

Puntarenas, April 30, 1949. alt. O, *Paul H. Allen 5278* (TYPE in Herbarium Escuela Agrícola Panamericana, duplicates distributed); corolla waxy white, calyx and pedicel green, immature berries pale green, largest fruit 1/2 inch in diameter, globose, understory small tree in deep forest, 8 m. tall, 6 miles inland from mouth of Estrella River, Prov. Limón, April 19, 1952, *H. E. Stork 4606*.

Two additional specimens from near Turrialba, Prov. Cartago, León 2472 and 3475 may belong to this species.

Gloeospermum consists of about ten species, one known from Honduras and the remainder South American. The present species is easily distinguished from the only other Central American species, *Gloeospermum boreale* Morton, by details of the flower structure. The sepals of the present species are of two shapes, the outer series of three being similar and the inner series of two similar, all of about equal size. In *G. boreale*, according to the description, the outer series is of two sepals which are smaller than the three sepals of the inner series. In *G. boreale* the petals are apparently similar while in *G. diversipetalum* there are two series, distinct in shape and size.

A REPORT ON IMPROVEMENT OF SUBTROPICAL FRUITS AT THE SUB-TROPICAL EXPERIMENT STATION, HOMESTEAD, FLORIDA

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THE SUB-TROPICAL EXPERIMENT STATION is one of 17 branch stations and field laboratories of the University of Florida Agricultural Experiment Station. It was founded in 1930 and thus the year 1955 marks its 25th anniversary. Dr. Gorge D. Ruchle, who joined the Experiment Station in 1935, has been Vice-Director since 1942. Although his training has been in Plant Pathology, he has done consider-

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able work with the fruit plants of South Florida. Other horticulturists who have worked at the Sub-Tropical Experiment Station include: Dr. H. S. Wolfe who was the director during the 1930's and is now head of the Department of Horticulture at the University of Florida in Gainesville; Mr. W. M. Fifield who was also with the Sub-Tropical Experiment Station in the 1930's and is now director of the Florida Agricultural Experiment Stations; Mr. S. J. Lynch who is now director of the University of Miami Experimental Farm; Dr. P. J. Westgate who is now at the Central Florida Station in Sanford; Mr. Milton Cobin who is now with the University of Puerto Rico. At the present time there are nine members on the research staff and the Experiment Station consists of 120 acres of rockland soil plus two vegetable farms on marl soils of 20 and 30 acres each respectively.

The research work is carried on under projects and these can be classified into three groups: Those which are devoted to winter vegetables, those devoted to tropical and subtropical fruits, and one which deals with plant introduction and study of ornamental plants.

This report will be confined to work with tropical and subtropical fruits.

The Station has approximately 220 species of economic plants in its collection. Some of them, like coffee, tea, cacao and teak, are represented merely as specimen plants and no actual horticultural work is being done with them. Some like the mangosteen and breadfruit are too tender to grow successfully in our climate and are kept as specimen plants in the greenhouse. The majority of the plants in our collection are those with edible fruits. Some like the Tahiti lime, avocado, mango, papaya, and lychee are commercial crops, while others like macadamia, sapodilla, West Indian cherry, are perhaps potential commercial crops. This leaves a large number of species that are of interest only to the home gardener who grows them as dooryard fruit plants. In Florida there is a tremendous amount of interest in this miscellaneous group of tropical and subtropical fruits, enough so that there are some nurseries that specialize in these plants. In this respect, then, these minor fruit plants do have a commercial importance.

Of the 36 kinds of fruit plants that we are working with, six have been selected for discussion in this report.

They are mango, sapodilla, guava, malpighia, rubus, and macadamia.

MANGO

There are many good varieties of mango in Florida and practically all of them are satisfactory for home use, the Edward variety being, beyond doubt, one of the best. But the mango industry needs good commercial varieties that have the following characteristics: good quality, attractive color, lack of fibers, thick skin but easy to peel, resistance to anthracnose; and most important, they must be capable of bearing good crops every year. Many of the varieties meet several of the requirements but few bear good crops regularly.

Thirty-nine varieties originating in Florida have been named (1) and of these perhaps only about a dozen are being planted today. The Kent seems to be the best variety so far, being fairly reliable in its annual production. Other varieties that are being planted include the Irwin, Keitt, Palmer, and Zill. Four varieties named only last year (1), Sensation, Ruby, Adams, and Sunset, seem promising as small-sized commercial fruits. The Adams, Sunset and another variety called Earlygold, were originally obtained from Pine Island, on the west coast of Florida, by Krome, Lynch and Ruehle in the early 1940's and have been under observation at the Sub-Tropical Experiment Station for several years.

Seedling selection seems to be the best method of developing new varieties. Hand-pollination has been tried in Florida, Hawaii, and India. In India a few varieties developed from this practice have shown promise, and the Edward mango in Florida is said to have originated as a cross made by Edward Simmonds in the 1920's. However, thousands of crosses must be made in order to obtain a few fruits and the results obtained are generally discouraging (2). All of the better Florida varieties, with the exception of the Edward mentioned above and the Davis-Haden which is said to be a mutation of the Haden, have originated as seedlings, mostly in back yard plantings.

Since 1948 hundreds of seedlings have been set out at the Sub-Tropical Experiment Station and every year after the fruits have been sampled the undesirable trees are

removed and new ones put in their place. So far, over 100 seedlings have fruited and only one is considered worthy of further testing.

The Sub-Tropical Experiment Station has over 100 varieties of mango in its collection, most of them having been planted since 1948. They represent varieties from India, Philippines, Indo-China, West Indies, and South America, while the majority are varieties originating in Florida. Growth behavior, anthracnose susceptibility, flowering and fruiting, etc., have been observed on all of these varieties, and yield records maintained since 1948. Thus we have comparative data on their performance and are in a position to evaluate and compare different varieties.

SAPODILLA

The sapodilla is a handsome tree and is very desirable for home planting for its fruit as well as an ornamental. A few small commercial plantings have been made in South Florida and the fruit sells well in such cities as Tampa. We have found that one of the best ways to serve the fruit is to freeze it whole; to serve, it is thawed just a little, sliced and eaten as a sapodilla ice.

Two varieties of sapodilla have recently been named (3). One, called Prolific, was one of the trees which was set out as a seedling in a windbreak formation at the Station in 1935-36. In 1941 this tree bore a heavy crop and fruits of good quality. It was propagated by veneer grafting and a number of grafted plants were set in the field in 1943. This variety has consistently produced good crops every year and is indeed worthy of its varietal name "Prolific". The quality is good, the size is medium-large, and the grafted trees bear at an early age. Also, grafted trees seldom grow to a large size.

The other variety is the Russell which originated as a seedling tree on the Florida Keys. It is of interest because of its good quality and large size, but the grafted plants are slower to bear and they produce fewer fruits than the Prolific. Six other selections have been made and are under study at the present time.

GUAVA

Most of the guavas in Florida are seedling trees which possess acid fruit suitable for jelly making. Guava breeding

at the Station has been concerned with the development of heavy fruiting clones with large fruit lacking offensive odor but with sweet or subacid flavor, high in vitamin A and C, with thick shells and small seed cavity, and resistance to alga spotting. These we call dessert fruits and they are to be eaten fresh or cooked as guava shells.

In 1946 Ruehle (4) named three varieties of guava. The Ruby was one of these; it originated as a seedling from among a number of plants set in the field at the Sub-Tropical Experiment Station in 1937. As the name implies, it is a red-fleshed fruit. The second variety, Supreme, is a white-fleshed fruit; the original seedling tree was located in Dr. Ruehle's yard in Homestead. The third variety is also red-fleshed and is called Red Indian and originated as a seedling near Homestead. The Ruby and Supreme are good varieties as a starting place for hybridizing, since they are both desirable clones. In 1945, Dr. Ruehle made crosses of these two. During that year a hurricane damaged the trees beyond recovery; all of the fruits were blown off except one green fruit which was held on by only a thin branch. The seeds were planted from this green fruit, resulting in 150 seedlings, 130 of which were planted in the field in 1946. Sixty percent of these plants produced fruits that were red-fleshed, while 40 percent had white-fleshed fruit with variations of salmon, light pink, yellowish, etc. Several of the plants resulting from this cross produced fruit superior to that of both of the parents. Yield records have been maintained since 1948 and in 1953 selections were made of the more promising trees and the rest removed. These selections are truly remarkable in their quality and yield.

Another hybrid has proved quite promising. In 1947 Dr. Ruehle crossed the Webber, one of the better varieties of guava originating in California, with the Supreme. One plant from this cross has produced white-fleshed fruit of unusual quality and possessing a sweet flavor. It will be tested further in the field and eventually be named and released.

In addition to the varieties already mentioned, the Station has seedling guavas from Brazil, India, and many other countries, as well as air layers from several outstanding plants throughout South and Central Florida. We also have the so called "seedless" forms as air layers from India and Indonesia. These seedless clones will be used in further

Miami in 1940. The flavor is between Sweet and Younghans and the color of the fruit is an unusual deep reddish purple.

The ascorbic acid content of the sweet variety and the tart varieties is similar, ranging from 1100 to nearly 2,000 mg/100 grams edible matter. The acidity of the fruit is apparently not due to ascorbic acid, for the sweet and tart are similar in the amount present. Rather it is malic acid, for the sweet fruits contain little or no malic acid, while the tart fruits often contain almost as much malic acid as ascorbic acid.

RUBUS

The species of *Rubus* that are grown in temperate climates do not fare so well when grown in South Florida; these species have certain chilling requirements which are not met in our subtropical climate. But there are many species of *Rubus* that grow in tropical and subtropical countries around the world and they apparently do not have chilling requirements comparable to those of northern species. Many of these species, of course, grow in the mountains where the hot humid climate characteristic of the low lands is considerably modified. It is these species that we must work with if we wish to produce a raspberry that will grow and fruit well in South Florida.

Greatest success has been had with *Rubus albescens*, the Mysore tropical black raspberry from India (7). Seeds were sent to the Station in early 1948 from Natal, South Africa. The plants first fruited in 1949. The growth, flowering and fruiting have been so successful in our south Florida climate, that the plant is now well established as a dooryard fruit plant. In addition to this species, 14 other species and 17 accessions designated as *Rubus spp.* have been tried in the last few years. These have come to us from Mexico, Guatemala, Honduras, Costa Rica, Colombia, Ecuador, Peru, Hawaii, Japan, Korea, India, Belgian Congo, and Puerto Rico. Some, like *R. glaucus*, the Andes blackberry, grow well during the winter months, but as soon as the hot summer sets in, the plants begin to die back. *Rubus Shankii* and *R. hondurensis*, both from Honduras, have also failed to survive our summer heat. To date only *R. albescens*, mentioned above, and *R. rosaefolius* have grown and fruited well. The latter is also native to India,

but it has escaped into mountains in many countries, especially in Africa and the West Indies. The fruit is not especially desirable so it has been discarded as not being worthy or further study.

Many people find that the fruit of *Rubus albescens* is quite agreeable and they grow it as a dooryard plant, and a few small commercial plantings have been made, the fruit being sold principally on roadside fruit stands. Others, however, find the fruit too bland, claiming that it needs more acidity or tartness. In 1950, the first crosses were made using pollen of Taylor, Sunrise and Latham red raspberries, the pollen being sent to us from Raleigh, North Carolina, by Dr. Carlos Williams. Seedlings of these crosses fruited in the summer of 1951; many of them were typical of the black parent, but a good portion of the plants possessed not only the vigor of *Rubus albescens*, but also produced red fruit. These fruits, however, were crumbly and of no particular value, although they had good flavor. Seeds were taken from the best of the F_1 red fruits to obtain an F_2 generation. In 1954 these F_2 seedlings fruited; some were black, some red, but many were purple the latter of large size, but unfortunately the purple fruits had the flavor of the black parent and in some cases were even more flat tasting. They were large, mushy and quite bland. Pollen of Sunrise and Latham red raspberries were obtained again from Dr. Williams and back crosses were made on the F_2 purple seedlings. At the same time pollen of Cumberland, Manteo, and Evans black raspberries were obtained and crosses were made on *Rubus albescens*. Seedlings of all these crosses will be planted in the field this summer.

Rubus albescens is remarkable in that it has no chilling requirements, at least as we understand this requirement for northern species. It grows well, flowers and fruits from December to June and producing heavy yields. So far it has been free of serious insect pests and fungus diseases. Material of this plant has been sent to a number of institution in the United States and other countries for use in breeding work for disease resistance and for low chilling requirements.

MACADAMIA

There are very few seedlings in Florida of this plant from which to make selections (8). Therefore, the only

selections that we have been able to make so far have been from seedlings grown at the Sub-Tropical Experiment Stations. Yield records have been taken since 1948 from 22 trees which range from 7 to 20 years of age. Four trees are of special interest, but only two selections have been propagated and only one is really of any value. The four selections are:

1. *Bow variety*. In 1937 seed was obtained from a tree, planted in 1910, at the Bow residence near Homestead and seedlings were planted in the field in 1938. One of these trees proved to be fast growing, attaining a relatively large size, with foot-long flower spikes, and producing a fair yield of large fruits. Unfortunately the shell is quite thick and the kernel averages only 25 percent by weight of whole nut.

The following three selections were made from seedlings set in the field in 1935, the seeds coming from Australia in 1934.

2. *SES 12-2*. It has produced fair yields, the fruits of medium size and containing an average of 36.45 percent kernel to whole nut. This is comparable with some of the Hawaiian varieties.

3. *SES 12-2½*. The yields have been fair, and the percentage of kernel to whole nut averages 31 percent.

4. *SES 11-1½*. This tree has produced the highest yields but the kernels average only 28 percent to whole nut.

Yields and percentages of kernels to whole nut from these and other trees has, on the whole, been not nearly as high as the named Hawaiian selections. We have the seven named Hawaiian varieties in our collection and their field performance will be compared with our selection.

We need more work on culture, propagation, and clonal selection before we can say that macadamia is a commercial crop for Florida. The selection of desirable clones is particularly important and we need hundreds and even thousands more of seedlings planted throughout Florida from which selections can eventually be made.

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