Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(5): 2132-2135

Received: 21-07-2020
Accepted: 24-08-2020

Balkishan Chaudhary
Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.), India

Jayant Bhatt
Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.), India

Corresponding Author:
Balkishan Chaudhary
Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.), India

Effect of different levels of inocula of *Meloidogyne incognita* on plant growth of Pea (*Pisum sativum* L.) and reproduction of nematodes

Balkishan Chaudhary and Jayant Bhatt

DOI: https://doi.org/10.22271/j.ento.2020.v8.i5ac.7796

Abstract
An experiment was carried out to study the effect of *Meloidogyne incognita*on growth of *Pisum sativum* (Cv. Kashi Nandini) under glass house conditions by inoculating different inoculums levels *i.e.* 0 (control), 10, 100, 1000, 10,000 second stage juveniles (J_2) of *M. incognita* along with supernatant. The results revealed that the increase in inoculum level of *M. incognita*, there was a progressive decrease in growth parameters of the crop as the levels of inocula increased. Significant reduction in plant height, root length and fresh and dry weights of roots and shoots were declined. Maximum galls, egg masses and eggs per egg mass were recorded more pronounced and significant reduction was observed at higher inoculum levels *i.e.* 1000 and 10,000 J_2/pot.

Keywords: Inoculum, *M. incognita*, *Pisum sativum*, Plant growth parameters.

Introduction
Pea (*Pisum sativum* L.) belonging to family Leguminosae is one of the major annual pulse crops of temperate region of the world. Pea occupies area of 7.62 million ha with a production of 14.36 MT globally. India occupies 6.51 million ha of land with a production of 10.95 MT with 906 kg/ha productivity [1]. Madhya Pradesh contributes 3.48 lakh ha area with 2.80 lakh tonnes production with an average productivity of 821 kg/ha [2]. This crop suffers from a number of diseases caused by fungi, bacteria, virus and nematodes which reduce growth and subsequently the yield. The root-knot nematode *M. incognita* is an economically important plant parasite with a wide host range of crops including pea, and abundant field populations can develop quickly under appropriate conditions. This rapid population growth is mainly due to the completion of several generations during a single growing season, combined with the high female fecundity. The exact number of eggs produced varies depending on environmental conditions. Under favorable conditions, a single female may produce 400–500 eggs [3, 4]. Among various obstacles in cultivating pea, the root-knot nematode, (*M. incognita*) has been reported to cause severe yield losses of up to 20-56 per cent in pea [5-7]. *M. incognita* alters metabolic processes of the host which are manifested in the form of cellular, physiological and biochemical changes occurring in the infected host. There is hardly any contribution on root knot nematodes infecting these groups of pulses. In the present study an attempt was made to determine the pathogenic potential of *M. incognita* on pea using different levels of inocula.

Materials and Methods
Experiment was conducted under glass house condition. The good, bold and healthy seeds of pea (Cv. Kashi Nandini) surface sterilized with sodium hypochloride (1%) and were sown in ten-centimeter earthen pots containing 500 g sterilized soil. Each pot received two seeds and after germination one was retained. Seven days old seedlings were used for inoculation. The treatment consisted of an uninoculated control and five different levels of inocula as 10, 100, 1000, 10,000 second stage juveniles (J_2) of *M. incognita* and supernatant. The extraction of nematodes was carried out by Cobb's sieving and decanting method followed by modified Baermann funnel technique [8]. The plant was inoculated by gently removing the soil around the seedlings in a circumference of four centimeters and then dispersing inoculum over the area. After appropriate inoculation, the roots were covered by fresh sterilized soil. Each

treatment was replicated five times and arranged on glasshouse bench following complete randomized block design (CRBD). The pots were irrigated with 100 ml fresh water every day if needed and thereafter with equal quantity of water per day as and when required. Adequate plant protection methods were adopted to grow healthy plants.

The observations on plant height, fresh and dry shoot and root weight, number of galls, egg masses, eggs and nematode population were recorded 45 days after inoculation. The entire root system along with the soil was tapped out of the pot and the roots were washed in a container with a gentle stream of water. For obtaining fresh weight, the roots were pressed gently between two pads of blotting paper and then their weights were recorded. This was followed by drying in an oven at 60°C±1°C until constant weights are recorded. The experiment was laid out on 15/10/2017 and terminated on the 29/11/2017 and second trail conduct on 01/11/2018 and terminated on the 16/12/2018. The glasshouse temperature during this period ranged between 21°C to 26°C. The data was analyzed statistically using ANOVA.

Results and Discussion

The data presented in Table 1 & 2 and Plate 1 revealed that with the increase of inoculum level there was a corresponding decrease in plant growth with increase in levels of inocula. Gradual stunting of plants was noted when inoculated with *M. incognita*. Maximum (37.69 cm) plant height was noted in control and minimum (14.61 cm) in 10,000 J_2/plant followed by1000 inoculum level (22.91 cm). Similar trend was also noted in root length. The plant height and root length reduction were gradual up to 1000 level but declined sharply when 10,000 larvae were added. The results are in accord with the findings of Dhawan and Sethi [9] on eggplant and Bora and Phukan [10] on jute. Bhagwati and Phukan [11] significant reduction in plant growth with an initial inoculum of 1000 larvae of *M. incognita* per 500 g of soil on pea was also demonstrated by Siddiqui *et al.* [12]. Khan *et al.* [13] reported that inoculum levels of 1000 and 10,000 juveniles/kg soil of *M. incognita* showed a significant decline in plant growth on broccoli. Ganaie*et et al.* [14] reported a significant reduction in plant growth parameters in okra plant with an inoculum level of 1000 J_2/plant.

There was a decline fresh and dry weight of shoot as the level of inoculums increased. Maximum (4.38g and 1.16g) fresh and dry weights were noted in control and minimum (0.89g and 0.199g) in 10,000 inoculum level. At 1000 inoculum level, the weights were recorded to be 1.22 and 0.27g. Similar trend was again noted when the fresh and dry weights of root were observed. Similar findings were also brought forward by Sharma and Bhatt [15] who reported that fresh and dry weight of root and shoot were declined at 1000 and 10,000 inoculum level of *M. incognita* applied per 500 g of soil on egg plant. Similarly, Abuzar [16] reported that the significant reduction in root-shoot fresh and dry weights at minimum initial inoculum level (500 J_2/pot) as compared to uninoculated plants. Reduction in growth parameters was increased with the corresponding increase in initial inoculum levels (10,000 J_2/pot).

Maximum number of root galls (146.30) were recorded at 10,000 inoculum level which declined drastically at 1000 (67.30) and 100 inoculum level (41.30) against no galling in un-inoculated control (Table-2). There was increase in the number of egg masses with the increase in inoculum levels. Maximum number of egg masses (10.26) was recorded with 10,000 inoculum level followed by 1000 inoculum level (7.29). Minimum (3.61) egg masses were recorded with supernatant followed by 10 inoculum level (4.29) against no egg masses in control. Significantly maximum (258.34) eggs/egg masses were recorded with 10,000 inoculum level followed by 1000 inoculum level (213.91). Minimum (100.33) eggs were recorded with supernatant followed by 10 (118.06) and 100 inoculum level (143.17) against uninoculated control (0.00). Minimum nematodes population was (165.62 N) recorded with supernatant followed by 10 inoculum level (583.92) and increased with increase in the inoculum level. The nematode population (root + soil) was maximum (19890.63 N) at 10,000 inoculum level followed by 1000 (7457.42 N) and 100 inoculum level (3048.22 N) against control where no nematodes were incorporated. The results are also in accord with the findings of Sumita[17], who reported that the highest galling, egg masses and nematode population of *M. incognita* (up to 1000 to 10000 J_2/plant). Raut and Sethi [18] on soyabean, Borah [19] on green gram and Sarmah and Sinha [20] on cowpea. Romabati and Dhanachand [21] on *Allium porrum*, Agwu and Ezigbo [22] on okra, Anwar *et al.* [23] on cotton, El Sherif *et al.* [24] and Dhurwey *et al.* [25] on wheat.

On the basis of results, it is therefore concluded that 1000 larvae of *M. incognita*in 500 g soil are pathogenic to pea. The results are in conformity with the results obtained by Das [26] on pea, Chandra *et al.* [27] on brinjal (Cv. Pusakranti), Khan *et al.* [13] on broccoli, Ganaie*et et al.* [14] on okra, Ahmed *et al.* [28] on chilli and Mahalik and Sahoo [29] on soybean (Cv Js 2034).

Table 1: Effect of different levels of inocula of *Meloidogyne incognita* on plant growth parameters of pea (pooled data of two years)

S. No.	Treatments	Plant height (cm)	Root length (cm)	Fresh weight (g)		Dry weight (g)	
				Shoot	Root	Shoot	Root
1	Control	37.69**	20.92	4.38	3.41	1.16	0.50
2	Supernatant	36.88	19.06	3.68	3.15	1.002	0.43
3	10N*	31.37	17.71	2.73	2.32	0.73	0.35
4	100N	27.17	16.99	1.89	1.76	0.45	0.27
5	1000N	22.91	13.99	1.22	0.98	0.27	0.114
6	10000N	14.61	8.29	0.89	0.71	0.199	0.069
S. Em ±		0.570	0.398	0.181	0.149	0.029	0.015
CD (p=0.05)		1.674	1.169	0.531	0.436	0.086	0.045

*N= Nematodes, ** Mean of five replications,

Table 2: Effect of different levels of inocula of *Meloidogyne incognita* on reproduction of *M. incognita* in pea (pooled data of two years)

S. No.	Treatments	No of galls/plant	No. of egg masses/galls	No. of eggs/ egg mass	Nematode population (root + soil)
1	Control	0.00 (1.00***)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
2	Supernatant	10.20 (4.19)	3.61 (2.90)	100.33 (11.01)	165.62 (13.86)
3	10N	20.30 (5.50)	4.29 (3.07)	118.06 (11.86)	583.92 (25.16)
4	100N	41.30 (7.42)	5.08 (3.25)	143.17 (12.96)	3048.22 (56.21)
5	1000N	67.30 (9.20)	7.29 (3.70)	213.91 (15.62)	7457.42 (87.35)
6	10000N	146.30 (13.09)	10.26 (4.20)	258.34 (17.07)	19890.63 (142.03)
S. Em ±		4.298 (3.07)	0.305 (1.55)	5.509 (3.34)	6.919 (3.63)
CD (p=0.05)		12.620 (4.55)	0.895 (1.94)	16.175 (5.02)	20.315 (5.50)

*** Figure in Parentheses are √ n+1 transformed values

Plate 1: Effect of different levels of inocula of *M. incognita* on growth of pea **A.** In pots **B.** Up rooted

Conclusions

From the results obtained after two years experimentation it is concluded that reduction in plant growth parameters with the increase in levels of inocula. The pathogenic potential of *M. incognita* on pea was noted to be 2 J_2/g soil.

Acknowledgement
The authors are thankful to Prof. and Head Department of Plant Pathology, JNKVV, Jabalpur for providing funds and facilities during the course of investigations.

References

1. Kirar BS, Jaiswal RK, Kirar NS, Yadav R. Impact of frontline demonstration of field pea in Bundelkhand region of Madhya Pradesh. International Journal of Chemical Studies. 2018;6(4):878-880.
2. Anonymous. Directorate of Economics and Statistics, Ministry of Agri., Govt. of India. 2018,311.
3. Abuzar S. Studies on the interactive effects of root-knot nematode (*Meloidogyne incognita*) and wilt fungus (*Fusarium oxysporum* f. sp. *vasinfectum*) on the growth of okra and its management. M.Sc. Thesis, AMU, Aligarh, 2003.
4. Sharma A, Haseeb A, Abuzar S. Screening of field pea (*Pisum sativum)* selections for their reactions to root-knot nematode (*Meloidogyne incognita*). Journal of Zhejiang University. 2006;7(3):209-214.
5. Reddy PP. Estimation of crop loss in peas due to *Meloidogyne incognita.* Indian Journal of Nematology. 1985;15(2):226.
6. De RK, Ali SS, Dwivedi RP. Interaction between *Fusarium oxysporum* f. sp. *lentis* and *Meloidogyne javanica* in lentil. Indian Phytopathology. 2000;53:353.
7. Mahapatra SN, Swain PK. Interaction between *Meloidogyne incognita* and *Fusarium oxysporum* on black gram. Annals of Plant Protection Sciences. 2001;9:92-94.
8. Christie JR, Perry VG. Removing nematode from soil. Proc. Helminthol. Soc. Wash. 1957;18:106-108.
9. Dhawan SC, Sethi CL. Observations on the pathogenicity of *Meloidogyne incognita* to egg plant and relative susceptibility of some varieties to the nematode. Indian Journal of Nematology. 1976;6:39-46.
10. Bora BC, Phukan PN. Studies on the Pathogenicity of Root-Knot Nematode, *Meloidogyne incognita* on Jute. Journal of Research Assam Agriculture University. 1982;3:176-180.
11. Bhagawati B, Phukan PN. Pathogenicity of root-knot nematode, *Meloidogyne incognita* on pea. Indian Journal of Nematology. 1991;21(2):141-144.
12. Siddiqui ZA, Mahmood I, Ansari MA. Effect of diffrerent level of inocula *Meloidogyne incognitaon the growth* of pea in the presence and absence of rizobium. Nematologia Mediterranea. 1995;23:249-251.
13. Khan TA, Ashraf MS, Riyaz, Dar RA. Pathogenicity and life cycle of *Meloidogyne javanica* on broccoli. Archives of Phytopathology and Plant Protection. 2010;43(6):602–608.
14. Ganaie MA, Rather AA, Siddiqui MA. Pathogenicity of root knot nematode *Meloidogyne incognita* on okra and its management through botanicals. Archives of Phytopathology and Plant Protection. 2011;44(17):1683-1688.
15. Sharma DK, Bhatt J. Effect of different levels of *Meloidogyne incognita* on *Solanum melongena* (Cv. Pusakranti). Indian Journal of Applied and Pure Biology. 2006;21(1):81-84.
16. Abuzar S. Pathogenic Potential of Root Knot Nematode, *Meloidogyne incognita* and Wilt fungus, *Fusarium oxysporum* f. sp. *vasinfectum* alone and in Combination on the Disease Development and Plant Growth of Okra, *Abelmoschus esculentus*. International Journal of Applied Research and Studies. 2012;1(2):1-16.
17. Sumita K. Pathogenicity of Root-Knot Nematode, *Meloidogyne incognita* in Green gram. International Journal of Pure and Applied Bioscience. 2014;2(6):182-184.
18. Raut SP, Sethi CL. Studies on the pathogenicity of *Meloidogyne incognita* on soybean. Indian Journal of Nematology.1980;10(2):166-174.
19. Borah A. Pathogenicity and management of *Meloidogyne incognita* on green gram (*Vigna radiata*). M.Sc. Thesis on Nematology, Assam Agricutural University, Jorhat, 1990.
20. Sarmah B, Sinha AK. Pathogenicity of *Meloidogyne incognita* on Cowpea. Plant Health. 1995;1:12-14.
21. Romabati N, Dhanachand C. Effect of *Meloidogyne incognita* on the growth, protein and lipid contents of *Allium porrum*. Journal of Mycology and Plant Pathology. 2000;30(1):60-63.
22. Agwu JE, Ezigbo JC. Effect of *M. incognita* on the development of *Abelmoschus esculentus* (okra). Animal Research International. 2005;2(3):358-362.
23. Anwar SA, McKenry MV, Javed N. Development, reproduction, and root galling of *Meloidogyne incognita* populations on several cotton cultivars. Journal of Nematology. 2007;39(1):68.
24. El-Sherif AG, Refaei AR, El-Nagar ME, Hagar MMS. The role of eggs inoculum level of *Meloidogyne incognita* on their reproduction and host reaction. African Journal of Agricultural Research. 2007;2(4):159-163.
25. Dhurwey DS, Bhatt J, Singh SN. Effect of different levels of root-knot nematode, (*Meloidogyne graminicola*) on the plant growth of wheat. Journal of Entomology and Zoology Studies. 2019;7(3):1370-1373.
26. Das N. Pathogenicity and Management of *Meloidogyne incognita* in Pea. Annals of Plant Protection Sciences. 2008;16(2):458- 460.
27. Chandra P, Sao R, Gautam SK, Poddar AN. Initial population density and its effect on the pathogenic potential and population growth of the root knot nematode *Meloidogyne incognita* in Four species of Cucurbits. Asian Journal of Plant Pathology. 2010;4:1-15.
28. Ahmed, Dania, Shahab S, Safiuddin. Disease complex of *Meloidogyne incognita* and *Fusarium solani*on Chilli (*Capsicum annuum* L.). Journal of Natural Product and Plant Resources. 2014;4:14-18.
29. Mahalik JK, Sahoo NK. Effect of inoculum density of root knot nematode (*Meloidogyne incognita*) on okra (*Abelmoschus esculentus* L.). International Journal of Plant Protection. 2016; 9(2):603-607.