INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 9 | ISSUE 2 | OCTOBER, 2016 | 603-607

● e ISSN-0976-6855 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/9.2/603-607

Effect of inoculum density of root knot nematode (*Meloidogyne incognita*) on okra (*Abelmoschus esculentus* L.)

■ J.K. MAHALIK* AND N.K. SAHOO

Department of Nematology, College of Agriculture, Orissa University of Agriculture and Technology, BHUBANESWAR (ODISHA) INDIA

ARITCLE INFO

Received : 03.08.2016
Revised : 14.09.2016
Accepted : 28.09.2016

KEY WORDS :
Okra, *Meloidogyne incognita*, Inoculums, Pathogenicity

ABSTRACT

A pot culture experiment was conducted to find out the effect of different inoculum levels of nematode on the plant growth and nematode multiplication on okra plant. Findings revealed that significant reduction occurred in plant growth parameters *viz.*, shoot length, root length, fresh shoot and root weight, dry shoot and root weight of plant inoculated with 1000 juveniles and above per pot. The highest gall index and egg masses were also recorded at inoculums levels of 1000 and 10000, respectively. Nematode population in soil increased progressively with an increase in nematode inoculum level from 10 to 10000 J_2/ kg of soil. Maximum population was recorded at inoculum level of 10000 J_2/ kg of soil followed by 1000 J_2/ kg of soil which were statistically at par. The reductions in growth parameters and nematode infestations were found to be directly proportional to the inoculums level. Considering the spectacular decline in plant growth parameters and steep rise in number of galls and eggmasses in infected roots caused by *Meloidogyne incognita* at the inoculum level of 1000 J_2 /kg soil and above, so it is considered that 1000 J_2 *M. incognita* /kg soil happened to be damaging the thresh hold in okra.

How to view point the article : Mahalik, J.K. and Sahoo, N.K. (2016). Effect of inoculum density of root knot nematode (*Meloidogyne incognita*) on okra (*Abelmoschus esculentus* L.). *Internat. J. Plant Protec.*, **9**(2) : 603-607, **DOI : 10.15740/HAS/IJPP/9.2/603-607**.

***Corresponding author:**
Email : jayanta_mahalik@yahoo.co.in

INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench] is one of the warm season crops grown in the tropical and sub-tropical regions of the world (Rashid *et al.*, 2002).It is known to be highly susceptible to root-knot nematodes and infected plants are stunted, exhibiting signs of nutrient deficiency and characteristics large irregular swellings on both primary and secondary roots (Sikora and Fernandez, 2005). Root- knot nematodes (*Meloidogyne* spp.) are major constraints in growing okra crop successfully in tropical and sub tropical regions. However, the yield loss may be as high as 60 per cent in continuously cultivated crop of vegetables due to root-knot nematode (Nag Nathan, 1984). Estimated over all annual yield losses due to *M. incognita* in okra has been

observed more than 14 per cent (Jain *et al*., 2007). Damage caused by the root knot nematode is determined by the initial nematode density which effect and yield of annual crops. The minimal density that causes a measurable reduction in plant growth or yield varies with nematode species, host plants, cultivar and environment (Barker and Olthof, 1976). Hence, a pot culture study was undertaken to find out the threshold level in terms of initial inoculum potential of *M. incognita* needed to cause significant damage to okra cv. UTKAL GOURAV.

MATERIAL AND METHODS

A pot culture experiment was conducted in the net house of department of Nematology, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, during the year 2014 to study the pathogenicity of M. incognita on okra plant at temperature range between 21-35ºC. Twenty earthen pots each of 15 cm diameter were surface sterilised in 1 per cent formalin solution, dried under sun and filled with 1 kg autoclaved sterilised soil + sand + FYM mixture in 2:1:1 ratio each. Seeds of okra cv. UTKAL GOURAV were surface sterilized in 2.5 per cent sodium hypochlorite solution for 20 minutes followed by rinsing in sterile water four times and sown in these pots. Plants attaining three leaves stage were thinned maintaining one healthy plant/pot. Ten days old plants were inoculated with freshly hatched second stage Juveniles (J_2) of *Meloidogyne incognita* separately in the series of 0, 10, 100, 1000 and 10000 J_2 / kg of soil. At the time of inoculation, the soil around the roots was carefully pulverized so as to partially expose the root system. The Juveniles suspension was poured around the roots and covered with sterilized soil. There were all together five treatments with four replications including an un inoculated check arranged in Completely Randomized Design. The treatments were: T_1= Check (No nematodes), T_2= 10 nematodes (J_2) / pot, T_3= 100 nematodes (J_2) / pot, T_4= 1000 nematodes (J_2) / pot, T_5= 10000 nematodes (J_2) / pot. Intercultural operation and irrigation were done as per requirement.The observations on plant growth parameters (shoot length, root length, fresh shoot weight, fresh root weight, dry shoot weight and dry root weight) and nematode infection parameter (number of galls, number of egg masses per plant, nematode population and reproductive growth of nematode population) were recorded at 60 days after inoculation. Various observations recorded from different treatments were subjected to statistical analysis following Fisher's method of analysis of variance at 5 per cent level.

RESULTS AND DISCUSSION

The observed data were compiled in a tabular form and were subjected to statistical analysis in order to test the significance of various inoculms on plant growth and the nematode population. The effect of *M. incognita* at different inoculums was estimated on the basis of the differential changes in plant growth parameters (shoot length, root length, fresh and dry shoot weight, fresh and dry root weights) and nematode infection parameter as number of galls, egg masses per plant and the reproductive growth of nematode population. Although significant differences was noticed among treatment means of these parameters the mean data revealed that there were no significant differences in the shoot growth parameters with initial inoculum level of 10 and 100 J_2 per pot in comparison to un inoculated treatment (T_1) and between 1000 and 10000 J_2 per pot. The shoot length (54.20 cm) was the highest at control followed by 53.80 cm, 52.50 cm, 47.50 cm and 45.30 cm in inoculated plant at 10, 100, 1000 and 10000 J_2 s per pot with 0.73 per cent, 3.13 per cent, 12.36 per cent and 16.42 per cent decrease, respectively over control. The tabulated data revealed that, there were significant differences in the root length with initial inoculum level of 1000 and 10000 J_2 per pot in comparison to un inoculated treatment. The root length was 30.50 cm at control and reductions in root length were recorded 29.80 cm, 28.10 cm, 23.40 cm and 21.50 cm at 10, 100, 1000 and 10000 J_2 s with 2.29, 7.86, 23.20 and 29.50 per cent decrease, respectively. There was maximum reduction in fresh shoot weight recorded at an inoculums level of 10000 J_2 s. The reductions in shoot weight caused at a level of 1000 J_2s was statistically at par at 10000 J_2s. But there was progressive increase in reduction of fresh shoot weight over check recorded as 1.41, 4.25, 16.60 and 24. 40 per cent at 10, 100, 1000 and 10000 J_2s, respectively. The tabulated data revealed that, inoculated plants resulted 6.08, 11.30, 34.78 and 46.95 per cent reduction in fresh weight of root with 10, 100, 1000 and 10000 larval inoculums, respectively. The fresh root weight at control was 11.50 g and on inoculated levels were 10.80 g., 10.20 g., 7.5 g. and 6.10 g., respectively. There was gradually decrease in the dry weight of shoot of okra

with an increase in the inoculum density of nematode. The dry shoot weight at control was 4.60 g. and the reductions in inoculated were 4.0 g., 3.8 g., 2.5 g. and 2.0 g with 13.04, 17.39, 45.65 and 56.52 per cent at 10, 100, 1000 and 10000 inoculum density of nematode. There was significant reduction of root dry weight was observed at and above 1000J_2 per kg soil. The inoculated plant resulted 2.10g., 1.70 g., 1.0 g. and 0.8 g. dry root weight at 10, 100, 1000 and 10000 inoculum density of nematode with 25.0, 39.28, 64.28 and 71.42 per cent reduction respectively over check (2.80 g.) It was evident from the observation that the reduction in plant growth character of okra was directly proportional to the inoculum level of *Meloidogyne incognita* with increasing level of the inoculums from 10 to 10000 J_2 of *M. incognita* with non-significant between the inoculum levels of 1000 and 10000 J_2/ pot (Table 1). But the significance reduction in plant growth was noticed at and above 1000 J_2/ pot. An increase in nematode inoculum was associated with progressive reduction in plant growth parameters of both the test crops which gave conclusive evidence that *M. incognita* is potential pathogens for these crops. More or less similar observations on plant growth in relation to inoculums levels have been reported by other workers on different crops (Mani and Sethi, 1984; Mahapatra *et al*., 1999; Khan, 2003; Khan and Hussain, 1989; Mucksood *et al.*, 2011; Singh *et al.*, 2012; Mukhtar *et al.*, 2013 and Anamika, 2015).

Statistical analysis on number of galls, egg masses and nematode population in soil indicated significant difference among the treatments. The number of galls per plant varied from 15.0 to 194.75 with the increase of inoculum level from 10 to 10,000 juveniles per kg of soil. Same trend was noticed in case of egg masses per plant varying from 12.25 to 171.75 with the increase of inoculum level from 10 to 10,000 juveniles per kg of soil.

Table 1 : Effect of different initial inoculums of *M. incognita* on plant growth parameters of okra (cv. UTKAL GOURAV)
(Average of four replications)

Treatments	Shoot length (cm)	% decrease over control	Root length (cm)	% decrease over control	Fresh shoot weight (g)	% decrease over control	Fresh root weight (g)	% decrease over control	Dry shoot weight (g)	% decrease over control	Dry root weight (g)	% decrease over control
T_1-Uninoculated	54.20	-	30.50	-	28.20	-	11.50	-	4.60	-	2.80	-
T_2 -10 J_2 / kg soil	53.80	0.73	29.80	2.29	27.80	1.41	10.80	6.08	4.00	13.04	2.10	25.0
T_3-100 J_2 / kg soil	52.50	3.13	28.10	7.86	27.00	4.25	10.20	11.30	3.80	17.39	1.70	39.28
T_4-1000 J_2 / kg soil	47.50	12.36	23.40	23.2	23.50	16.60	7.50	34.78	2.50	45.65	1.00	64.28
T_5-10000 J_2/kg soil	45.30	16.42	21.50	29.5	21.30	24.40	6.10	46.95	2.00	56.52	0.80	71.42
S.E.±	1.95		1.76		1.62		1.05		0.44		0.53	
C.D. (P=0.05)	4.15		3.76		3.45		2.23		0.94		1.14	

Table 2 : Effect of different initial inoculums of *M. incognita* on nematode multiplication in okra (cv. UTKAL GOURAV)
(Average of four replications)

Treatments	No. of gall per plant	No. of egg masses per plant	Nematode population	Rate of multiplication $R=P_f/Pi$
T_1-Uninoculated	0.00 (1.0)*	0.00 (1.0)	0.00 (1.0)	-
T_2 -10 J_2 / kg soil	15.00 (2.23)	12.75 (1.34)	178.75 (1.39)	17.87
T_3-100 J_2 / kg soil	42.00 (3.12)	32.50 (1.62)	1350.00 (1.71)	13.50
T_4-1000 J_2 / kg soil	167.50 (3.92)	148.25 (2.19)	8285.00 (2.25)	8.28
T_5-10000 J_2 / kg soil	194.75 (4.07)	171.75 (2.26)	11746.00 (2.31)	1.17
S.E.±	0.087	0.058	0.053	
C.D. (P=0.05)	0.19	0.12	0.11	

*Figure in parentheses are log (n+10) values

As the inoculum level increased, the final nematode population in soil was also increased significantly. The final nematode population in soil was minimum (178.75) at 10 juveniles level and maximum (11746) at 10,000 Juveniles level. However, no significant difference was recorded between the final nematode populations with initial inoculum level of 1000 juveniles and 10,000 juveniles. Although, final nematode population increased from the lowest inoculum level to the highest, multiplication rate (Rf) however was recorded to be in reverse order, maximum multiplication (17.87) was recorded in treatment with $10J_2$ per pot as against the minimum (1.17) in 10,000 J_2/pot. The multiplication rate was 8.28 in 1000 J_2 per pot. It was noticed that with an increase in level of inoculum from 10-1000 J_2 there was a significant progressive increase in root infection by root knot nematode as indicated by the number of galls, number of egg masses and population of nematodes. Further increase to 10,000 juvenile in the inoculum resulted in more increase in root knot galls and egg masses but not significant with 1000 level (Table 2). The high rate of multiplication at low levels of inoculum, on the other hand, could possibly be due to positive factors live abundance of food, lack of competition and the ability of host to support these levels of population (Das, 2013). But, the lower rate of nematode build up at higher inoculum levels may be due to overcrowding of the larvae which compete for food. This might be due to the destruction of root system by the parasitism of root knot nematode which led the competition for food and nutrition among the developing nematodes and also due to inability of juveniles to find out new infection sites for subsequent generations (Hussain *et al*., 2011; Kayani *et al.*, 2012; Prasad and Chawla, 1992 and Triantaphyllu and Hirschmann, 1960). So keeping in view the drastic reduction of all plant growth parameters and steep rise on the number of galls and eggmasses at inoculm level of 1000 J_2/ kg soil and above, there is conclusive evidence that the thresh hold damaging potential of *Meloidogyne incognita* in okra is1000 J_2 / kg soil.

REFERENCES

Anamika (2015). Study on pathogenicity test of *Meloidogyne incognita* on different vegetable crops. *J. Agric. Sci.,* **7** (3) : 105 - 110.

Barker, K.R. and Olthof, T. H. A. (1976). Relationship between nematode population densities and crop responses. *Ann. Rev. Phytopathol.,* **14** : 327-353.

Das, P. (2013). Pathogenicity and management of root knot nematode (*Meloidogyne incognita*) infecting chilli, M.Sc. (Ag.) Thesis, Orissa University of Agriculture and Technology, Bhubaneswar, ODISHA (INDIA).

Hussain, M.A., Mukhtar, T. and Kayani, M.Z. (2011). Assessment of the damage caused by *Meloidogyne incognita* on okra (*Abelmoschus esculentus*). *J. Anim. & Plant Sci.,* **21**(4) : 857-861.

Jain, R.K., Mathur, K.N. and Singh, R.V. (2007). Estimation of losses due to plant parasitic nematodes on different crops in India. *Indian J. Nematol.,* **37**(2) : 219-221.

Kayani, M.Z., Mukhtar, T. and Hussain, M.A.(2012). Evaluation of nematicidal effects of *Cannabis sativa* L. and *Zanthoxylum alatum* Roxb. against root-knot nematodes, *Meloidogyne incognita*. *Crop Protec.,* **39** : 52-56.

Khan, M.R. (2003). Life cycle, pathogenicity and management of root-knot nematode, *Meloidogyne incognita* Race-2 infecting balsam (*Impatiens balsamina* L.). *Indian J. Nematol*., **33** (1) : 72-73.

Khan, T.A. and Hussain, S.I. (1989). Studies on the pathogenicity of *Meloidogyne incognita* and *Rotylenchulus reniformis* on cowpea (*Vigna ungiculata* var. Pusa Barsati). *Pak. J. Nematol.,* **7**:109-113.

Mahapatra, S.N., Swain, P.K. and Behera, B. (1999). Pathogenicity and management of root - knot nematode, *M. incognita* in pointed gourd. *Indian J.Agric.Sci.,* **69** : 275-277.

Mani, A. and Sethi, C.L. (1984). Pathogenicity and growth of chickpea as influenced by initial inoculum levels of *Meloidogyne incognita*. *Indian J. Nematol.,* **14** : 41-44.

Mucksood, A.G., Rather, A.A. and Siddiqui, M.A. (2011). Pathogenicity of root knot nematode *Meloidogyne incognita* on okra and its management through botanicals. *Archiv. Phytopathol. & Plant Protec.,* **44** (17) : 1683-1688.

Mukhtar, T., Arshad, I., Kayani, M.Z., Hussain, M.A., Kayani S.B., Rahoo, A. and Ashfaq, M.(2013). Estimation of damage to okra (*Abelmoschus esculentus*) by root-knot disease by *Meloidogyne incognita*. *Pak. J. Bot.,* **45** (3): 1023-1027.

Nag Nathan, T.G. (1984). Studies on yield loss in vegetables due to *Meloidogyne incognita*.*South Indian J. Hort.,* **32**: 115-116.

Prasad, D. and Chawla, M.L.(1992). Pathogenicity of *Meloidogyne incognita* on sunflower, safflower and mustard. *Curr. Nematol.,* **3**(2): 127-132.

Rashid, M.H., Yasmin, L., Kibria, M.G., Millik, A.K.M.S.R. and Hossain, S.M.M. (2002). Screening of okra germplasm

for resistance to yellow vein mosaic virus under field conditions. *Plant Pathol. J.*, **1** : 61-62.

Sikora, R.A. and Fernandez, E. (2005). Nematodeparasites of vegetables. In: Luc, M., Sikora, R.A. and Bridge, J. (Eds). *Plant parasiticnematodes in subtropical and tropical agriculture.* 2nd Ed., CABI Publishing. pp.319-392.

Singh,V.K.,Singh,V.B. and Zalpuri, L.(2012). Survey, pathogenic effect and management of root- knot nematode, *Meloidogyne incognita* on okra. *Indian J. Nematol*., **42** (2) : 161-168.

Triantaphyllou, A.C. and Hirschmann, H. (1960). Post-infection development of *Meloidogyne incognita* Chitwood, 1949 (Nematoda: Heteroderidae) *Ann. Inst. Phytopathologique Benaki.*, **3** (1) : 1–11.