

DISEASE POTENTIAL AND RECOVERY OF *PHYTOPHTHORA CINNAMOMI* IN RELATION TO THE SEVERITY OF AVOCADO ROOT ROT

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OPSOMMING

'n Grootse *Phytophthora cinnamomi* opname is by Westfalia Landgoed in avokadoboorde met behulp van die lupine saailing lokaas tegniek, uitgevoer. Die persentasie positiewe *P. cinnamomi* besmette bome en die siektepotensiaal (persentasie lupienzaailinge gedood deur die swam) is bepaal in verhouding tot die siektegraad van die bome. Dit is gevind dat die *P. cinnamomi* besmette bome en die besmettingspotensiaal, aanvanklik toegeneem het met die vordering van wortelvrot. Nadat 'n hoogtepunt bereik is, het die siektepotensiaal afgeneem op die bome wat die grootste agteruitgang getoon het.

SUMMARY

A large scale *Phytophthora cinnamomi* survey was conducted at Westfalia Estate in avocado orchards with the aid of the lupine seedling bait technique. The percentage of positive *P. cinnamomi* infected trees and the disease potential (percentage lupine seedlings killed by the fungus) was determined in relation to the disease rating of the trees. It was found that both the positively infected trees and the disease potential increased initially with the progress of root rot and that after reaching a maximum there was a decrease on the severely retrogressed trees.

INTRODUCTION

Tsao (1960) described a serial dilution end-point method for estimating disease potentials for *Phytophthora* spp. in citrus soils and he found a good correlation between estimated disease potential and actual root damage. However, there is no information available in the literature on the population dynamics or disease potential changes of *Phytophthora cinnamomi* in the soil in relation to the severity of root rot of avocados.

A large scale survey of the naturally occurring disease potential of *P. cinnamomi* was carried out at Westfalia Estate in order to determine the relationship between disease potential in the root zone and the severity of root rot of avocado trees.

MATERIALS AND METHODS

A lupine seedling bait technique described earlier by Darvas (1979) for the semi-quantitative analysis of *P. cinnamomi* was used in the study. The method consists of collecting soil samples from under the canopy areas of the tree. Soil samples were taken from around feeder roots, but all visible root pieces were sieved out. Samples were placed in an eight cm diameter plastic cup with an approximate volume of 300ml. The soil was moistened and planted with five pre-germinated blue lupine (*Lupinus angustifolius* L.) seedlings, one in the centre and four in the perimeter of the cup. To produce the pre-germinated lupine seedlings, lupine seeds were surface sterilized with 0,1% Hg Cl₂ solution for one minute, rinsed with sterile water and germinated on a growing medium in Petri dishes (Vaartaja and Cram, 1956). Normally emerging seedlings with about two cm radicles were planted in the soil sample. Seedlings were moistened regularly, but not flooded so as to reduce the possibility of zoospores moving to plants further away from the inoculum source. Zentmyer and Mircetich (1966) found that the inoculum source of the fungus should be within three cm of the site of the material to be invaded and it is believed that with this method most lupines become infected by the fungus from a soil core of about three cm radius around the root. Roots of diseased lupine plants were removed from the cups, surface sterilized with 0,1% Hg Cl₂ for ten seconds and plated on Potato Dextrose Agar. A few days later the isolated fungi were identified. Since root pathogenic fungi other than *P. cinnamomi* were also recorded, the use of PDA was preferred to selective media.

1 300 Trees were randomly selected and marked in various avocado orchards of Westfalia Estate. These trees were surveyed five times, three times in the relatively dry winter months (June, July, August 1979, 1980 and 1981) and twice in the rainy summer months (January, February, March 1980 and 1981). Above-ground disease severity of the trees was rated on a scale from 0 (healthy) to 10 (dead) and trees in this survey ranged from 0 to 8.

One soil sample was drawn from each test tree in each survey giving a total of 6 500 plastic cups filled with soil samples and 32 500 lupine seedlings and 162 500 isolations from the diseased lupine seedlings on PDA.

RESULTS

The percentage of trees positively infected with *P. cinnamomi* (a minimum of one positive isolation per tree) and the disease severity rating of the trees is shown in Fig. 1.

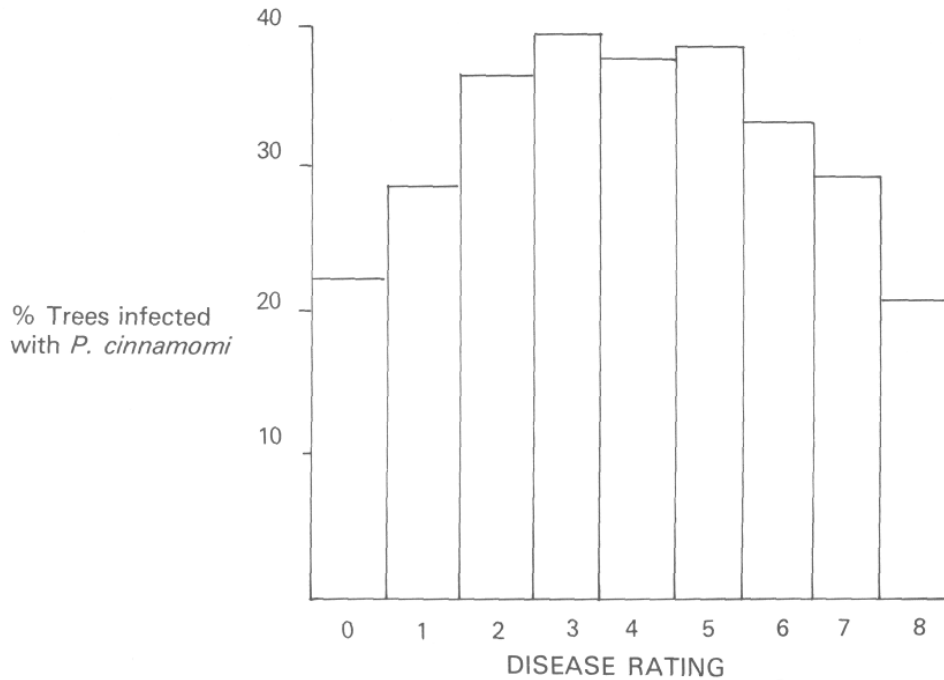


FIG. 1: Percentage of *P. cinnamomi* infected avocado trees and disease severity rating

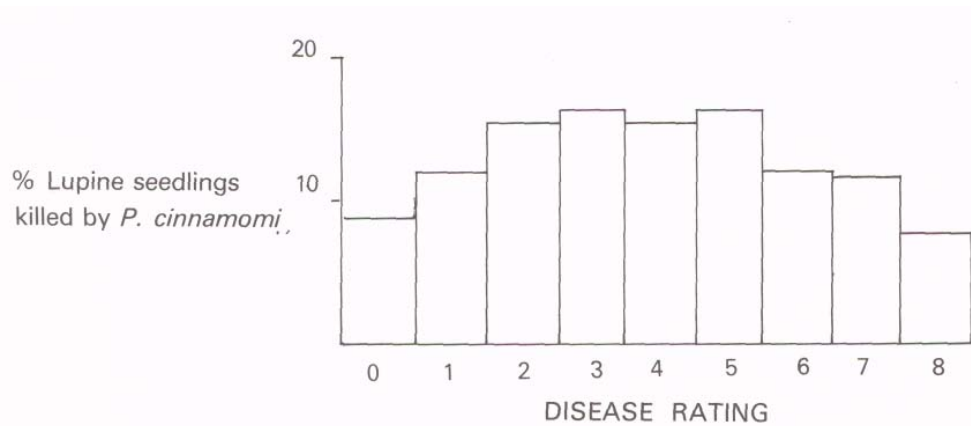


FIG. 2: Percentage lupine seedlings (disease potential) killed by *P. cinnamomi* in soils from under various disease rating avocado trees

DISCUSSION

The percentage of trees positively infected with *P. cinnamomi* shows a gradual increase from the lower (healthy) end of the disease rating scale (Fig. 1). Maximum readings were found on trees with ratings 2, 3, 4 and 5. Progressively decreasing positive isolations were observed on trees with disease ratings of 6 and higher. It is interesting to note that a higher percentage of trees with no apparent above-ground root rot symptoms (rating 0) yielded *P. cinnamomi* than trees with a disease rating of 8.

A similar distribution pattern was obtained with the analysis of the disease potential expressed as the percentage lupine seedlings killed by *P. cinnamomi*. Maximum readings were obtained with disease ratings 2, 3, 4 and 5 and again healthy (rating 0) trees exhibited a higher disease potential than disease rating 8 trees (Fig. 2).

It was noted during this study that it was more difficult to find feeder roots under trees with higher disease rating than under trees with slight root rot symptoms. Since *P. cinnamomi* is not a particularly competitive saprophyte, the killing and disappearance of the primary food source of the fungus, viz, the feeder roots, cause a reduction in propagule numbers as the disease progresses.

A further practical implication of the findings of Fig. 1 is that research workers using this lupine seedling bait technique for the detection of *P. cinnamomi* should collect and analyze more soil samples per tree, especially from trees with high or low disease ratings. For instance, the number of soil samples from the root zone of 0 or 8 disease rating trees should be no less than five, while three soil samples from trees with ratings 2, 3, 4 and 5 would ascertain the presence of the fungus. This may, however be different in soil types and climatic conditions other than that experienced at Westfalia Estate.

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