

The Origin of the G6 Rootstock

George A. Zentmyer, Eugenio Schieber, Fred Guillemet, and Ed Johnson—

The large-scale search for avocado rootstock resistant to *Phytophthora* root rot of avocado, caused by the fungus *Phytophthora cinnamomi*, began at the Citrus Experiment Station (now U.C. Riverside) in the early 1950s when I (G.A.Z.) made my initial exploration and collecting trips to Mexico and Central America.

The search for resistance involved several different approaches: 1) testing miscellaneous avocado varieties and seedling trees growing in California; 2) a search for trees that appeared to be resisting the disease in California groves severely affected with root rot; 3) a search in the native home of the avocado (primarily Mexico and Central America, but extending into northern South America) for a wide variety of seedling avocado trees to test for resistance—also as in (2), a search for trees in root rot situations in Latin America that might be resisting the disease; and 4) a search in Latin America for trees of the many related species of *Persea* (avocado is *Persea americana*) that might have resistance to root rot. Some 80 species of *Persea* have been described as native to Latin America; the first author obtained locations for many of these by visiting botanical garden herbarium collections in the United States. Species of *Persea* are found from Florida south to Argentina and Chile.

The second author (E.S.) joined our project in 1971 and was involved in approaches 3 and 4 above. By that time, explorations had been made by G.A.Z. in 20 countries in Latin America and the Caribbean, which included thousands of seeds and budwood collections of the avocado, as well as 22 other species of *Persea* and related species in the family Lauraceae. After 1971, E.S. was involved primarily in the cooperative collections in Guatemala and Mexico, with some collecting trips also to Honduras, El Salvador, Nicaragua, Costa Rica, and Ecuador, some of these in conjunction with the first author.

This article provides information on the origin of one of the interesting rootstock collections with moderate resistance that we made in Guatemala—designated as G6. This rootstock was obtained as a result of our collections in category 3 above—the search in the native home of the avocado among a wide variety of seedling avocado trees.

We first detected the original G6 tree in the spring of 1971, when G.A. Zentmyer and Ed Johnson (Staff Research Associate in Plant Pathology at Riverside) visited Eugenio Schieber in Guatemala to plan some of the collecting program. One day we were exploring the forested area on the slopes of the volcano Acatenango, near the town of Antigua, with a Guatemalan avocado grower, Arturo Falla. He showed us a wild tree related to the avocado, known as "Aguacatillo," growing in a small canyon about half-way up the volcano. I later identified this tree, which had small purplish black fruit, in the

herbarium collections at the New York Botanical Garden as a tree related to the avocado, in the genus *Arouea*. We collected fruit and budwood from this tree, and tests in Riverside showed that it was not compatible with avocado.



Fig. 1. Slopes of volcano Acatenango, with arrow showing location of the original G6 tree.



Fig. 2. Original G6 tree photographed in 1971.



Fig. 3. Unripe fruit of G6; photo in 1972.



Fig. 4. Narziso, Eugene Schieber's Mayan helper in front of G6 tree, October 1988.



Fig. 5. Original G6 tree in full bloom; October 1988.

(Photos by E. Schieber and G. A. Zentmyer)

While we were collecting material of the Aguacatillo tree, a local native came by and told us that there was another avocado tree below on the mountain, saying, "hay otro aguacate allá abajo." We went down to the edge of an open field and found a large avocado tree. This was obviously a Mexican type, with anise-scented leaves. Later we found that the fruit were small, purplish black, and smooth skinned, somewhat similar to

the Mexicola variety known in California for many years. This was the tree that we designated as G6 which has been propagated considerably as a rootstock in California and other areas.

Mature fruit were later collected from this tree on the slopes of Acatenango, with a number of collections made over the next several years. The seed were shipped to Riverside for testing for resistance to *Phytophthora cinnamomi*. Budwood was also collected several times from this tree, for establishment of the G6 clone at U.C. Riverside and at our South Coast Field Station.

The first G6 seedlings were screened in our greenhouse at Riverside by Fred Guillemet in June 1972; these showed significant resistance to root rot, so further collections were made in Guatemala and further propagations were made. The first G6 seedling trees were planted on the Atkins grove in Fallbrook in June 1974, followed by other plantings in San Diego and Santa Barbara counties. The first grafted trees (Hass on G6) were planted in the Sponsel grove in Santa Barbara in June 1975, with more plots planted soon thereafter. One G6 seedling that was particularly vigorous was also propagated as a separate clone, labeled G6-1; nurseryman Crawford Teague, in Corona, propagated a number of trees of this variant of G6.

Some of these trees on G6 rootstock made excellent growth in root-rot infested soil in the field, though there was some variability. In general, G6 appeared to have moderate resistance to *P. cinnamomi*, somewhat similar to Duke 7; resistance was not as high as with the Martin Grande rootstock. Trees on G6 rootstock in general made quite uniform growth; it appears to be a satisfactory, compatible rootstock. G6 seedlings and rooted cuttings are very prolific in fruit production in California. A large number of trees on this rootstock have been planted in the different avocado areas in southern California. Nurseryman Crawford Teague of Corona, in particular, has propagated many trees of G6 rootstock.

G6 is a type of avocado known by the Mayan natives of Guatemala as "Matul-oj". Botanically, this is *Persea drymifolia*, following Wilson Popenoe's designation of the Mexican race of avocado, or *Persea americana* var. *drymifolia*, as classified by Lucille Kopp of the New York Botanical Garden and Bob Bergh of UCR. This tree is typical of the Mexican avocados that occur widely in many regions of Mexico as native or semi-cultivated trees. We have observed many similar trees also throughout the highlands of Guatemala. Some of these may be indigenous there; others may be descendents of Mexican avocados perhaps carried to Guatemala by the Spanish conquistadores or the Mayan natives.

There is great variability in Mexican avocados. Some trees have strong anise odor in the leaves and fruit, others have little or no anise odor. Fruit vary in size, though they are usually small (2-3 inches in length), and range from green to purplish black or black. The skin of the fruit is usually smooth and thin, although occasional trees have fruit with slightly roughened skin.

It is interesting to speculate on the origin of this specific G6 parent tree, though difficult to be certain of its origin. The G6 parent is perhaps 50 to 60 years old, growing on the edge of a field that has been cultivated on the slope of the volcano Acatenango probably for many years. Was it a chance seedling that came from a Mexican avocado

seed discarded in the area? Was it a seedling grown by a native from a seed that he had obtained in some nearby area? There are a number of Matul-oj trees around the base of Acatenango and in little nearby villages such as Parramos and San Andres Itzapa.

The second author recently (October 1988) made observations on the location where G6 is still growing. Following are his comments:

After over 10 years, because of the violence existing in the region, I went with a helper of the coffee farm of my mother at Parramos to the slopes of Acatenango volcano eager to see if the original G6 tree was still standing. It was a clear morning with a deep blue sky after so much rain in recent months. There were tremors, but not serious quakes, that morning, and army trucks were passing the farm, going toward the Aldeas of Chicasanga, Panamaquin, Chimachoy, and Chiparquf, carrying tents and food. I had just returned from a visit to southern Spain, so was not aware of the situation in the Parramos region, with constant tremors.

Narziso, my Mayan helper from the farm, fixed his "machete" and a "lazo," and we drove up in a small pick-up toward Acatenango volcano. We passed signs saying "Area of earthquake; drive at your own risk!" Narziso and I saw deep cracks on both sides of the dirt road up to the towns of Calderas and Concepción. I even took video and photographs of the deep fissures and some landslides. We reached the aldea of Concepción and saw refugees and camping tents and lines of Cakchiqueles-Mayans waiting for food.

The Arturo Falla property that is between Aldea Concepción and the slopes of the volcano where the original G6 tree was found was closed with a new gate, so we left the truck in Concepción. We walked 40 minutes between cleared land and fruit trees until we reached the cloud forest of the volcano Acatenango. The forest was splendid, silent with no sound of machine guns; birds were singing and you could hear bees humming.

We climbed the canyon, with the original forest trees with bromeliads, and reached the top of the trail where we turned down from the edge of the cloud forest to see if the G6 tree was still there. Suddenly Narziso and I exclaimed almost at the same time, "There it is in full bloom; there is the G6 tree! Allí esta el árbol de Matul-oj!"

Literatura

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