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CERTAIN STUDIES ON THE MANAGEMENT OF *P. APHANIDERMATUM* CAUSING RHIZOME ROT OF TURMERIC BY USING FUNGICIDES AND BIO INOCULANTS

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Abstract

Turmeric is infected by many fungal, bacterial, viral, nematode diseases. Among all rhizome rot caused by *P. aphanidermatum* is most destructive and widespread disease causing very high crop loss under favorable conditions. Results revealed that all the fungicides tested @ 500, 1000 and 1500 ppm significantly inhibited the mycelial growth of *P. aphaniderrmatum,* over untreated control. Further, per cent mycelia inhibition was increased with increase in concentration of the fungicides tested. Of the antagonists tested, *T. viride* was found to be most effective with maximum mycelial inhibition of the test pathogen followed by *T. hamatum* and *T. harzianum.*

Keywords: Turmeric, *T. viride,* antagonists, fungicides, bio efficacy

Introduction

Turmeric (*curcuma longa* L.) is one of the major spices cultivated for its underground rhizome.It is also called as hidden Lilly or golden spice or turmeric of commerce or Indian saffron . Turmeric is the third largest spice produced in the country and it accounts for about 14% of total spices produced in India. India is the world's largest producer of turmeric and apparently accounts for more than 80 percent of the world's production. The area, production and productivity of turmeric in India has been reported to be 175.73 and 185.58 thousand hectares, 959.35 and 943.33 thousand tones and 5459 and 5083 kg/ha, respectively, during year 2014-15 and 205-16 (Anonymous, 2016). The total area in TN under turmeric was11.0 thousand hectares, with production 11.0 thousand tonnes and productivity of 1000kg/ha, respectively (Anonymous, 2015). Turmeric is infected by many fungal, bacterial, viral, nematode diseases. Among all diseases rhizome rot caused by *P. aphanidermatum* is most destructive and widespread disease causes very high crop loss under favorable conditions (Rathaiah, 1982). The disease has been reported to causes more than 60 percent mortality of seedlings both in nursery and field condition and about 50-80 percent losses during storage (Nirmal, 1992). Experiments were done to find out the efficacy of certain fungicides and bio agents in inhibiting the growth and development of *P. aphanidermatum* under *in vitro* conditions.

Materials and Methods

In vitro evaluation of fungicides

Efficacy of five fungicides *viz*., Carbendazim 50 WP, Metalaxyl 50 WP, Hexaconazole 5 EC, Penconazole 10 EC and Fosetyl –AL 80 WP were evaluated *in vitro* at various concentrations against *P. aphanidermatum*, applying poisoned food technique (Nene and Thapliyal, 1993) and using potato dextrose agar (PDA) as basal culture medium. Based on active ingredient, requisite quantity of the test fungicides was calculated, mixed separately thoroughly with autoclaved and cooled (40 ºC) PDA medium in conical flasks to obtain desired concentrations. This PDA medium amended separately with the test fungicides was then poured (20 ml/plate) aseptically in Petri plates (90 mm dia.) and allowed to solidify at room temperature. 3 replication were maintained. After solidification of the PDA medium, all the plates were inoculated aseptically by placing in the centre a 5mm culture disc obtained from actively growing 7 days old culture of *P. aphanidermatum* and incubated in an inverted position at 28± 2ºC. Petri plates filled with plain PDA (without any fungicide) served ascontrol. Observations on radial mycelial growth / colony diameter were recorded at an interval of 24 hours and continued till any plate was fully covered with mycelial growth of the test pathogen. Percent inhibition was calculated by applying formula of Vincent, 1927.

Assesing the Efficacy of Bio Agents

Three fungal and two bacterial bioagents viz., *Trichoderma viride, Trichoderma harzianum, Trichoderma hamatum, Pseudomonas fluorescens, Bacillus subtilis* were evaluated *in vitro* against *P. aphanidermatum*, applying dual culture technique (Dennis and Webster, 1971). Seven days old cultures of the test bioagents and test pathogen (*P. aphanidermatum*) grown on PDA were used for the

study. Two 5mm culture discs, of each of the test pathogen and test bioagents were cut out with sterilized cork borer and placed at equidistance, exactly opposite to each other on autoclaved and solidified PDA medium in petriplates and incubated at 28± 2ºC. PDA plates inoculated with test pathogen alone served as control.

Observations on linear mycelial growth of the test pathogen and test bioagent were recorded at an interval of 24 hour still any plate was fully covered with mycelial growth of the test pathogen. Percent inhibition of the test pathogen with the test bioagent, over untreated control was calculated by applying formula (Arora and Upadhyay, 1978).

Results and Discussion

Evaluation of various fungicides against *P. aphanidermatum*

Results revealed that all the fungicides tested (500, 1000 and 1500 ppm) significantly inhibited mycelia growth of *P. aphaniderrmatum,* over untreated control. Further, per cent mycelia inhibition was increased with increase in concentration of the fungicides tested. Of all the fungicides, Metalaxyl gave cent per cent (100%) mycelial inhibition with all three concentrations. The next best fungicide was Carbendazim 50 WP which recorded an inhibition percentage of 93.35% at 0.05 concentration and recorded cent per cent inhibition at 0.1% concentration. Hexaconazole 5 EC and Fosetyl-AL showed lesser degree of success recording 77.9 & 76.34% inhibition.

In vitro evaluation of bio agents against *Pythium aphanidermatum*

Results revealed that all the bioagents evaluated exhibited significant fungi static/ antifungal acivity against *Pythium apanidermatum* and inhibited its growth, over untreated control. Of the antagonists tested, *T. viride* was found most effective with highest mycelial inhibition of the test pathogen. The second and third inhibitor antagonists were *T. hamatum* and *T. harzianum* with an inhibition of percentage of (85.24 & 80.64%), respectively. However, *Bacillus subtilis* and *P. fluorescens* were found least effective recording percent mycelial inhibition of (45.64 & 42.02%) respectively.

These results are in conformity with the earlier findings of workers who reported that fungicides are significantly superior in inhibiting the mycelial growth of *P. aphanidermatum* infecting turmeric (Rekha 2006).

The present results are in conformity with the earlier findings of those workers who reported that bioagents viz., *Trichoderma viride, Trichoderma hamatum, Trichoderma harzianum, Pseudomonas fluorescens* and *Bacillus subtilis* had significantly inhibited mycelial growth of *P. aphanidermatum* infecting turmeric (Sagar, 2006; Ushamalini *et al*., 2008; Anoop & Bhai, 2014), *P. aphanidermatum P. myriotylum* & *Pythium* spp. infecting ginger (Bhai *et al*., 2005; Sagar, 2006; Kadam, 2014; Dhroo *et al*., 2015). P.G. Chavan *et al.,* 2017).

Table 1 : *In vitro* bioefficacy of fungicides against *P. aphanidrematum*

Tr. No.	Treatments	Colony Dia.*(mm)atppm			Av. (mm)	% Inhibition *at ppm			Av. inhibition (%)
		500	1000	1500		500	1000	1500	
T1	Carbendazim 50 WP	5.98_{b}	00.00_{a}	00.00_{a}	5.98_{b}	93.35_{b}	100.00_{a}	100.00_{a}	97.78_{b}
T2	Metalaxyl 50 WP	00.00_{a}	00.00_{a}	00.00_{a}	00.00_{a}	100.00_{a}	100.0_{a}	100.0_{a}	100.00a
T3	Hexaconazole 5 EC	17.24_{c}	11.08_{b}	8.22_{b}	12.23_{c}	70.84_{c}	87.68_{b}	90.86_{b}	83.12_{c}
T4	Penconazole 10 EC	22.72_{d}	16.78_{c}	10.92_{c}	16.80_{d}	64.75_{d}	81.35_{b}	87.86_{c}	77.9_{8d}
T5	Fosetyl –AL 80 WP	17.28_{c}	12.18_{b}	8.24_{b}	12.56_{c}	70.8_{c}	76.46_{c}	81.76_{d}	76.34_{d}
T6	Control	90.00_{e}	90.00_{d}	90.00_{d}	90.00_{e}	0.00_{e}	0.00_{d}	0.00_{e}	0.00_{e}

Table 2 : *In vitro* bioefficacy of bioagents against *P. aphanidermatum*

Tr. No.	Treatments	Colony dia. of test pathogen *(mm)	% inhibition
T1	*Trichoderma viride*	13.28_{a}	85.24_{a}
T2	*Trichoderma harzianum*	24.18_{c}	73.13_{c}
T3	*Trichoderma hamatum*	17.42_{b}	80.64_{b}
T4	*Pseudomonas fluorescens*	52.18_{e}	42.02_{e}
T5	*Bacillus subtilis*	48.92_{d}	45.64_{d}
T6	Control (untreated)	90.00_{f}	0.00_{f}

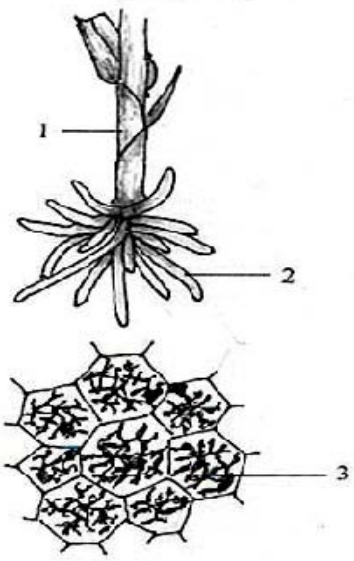

Fig.1 Endotrophic mycorrhiza (e-g) *Neottia*

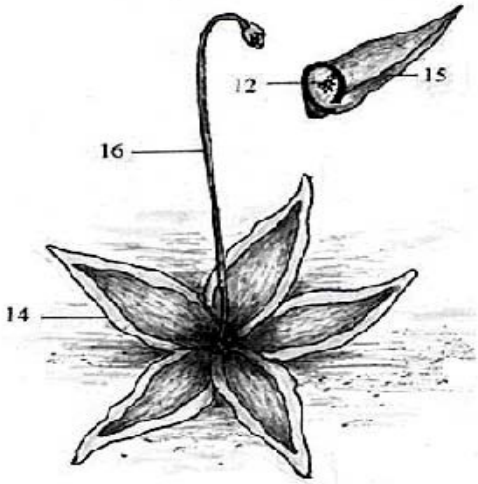

Fig. 3 Butterworts (e-g) *Pinguicula* sp.

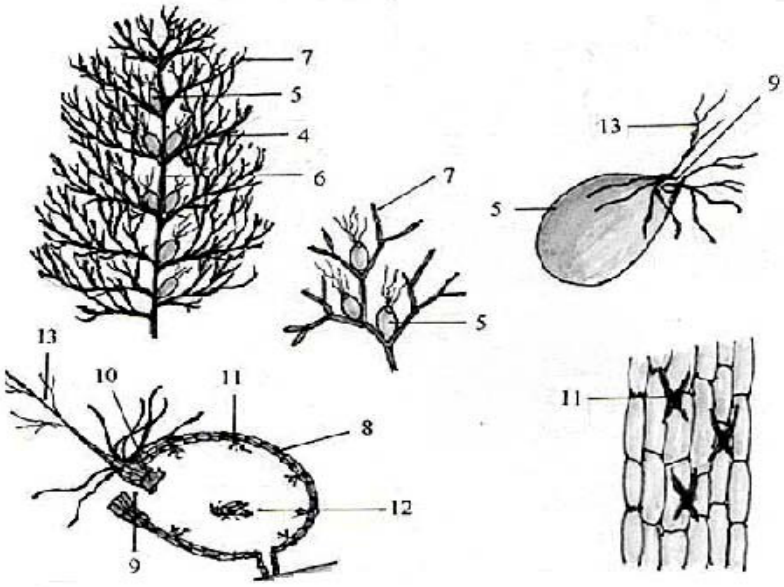

Fig. 2 Bladderworts (e-g) *Utricularia* sp.

1.Stem of orchid plant 2.Roots 3.Mycorrhiza fungus within the cells of the root cortex 4.Portion of submerged plant 5.Thin bladder-like bag trap 6.Stolon 7.Leaf-like structures 8.Outer wall of the bag 9.Entrance door of the trap 10.Valve (Trap door) 11.Absorbing structures 12.Trapped insect 13.Bristle-like protuberances 14.Rosette of basal leaves 15.Rolled leaf 16. Rachis

References

Anonymous, (2015). Horticultural Statistics at a Glance. Pp-225.

Anonymous, (2016). Spices Area, Production and Productivity in India, All India Coordinated Research Project on Spices, Kasaragod, Kerala, India, pp-1.

Anoop, K. and Bhai, S.R. (2014). Evaluation of antagonistic potential of indigenous *Trichoderma* isolates against *Pythium aphanidermatum* (Edson) Fitz. Causingrhizome rot in turmeric (*Curcuma longa* L.). J. Sci., 4(2): 99-105.

Arora, D.K. and Upadhyay, R.K. (1978). Effect of fungal staling substances on colony interaction. Plant Soil, 49: 685-690.

Bhai,S.R.; Kishore, V.K.; Kumar, A.; Anandaraj, M.E. and Santhosh, J. (2005). Screening of rhizobacterial isolates against soft rot disease of ginger (*Zingiber officinale* Rosc.). J. Spices Aromatic Crops, 14(2): 130-136.

Dennis, C. and Webster, J. (1971). Antagonistic properties of species groups of *Trichoderma* II. Production of volatileantibiotics. Trans. British Mycol. Soc., 57: 41-48.

Dohroo, N.P.; Kansal, S. and Ahluwalia N. (2015). Studies on eco farmer friendly practices for management of soft rot of ginger (*Zingiber officinale*). Ind. Phytopath, 68(1): 93-96.

Kadam, R.V. (2014). Investigations on rhizome rot of ginger. M.Sc. (Agri.) thesis submitted to Vansantro Naik.

Nene, Y.L. and Thapliyal, P.N. (1993). Fungicides in plant disease control (3 Ed.) Oxford, IBM Publishing Co., New Delhi, 331.

Nirmal, B.K.; Samsuddin, K. and Ratnambal, M.J. (1992). *In vitro* plant regeneration from leaf derived callus in ginger (*Zingiber officinale* Rosc.). Plant, Cell Tissue and Organ Culture, 29: 71-74.

Rajalakshmi, J.; Durgadevi, D.; Harish, S. and Raguchander, T. (2016). Morphological and molecular characterization of *Pythium aphanidermatum* the incitant of rhizome rot in turmeric. Int. J. Env. Ecol. Family and Urban Studies, 6(4): 1-8.

Rathaiah, Y. (1982). Rhizome rot of turmeric. Ind. Phytopath, 35: 415-417.

Sagar, S.D. (2006). Investigations on the etiology, epidemiology and integrated management of rhizome rot complex of ginger and turmeric. Ph.D. Thesis submitted to University of Agriculture, Dharwad.

Ushamalini, C.; Nakkeeran, P. and Marimuthu, T. (2008). Induction of plant defense enzymes in turmeric plants by *Trichoderma viride*. Arc. Phytopathol. Pl. Protec., 41(2): 79-93.