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Effect of two bio-agents against root knot nematode *Meloidogyne graminicola* (Golden and Brichfield, 1965) in Wheat

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Abstract:

Pot experiments conducted for the evaluation of efficacy of biocontrol agent viz., Arthrobotrys oligospora and Paecilomyces lilacinus against root knot nematode Meloidogyne graminicola in wheat revealed that soil application of Arthrobotrys oligospora and Paecilomyces lilacinus alone or in combination was able to control the nematode population and improve the yield. Combined soil application of A. oligospora (@ 5ml/pot) + P. lilacinus (@ 5ml/pot) as soil application was effective to check the root knot nematode in wheat.

Key words:

Introduction

Wheat (*Triticum aestivum* L.) is a member of the family Poaceae, which includes major cereal crops such as sorghum, maize, wheat, rice, millet and barely **(**Briggle and Reitz, 1963). It is the most important stable food crop for more than one third of the world population and contributes more calories and proteins to the world diet than any other cereal crops (Haleem

et al., 1998; Adams *et al.*, 2002; Shewry, 2007). It is nutritious, easy to store and transport and can be processed into various types of food. Wheat provides 70-90% of all calories and 66-90% of the protein, 55% of the carbohydrate and 20% of the calories consumed globally in developing countries (Breiman and Graur, 1995). Wheat is cultivated under a wide range of climatic conditions .Common bread wheat (*Triticum aestivum*, L.) and durum wheat (*Triticum durum* Desf.) make up 90% of the world's wheat crop. Wheat is further classified as winter or spring, hard or soft, red or white, and by protein content (Briggle and Curtis, 1987). Most people consume wheat more than any other cereal grain (Singh *et al*., 2007). The majority of wheat produced is used for human consumption (Wiese, 1987). It is an excellent health-building food. Wheat flour is used to prepare bread, produce biscuits, confectionary products, noodles and vital wheat gluten or seitan. Wheat is also used as animal feed, for n2ethanol production, brewing of wheat beer, wheat based raw material for cosmetics, wheat protein in meat substitutes and to make wheat straw composites. Wheat germ and wheat bran can be a good source of dietary fiber helping in the prevention and treatment of some digestive disorders (Simmonds, 1989). The antioxidant activity and phytochemical content were studied in milled grain of eleven varieties which included a range of red and white wheat and durum wheat. The world's major bread wheat producing areas are in Northern China, Northern India, Northern USA and adjoining areas in Canada, Europe, Russia, Latin America and Africa (Kole, 2006). It covers around 25% of the total global area devoted to cereal crops and demand for wheat grows faster than that for any other major crop. *Meloidogyne graminicola* Golden and Birchfield, is the most common RKN species infecting wheat. In India, it is reported to cause 17-30% yield loss due to poorly filled kernels (MacGowan, 1989; Jain *et al.,* 2007). Second stage juvenile of *M. graminicola* is considered to be the infective stage, making their point of entry at the zone of elongation just

behind the root cap and occasionally through the root cap, damaged root tip or at the juncture of developing rootlets, at 4 h after inoculation. After penetration, the juveniles enter into the cortex, orienting their bodies parallel to the stele, and move in the cortical layers of cells in the direction of the apical meristem within 20-24 h after invasion and commence feeding. Juveniles become sedentary themselves in the region of the apical meristem 24-42 h after inoculation. Within 42-72 h after inoculation extreme hypertrophy of cortical cells accompanied by hyperplasia may occur. At 3 days, a root knot/gall is formed around the site of establishment of the nematode. Giant cells are formed in the stellar region around the head of nematodes in the nearest metaxylem vessel. Mechanical disruption of metaxylem vessels interfere with the uptake of water and nutrients (Patnaik & Padhi, 1987).

Materials and Methods

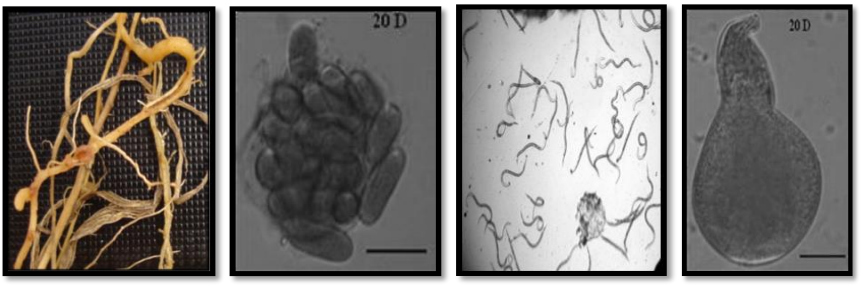
The experiment was laid out in the research plot of the department of Plant Protection, Sam Higginbottom Institute of Agriculture Technology and Sciences, during the *Rabi* season of 2013. Allahabad district of Uttar Pradesh, India is situated at 25.27^0 north and 81.50^0 east latitude with an altitude of 98 m above the mean sea level. The climate is typically semi-arid and sub-tropical. The maximum temperature reaches up to 47.5 ^{0}C in the summers and drops down to 1.5 ^{0}C in the winters. The inoculums of *Meloidogyne graminicola* was collected from 5 months infected root of wheat from central field of Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad, U.P., India.

Preparation of pots and inoculation of bio-agents: The pots (18 nos.) having capacity of 1 kg filled with sterilized soil at 15/lb. pressure for 3 hrs at 121^0c and further the filled pots were treated/ inoculated with 5 ml bio-agents suspension

formulation before one week to inoculation of nematode. The bio-agents were isolate and purified in different specific media. The C.F.U. of bio-agents was taken before inoculation to soil. The two weeks old wheat seedlings were inoculated with 2000 J_2 of *Meloidogyne graminicola* were obtained from the infested wheat plants root by sieve method. Pots were divided into six groups, each with three replicates and were arranged in a randomized block design (RBD). There should be well management with the normal agricultural practices. The pots were inoculated with 2000 J_2 larvae of *M. graminicola* per pot to each treatments *viz.* T_1, T_2, T_3, T_4, T_6 except control T_5 (Pang, 2009).

Preparation of formulation of bio-agents

The liquid formulation of *Arthrobotrys oligospora* (2x 10^5cfu/ml) and *Paecilomyces lilacinus* (2x 10^6cfu/ml) were obtained from NFCCI, Pune, multiplied into the PDA for soil treatments. The isolated *A. oligospora* and *P. lilacinus* were grown on PDA at 28 ^oC for three weeks, until sporulation was completed. The conidiospores were then obtained by gently washing the culture plates with a small quantity of sterile distilled water and thoroughly mixed with the soil one week after sowing into the pots (Chandranathan *et al*., 1998). The numbers of conidia were counted using a haemocytometer.



Root knot **Eggs** **J_2** **Female**

The observations were recorded for the shoot length, shoot weight, root length, root weight, number of nematode galls formation and number of larvae/root system. The plants in each pot were uprooted and gently separated from soil, washed with tap water and dried by pressing lightly between blotting paper. Observations were taken on following plant growth parameters *viz*., Shoot Length (cm) – 30, 60 and 90 DAS, Root Length (cm) - 90 DAS, Shoot Weight (gm) –90 DAS, Root Weight (gm) –90 DAS, No. of root knot at root system - 90 DAS, No. of Juveniles at root system – 90 DAS.

Results and Discussion

In this study two fungi *viz. Arthrobotrys oligospora, Paecilomyces lilacinus* were used as bio-control agents and Carbofuran 3G against *Meloidogyne graminicola* in pot experiment condition. The selected bio-control agents were evaluated to observe the effect on *M. graminicola* root knot development and growth parameters and reduce the population of *M. graminicola* compared to the untreated control **(Table; 1, 2, 3 & Fig; 1a, 2a, 3a).**

Table: 1. Effect of bio-agents on Shoot Length at 30, 60 and 90 DAS.

Treatments	Avg. Shoot Length (cm) at 30 DAS	Avg. Shoot Length (cm) at 60 DAS	Avg. Shoot Length (cm) at 90 DAS
T1- *A. oligospora* @5ml	10.07	20.30	40.17
T2-*P. lilacinus* @5ml	11.77	19.37	35.00
T3-*A.oligospora* + *P.lilacinus* @5ml	12.57	22.07	34.63
T4-Carbofuran 3G @ 2g/pot	11.33	17.10	34.10
T5-Control without nematode	9.20	19.87	35.60
T6-Control With nematode only.	9.07	16.77	28.50
CD (p=0.05%)	**3.33**	**4.50**	**8.57**

Fig: 1a. Effect of bio-agents on Shoot Length at 30, 60 and 90 DAS.

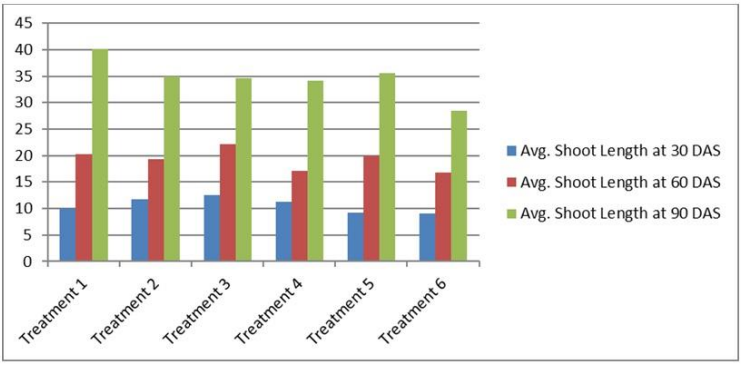


Table: 2. Effect of bio-agents on growth parameters after 90 DAS.

Treatments	**Avg. Shoot Weight (gm)**	**Avg. Root Length (cm)**	**Avg. Root Weight (gm)**
T1- *A. oligospora* @5ml	1.33	6.83	1.08
T2-*P. lilacinus* @5ml	2.13	8.13	0.73
T3-*A.oligospora* + *P.lilacinus* @5ml	1.57	9.40	0.91
T4-Carbofuran 3G @ 2g/pot	1.63	7.10	0.71
T5-Control without nematode	2.13	6.53	0.96
T6-Control With nematode only.	1.10	3.47	0.64
CD (p=0.05%)	0.47	2.79	0.41

Fig: 2a. Effect of bio-agents on growth parameters of wheat at 90 DAS.

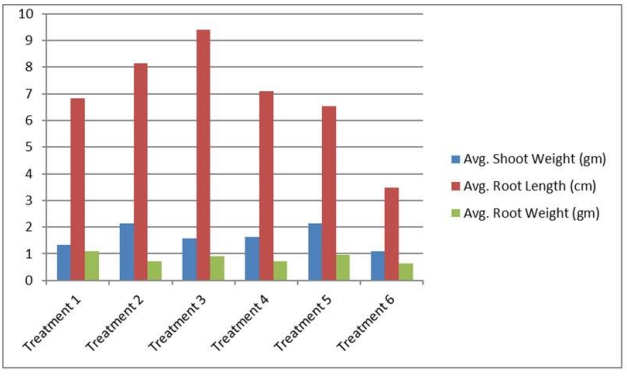
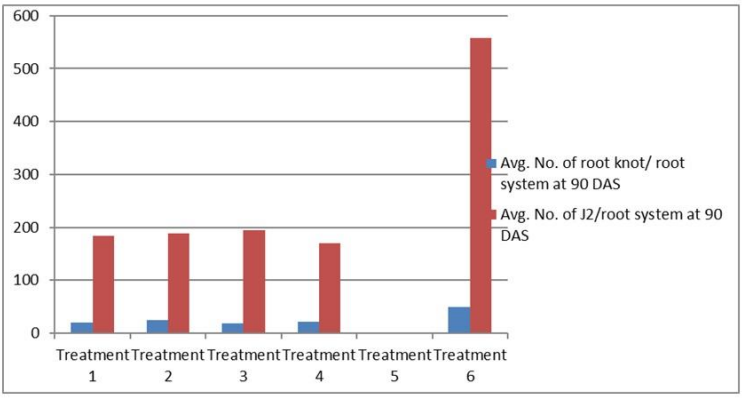


Table: 3. Effect of bio-agents on No. of galls formation and No. of J_2 at 90 DAS.

Treatments	Avg. No. of root knot/ root system at 90 DAS	Avg. No. of J_2 / root system at 90 DAS
T1- *A. oligospora* @5ml	20.00	183.33
T2-*P. lilacinus* @5ml	25.00	188.0
T3-*A.oligospora* + *P.lilacinus* @5ml	18.33	194.0
T4-Carbofuran 3G @ 2g/pot	21.00	169.67
T5-Control without nematode	0.00	0.00
T6-Control With nematode only.	50.00	558.00
CD (p=0.05%)	**10.89**	**108.45**

Fig: 3a. Effect of bio-agents on No. of galls formation and No. of J_2 at 90 DAS.



Our results suggest that the dose of 5ml/pot each of *A. oligospora*, *P. lilacinus* alone and combined could provide significant reduction in *M. graminicola* population and effective to growth of wheat crop. Data on shoot length, root length, shoot weight, root weight and nematode multiplication and development were recorded after 90 DAS. This finding suggested that application of biological agents is significant and safer for wheat cultivation. Present results showed that soil application of *A.oligospora*, *P. lilacinus* alone and combined

gave significant reduction in *M. graminicola* infestation and also to increase the growth of wheat crop compared with Carbofuran 3G. This finding suggested that application of biological agents is significant and safer for wheat cultivation. Present results showed that soil application of *A. oligospora, P. Lilacinus* alone and combined @ 5ml/pot gave significant reduction in *M. graminicola* infestation and also to increase the growth and yield of wheat crop compared with carbofuran 3G.

REFERENCES

Adams, M.L., Lombi, E., Zhao, F.J., and McGrath, SP. 2002. "Evidence of low selenium concentrations in UK bread-making wheat grain." *Journal of the Science of Food and Agriculture* 82:1160-1165.

Breiman, A. and Graur, D. 1995. "Wheat Evaluation." *Israel J Plant Sci.* 43:58-95.

Briggle, L. W. and Curtis B. C. 1987. "Wheat worldwide." In *Wheat and wheat improvement,* E. G. Heyne ed. *Agronomy* 13(2):1-32.

Briggle, L.W. and Reitz, L.P. 1963. "Classification of Triticum species and of wheat varieties grown in the United States." *Technical Bulletin 1278*. United States Department of Agriculture.

Chandranathan, P., Omar, J. and Waller, P. J. 1998. "The control of free-living stages of *Strongylodes papillorus* by the nematophagous fungi, *Arthrobotrys oligospora." Veterinary Parasitology* 76: 321-325.

Colwell, J.D. 1994. "Estimating Fertilizer Requirements. A Quantitative Approach." CAB International, UK. p. 259.

Haleem, Abd-El- SHM, Reham, M.A., Mohamed, S.M.S., Abdel-Aal, E.S.M., Sosulski, F.W., and Hucl, P. 1998. "Origins, characteristics and potentials of ancient wheats." *Cereal Foods World* 43: 708–715.

Jain, R.K., Mathur, K.N., Singh, R.V. 2007. "Estimation of losses due to plant parasitic nematodes on different crops in India." *Ind. J. Nematol*. 37: 219-220.

Kole, C. 2006. *Cereals and millets*. Berlin; New York: Springer.

Macgowan, J.B. 1989. "Rice root-knot nematode *Meloidogyne graminicola* Golden and Birchfield." 1965. Fla. Dept. of Agric. and consumer Serv., Div. Plant Ind., Nematology Circular No. 166, June 1989.

Pang, W., Hafez, S. L., and Sundararaj, P. 2009. "Screening of onion cultivars for resistance and tolerance to *Pratylenchus penetrans* and *Meloidogyne hapla*." *Nematropica* 39:47-55.

Patnaik, N.C. & Padhi, N.N. 1987. "Damage by rice root-knot nematode." *International Rice Research Newsletter* 12: 27.

Shewry, PR. 2007. "Improving the protein content and composition of cereal grain." *Journal of Cereal Science* 46: 239–250.

Simmonds, D.H. 1989. "Inherent quality factors in wheat. Wheat and wheat quality in Australia." *Australia Wheat Board*. *Melbourne*, 31–61.

Singh, H. and Singh, A. K. 2007. "Energy consumption pattern of wheat production in India." *Energy* 32: 1848-1854.

Wiese, M. V. 1987. *Compendium of wheat diseases*. 2nd ed. Pp. 1-9.