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INTEGRATED MANAGEMENT OF RHIZOME ROT OF SMALL CARDAMOM USING *TRICHODERMA* SP.

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ABSTRACT

Rhizome rot caused by *Pythium vexans*, *Rhizoctonia solani* and *Fusarium oxysporum* is a major disease of small cardamom (*Elettaria cardamomum* Maton) in India, causing about 30 percent crop loss. A field trial for the integrated management of rhizome rot disease was conducted in disease prone field at Indian Cardamom Research Institute's Regional Research Station, Thadiyankudisai, Tamil Nadu for two consecutive years during 2000-2001 and 2001-2002. There were five treatments laid out in completely randomized block design with five replications following standard agronomical practices. The treatments include i) Copper oxychloride 0.2% (Soil drenching) ii) Akomin 0.3% (foliar spray) iii) *Trichoderma harzianum* multiplied in coffee husk media @ 1kg/plant (basal application) iv) Akomin 0.3% + *Trichoderma* and v) control without any treatments. Two rounds of treatments were given during September and November months. Observations were taken on disease incidence and the population levels of *Trichoderma* were recorded for two years and the results were analysed statistically. The results indicated that *Trichoderma harzianum* either alone or in combination with Akomin promises to be an effective antagonist to manage the rhizome rot disease of cardamom in the field. The population of *Trichoderma* antagonist was found to increase by the end of the second year.

INTRODUCTION

Rhizome rot (clump rot) of small cardamom (*Elettaria cardamomum* Maton) is a serious soil-borne fungal disease in India resulting in about 30 per cent crop loss. The disease is caused by one or more rot pathogens such as *Rhizoctonia solani*, *Pythium vexans* and *Fusarium oxysporum*. It is observed in cardamom growing regions of Kerala and Karnataka and in plantations of high rainfall regions of Tamil Nadu. The disease incidence in plantations usually ranges from 2 to 16 per cent. Fungicides have been extensively used for controlling the disease (Pattanshetty *et al.*, 1974, Siddaramaiah *et al.*, 1988, Joseph Thomas *et al.*, 1993, Joseph Thomas and Vijayan, 1996). However, the fungicidal control has its own constraints such as the cost factor, environmental pollution, residual effects in the crop etc. In recent years, fungal pathogens have been successfully managed by using antagonists in crops like beans, cotton (Elad *et al.*, 1980) and small cardamom (Joseph Thomas *et al.*,1993; Vijayan *et al.*, 1994), but no work has been reported on the integrated management of rhizome rot in the field using the antagonists (Sharma and Mishra, 1995). Keeping this in view, a field study was conducted to manage the disease using a promising native strain of the antagonist viz., *Trichoderma harzianum* and selected fungicides, and the results are presented in this paper.

MATERIALS AND METHODS

The experiment was conducted in a disease prone field at the Regional Research Station, Indian Cardamom Research Institute, Thadiyankudisai, Tamil Nadu during 2000-2002 period. The trials included five treatments laid out in Randomized Block Design and each treatment was replicated five times with 12 plants per plot. The plots were maintained following standard agronomical practices. The treatments include (i) Copper oxychloride (0.2%) as soil drenching (ii) Akomin (Potassium phosphonate, 0.3%) as foliar spraying plus soil drenching (iii) *Trichoderma harzianum* as basal application (iv) Akomin (0.3%) as foliar spray and soil drenching plus *T.harzianum* as basal application and (v) Control without any bio-agent or fungicide. *T. harzianum* was mass multiplied on decomposed coffee husk as carrier medium and was applied at the base of each plant @ 1kg/plant (6×10^5 CFU/gm^{-1}). Dilution plate method was employed for monitoring the population of antagonist in the soil using selective media (Elad and Chet, 1983). First round of application of the bio-agent (*T. harzianum*) and fungicide was done before the onset of monsoon rains. Thirty days later, second application of the bio-agent and fungicide was given. The control plots were kept untreated (without any fungicide and antagonist). The per cent rhizome rot incidence and soil population level of the bio-agent were recorded. The data were statistically analysed.

RESULTS AND DISCUSSION

The pooled data for the year 2000-2001 and 2001-2002 are presented in Table 1. The results indicate that foliar spray with Akomin at 0.3 per cent combined with basal application of *T. harzianum* significantly reduced the rhizome rot disease incidence in the field. As compared to control plots, there was significant disease reduction in all the plots treated either with the bio-agent or fungicides (Akomin and Copper oxychloride). All the treatments were statistically at par except the control. The treatments were non significant during the first year of the field trial. However, during the second year of the trial, a minimum disease incidence of 0.78 per cent was recorded with *T. harzianum* application followed by the combined treatments of Akomin and *T. harzianum*. Further, the population level of *T. harzianum* in the treated soil was not adversely affected with Akomin at 0.3 per cent (Table 2).

The results of present findings indicate that *T. harzianum* either alone or integrated with Akomin promises to be an effective practice for management of rhizome rot disease of small cardamom in the field. The integrated approach of basal application of the *Trichoderma* with Akomin at 0.3 per cent not only reduces the disease incidence significantly but also enhanced the population of *Trichoderma* in the field. Sharma and Mishra (1995) integrated *Trichoderma* spp. with lower dose of fungicides for the management of soil-borne pathogens. Integration of biocontrol agent with fungicides gave significantly higher disease control in several crops than obtained by

Table 1. Effect of fungicides and *Trichoderma harzianum* on rhizome rot disease incidence in small cardamom

Treatments	Conc. (%)	Mean disease incidence (%)		Pooled Mean
		1st year	2nd year	
T1 – COC	0.2	14.89 (3.859) *	2.32 (1.676) b	8.74 (3.040) b
T2 – Akomin	0.3	14.56 (3.816)	1.22 (1.308) b	8.03 (2.921) b
T3- *T. harzianum*	1 kg/plant	14.81 (3.849)	0.78 (1.128) b	7.85 (2.892) b
T4 – Akomin + T. harzianum	0.3 1 kg/plant	13.78 (3.712)	1.32 (1.353) b	7.57 (2.840) b
T5 – Control	-	17.14 (4.144)	9.80 (3.211) a	13.56 (3.749)a
CD (5%)		NS	0.66	0.39

* Figures in parenthesis are square root transformed vales
In a column means followed by a common letter do not differ significantly at 5%level by DMRT

Table 2. Survival of *Trichoderma harzianum* in rhizome rot affected field plots

Treatments	Conc. (%)	Population of *T. harzianum* (Mean CFU/ gm^{-1})	
		October (CFU x 10^2)	December (CFU x 10^3)
T1 - COC	0.2	0.05 b	0.0 b
T2 - Akomin	0.3	0.15 b	0.02 b
T3 - *T. harzianum*	1 kg/plant	40.69 a	44.66 a
T4 - Akomin + *T. harzianum*	0.3 1 kg/plant	41.66 a	44.80 a
T5 - Control	-	0.12 b	0.01 b
CD (5%)		0.059 **	1.166 **

** - highly significant at (1% level)
In a column means followed by a common letter do not differ significantly at 5% level by DMRT.

either biocontrol agent or fungicide (Henis *et al.*, 1978 ; Sawant and Mukhopadhyay, 1990 ; Vyas, 1994).

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