

RHIZOCTONIA SEED AND ROOT ROT OF AVOCADO

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During the past two years occasional poor stands of avocado seedlings have been observed in connection with growing large numbers of seedlings for various experiments. Rotted seeds have been observed in the greenhouse and under field conditions. Occasional dead or dying young seedlings have been found which were not affected by **Phytophthora cinnamomi**.

Cultures from large numbers of seedlings and seeds have resulted in consistent isolation of the soil fungus **Rhizoctonia solani**, which is pathogenic to a wide variety of plants, mostly of the herbaceous type. Included in its hosts are bean, pepper, potato, alfalfa, cotton, tea, etc. This is the first report of its pathogenicity to avocado.

Following isolation of this fungus from roots and seeds of avocado, several experiments were conducted to confirm the pathogenicity to avocado and to the avocado relative, **Persea indica**.

1. Seedlings of avocado and of **P. indica** were grown in aerated nutrient solution in five-gallon ceramic jars. **Rhizoctonia solani** (avocado isolate) was grown on potato dextrose agar in the laboratory; one-half of the petri dish culture was chopped in water in a Waring blender and the mixture poured into the jar with the seedlings; the other half of the culture was placed in a cheesecloth bag suspended in the nutrient solution.

In 16-21 days brown lesions appeared on the roots, either at the base of the feeder roots at the point of attachment with larger roots, or at the very tip of the root. The lesions gradually spread until 60 to 95 percent of the root surface was infected. The rot was soft, not firm or brittle as is the case with **P. cinnamomi**. **R. solani** was readily isolated from these infected roots.

2. Seed of avocado and of **P. indica** were planted in pots containing steam-sterilized sand. Mycelium of **R. solani** chopped in a Waring blender was added to one pot before planting the seed. None of the **P. indica** seed germinated, and only one of three avocado seed germinated in the pot containing the fungus. Plants in the non-infested pot germinated and grew normally.

3. Seed of avocado and of **P. indica** were planted in small seed flats (14 x 56 x 12.5 cm) containing steam-sterilized sand. Mycelium of **R. solani** was chopped in water in a Waring blender and watered on the sand in one flat after the flat was two-thirds full of sand; then sterile sand was added and 10 seeds of the Topa Topa variety of avocado and 10 seeds of **P. indica** were planted. The second flat was treated similarly, except a petri dish of potato dextrose agar without the fungus was blended and added to the

sand.

Seeds in the non-infested flat all germinated in four weeks, with healthy tops and good root systems developing. Seeds in the flat infested with **R. solani** did not germinate until eight weeks after planting; only 50 percent of the Topa Topa seed germinated and only 20 percent of the **P. indica** seed germinated (see Table 1). The plants developing from seed in the infested flat were weak and retarded in growth, with severely rotted roots. **R. solani** was isolated from the root lesions.

Table 1. Infection of avocado seed and seedling roots by *Rhizoctonia solani*.

Treatment	No. of Seed		No. Germinating		Av. Wt. of Roots	
	Avocado	<i>P. indica</i>	Avocado	<i>P. indica</i>	Avocado	<i>P. indica</i>
Sand infested with Rhizoctonia solani	10	10	5	2	2.2 g.	0
Non-infested	10	10	10	9	10.9 g.	2.3 g.

4. Seed of avocado and of **P. indica** were planted in small seed flats as above, except each flat was infested with a different isolate of **R. solani**. Isolates used were from avocado, citrus (R109), potato root (R42), alfalfa (R47), lima bean (R12), and nutgrass (R37). Isolates R109, R42, R47, R12, and R37 were obtained from Dr. J. B. Kendrick, Jr.

Results (Table 2) show that all of the isolates except the one from citrus were pathogenic to avocado and to **P. indica**. Damage varied from killing of the embryo and rotting of the cotyledons to small lesions on roots.

Table 2. Pathogenicity of six isolates of *Rhizoctonia solani* to avocado seed and seedlings.

Isolate	Percent Emergence		Average Height	Average Weight	
	30 days	55 days		Top	Root
Non-inoculated control	100	100	16.3 cm	4.7 g.	2.3 g.
Avocado	22	60	4.3	0.96	0.2
Alfalfa (R47)	11	60	2.9	1.1	0.5
Potato root (R42)	0	80	6.1	1.7	1.0
Lima bean (R12)	55	80	8.4	3.2	1.5
Nutgrass (R37)	66	80	9.3	2.8	1.8
Citrus (R109)	88	100	12.5	4.4	2.5

It is apparent from observations of these inoculation tests and of naturally-infested flats that various degrees of damage can be caused by this fungus. **R. solani** in some cases invades the cotyledons and spreads to the embryo, killing it and preventing germination of the seed. In other cases it invades the embryo first, then spreads to the cotyledons. Sometimes only the radicle is destroyed and the plumule begins to grow, but before the young etiolated shoot emerges from the cotyledons, it is attacked. Occasionally the young shoots escape infection and grow even though the radicle or the young root is

completely rotted. In such instances secondary roots are often formed; these may have lesions but make some growth.

If infection occurs after the primary root has grown several inches, the fungus usually attacks the youngest part of the root, causing girdling lesions and spreading until the root is completely destroyed. Also, infection can take place on a normal root system, with lesions occurring at the growing tips, then spreading to the remainder of the root.

This fungus has been found occasionally in the field on young seedlings or on roots of older trees. However, in such cases it is not nearly as severe a pathogen as **Phytophthora cinnamomi**; **R. solani** attacks only occasional roots on large trees and regeneration of roots usually occurs. It is believed that the principal damage caused by **R. solani** is in seed beds where it attacks the embryo, the cotyledons, or the young roots.

The fungus can be controlled under greenhouse or nursery conditions by steaming the sand or soil used for the seed flats or for the container grown stock for 45 minutes to one hour. Seeds used for planting should be taken from fruit picked from the tree to avoid the possibility of contamination by *Rhizoctonia* of seed taken from the ground. Sanitary measures to keep contaminated soil from the growing area are also important, including care with transplanting tools and keeping ends of hoses from possibly contaminated soil.