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Pathogenicity of *Meloidogyne incognita* on *Cucurbita Pepo*

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A B S T R A C T

The experiment was carried out in the net house of Department of Nematology during *rabi* season 2019-20 to study the pathogenicity of *M. incognita* on pumpkin. The pumpkin cultivar Karbi-I was used to test the pathogenicity of *M. incognita* on pumpkin. The pots were arranged in completely randomized design with 5 replications for each treatment. The seedling were inoculated with second stage juvenile of *M. incognita* at three leaf stage in a logarithmic series of check, associated check, 10, 100, 1000, 10,000 juveniles (J_2) per kg of soil. After 60 days of inoculation, it was recorded that the maximum plant height (142.20 cm), fresh and dry weight of shoot (41.26 and 7.08 gm), fresh and dry weight of root (21.04 and 6.85 gm) were recorded in the check, with no inoculation of *M. incognita* whereas, the minimum plant height (43.20 cm), fresh and dry shoot weight (17.00 and 1.27 gm) and fresh and dry weight of root (9.98 and 1.01 gm) was recorded in the treatment with 10000-inoculum level of the nematodes. In respect of nematode multiplication, number of galls and eggmasses per root system increased with the increased inoculum level up to 1000 and then it decreased. The maximum number of galls with egg masses was recorded in the 1000 inoculum level and minimum was recorded in the 10 inoculum level. Further, It was observed that there was a progressive increase in nematode population with the increasing level of inoculum from 10 to 10,000 nematodes per pot. The maximum and minimum nematode population in soil was recorded in the treatment with 10000 and 10 larval inoculation per pot, respectively. From this experiment, it concluded that inoculum level at 1000 J_2 of *M. incognita* per kg of soil showed pathogenic to pumpkin because a significant reduction of plant growth parameters of pumpkin was recorded at 1000 J_2 inoculum level of *M. incognita* per kg of soil.

Introduction

Pumpkin (*Cucurbita pepo*) is a climber as well as trailer and able to complete their life cycle within one growing season. It is one of the widely grown vegetables. It is rich in flavonoids, poly-phenolics and antioxidants including lutein and both alpha and beta carotene, the latter of which generates vitamin A in the body. The colour of pumpkin is derived from the orange pigments abundant in them. In India, it is grown mainly in Bihar, West Bengal, Tamil Nadu, Karnataka, Madhya Pradesh, Uttar Pradesh, Orissa and Assam. India has total production of 1079 thousand MT according to estimate on 2017-18 horticultural crops (Anonymous, 2018).

Pumpkin belongs to the family Cucurbitaceae. Some other members of this family are cucumber, gherkin, sponge gourd, ridge gourd, ash gourd, pointed gourd, snake gourd, bitter gourd, long melon etc. The plants belong to this family are highly susceptible to the attack of pest and diseases. Among them root knot nematode were first discovered as a pest of cucumber by Berkeley in 1855 at England. It was reported that root knot nematode feed on more than 3000 hosts plants and globally it destroys 29-30 per cent of vegetable crops. However, in Assam, it caused 17.92 per cent of an avoidable yield loss in the cucumber (Anonymous, 2011). In general, *M. incognita* produces egg masses on galls and it contains more that 250-500 eggs. Such reproductions are governed by many factors like susceptible host, nematode inoculum density and environmental conditions. Our main aim is to lessen the pathogen density at below ETL (economic injury level). So, it is crucial to conduct a study on the pathogen density levels against a susceptible host under controlled condition and it helps in the making proper decisions for the integrated management of pathogen. Keeping this in view an experiment was carried out on pathogenicity *of M. incognita* on chickpea.

Materials and Methods

The experiment was carried out in the net house of Department of Nematology during *rabi* season 2019-20 to study the pathogenicity of *M. incognita* on pumpkin. Required numbers of earthen pots were collected, cleaned and dried under the sun. Pots were filled with 2 kg autoclaved soil, placing few sterilized broken bricks at the bottom. Then, these pots were labelled according to the allotted treatments and replications. The pumpkin cultivar Karbi-I was used to test the pathogenicity of *M. incognita* on pumpkin. The pots were arranged in completely randomized design (CRD) with 5 replications for each treatment. The seedling were inoculated with second stage juvenile of *M. incognita* at three leaf stage in a logarithmic series of check, associated check, 10, 100, 1000, 10,000 juveniles (J_2) per kg of soil. The plants were watered regularly. Observations on different plant parameters were taken after 60 days of inoculation. Plant heights were recorded before uprooting the plants. The potted plants were uprooted very carefully and the root system was washed carefully with tap water so that there was no loss of roots and egg masses. Number of galls and egg masses per root system were recorded. Similarly, fresh shoot and root weights were taken. For recording dry weight, the plants along with their root systems were packed in paper bags labelled according to the treatments. The bags were kept in an oven at 60°C till constant weight of dried plant materials was obtained. The nematode population in the pot soil was determined by washing 250cc of homogenously mixed pot soil by modified Cobb's sieving and decanting technique. Statistical analysis was performed by using WASP 1.0 software.

$$\text{Reproductive rate} = \frac{\text{Final nematode population}}{\text{Initial nematode population}}$$

Results and Discussion

In the present experiment mean data on plant growth parameters *viz*., plant height, fresh and dry weight of shoot and root, number of galls, number of egg masses, final nematode population in soil and reproductive rate in different treatments are presented in Table 1 and 2 along with their CD values and illustrated in Fig. 1 to 7. The results obtained in the study of pathogenicity of root-knot nematode *M. incognita* on pumpkin indicated that plants became stunted with the increase of inoculum level of the nematode.

Table.1 Effect of different inoculum levels of *Meloidogyne incognita* on plant growth parameters of Pumpkin

Inoculum level (J_2/kg soil)	Plant height (cm)	Fresh weight of shoot (g)	Dry weight of shoot (g)	Fresh weight of root (g)	Dry weight of root (g)
T_1 : Check	142.20^{a}	41.26^{a}	7.08^{a}	21.04^{a}	6.85^{a}
T_2 : Associated check	141.80^{ab}	41.14^{a}	7.00^{a}	20.89^{a}	6.72^{a}
T_3 : 10	140.30^{ab}	40.70^{a}	6.72^{a}	20.62^{a}	6.51^{a}
T_4 : 100	139.82^{b}	39.30^{a}	5.78^{a}	18.98^{a}	5.89^{a}
T_5 : 1000	82.70^{c}	26.07^{b}	3.14^{b}	13.64^{b}	2.72^{b}
T_6 : 10,000	43.20^{d}	17.00^{c}	1.27^{c}	9.98^{c}	1.01^{c}
S.Ed.(±)	1.079	1.038	0.709	1.174	0.825
$CD_{0.05}$	2.229	2.144	1.464	2.423	1.705

Mean followed by the same letter in the superscript(s) are statistically *at par*

Table.2 Effect of different inoculum levels of *Meloidogyne incognita* on number of galls, eggmasses and nematode population on Pumpkin

Inoculum level (J_2/kg soil)	No. of galls/root system	No. of eggmasses/root system	Final nematode population (200 cc of soil)	Reproductive rate (%)
T_1 : Check	0.00 $(0.707)^{e}$	0.00 $(0.707)^{e}$	0.00 $(0.707)^{e}$	0.00
T_2 : Associated check	0.00 $(0.707)^{e}$	0.00 $(0.707)^{e}$	0.00 $(0.707)^{e}$	0.00
T_3 : 10	45.4 $(6.772)^{d}$	32 $(5.700)^{d}$	353 $(18.801)^{d}$	35.30
T_4 : 100	54.4 $(7.484)^{c}$	44.8 $(6.727)^{c}$	1195 $(34.576)^{c}$	11.95
T_5 : 1000	196 $(14.018)^{a}$	84 $(9.191)^{a}$	2732 $(52.253)^{b}$	2.73
T_6 : 10,000	131.6 $(11.493)^{b}$	63.4 $(7.992)^{b}$	3116 $(55.826)^{a}$	0.31
S.Ed(±)	0.11	0.08	0.43	
$CD_{0.05}$	0.23	0.19	0.87	

Values of numbers of galls, egg masses and final nematode population within parentheses are square root ($\sqrt{x + 0.5}$) transformed data
Mean followed by the same letter in the superscript(s) are statistically *at par*

Fig.1 Effect of different inoculum levels on plant height (cm) of Pumpkin cv Karbi-I

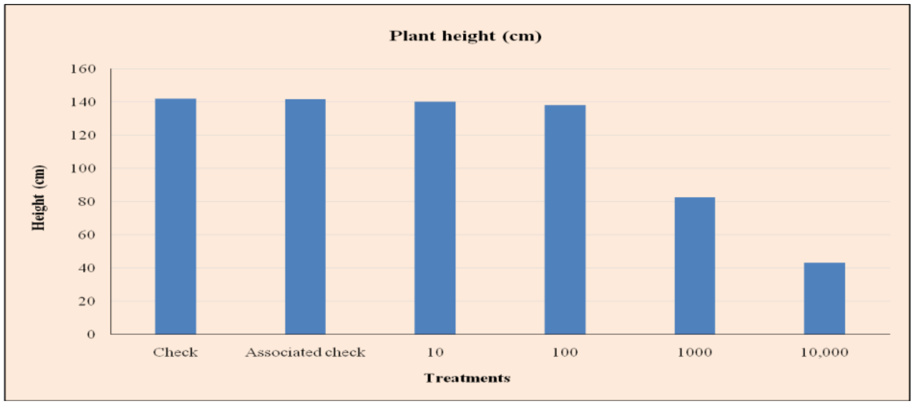


Fig.2 Effect of different inoculum levels on shoot and root weight (fresh and dry) of Pumpkin cv Karbi-I

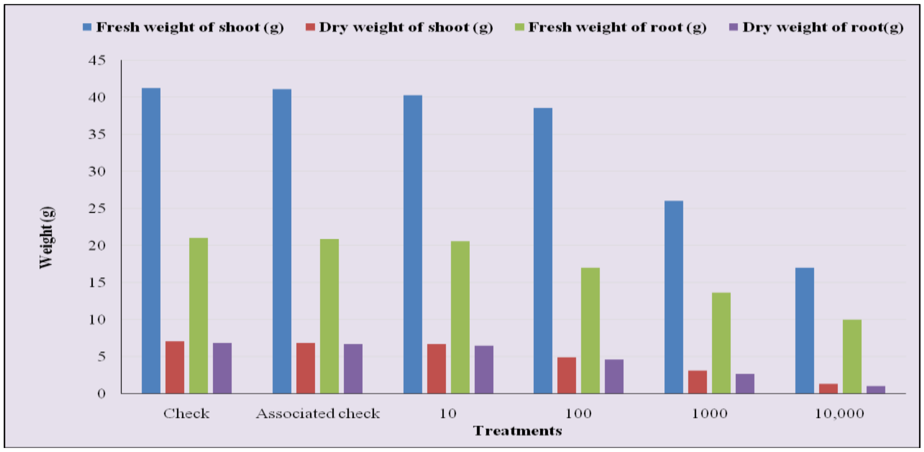


Fig.3 General view of the experiment - pathogenicity of *Melodogyne incognita* on pumpkin

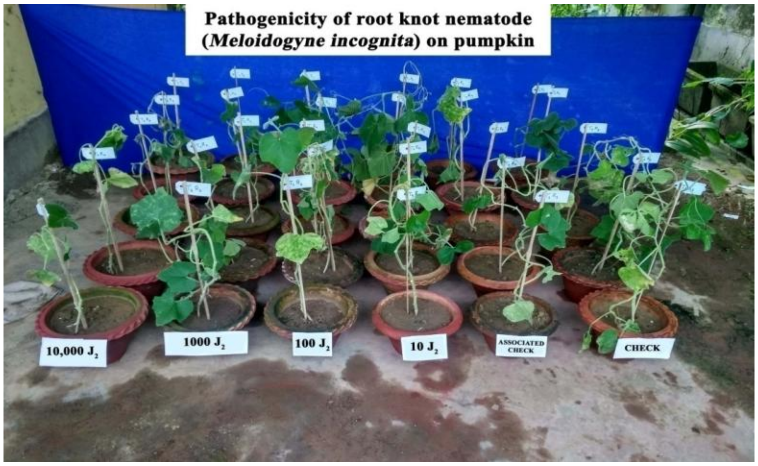


Fig.4 Growth of pumpkin under different inoculum levels of *Meloidogyne incognita*

Fig.5 Effect of different inoculum levels of *Meloidogyne incognita* on number of galls and eggmasses on Pumpkin cv Karbi –I

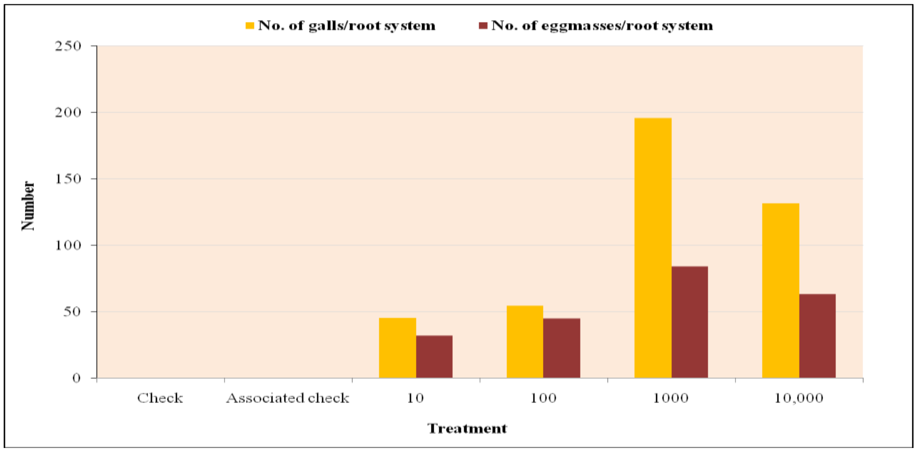


Fig.6 Effect of different inoculum levels on final nematode population of *Meloidogyne incognita*

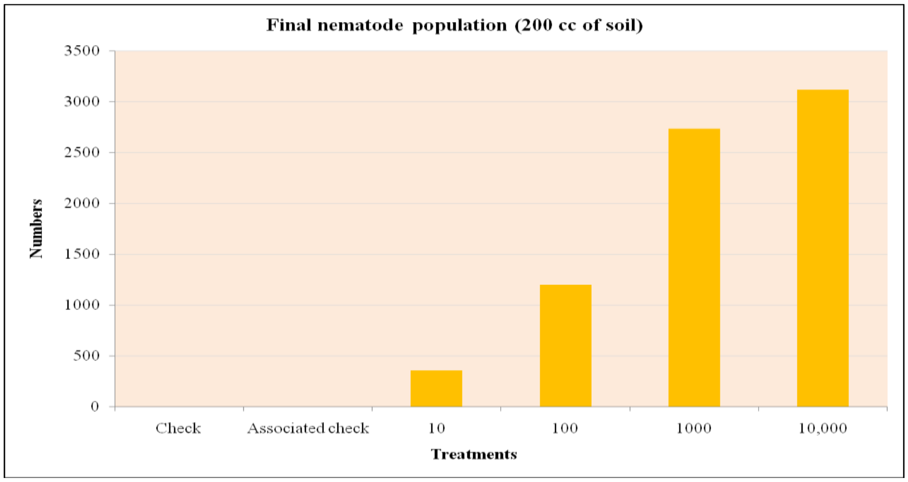
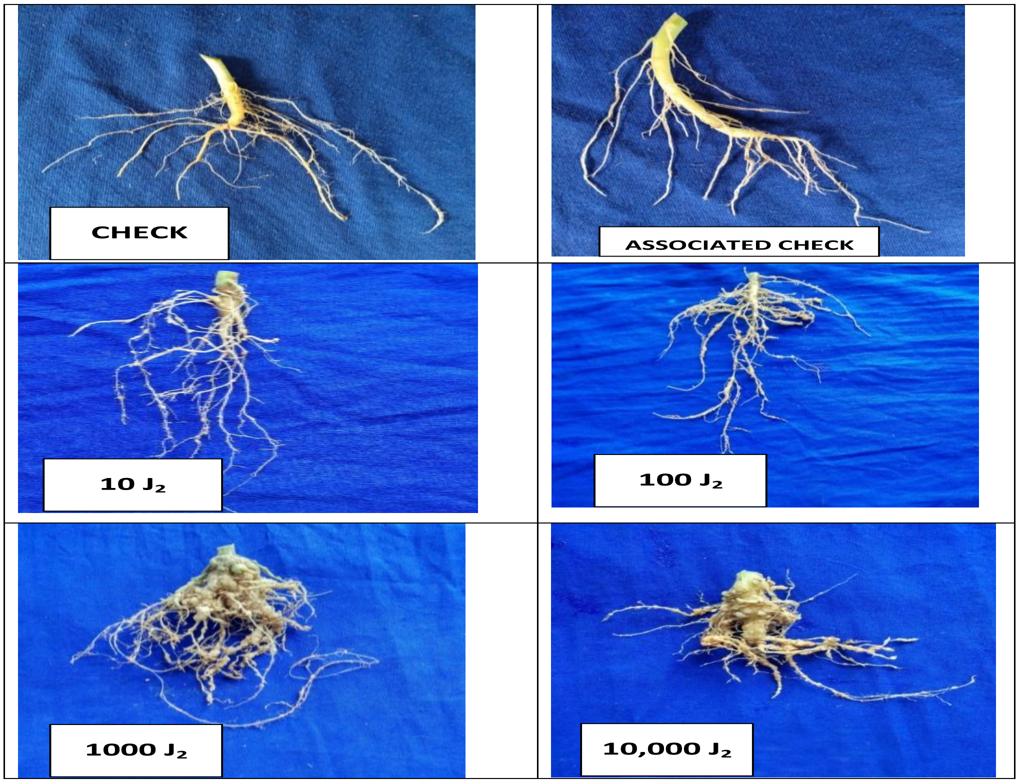


Fig.7 Effect of different inoculums level of *Meloidogyne incognita* on root growth of pumpkin



This finding is in agreement with the findings obtained by Sable and Darekar (1985) on bitter gourd, Dhankar *et al.,* (1986) on watermelon. Similar findings had also been recorded by Savitri (2006) on Gherkin (small variety of cucumber) and Ash gourd, Singh (2011) on bottle gourd. Further, it is observed that there was a significant reduction in plant height of pumpkin at and above 100 J_2 per pot. Similar results were also obtained by Bharali (1996) on cucumber, Savitri (2006) on Ash gourd.

The growth parameters of the crop were severely affected with increasing inoculum levels of the nematode which might be due to the destruction of the root system which ultimately affected the nutrient and water uptake. There was a corresponding reduction in fresh and dry weight of shoot of the plants with increase in level of inoculums from 10 to 10,000 J_2 per pots. Similar, results were reported by Gupta *et al.,* (1999) on bitter gourd in case of *M. javanica*. Mahapatra *et al.,* (1999) on pointed gourd and Singh (2011) on bottle gourd. The results further revealed that there was a progressive decrease in root weight (fresh and dry) when the inoculum level of *M. incognita* increased. This finding is in conformity with that of Bharali (I996) who reported significant reduction in fresh and dry root weight on cucumber, Mahapatra *et al.,* (1999) on pointed gourd, Savitri (2006) on Ash gourd. Further, it was observed that the plants at highest inoculum level (100,000 J_2 per pot) had a poor stand, root system was very much reduced and feeder roots were completely absent. Similar, results were reported by Dhankar *et al.,* (1986) on watermelon and also by Bharali (1996) on cucumber. There were a progressive increase in number of galls and egg masses with increase in inoculum level from 10 to 1000 and declined at 10,000 inoculum level per pot. However, it may be due to lack of sufficient feeding site for the nematode at highest inoculum level of 10,000 J_2 per kg of soil. Similar, findings were obtained by Paruthi and Gupta (1985) on bottle gourd, Dhankar *et al.*, (1986) on watermelon and Bharali (1996) on cucumber.There was a progressive increase in nematode population in pot soil with the increase in inoculum level from 10 to 10,000 J_2 per pot. A gradual increase in nematode population with increase in the inoculum level was reported by Venkatesan (2009) on bitter gourd, Singh (2011) on bottle gourd. A gradual decrease in reproductive rate was observed with the increase of inoculum level of *Meloidogyne incognita* from 10/kg to 10,000/kg soil. Maximum reproductive rate (35.30) was recorded in the inoculum level of 10 kg of soil while minimum reproductive rate of (0.31) was recorded in the highest inoculum level of 10,000 per kg soil. This variation in growth rate of *M. incognita* may be attributed to competition for food and overcrowding condition at higher inoculum level. Similar, findings were reported by Verma and Anwar (I995) on pointed gourd and Singh (2011) on bottle gourd.

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