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Diseases of Avocado Caused by Soil Fungi in the Southern Mediterranean Coast of Spain

Carlos J. López-Herrera
Departamento de Protección Vegetal, D.G.I.E.A. Cortijo de la Cruz s/n, 29140 Churriana (Málaga), Spain

José M. Melero-Vara
Departamento de Protección Vegetal, D.G.I.E.A. Alameda del Obispo, Apdo. 240. 14080 Córdoba, Spain

Abstract. **Disease surveys were performed in avocado groves on the Mediterranean coast of Andalucía (southern Spain) in the period 1986-88. Isolations from feeder or secondary roots of the symptomatic trees (leaf drop and death) yielded mainly *Cylindrocarpon* sp., *Rosellinia necatrix* and *Fusarium* sp. *Phytophthora cinnamomi* and *Rhizoctonia* sp. were less frequently isolated. *Armillaria mellea* and *Verticillium dahliae* were isolated on a few occasions. Pathogenicity tests with isolates of the five former soil fungi indicated that all isolates of *R. necatrix* and *P. cinnamomi* tested, except one of the latter, were pathogenic to six-month-old Topa Topa plants grown in pots under greenhouse conditions, whereas *Cylindrocarpon* sp., *Fusarium* sp. and *Rhizoctonia* sp. were not pathogenic. The high virulence shown by *R. necatrix* and its incidence in diseased trees indicated that *R. necatrix* is the main agent causing disease in our avocado crops.**

The commercial cropping of avocado *(Persea americana* Mill.) in the Mediterranean coast of Andalucía (southern Spain) currently occupies 8,675 Has. The production was 22,000 metric tons (tm) in 1986 (Shachar, 1989), and it is estimated to increase up to 40,000 to 50,000 tm by 1993 (Farré and Pliego-Alfaro, 1987). The most important cultivars grown in this area are: Hass, Fuerte, Reed, Bacon, and Pinkerton. The rootstocks used are plants obtained from seeds of Mexican (cv. Topa Topa) or of hybrids Antillean X Guatemalan (cvs. Lula and Waldin).

At present, the most important diseases of this crop are those caused by soil fungi. These induce root rots or vascular wilts.

Material and Methods

Three field surveys were carried out in this area during 1986, 1987, and 1988 to obtain information on the pathological status of the crop. The symptoms observed were tree

decline (chlorotic or brown leaves, drop of leaves from the top of the tree or from the lateral shoot apices) frequently leading to death.

The number of symptomatic trees sampled were 62 (1986), 61 (1987) and 29 (1988) from 28, 33, and 13 different orchards respectively. Isolation of fungi was carried out from feeder roots (1-3 mm diam.) and from secondary roots (1-3 cm diam.) on different growth media: potato dextrose agar acidified with 10 mL of 25% lactic acid per liter) (APDA) and Tsao's medium (corn meal agar containing antibiotics and PCNB) (Tsao and Ocana, 1969). The isolates were incubated at 24C in darkness and afterwards identified. The pathogenicity of different isolates was tested by means of artificial inoculations of six-month-old cv. Topa Topa plants grown in a sand, soil and peat substrate previously fumigated with methyl bromide. The inoculation was made by the injection of 200 mL of a concentrated fungal suspension into the soil of each pot (5 kg) , except for *Rosellinia necatrix* which was inoculated by transplanting to a soil infested with wheat seeds colonized by the pathogen for 1 5 days at room temperature in darkness (Sztejnberg and Madar, 1980).

Disease evaluation was performed sequentially until six months after inoculation, when a severity degree (0 to 5) was given to each plant.

Results and Discussion

Several genera of fungi were isolated from a total of 152 sampled trees (from 74 orchards), during the surveys. Their incidences and frequencies of isolation (%) are shown in Fig. 1.

Rosellinia necatrix, the main agent of white rot in our avocado groves, showed a high incidence and all isolates tested (13) were highly virulent and caused plant death within 15 days.

Cylindrocarpon sp. and *Fusarium* sp. were very frequent from avocado roots but the isolates tested did not induce above ground symptoms although they were consistently isolated from necrotic feeder roots. The same was true for plants inoculated with *Rhizoctonia* isolates but the incidence of trees with this fungus was very low. The incidence of *Phytophthora* root rot was very low (Fig. 1). However, five out of the six *P. cinnamomi* isolates tested were pathogenic with an average disease severity ranging from 1 to 4.6 (Fig. 2).

Armillaria mellea and *Verticillum dahliae* were isolated occasionally from wilted and dead trees, and from wilted trees respectively. Other fungi which were isolated in low frequencies were *Macrophomina phaseoli,* Oomycetes *(Pythium* and *Phytophthora* spp. other than *P. cinnamomi* and common saprophytes.

Cylindrocarpon sp., *Fusarium* sp. and *Rhizoctonia* sp. could predispose trees to infection by other causal agents since they are able to reduce tree vigor by feeder root lesion.

We can conclude that white rot is the most important disease of avocado crops in the Mediterranean coast of Spain, *Rosellinia necatrix* being the main agent of wilting and death of avocado trees in the area. In contrast, *Phytophthora* root rot seems to be less important so far, although the high virulence of the isolates of *P. cinnamomi* tested indicated that the disease could reach increased importance in the future.

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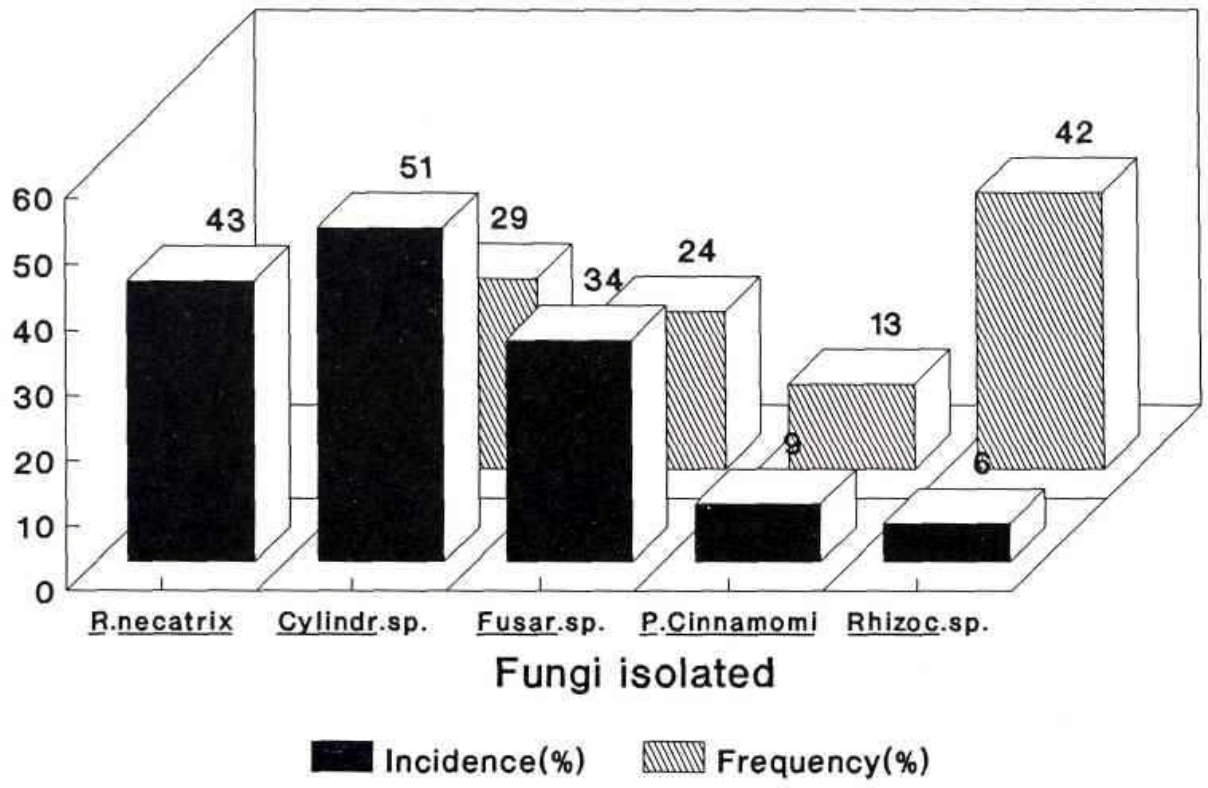

Fig 1. Incidence and frequency of soil fungi isolated from avocado symptomatic trees. Surveys or 1986-1988: 152 trees sampled from 74 orchards.

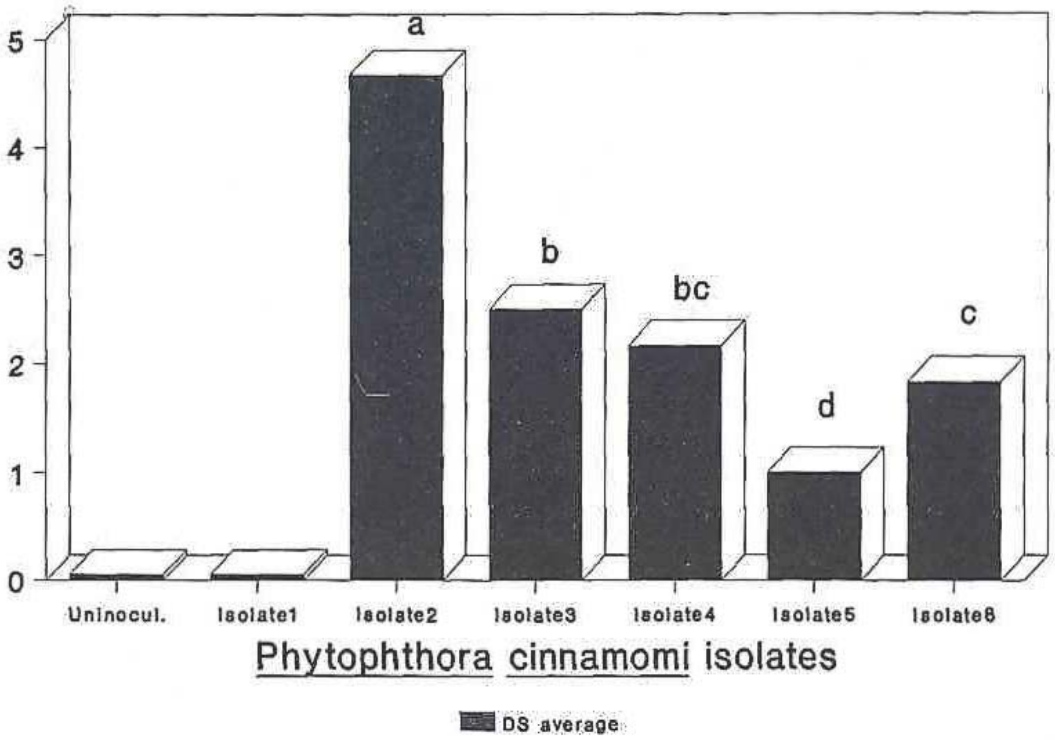

Fig. 2. Virulence of *P. cinnamomi* isolated. Scale of severity; 0 = asymptomatic. 5 = dead. Bars with the same letter are not significantly different at $p \leq 0.05$ (S.N.K. test).