Chemistry and Materials Research
ISSN 2224- 3224 (Print) ISSN 2225- 0956 (Online)
Vol.6 No.3, 2014

Evaluation of Fungal Bio-agents on plant growth and M.*incognita* infestation on chick pea

Kaushal Kumar Mishra,Shudhanshudhar Dwivedi,Praveen Kumar Pandre*

Govt. Science & Commerce College, Benazeer, Bhopal

*Govt. SSP College, Waraseoni, (MP), India

Abstract

Chick pea (Cicer arietinum) is a tropical, subtropical and temperature region leguminous crop. Among different legumes growrm in india, chick pea rank first both in terms of area and Production. Chick pea suffer dreadly from infection of root-knot nematode *M.incognit*a.The present investigation evaluate the efficacy of Fungal bioagent VIZ *Trichoderma harizianum, T. viridae* and *Paecilomyces* against *M.incognita* on chick pea and found that 4gm/pot dosage of a fore said, fungal bioagent showed positive response. Result revealed that experimental plants treated with fungal bioagent were even better than control plants in terms of growth parameter.

Keyword: *M. incognita,* chick pea, *Trichoderma, Paecilomyces*.

Among the several pulse crops grown in our country, chick pea (Cicer *arietinum*) is grown in tropical, subtropical and temperature region. India is a leading chick pea producer among four chick pea growing countries in the world, sharing 65% of acreage and 5% of total grain yield in world. (Jagdish Kumar et.al.1997). Among different legumes grown in India, chick pea rank first, both in term of area and production, with 26.09 and 32.8% respectively (Anon,1978). chick pea is valued for its nutritive seeds with high protien content, 25.3-28.9% after Dehulling (Hulse 1991). According to international crop research institute for semiarid tropic, chick pea seeds on an average contain 23% protein, 64% total carbohydrate, 5% fat, 6% crude fibre and 3% ash.Chick pea suffers dreadly from several abiotic and biotic stress leading to huge decliyne in crop production. On the global basis plant parasitic nematodes are estimated to cause losses in yield of chick pea to about 13.7% (Sasser & Frackmah 1987).In India meloidogyne Incognita on reduce yield from 17% to 60% depending on nematode inoculums density and soil type (Upadhyaya & Dwivedi, 1987a). Being a susceptible crop to root knot nematodes it requires effective management.

Material method-

A pot study was conducted with three replication to test the effect of fungal bioagents, Trichoderma viridae, *T. harizianum* and *Paecilomyces lilocinus* on plant growth of chick pea and suppression of *M. incognita* invitro. These fungal floras were identified and isolated from Phizospheric soil from various farmer's field of tomato. Pure culture were maintained on potato dextrose agar (PDH) stands at 4^0 c and were multiplied on sterilized sorghum seeds at 27 ^{0}c in BOD incubator and tumbled daily to ensure uniform fungal growth .The above listed fungal bioagent were added in soil seperatly at the rate of 4gm/pot soil, a day before sowing chick pea seeds. Seven days after germination each of the experimental pots except control. Pots, were inoculated with 2000 J2/2kg soil. After termination of the experiment the data observed were pooled and analysed statiscally.

Result

The comparism of potential of different treatments were based on the value of three replicates of the experimental plants. Further the comparative trends emerging from ANOVA were substantiated by the evaluation of efficiency of all the three fungal bioagents in terms of growth parameters. The mean values of three replicates have been mentioned in parentheses.

01- Effect on shoot length:

The pooled data indicated thar application of all the fungal bioagents promoted shoot length significantly over untreated inoculated controls (20.90 cm) (T1). The sequence of their effective is as under:-

4gm/pot *T. Harzianum* (35.57 cm) (T3)>4gm/pot *P.lilacinus* (35.20 cm) (T4)>4gm/pot *T.viridae* (35.00 cm) (T2). Incorporation of fungal bioagents into the soil without nematode inoculation resulted into taller plants with respect to uninoculated check (36.57 cm) (T0) (Fig.115).

The Results of ANOVA are presented below:-

Source	Df	SS	MS	Fcal	F Tab
Replication	2	58.60083	29.30042	36.02774	
Treatment	7	829.8667	118.5524	145.7718	
Error	14	11.38583	0.813274		
Total	23				

SEM=0.520664, SE=0.736323, CD5%=1.116825, CDI%=2.192035

02- Effect on root length:-

The maximum influence on length of root was observed in the test plants treated with 4gm/pot. *T.harzianum* (16.70cm) (T3). It was followed by 4gm/pot *P.lilacinus* (16.37 cm) (T4).The fungal application that proved to be least effective over untreated inoculated controls (7.47cm) (T1) was 4gm/pot *T. viridae* (15.93 cm) (T2) (Fig.116).

4gm/pot *T.harzianum* (T6) treated alone without nematode inoculation accelerated root growth to 19.70cm which was superior than the value of uninoculated controles (17.30 cm) (T0).

The ANOVA results are as under:-

Source	Df	SS	MS	Fcal	F Tab
Replication	2	29.30083	14.65042	12.00444	
Treatment	7	318.7729	45.53899	37.3143	
Error	14	17.08583	1.220417		
Total	23				

SEM=0.637813, SE=0.901995, CD5%=1.368109, CDI%=2.68524.

03- Effect on weight of pods.

The weight of the pods treated by three fungus separately was approximately equal having little variation in following order 4gm/pot *T.harzianum* (7.95gm) (T3)>4gm/pot *P.lilacinus* (7.77gm) (T4)> 4gm/pot *P.lilacinus* (7.63gm) (T2) (Fig.123).

Fungal influence on uninoculated plants was maximum in 4gm/pot *T.harzianum* (10.60gm) (T6) Followed by 4gm/pot *P.lilacinus* (9.70gm) and 4gm/pot *T.viridae* (9.20gm).

The Results of ANOVA are as under:-

Source	Df	SS	MS	Fcal	F Tab
Replication	2	7.290208	3.645104	20.13241	-
Treatment	7	169.9999	24.2857	134.1332	-
Error	14	2.534792	0.181057	-	-
Total	23				

SEM=0.245667, SE=0.347422, CD5%=0.526955, CDI%=1.034275

04- Effect on number of J_2/ml soil:

4gm/pot *P.lilacinus* (11.33) (T4) emerged as most efficient treatment in reducing the number of J_2 larvae/ml soil.4 gm/pot *T.harzianum* (13.00) (T3) and 4 gm/pot *T.viridae* (16.00) (T2) also revealed significant reduction over untreated inoculated control (28.00) (T1) (Fig.124).

ANOVA results are as follows:-

Source	Df	SS	MS	Fcal	F Tab
Replication	2	16.33333	8.166667	5.119403	-
Treatment	7	2261.292	323.0417	202.5037	-
Error	14	22.33333	1.595238	-	-
Total	23				

SEM=0.729209, SE=1.031248, CD5%=1.564154, CDI%=3.070024.

05- Effect on Number of J_2 in root:-

The decrease in the number of J_2 was reported to be maximum in plants treated with 4gm/pot *P.lilacinus* (6.67) (T4) over untreated inoculated control (12.00) (T1) 4gm/pot *T.viride* (9.67) (T2) had least deleterious effect on phytonematodes as compared to other two fungus (Fig.125).

The detailed results of ANOVA are as Under:-

Source	Df	SS	MS	Fcal	F Tab
Replication	2	5.083333	2.541667	5.693333	-
Treatment	7	542.625	77.51786	173.64	-
Error	14	6.25	0.446429	-	-
Total	23				

SEM=0.385758, SE=0.545539, CD5%=0.827452, CDI%=1.624071.

06- Effect on number of galls:-

Nematicidal influence was observed to be highest in potted plants applied with 4gm/pot *P.lilacinus* as exhibited minimum number of galls (29.00) (T4) in comparison with 4gm/pot *T.harzianum* (33.00) (T3) and 4gm/pot *T.viridae* (39.00) (T2) over untreated inoculated controls (85.00) (T1) (Fig.126).

Results of ANOVA are given below:-

Source	Df	SS	MS	Fcal	F Tab
Replication	2	27	13.5	3.436364	-
Treatment	7	19054.5	2722.071	692.8909	-
Error	14	55	3.928571	-	-
Total	23				

SEM=1.144344, SE=1.618332, CD5%=2.454618, CDI%=4.817773.

Discussion:-

All the treatment comprising fungal bioagents namely *Trichoderma harzianum, Trichoderma viridae* and *Paecilomyces lilacinus* at 4gm/pot dosage showed positive response on plant growth whether applied alone or with nematode inoculation. Results revealed that un-inoculated experimental plants treated with fungal bioagents were even better than control plants in terms of growth parameters. This increment in growth might be because of availability of nitrogen and carbon sources due to kitinase enzyme. Observations taken during the investigation indicated that incorporation of Trichoderma species by *M.incognita*. *Trichoderma harzianum* showed maximum efficacy in increasing length of shoot and root, fresh and dry weight of shoot and root number of branches and pod yield (Figs.115-123) followed by *Paecilomyces lilacinus* and *T. viridae*. Our findings are in agreemnt with Rao etal. (1998). who reported efficacy of *T. harzianum* in producing vigorous seedlings in nursery beds of brinjal. Similarly Sankarnarayan et al. (2000) also stated that *T. harzianum* resulted in improved plant growth of tomato plants infested with *M. incognita, P.lilacinus* increased yield of soyabeen and winter vetch by suppressing soil population of *M. incognita* (Dube and smart, 1987). Application of *P.lilacinus* at 10gm/pot increased shoot and root weight and colonized 34% egg masses of *M. javanica* in tomato (Abu-Laban

& Saleh, 1992). Zaki (1994) recorded the optimum dose of *P.lilacinus* as 4 gm/kg soil. Improved plant growth parameters by *T. viridae* application were also reported by Stephan et al. (1996) on tomato.

T.harzianum was a good egg parasite of *M.javanica* race 3 killing 53% eggs in vitro (Dos Santos et. al. 1992). (Saifullah (1996c) tested this fungus against potato cyst nematodes (Globodera rostochinesis and *G.pallida*) and found it very effective nematophagous fungus. The fungus was found to attack young ans mature females and eggs of potato cyst nematode invitro. Nematode management with reduced dose, exhibited a remarkable improvement on plant growth parameters which was attributed mainly towards the characteristics of *T.viride* that, in addition to its toxic and egg parasitic nature against M.incognita, also possessed growth hormonal properties to host plants (Chang et.al. 1986),

According to Prasad and Anes (2008) the biological control ability of *Trichoderma spp.* Seems to be due to multiple factors, as they had the ability to produce a variety of extracellular lytic enzymes and production of many secondary metabolites. *Trichoderma spp.* are also highly rhizosphere component i.e. able to colonize on roots as they develop, thus promote plant growth. They may also exert several other mechanism such as tolerance to stress through enhanced root and plant development, induced resistance, inactivation of the pathogens enzymes in promoting plant growth and suppressing palnt pathogens (Weeder et al. 2008). Bhat et al. (2009) reported that bitter gourd plants treated with P.lilacinus decreased the size of giant cells. The fungus after entering the giant cells and also into the body of mature females destroyed the eggs and egg masses in and out side females. The fungus by destroying eggs checked the possibility of secondary infection that ultimately arrested increase of gall size.

Kumar et al. (2009) reported that P.fluorescens used in combination with various *Trichoderma spp*. Significantly reduced root-knot development and infection in brinjal. Srivastava et al. (2010) found combination of seed dressing and soil application of *T.viride* as most effective in reducing number of galls.

References

- Weeder,C.R. Shelton,A.M. and Hoftman,M.P. (2008).Biological Control, A guide to natural enemies in North America PP1-14.
- Srivastava, R.K., Neeraj kumar,R.k. singh and L.P. Awasthi (2010). Efficiacy of bioagents against root-knot nematode on jute. Ann. Pl. Protee.Sci 18(2)-489-556.
- Kumar, vipin, A.Haseeb and Anita Sharma (2009). Integrated management of M. Incognita.Ann.Pl. protect. Sci. 17:192-194.
- Bhat, mohd, Yaqub, Hissa muddin, Nazir Ahmed Bhat (2009).Histological interaction of P.lilacinum and M.incognita on bitter ground. Journal of American Science 5(1):8-12.
- Saifullah (1996c)-effect of nemato phagus fungi on the growth of potato. Afro-Asian Journal of Nematology 6:128-132.
- Chang, Y.C., Baker R, Kleifeld and chat, I 1986. Increased growth of plants in the presence of biological control agent. Plant disease 70:145-148.
- Prasad, D and Anes K.M. (2008). Effect of metabolites of T.harizianum, and T.Viridae on plant growth and M.incognita on okra.Ann.Pl.Protec. sci. 16(2) : 461-465
- Zaki; F-A(1994)-Dose optimization of Paecilomyces lilacinus for the control of M.Javanica on Tomato.Nematologica mediterranea.22:45-47.
- Abu-laban, A.Z. and Saleh, H.M. (1992) Evaluation of animal manures for mass production, storage and application of some nematode egg parasitic fungi nematologica 38:237-244.
- Dos Santos, M.A., S. Ferraz and J.J. muchovez (1992). Evaluation of 20 Species of fungi from Brazil for bio control of M.incognita race.3 Nematropica 22-183-192.
- Upadhyay, K.D. and K. Dwivedi (1987a) Analysis of crop losses in pea and gram due to M. incognita. Int. nematol. Network News 4:6-7.
- Rao, M.S.,Parvatha Reddy, Nagesh, M (1998). Evaluation of plant based formulation of Trichderma harizianum for the management of M. incognita on egg. Plant nematologica mediterranea 26:59-62.

- Sankaranarayanan,C. Husaini, S.S.,Sreerama Kumar,P. and Rangeshwaran R. (2000). Granular application of antagonistic fungi for the biological control of M.incognita on Tomato. Indian Journal of nematology 30:157-161.
- Jagdish Kumar et.al. (1997). Growing chick pea in india. Indian council of Agricultural research and International crops research Institute for the semi arid Tropic. 60pp.
- Anonymous (1978)- FAO Production year Book. Vol.32.
- Hulse (1991)-Nature,composition and utilization of grain legumes.P.11-27: uses of Tropical legumes: Proceding of a consulants. Meeting 27-30 march 1989, 1CRISAT, center, ICRISAT, Patancheru A.P.India.
- Sasser,J.N. and Freck man,D.W.1987.A world perspective on nematology.The role of society P.7-14 in J.A.Veech and D.W. Dickson (eds). Vistas on nematology society of nematologists, Hyattsville,M.D.