J. Biol. Control, 12 (1): 77-80, 1998

Antifungal properties of biocontrol agents and plants extracts against causal fungi of yellows and rhizomes rot of ginger

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ABSTRACT: In dual cultures, biocontrol agents *viz.*, *Trichoderma harzianum*, *T. viride*, *Gliocladium virens*, *Absidia cylindrospora* and plant extracts *viz.*, *Agave americana*, *Azadirachta indica*, *Cassia fistula*, *Eucalyptus terticornis*, and *Vitex negundo* were evaluated against causal fungi of yellows and rhizome rot of ginger. *Trichoderma harzianum*, *T. viride*, *Azadirachta indica* and *Agave americana* were most effective in reducing mycelial growth of *Fusarium oxysporum* f sp. *zingiberi* Trujillo and *Pythium aphanidermatum* (Eds.) Fitz causing yellows and rhizome rot of ginger, respectively.

KEY WORDS: Antifungal properties, biocontrol agents, ginger, plant leaf extracts, rhizome rot

Ginger (*Zingiber officinale* Rosc) is an important cash crop of low and mid hills of Himachal Pradesh. The production of ginger in the state has declined due to rhizome rot and lately with the severe out break of yellows (Dohroo *et al.*, 1988). Both these diseases are seed (rhizome) and soil borne. The use of synthetic fungicides to control these pathogens, besides having long residual effect is hazardous to the environment. In the present studies biocontrol agents (BCA) and plant leaf extracts (PLE) were evaluated against causal fungi of these diseases.

The fungi causing yellows and rhizome rot of ginger were isolated during *kharif* 1997 from the diseased rhizome on Potato Dextrose Agar (PDA) medium. Cultures of *Trichoderma harzianum* Rifai, *T. viride* Pers. ex Fr., *Gliocladium virens* Miller, Giddens and Foster and *Absidia cylindrospora* Hagem from ginger rhizosphere (IIM No. 343136) were used in the studies. These fungal antagonists were screened against casual fungi of rhizome rot and yellows of ginger by the dual culture technique (Dennis and Webster, 1971). The fungal disc of the

pathogen was placed on PDA medium 24h after placing the fungal disc of the BCA. The growth of the pathogens was measured after 96 h of incubation at 22 ± 2°C and per cent inhibition was calculated using the formula of Vincent (1947).

Water extracts of *Agave americana* L., *Azadirachta indica* A. Juss, *Cassia fistula* L., *Eucalyptus terticornis* Sm. and *Vitex negundo* L. were prepared by washing, chopping and grinding the leaves in a pestle and mortar with the addition of the distilled water at the ratio of 1:2 (1 part leaf : 2 parts water). The extracts were squeezed through cotton wool and used immediately. *In vitro* assay of the leaf extracts was done by filter disc bioassay (Sharville and Pelletier, 1956). Filter paper discs soaked in Carbendazim + Mancozeb (0.1 + 0.25%) and in sterile distilled water served as controls. PDA medium was used throughout the laboratory studies. Each treatment was replicated thrice and the radial growth of the pathogen was measured after 96 h of incubation at 22 ± 2°C.

The causal fungi of yellows was identified as *Fusarium oxysporum* f sp. *zingiberi* Trujillo and that of rhizome rot as *Pythium aphanidermatum* (Eds.) Fitz. In the dual culture test, maximum inhibition of mycelial growth of *F. oxysporum* was obtained with *T. harzianum* (84.98%), *T. viride* (82.57%) and *G. virens* (79.74%). *Trichoderma harzianum* and *T. viride* showed, in general, high antagonistic activity as compared to *G. virens* and *A. cylindrospora* (Table 1). All the biocontrol agents were effective *against P. aphanidermatum* inhibiting more than 80

Table 1. Inhibition of mycelial growth (%) of fungi causing yellows and rhizome rot of ginger by different biocontrol agents and plant leaf extracts

Biocontrol agents/ Plant leaf extracts	Radial growth (mm)	
	F. oxysporum	*P. aphanidermatum*
Trichoderma harzianum	10.6 (84.98)	5.6 (87.71)
T. viride	12.3 (82.57)	7.3 (83.99)
Gliocladium virens	14.3 (79.74)	6.6 (85.52)
Absidia cylindrospora	17.6 (75.07)	4.6 (89.91)
Azadirachta indica	16.3 (76.91)	8.6 (81.41)
Agave americana	22.6 (67.98)	10.6 (76.75)
Cassia fistula	33.6 (52.40)	15.6 (65.78)
Eucalyptus terticornis	27.6 (61.33)	18.3 (59.86)
Vitex negundo	28.6 (59.49)	19.3 (57.67)
Carbendazim + Mancozeb (0.1 + 0.25%)	0.0 (100.00)	0.0 (100.00)
Sterilized distilled water	70.60	45.60
CD (P=0.05)	4.92	1.82

Figures in parentheses indicate per cent inhibition of mycelial growth over control

per cent of mycelial growth. *Absidia cylindrospora* was most effective and inhibited 89.91 per cent mycelial growth.

Bhardwaj *et al.* (1988) found good control of *F. equisetti* by pre-storage steeping of inoculated rhizomes in *T. harzianum* suspension or by smearing with *T. viride* and *T. hamatum against P. aphanidermatum* on seed ginger. Bhardwaj and Gupta (1987) also achieved inhibition of *P. aphanidermatum*, *F. equisetti*, *F. solani* and *Mucor hiemalis* with *T. harzianum* and *T. viride*.

All the plant leaf extracts were less effective than the fungicidal treatment. Sivasithambaram *et al.* (1981) found bark extracts of Eucalyptus effective in the control of *Phytophthora cinnamomi* Rands. *Agave americana* was found to very effective in controlling the rhizome rot caused by *F. oxysporum* under laboratory and field conditions (Pandey *et al.*, 1992). Antifungal properties of *A. indica* against several fungi are well known. Reddy and Reddy (1987) observed complete inhibition of growth and sporulation of *Fusarium* sp. by *A. americana* and *Cassia nodosa*.

Due to high cost of fungicides and the worldwide awareness regarding environmental pollution and residual problems, the excessive use of fungicides is discouraged. Some of the plant leaf extracts with fungicidal properties have been identified. These plant leaf extracts and biocontrol agents are ecofriendly and safer alternatives to fungicides for rhizome seed treatment against fungi of yellows and rhizome rot of ginger.

REFERENCES

Bhardwaj, S. S. and Gupta, P. K. 1987. *In vitro* antagonism of *Trichoderma* spp. against pathogens associated with rhizome rot of ginger. *Indian Journal of Plant Pathology*, **5** (1): 41-42.

Bhardwaj, S. S., Gupta, P. K., Dohroo, N. P. and Shyam, K. R. 1988. Biological control of rhizome rot of ginger in storage. *Indian Journal of Plant Pathology*, **6** (1): 56-58.

Dennis, C. and Webster, J. 1971. Antagonistic properties of species group of *Trichoderma* XXX, Hyphal interaction. *British Mycological Society*, **57**: 363-365.

Dohroo, N. P., Korla, B. N. and Rattan, K. S. 1988. Proceedings of National Symposium on Chillies, Ginger and Turmeric. Spices Board, Ministry of Commerce, Govt. of India, Cochin and A. P. A. G. Rajindernagar, Hyderabad, pp. 153-155.

Pandey, J. C., Kumar, R. and Gupta, R. C. 1992. Possibility of biological control of rhizome rot of ginger by different antagonists. *Progressive Horticulture*, **24** (3-4): 227-232.

Reddy, V. K. and Reddy, S. M. 1987. Screening of indigenous plants for their antifungal principle. *Pesticides*, **21**: 17-18.

Sharvelle, E. G. and Pelletier, E. N. 1956. Modified paper disc method for laboratory fungicidal bioassay. *Phytopathology*, **46**: 26.

Sivasithambaram, K., Smith, L. D. J. and Goss, O. M. 1981. Effect of potting media containing fresh saw dust and composted tree barks on *Phytophthora cinnamomi* Rands. *Australian Plant Pathology*, **10**: 20-21.

Vincent, J. H. 1947. Distortion of fungal hyphae in the presence of certain inhibitors. *Nature*, **15**: 856.