

COLLECTIONS FOR PHYTOPHTHORA ROOT ROT RESISTANCE IN MEXICO AND THE CARIBBEAN

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Several areas in Mexico and in the Caribbean were visited in 1960 in the further search for avocado rootstocks resistant to *Phytophthora* root rot and with the aim of establishing contacts for making future collections of avocado material. This paper summarizes the seed and budwood collections and the results of culture made to determine the presence of the avocado root rot fungus, ***Phytophthora cinnamomi***, in additional areas.

Collections were made in the following areas in Mexico:

State of Tabasco.—Several days were spent in different parts of this State with Professor Efraim Hernandez and a number of his botany students from the Escuela Nacional de Agricultura in Chapingo. The village of Teapa (foothills of the Sierra south of Villahermosa) is interesting, and there are numerous trees of ***Persea schiedeana***, known locally as "chinini," in the vicinity. Fruit of this tree are common in the market in Teapa; they are variable in size, but some are quite long (6 to 8 inches) with a long neck and are purple when mature. Others are shorter with shorter neck and remain green. The flesh is generally whitish and somewhat mealy. This is a very wet area, and there is a dense rain forest in the hills near Teapa.

Avocado fruits in the market at Acayucan (west of Minatitlan) were variable in color but generally small (2 to 4 inches in length) and appeared to be more closely related to West Indian than to Mexican types. Some of the fruit types showed indications of relation with the "chinini"; there may have been some hybridization in this area and in the Teapa region between the avocado (***Persea americana***) and ***Persea schiedeana***.

From Acayucan a trip was made to the village of Jesus Carranza; then a 20-mile trip by dugout canoe down the Rio Jaltepec and a hike by trail and, with the aid of machetes, through the dense forest. Avocado trees or ***Persea species*** are not common in this remote area, although one specimen was found in a little native village. Fruit was immature in July, but the tree appeared to be a West Indian type, with no anise odor in the leaves; budwood was collected from this tree.

State of Chiapas.—The wet area of Tapachula near the Guatemalan border was visited with the cooperation of Dr. Gordon Ross. Most of the avocado trees in this area are West Indian types; some of the fruit are huge, weighing 2 pounds or more. There are some avocado plantings of several acres in the vicinity of Tapachula. The principal fruiting season there is earlier in the spring, in April or May. ***Phytophthora cinnamomi*** was isolated from roots of a large, healthy-appearing tree near Tapachula; no fruit were

on the tree, so budwood was collected.

There were some avocados of variable type in the market at Tuxtla Gutierrez (200 miles north of Tapachula), although fruit were not abundant there in late June.

State of Puebla.—Additional collections were made at the Rodilles grove near Atlixco, through the cooperation of Ing. Jorge Galindo of the Rockefeller Foundation, and Sr. Henri Gilly. Seed and budwood collections were made from trees that showed some resistance in previous collections in that grove and additional collections were made from trees similar in appearance to the Duke variety. Many small Mexican-type avocado fruits were found in the Atlixco market in early July. The Fuerte tree planted in the plaza at Atlixco by the California Avocado Society is growing well.

State of Veracruz.—Through the cooperation of Ing. Galindo, collections were made in markets and various areas in or near the towns of Jalapa, Huatusco, Orizaba, Tehuacan, and Puebla. Most of the fruit, with the exception of the **Persea schiedeana** types, were small Mexican-type fruit, some such as those from Maltratta being less than 1 inch in length. The area near Huatusco where **Phytophthora cinnamomi** was found on **Persea schiedeana** several years ago was revisited and additional isolations' made of the fungus. The trees still are in good condition.

State of Nuevo Leon.—Through the cooperation of Mr. Dennis Currie and Mr. Jose Ramirez of the U.S. Department of Agriculture in Monterrey, additional collections were made from the interesting and variable old avocado trees in Sabinas Hidalgo. One collection that showed moderate resistance in 1958 was re-collected. There is considerable variation, both in type of fruit and in season of maturity, in the tremendous number of avocado trees in Sabinas Hidalgo. There appear to be some fruit in production most of the year, with sizable crops in July and also in September. Some of the huge seedlings in this area are at least 50 years old. No *Phytophthora* was found in the area.

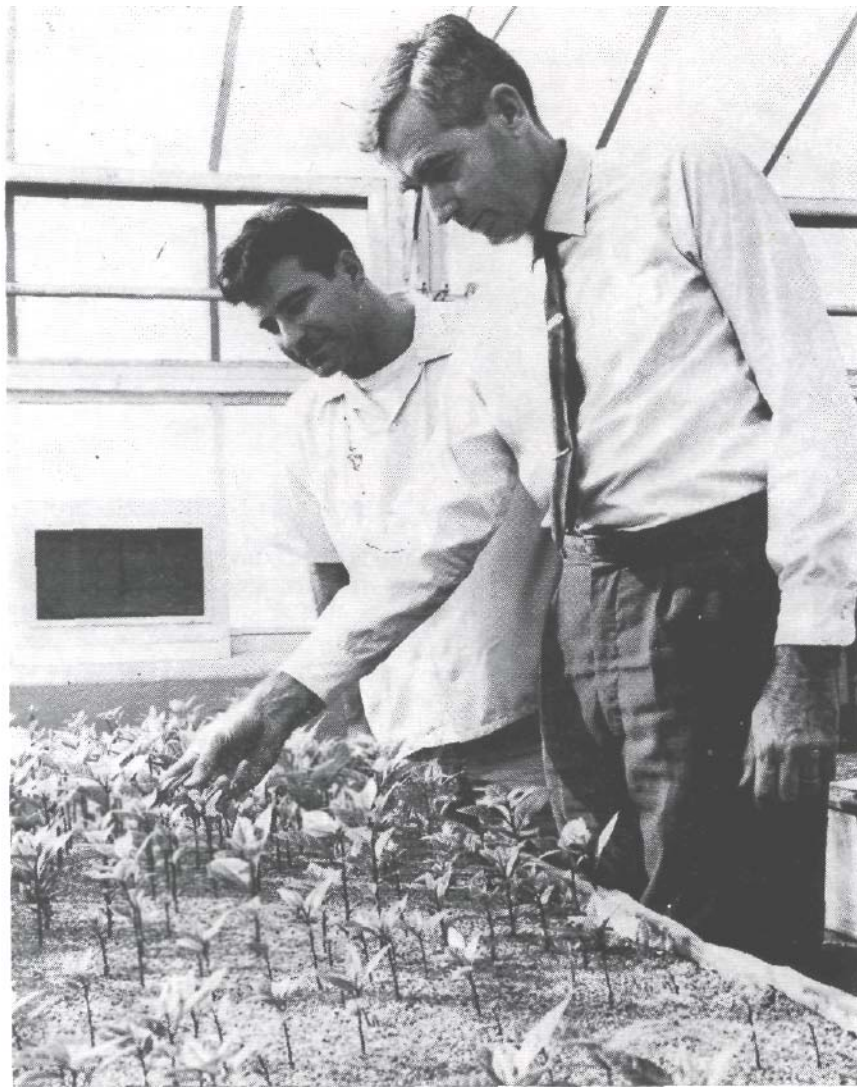
State of Tamaulipas.—With the assistance of Mr. Ramirez and Ing. E. E. Calles (with the Secretaria de Agricultura y Ganadería), several extremely interesting collections were made in the mountains near Montemorelos. The most interesting of the collections were from the native wild avocado trees in these mountains; these are obviously native trees, growing with the general forest flora, including oak trees, some pines, and miscellaneous other native trees and shrubs. Locally the avocado trees are known as "aguacatillo." The fruit is small, ranging from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. in length, slightly oval as a rule, although some are flattened, green, and with very little flesh. The leaves are typical of **Persea americana**, ranging in length from 3 to 6 inches, and of green color or sometimes slightly yellowish-green, with many leaf galls. The leaves of these native "aguacatillos" do not have an anise odor. This is one of the few regions where avocado trees are found growing as native trees; these must be the ancestors of some of the edible types. The older trees in this area varied from 12 to 24 inches in diameter near the base and were 30 to 50 feet in height. Two additional similar but larger trees were found near the locality of Los Lirios (northwest of Montemorelos). Only a few fruit remained on these trees in mid-September; many fruit recently fallen and seeds were found on the ground.

Collections were also made in the following Caribbean countries:

Puerto Rico.—A number of additional collections of avocado seed and budwood and now isolates of **Phytophthora cinnamomi** were made in this area with the cooperation of Dr. William G. Pennock and Dr. Fred Wellman, both at the Estacion Experimental, Rio Piedras.

Several additional healthy trees were found which had **P. cinnamomi** on their roots. Areas were found also where huge old avocado trees are growing vigorously in wet sites. An agreement was developed with the Experiment Station at Rio Piedras whereby collections will be made in 1961 and forwarded to Riverside for testing for root rot resistance.

At the Isabella field station, avocado seedlings are being grown under the conditions to produce clean nursery stock as developed in California, including hot-water treatment of seed, fumigation of soil, and growing stock in containers on raised benches.



MEXICAN SEEDLINGS—Dr. George A. Zentmyer (right) and Technician S. R. Mircetich, University of California, Riverside, examine aquacatillo seedlings, part of large new avocado importation being tested by the Citrus Experiment Station researchers for use in California.

St. Croix.—Dr. R. M. Bond and Mr. Axel Fredricksen of the Federal Experiment Station on this island, assisted with several collections made here. There are some huge old avocado trees on St. Croix; October is late for fruit production. The Federal station has a good collection of avocado varieties, principally types from Florida and Puerto Rico, with a few Hass and Emerald trees. No *Phytophthora* was found.

Haiti.—Several collections of West Indian types were made in and near Port-au-Prince, at Damien, and in Kenscoff, with the cooperation of Dr. H. Atherton Lee and Dr. J. A. Jolicoeur. No *Phytophthora* was found.

Jamaica.—Several collections of West Indian types were made in the vicinity of Kingston with the cooperation of Dr. George Proctor, botanist at the Institute of Jamaica. There are scattered avocado trees in Kingston and vicinity; the principal fruiting season is in the summer or early fall, but a few fruit were still available in October. There is considerable variation in size and color of fruit. There is a small avocado planting at Hope Gardens, on the outskirts of Kingston, which includes several California varieties: Nabal, Anaheim and Eagle Rock.

SUMMARY

Avocado and Persea collections in Mexico in 1960: A total of 69 seed collections were made, involving approximately 1,400 seeds, including those made during the botanical trip by Professor Hernandez. Budwood was collected from 8 trees. Collections included principally *Persea americana* types, but also some *P. schiedeana*. Both budwood and seed were collected from several trees, collected previously, that showed promising resistance in our temperature tank tests.

Root cultures were made from 21 trees. *Phytophthora cinnamomi* was recovered from six of these; two in the Tapachula area (Chiapas), three near Atlixco (Puebla), and one from *P. schiedeana* near Huatusco.

Collections in the Caribbean: Twenty-three seed or budwood collections were made from Puerto Rico, St. Croix, Haiti, and Jamaica involving trees principally of West Indian types and one tree in the related genus *Ocotea*. Three additional trees were found in Puerto Rico that are in healthy condition with *Phytophthora cinnamomi* present. Several large healthy trees were found in Puerto Rico, St. Croix, and Haiti growing under wet soil conditions; the largest and most vigorous of these was an old seedling on St. Croix with a trunk 5 feet in diameter.

Root cultures were made from 28 trees in the same four areas. *P. cinnamomi* was recovered from 8 of these, all in Puerto Rico.

Arrangements were made for continuing cooperation and future seed shipments from selected trees in Puerto Rico, St. Croix, Haiti, and Jamaica and for additional collections in Mexico.

Deep appreciation is expressed to all those mentioned in this paper and to Dr. Ralph Richardson, Director of the Rockefeller Foundation Program in Mexico, and Mr. W. K. Clore, in charge of the U.S. Department of Agriculture Plant Pest Control Division in Monterrey, for arrangements making many of the collections possible. A number of

other people also were of assistance. Appreciation is also expressed to S. R. Mircetich and W. A. Thorn for technical assistance in propagating and testing collections in our greenhouse at Riverside.