

Fungi Associated with Decline of Avocado in California

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In order to determine the extent to which fungi might be the causative agents of decline or collapse of avocado trees in California, roots and soil samples have been taken from both healthy and diseased trees in many localities. Pieces of diseased and healthy roots from the individual trees were incised, washed in water, sterilized in 70 percent alcohol to destroy surface contamination, blotted, and placed upon corn meal agar plates. After three to six days the plates would be examined for their root fungus populations. In this manner, some conception as to what the possible causative agents are has been obtained.

About twenty-five species of molds, mildews, and other fungi have been identified, and accurate records of their frequency kept. Only those fungi which have appeared consistently from the roots of declining trees or those fungi of known parasitic nature need be of concern here.

Phytophthora cinnamomi (the common "cinnamon fungus") has been most frequently obtained from declining trees and less numerous (by far) from non-diseased trees. Healthy individuals yielding the fungus have been those trees growing near infested ones in decline areas. Conversely, it is worthwhile to note that in wholly healthy groves or in isolated non-diseased portions of affected groves this fungus has not been taken.

Of 438 diseased trees sampled, 240 (55 percent) of the individuals yielded the "cinnamon fungus," whereas 198 did not. The latter group included several dead trees and others in the last stages of decline. It is also quite probable that the serious condition of many of these avocado plants is not the result of true decline but that of improper care—destruction of surface roots by over-cultivation, the actual lack of irrigation, etc. Of 442 non-declining specimens examined, 352 trees (80 percent) **did not** yield the fungus in question, while 90 trees did show such infestation. All of the 90 fungus-producing, apparently healthy individuals were located in declining groves, among or near obviously affected trees.

The total of 880 samplings was made during a ten-month period, ending December 31, 1944. Repeated visits to selected groves have been made, and close checks on individual trees have been kept. It seems evident that the disease may spread from an infected area to a healthy one, especially when water conditions permit.

In a limited number of cases in northern California, in a few places where avocados are grown, a continuously wet environment did not appear to affect the trees profoundly. It is of interest to note that **Phytophthora cinnamomi** was not taken from avocado roots in the northern counties, i.e., north of a line drawn westerly-easterly through the latitude of

Goleta and the Tehachapi Mountains. This observation, though limited in scope, coincides with the author's earlier, more extensive, findings with respect to other types of water fungi and their scarcity in the northern half of the state.

In the table I, the distribution of the "cinnamon fungus" is given by counties. In this study, both declining and healthy trees are considered. A plus (+) indicates the presence of the parasite (**Phytophthora cinnamomi**) and the minus sign (—) tells of its failure to appear in culture.

TABLE I

County	Declining avocado trees		Healthy avocado trees	
	(+)	(—)	(+)	(—)
San Diego	102	66	19	108
Los Angeles	65	60	59	133
Orange	26	28	6	8
Ventura		2		2
Santa Barbara	47	38	6	64
San Luis Obispo		*4		7
Santa Cruz				12
Santa Clara				4
Tulare				4
Miscellaneous				10
	—	—	—	—
	240	198	90	352

*Possibly not true decline; trees showed evidence of improper care.

One other fungus species, **Pythium vexans**, has been commonly present, often in the very same cultures with the "cinnamon fungus". The writer has not been able to isolate **P. vexans** (nor **Phytophthora Cinnamomi**) directly from the soils, and, with one exception, he has obtained **P. vexans** only from avocado; however, this fungus is reported from a number of other hosts. (Along with avocado decline, a study has been made on declining Citrus. **P. vexans** was taken once from a non-declining Valencia orange.)

The distribution of **Pythium vexans** in avocado may be seen in the table II.

TABLE II

County	Declining avocado trees		Healthy avocado trees	
	(+)	(—)	(+)	(—)
San Diego	58	110	34	93
Los Angeles	70	55	79	113
Orange	30	24	6	8
Ventura		2		2
Santa Barbara	43	42	24	46
San Luis Obispo		*4		7
Santa Cruz				12
Santa Clara				4
Tulare				4
Miscellaneous				10
	—	—	—	—
	203	233	143	299

*Possibly not true decline; trees showed evidence of improper care.

Other data gathered but not used in this report concern the variety, source, and age of trees, the kinds of soil upon which the trees are growing, fertilizer, irrigation, and drainage practices, as well as the proximity of plants that might harbor the parasitic fungi. Although not tabulated in this report, there appears to be a definite correlation between soil moisture and the distribution of the "cinnamon fungus" with decline in avocados.

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