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ECOLOGY OF AVOCADO ROOT PATHOGENS

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OPSOMMING

*Behalwe **Phytophthora cinnamomi,** die bekende wortelvrot patogeen, is 15 ander patogeniese swamme ge'isoleer vanaf avokado wortels en wortelsones. In patogenisiteitswetse was **P. cinnamomi** die mees verwoestende organisms. Die voorkoms van sommige van die organismes was in 'n grootskaalse opname van avokado grond aangeteken en hulle frekwensie was ontleed in grond wat met swamdoders behandel is. Dit is bevind dat CGA 48988 (Ridomil) **P. cinnamomi** en **Pythium** spp. inhibeer maar dat die relatiewe voorkoms van **Fusarium oxysporum** terselfdertyd toegeneem net in die lupien saailingtoets. Hierdie swamdoder net die **Pythium** spp. waarskynlik uitgeroei in die grond.*

SUMMARY

*Apart from **Phytophthora cinnamomi,** the common root rot pathogen, 15 other fungi which are known to be pathogenic on avocado and other host plants, were isolated from avocado roots and root zones. In Pathogenicity tests **P. cinnamomi** was the most destructive organism. The incidence of some of the organisms were recorded in commercial scale survey from avocado soils and their occurrence was analyzed in soils treated with fungicides. It was found that CGA 48988 (Ridomil) inhibits **P. cinnamomi** and **Pythium** spp. but simultaneously increased the relative frequency of **Fusarium oxysporum** when tested with the lupine seedling bait technique. This fungicide has apparently eradicated **Pythium** spp. from the soil.*

INTRODUCTION

Darvas (1978) isolated a number of fungi from roots and root zones which are known to be parasitic to avocados and other host plants. The pathogenicity of these fungi was tested on lupine and avocado roots to determine their importance. The possibility that various soil fungicides which are under investigation for *Phytophthora* root rot control, could influence population changes of these pathogens ¡n the soil was also investigated.

MATERIALS AND METHODS

Direct isolations from roots mainly on PDA and the lupine bait technique were employed.

Fungi were first identified and afterwards submitted to the Commonwealth Mycological Institute, Kew, England, for confirmation or full identification. Pathogenicity tests were conducted on lupine seedlings according to the method of Vaartaja & Cram (1956). Pathogenicity on avocado roots was tested with test tube cultures of the various fungi. Test tubes were filled with rich nursery soil mixed with V-8 juice (about 100 ml/kg soil), sterilized and inoculated. Ten days later the medium was loosened and a healthy, thick feeder root of large trees on Guatemalan rootstock was inserted undetached, into the test tube and closed again with a cotton plug. Reading of root rot took place 7 days later.

TABLE 1: Pathogenic fungi isolated direct from avocado roots and from root zone by using the lupine seedling bait technique

Fungi direct from avocado roots	Fungi from avocado root zone
Phytophthora cinnamomi	*Phytophthora cinnamomi*
Pythium debaryanum	*Pythium acanthicum*
Pythium irregulare	*Pythium debaryanum*
Pythium splendens	*Pythium irregulare*
Pythium ultimum	*Pythium myriotylum*
Cylindrocarpon destructans	*Pythium spinosum*
Cylindrocladium parvum	*Pythium splendens*
Cylindrocladium scoparium	*Pythium ultimum*
Fusarium oxysporum	*Cylindrocarpon destructans*
Fusarium moniliforme	*Cylindrocladium parvum*
Macrophomina phaseolina	*Cylindrocladium scoparium*
Rhizoctonia solani	*Fusarium oxysporum*
Verticillium theobromae	*Macrophomina phaseolina*
	Rhizoctonia solani
	Verticillium theobromae

A great number of non-pathogenic fungi was also isolated. *Mortierella* was particularly abundant in decomposing avocado roots.

The frequency of occurrence of the more common pathogenic fungi from the avocado root zone in our commercial survey with the lupine seedling bait technique together with the results of pathogenicity tests on lupine seedlings as well as on avocado roots is shown in Table 2.

TABLE 2: Incidence and pathogenicity of avocado root rot pathogens

Fungi	% Incidence from lupine seedlings	No. of days needed to kill lupine seedlings	% of root killed in 7 days
Phytophthora cinnamomi	9,7	5	95
Pythium spp.	13,7	—	—
Pythium acanthicum	—	18	—
Pythium debaryanum	—	11	61
Pythium irregulare	—	7	—
Pythium myriotylum	—	9	57
Pythium spinosum	—	7	53
Pythium splendens	—	7	43
Pythium ultimum	—	5	29
Cylindrocarpon destructans	0,9	12	62
Cylindrocladium parvum	—	15	35
Cylindrocladium scoparium	0,3	8	53
Fusarium moniliforme	—	9	26
Fusarium oxysporum	27,3	10	27
Macrophomina phaseolina	0,04	9	44
Rhizoctonia solani	0,8	8	49
Verticillium theobromae	—	17	9

In one of the field experiments where various chemicals were tested against *Phytophthora* root rot the incidence of a few common pathogens was determined by using the lupine seedling bait technique (Table 3). This study was undertaken in the second year of the experiment and data were obtained from two separate surveys, one made in the summer (January) and one in the winter (June).

TABLE 3: Incidence of some pathogens in an avocado soil treated for two years with fungicides against *Phytophthora* root rot

Treatment	Fungi	% Incidence (average of 2 surveys)
1. CGA 48988 (Ridomil) 0,5 g a.i./m²	*Phytophthora cinnamomi*	31
	Pythium spp.	19
	Fusarium oxysporum	42
	Rhizoctonia solani	2
	Cylindrocarpon destructans	2
	Others	4
2. CGA 48988 (Ridomil) 2,5 g a.i./m²	*Phytophthora cinnamomi*	16
	Pythium spp	0
	Fusarium oxysporum	71
	Rhizoctonia solani	5
	Cylindrocarpon destructans	1
	Others	7
3. Ethazole 5,0 g a.i./m²	*Phytophthora cinnamomi*	37
	Pythium spp.	25
	Fusarium oxysporum	26
	Rhizoctonia solani	5
	Cylindrocarpon destructans	3
	Others	4
4. LS 74-783 0,3% spray	*Phytophthora cinnamomi*	40
	Pythium spp.	13
	Fusarium oxysporum	36
	Rhizoctonia solani	9
	Cylindrocarpon destructans	1
	Others	1
Control	*Phytophthora cinnamomi*	41
	Pythium spp.	21
	Fusarium oxysporum	23
	Rhizoctonia solani	11
	Cylindrocarpon destructans	1
	Others	3

DISCUSSION

The number of pathogenic fungus species, particularly those of the genus *Pythium*, was higher from lupine seedlings than on avocado roots, but this may be due to a much larger sampling with the lupine seedlings. The commercial pathological soil analysis with lupine seedling bait technique was done during the winter months when the soil was relatively dry. The percentage incidence was recorded for *Phytophthora cinnamomi*, *Pythium* spp. *Cylindrocarpon destructans*, *Cylindrocladium scoparium*, *Macorphomina phaseolina* and *Rhizoctonia solani.* The most common *Pythium* spp. was *P. splendens*, followed by *P. spinosum*. There is a great variation in the pathogenicity of these organisms and the extent of damage caused by the same pathogen may differ on the two hosts. *P. cinnamomi* was very virulent on both avocado root and lupine seedlings.

A similar soil flora analysis on a site where various fungicides were applied during the past two years showed that high rate CGA 48988 caused an effective inhibition of *P. cinnamomi* while its aftereffects lasted, after which it was recovered at a lower incidence. It seems that a higher concentration of this product eliminated *Pythium* species. The lower rate CGA 48988 less effectively inhibited P. cinnamomi and *Pythium* spp. The incidence of *F. oxysporum* appeared to be higher in these treatments, particularly at the higher dose rate. LS-74783 reduced *Pythium* and increased the incidence of *F. oxysporum*. Apparently the reduction of Oomycetes is linked with an increase in *F. oxysporum*.

There has been little change in the occurrence of the other root pathogens following treatments with the above mentioned chemicals.

REFERENCES

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