TRICHODERMA VIRIDE A MYCOPARASITE FOR THE CONTROL OF *PHYTOPHTHORA CINNAMOMI*

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Introduction

Phytophthora cinnamomi Rands is a serious pathogen of trees and was first recorded in South Africa (Doidge and Bottomley, 1931). The fungus is an important cause of damage in *Cedrus deodara* and resulted in the mortality of about 8 ha of Deodar forest at Chail, Himachal Pradesh. The fungus attacks the roots and suppresses the water translocation, ultimately leading to the death of trees (Karthikeyan *et al.*, 2000). All over the world a lot of research has been undertaken on *P. cinnamomi*. However, the possibility of controlling pathogenic fungi with antagonistic micro-organisms has long been studied and found useful. The potential micro-organism is *Trichoderma viride*, which can be used as a biocontrol agent. *T. viride* is not only a biocontrol agent but also a biofertile agent (Baker *et al.*, 1984). *T. viride* is a mycoparasite that coils around the potential host hyphae and in some cases, appressoria like structures are formed prior to host penetration. *T. viride* has also been shown to produce wall-lysing enzymes, which help penetration of the host species (Whipps *et al.*, 1988). Hence, an attempt has been made to control the *P. cinnamomi* by *T. viride* in laboratory conditions with the following objectives :

1. Application of *T. viride* against *P. cinnamomi* in laboratory conditions to find out the effect of *T. viride* on *P. cinnamomi* and
2. Application of fungicides against *P. cinnamomi* to find out the rate of control compared with *T. viride*

Material and Methods

The mother culture of *T. viride* was obtained from Tamil Nadu Agricultural University, Coimbatore and multiplied on Potato Dextrose Agar medium at 28 ±1°C for seven days. The culture in petridishes showed profuse mycelial patches, which is initially white, and turned green after four days. The culture was centrifuged with sterile water at 3000 rpm to obtain the conidial suspension. The culture of *P. cinnamomi* is white in colour and colonies exhibits as typical rosette structure. The following treatments were made viz. :

1. Zn dust
2. Carbendazim
3. Carbendazim + Zn dust
4. *T. viride* and
5. Control.

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The fungicides Carbendazim (1 ml of 1 mg/lit), Zn dust (1mg), Carbendazim + Zn dust (1:1 w/w) and the centrifuged suspension (1 ml) of *T. viride* were inoculated in the petridishes (9 cm dia) along with the 1 ml of serially diluted (10^{-9}) *P. cinnamomi*. For comparison a control was also maintained and each treatment was replicated five times. Further the inoculated cultures were examined under the microscope to observe the development of *P. cinnamomi* and *T. viride*. The growth intensity of both the fungi was measured as growth area where the fungal mycelium is spread over the petridishes. The growth incidence (%) of *P. cinnamomi* was calculated by the following formula :

$$\text{Growth incidence (\%)} = \frac{\text{Growth area}}{\text{Total area}} \times 100$$

The zoosporangial development of *P. cinnamomi* was also monitored and the number of zoosporangia is denoted as Zoosporangial Index (ZI). Apart from this, the growth retardation of pathogen in the each treatment was calculated.

Results

The growth of *T. viride* and *P. cinnamomi* were observed under microscope and the growth area of *P. cinnamomi* in each treatment was calculated and presented in the Table 1. The *T. viride* has significantly controlled the *P. cinnamomi* growth where as the chemical fungicides controlled the *P. cinnamomi's* growth rate than control (Table 1). The growth incidence is, also significantly low in *T. viride* treatment than other treatments (Table 1). Similarly the *T. viride* showed significant effect on zoosporangial index of *P. cinnamomi* (Fig. 1) where the zoosporangial index is significantly lower than other treatments. The chemical treatment of Carbendazim and Zinc dust were found suitable for retarding the zoosporangial population than control but lesser than the *T. viride*. Over all, the results showed that the *T. viride* controlled significantly the growth incidence and zoosporangial development of *P. cinnamomi*.

Discussion

Many bacteria and fungi have been reported to stimulate plant growth and control the diseases (Schroth and Hancock, 1982). Baker *et al.* (1984) found that *T. viride* can also stimulate the growth of plants including various floricultural and horticultural species (Chang *et al.*, 1986) Earlier works revealed that *T. viride* controlled the *Pythium* spp. in tomato

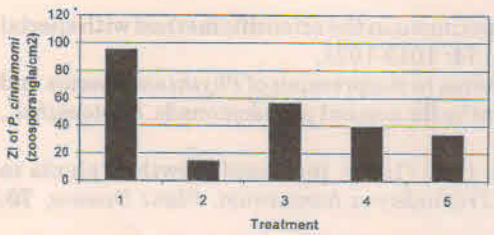
Table 1

Growth of P. cinnamomi in the presence of T. viride and fungicides

Growth rate	Control	*T. viride*	Zn dust	Carbendazim	Carbendazim + Zn dust
Growth area (cm^2)	8.0	1.3	4.5	3.8	4.0
Growth incidence (%)	42.0*	6.8*	23.7*	20.0*	21.0*
C.D. (5%) P< 0.05	6.5	3.2	6.1	5.4	5.7

* Significant values.

Fig. 1



1. Control. 2. *T. viride*. 3. Zn dust. 4. Carbendazim. 5. Carbendazim+ Zn dust

Effect of bio- and chemical treatments on *P. cinnamomi*

(Becker and Cook, 1988). It is also reported that *T. viride* controlled the *Rhizoctonia solani* in cucumber plants. These studies strongly supported the use of *T. viride* as a biocontrol measure.

In the present study also it is found that there is an antagonistic effect of *T. viride* on *P. cinnamomi*. The fungicides Zn dust and Carbendazim controlled the zoosporangia of *P. cinnamomi* but the harmful effects of these chemical substances may result in the change of the essential micro-nutrients ratios in the soil by release of toxic residues. The reduction of zoosporangial index of *P. cinnamomi* indicates that the *T. viride* suppresses the growth of *P. cinnamomi* by producing hyphal coils and arrest the chlamydospores (Whipps *et al.*, 1988). The reduction of growth incidence of *P. cinnamomi* by *T. viride* supported the earlier studies in raddish, pea and rice where the disease incidence was reduced (Harman *et al.*, 1980; Rosales *et al.*, 1993). Therefore, the biocontrol methods are always advisable because as they are eco-friendly and help to protect of the local environment. The chemical funficides percolate in the soil and many be harful to rhizosphere of healthy trees. The bio-control agent *T. viride* is more effective and less expensive.

Control of *P. cinnamomi* by *T. viride* is more advantageous then chemical methods because once the *T. viride* builds up in the roots, the disease resistance of the trees will be enhanced.

SUMMARY

A laboratory experiment was conducted to study the biocontrol effect of *Trichoderma viride* on *Phytophthora cinnamomi*. Simultaneously, the chemical treatments like carbendazim and Zn dust individually and in combinations were applied on *P. cinnamomi*. In this experiment, *T. viride* suppressed the growth of *P. cinnamomi* and zoosporangial development more effectively than other chemical treatments. It is, therefore, concluded that applying *T. viride* against *P. cinnamomi* might be an eco-friendly method for controlling the disease.

फायटोफ्थोरा सिन्नामोमाई का नियन्त्रण करने के लिए कवक परपोषी *ट्राइकोडर्मा वीरिडे*

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सारांश

फायटोफ्थोरा सिन्नामोमाई पर *ट्राइकोडर्मा वीरिडे* का जैव नियन्त्रण प्रभाव अध्ययन करने के लिए एक प्रयोगशाला संपरीक्षण किया गया । साथ-साथ, *फा० सिन्नोमोमाई* पर कार्बेन्डाजिम और जस्ते की धूलि का अलग-अलग तथा दोनों को मिलाकर उपचारित करके भी देखा गया । इस संपरीक्षण में *ट्रा० वीरिडे* ने *फा० सिन्नामोमाई* और जीवबीजाणुधानी विकास रासायनिक उपचारों की अपेक्षा अधिक प्रभावशाली ढंग से नियन्त्रित किया । अत: निष्कर्ष यह है कि *फा० सिन्नामोमाई* के विरूद्ध *ट्रा० वीरिडे* को प्रयुक्त करना इस रोग के नियन्त्रणार्थ ज्यादा परिस्थितिमित्र तरीका सिद्ध हो सकता है ।

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