INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

Volume: 2: Issue-2: April-June -2011 IJABPT ISSN 0976-4550

INVESTIGATIONS ON FUNGICIDAL SENSITIVITY OF *TRICHODERMA* SPP AND *SCLEROTIUM ROLFSII* (COLLAR ROT PATHOGEN) IN CROSSANDRA

P. Arunasri[1], T.V. Chalam[1], N. P. Eswara Reddy[1], S. Tirumala Reddy[2] and B. Ravindra Reddy[2]

[1]Dept. of Plant Pathology, S. V. Agricultural College, Tirupati - 517 502
[2] Acharya N G Ranga Agricultural University, Regional Agricultural Research Station, Tirupati-517 502

ABSTRACT : Crossandra is an important flower plant of our country earning a lot of revenue and trade. Of different diseases affecting crossandra cultivation, collar rot induced by *Sclerotium rolfsii* Sacc. is an important soil borne disease causing devastating losses. In the present study, the sensitivity of the collar rot pathogen was investigated. Also the compatibility of fungal biocontrol agent, *Trichoderma* spp. with these fungicides was worked out to for further devising Integrated Management strategies for collar rot disease. Four fungicides, *viz.,* captan 50% WP, propiconazole 25% EC, thiophanate-methyl 70% WP and thiram 75% SD were evaluated at five different concentrations against collar rot pathogen, *S. rolfsii*. Further, the compatibility of these fungicides and the antagonist *Trichoderma* isolate-1 (T_1). Results indicated that the fungicides, propiconazole, thiram and captan have significantly reduced the mycelial growth of test pathogen over control. Maximum inhibition was with propiconazole (100%), followed by thiram (81%) and captan (78%). Results on compatibility of *Trichoderma* spp. with these fungicides revealed that the bioagent was highly compatible with thiram (32% growth inhibition), followed by captan (47.5%). However, the *Trichoderma* isolate is not compatible with thiophanate methyl (88% growth inhibition) and propiconazole (100% growth inhibition). The *Trichoderma* isolate-1 (T_1) and the fungicide, thiram were selected for further studies to devise integrated management strategies against collar rot disease.

Key words : Crossandra, Collar Rot, *Sclerotium rolfsii*, *Trichoderma* and fungicidal compatibility

INTRODUCTION

Collar rot of crossandra [*Crossandra infundibuliformis* (L.) Nees.] caused by *Sclerotium rolfsii* Sacc. is a problematic disease for the Chittoor district of Andhra Pradesh. *Sclerotium rolfsii* is a polyphagous pathogen having a wide host range of 500 plant species (Punja, 1985). The pathogen is a soil borne fungus and survives in the form of sclerotia in the soil. Several management options are available for control of soil borne collar rot disease. However, disease outbreaks of collar rot disease are still not uncommon. Presently, the collar rot disease is managed through application of chemical fungicides that have several concerns in the areas of environmental safety, pathogen resistance to fungicides, groundwater pollution and escalated costs. Keeping in view these negative effects of fungicidal usage, an alternative or a supplement of chemical fungicidal management of collar rot disease in crossandra is the order of the day to save the crop from such a devastating disease.

Biological control of soil borne diseases is gaining popularity in present day agriculture due to its advantages over that of chemical control methods. Among different biocontrol agents, use of *Trichoderma* spp is popular and has several advantages especially in controlling propagules of sclerotia producing pathogens such as *S. rolfsii*.

In devising integrated disease management (IDM) strategies against collar rot disease, the compatibility of these bioagents with commonly used fungicides is essential. Since, elimination of soil-borne inoculum such as *S. rolfsii* is very difficult due to prolonged saprophytic survival ability of the pathogen, the idea of IDM assumes significance. The package of IDM involving chemicals and compatible antagonists not only protects the seeds and seedlings from soil-borne inoculum but also provides protection from seed-borne inoculum (Dubey and Patil, 2001). In view of this, the present study was taken up to elucidate the fungicidal sensitivity of collar rot pathogen, S. rolfsii to commonly used fungicides in crossandra. Further, the compatibility of these fungicides to the fungal bioagent, *Trichoderma* spp. was worked out. The long term goal is to evolve a IDM package by juxtaposing *Trichoderma* and fungicides so as to prevent pathogen from gaining resistance to chemical fungicides as well as in building up of *Trichoderma* spp population levels in the soil that will be effective on a long term basis.

MATERIALS AND METHODS

Sclerotium rolfsii was isolated from collar region of collar rot affected crossandra plant and *Trichoderma* isolate-1 (T_1) was isolated from rhizosphere of crossandra. Poisoned food technique (Nane and Thapliyal, 1993) was adopted for evaluation of fungicides *in vitro*. Four fungicides, *viz.,* Captaf (captan 50% a.i.), Tilt (propiconazole 25% a.i.), Roko (thiophanate-methyl 70% a.i.) and Tagthiram (thiram 75% a.i.) were screened at five different concentrations (50, 100, 250, 500 and 1000 ppm) against *S. rolfsii* and T_1 isolate to examine their inhibitory effect on the mycelial growth and to determine the most effective fungicide for integration with bioagent which may inhibit the pathogen but not that of the antagonist. Petridishes were inoculated with 6 mm disc of pathogen or antagonist and incubated at room temperature (28 ± 2°C). The relative efficacies were estimated by the radial growth of mycelium and inhibitory effect. The PDA plates without fungicide served as control.

RESULTS AND DISCUSSION

Fungicidal sensitivity of *Sclerotium rolfsii*

Among different fungicides evaluated under in vitro conditions against S. rolfsii., mean maximum inhibition of test pathogen was obtained with propiconazole (100% inhibition). This is followed by thiram (81% inhibition) and captan (78% inhibition). The fungicide, thiophanate methyl was found to be least effective (9.5% inhibition) in inhibiting the test pathogen under *in vitro* conditions (Table 1).

Fungicidal compatibility of *Trichoderma*

Compatibility studies revealed that the *Trichoderma* isolate under study was highly compatible with thiram (32% growth inhibition). This is followed by captan (47.5% growth inhibition). On the other hand, the *Trichoderma* isolate was not compatible with thiophanate methyl (88% growth inhibition) and propiconazole (100% inhibition) (Table 2). Thiram (Table 2) had inhibited T_1 to minimum extent only whereas propiconazole had completely inhibited it even at 50 ppm concentration.

Table 1 : *In vitro* evaluation of efficacy of fungicides on mycelial growth of *S. rolfsii*

Fungicide	*Per cent inhibition of mycelial growth of *S. rolfsii*					
	Concentration (ppm)					
	50	100	250	500	1000	Mean
Captan (Captaf 50WP)	58.42 (49.84)	70.97 (57.35)	78.42 (62.31)	89.01 (70.63)	94.89 (76.82)	78.34 (62.24)
Propiconazole (Tilt 25 EC)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
Thiophanate - methyl (Roko 70WP)	5.88 (13.94)	7.44 (14.65)	8.62 (17.05)	10.97 (19.28)	14.50 (22.38)	9.48 (17.85)
Thiram (Tagthiram75SD)	70.19 (56.85)	78.03 (62.03)	80.78 (63.94)	84.30 (66.32)	92.54 (74.11)	81.16 (64.23)

*Mean of 3 replications
Figures in parenthesis are angular transformed values

	Em ±	CD at 5%
Fungicide	0.1488	0.4310
Concentration	0.1664	0.4819
Fungicide x concentration	0.3328	0.9638

Table 2 : *In vitro* compatibility of *Trichoderma* isolate - 1 (T_1) with fungicides

Fungicide	*Per cent inhibition of growth of T_1					
	Concentration (ppm)					
	50	100	250	500	1000	Mean
Captan (Captaf 50WP)	5.87 (13.94)	24.30 (29.53)	41.56 (40.11)	80.37 (63.65)	85.09 (67.21)	47.43 (43.51)
Propiconazole (Tilt 25 EC)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.0 (90.00)	100.0 (90.00)
Thiophanate - methyl (Roko 70WP)	65.84 (53.97)	81.56 (64.53)	93.32 (75.00)	100.00 (90.00)	100.00 (90.00)	88.07 (69.73)
Thiram (Tagthiram 75SD)	3.52 (10.78)	6.66 (14.89)	21.56 (27.62)	59.60 (50.53)	68.61 (55.92)	31.99 (34.39)

*Mean of 3 replications
Figures in parenthesis are angular transformed values

	SEm ±	CD at 5%
Fungicide	0.2291	0.6636
Concentration	0.2562	0.7419
Fungicide x concentration	0.5123	1.4838

In our investigations, the fungicide, propiconazole though highly inhibitory to collar rot pathogen, *S. rolfsii*, it was also highly detrimental to the growth of Trichoderma isolate under study (100% inhibition) (Table 2). The other fungicide, thiram that was highly inhibitory to the test pathogen (81%) and compatible to Trichoderma isolate (growth inhibiton of only 32%) was selected for further studies on IDM of collar rot disease.

Several reports on the management of collar rot disease were reported earlier. Mukherjee and Tripathi (2001) reported that propiconazole completely inhibited *S. rolfsii* of french bean at 50 µg/ml. Complete inhibition of tuberose isolate of *S. rolfsii* at 100 ppm concentration was reported by Das and Panda (1997). Anitha Chowdary (1997) and Narayana Bhat and Srivastava (2003) reported complete inhibition of *S. rolfsii* (Bell pepper and french bean) at 250 ppm concentration of propiconazole. Thiram was found to be compatible with *Trichoderma* by several workers (Vyas, 1993; Kay and Stewart, 1994 ; Karpagavalli, 1997 and Deepak Kumar and Dubey, 2001).

Overall, our results indicated that thiram was highly effective against *S. rolfsii* and also found to bc compatible with fungal bioagent, *Trichoderma* spp under the conditions evaluated. Our future studies are directed in working out the compatibility of *Trichoderma* and fungicides in managing collar rot of crossandra under greenhouse and field conditions.

REFERENCES

Anitha Chowdary, K. (1997) Studies on scleortial wilt of bell pepper (*Capsicum annuum* L.) M.Sc. (Ag.) Thesis Acharya N.G. Ranga Agricultural University, Hyderabad (A.P).

Das, S. R. and Panda, S. N. (1997) Evaluation of fungicides against *Sclerotium rolfsii* causing collar rot of tuberose. Orissa Journal of Horticulture 25: 46-48.

Deepak Kumar. and Dubey, S. C. (2001) Management of collar rot of pea by the integration of biological and chemical methods. Indian Phytopathology 54: 62-66.

Dubey, S. C. and Patel. (2001) Determination of tolerance in *Thanetophorus cucumeris, Trichoderma viride, Gliocladium virens* and *Rhizobium* sp. to fungicides. Indian Phytopathology 54: 98-101.

Karpagavalli, S. (1997) Effect of different fungicides on the growth of *Trichoderma*. Indian Journal of Plant Protection 25: 82-83.

Kay, S. J. and Stewart, A. (1994) The effect of fungicides on fungal antagonists of onion white rot and selection of dicarboximide - resistant biotypes. Plant Pathology 43: 863-871.

Mukherjee, S. and Tripathi, H. S. (2001) Biological and chemical control of wilt complex of French bean. Journal of Mycology and Plant Pathology. 30: 380-385.

Narayana Bhat. and Srivastava, L. S. (2003) Evaluation of some fungicides and neem formulations against six soil-borne pathogens and three *Trichoderma* spp. *In vitro*. Plant Disease Research 18: 56-59.

Nene, Y. L. and Thapliyal, P. N. (1993) Evaluation of fungicides. In: *Fungicides in Plant Disease Control.* Oxford and IBH Publishing Company, New Delhi, p. 531.

Punja, Z. K. (1985) The biology, ecology and control of *Sclerotium rolfsii*. Annual Review of Phytopathology 23: 97-127.

Vyas, S. C. (1993) Biocontrol agents and fungicide interaction. In: *Handbook of Systemic Fungicides - General aspects* (Volume I), Tata McGraw - Hill Publishing Company Ltd., New Delhi, pp. 206-233.