

## THE LYCHEE - WITH REMARKS CONCERNING ITS STATUS IN CALIFORNIA

### W. B. Storey

*R. B. Storey is Associate Horticulturist, University of California, Citrus Experiment Station, Riverside, California.*

The lychee (*Litchi chinensis*) is a fruit, native to south China, where its beginnings as a cultivated crop are lost in antiquity. To the people of south China, as well as to many persons of other lands into which it has been introduced and cultivated successfully, there is no fruit in the world more delicious. It is one of a number of delicious tropical and subtropical fruits with which the American public is only now beginning to become acquainted.

Many persons throughout the United States have eaten "Chinese lychee nuts", which formerly were imported into this country from China in large quantities. The "lychee nut" is the dried form, having about the same relation to the fresh fruit as a raisin does to a grape. In recent years, many persons, in many parts of the country, have had the opportunity to sample fresh fruit produced in Florida.

The lychee was introduced into the United States and established successfully in Florida about 1870. Trees were reported to be bearing in that State in 1883. Up to 15 years ago, however, the lychee was still grown very little in Florida, and then, only as a home garden tree. Today, it is being set out in commercial orchards, with possibly as many as 500 acres already planted. In 1952, the Florida Lychee Growers Association was founded by a group of forehanded individuals who saw the need for an organization to disseminate information on lychee culture and to assist in marketing the fruit. The Association's marketing report for 1955 shows 25,649 pounds of fruit handled that year, and notes that the 1956 crop could reach 100,000 pounds. It is interesting to note that 4,000- pounds, or roughly, one-sixth of the 1955 crop, were shipped into California and sold in Los Angeles, San Francisco, Oakland, and Palo Alto.

What affect the recent discovery of the Mediterranean fruit fly in Florida will have upon future shipments of fresh lychee fruit into California is strictly a matter for conjecture at this time. If the fly is eradicated, as it was once before, we can expect to see increasingly larger shipments coming into our markets for sale at nominal retail prices. The lychee quick-freezes and cans well, so we may expect to see more of it in these forms, also, particularly if a quarantine against fresh fruit lasts for any appreciable time. Shipments of fresh, quick-frozen, or canned lychees undoubtedly will be supported by promotion and advertising to arouse consumer interest in them as a new taste treat among fruits and to attempt to establish them firmly in the fruit merchandizing market.

The Florida development continues to arouse the curiosity of persons in southern California as to just what is a lychee and what is the prospect of growing it here. This

article was prepared to answer the first question, and to allow one to draw his own conclusions with regard to the second.

### **COMMON NAMES AND PRONUNCIATION**

The spelling *lychee* is the form of common name adopted by the American Joint Committee on Horticultural Nomenclature. The late Prof. Groff (2), in his book *The Lychee and Lungan*, stated that the word *lychee*, with the *ly* pronounced as in *lying* and the *chee* as in *cheese*, would best convey the correct Cantonese sound of the word. Most horticulturists in the United States have adopted this form of common name.

The Mandarin sound of the word is *lee — chee*. This pronunciation is commonly used in North China, India, South Africa, and a number of other countries where the lychee now grows. The preferred spelling in the horticultural literature of these countries, however, is *litchi*, which is identical to the generic name of the species.

Groff's preference for the Cantonese pronunciation and the spelling which most closely approximates it lay in the fact that the lychee is indigenous to south China and had its origin as a cultivated fruit tree in the Canton delta region of the Pearl River.

Variations in spelling may be encountered in the horticultural literature on the lychee, as well as on the labels of boxes of dried fruit and of cans of preserved fruit which occasionally appear in local grocery stores. Among the more common variations are lichee, leechee, litchee, lychi, laichi, laichee, laitchi, laitchee, and lici.

### **BOTANY**

The botanical name of the lychee is *Litchi chinensis* Sonn. It is a member of the soapberry family, Sapindaceae. A related native species is the California buckeye, *Aesculus californica* (Spach.) Nutt. A closely related species of south China is the lungan or dragoneye, *Euphoria longana* (Lam.), which also bears an edible fruit. Specimen trees of the lungan are to be seen in a number of localities in southern California.

The lychee tree is a medium to large, handsome evergreen, with a short, stocky trunk and a low, large head. (*Fig. 1*) In Florida, Hawaii, and elsewhere, trees reach a height of 40 feet, with an approximately equal spread when grown under favorable conditions. In some varieties, the branches are crooked or twisting, and low-hanging and spreading, forming a head broader than high. In other varieties, the branches are fairly straight and more or less upright, forming a compact, rounded head.



*Fig. 1. Lychee trees near Bostonia, California*

The leaves of the lychee are arranged alternately on the stems. They are pinnately-compound, consisting of a leaf stalk (petiole) and its extension (rachis) with 2—5 pairs of leaflets. The combined length of petiole and rachis is 3—9 inches. The leaflets are arranged in opposite or slightly oblique order along the rachis on short stalks (petiolules) of their own which measure  $\frac{1}{8}$ —1 inch in length. The blades of the leaflets are a lustrous deep green on the upper surface, and a waxy lighter green (glaucous) on the under surface. They are soft-leathery to the touch. Mature leaflets measure 3—8 inches in length and 1—2½ inches in width. They are elliptical to lance-shaped in outline. The bases of the blades are wedge-shaped, and the apical ends may be tapered to a long point, wedge-shaped, or even more or less rounded. Length of petiole and of rachis, arrangement of leaflets on the rachis, number of leaflet pairs, and leaflet shape and dimensions are useful characters for identifying varieties.

The inflorescence is a many-branched panicle which, depending on variety, may vary in length from 3 inches to over one foot. It bears hundreds of small white or yellowish flowers which give off a mild, unpleasant odor when the tree is in full bloom. The numbers of fruit maturing on a panicle may vary from one to 40, or more, (*Fig. 2*)

Lychee flowers measure about  $\frac{1}{8}$ — $\frac{1}{4}$  inch across when fully expanded, resting on flower stalks (pedicels) about  $\frac{1}{16}$  inch long. They have 4 or 5 short dentate sepals, but are without petals. They have 6—10 stamens.



*Fig. 2. Lychee fruit clusters hanging on tree.*

Five different types of flowers have been described in the literature on the lychee. Classification of the types is based primarily upon length and functionality of the stamens, and on development and functionality of the pistil. The flowers are unisexual in function, so they may be classified broadly as male and female. Both classes of flowers are borne in the same panicle, but tend to alternate in their periods of opening.

The typical male flower has a vestigial or abortive pistil at its center. Surrounding this are the 6—10 stamens with filaments up to 1/4 inch in length. A single flower remains functional for several days during which the pollen sacs ripen and shed pollen successively rather than simultaneously.

The typical female flower has a small, but fully developed, pistil which rests on a short stalk or gynophore. The ovary is two-lobed with each lobe containing an ovule. It is surmounted by a short style, which is cleft at the apex into two rays that expose white, sticky, stigmatic surfaces when expanded. The pistil is surrounded by the stamens which, however, have very short filaments, usually no more than 1/16 inch long. The pollen sacs do not open, so the flower sheds no pollen.

Generally, only one lobe of the ovary develops into a fruit, the other lobe aborting. Occasionally, both lobes develop, and the mature fruit superficially resembles two fruits adherent to each other at their bases, each containing a seed.

The typical one-seeded fruit may be round, ovoid, or heart-shaped, depending a good

deal on the variety. (Fig. 3) The outer covering is a thin, leathery shell (pericarp), which is bright red in color in most varieties. It is rough in appearance and to the touch; its surface being covered with angular or conical protuberances. The shell becomes brown and brittle upon drying.



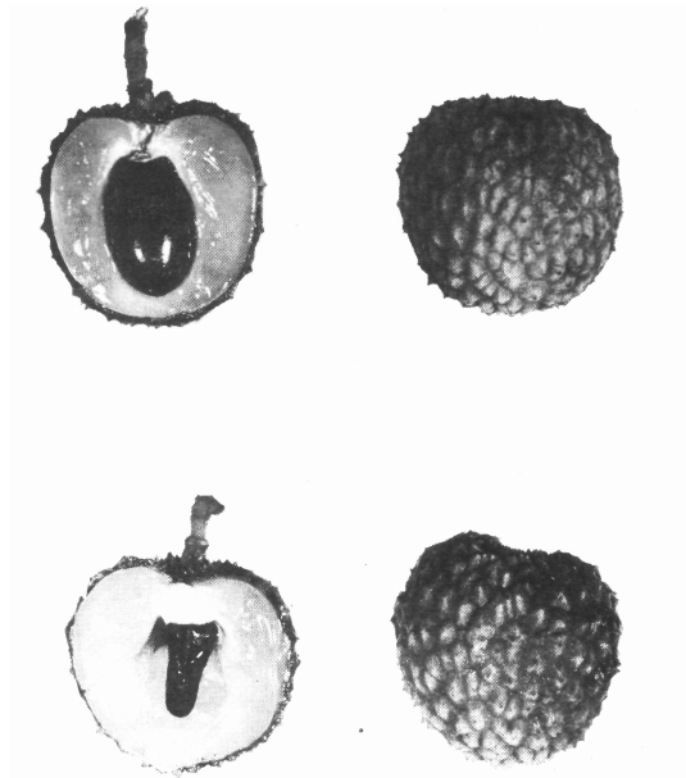
*Fig. 3. Single cluster of lychee fruits.*

The fleshy edible portion of the fruit is an interesting structure. It is an outgrowth of the seed stalk, and is called an aril. It grows as the fruit develops until it completely envelops the seed. It is white and translucent, and has a consistency about like that of a grape. The flavor, which is sub-acid and quite distinctive in its own right, is likened by many persons to that of a prime muscat grape.

Upon drying, the aril shrinks away from the shell, and becomes shriveled, brown, and date-like in character. It is in this form only that many persons are acquainted with the fruit as the "Chinese lychee nut".

The chestnut-brown seeds are ovoid to oblong in shape, measuring  $\frac{3}{8}$ — $\frac{7}{8}$  inch in

length and 1/4—1/2 inch in width. In some varieties, a high percentage of the seeds in fully developed fruits may be abortive. The abortive seeds are small and shriveled. (Fig. 4) The Chinese people call the abortive seeds "chicken tongue" seeds. Fruits with abortive seeds are preferred, for they are no smaller than fruits with normal seeds, and, consequently, contain a larger proportion of flesh.



*Fig. 4. Lychee fruits showing normal and abortive seeds.*

In Hawaii, the lychee begins to bloom as early as mid-December in some years, and as late as March in others, with slight differences between varieties in a given season. The fruit crop ripens from about the middle of May to the middle of August. In south China and in Florida, flowering commences in mid-February and tapers off toward the end of March. In China, where numerous varieties are grown, the fruiting season extends from the middle of May to the middle of August. In Florida, where production is limited almost entirely to a single variety, the bulk of the crop ripens in June and July. In California, flowering usually occurs no earlier than April, and in some localities, does not reach its height until late in May to the middle of June. The fruit crop matures in September and October.

The lychee is a heavy bearer when conditions are favorable for fruiting. In Florida, 155 pounds of fruit were harvested in 1948 from a 10-year-old tree at Laurel, and 400 pounds from a 24-year-old tree at Auburndale. In Hawaii, 7 and 8-year-old trees have produced up to 100 pounds, and 15 to 20-year-old trees up to 300 pounds of fruit.

## **NATURAL REQUIREMENTS**

The lychee thrives and bears best under subtropical conditions in the absence of injurious frosts. From Florida, it is reported that the mature lychee tree is hardier than the mango and avocado, but somewhat less hardy than the sweet orange. At Homestead, Florida, no injury was observed on mature trees that were not in active growth at a temperature of 28 degrees F. On the other hand, tender growth was damaged when temperatures fell below 32 degrees F, and young trees were severely damaged or killed at temperatures of 29—30 degrees F in unprotected plantings.

For best fruiting, the lychee is said to require cool dry winters and warm humid summers. Winter dormancy seems necessary in order for flower buds to be initiated in the spring. It is because conditions closely approximating these occur in Florida that the history of fruiting has been fairly consistent. In Hawaii, where the winters are normally wet and the summers normally dry, the winter temperature rarely falls below 56—58 degrees F, bearing is highly erratic.

The lychee requires a large supply of water for optimum growth. The consensus of opinion seems to be: if rainfall is less than 50—60 inches, distributed through the major portion of the year, supplementary water should be supplied through irrigation. The soil around a lychee tree should never be allowed to dry out.

The lychee will grow on a wide variety of soil types, providing they are sufficiently deep and are well drained. In Hawaii, they are grown on fairly heavy clay soils. In Florida, they are grown in some areas where the soils are very sandy. Acid soils are thought to be best, but in Florida and India, they are grown satisfactorily on neutral and slightly alkaline soils.

## **PROPAGATION**

The most widely practiced method of propagating the lychee is by air-layering or marcottage. Branches about 1/4—1/2 inch in diameter are the ones most generally used. First, the branch is girdled by removing a ring of bark, about one inch wide, a foot or two from the end. Then, a ball of damp sphagnum moss is placed around the girdle, and firmly wrapped with a sheet of polyethylene film cut to proper size. The edges of the wrap are lapped or folded, and the ends are tied secure. A sufficient root system, to allow for cutting the layer from the tree, forms in 3—4 months, if layering is done during the warm seasons of the year. Usually, the rooted layers are cut from the tree and planted in containers. They are kept in partial shade and under conditions of fairly high humidity until ready for transplanting to the field.

Grafting and budding are not widely used as means of propagating varieties, because of the time required to grow rootstocks to adequate size and because the percentage of successful takes has generally been of a rather low order.

The lychee can be propagated by cuttings, but this is not often done because of special conditions and techniques which must be used. The root systems of cuttings are usually inferior to those of air-layers.

## VARIETIES

There are about 50 varieties in cultivation in the lychee growing region of south China. The most important of these, from the commercial standpoint, have the following names: No Mai T'sz, Kwai Mi, Hak Ip, Sheung Shu Wai, Wai Chi, Pak Lap Lai Chi, and Heung Lai.

Singh and Singh (5) describe 12 varieties in the lychee growing region of India. These are: (1) Early Seedless (Early Bedana); (2) Rose Scented; (3) Early Large Red; (4) Dehra Dun; (5) Late Large Red (Muz-affarpur); (6) Pyazi; (7) Extra Early Green; (8) Kalkattia (Calcutta); (9) Gulabi; (10) Late Seedless (Late Bedana); (11) Khatti; (12) Pickling.

Commercial plantings in Florida consist of a single variety, Brewster. This variety was sent to the United States by the Rev. ft. N. Brewster in 1907 and was received by the United States Department of Agriculture as S.P.I. No. 21204. It is now said, on good authority, to be identical to the variety known in Fukien province, China, as Chan Ka Tsz or Chen Family Purple.

In 1955, the U.S.D.A. and the University of Miami jointly introduced a Florida-grown seedling as a new variety, Bengal. It is reported to be a vigorous grower, which does not show chlorosis when grown in the limestone soil of Dade County.

Lychee production in South Africa is based on a single variety, Mauritius.

The principal producing varieties in Hawaii are the Chinese varieties, Kwai Mi, Hak Ip, Brewster, Heung Lai, and Wai Chi. In 1953, the Hawaii Agricultural Experiment Station introduced a new variety which it named Groff. This variety seemed to offer considerable promise of producing good crops annually in Hawaii, despite lack of the winter chill which is thought necessary for good bearing.

## THE LYCHEE IN CALIFORNIA

The first known lychee tree in California was one planted by Mr. E. D. Hadley at his residence on East Sola Street in Santa Barbara in 1897. Mr. Hadley obtained the tree from Reasoner Brothers Royal Palm Nursery of Oneco, Florida, which had imported it from Saharanpur, India. It fruited for the first time in 1913, and continued to fruit off and on for the next half dozen years. In 1916, it was reported to be about 10 feet high and 15 feet in spread. Mr. Hadley sold the property in 1919, and there seems to be no record of the tree after that date. Neither it, nor the old home near which it stood, exists today.

The writer has seen about 25 lychee trees growing in various localities in southern California. These vary all the way from large healthy specimens down to specimens which are stunted in growth and seem to be struggling for existence, what is probably the handsomest specimen tree in California is one growing at the Sidney Geering residence in La Mesa. The history of this tree is somewhat obscure, but it is thought to be about 30 years old. It stands 20 — 25 feet high, and has a spread of 30 feet or more. It is said to bear good crops annually. It was still carrying a fairly heavy load of fruit when I saw it toward the end of the 1955 crop season.



There are about a dozen fine trees on the R. E. Hamilton property near Bostonia. They average around 15 feet in height and 25 feet in spread, and are thought to be 25—30 years old. They are said to have produced fruit crops annually for many years, with an average of about 40 pounds per tree.

In 1927, a seedling of Shan Chi, the wild mountain lychee of China, was planted on the grounds of the Citrus Experiment Station at Riverside. The tree is now about 10 feet in height and spread, and is thrifty in growth. The size of the trunk, which was cut off near the ground sometime in the past, suggests that the tree may have been much larger at one time. It has borne fruit crops of a few pounds each in the two seasons in which I have observed it. At this time (May, 1956), it has a light flower crop.

Although flourishing trees are now established in a number of localities, suggesting the possibility of expanding lychee culture in California, the over-all picture has been one of disappointment and frustration. In 1955, as many as 350 rooted air-layers were imported into the State by various nurserymen and interested growers. Additionally, a large number of layers, at least 500 and possibly more, were rooted on established trees in California. These proved difficult to grow when planted in containers, even though procedures, which have been eminently successful in Florida and Hawaii were followed. Probably, no more than 50 of them now survive, and the survivors have yet to attain the growth and root development which would permit them to be planted out in the open.

In the past, trees which have been well established in large containers have tended to stand still, or to decline and eventually to die when planted in the open. For every tree that has become established in the ground in California, untold numbers have been lost. It is interesting to note, however, that well established, well cared for trees, out in the open, seem able to withstand the rigors of the southern California climate. In the past two winters, frosts which injured avocados and other subtropicals adjacent to lychee trees had no apparent effect on the lychees. In August - September, 1955, there was a protracted hot spell in which air temperatures reached 112-115 degrees F, and relative humidities were often below 10 per cent. No appreciable injury was seen on the lychee trees, whereas avocado trees were severely damaged and citrus trees showed stress.

Just why the lychee should be so difficult to grow in containers in the greenhouse or lath house, and why it should be even more difficult to establish in the open, are questions which have generated much speculation. Various arguments have been advanced as to what the cause, or causes, of the difficulty might be. Among the chief causes cited are the following: the low relative humidities of the atmosphere which prevail a good deal of the time; alkalinity of the soil in most areas, salinity of the water used for irrigation; lack of organic matter in the soil; lack of mycorrhizal fungi in the soil, which are believed to be related to satisfactory growth; soil temperatures too low for optimum root growth during much of the year; poor soil aeration; deficiency in one or more minor elements which may be requisite for growth. It is worth remarking, however, that various attempts to approximate what are believed to be optimum conditions for growth in greenhouse culture have been rewarded with only a modicum of success.

At this juncture, it must be confessed that little is known about just what does spell the

difference between success and failure in growing the lychee in California, especially as an outdoor tree. This, we are trying to find out, taking hope from the fact that some persons have managed to grow it successfully in some localities; for the lychee is so desirable a fruit that it deserves to be cultivated more widely in southern California, if the way toward making this feasible can be found.

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