WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 6.805
Volume 5, Issue 3, 1312-1317. Research Article ISSN 2277– 7105

INTEGRATED DISEASE MANAGEMENT OF ROOT ROT IN *COLEUS FORSKOHLII*

Dr. B. Meena*

Department of Medicinal and Aromatic Crops, Tamil Nadu Agricultural University, Coimbatore, India.

Article Received on 09 Jan 2016,

Revised on 30 Jan 2016,
Accepted on 20 Feb 2016

***Correspondence for Author**
Dr. B. Meena
Department of Medicinal and Aromatic Crops, Tamil Nadu Agricultural University, Coimbatore, India.

ABSTRACT

The root rot disease caused by *Rhizoctonia bataticola* is the serious soil-borne disease affecting *Coleus forskohlii*. The field experiment was conducted on the effect of fungicides and biocontrol agents for the management of root rot disease. The results showed that dipping stem cuttings in carbendazim (0.1%) followed by drenching with carbendazim (0.1%) on 30 DAP was effective in managing the root rot disease by recording 12.0% and 14.7% on 45 and 90 DAP respectively. In control, the highest root rot disease incidence of 22.7 and 30.7 per cent was recorded on 45 and 90 DAP respectively. The growth and yield parameters viz., plant height, number of tubers per plant, length of tubers, fresh weight and dry weight of the tubers and dry tuber yield were also found to be the highest in the treatment of dipping stem cuttings in carbendazim (0.1%) followed by drenching with carbendazim (0.1%) on 30 DAP.

KEYWORDS: *Coleus forskohlii*, root rot, carbendazim**,** biocontrol agents.

INTRODUCTION

Coleus forskohlii Briq. belonging to the family Lamiaceae is an important medicinal plant with fasciculate tuberous roots. In Tamil Nadu alone, it is cultivated in more than 1000 hectares across Salem, Attur, Kallakurichi, Thiruvannamalai, Trichy and Vellore regions (Rajamani *et al.*, 1999). The tuberous roots are known to be rich source of forskolin (diterpenoid), which is being developed as a drug for glaucoma, congestive cardionyopathy, hypertension, asthma and certain types of cancers. Forskolin content has been found to vary from 0.07 to 0.59 per cent of dry tubers (Gowda, 2000). This alkaloid has the unique property of activating all hormone sensitive adenylate cyclase enzymes in biological systems.

Root rot of *Coleus forskohlii* caused by *Rhizoctonia bataticola* is the destructive disease in Tamil Nadu leading to drastic reduction in tuberous root yield. Yellowing of leaves, discolouration and rotting of roots are the prominent symptoms of root rot disease. The presence of sclerotial bodies as small, black dot like structures are seen in the stem portions. The pathogen survives in the soil for several years. The yield loss was ranged up to 50 to 60 per cent due to this disease. Management of disease through fungicides alone leads to cause soil residual problem and health hazards, besides involving higher input cost. Use of biological control agents is the alternative method of plant disease control.

Biological control through the use of antagonistic microorganisms has recently emerged as a viable disease management strategy (Meena *et al*., 2002; Alvindia and Natsuaki, 2008; Minaxi, 2010; Meena, 2012). The main modes of action of the biocontrol agent include competition for nutrients and space, production of cell wall degrading enzymes, production of antifungal diffusible and volatile metabolites and mycoparasitism. Hence in the present study, the effect of fungicides and biocontrol agents were evaluated against root rot disease of *Coleus forskohlii*.

MATERIALS AND METHODS

The root rot pathogen of *C. forskohlii* was isolated from infected roots of Coleus plants using potato dextrose agar medium by tissue segment method (Rangaswami, 1972) and identified as fungus, *Rhizoctonia bataticola* and pathogenicity test was proved. The mycelium is greyish black and sclerotia are black and irregular with mycelial appendages.

The field experiment was conducted in the farmer’s field at Kaalipalayam, Coimbatore district, Tamil Nadu during 2015 to find out the effect of fungicides and biocontrol agents for the management of root rot disease of *C. forskohlii*. The stem cuttings were dipped in fungicide carbendazim (0.1%) or biocontrol agents viz., *Trichoderma viride* 0.2% or *Pseudomonas fluorescens* (0.2%). Soil drenching with carbendazim (0.1%) or *T. viride* (0.2%) or *P. fluorescens* (0.2%) was done at 30 days after planting. The soil was treated with zinc sulphate, neem cake and *T. viride* mixture at the rate of 50 g per plant. The root rot disease incidence was recorded at 45 and 90 days after planting by counting the number of diseased plants and total plants. The growth and yield parameters viz., plant height, number of tubers per plant, length of the tubers, fresh weight and dry weight of tubers and dry tuber yield were also recorded.

RESULTS AND DISCUSSION

The results of the field experiments revealed that dipping stem cuttings in carbendazim (0.1%) followed by drenching with carbendazim (0.1%) on 30 DAP recorded the lowest root rot disease incidence of 12.0% and 14.7% on 45 and 90 DAP respectively. Dipping stem cuttings in *P. fluorescens* (0.2%) ranked next which recorded the root rot disease incidence of 13.3% and 16.0% at 45 and 90 DAP respectively. The treatment consisting of soil application of zinc sulphate, neem cake and *Trichoderma viride* mixture (50 g/plant) recorded the root rot disease incidence of 13.3% and 17.3% at 45 and 90 DAP respectively. In control, the highest root rot disease incidence of 22.7 and 30.7 per cent was recorded on 45 and 90 DAP respectively (Table 1). Monga and Raj (2000) reported that carbendazim was highly toxic to root rot pathogen of cotton. Kumari *et al*. (2012) highlighted that among the seven fungicides tested *in vitro* by poisoned food technique, carbendazim was the most effective to inhibit mycelial growth of pathogen as well as reducing root rot incidence in mungbean incited by *Macrophomina phaseolina*.

Table 1. Management of root rot disease in *Coleus forskohlii*

Treatments	45 DAP		90 DAP	
	Root rot disease incidence (%)	Disease reduction over control (%)	Root rot disease incidence (%)	Disease reduction over control (%)
T_1: Dipping stem cuttings in carbendazim (0.1%) + Drenching with carbendazim (0.1%)	12.0 (12.2)	47.1	14.7 (13.5)	52.1
T_2: Dipping stem cuttings in *Trichoderma viride* (0.2%) + Drenching with *T. viride* (0.2%)	14.7 (13.5)	35.2	18.7 (15.3)	39.1
T_3: Soil application of Zinc sulphate + Neem cake + *T. viride* mixture (50 g/plant)	13.3 (12.8)	41.4	17.3 (14.7)	43.6
T_4: Dipping stem cuttings in *Pseudomonas fluorescens* (0.2%)	13.3 (12.8)	41.4	16.0 (14.1)	47.9
T_5: Soil application of Zinc sulphate + Neem cake mixture (50 g/plant)	17.3 (14.2)	23.8	21.3 (16.5)	30.6
T_6: Drench with *T. viride* + *P. fluorescens* (0.2%)	16.0 (14.7)	29.5	18.7 (15.3)	39.1
T_7: Drench with carbendazim (0.1%)	17.3 (14.2)	23.8	22.7 (17.0)	26.1
T_8: Control	22.7 (22.1)	-	30.7 (20.2)	-
CD (P=0.05)	0.9		1.3	

Mean of three replications; Figures in the parenthesis are arcsine transformed values

Table 2. Effect of fungicides and biocontrol agents on growth and yield parameters of *C. forskohlii*.

Treatments	Plant height (cm)	No. of tubers/ plant (no.)	Tuber length (cm)
T_1: Dipping stem cuttings in carbendazim (0.1%) + Drenching with carbendazim (0.1%)	46.3	19.8	24.6
T_2: Dipping stem cuttings in *Trichoderma viride* (0.2%) + Drenching with *T. viride* (0.2%)	44.8	16.5	20.7
T_3: Soil application of Zinc sulphate + Neem cake + *T. viride* mixture (50 g/plant)	45.7	17.9	21.5
T_4: Dipping stem cuttings in *Pseudomonas fluorescens* (0.2%)	48.1	16.5	22.6
T_5: Soil application of Zinc sulphate + Neem cake mixture (50 g/plant)	42.2	15.8	16.5
T_6: Drench with *T. viride* + *P. fluorescens* (0.2%)	43.7	13.6	18.6
T_7: Drench with carbendazim (0.1%)	41.2	11.2	15.8
T_8: Control	37.8	9.8	10.8
CD (P=0.05)	1.2	1.4	1.1

Mean of three replications

Table 3. Effect of fungicides and biocontrol agents on yield of *C. forskohlii*.

Treatments	Fresh weight of tubers/ plant (g)	Dry weight of tubers/ plant (g)	Dry tuber yield (kg/ha)	Increased yield over control (%)
T_1: Dipping stem cuttings in carbendazim (0.1%) + drenching with carbendazim (0.1%)	165.0	26.7	2008.6	51.7
T_2: Dipping stem cuttings in *Trichoderma viride* (0.2%) + Soil drenching with *T. viride* (0.2%)	144.0	24.0	1680.7	42.3
T_3: Soil application of Zinc sulphate + Neem cake + *T. viride* mixture (50 g/plant)	146.0	24.7	1750.3	44.6
T_4: Dipping stem cuttings in *Pseudomonas fluorescens* (0.2%)	151.0	25.0	1924.4	49.6
T_5: Soil application of Zinc sulphate + Neem cake mixture (50 g/plant)	136.3	22.3	1395.3	30.5
T_6: Drench with *T. viride* + *P. fluorescens* (0.2%)	142.3	23.3	1489.7	34.9
T_7: Drench with carbendazim (0.1%)	127.7	21.0	1294.0	25.1
T_8: Control	75.7	13.0	969.2	-
CD (P=0.05)	14.6	1.8	82.3	

Mean of three replications

The growth and yield parameters viz., plant height, number of tubers per plant, length of tubers, fresh weight and dry weight of tubers and dry tuber yield were also recorded. From the results, it was found that the growth and yield parameters were the highest in the treatment of dipping stem cuttings in carbendazim (0.1%) followed by drenching with carbendazim (0.1%) which recorded plant height (46.3 cm), number of tubers per plant (19.8), length of tubers (24.6 cm), fresh weight of tubers (165.0 g) and dry weight of tubers per plant (26.7 g) (Tables 2 & 3). In control, the growth and yield parameters were found to be the lowest which recorded plant height (37.8 cm), number of tubers per plant (9.8), length of tubers (10.8 cm), fresh weight of tubers (75.7 g) and dry weight of tubers per plant (13.0 g) (Tables 2 & 3). Kumar *et al*. (2011) reported that carbendazim and vitavax were effective in inhibiting the growth of *R. bataticola* and reducing the incidence of jatropha root rot. These fungicides resulted in 100% inhibition of mycelial growth at 50 ppm. Seed treatment with carbendazim and its soil drenching caused the least pre-emergence (16.7%) and post-emergence mortalities (10.1%). Ilyas *et al*. (1976) reported that there was a greater reduction of sclerotium viability in soybean stem pieces placed in benomyl-treated soil.

Dipping stem cuttings in carbendazim (0.1%) followed by drenching with carbendazim (0.1%) recorded the highest dry tuber yield of 2008.6 kg/ha. In control, the lowest dry tuber yield of 969.2 kg/ha was recorded (Table 3). Hence, root rot disease of *C. forskohlii* can be successfully managed by integrated disese management.

ACKNOWLEDGEMENT

The authors are thankful to ICAR – All India Co-ordinated Research Project on Medicinal and Aromatic Plants and Betelvine for the financial support.

REFERENCES

1. Alvindia DG, Natsuaki KT. Evaluation of fungal epiphytes isolated from banana fruit surfaces for biocontrol of banana crown rot disease. Crop Protection, 2008; 27: 1200-1207.
2. Gowda S. *Coleus forskohlii*. Agro India, 2000; 8: 27-28.
3. Kumar S, Sharma S, Pathak DV, Beniwal J. Integrated management of jatropha root rot caused by *Rhizoctonia bataticola*. Journal of Tropical Forest Science, 2011; 23: 35-41.
4. Kumari R, Shekhawat KS, Gupta R, Khokhar MK. Integrated management against root-rot of mungbean [*Vigna radiata* (L.) Wilczek] incited by *Macrophomina phaseolina*. J Plant Pathol Microb, 2012; 3: 1-5.

5. Ilyas MB, Ellis MA, Sinclair JB. Effect of soil fungicides on *Macrophomina phaseolina* sclerotium viability in soil and in soybean stem pieces. Dis Control and Pest Mgt., 1976; 66: 355-359.
6. Meena B, Radhajeyalakshmi R, Marimuthu T, Vidhyasekaran P, Velazhahan R. Biological control of groundnut late leaf spot and rust by seed and foliar applications of a powder formulation of *Pseudomonas fluorescens*. Biocontrol Sci Technol, 2002; 12: 195-204.
7. Meena B. PGPR-mediated systemic resistance for sustainable agriculture. In: Maheswari DK (eds.). Bacteria in Agrobiology - Plant Probiotics, Springer Publications, Hidelberg, Germany, 2012: 269-285.
8. Minaxi JS. Disease suppression and crop improvement in mung bean (*Vigna radiata*) through *Pseudomonas* and *Burkholderia* strains isolated from semi arid regions of Rajasthan, India. Biol Cont, 2010; 55: 799-810.
9. Monga D, Raj S. Root rot disease of cotton and its management. CICR Technical Bulletin, 2000; 3: 12.
10. Rajamani K, Kempuchetty N, Thamburaj S. Medicinal plant cultivation. Agro India, 1999; 5: 4-5.
11. Rangaswami G. Diseases of crop plants in India. Prentice Hall of India Pvt. Ltd., New Delhi, India, 1972; 520.