World Journal of Agricultural Sciences 4 (4): 492-494, 2008
ISSN 1817-3047

Biomanagement of Reniform Nematode, *Rotylenchulus reniformis* by Fruit Wastes and *Paecilomyces lilacinus* on Chickpea

Mohd. Shaikhul Ashraf and Tabreiz Ahmad Khan

Section of Plant Pathology and Nematology, Department of Botany,
Aligarh Muslim University, Aligarh - 202002, India

Abstract: Fruit wastes of apple (*Malus pumila*), banana (*Musa paradisiaca*), papaya (*Carica papaya)*, pomegranate (*Punica granatum*) and sweet orange (*Citrus sinesis*) @ 20g/plant and the fungal biocontrol agent *Paecilomyces lilacinus* @ 2g (mycelium+spores)/plant, alone and in combination were evaluated for the management of reniform nematode, *Rotylenchulus reniformis* infecting chickpea under glasshouse conditions. The individual applications of fruit wastes of sweet orange and fungal biocontrol agent *P. lilacinus* significantly (P= 0.05) reduced the nematode multiplication of *R. reniformis*, which ultimately increased the plant growth of chickpea as against the plant inoculated with *R. reniformis* alone. The rest of the fruit wastes did not significantly improved the plant growth as compared to plants inoculated with *R. reniformis*. The best protection of chickpea against *R. reniformis* was recorded on the integration of *P. lilacinus* with fruit wastes of papaya followed by apple and pomegranate, which ultimately increased the plant growth and reduced population buildup of reniform nematode. The integration of *P.lilacinus* with fruit wastes of either sweet orange or banana did not significantly improved the plant growth and reduced nematode multiplication as compared to the individual application of *P. lilacinus.*.

Key words: Biomanagement · fruit wastes · *Paecilomyces lilacinus* · *Rotylenchulus reniformis* · chickpea

INTRODUCTION

Chickpea is an important pulse crop in India constituting a major source of protein to large vegetarian population. The reniform nematode, *Rotylenchulus reniformis* is an important pest of this crop [1]. Due to environmental and health concerns, the use of several widely applied nematicides has been now restricted to control plant parasitic nematodes. Therefore, there is a need to develop alternative strategies and tactics, including biological control to manage plant parasitic nematodes. Considerable information available in the literature has documented the effectiveness of biocontrol agents in the management of plant parasitic nematodes [2, 3]. Moreover, the incorporation of soil amendments may also be effective in controlling plant parasitic nematodes, primarily by altering the soil microflora [4, 5]. Therefore, the combination of the organic amendments with promising biocontrol agents might result in the enhanced biocontrol activities against plant parasitic nematodes [6].

The aim of present study was to evaluate the efficacy of fruit wastes of apple, banana, papaya, pomegranate and sweet orange in presence and absence of *P.lilacinus* for the management of reniform nematode, *R. reniformis* infecting chickpea under glasshouse conditions.

MATERIALS AND METHODS

Fruit wastes of apple (*Malus pumila*), banana (*Musa paradisiaca*), papaya (*Carica papaya)*, pomegranate (*Punica granatum*) and sweet orange (*Citrus sinesis*) @ 20g/pot were incorporated into sterilized soil+river sand+farmyard manure (3:1:1) mixture contained in six inch earthen pots. These pots were regularly watered for the decomposition of amendments. After one week of waiting period, seeds of chickpea var. Avarodhi @5 seeds per pot were sown in these pots, which were thinned to one seedling per pot soon after germination. Two-week-old seedlings were then inoculated with 2000 immature females of *R. reniformis* and/or 1g (mycelium+spores) of *P. lilacinus*. Unamended and uninoculated plants served

Corresponding Author: Dr. Tabreiz Ahmad Khan, Section of Plant Pathology and Nematology, Department of Botany, Aligarh Muslim University, Aligarh-202002, India

as control and each treatment was replicated thrice. Observations on plant growth parameters (length and dry weight) were recorded after 60 days of inoculations. For interpretation of results, the reduction in plant dry weight was calculated in terms of percentage dry weight reduction. The number of nematodes per Kg soil and number of females per root system were recorded according to Southey [7]. Reproduction factor "R" was calculated by dividing final nematode population with initial nematode population. The data obtained were analyzed statistically at 5% level of probability.

RESULTS

It is clear from the data presented in Table 1 that *Rotylenchulus reniformis* caused significant reduction in plant growth (43.0%) as compared to unamended-uninoculated plants grown in unamended soil. The individual applications of fruit wastes of sweet orange and fungal biocontrol agent *P. lilacinus* significantly reduced the nematode multiplication of *R. reniformis*, which ultimately increased the plant growth of chickpea as against the plant inoculated with *R. reniformis* alone On the other hand, the individual treatments of either of the fruit wastes of apple, banana, pomegranate and papaya did not significantly improved the plant growth as compared to plants inoculated with *R. reniformis* alone. The best protection of chickpea against *R. reniformis* was recorded on the integration of *P. lilacinus* with fruit wastes of papaya followed by apple and pomegranate, which ultimately increased the plant growth and reduced population buildup of reniform nematode. However, the integration of *P.lilacinus* with fruit wastes of either sweet orange or banana did not significantly improved the plant growth and reduced nematode multiplication as compared to the individual application of *P. lilacinus.*

DISCUSSION

The results indicate that the biocontrol agent *Paecilomyces lilacinus* effectively manages the reniform nematode, *R. reniformis* under Indian agro climatic conditions and its efficacy increased in the presence of fruit wastes of papaya, apple and pomegranate. *Paecilomyces lilacinus* is an important fungal biocontrol agent and has been reported to be effective in controlling reniform nematodes in different crops [2, 3, 8]. The literature concerning suppression of phytonematode densities by organic amendments is replete with both promising and inconsistent results [5, 9-12]. Addition of organic materials to soils have been known to improve crop productivity. Moreover, the organic matter contributes to cation exchange capacity, water holding capacity, aggregate stability and nutrient availability [13]. These changes in soil chemical and physical properties may induce plant responses that have increased their tolerance to nematodes, as suggested by McSorley and Gallaher [14]. The efficacy of organic amendments against the plant parasitic nematodes depends on different factors, including the nematode species [12], the chemical

Table 1: Integrated management of *Rotylenchulus reniformis* using fruit wastes and/or *Paecilomyces lilacinus* on chickpea

Treatment	Plant length (cm)	Plant dry weight (g)	%Reduction (-) /increase (+) over control	Nematode population/pot			
				Females/root system	Nematodes/Kg soil	Total population	R = Pf/Pi
Unamended-Uninoculated	51.2	7.2	-	-	-	-	-
R.reniformis (Rr) (Control)	29.6	4.1	(-43.0)	480	17120	17600	8.8
Rr+*P.lilacinus* (Pl)	38.8	5.5	+34.1	287	8921	9208	4.6
Rr+Apple (A)	29.9	4.3	+4.8	465	16559	17024	8.5
Rr+Banana (B)	28.2	3.9	-4.8	490	17324	17814	8.9
Rr+Papaya (P)	30.9	4.2	+2.4	476	16759	17235	8.6
Rr+Pomegranate (Pg)	28.3	4.0	-2.4	482	17718	18203	9.1
Rr+Sweet orange (S)	34.5	4.8	+17.0	334	12774	13108	6.5
Rr+Pl+A	43.1	6.0	+46.3	201	7519	7720	3.6
Rr+Pl+B	39.1	5.4	+31.7	301	8514	8815	4.4
Rr+Pl+P	44.7	6.4	+56.0	187	6240	6427	3.2
Rr+Pl+Pg	41.0	5.8	+41.4	235	7807	8042	4.0
Rr+Pl+S	39.4	5.6	+36.5	263	9148	9411	4.7
C.D. (P = 0.05)	2.764	0.267		30.124	605.250	715.362	0.397

Reduction in parenthesis is calculated from unamended-uninoculated plants

composition of the amendments and the ratio of C:N [11, 15] and the interval between the application of the organic matter and evaluation of the nematode population [12]. The ability of *P. lilacinus* in controlling reniform nematode increased in the presence of organic amendments which may be attributed to several factors. It is also assumed that the decomposition of organic matter released nematicidal principle(s) and the residual organic matter increased fungal activity and persistence [16, 17]. Moreover, organic materials contribute to enhanced biological activities for the target pest by providing the needed nutrients for the growth of biocontrol agents in soil and may be used as carriers to facilitate their distribution. Hence it can be concluded from the above results that fruit wastes of apple, banana, pomegranate, papaya and sweet orange have a great potential as organic amendments for managing reniform nematode and can be integrated with *P.lilacinus* for the effective management of *R. reniformis* on chickpea.

REFERENCES

1. Sharma, S.B. and D. McDonald, 1990. Global status of nematode problems of groundnut, pigeonpea, chickpea, sorghum and pearl millet. Crop Protection, 9: 453-458.
2. Jatala, P., 1986. Biological control of plant parasitic nematodes. Ann. Rev. Phytopathol., 24: 453-489.
3. Nagesh, M. and P. Parvatha Reddy, 2003. Current trends in biological control of nematode pests in India. In: Nematode management of Plants. Trivedi, P.C. (Ed.). Scientific Publishers, India, pp: 203-239.
4. Godoy, G., R. Rodriguez-Kabana and G. Morgan-Jones, 1983. Fungal parasites of Meloidogyne arenaria eggs in an Alabama soil. A mycological survey and greenhouse study. Nematropica 13: 201-213.
5. Rodriguez-Kabana, R., G. Morgan-Jones and I. Chet, 1987. Biological control of nematodes with soil amendments and microbial antagonists. Plant and Soil, 100: 137-147.
6. Chen, J., G.S. Abawi and B.M. Zuckerman, 2000. Efficacy of Bacillus thuringiensis, Paecilomyces marquandii and Streptomyces costaricanus with and without organic amendments against Meliodogyne hapla infecting lettuce. Journal of Nematology, 32: 70-77.
7. Southey, J.F., 1986. Laboratory methods for work with plant and soil nematodes. In: Reference Book 402. Min. Agr. Fish Food, Her Majesty's Stationary Office, London.
8. Ashraf, M.S., T.A. Khan and S. Nisar, 2005. Integrated management of reniform nematode. Rotylenchulus reniformis infecting okra by oil cakes and biocontrol agent Paecilomyces lilacinus. Pak. J. Nematol., 23: 305-309.
9. Mankau, R., 1968. Reduction of root-knot disease with organic amendments under semi-field conditions. Plant Disease Reporter, 52: 315-319.
10. Muller, R. and P.S. Gooch, 1982. Organic amendments in nematode control. An examination of literature. Nematropica, 12: 319-327.
11. Stirling, G.R., 1991. Biological control of plant parasitic nematodes. CAB International: Wallingford, UK.
12. McSorley, R. and R.N. Gallaher, 1996. Effect of yard waste compost on nematode densities and maize yield. Journal of Nematology, 28: 655-660.
13. McConnell, D.B., A. Shiralipour and Smith, 1993.Compost application improves soil properties. Biocycle, 4:61-63.
14. McSorley, R. and R.N. Gallaher, 1995. Cultural practices improve crop tolerance to nematodes. Nematropica, 25:53-60.
15. Mojtahedi, H., G.S. Santo, J.H. Wilson and A.N. Hang, 1993.Managing Meloidogyne chitwoodi on potato with rapeseed as green manure. Plant Disease, 77: 42-46.
16. Alam, M.M., A.M. Khan and S.K. Saxena, 1979. Mechanism of control of plant parasitic nematodes as a result of the application of organic amendments to the soil. V-Role of phenolic compounds. Ind. J. Nematol., 9: 136-142.
17. Kerry, B.R., 1984. Nematophagous fungi and the regulation of nematode population in soil. Helminthol. Abst., Series B, 53: 1-14.