

THE CHERIMOYA

A Bit of Background, and Something About Spain

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Though I have been asked to base this paper on the cherimoya culture in Spain, I am going to spread out a little and make some comments and ask a few questions. First of all, what do we know about the native home of the cherimoya?

In my paper "The Cherimoya in California" (Pomona College Journal of Economic Botany, May 1912) I wrote that Alphonse de Candolle, our great authority on the origin of cultivated plants, considered it "most probable that the cherimoya is indigenous in Ecuador and perhaps in the neighboring parts of Peru." Then I went on to write that Professor Gabriel Alcocer of the Mexican National Museum believed that it was exclusively Central American, having been taken from Guatemala to South America. He cited Padre Bernabé Cobo, well known to us avocado men as having been the first to classify avocados in three races, which we now call the Mexican, Guatemalan, and (erroneously) the West Indian. In his "Historia el Nuevo Mundo" (1653) the Padre wrote that in 1629 he had seen cherimoyas in Guatemala, and had sent seeds to Peru, where the cherimoya was unknown at that time.

Not many modern botanists have accepted Padre Cobo's story, including W. E. Safford, who found clay artifacts which looked like cherimoyas in pre-Columbian graves in Peru.

When I was in Ecuador in 1921, as an agricultural explorer of the U.S. Department of Agriculture, hunting for avocados but interested in everything else, it occurred to me to hunt for the native home of the cherimoya. So I went down to the Malcatos valley, close to the Peruvian border, and I found plenty of cherimoya trees in what certainly seemed to be an indigenous state. I published an article in the Journal of Heredity (Vol. XII. No. 7, 1921) in which I told the story. Since my time, Peruvian horticulturists have searched for wild cherimoyas on their side of the border and have found plenty of them.

You may say, "We are not interested in what Padre Cobo wrote. We are interested in growing cherimoyas?" The answer is, sometimes we can learn something by knowing the conditions under which a fruit tree grows on its native heath.

In the paper just mentioned, I wrote that I found wild cherimoyas at elevations from 4700 to 6000 feet. And I went on to say "The situations at which the trees are most commonly seen, so far as I have observed, were on the slopes or sides of small ravines, and occasional bits of alluvial land which are formed in the narrow mountain valleys. The valley soils seem to be preferred by the cherimoya, and such lands appear to produce the largest trees; never-the-less it is not rare to find scattered specimens on clay slopes of somewhat rocky character. The climate of this part of Ecuador is warm,

as indicated by the elevation, yet it is not so hot as the coastal lowlands. Sugar cane is grown, though not extensively, and around the houses of the people there are orange and avocado trees and a few food crops such as corn and yucca. There is a long dry season, rather severe I believe, which extends from May or June to October or November."

I was interested to see if the various "types" which we recognize in cultivation, accordingly as the surface of the fruit is smooth or rough, were to be found upon the wild trees. They were. In the numerous specimens examined, most of them not over a pound in weight, the surface was most commonly smooth, with the carpellary areas marked by raised lines ("finger-printed") but there were also the other types with which you are familiar in California. I did not see what Dr. Franceschi Fenzi of Santa Barbara called "mammillaris" — fruits with prominent conical protuberances all over the surface, one from each Carpellary area. I believe a French horticulturist has called this form "Teton de Venus."

Early Days in California

Every time I try to determine just when the cherimoya was first introduced into California, or the avocado into California or Florida, Art Schroeder or some other real scientist comes along and shows that I put the date fifty years or more too late. Maybe more. When I was a kid, Knowles Ryerson and I used to sit at the feet of that grand old horticultural pioneer, Dr. Franceschi Fenzi. He did not attempt to tell us just when the cherimoya first came to California, but he did tell us about some of the earliest trees in the Santa Barbara region. His little work "Santa Barbara Exotic Flora" published in 1895 (now a collector's item; I wonder how many copies are to be found in California libraries) gives us this information: "to my knowledge, the first tree raised in Santa Barbara was planted by Mr. Packard and is still flourishing, bearing good crops every year." In the light of recent experience, one wonders just what he meant by "good crops."

Some 15 years after this little book was published, I tried to evaluate the possibilities of cherimoya culture in California. I mentioned the work done by Jacob Miller, who lived in the Cahuenga Valley at Hollywood, and had been a leading pioneer in the introduction of avocados and a few other tropical fruits. This was in my paper on the "Cherimoya in California" (Pomona College Journal of Economic Botany, 1912) where I also wrote about the remarkable little orchard of A. Z. Taft at Hollywood. When I examined it, this orchard consisted of about 80 trees 15 years old. Tremendously interesting, for those days. "No finer specimens could be desired than some of these, but the majority of them are deplorably unproductive. If the five best trees were taken out, not a bushel of fruit could be gathered from the lot. One tree alone, more prolific than the others, produced about one-fourth as many fruits as the remaining trees taken altogether." In line with our horticultural feeling at that time I thought it was a matter of seedling variation, and that the answer was vegetative propagation. I feel sure hand pollination had not been thought of at that time. What was the answer?



THE CHERIMOYA AT ITS BEST—A handsome specimen, more than two pounds in weight, grown in the Guatemalan highlands. California growers no longer want the largest avocados; Spanish cherimoya growers are finding that the market prefers fruits half the size of the one here shown.

Cherimoyas in Tropical America

In the early 1900s a few horticulturists had begun talking about protogyny, the difficulty in getting good crops because the pistils of the cherimoya flower mature and are receptive before the anthers dehisce and liberate their pollen. In many regions the stigmas pass the receptive stage before pollen in the same flower is available. P. J. Wester, an able horticulturist who worked at the little Plant Introduction Garden of the U.S. Department of Agriculture in Miami, Florida, had called our attention to this problem.

In my travels in tropical America between 1916 and 1923 I saw many cherimoya trees, from Mexico to Chile. Once in a while I came upon a tree which was carrying a fair crop — or what we called at that time a fair crop. In Guatemala several of these trees had been pruned back severely, and there was more fruit on the new wood than on the old branches. I doubt, however, that any of these trees had been pruned with that idea in mind. I am not sure. In recent years we have heard of plants of *Annona squamosa* which were believed to have produced more fruit after very heavy pruning had brought vigorous young wood into the picture. I do not know just how much information has been accumulated on this point.

Many years ago hand pollination began to receive a little attention. Charles H. Gable, a

young American horticulturist working in Madeira, wrote me in 1914 that by hand pollinating 49 flowers he obtained 36 fruits. Madeira must have a climate something like that of southern Spain, where cherimoya trees bear good crops *without* hand pollination. In recent years I have been wondering if climate was not a factor in Gable's case.

It is not for me to discuss hand pollination. I trust that Art Schroeder and others who have in recent years put so much time and intelligent effort into an investigation of its practical application will tell us the whole story in this Yearbook.

The Cherimoya in Spain

The flourishing cherimoya industry on the Mediterranean coast of Spain, extending approximately from Motril, due south from Granada, to Marbella on the West, probably tells us more about this fruit than we can learn anywhere else in the world. I spent the best part of 1958 at Rancho California, near Almuñecar — the very heart of the industry -- and as I have mentioned above, I visited the region, (for the fourth time) only a month ago. But I want to make it clear that what I know is mainly what I have learned from Luis Sarasola, an intelligent and devoted horticulturist, who has spent some 15 years developing the Rancho California for Roger Magdahl, the owner, who lives in Chile. They have switched from cherimoyas to avocados, and now have the finest little orchard in Spain — and the oldest one, planted almost wholly to Hass, which has proved more profitable than any other, including Fuerte.

I was delighted to see so many new cherimoya plantings on the Mediterranean coast. Sarasola told me that the secretary of the Hermandad de Labradores reports that the total area now in cherimoyas is 500 hectares. In 1958 we talked of 300 acres, not hectares. There must have been extensive plantings in areas I did not see. But how I enjoyed looking at those new plantings! Trees well formed, with straight, single trunks, and compact round-topped crowns of the most beautiful light green foliage. A young California citrus orchard is not a prettier sight. Incidentally, when I talked with one of the growers he confirmed what you already know, that there are few if any fruit trees easier to graft than the cherimoya. Commercially they use shield budding exclusively, and they bud seedlings already set out in orchard form. No other rootstock is used. In tropical America we have grafted, experimentally, one or two others, mainly *Annona reticulata* because it seems to do well on poor soils with little water. I did not hear that they have tried the veneer or side-veneer graft, which Sarasola has found much more satisfactory with avocados than shield-budding, and which we have adopted in Central America for many fruit trees, in fact almost everything but citrus.

I was interested in the figures on production which Sarasola gave me. He says that mature trees may produce from 100 to 150 kilograms, which means 15,000 to 20,000 kilograms per hectare. But he adds that it must be remembered that there are good years and poor years, hence commercial production over a period of years is not so high. In my recent visit I was impressed by the fact that 1970 was an "off" year; I did not see nearly as much fruit on the trees as I did in 1958.



A FRUITING CHERIMOYA BRANCH AT ALMUNECAR—These fruits were not tied on the branch, they grew this way, and without hand pollination. Of course not all branches bear like this, but it shows what the right natural environment can do.

As for cultural practices, little pruning is done except to remove dead wood, and lower branches which interfere with the passage of oxen when growers do their annual plowing of the orchard. Under mature trees there is usually plenty of shade and the surface of the land is clean. Incidentally, in his 1960 report Sarasola called to our attention a practice which I did not see. This consists in cutting back large limbs, almost down to the trunk, the object being what they term "rejuvenation." This may be carried out all at one time, or half the branches cut and the other half left for later treatment. New crowns are formed, and I wonder if growers have learned by long experience with old trees that they get more flowers and fruit on young wood?

Irrigation is somewhat sketchy. It has to be based on cycles which are established officially and which vary from year to year. As Sarasola says, "after seasons of good rainfall, the cycles may be 12 to 15 days; after seasons of poor rainfall, water is scarce, and the cycles may be as far apart as 40 days," which reminds me to add that on the valley floor, where the soils are silt loams, Sarasola was having trouble with his cherimoyas in 1958. We dug around several trees and found the feeding roots in very bad condition. We concluded that it is dangerous to over-irrigate cherimoyas on that sort of land.

The use of fertilizers also seems to be sketchy. Sarasola says the owners like to use stable manure - "cuando lo hay" - when there is any. Then he adds, since practically none is available, it is used very little. Chemical fertilizers are always complete, that is,

they contain N P and K, a 5-8-12 formula applied at the end of the cool season (winter), four or five kilos per mature tree, has given good results. Toward the end of summer it is desirable to give a light application of nitrogen.

In 1958 Sarasola and I made some observations, to convince ourselves that protogyny is not a major problem. At that time he wrote, "good crops are not a matter of hand pollination nor of cultural treatment. Almost certainly they are the result of favorable climatic conditions, most probably temperatures which rarely go above 85 F., and relative humidities which throughout the flowering season in spring are commonly 60 to 75 percent during the driest hours of the day." We believed we found that the stigmas were still receptive when pollen had become available in the same flower. We did not see many insects busily engaged in pollinating the flowers. However, we did not make a really careful study of this. Last month, when I was at Rancho California, I asked Sarasola what he had learned since 1958. He said that he still could not find evidence of pollination by insects, and that he believed light currents of air during the night suffice to put pollen from the anthers onto stigmas of the same flower. It is not a matter of anemophily, of course; he thinks that slight movement of the leaves is sufficient. Pollen is abundant, and the cone-shaped mass of pistils is close-by. It may be pretty easy for pollen to get onto receptive stigmas. I think we all believe, nowadays, that in hot dry climates stigmas do not remain receptive as long as they do in climates like that of Almuñecar.

But now about this variety or "cultivar" business. (I have spent 50 years trying to get my tropical American friends to speak of clones as "varieties," not "classes" and many Spaniards still call them "castas"). Luis Sarasola gave us a lot of information in his 1960 report, and on this recent trip he gave me a lot more. I feel that long familiarity with the commercial merits and defects of varieties, on the part of growers in southern Spain, can teach us a lot.

Sarasola says "At the present time practically the only variety planted is the JETE. No other has achieved great commercial importance. Why has Jete attained this supremacy? I am not quite clear about this. But its fruits are less susceptible to attacks of the Mediterranean fruit fly. The variety PINA, on the other hand, is severely attacked. And Jete is more productive than any other. And a more regular bearer. I do not think the fruits have less seeds, on the contrary, they have more than those of NEGRITO. But the number of seeds does seem to be altogether a matter of variety, because on the same tree will be found fruits which have an excessively large number of seeds, while others have few. Another point: growers insist the flesh of Jete is whiter, a characteristic appreciated in the markets, but at the same time they agree that the quality is not the best. Good fruits of Negrito are superior in this respect. The variety CAMPAS is holding its own to a certain degree, because its large fruits look so well when used to "dress" the top of the shipping basket. But at the same time they are too large for the market, which prefers fruits of one-half kilo. Campas is good for fancy "gift baskets" just as is the case with other fruits."

In the early 1950s, Roger Magdahl, well known to us at long range because he is a leading grower of avocados and cherimoyas at Quillota, Chile, and because he is one of the few life members of the California Avocado Society, sent to his Rancho California trees of Ott, Chaffey and Deliciosa, purchased from Armstrong Nurseries at Ontario,

California. Sarasola did not find that any of these produced fruits which he considered as good as the local "castas." Later Magdahl sent trees of Bronceada, from Chile, a variety which at Quillota produces fruits two kilos in weight. Sarasola did not find this variety very interesting.

Commenting on cherimoya pests at Almunecar, Sarasola mentioned first of all what he calls chlorosis. He suspects this is caused by a *Phytophthora*, perhaps *Ph. citrophora* (and he adds "I sure hope it is not *cinnamomi*"). Then there is the Mediterranean fruit fly, which we sure hope will never become a pest in California! He believes the fruit fly will be controlled with insecticides. Then he mentions "splitting" of the fruits upon ripening. He says this sometimes happens when you pick the fruits and are still holding them in your hand. This sounds like the splitting which is so characteristic of *Annona diversifolia* in the Central American semi-arid lowlands. He believes splitting is aggravated by too much nitrogen in the soil.

As regards insect pests, *Pseudococcus citri* is troublesome in a few places. One or two other insects are occasionally seen. But up to now, it can be said that coccids are not a serious problem.

Finally, I should add that Luis Sarasola, who has for many years been intimately associated with avocado and cherimoya growing in southern Spain, is enthusiastic about the future of the cherimoya on the Mediterranean coast. But he says there are problems in connection with marketing. The principal one is the short "shelf life" of this fruit. It softens within seven or eight days from harvesting, and after that can not be handled in the market. Another problem is the variability in quality. From the same tree you will harvest some large fruits of excellent quality, and a little later you will get fruits which are not worth *two reales* in the market. The best fruits are those which ripen early in the season (October) when the weather is still warm; fruits which do not mature until December are not so good.