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Effect of Temperature on Penetration and Multiplication of Root-Knot Nematode, Meloidogyne Incognita on Tomato

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A B S T R A C T

Penetration was not affected by temperature but, migration and post-penetration inside the root tissue were influenced by temperature. At 27±1°C, *M. incognita* second stage juvenile (J_2) took 5 days to reached stele region followed by 31±1°C and 23±1°C (7 days) while, at 21±1°C, it took 10 days. Multiplication of *M. incognita* was greatly affected by temperature. Maximum number of galls per root system (119.6), number of egg masses per root system (275.2), number of eggs per egg mass (343.6), final nematode population (1335.2) and reproduction factor of nematodes (2.67) was observed at 27±1°C followed by 31±1°C, 23±1°C and 21±1°C respectively.

Introduction

Plant parasitic nematodes belonging to the family Meloidogynidae (Order: Tylenchida) are obligate sedentary endoparasite widely distributed in both tropical and temperate climate. The infective second stage juvenile (J_2) penetrate into the roots at the zone of elongation and establish feeding sites in the phloem causing disruption, hypertrophy and hyperplasia of cells resulting in formation of giant cells and swellings at the sites of establishment due to which the nutrient uptake of the root is hampered; crop become stunted in growth. Sasser and Carter (1985) reported that root-knot nematodes are responsible for 5 per cent (approximately) global crop loss and estimated yield loss due to *Meloidogyne* spp., mainly *M. incognita* and *M. javanica*, ranged from 17 to 20 per cent on brinjal, 18 to 33 per cent on melon and 24 to 38 per cent on tomato (Sasser,1979). In India, yield losses due to *Meloidogyne* spp. in vegetable crops such as okra, tomato and brinjal were estimated to be 91 per cent, 42 to 54 per cent and 18 per cent, respectively (Bhatti and Jain, 1977; Subramaniyan *et al.*, 1990).

Materials and Methods

Autoclaved soils containing mixture of soil, dried cowdung and sand at 2:1:1 respectively

was filled in pots of 150 gm capacity (penetration experiment) and 500 gm capacity (multiplication experiment). Three seeds of susceptible tomato (var. Bioseed) were sown to each pot. One week after germination, seedlings were thinned out to one healthy seedling in each pot. J_2 of *M. incognita* were inoculated with the help of micro pipette to the feeder root @ $1J_2$/1gm of soil. Inoculated pots were kept in growth chamber at 21±1°C, 23±1°C, 27±1°C and 31±1°Cof Department of Crop Physiology, AAU, Jorhat.

Penetration of *M. incognita*

Three seedlings were carefully uprooted on time interval starting from one hour after inoculation. The root system was washed very carefully under tap water and teased with the help of a fine needle under stereo-zoom binocular microscope to observe the penetration of juvenile (s) inside the root tissue.

Multiplication of *M. incognita*

After 45 days of inoculation, plants were uprooted carefully. 200cc of soil was processed from each pot to find out the final soil population of *M. incognita* by the Cobb's sieving and decanting method. Roots were washed carefully under tap water and number of galls per root system, number of egg mass per root system, number of eggs per egg mass, final nematode population and its reproduction factor were recorded at 21±1°C, 23±1°C, 27±1°C and 31±1°C. All the treatments were replicated 5 times.

Results and Discussion

Penetration and post penetration

In the present investigation, it was observed that temperature does not effect on penetration of J_2*M.incognita* rather, showed effect on migration inside the root tissue. At all the temperatures (21±1°C, 23±1°C, 27±1°C and31±1°C), *M. incognita*J_2started to penetrate root within 2 hours of inoculation, just behind the root tip (root cap).At 27±1°C, after 4 hours, J_2penetrated fully inside the root epidermis and reached stele region within 5 days resuming the vertical position with tail towards the cortex. But at 31±1°C and 23±1°C,J_2 reached stele region within 7 days while, at 21±1°C, it took 10 days. Similarly, Mishra *et al*.(1985) alsoreported that *Heteroderazeae*J_2 penetrated roots within 3 hrs of inoculation, complete penetrationwithin 6 hrs and move to the central portion of root within 5 days but temperature was not mention. Haque and Padmavathy (1985) recorded that *R. reniformis* penetrated both Pusa Ruby and Patriot tomato varieties within 48 to 72 hrs. However, penetration times were found to be significantly different and highest number of juvenile in roots was invariably observed after 96 hrs.

Multiplication of *M. incognita*

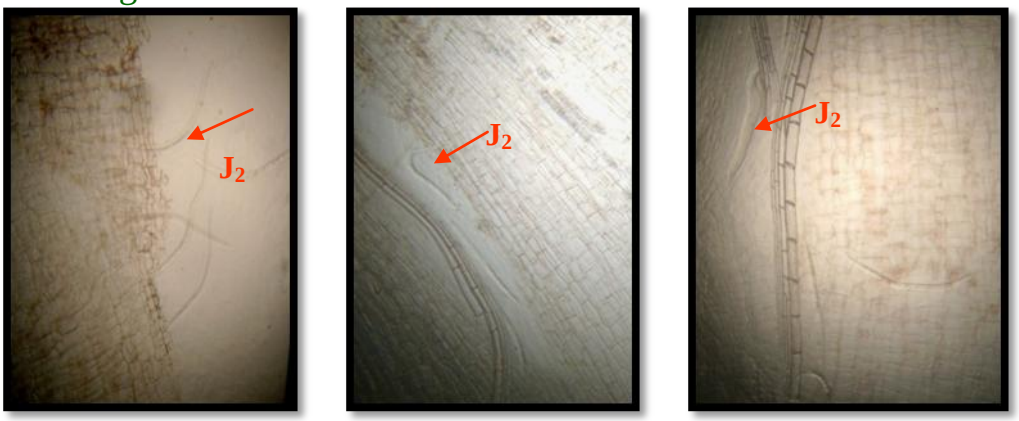
Result presented in Table 1, revealed that all the four treatments at different temperature significantly increased multiplication of *M.incognita* and decreased in root system. The number of gall per root system (119.6), egg masses per root system (275.2), eggs per egg mass(343.6), final nematode population (1335.2) and reproduction factor (2.67) was found to be maximum at 27±1°C followed by 23±1°C and 31±1°C. Minimum number of gall, egg masses, eggs, final nematode population and reproduction factor was recorded in 21±1°C.Present study on multiplication of *M. incognita* revealed that temperature influenced the multiplication of *M. incognita*. Similar findings were also observed by Ustinov and Tereshchenko (1959) in *Ditylenchus destructor* reporting that, temperature influenced the life cycle of *D. destructor* (Fig. 1 and 2).

Table.1 Effect of temperature on multiplication of *M. incognita* on tomato var. Bioseed

Temperature levels	No. of galls/ root system	No. of egg mass/ root system	No. of eggs/ egg mass	Initial nematode population/ 200 cc of soil	Final nematode population/ 200cc of soil	Reproduction factor
21±1°C	71.6_a	98.6_a	246.4_a	500	687.6_a	1.37
23±1°C	83.2_b	138.2_b	278_b	500	819.0_b	1.63
27±1°C	**119.6_c**	**275.2_c**	**343.6_c**	500	**1335.2_c**	**2.67**
31±1°C	93.8_d	171.8_d	298.8_d	500	924.4_d	1.84
C.D= 0.05	6.71	8.41	12.62	-	33.72	-
C.D= 0.01	10.96	13.73	20.60	-	55.06	-

Means followed by the same letter shown in the subscript (s) are significantly different

Fig.1 Penetration and post-penetration of *M. incognita* in different root zones A. Initiation of penetration by J_2; B. J_2 near the stele region; C. J_2 feeding in the stele region



A **B** **C**

Fig.2 Root infected by *M. incognita* on tomato var. Bioseedat different temperature levels

21±1°C **23±1°C** **27±1°C** **31±1°C**

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