Int.J.Curr.Microbiol.App.Sci (2017) 6(8): 2287-2291

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 Volume 6 Number 8 (2017) pp. 2287-2291
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.608.268

Efficacy of Different Bio Control Agents against *Meloidogyne incognita* and *Fusarium oxysporum* on Black gram (*Vigna mungo* L)

Dilip Kumar*, Jayant Bhatt and Ratan Lal Sharma

Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur, MP- 482004, India
**Corresponding author*

A B S T R A C T

An experiment was carried out to study the interaction of root knot nematode, *Meloidogyne incognita*, *Paecilomyces lilacinus*, *Pochonia chlamydosporia*, *Trichoderma viride*, *Bacillus subtilis* and *Pseudomonas fluorescence* on the growth of black gram. This study was done to investigate the role of some bacterial genera as biocontrol agent against *Meloidogyne incognita*. *Paecilomyces lilacinus* significantly increased the growth parameters of the black gram viz., plant height, root length, fresh and dry weight of shoot and roots with significant decrease in the number of galls and final nematode population. *Pochionia chlamydosporia* was also noted to be superior and took second rank in improving the plant growth and reduced nematode population. Maximum plant height (19.02 cm) was recorded with *Paecilomyces lilacinus* followed by *Pochonia chlamydosporia* (17.70 cm), *Trichoderma viride* (16.46 cm), *Bacillus subtilis* (15.68 cm) and *Pseudomonas fluorescence* (13.96 cm). Inoculated control recorded minimum (11.10 cm) plant height. Similarly maximum (18.38 cm) root length was noted with *P. lilacinus* and minimum (11.24 cm) with control rest of the treatments were significantly superior over control.

Keywords

Fusarium oxysporum, *Meloidogyne incognita*, Black gram, Bio control agents.

Article Info

Accepted:
21 June 2017
Available Online:
10 August 2017

Introduction

Black gram (*Vigna mungo L*), one of the pulses, is mostly produced in Asian countries as their tropical climate and soil type suits its cultivation. India occupies 31 lakh hectares of land with 14 lakh tones production and 451.61 kg/ha productivity. Madhya Pradesh alone contributes 4.72 lakh hectares of land with 1.66 tones production and 351.69 kg/ha productivity (Anon., 2012). *Meloidogyne incognita is* considered to be one of the most severe pests of blackgram. The nematodes adversely affect nodulation Nitrogen fixation and yield (Hussaini and Seshadri, 1975). *Meloidogyne* infection, which primarily impairs water and nutrient uptake, and upward translocation by the root system (Karssen and Moens, 2006). *Meloidogyne incognita* has evolved a specialized adoptive mechanism with the vascular wilt fungus *F. oxysporum* to cause a disease complex etiology in a variety of crop plants (Powell, 1971; Mai and Abawi, 1987). Such a disease complex, involving both the organisms has also been reported in black gram inflicting an appreciable loss in yield to the tune of 49 percent (Mahapatra and Swain, 1999). Application of biological control agents (BCA) is a promising and ecofriendly tool in improving current levels of agricultural production. It assists in reducing use of chemical pesticides thereby controlling release of their residues into environment. One of the most efficient ways to achieve this objective is to develop BCAs for disease control alone, or to integrate it with reduced doses of chemicals in the control of phytopathogens resulting in minimal impact of chemicals on the environment. If complexities exist between the two organisms, application of either a fungicide or a nematicide alone will reduce the respective pathogen only. More over extensive use of chemicals have adverse effect on the environment (Latha *et al.,* 2000).

Materials and Methods

The experiment was conducted in ten cm earthen pots containing 500 cm sterilized soil employing five bio-control agents viz, *Trichoderma viride, Paecilomyces lilacinus, Psuedomonas fluorescens, Bacillus subtilis and Pochonia chlamydosporia.* The fungus *P. lilacinus* and *T. viride* were isolated from the soils of J.N.K.V.V Jabalpur from by sprinkling it on Petri plates containing sterilized Potato Dextrose Agar (PDA) medium. Both the organisms were purified and maintained on PDA plants. The fungus *T. viride* was multiplied on wheat seeds. The seeds were boiled in water for half an hour and excess moisture was drained out. The boiled seeds were filled in polypropylene bags @ 500g seeds per bag and autoclaved at 1.05 kg/ cm^2 for 20 minutes. After cooling the bags were inoculated with pure culture of *T. viride* and inoculated at 24^0C for 10 days. When sufficient growth was achieved the seeds along with fungus were mixed with the pot soil @ 2g/pot. Before mixing the fungus spore load was calculated by haemocytometer. *Paecilomyces lilacinus* was mass multiplied on wheat seeds following the technique described earlier and at maximum growth and spore load mixed with the pot soil @ 2g per pot. Commercial formulations of *Pochonia chlamydosporia, Psuedomonas fluorescence* and *Bacillus subtilis* were obtained from Department of Nematology, Tamil Nadu Agricultural University with a spore load 2×10^7 colony forming units (cfu). These formulations were mixed with the pot soil @ 2g/pot. After mixing the test bioagents in to the soil infested with *F. oxysporum* the pot soil was sprayed by freshly hatched and surface sterilized second stage juveniles of *M. incognita*. The population of root-knot nematode (2 j_2/g soil) was determined by the method described earlier. The soil with test bioagents and *M. incognita* was filled in ten cm earthen pots and sown with blackgram seeds. Each treatment was replicated five times and randomized on glass house earlier. The experiment was terminated 45 days after inoculation and observations on plant height, root length, shoot weight (fresh and dry), root weight (fresh and dry), number of galls, and nematode population in soil and roots were recorded.

Results and Discussion

The five biocontrol agents *viz*; *Trichoderma viride, Pochonia chlamydosporia, Paecilomyces lilacinus, Bacillus subtilis and Pseudomonas fluorescense* were tested against disease complex produced by *M. incognita* and *F. oxysporum* in black gram and the data is presented in table 1. All the treatments reduced incidence of nematode and fungus on growth of black gram and multiplication of nematode. The data presented in table 1 revealed that maximum plant height (19.02 cm) was recorded with *Paecilomyces lilacinus* followed by *Pochonia chlamydosporia* (17.70 cm), *Trichoderma viride* (16.46 cm), *Bacillus subtilis* (15.68 cm) and *Pseudomonas fluorescence* (13.96 cm). Inoculated control recorded minimum (11.10 cm) plant height. Similarly maximum (18.38 cm) root length was noted with *P. lilacinus* and minimum (11.24 cm) with control rest of the treatments were significantly superior over control but inferior over *P. lilacinus*, *P. chlamydosporia*, *T. viride*, *B. subtilis* and *P. fluorescence* which recorded 16.66, 15.44, 11.78 and 15.12 cm lengths respectively the effect of *P. fluorescence* and *T. viride* remained at par with each other.

Significantly increased fresh weight of shoot (0.89g) was recorded with *P. lilacinus* which remained almost at par with *P. chlamydosporia* (0.87g) and *T. viride* (0.85), *B. subtilis* and *P. fluorescence* recorded 0.78 and 0.69g shoot weight respectively against minimum (0.62g) in control. Maximum (0.86g) root weight on fresh weight basis was noted with *P. lilacinus* and *P. chlamydosporia* (0.85g) which remained at par with each other. This treatment was followed by *T. viride* (0.81g), *B. subtilis* (0.76g) and *P. fluorescence* (0.64g) Minimum root weight was recorded with inoculated control (0.32g). Dry weight of shoot was significantly increased (0.41g) in *P. lilacinus* against minimum (0.26g) in control. The effect of *P. chlamydosporia* and *T. viride* remained at par with each other. These treatments recorded 0.38 and 0.36g root weights respectively. Significantly lower shoot weights were recorded in *B. subtilis* (0.33g) and *P. fluorescence* (0.29g) but superior over inoculated control. All the treatments have significantly increased dry root weight of black gram. Maximum (o.39g) dry root weight was recorded with *P. lilacinus* followed by *P. chlamydosporia* (0.36g) and *T. viride* (0.34g), *B. subtilis* and *P. fluorescence* recorded 0.32 and 0.28g dry root weight respectively. Minimum (0.25g) dry root weight was recorded in inoculated control. Minimum number (8.20) of galls were recorded in *P. lilacinus* followed by *P. chlamydosporia* (9.80) and *T. viride* (10.40), *B. subtilis* recorded 12.20 and *P. fluorescence* recorded 11.00 galls/plant respectively with maximum (13.80) galling in inoculated control. Maximum (1890.20) nematode recovery was noted in inoculated control. Which was significantly reduced in *T. viride* (1178.60) followed by *P. chlamydosporia* (1156.40) and *P. lilacinus* (1115.4). *B. subtilis* and *P. fluorescence* recorded 1230.40 and 1342.40 nematode (Root+ Soil).

The data presented in table 1 indicated that *Paecilomyces lilacinus* significantly increased the growth parameters of the blackgram viz., plant height, root length, fresh and dry weight of shoot and roots with significant decrease in the number of galls and final nematode population. These results are in accord with the finding of Latha *et al.,* (2000) who observed increase in growth parameter and decrease in nematode multiplication of *Hetrodera cajani* in presence of *Macrophomina phaseolina* on *Vigna mungo*. Similar results have also been observed by Verma *et al*; (2005). On *P. Iilacinus* has been reported to produce peptidal antibiotic viz; lilacin and paecilotixin that are toxic to root knot nematode (Verma *et al*., (2005).

The biocontrol agent *Pochionia chlamydosporia* was also noted to be superior and took second rank in improving the plant growth and reduced nematode population. Similar finding have also been reported by Siddiqui and Mahmood on pigeon pea in the presence of *Hetirodera cajani* and *Fusarium udum*. *Bacillus subtilis,* and *Psueudomonas fluorescens* showed its efficacy in reducing the nematode population and enhancing the growth characters of the blackgram. These findings have also been supported by the result shown by Siddiqui and Mohmood (1995) on chickpea with *M. incoginita* and *M. phaseolina*. *Poornima et al., (2007) on banana with Fusarium oxysporum and Helicotylenchus multicinctus, Latha et al., (2000) on blackgram, Haseeb et al., (2005) on green gram and Akhtar et al., (2012) on blackgram.*

Table.1 Efficacy of different biocontrol agents *Meloidogyne incognita* and *Fusarium oxysporum* on plant growth parameters

S. no	Treatment	Plant height (cm)	Root length (cm)	Fresh weight(g)		Dry weight(g)		No of galls/plant	Total No. of nematode
				Shoot	Root	Shoot	Root		
1	Control	11.10	11.24	0.62	0.32	0.26	0.25	13.80 (3.71)	1890.20 (43.47)
2	*Psuedomonas fluroscence*	13.96	15.12	0.69	0.64	0.29	0.28	11.00 (3.31)	1342.40 (36.63)
3	*Bacillus subtillus*	15.68	11.78	0.78	0.76	0.33	0.32	12.20 (3.49)	1230.40 (35.07)
4	*Trichoderma viride*	16.46	15.44	0.85	0.81	0.36	0.34	10.40 (3.22)	1178.60 (34.33)
5	*Pochonia chlamydosporium*	17.70	16.66	0.87	0.85	0.38	0.36	9.80 (3.13)	1156.40 (34.00)
6	*Paecilomyces lilacinus*	19.02	18.38	0.89	0.86	0.41	0.39	8.20 (2.86)	1115.40 (33.39)
S.E.(M) ±		0.957	0.844	0.043	0.035	0.013	0.012	0.503	16.160
CD (P=0.05)		2.809	2.480	0.126	0.103	0.037	0.034	1.478	47.450

*Mean of four replication
** Values in parentheses are $\sqrt{n+1}$ transformation

It can be concluded that the *Paecilomyces lilacinus* significantly increase the growth parameters of the black gram viz., plant height, root length, fresh and dry weight of shoot and roots with significant decrease in the number of galls and final nematode population. *Pochionia chlamydosporia* was also noted to be superior and took second rank in improving the plant growth and reduced nematode population. The egg parasitic *Paecilomyces lilacinus* and *Pochionia chlamydosporia* were found to have a significant effect in reducing galls and enhancing plant growth.

Acknowledgement

The authors are thankful to the Dean, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur for providing necessary facilities and permission to conduct the study.

References

Akhtar, A., Abbasi, Hisamuddin, and R. Sharf. 2012. Antagonistic effects of *Pseudomonas fluorescens* and *Bacillus subtilis* on *Meloidogyne incognita* infecting *Vigna mungo* L. *Inten. Animal and Environ. Sci.*, 2: 55-63.

Haseeb, A., Ahmad Vigar and P.K. Shukla. 2005. Comparitive efficacy of pesticides, biocontrol agents and botanicals against *Meloidogyne incognita- Fusarium oxysporurn* disease complex on *Vigna mungo. Ann. Pl. Protec. Sci.*, 13: 434-437.

Hussaini, S.S. and Seshadri, A.R. 1975. Interactionships between *Meloidogyne incognita* and *Rhizobium* spp. on mungbean. *Indian J. Nematol., 5*: 189-199.

Karssen, G. and M. Moens. 2006. Root-knot nematodes. In: R.N. Perry and M. Moens, eds. *Plant Nematol.*, Wallingford, UK: CABI Publishing, pp. 59–90.

Latha, T.K.S., E. Rajeswari and V. Narasimhan. 2000. Management of root-rot disease complex through antagonists and chemicals. *Indian Phytopath.*, 53: 216-218.

Mahapatra, S.N. & P.K. Swain. 1999. Avoidable yield loss due to *Meloidogyne incognita and Fusarium oxysporum* in blackgram. *Indian J. Nematol.*, 29: 87-89.

Mai, W.F. & G.S. Abawi. 1987. Interaction among root-knot nematode and *Fusarium* wilt fungi on host plants. *Ann. Rev. Phytol.*, 25: 317-338.

Poornima, K., Angappan, R., Kannan, N. Kumar, and T.N. Balanoha. 2007. Interactions of nematodes with the fungal Panama wilt disease of banana and its management. *Nematol. Medite*., 35: 35-39.

Powell, N.T. 1971. Interactions between nematodes and fungi in disease complexes. *Annu. Rev. Phytopath.*, 9: 263-274.

Siddiqui, Z.A. and I. Mahmood. 1995. Management of *Meloidogyne incognita* race 3 and *Macrophornina phaseolina* by fungus culture filtrates and *Bacillus subtills* in chickpea. *Fundamental and Appl. Nematol.*, 18: 71-76.

Verma, A.C., H.K. Singh, and M. Nehal Khan. 2005. Management of root-knot nematode, *Moloidogyne incognita* through antagonistic approaches in pointed gourd. *Indian J. Nematol.*, 35: 78-79.

How to cite this article:

Dilip Kumar, Jayant Bhatt and Ratan Lal Sharma. 2017. Efficacy of Different Bio Control Agents against *Meloidogyne incognita* and *Fusarium oxysporum* on Black gram (*Vigna mungo* L). *Int.J.Curr.Microbiol.App.Sci.* 6(8): 2287-2291. doi: https://doi.org/10.20546/ijcmas.2017.608.268