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Influence of moisture and pH on the efficiency of VA-mycorrhiza, *Glomus mosseae* (Nicol & Gerd.) Gerd. & Trappe against *Meloidogyne incognita* (Kofoid and White) Chitw. on blackgram (*Vigna mungo* L.) Hepper

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ABSTRACT: **Influence of moisture and pH on the efficiency of VA-mycorrhiza, *Glomus mosseae* against *Meloidogyne incognita* on blackgram was studied under potted conditions. The moisture level of 40 to 70 per cent was found suitable for the mycorrhizal colonization and unfavourable for nematode multiplication. Among the moisture levels tested 70 per cent moisture was found suitable for the well establishment of VAM to control root knot nematode. Higher moisture level (80-100%) was found detrimental to VAM fungus and due to poor establishment of VAM it resulted in increased nematode population. Among the different pH levels tested for interaction studies, pH7 was suitable for better mycorrhizal colonization and spore production.**

KEY WORDS: Biocontrol, blackgram, *Glomus mosseae*, *Meloidogyne incognita*, moisture, pH

Root-knot nematode, *Meloidogyne incognita* (Kofoid and White) Chitwood, is one of the most serious nematode problems of blackgram, which causes stunting and reduction in number of nodules with heavy losses in yield (Chahal *et al.*, 1988). Among the various kinds of organisms engaged in biological control of nematodes, mycorrhizal fungi, especially VAM are now attracting greater attention as potential biocontrol agents (Jain and Hasan, 1994). The efficiency of VA mycorrhiza is influenced by several factors such as soil moisture and soil pH (Mosse, 1972). Early reports indicated that the nematode population was positively correlated with the moisture level whereas VAM was negatively correlated with the moisture level. Influence of pH on the interaction of VA-mycorrhizae and *M. incognita* has not been documented so for. Detailed studies on the development of *M. incognita* in root system grown in soil infected with mycorrhizal fungi at varied levels of moisture or pH should help to understand these interactions. Hence an attempt was made to find out the influence of moisture and pH separately on the biocontrol efficacy of *Glomus mosseae* (Nicol & Gerd.) Gerd. & Trappe against *M. incognita* on blackgram.

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MATERIALS AND METHODS

A pot culture experiment was conducted to study the effect of different levels of moisture on the interaction of *Glomus mosseae* with *M. incognita*. Sterilized pot mixture of red soil: sand: FYM (2:2:1) was taken and oven dried at 100°C for 24 hours and filled in 150g capacity plastic pots. The initial weight of the pots was taken. Water was added slowly to bring it to saturation and then the final weight of the pots was taken separately. The water required to bring the pots to saturation point was considered as 100 per cent moisture level. From this the other levels of moisture were worked out and maintained throughout the experimental period (Santhi and Sundarababu, 1990). The different levels of moisture taken for the experiments were 30, 40, 50, 60, 70, 80, 90 and 100 per cent and replicated thrice. The *G. mosseae* (multiplied on maize plants) inoculum of 5g containing hyphae in the infected roots and soil containing spores was mixed well in each pot. Blackgram cv. Co5 seeds were sown @ two seeds/pot and after germination thinned to one seedling/pot. At the time of sowing, measured amount of water was added in each pot to bring it to different levels of moisture as per the treatments. Daily the required amount of water was added in each level in order to maintain the moisture level of the pots. Ten days after sowing, the second stage juveniles of *M. incognita* were inoculated @150 juveniles/pot. Forty five days after sowing the shoot length, shoot weight, root length, root weight, per cent mycorrhizal colonization, final nematode population, gall index (Heald *et al.*, 1989) and total P content were recorded. VAM root infection level was assessed from randomly selected root material after cutting the entire system into one cm pieces. Roots were cleared in KOH and stained in tryphan blue (Phillips and Hayman, 1970). Per cent root colonization was determined as observed by Giovannetti and Mosse (1990). The total P content in the plant material was estimated by vanadomolybdate method in the nitric acid system (Jackson, 1973).

The effect of pH on the interaction of *G. mosseae* with *M. incognita* on blackgram was conducted under potted condition. Soils were collected from different localities of Tamil Nadu with different pH levels or by adding either 0.1 N HCl or NH_4OH to the soil to adjust the recommended pH level of 4,5, 6, 7, 8 and 9 (Narayana Bhat, 1992). The soils were sterilized and filled in two kg capacity pots. Six treatments and four replications were maintained. Before sowing, the pots were mixed with *G. mosseae* inoculum @ 20 g/pot. The blackgram cultivar Co.5 seeds were sown @ two seeds/pot and after germination thinned to one seedling/pot. Ten days after germination the second stage juveniles of *M. incognita* were inoculated @ 2000 juveniles/pot. Data on growth parameters, nematode reproduction, gall index, spore population, per cent mycorrhizal colonization and total P content (Jackson, 1973) of plants were recorded after 70 days.

RESULTS AND DISCUSSION

From the study, it is clear that, moisture levels of 60 and 70 per cent were found favourable for the establishment of *G. mosseae* (Table 1). As the moisture level increased up to 70 per cent there was increased mycorrhizal colonization and above 70 per cent a decline in mycorrhizal colonization was observed. Daniel (1980) and Gokuldas *et al.* (1990) obtained similar type of results. Among the moisture levels tested, 70 per cent was found suitable for VAM establishment and growth of blackgram. The moisture levels of 80 to 100 per cent were found detrimental to VAM fungus and due to poor establishment of VAM under higher moisture levels it resulted in increased nematode population. The gall index ranged from 2 to 3 in all the moisture levels, the maximum of 3 was observed in the moisture levels of 80, 90, and 100 per cent.

Maximum spore population and mycorrhizal colonization of VAM were obtained in the pH range of 6 to 7 (Table 2). This conforms with the results of Green *et al.* (1976) and they reported

that spores of *G. mosseae* germinated best at pH 7. Although mycorrhizal development was noticed above pH 7, the mycorrhizal development declined rapidly below pH 7. Mycorrhizal growth at pH 5

Table 1. Effect of moisture on the interaction of *G. mosseae* and *M. incognita* on blackgram

Treatment	Shoot length (cm)	Shoot weight (g)	Root length (cm)	Gall weight (g)	Nematode index/ 100g soil	Mycorrhizal population (%)	Total P colonization (%)	Content
30% moisuture+ Gm + Mi	-	-	-	-	-	-	-	-
40% moisture+ Gm + Mi	17.4	3.8	10.4	1.8	2	120.0	30.0	0.36
50% moisture+ Gm + Mi	21.8	6.4	14.3	2.1	2	160.0	36.0	0.38
60% moisture+ Gm + Mi	26.4	7.2	16.4	2.9	2	180.0	45.0	0.41
70% moisture+ Gm + Mi	32.8	10.1	25.4	4.2	2	190.0	51.0	0.48
80% moisture+ Gm + Mi	28.2	8.6	22.6	3.5	3	220.0	36.0	0.34
90%moisture+ Gm + Mi	29.4	7.8	21.7	3.3	3	240.0	31.0	0.30
100% moisture +Gm + Mi	27.8	7.2	20.4	3.0	3	230.0	28.0	0.29
CD (P=0.05)	1.8	0.9	1.5	0.6	NA	15.5	3.3	0.02

Gm - *Glomus mosseae*; Mi - *Meloidogyne incognita* ; NA-Not analysed

Table 2. Effect of pH on the interaction of *G. mosseae* and *M. incognita* on blackgram

Treatment	Shoot length (cm)	Root length (cm)	Shoot weight (g)	Root length (cm)	weight (g)	Pod yield (g)	Gall index	Nematode population /100g soil	Mycorrhizal colonization (%)	Total P content (%)
pH 4	-	-	-	-	-	-	-	-	-	-
pH 5	12.1	10.1	8.7	1.2	0.9	3.0	120.0	80.0	27.6	0.21
pH6	26.4	22.4	22.3	5.3	4.3	3.8	410.0	120.0	38.7	0.23
Ph7	32.4	28.5	26.8	14.4	6.4	2.9	310.0	130.0	51.6	0.39
pH8	27.8	20.4	21.4	5.3	4.2	3.2	280.0	110.0	34.6	0.31
pH9	15.1	12.3	10.4	3.7	0.8	3.0	240.0	50.0	18.4	0.29
CD (P = 0.05)	1.8	0.9	1.8	0.6	0.4	0.5	15.6	7.8	3.1	0.01

was nearly negligible and at pH 4, *G. mosseae* failed to establish. The gall index was least (2.9) in pH 7. From the study it could be concluded that pH 7 was found suitable for good establishment of VAM, growth of blackgram and suppression of *M. incognita*.

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