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Biological and chemical control of *Pythium aphanidermatum - Meloidogyne incognita* disease complex in chilli and brinjal

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Abstract : Biological and chemical control of *Pythium aphanidermatum* (Edson) Fitz.-*Meloidogyne incognita* (Chitwood, 1949) disease complex in chilli (*Capsicum annum L.)* and brinjal (*Solanum melongena* L.) were evaluated in field. Seed treatement with Diafuran 3G + Ridomil MZ-72, significantly reduced the incidence of damping-off followed by seed treatment with Ridomil MZ-72, *Trichoderma viride, T. harzianum* and *Paecilomyces lilacinus* treatments. There was increase in dry shoot and root weight of both crops, when *T. viride* was used as seed treatment followed by *P. lilacinus* and *T. harzianum.* The nematode gall-index was highly reduced in Diafuran 3G + treatment followed by *P. lilacinus* and Diafuran 3G-Ridomil MZ-72 treaments. *(Key Words: Biological control, Chemical control, Pythium - Meloidogyne complex)*

Chilli (*Capsicum annuum* L.) and brinjal (*Solanum melogena* L.) are the most important vegetable crops grown in India. These crops are usually affected by several fungal, bacterial, viral and nematode diseases. Among these, the fungal disease viz., damping-off due to *Pythium* spp. is of cosiderable importance, because the crop is damaged in the early growth phase. Among the nematodes, root-knot nematode, *Meloidogyne* spp. has importance by forming rootgalls from the erarly stages of the crop. Since both *Pythium* and *Meloidogyne* sp. results in serious damages to these two crops.

Biological control methods has been considered as a promising approach for the management of soil borne diseases. If a biocontrol agent has consistently high antagonistic activity against *Pythium* and *Meloidogyne,* it may form a realistic alternative to complement other existing control methods. Thus it was thought to be worthwhile to undertake an investigation on the management of *Pythium-Meloidogyne* disease complex in chilli and brinjal.

The biological control of *M. incognita* and *Macrophomina phaseolina* on chickpea has been reported by Siddiqui and Hussain (1991). Siddiqui and Mahmood (1993) reported that the combined inoculation of *Paecilomyces lilacinus* and *Bacillus subtilis* improved dry shoot weight of chickpea when plants were simultaneously inoculated with *Meloidogyne incognita* and *Macrophomina phaseolina.* The chemical content of various disease complexes has been reported by Dwivedi *et al.,* (1993).

Materials and Methods

The cultures of *Trichoderma viride* and *T. harzianum* were mass multiplied by inoculating in 250 ml conical flasks containing 70 ml of Molasses-Yeast medium (Molasses 30 g. and Yeast extract 5 g. in one litre of distilled water and sterilized). The flasks were incubated at room temperature for 10 days. After 10 days, the suspension was pooled and one litre each of *Trichoderma* suspension was mixed with 2 kg of talc powder. To one kg of this mixture 10 g of Carboxy Methyl Cellulose (CMC) was added and packed in poly bags. These talc based formulations were further used for the seed treatments. The fungus *Paecilomyces lilacinus* was selected as an antagonist against *M. incognita.* The culture of *P. lilacinus* was subcultured on Potato Dextrose Agar (PDA) slants.

Two field trials were conducted in a Randomized Block Design (RBD) with five replications in the year 1995. Cultivar Co2 was used in both chilli and brinjal. The treatments were as follows.

1. *Trichoderma viride* at the rate of 4 g talc formulation / kg of seed.
2. *T. harzianum* at the rate of 4 g talc based formulation / kg of seed.
3. *P. lilacinus* at the rate of 1 g of culture / kg of seed.
4. Diafuran 3G at the rate of 10 g / kg of seed.
5. Ridomil MZ-72 at the rate of 8 g / kg of seed.
6. Ridomil MZ-72 at the rate of 8 g / kg of seed + Diafuran 3G at the rate of 10 g / kg of seed.
7. Aureofungin sol. at the rate of 4 g / kg of seed.
8. Control.

The bed size was 30 x 45 cm with a 60 cm gap between the beds. The seeds were surface sterilized with 0.1 per cent mercuric chloride and after drying they were treated with the antogonists and chemicals as mentioned above. One gram of

seeds were sown in each bed by line sowing. The germination percentage of both chilli and brinjal were determined by roll towel method.

Weekly plant stand was taken by counting the normal seedlings upto 45 days. The nematode-gall index was determined by using 1-5 scale at 45 days after sowing, where

1 - Less than 1% of total roots galled
2 - 1 to 25 per cent of total roots galled
3 - 26 to 50 per cent of total roots galled
4 - 51 to 75 per cent of total roots galled
5 - 76 to 100 per cent of total roots galled.

The seedlings were dried in an oven at a temperature of 70°C for 24 h and the dry shoot weight and dry root weight were determined, at 45 days after sowing (DAS).

Results and Discussion

Damping-off of chilli and brinjal was reduced when Ridomil MZ-72+Diafuran 3G was used as seed treatment. The percent indidences of pre-and post-emergence damping-off of chilli were 7.52 and 8.04 respectively (Table 1), whereas it was 1.51 and 17.47 percent in brinjal. Table 2 similar observations were made by Deol et.al. (1989), in brinjal when Carbofurn+Bavistin were used to control *Fusarium-Meloidogyne* disease complex. Several workers have reported Ridomil to be effective against a number of species of *Pythium*, when it was used as soil treatment and / or spray (Reddy and Nagarajan, 1985 and Powell, 1986). The above Ridomil MZ-72+Diafuran 3G treatment was followed by Ridomil MZ-72 alone was used to treat the seeds.

Among the bio-control agents, *T.viride* recorded lower incidence of damping-off followed by *T. harzianum* and *P.lilacinus*. In *T.viride* treatment the per cent incidence of pre-and post-emergence damping-off of chilli was reduced to 1.89 and 16.26, whereas in brinjal it was reduced to 22.75 and 25.96 per cent respectively.

According to Sharma and Saxena (1992), the culture filtrate of *T. viride* adversely influenced the hatching of *M. incognita* larvae. Biological control of *Pythium* spp. by T. *viride* has been reported by Ramanathan (1989) and Krishnamoorthy and Bhaskaran (1990). Seed treatment with *T. harzianum* was reported to be effective against *Pythium* spp. (Krishnamoorthy and Bhaskaran, 1990).

Many workers have reported about the efficiency of *P. lilacinus* in effectively controlling the roor-knot nematode (Jatala *et al.*, 1980: Siddiqui and Mahmood, 1983).

The dry shoot weights were increased in chilli and brinjal in *T. viride* treatment, followed by *P. lilacinus* treatment. The dry roots weights were higher in *T. viride* treatments of both crops. In brinjal it was followed by *P. lilacinus* treatment and Diafuran 3G treatment and in chillies it was followed by Ridomil MZ-72 + Diafuran 3G and *P. lilacinus* treatments. In the present investigation, it was observed that there has been a substantial increase in shoot and root weights of chilli and brinjal, when fungal antagonists were used to control *Pythium-Meloidogyne* disease complex. Similar result was also obtained by Emayavaramban (1994). Seed treatment with *Trichoderma* reduced the population of *P. aphanidermatum* and in the absence of any competition from the pathogen the growth of seedlings enhanced the dry shoot and root weight (Siddiqui and Mahmood, 1993; Dube and Smart, 1987). The fungus *P. lilacinus* produces a pepticidal antibiotic which has antimicrobial activity (Isogai *et al.*, 1981).

The nematode gall-index was reduced when Diafurun 3G was used as seed treatment followed by Ridomil MZ-72 + Diafuran 3G and *P. lilacinus* treatment. Deol *et al.*, (1989) found that carbofuran at 2 kg ai / ha alone or in combination with Bavistin 2000 ppm reduced the gall-index in *M. incognita - Fusarium solani* disease complex of brinjal. Siddiqui and Mahmood (1993) reported that the number of galls were reduced by the application of *P. lilacinus* alone with *Bacillus subtilis* of the *Meloidogyne-Macrophomina* diseases complex on chick pea. The efficacy of *P. lilacinus* in effectively controlling the root-knot nematode, in reducing nematode gall-index and in increasing yield has been reported by Jatala *et al.*, 1980; Siddiqui and Mahmood, 1993.

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Table 1. Effect of antagonists and chemicals on interaction of *Pythium aphanidematum* and *Meloidogyne incognita* in chilli at 45 DAS.

S. No.	Tratments	% incidence of damping - 0ff		Shoot weight / Plant (g)	Root weight /plant (g)	Root knot Index
		Pre-emergence	Post-emergence			
1	*T. viride*	11.89	16.26	1.103^{a}	0.340^{a}	2.75^{a}
2	*T. harzianum*	18.01	23.08	0.918^{bc}	0.918^{ab}	3.00
3	*P. lilacinus*	20.98	24.30	1.085^{a}	0.289^{a}	2.25^{a}
4	Diafuran 3G	28.67	31.47	0.934^{bc}	0.212^{ab}	2.00^{a}
5	Ridomil MZ - 72	10.31	11.01	0.916^{bc}	0.189^{ab}	2.75^{a}
6	Ridomil MZ - 72 + Diafuran 3G	7.52	8.04	1.009^{ab}	0.302^{a}	2.25^{a}
7	Auerofungin sol.	29.20	31.29	0.837^{c}	0.284^{ab}	2.50^{a}
8	Control (untreated)	33.43	37.06	0.916^{bc}	0.318^{a}	3.00
	CD (P=0.05)	1.349	1.353	0.100	0.140	0.632

Mean of two trials
Mean of three replications
In the columns each figure followed by a same letter do not differ significiantly at 5 per cent level by DMRT

Table 2. Effect of antagonists and chemicals on interaction of *Pythium* and *Meloidogyne* in brinjal at 45 DAS.

S. No.	Tratments	% incidence of damping - 0ff		Shoot weight / Plant (g)	Root weight /plant (g)	Root knot Index
		Pre-emergence	Post-emergence			
1	*T. viride*	22.75	25.96	1.283^{a}	0.433^{a}	2.25^{a}
2	*T. harzianum*	29.81	33.81	1.064^{b}	0.318^{bc}	1.75^{ab}
3	*P. lilacinus*	32.69	35.42	1.123^{b}	0.394^{ab}	1.75^{ab}
4	Diafuran 3G	38.94	41.19	0.979^{bc}	0.189^{dc}	1.25^{b}
5	Ridomil MZ - 72	22.28	23.08	0.902^{cd}	0.230^{cd}	3.00^{c}
6	Ridomil MZ - 72 + Diafuran 3G	16.51	17.47	1.073^{b}	0.387^{ab}	1.25^{b}
7	Auerofungin sol.	39.90	42.79	0.783^{dc}	0.136^{dc}	2.25^{a}
8	Control (untreated)	42.15	44.87	0.731^{e}	0.091^{a}	3.00^{c}
	CD (P=0.05)	0.874	1.887	0.137	0.106	0.727

Mean of two trials
Mean of three replications
In the columns each figure followed by a same letter do not differ significiantly at 5 per cent level by DMRT

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Effects of organic amendments and zinc on the yield content and uptake of zinc by wheat and maize grown in succession

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Abstract : A green house experiment was conducted on a Zn deficient sandy soil, to study the effect of FYM (10 and 20 t/ha), wheat straw 5 and 10 t/ha and Zn levels (0, 12.5, 25.0 and 50.0 kg. Zinc sulphate / ha) on the yield, content and uptake of Zn by wheat (HDM-1553) and hybrid maize (ganga-5) grown in succession. Application of FYM and wheat straw increased the yields of both wheat and maize crops. The magnitude of increase in yield of wheat crop was more with FYM than with wheat straw. Higher level of wheat straw showed more increase in second crop of maize and indicated a residual effect. In absence of organic amendments, application of Zn increased the yield of both the crops. Application of organic amendments increased the content and uptake of Zn in wheat and maize crops. Application of FYM showed higher values of content and uptake of Zn in wheat and maize crops. Application of FYM showed higher values of content and uptake than wheat straw. Increased application in levels of Zn increased the content and uptake of Zn in both the crops. *(Key Words : Organic amendments, Zinc, Yield, Content, Uptake)*

Intensive agriculture, no doubt, has increased the production, but it has also given problems of exhaustion of soil fertility. Wide spread deficiency of Zn and response of crop to its application have been reported by several workers. There are problems of disposal of agricultural residues such as straw of wheat and paddy and stalks of bajra, jowar and maize. Reports on the effect of addition of organic matter on the availability of Zn are of variable nature. The availability of Zn has been found to decrease or increase depending on the type of organic material added to the soil (Duraiswamy et al., 1988). The availability of Zn, due to addition of organic matter was also affected by the type of soil (Shukla, 1971), kind and the quantity of organic matter added to the soil. Keeping these facts in