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# Pathogenicity of root-knot nematode, *Meloidogyne incognita* (Kofoid and white, 1919) chitwood, 1949) on okra

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**Abstract**
A pot experiment was conducted at Department of Nematology, B. A. College of Agriculture, Anand Agricultural University, Anand to study Pathogenicy of *Meloidogyne incognita*. The results showed that an inoculum level of 1000 juveniles/plant/pot was found detrimental to the growth and development of okra. Root, soil and total nematode population of *M. incognita*/plant increased progressively with an increase in inoculum levels from 10 to 10,000 $J_2$/plant. Nematode reproduction rate decreased with an increase in inoculum levels and it was maximum in the level of 10 $J_2$/plant and minimum in 10,000 $J_2$/plant.

**Keywords:** Pathogenicity, okra, *M. incognita*

## Introduction

Okra (*Abelmoschus esculentus* L. Moench) is an important vegetable crop belonging to the family Malvaceae and grown throughout the tropical and subtropical regions of the world. In world, India ranks second in production of vegetables, next to China. In India, okra is cultivated in 0.53 million ha area with an annual production of 6.35 million tonnes with productivity of 12 tonnes/ha. In India, it is widely cultivated in Bihar, Orissa, West Bengal, Andhra Pradesh, Madhya Pradesh, Karnataka, Gujarat and Assam. Okra is one of the important vegetable crops of Gujarat, covering 65.99 thousand ha area with an annual production of 759.04 thousand MT and productivity of 11 MT/ha (Anon., 2014) [1]. Ahmedabad, Anand, Gandhinagar, Dang, Narmada, Navsari, Panchmahal, Bharuch, Sabarkantha, Surat and Tapi are major okra growing districts in Gujarat state. Various researchers also estimated yield losses ranging from 13.51 to 27.0% (Sikora and Fernandez, 2005 and Anon., 2015) [7, 2]. In Gujarat, 39.74% loss in okra yield due to root-knot nematode has been reported (Anon., 2015) [2]. Therefore, present investigation was carried out to determine the threshold level of *M. incognita* on okra.

## Materials and methods

An experiment was conducted to study the effect of *M. incognita* on plant growth and nematode reproduction on okra cv. Gujarat Anand okra 5 at department of nematology, B. A. College of Agriculture, Anand Agricultural University during Kharif 2016.

Earthen pots of 15 cm diameter were washed with water and disinfected by 4% formaldehyde (Formalin 40 EC) solution. After drying, the pots were filled with steam sterilized soil (1.5 kg/pot). Three seeds of root-knot nematode susceptible okra variety Gujarat Anand Okra 5 (GAO 5) were seeded in each pot. On germination, plants were thinned down to one plant/pot. Second stage juveniles ($J_2$) were extracted from the egg masses and inoculated in the rhizosphere of each plant after 15 days of sowing by removing soil around plant stem with the help of forcep. The inoculum levels were 0, 10, 100, 1,000 and 10,000 $J_2$ of *M. incognita* /plant. The uninoculated plants served as control. Each treatment was repeated five times. Plants were watered as and when required and protected from insects-pest and diseases using recommended practices in vogue. After 45 days of nematode inoculation, plants were depoted carefully. Roots were washed with water to make free from the soil particles, observations on plant growth parameters, root-knot index and nematode multiplication were recorded and data were statistically analysed using CRD design.

## Results and Discussion

Results revealed that with an increase in nematode inoculum levels progressively decreased plant height, fresh shoot and root weights of plants with corresponding increase in root-knot index as well as soil, root and total nematode population/plant. Control (uninoculated) plants has significantly more plant height (Table 1) followed by inoculum levels of 10 and 100 $J_2$/plant which were statistically at par with control. Inoculum levels 1000 and 10,000 $J_2$/plant differed significant with each other significantly. The lowest plant height was recorded in the level of 10,000 $J_2$/plant. There was significant reduction in plant height at an inoculum level of 1000 $J_2$ and above/plant. Fresh shoot weight was maximum in control plants which were statistically at par with the level of 10 and 100 $J_2$/plant. Minimum fresh shoot weight was recorded in the level of 10,000 $J_2$/plant and it differed significantly with the level of 1,000 $J_2$/plant. Inoculum level 1,000 $J_2$/plant significantly differed with level of 100 $J_2$/plant. Significant reduction in fresh shoot weight was recorded at inoculum of 1000 $J_2$/plant and above (Table 1). Maximum fresh root weight was recorded in control plants, which was statistically at par with inoculum level of 10 $J_2$/plant. Significant reduction was noticed at the level of 100 $J_2$/plant. However, it was statistically at par with the level of 10 $J_2$/plant. Lowest fresh root weight observed in the level of 10,000 $J_2$/plant which was statistically at par with 1000 $J_2$/plant. With regard to root-knot index (RKI), it increased with an increase in nematode levels (Table 1). As expected, control (uninoculated) plants had significantly less root-knot index followed by 10, 100, 1,000 and 10,000 $J_2$/plant. Inoculum level 10,000 $J_2$/plant had maximum root-knot index and statistically at par with inoculum level of 1000 $J_2$/plant (Table 1). Regarding reproduction of *M. incognita*, there was an increase in number of females (different stages), soil and total nematode population with an increase in inoculum levels. Maximum root and soil nematode population was recorded in the level of 10,000 $J_2$/plant and it was significantly differed with rest of the levels. Minimum nematode population was noticed in the inoculum of 10 $J_2$/plant and it differed significantly from the level of 100 $J_2$/plant. Nematode reproduction rate (pf/pi) showed negative relationship with the levels of nematode inoculum. There was corresponding decrease in nematode reproduction with an increase in nematode inoculum level. Highest reproduction rate of 15.46 was recorded in the inoculum level of 10 $J_2$/plant, while lowest 0.24 was recorded in level of 10,000 $J_2$/plant. Other levels had mediocre reproduction rate. The reduction in nematode reproduction rate at higher inoculum levels may be due to nematode competition for feeding on limited plant root system. As a result, some of the nematode might have not been able to infect crop roots (Table 2). Results obtained under study agreed with the results reported by Mishra and Awasthi (2007) [6], Khan and Saxena (1993) [5] and Ganaie *et al*. (2011) [4] who reported that an inoculum of 1000 J2 *M. incognita*/plant was found damaging to most of the plant growth characters and favoured nematode multiplication.

**Table 1:** Effect of different inoculum levels of *M. incognita* on growth and development of okra

| Inoculum level | Plant height, cm | Fresh weight, g | | RKI (0-5)* ($\sqrt{x+0.5}$) |
|---|---|---|---|---|
| | | Shoot | Root | |
| 0 | 52.6 | 34.76 | 7.384 | 0.71 (0.00) |
| 10 | 52.2 | 32.61 | 7.064 | 1.63 (2.15) |
| 100 | 50.0 | 30.98 | 6.576 | 1.97 (3.38) |
| 1000 | 35.6 | 13.17 | 2.888 | 2.26 (4.60) |
| 10000 | 24.8 | 2.24 | 1.416 | 2.34 (4.97) |
| S.Em. ± | 1.5 | 1.42 | 0.230 | 0.06 |
| C.D 0.05 | 4.5 | 4.18 | 0.680 | 0.19 |
| C.V. % | 7.9 | 13.9 | 10.1 | 8.1 |

*0 = Free; 5 = Maximum disease intensity
Figures in parentheses are re-transformed values of $\sqrt{x}$+0.5

**Table 2:** Population of *M. incognita* at different inoculum levels on okra

| Inoculum level | Nematode population | | | |
|---|---|---|---|---|
| | No. of females/3g root (Log X+1) | No. of juveniles/200 cm$^3$ soil (Log X+1) | Total (Log X+1) | Reproduction rate (pf/pi) |
| 0 | 0.00 (0.00) | 0.00 (0.00) | 0.00 (0.00) | 0.00 |
| 10 | 1.71 (50.29) | 2.00 (99.00) | 2.18 (150.36) | 15.46 |
| 100 | 2.66 (456.09) | 2.61 (406.38) | 2.94 (869.96) | 8.66 |
| 1000 | 2.93 (850.14) | 2.98 (953.99) | 3.25 (1777.28) | 1.80 |
| 10000 | 3.05 (1121.02) | 3.12 (1317.26) | 3.39 (2453.71) | 0.24 |
| S.Em. ± | 0.03 | 0.03 | 0.02 | - |
| C.D 0.05 | 0.10 | 0.09 | 0.07 | - |
| C.V. % | 3.7 | 3.1 | 2.4 | - |

Figures in parentheses are re-transformed values of log X+1

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