

PATHOGENICITY OF AVOCADO ROOT ROT FUNGI TO EDRANOL SEEDLINGS AND DUKE 7 ROOTED CUTTINGS

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OPSOMMING

*Verskeie swamisolatate vanaf avokadowortels is geëvalueer vir hulle patogenisiteit op Edranol-saailinge en gewortelde Duke 7-steggies. Die droë massa van die late-rale wortels was gebruik as aanduidings van patogenisiteit. Op Edranol saailinge net *Phytophthora cinnamomi* 50% vermindering in droë massa van laterals wortels in 6 maande veroorsaak. *P. cinnamomi* en *Cylindrocladium scoparium* gesamentlik net die wortelmasse van Edranol met 48% verminder en *P. cinnamomi* saam met *Fusarium oxysporum* net 'n 53% vermindering veroorsaak. *P. cinnamomi* het 'n 9% vermindering op Duke wortels veroorsaak en saam met *Cylindrocarpon* het dit 'n vermindering van 32% veroorsaak.*

SUMMARY

*Various fungi, isolated from avocado roots, were evaluated for their pathogenicity towards Edranol seedlings and Duke 7 rooted cuttings. The dry mass of lateral roots of the seedlings was used as criterion for pathogenicity. On Edranol seedlings *Phytophthora cinnamomi* caused a 50% reduction in dry mass of lateral roots after 6 months. *P. cinnamomi* and *Cylindrocladium scoparium* in combination reduced the root mass of Edranol with 48% while *P. cinnamomi* in combination with *Fusarium oxysporum* caused a 53% reduction in dry mass of Edranol roots. On Duke 7 cuttings *P. cinnamomi* caused a reduction of 9% in the dry mass of the roots, while *P. cinnamomi* and *Cylindrocarpon destructans* in combination caused a reduction of 32% in the dry mass of the roots.*

INTRODUCTION

Phytophthora cinnamomi Rands is the major cause of root rot of avocado (*Persea americana* Mill). However, various other fungi are also associated with avocado root diseases. These include *Rhizoctonia solani* Kühn, *Pythium debaryanum* de Bary, *Pythium spinosum* Sawada, *Fusarium oxysporum* Schlecht, emend Snyder & Hansen, *Tiarosporella phaseolina* Tassi, *Cylindrocladium scoparium* Morgan and *Cylindrocarpon destructans* Wollenw. In a preliminary experiment, Snyman & Darvas evaluated these fungi for pathogenicity towards Edranol seedlings and Duke 7 rooted cuttings.

Information on the performance of Duke 7 against the whole spectrum of root pathogens is urgently required since this rootstock is being actively promoted and introduced to replace the more susceptible Mexican and Guatemalan types. The present paper reports on a more elaborate study on the effect the various root pathogens Edranol seedlings and Duke 7 rooted cuttings using a new technique.

MATERIALS AND METHODS

Isolates of *P cinnamomi*, *Ft solani* *P debaryanum*, *P spinosum*, *F oxysporum*, *T phaseolina*, *C scoparium* and *C destructans* were kindly supplied by Dr JM Darvas of Westfalia Estate. Inocula of the various isolates were prepared by growing them separately for 4 weeks at 25 °C on an autoclaved mixture (4:1) of crushed maize and water.

Plastic bags (10< capacity) were filled with a methyl bromide sterilized growth medium consisting of imported Irish peat moss, vermiculite, perlite and coarse river sand (10 : 6 :4 :1 v/v). Two 32 mm diameter 300 mm long plastic tubes were inserted vertically in each plastic bag. These tubes were not filled with growth medium but were left empty for the introduction of inoculum. Edranol seedlings and Duke 7 rooted cuttings, obtained from the nursery of Westfalia Estate were planted, two each, in the plastic bags containing the growth medium. The bags were placed in a greenhouse in which the temperatures fluctuated between 10°C and 30 °C and the plants were watered regularly with deionized water. In addition, each bag received 750 ml of full strength Hoagland solution every week. After 3 to 4 weeks the plants were inoculated (Table 1) by placing 20 ml inoculum of the various pathogens or combinations of pathogens, (Table 1) in each tube, after which the tubes were removed. This presents a new way to inoculate plants without disturbing their roots. Eight replicates per Duke 7 treatment and nine replicates per Edranol treatment were used.

After six months, the plants were removed from the growth medium and the lateral roots were cut from the tap root and dried at 60 °C. The dry mass of the lateral roots was used as criterion for pathogenicity.

RESULTS

The Duke 7 rooted cuttings were affected to a considerably lesser degree by the various pathogens and combinations of pathogens than the Edranol seedlings (Table 2). In fact, not one of the treatments resulted in a significant reduction in root mass of the former rootstock, while inoculation with *P debaryanum* actually resulted in a significant increase in root development. Growth of the Edranol seedlings was retarded significantly by *P cinnamomi*, *R solani* and the combinations *P cinnamomi* + *P spinosum* + *P debaryanum*, *P cinnamomi* + *C scoparium* and *P cinnamomi* + *F oxysporum*.

DISCUSSION

It is clear that Duke 7 is more resistant to root rot than Edranol, but Duke 7 is not immune to *P cinnamomi*. There are indications that Duke 7 is relatively susceptible to *C destructans* in combination with *P cinnamomi*.

It appears from the result that *P cinnamomi* is the most destructive of the pathogens evaluated, while *R solani* is also capable of causing considerable damage to Edranol seedlings.

The stimulating effect of *P debaryanum* on both rootstocks warrants further attention.

At this stage of our investigation there is no evidence that Duke 7 is now susceptible to known root pathogens than Guatemalan seedlings. It is undoubtedly more resistant to *P cinnamomi*.

TABLE 1. Pathogens and combinations of pathogens evaluated.

Pathogens and combinations of pathogens	Rootstocks	
	Duke 7	Edranol
Control - uninoculated	✓	✓
<i>P cinnamomi</i>	✓	✓
<i>P debaryanum</i>	✓	✓
<i>C scoparium</i>	—	✓
<i>C destructans</i>	✓	—
<i>R solani</i>	✓	✓
<i>F oxysporum</i>	✓	✓
All eight pathogens	✓	✓
All eight pathogens except <i>P cinnamomi</i>	✓	✓
<i>P cinnamomi</i> , <i>P spinosum</i> and <i>P debaryanum</i>	✓	✓
<i>P cinnamomi</i> and <i>C scoparium</i>	—	✓
<i>P cinnamomi</i> and <i>C destructans</i>	✓	—
<i>P cinnamomi</i> and <i>F oxysporum</i>	✓	✓

TABLE 2. Effect of various pathogens and combinations of pathogens on the dry mass of Edranol seedlings and Duke 7 rooted cuttings.

Pathogens and combinations of pathogens	Edranol seedlings		Duke 7 cuttings	
	Dry mass of roots (g)	% reduction in root mass	Dry mass of roots (g)	% reduction in root mass
Control — uninoculated	14,03abc	0	11,83b	0
<i>P cinnamomi</i>	6,98e	50	10,80b	9
<i>P debaryanum</i>	17,30e	0	19,57a	0
<i>C scoparium</i>	14,41ab	0	—	—
<i>C destructans</i>	—	—	12,71ab	0
<i>R solani</i>	8,32de	41	16,02ab	0
<i>F oxysporum</i>	13,63abcd	3	11,94b	0
All eight pathogens	8,64cde	38	8,35b	29
All eight pathogens except <i>P cinnamomi</i>	10,52cde	25	12,11ab	0
<i>P cinnamomi</i> , <i>P spinosum</i> and <i>P debaryanum</i>	7,16e	49	12,51ab	0
<i>P cinnamomi</i> and <i>C scoparium</i>	7,34e	48	—	—
<i>P cinnamomi</i> and <i>C destructans</i>	—	—	8,10b	32
<i>P cinnamomi</i> and <i>F oxysporum</i>	6,67e	52	10,30b	13
CV	48%		52%	

1. Means followed by the same letter do not differ significantly according to Duncan's multiple Range test ($p = 0,05$).

The better performance of Duke 7 cuttings in comparison to Edranol seedlings may be due to a difference in root morphology. Normally Edranol seedlings produce only thin absorbing roots, while the control Duke 7 cuttings as well as those infected with *P debaryanum* produced thin absorbing roots as well as thicker roots. It is possible that the thicker roots of Duke 7 cuttings are correlated with the relative resistance of this rootstock.

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