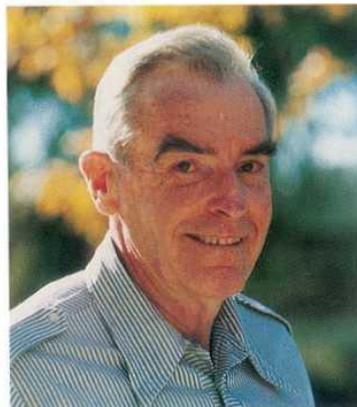


Early *Persea* Collections-Beginning of a 40-Year Saga

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The first avocado relative that I collected, in the search for a *Phytophthora*-resistant avocado rootstock, was in a beautiful cloud forest near the summit of Mt. Uyuca, in Honduras, in July 1952. The story will return to Mt.

Uyuca shortly; but by way of introduction, this narrative provides more detail than previously published on how the search in Latin America was initiated for resistance to *Phytophthora* root rot of avocado. The story actually begins in the early '50s in an unlikely place: the herbarium of the noted New York Botanical Garden in the Bronx. There, I obtained permission from Director W. J. Robbins to visit the herbarium and take detailed notes from their excellent collection of dried plant specimens of the genus *Persea*, the most prominent food source in this genus being the avocado (*Persea americana*).

Copious notes were taken of the locations where these species of *Persea* had been collected in the past-some as early as the mid- to late-1800s. Some locations were very precise, making it easier to find those trees again in the field. Others were very vague, so that it was difficult or impossible to re-collect that particular tree.

Armed with this information from New York and with similar information from other herbarium collections in the U.S. and Europe, I headed south from Riverside in July 1952. Thus began a rewarding, exciting, and remarkable 40-year saga of collections primarily in Central America (the principal area of origin of the avocado and other species of the genus *Persea*), but also in South America and the Caribbean.

This research project involved collections in many diverse locales-cloud forests, swamps, volcano slopes, montane highlands, some hot and humid lowlands-and encounters with many friendly and helpful natives of some 21 countries, in addition to help from capable scientists in many countries and assistance from various fine organizations such as the Rockefeller Foundation, US AID, and ministries of agriculture in many countries. Transportation involved the old, reliable DC-3, DC-4, DC-6, DC-7, Constellation, 747, DC-10, 767, sometimes rickety local buses, jeeps, pickups, and lots of foot travel. This article covers a few of the earliest trips to Central America.



Fig. 1. Map of Central America showing some locations visited in search for *Phythophthora*-resistant avocado rootstock.

To return to the Mt. Uyuca story, the flight from Los Angeles that July 1952 day on a Pan Am (pre-jet) DC-4 was uneventful but fascinating because of the aerial view of four Latin American countries, with stops in Mexico, Guatemala, and El Salvador. Final arrival was in Tegucigalpa, the capital of Honduras.

The next stop was the Escuela Agricola Panamericana (EAP), a fine agricultural school for Latin Americans, planned and organized by Dr. Wilson Popenoe for the United Fruit Company in the 1940s. The EAP is about one and one-half hours by car from Tegucigalpa.

The EAP was quite new in 1952, with a beautiful campus at 2,800 feet elevation in a green valley surrounded by mountains. Buildings were constructed of a fine local whitish granite, with a Spanish motif and tile roofs. It was an oasis in that country, with pure water piped from springs in the mountains, pasteurized milk, fruit, vegetables, and meat raised on the property. There were 160 students from ten countries in 1952, with Director Popenoe in charge of the remarkable school and farm.

I met Wilson Popenoe, world-renowned horticulturist, plant explorer (with emphasis on the avocado), administrator, and educator, the day of my arrival in Honduras. Dr. Popenoe, who spent most of his prolific life in Central America, was universally admired and respected, and was a good friend of the California Avocado Society-of which his father, in 1915, was a founder-member. After a wonderful dinner in his fine Spanish-style house on the school grounds, we planned the next day's collecting trip, and other research and collections for the next week.

Dr. Popenoe invited me to hike up Mt. Uyuca-a 6,000 foot peak-the next day to see the strange new species of *Persea* (*P. gigantea*) growing there that he and Dr. Louis

Williams, botanist at EAP, had recently described. Also, he had recently established an avocado planting high on the mountain. It was with great anticipation that we began the hike early that morning in July. Unfortunately, even though it was a warm summer day at the school, as we climbed higher, the fog and clouds became so dense that we could not see above the bases of the huge trees. There was an eerie, ghostly, but beautiful effect as we groped our way among the trees at the summit of the mountain. We decided to return the next day.

The next day, we hiked back up the mountain. It was a beautiful, clear day with a spectacular vista of Mt. Uyuca, nearby mountains, and the valley below where the EAP sparkled in the bright sun. This time, we could see clearly the massive *P. gigantea* trees. It was exciting to see this huge native tree with primitive avocado-like fruit in the cloud forest. The fruit is like a small, thick-skinned Guatemalan criollo type.

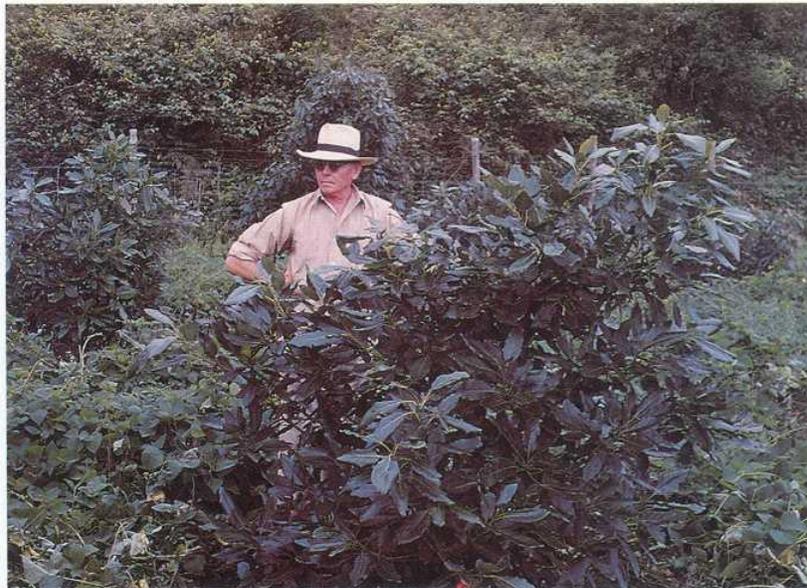


Fig. 2. Dr. Wilson Popenoe in experimental avocado planting on tire slope of Mt. Uyuca, Honduras, 1953.



Fig. 3. Comparison of seed of avocado [left], fruit of "aguacatillo " (*Persea skutchii*) from Honduras [upper right], and fruit of another avocado-like related species (*Phoebe mexicana*), lower right.

Guatemalan criollos were first collected by Wilson Popenoe in the Guatemalan highlands and sent to California, beginning in 1917. The California-originated variety 'Hass' is, of course, the present major representative of the Guatemalan race in California and around the world.

The Mt. Uyuca trees were later reclassified by New York Botanical Garden botanist Lucille Kopp and combined with *P. nubigena*, a similar primitive avocado relative native to the mountains of Guatemala at from 6,500 to 8,000 feet elevation. More recent classifications put *P. nubigena* under *P. americana* var. *nubigena*.

Collection of another avocado relative was made on this same trip in 1952. There were several dried specimens in the Standley Herbarium at EAP of a much different species, *Persea skutchii*, collected originally by Dr. Paul Standley, noted U. S. botanist who spent many years collecting plants in Central America. Several of these collections were from trees growing not far from the school. Dr. Standley was working in the herbarium in 1952 and gave me detailed descriptions of the location of this species.

The next morning, I hiked down the Rio de la Orilla that ran through part of the Escuela grounds and found one to two miles from the school the trees described by Dr. Standley. These were very different from *P. gigantea*. They were moderate-sized trees (30 to 40 feet in height), with rather sparse, small leaves-and what strange fruit! These were small, purplish-black fruit a little larger than a pea, growing in clusters. The tree is known locally as "aguacatillo", or "small avocado". This was my first encounter with trees in the subgroup of the genus *Persea*: *Eriodaphne*. This is quite distinct from the subgenus *Persea* that includes the avocado. Later, we collected other species similar to *P. skutchii* in other countries: Guatemala, Nicaragua, Costa Rica, Venezuela, and Brazil.

I collected large numbers of these fruits and sent them by air express to Riverside under quarantine permit for propagating and testing- for resistance. These aguacatillo seedlings were found in our greenhouse tests later that year to be highly resistant to *Phytophthora cinnamomi*. This appeared to be a very promising collection, but soon we were disillusioned as research showed that *P. skutchii* is not graft compatible with the avocado and could not be hybridized. This species is now classified under *P. caerulea*.

1953 provided further opportunity for explorations in Central America -this time beginning in Guatemala, that fascinating, spectacularly colorful, scenic, and turbulent country. This is the land of the Maya, many of whose descendants still live in the rugged and remote highlands much as they have for centuries-gentle, colorfully-clad, hard-working people.

Records showed definite collection possibilities in Alta Verapaz, Guatemala, for *Persea donnelli-smithii* and *P. schiedeana*. So, I took a Pan Am DC-7 from Los Angeles to Mexico City and on to Guatemala City in search of these "wild avocados."

A visit to the principal agricultural research center in Guatemala, the Instituto Agropecuario Nacional on the edge of Guatemala City, soon revealed that there was not much information there about avocados or *Persea* species. They were very helpful, though, on how to reach Cobán and Tactic, two towns in Alta Verapaz which were the focus of my quest for native *Persea* collections.

A trip to Cobán by car would have taken about a week, with the status of the questionable roads in the area, so I took an ancient DC-3 of Aviateca, the Guatemalan airline. The plane was reasonably held together by strategic repairs here and there, so with some trepidation, I boarded with two other passengers. The trip was uneventful over beautiful, green hills and valleys. The main interesting event was the landing. Cobán is not exactly a hub of civilization, but fortunately did have an airport-a remarkably short- looking dirt strip. We had to make a couple of passes over the airport so that the airport personnel (one Mayan descendant) could chase the cattle from the landing strip.



Fig. 4. Cobán airport, Alta Verapaz, Guatemala, with DC-3, 1953.

Cobán had one nice looking small hotel, or posada, to which I had been referred. On checking in, I made inquiries about getting to Tactic, a much smaller village some 20 miles south. There were no agricultural scientists or farm advisors to meet me, so I was on my own with my somewhat meager Spanish. A friend of the hotel proprietor had a reasonably intact car I could hire for the Tactic trip, for a quite modest price. This was the rainy season in Guatemala, and it usually rained heavily every afternoon and night, so I was advised to leave early next morning. True to predictions, it poured that day and most of the night. The happy driver picked me up about 6:30 a.m. This was definitely not tourist country, and the driver was delighted to see a real, live U. S. "tourist." In fact, in the three days I was in the area, I was the only foreigner of any description and quite a center of interest.

To drive to Tactic was only about 20 miles, but it took about 11/2 hours over a muddy, rough road. The herbarium notes described *P. donnell-smithii* as growing in a swamp on the east edge of Tactic. José, the driver, found a native who knew about those strange "aguacatillos" and pointed us in their general direction. A little out of town, we came to a swampy area with water engulfing the vegetation for a considerable distance. While driving along the near edge of the swamp, I spotted several trees that looked like *Persea* specimens and, as the herbarium sheets had indicated, they were definitely growing in a swamp. As swamps go, this one wasn't very deep; and by wading in 12 to 24 inches of water for some 100 to 150 feet, I reached these remarkable specimens. This was definitely *P. donnell-smithii*, with a small, purplish-black fruit slightly larger than the Honduras collection of *P. skutchii*. By this time, the rain was attempting to raise the level of the swamp even higher, so after collecting several hundred fruit, we headed back to Cobán.



Fig. 5. Branch of *Persea donnell-smithii* with immature fruit, from swamp near Tactic, Guatemala, 1953.

To "fast forward" this story, the seeds from the swamp arrived in Riverside through quarantine about ten days later, were germinated, and tested in October for resistance. This collection had moderate resistance to *Phytophthora*, but unfortunately like *P. skutchii*, was not graft-compatible.

The other *Persea* that I had targeted for collection in the Cobán trip was easy to find. Known as the "coyou" or "chupte" (*Persea schiedeana*), it is an edible fruit somewhat similar to avocado, but with a rather disagreeable-looking brownish-gray flesh, and it is not very palatable. The natives seem to like it, however, and many wild trees grow in the hills around the town-and some in the town, so the fruit is readily available.

By just using the local name, I was directed to many trees within a mile of Cobán. The problem with that collection, however, was that July was the wrong month for fruit of *P. schiedeana*. Thus, I had to delay the collection of "coyou" fruit until 1954. The "coyou" is a beautiful, large tree with dark green leaves and a rounded top. Based on collections of this species made later in the 1950s and '60s, *P. schiedeana* varied considerably in resistance, but was not very promising. Interestingly, Cobán is the area where Dr. Schieber collected sample G755 ('Martin Grande') that in the 1980s tests showed significant resistant to root rot. G755 was apparently a natural hybrid between *P. americana* and *P. schiedeana*. It is compatible with avocado and makes a vigorous

rootstock. Trees on G755 rootstock have problems with production in California, but some trees produce quite well, especially in warmer locations. It is a rootstock still worth experimentation and evaluation.

This paper provides a sampling of the many and varied collections made since 1952, of the many varieties of avocado and species, and locales involved in the search for the ideal *Phytophthora-resistant* rootstock.

For the past 22 years, we have been fortunate in enlisting Dr. Eugene Schieber's help in our collection project. He is an expert plant pathologist and botanist, a native of Guatemala with college education at the University of Arkansas and the University of Wisconsin (Ph.D.), and is a great and enthusiastic friend. We have been on many trips together in the tropic and subtropics, especially over many different locales in Guatemala.