves gives a tendency to tangleroot. After cutting the end off square, the leaves may be stripped off until the newly formed roots are visible.

The suckers should be set 3 to 5 inches deep, according to size, care being taken not to set it so deep that sand can be easily blown into the bed. Many planters prefer to clip off the ends of the leaves to keep the wind from blowing the plants over.

Crowns are not utilized extensively for planting because they are shipped with the fruit and it requires a year longer for them than for suckers to come into bearing. In the vicinity of canneries they might be used, but as a rule they are not worth the cost of saving. They are set out just as suckers are, but there is less danger from sanding and from being blown out.

Slips are usually so small that they are used only in the high priced varieties, or when plants are scarce. They are treated very much as the sucker, but need much more attention and care. They cannot be set more than 2 to 4 inches deep, and even then there is danger of their sanding or being blown out. It usually takes slips a year longer to mature a crop than it does well-matured suckers, though large slips planted at the right time may mature a crop in twenty months.

Seed is used only for experimenting purposes, like originating new varieties. It is said to take these ten or twelve years to mature a crop.

Growing Period

Most fruit crops take kindly to a good coating of mulch, and the pineapple is no exception to this rule. After the

first crop has been gathered most of the old foliage dies and makes a covering for the soil.

During the growing season the leaves of the pineapple plants are very easily broken. The peculiar and complicated structure of the pineapple leaf makes it very resistant to drought, but if the epidermis is broken it soon loses moisture to an excessive extent, and damage to the plant results. Whatever implements are used or whatever operations are performed in the field, special care must be exercised to avoid breaking leaves.

Marketing

Gathering. The fruit should be dry when gathered. The first act in gathering is to select the fruits thought to be ripe enough to reach the market in the best condition. In the summer, if the fruit is to go forward as freight it is selected when it is "just turning." If it is to go by water it is selected a little less mature, and if by express the fruit may be permitted to become "quite well colored." The matter of selecting depends so much on judgment that no hard and fast rule can be laid down. The distance from the market, the condition of the weather, and the variety planted are all factors which must be considered.

Care in Handling. In the United States, the laborer who goes among the fruit is usually provided with a pair of legging that reach above the knees and a pair of mittens made of canvas. He seizes the pineapple, usually in both hands, and gives it

a slight twisting bend to cause the stem to snap off a half inch or so below the fruit. If the stem be broken off too near to the fruit it is apt to rot in transit, and if the stem is broken too long it has to be broken again at the shed at a loss of considerable time. In gathering some of the fancy varieties the stems are cut several inches long, the fruit taken to the packing house, and the stem cut off even with the fruit. In some cases the cut ends of stems are covered with paraffin wax to prevent, as much as possible, evaporation and the loss of flavor.

Grading and Packing. At the packing house the fruit is sized, sorted and packed into barrels (12x20x36 in.) and half barrel (12x10x36 in.) crates, usually in the latter, and designated as 18's, 24's, 30's, 36's, 42's, 48's and 54's, according to the number required for a half barrel crate. In packing a crate the fruit must be pressed down firmly so it will not shake in transit, and, on the other hand, it must not be squeezed down to the extent of mashing or bruising. Each fruit is wrapped separately in brown paper. In addition to lessening the danger of breaking the skin the wrapping protects the fruits from wilting and from dust while being shipped or carted. Pineapples sell largely upon their looks.

Canning

Canned pineapple has long been known as an article of commerce. Large canneries use from 25,000 to 50,000 pineapples per day. This means about 500 crates, or more than a

carload a day, to run a canning factory of the size of some in the British West Indies. The process of canning is not complicated, and is practically the same as for other fruit. Of course, experience is necessary to successful work. The fruit is peeled and sliced, put into cans, and the syrup added. The cans are then soldered and immersed in the steam cooking or sterilizing vat. After removal from the vat the cans are perforated to allow the steam to escape, and then the perforation is sealed and the contents allowed to cool. The size of the cans and the concentration of the syrup depend upon the market that is to be supplied. Two conditions--plenty of cheap labor and plenty of cheap pineapples--are necessary to successful pineapple canning. For Home use, the pineapple is easily canned. The peeling is removed carefully, the fruit quartered or sliced, and the core taken out. The cans, preferably glass jars, are filled with sections and boiling syrup poured on to fill the jars. These are then set into a kettle of boiling water for fifteen or twenty minutes, then they are removed from the kettle, and the cap, which, with the rubber, has been sterilized, screwed on.

For flavoring. For this purpose the pineapples are secured as fully ripe as practicable. The peeling and slicing is done in the same way as for canning. The sections are then ground and put up in cans or jars of suitable size. Just as little cooking as possible is done when the fruit is intended for flavoring. To avoid sterilizing by means of heat, preservatives of various kinds are used to preserve ground

fruit. For the cheaper trade, such as the soda water fountains in villages of the United States, this ground fruit is put up in small tins holding about half a pound. For larger trade it is put up in large cans, and for the best trade in glass jars. This method of putting up fruit for flavoring by means of preservatives is injurious. The fruit to be used for flavoring may be prepared by boiling and sterilizing the ground fruit in the same way as the sliced fruit in canning. This has the disadvantage of losing a part of the flavor, but this avoids the bad effects of the preservatives used.

Preparing for Table Use. While canned pineapple may be used when the fresh fruit cannot be obtained, it is only an inferior substitute. To secure the full benefit of this fruit it should be allowed to ripen fully, preferably on the plant. No matter how daintily a pineapple is served it is not quite equal in flavor to the dead ripe fruit just picked from the plant and eaten out of hand.

Sliced. With a large knife remove all the peeling, being careful to remove the last bit of the eyes that remain. Any part of the peel is liable to prove quite acrid. The crown may be used as a part to hold the fruit by, or it may be removed and the fruit held by the use of a carving fork. Beginning at the base of the fruit, slice off whole segments three-quarters of an inch or an inch thick. Sprinkle each segment with sugar to give the desired sweetness. After the entire fruit has been sliced and treated with sugar, set aside for twelve hours. At the end of this time considerable

pineapple syrup will have formed in the fruit dish, and the flavor and palatableness will have been improved greatly, especially if it has been standing in a refrigerator. A good pineapple should be so tender that it can be eaten with an ordinary fruit spoon.

Dug out. For this purpose select a large pineapple. Cut the base off square and take the crown out. Then with a thin-bladed, sharp kitchen knife cut around just under the peel, so as to remove the entire meat and leave the peel intact. Cut or shred the meat into suitable shape for use and sprinkle thoroughly with sugar. Set the cylinder made by the peel on a large plate, right end upward. Put the prepared pineapple into this cylinder and place the crown in position until ready to serve. This makes a very pretty ornament on the dining table, as it looks like a whole pineapple. To serve, the crown is taken off and the prepared pineapple taken out with a fruit ladle or a large fruit fork. Only large fruits can be used in this way, and they must be used soon after being prepared, or else the sugar should be withheld until the fruit is served.

To Flavor other Fruit. Some fruits when put up to keep lack character or special flavor. A small amount of pineapple prepared with them imparts a flavor and tartness that is pleasing. This is specially true of oriental pears and quinces.

Pineapple Sheds

The desire to protect this plant from the winter's cold seems to have been the origin of the present pineapple sheds in the United States, though the protecting of pineapples by sheds has now extended to the region where there is little danger of freezing. The value of the half-shade condition in improving the quality of the fruit is now generally recognized. The sheds not only prevent extremes in temperature but also an excessive evaporation. The cost of shed prohibits its profitable use for the lower grades of pineapples.

Trees for Shade. Hardwood trees that have a deep taproot frequently grow in the midst of a pineapple plot without any apparent bad effect and with considerable protecting influence. It is not probable that such conditions would continue indefinitely, since the fertilizer applied to the pineapple plants would sooner or later draw some of the feeding roots of the tree to the surface and thus divert the fertilizer applied for the use of the pineapple plants. Besides the fertilizer taken from the soil, the trees absorb more or less moisture, which would be of some detriment to the crop during a dry season at least. The first difficulty may be removed by digging a trench between the native growth and the pineapple plants. This cuts off the feeding roots of the trees and keeps them from taking the plant food and the moisture from the field crop. The second difficulty may be removed by watering and irrigation.

Department of Agriculture, brings forth very strong arguments for the belief that the good effect produced by planting trees in coffee plantations is to be accounted for by the fact that nitrogen gathering trees, such as belong to the order Leguminosae, add fertility to the soil rather than by the direct effect of shade upon the coffee plant. The building of pineapple sheds is the greatest expense, and, aside from plants, the cost of fertilizer the next most important consideration. If, therefore, a shade can be produced by the use of leguminous trees, and they at the same time supply the amount of nitrogen needed, it will greatly reduce the cost of producing the finer varieties of pineapples.

By-products

The industry of raising the fruit for market is so remunerative that no earnest attention is given by the pineapple growers to the use of the by-products.

Some attention has been paid to the preparation of extract for flavoring and for medicinal purposes, but this was not for the purpose of using up a waste product, but for the direct profit of selling the extract. It is well known that this fruit contains an active principle called "ananasine," which possesses active digestive properties. Advantage is taken of this fact in the manufacture of pineapple digester and in separating the active principle for medicinal purposes if there should occur an over supply of pineapples.

Marmalade. Small fruits and ill-shaped and defective

specimens may be prepared and worked up into marmaldes, or what is sometimes called "preserves."

Pineapple Fibre. The plant after maturing a fruit gives rise to one or more suckers and later in the season dies to become a waste in the field. In this form it is of very little use except that it forms a slight covering or mulch. During the dry season it may even become a source of danger from accidental fires.

There are said to be about 60 pounds of fiber in a ton of green leaves, about double the amount in a ton of green ramie stalks. The fiber has many qualities that give it superior merit, and it will doubtless be used some day in the textile industry.

Banana, *Musa sapientum* (Linn.)

Description and Habitat

Stoloniferous, stem tall cylindrical, leaves petioled, spike drooping, bracts ovate, many flowered, usually deciduous,, calyx 5-toothed at the tip, petal shorter than the calyx, fruit pulpy.

Indigenous in Behar and the Eastern Himalayas ascending to 4,000 ft., Ceylon ; cultivated throughout India and the tropics. Distribution, Malay Isles, etc.

Stem 8-12 ft. Leaves 4-5 ft. oblong, bright green above, paler beneath. Inflorescence about as long as the leaves ; bracts ovate, more or less pinnose, lower 6-8 in., upper much shorter, falling before the fruit matures. Calyx

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M. Corniculata, (Rumph.) ; flower larger than in any other form, only 2-3 rarely 4 whorls of flowers produced, fruit as large as in *paradisiaca*.

M. Textilis ; leaves firmer in texture than in *sapientum*, yielding a useful fibre, bracts polished, seeds very small and scarcely at all angled. Native of the Philippines, cultivated in India.

M. Arakanensis ; a fibre yielding form from Arrakan.

M. Zebrina ; a handsome form with variegated leaves.

Culture

The banana plant is prized for its fruit, textile fibre and decorative effect in landscape gardening. The species mostly in demand for fruiting seldom or never produce seeds, and naturally increase by suckers around the base of each plant. These form a large clump, if allowed to grow without care. They are most readily separated from the parent root-stalk by a spade, and are then fit for further planting. This is slow process of increase, but it is sure, and the suckers so produced make large and vigorous plants. A quicker method of propagation is to cut the entire root-stalk into small, wedge shaped pieces, leaving the outer surface of the root about 1 by 2 inches in size, planting in light, moist soil, with the point of the wedge down and the outer surface but slightly covered. The best material for covering these small piece is fine peat, old leaf mould, mixed moss and sand, or other light material which is easily kept moist. The bases

so planted should be in a full open sunshine. The small plants from root cuttings should not be allowed to remain on the original bed longer than is necessary to mature one or two leaves, as that treatment would stunt them. The textile and ornamental species, also, may be increased by the above process, but as these species usually produce seeds freely, seedlings can be more quickly grown and with less trouble. The seeds of banana should be sown as fresh as possible, treating them the same as recommended for root cuttings. As soon as the seedlings show their first leaves, they should be transplanted into wellprepared beds of rich, moist soil. Both seedlings and root cuttings should have proper transplanting, sufficient room and rich soil, as a rapid, unchecked growth gives the best and quickest results.

The cultivation of bananas for fruit is carried on very extensively in all tropical countries. In the West Indies, Central America and Mexico, they are raised for export to the United States and Canada. The site selected is usually a level plain in the lowlands, near the coast, or in valleys among the hills, where the rainfall or artificial moisture is sufficient. The variety most commonly grown at present is the Martinique having large bunches, with long, yellow fruit. The Red Jamaica is more sparingly grown now than formerly, and its dark red fruits of largest size are not commonly exported. For distant shipping, bunches of fruit are cut with "matchets" or knives, after they reach their full size and are almost

mature, but quite green in color. Ripening is affected during shipment in warm weather, and by storing in dark, artificially heated rooms during cold weather. Banana flour is a valuable product of ripe bananas prepared among the plantations in the tropics. It is nutritious, and has an increasing demand and use as human food.

Papaw, *Carica Papaya*

Origin

West Indies, Central America. Cultivated before the discovery of America, without showing signs of a great antiquity of culture.

The papaw is commonly cultivated, and is more or less naturalized in various parts of India.

Description

Small trees, mostly with unbranched trunks, the juice milky. Leaves near the top of the trunk, alternate, large and variously lobed, soft, long stalked, plant usually dioecious; flowers in racemes from the leaf axils, the staminate funnel shaped, and bearing 10 anthers on the throat, the pistillate larger and with 5 distinct petals and 1 pistil with 5-rayed stigma. There are about twenty species of *Carica* in tropical America. They have somewhat the aspect of palms. Under glass in frosty countries, the common *C. papaya* is frequent, and is grown for its foliage and interesting habit. In frostless countries this species is grown for its fruit, which is

oblong or egg-shaped, a foot or so long, orange-yellow when ripe, thick-skinned, with many small black seeds. The ripe fruit is much relished for its cooling effect. The young unripe fruit is also cooked and eaten as a vegetable.

The soil most suited for Caricas is a rich loam, having perfect drainage. As the stem is succulent and tender, great care is necessary to avoid bruising ; hence pot-grown plants are much to be preferred to seedlings from the open ground. Seeds should be selected from the best and largest fruits and should be dried in the sun and after being kept a week, sown in a box or under cover in a rich but light soil. The soil should consist of sand and two-year old manure. If weeds are quite dry or old they should be soaked in warm water before sowing. The seedling plants are delicate, and require close watching at first to avoid damping off. When the plants are a few inches high they should be transplanted to a nursery, and when 2 or 3 feet high they should be planted out in the fields 10 ft. apart in holes in which plenty of manure and a few pieces of bones should be put. The trees should be planted in the open and not in shade.

When six feet high the central bud should be nipped off and growth of side branches encouraged. The size and quality of fruits are both enhanced by this operation. Caricas seldom branch, but usually grow upright like a palm, hence cuttings are not often available. Sometimes small branches form, and these may be cut off and as readily rooted as most tropical decorative plants provided the cutting is not too young and

tender. In temperate climates Caricas have been found to be good decorative plants, for both conservatory and summer bedding, the deeply cut palmate leaves forming a striking contrast to ordinary vegetation. In bedding out, select open, sunny exposure, with perfect drainage, and make the soil rich and friable. Constant cultivation with a light hoe will cause a luxuriant growth under these conditions, and the planter will be amply repaid for his trouble by beautiful showy specimens as unique and tropical appearing as palms.

As a heavy yielding fruit and vegetable crop the papaya has hardly its equal and it deserves to be cultivated as a regular crop. The fruit grows plentifully during the monsoon, but it goes on yielding all the year round.

Apart from the great value of the papaya as a drought resisting crop yielding a highly nourishing vegetable (when the fruit are green) and ripe fruit, the crop is of great value as the source of Papain or Papayotin. The juice of the fruit or the macerated leaves, if rubbed on animal flesh makes it very tender. It is for this softening property that the milk of the fruit is generally added to the meat while cooking it.

Pomegranate, *Punica Granatum* (Linn.)

Origin

Persia, Afghanistan and Beluchistan, cultivated for more than four thousand years.

Description

The tree is grown both for its ornament and for its edible fruit. The natural habit of the pomegranate is of rather bushy growth, but by careful training a tree 15-20 ft. may be produced. A great many shoots spring from the base of the plant ; these should be cut out as it is contended that they withdraw the nutriment which should go to the fruit bearing stems. The branches are slender, twiggy, nearly cylindrical, somewhat thorny ; leaves lanceolate, long, narrow, glossy green and with red veins ; flowers with a red colored, thick, fleshy calyx, crowned with bright scarlet, crumpled petals, and numerous stamens. The fruit is globular, topped with a crownlike calyx, has on the outside a hard woody rind, very astringent, and covering numerous seeds enveloped in a bright, crimson colored pulp, seeds being arranged in segments, separated by a thin skin, and very acid in the typical variety. A cooling, acescent drink is made from the pulpy seeds, with the addition of water and sugar. This is much used in the southern part of the United States, and is especially grateful in fevers.

The pomegranate may be considered as one of the most valuable fruits, both as to its beauty and medicinal properties. The bark of the root is a well-known astringent employed in therapeutics, in dysentery and diarrhoea ; the rind of the fruit when boiled has for many generations past been the remedy for tenia, and a jet-black, smooth writing ink is also made of it. The pulp of the fruit is invaluable for invalids.

Propagation

Propagation is effected largely by seeds and all varieties are increased by cuttings, suckers, layers, and scarce sorts by grafting on a common sort.

Soil

It requires a rich, but at the same time a rather sandy soil.

Culture

The pomegranate requires much pruning, and the center shoots being kept thinned out, or it will soon get crowded and straggling, with a quantity of useless wood.

Litchi, *Nephelium Litchi* (Comb.)

Origin

Tropical America, cultivated for how many centuries not known.

Description and Habitat

Leaflets 2-8, opposite or alternate oblong lanceolate or ovate, acuminate above, quite glabrous, shining beneath, glaucous, glabrous or very nearly so, lateral veins obsolete, base cuneate, panicle terminal, calyx 4-5 dentate, petals 0, disk glabrous, stamens 6-10 at length, exserted, fruit tubercled.

Widely cultivated in India ; introduced from S. China. A fine tree of moderate height with spreading branches.

Leaves 3-9 in.; leaflets 1 1/2-6 by 1 1/2-1 3/4 in.; petioles 1/12-1/4 in. Inflorescence tawny puberulent ; flowers greenish white, 1/12-1/8 in. wide. Anthers shorter than the filaments. Disk glabrous. Ovary 2-3 celled, ferruginous-hairy; style 2-3 lobed, lobes recurved. Fruit 2-1 lobed, globose, about 1 in. diameter, pericarp dry, at length brittle ; tubercles angular, aril fleshy, whitish edible. The fruit has a stiff, rough, reddish skin and the pulp is sweet and firm.

In America, the Litchi is only known in its dried state, that is, when the outer warty shells have become woody, and the inner pulp, or aril which envelopes the seed, has somewhat shrivelled and become black. In this state the pulp has simply a sweet taste, but in the fresh state the pulp is whitish, or slightly tinged with pink, and has a refreshing acid taste.

Propagation

Propagation may be effected by seeds or by cuttings made of half ripened wood. In India layering is considerably practiced as the plant readily throws out roots.

Soil

A rich mould, not too dry is the best suited to the Litchi.

Culture

After the young plant is put into the fruit garden, it must be carefully watched to train the stem and remove the lower shoots and suckers, as this tree is much disposed to

become crooked, straggling and ill shaped. When bearing, which takes place generally from about the sixth year, the roots should be occasionally watered moderately. The fruit ripens in March and April.

Jack Fruit, *Artocarpus Integrifolia* (Linn.)

Origin

India, cultivated perhaps for more than two thousand years.

Description

A tree with stipulate leaves like the fig tree, the flowers closely packed upon the outside of large oblong spikes, the male and female flowers on distinct spikes. The perianth of the male is two lobed, enclosing a single stamen ; of the female, entire and more or less adherent to adjoining perianth, so that the whole grow together, and when mature form a huge collective fruit, ten to sixty pounds in weight. The seeds are ex-albuminous.

The fruit issues by short stalks direct from the stem. The seeds when roasted have something of the flavor of a chestnut, and are eaten like it. It is a curious circumstance in the growth of this tree, that the finest and most esteemed fruits are produced from the roots below the surface of the ground and are betrayed by the cracking of the earth above them, and the effluvia issuing from the fissure ; a high price is charged for fruit so produced. As the pulp has a strong disagreeable smell, it is not liked much by the richer class.

Propagation

Suckers produce the best plants, but they may be raised from seed or layers.

Soil

A rich soil is most sought for by this tree, but no culture is required.

Jujube, *Zizyphus Jujuba* (Lamk.)Syn., native plum

Origin

Burmah, India. Cultivated for more than four thousand years.

Description and Habitat

Usually armed, leaves 1-2 1/2 by 3/4-2 in., elliptic ovate or suborbicular dark green and glabrous above, covered beneath with a dense woolly pale colored tomentum, fruit 1/2-3/4 in. diameter.

Throughout India, from the Northwest frontier, Sindh, and base of the Himalaya to Ceylon, and Malacca ; wild and extensively cultivated. Distribution, Alghanistan, tropical Africa, the Malay Archipelago, China, Australia.

A small tree 30-50 ft., young branches and flowers covered with a dense fuscous tomentum. Prickles solitary and straight, or germinate, and then one shorter and recurved. Cymes 3/4 in. long. Calyx glabrous within ; petals subspatulate, very concave, reflexed ; disk of 10 grooved lobes ; ovary 2-celled ; styles 2, united at the middle. Fruit globose, 2-celled,

fleshy and mealy, glabrous. There are many cultivated varieties, differing greatly in the shape and size of the leaves, as also in the size and nature of the fruit, of which the most remarkable is Edgeworth's var. *Hysudricus* (Journ. Linn. Soc. VI 201), with erect or spreading not drooping branches, obtuse ovate oblong or obicular leaves, glabrous or slightly tomentose beneath, and long petioles. This, according to Aitchison, is always raised by grafts. Two other varieties are described by Edgeworth--viz., *hortensis* and *spontanens*.

Propagation

Propagation is effected by seeds and cuttings

The Native Olive, *Elaeocarpus Serratus* (Linn.)

Description and Habitat

Leaves elliptic obtuse or acuminate, crenate serrate, stamens 20-35, anther valves sparingly bearded, drupe oblong, stone tubercled, 1-celled, 1-seeded.

Tropical Himalaya ; Sikkim, 2-3,000 ft., Nipal, Eastern Bengal and the Eastern and Western Peninsulas. Distribution, Java.

Leaves 4-5 by 2 1/2 in., glabrous, base tapering ; petiole 1 1/2 in. Racemes scarcely so long as the leaves, ascending. Flower buds ovoid-conical. Flowers 1/2 in. diameter. Sepals ovate, speckled, glabrous. Petals lacinate half way down, ciliate at the edges. Ovary villous, 3-celled, Drupe the size and form of a small olive, edible ; stone oblong, pointed,

tubercled, pitted, 1-celled.

The tree never exceeds 20 ft. in height. The fruit is eaten fresh, or pickled or preserved dried.

Propagation

Any garden soil will suit this tree which is easily produced from cuttings.

Tropical Almond, Terminalia Batappa

Tall deciduous tree (sometimes 80 ft., with leaves and branches in horizontal whorls or layers ; leaves broadly ovate-obtuse, the narrow base slightly auricled or cordate, simple and entire, very short petioled, 6-9 in. long ; spikes solitary from the axils, not exceeding the leaves : flowers greenish white, the upper ones staminate and the lower ones perfect, fruit almond shaped, 1 1/2 in. or less long, 2-edged, indehiscent, glabrous, with a hard shell, containing an edible meat. Useful both as a street tree and for its filbert flavored nuts. The nuts are eaten either raw or roasted. Foliage is usually brilliant in autumn. As seen in the market the

outer brown skin or covering of the nuts is often removed. *Terminalia Catappa* is sometimes called "Olive Bark Tree." The tree is extensively planted in Porto Rico, where the nuts are called "almonds."

Propagation

Propagation is effected by seed. Requires no particular cultivation.

Tamarind, *Tamarindus Indica* (Linn.)

Diffused through India and the tropics generally, probably indigenous in Africa. A large unarmed tree. Leaves abruptly pinnate, with 20-40, glabrescent, close obtuse opposite oblong leaflets. Flowers few together, in copious lax racemes at the end of the branchlets ; pedicels articulated at the base of the calyx ; bracts boat shaped, enclosing the buds, caducous. Petals under 1/2 in. long, yellow, striped with red. Pod 3-6 in. by 1 in. or more, 3-10 seeded.

The fruit when ripe has a strong but agreeable acid flavor, makes a pleasant sherbet and is preserved in a dried condition. The fruit ripens from December to February, but it is seldom cultivated, though few gardens are without a tree of natural growth. The tree is prized both for its usefulness and its beauty.

Averrhoa Carambola, (Linn.)

Description and Habitat

Leaflets 2-5 pairs, ovate or ovate lanceolate, acute glabrous and glaucous beneath, fruit with acutely angled lobes, seeds arillate.

In gardens throughout the hotter parts of India as far north as Lahore. Native country unknown.

A small tree, densely branched. Leaflets 1 1/2-3 in.; petiole stout, pubescent. Flowers chiefly axillary, variegated, white and purple. Calyx glabrous, half as long as the petals. Stamens 10, 5 shorter without anthers, or sometimes 1 or 2 of these longer and antheriferous. Ovary pubescent. Fruit 3 in. long, yellow; aril 2-lobed, lacerate. Two varieties are known, sweet and sour. The former is eaten raw and cooked. Leaflets irritable to the touch. The acid kind is of rather pleasant flavor, something like an insipid apple.

Propagation is effected by cuttings in sandy loam.

Soil is common garden mould.

The fruit ripens from December to February, a second smaller crop is also obtained at the close of the rains.

Rozelle, *Hibiscus Sabdariffa* (Linn.)

Synonyms. Red Sorrel of the West Indies.

Description and Habitat

Annual, glabrous, unarmed, stem purplish, leaves entire or lobed, glandular beneath, peduncles very short, thickened at the summit, bracteoles 8-12 linear adnate to the base of the calyx, sepals bristly.

Generally cultivated in the hotter parts of India, and in Ceylon. Distribution, Cultivated in the tropics.

Erect. Leaves polymorphous, midrib glandular beneath; petiole 2 in. Peduncle solitary, axillary, shorter than the petiole. Bracteoles and calyx accrescent. Sepals deltoid, acuminate, cuneate below the middle into a purplish fleshy cup. Corolla 2 1/2 in. diameter, yellow. Capsule ovoid, pointed, villous, shorter than the calyx. Seeds reniform, sub glabrous.

Uses

The capsules are of a crimson succulent substance, that makes good tart, a jelly, or a cheese similar to damson cheese, becoming ripe towards the end of November.

Propagation and Soil

Propagation is by seed, thriving in any good garden soil.

