J. Phytol. Res. 1 (1), 1988

BIOLOGY OF *MELOIDOGYNE JAVANICA* AND THREE RACES OF *M. INCOGNITA* IN RESISTANT AND SUSCEPTIBLE BRINJAL CULTIVARS

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Studies were conducted on the invasion and reproduction of *Meloidogyne javanica*, race-1, race-2, and race-3 of *M. incognita* in the roots of resistant ('Gulla') and susceptible ('Erengere') brinjal cultivars. Although both the cultivars were invaded by the larvae of all the four nematode populations, race-1 and race-2 of *M. incongnita* failed to reproduce in 'Gulla' roots. *M. javanica* took 28 days to produce galls and reproduce on 'Erengere' where as *M. incognita* (race-1) required only 21 days. Maximum number of eggs per egg-mass was recorded by race-3 on 'Erengere' and by *M. javanica* on 'Gulla'.

Keywords : *Meloidogyne javanica; Meloidogyne incognita;* Brinjal.

Introduction

Root-knot nematodes (*Meloidogyne* spp.) are known to cause significant yield losses in brinjal (*Solanum melongena* L.), however, detailed studies on the biology of this nematode pest in brinjal have not been made though there are some reports on few aspects of the biology (Dhawan and Sethi, 1978; Verma *et al.*, 1979). Investigations pertaining to the biology of several populations of the root-knot nematode with respect to the larval invasion into the roots and their reproduction in cultivars which differ in their reaction to various nematode populations have not been carried out in brinjal. Present paper, hence deals with the larval invasion and time taken by *M. javanica*, race-1, race-2 and race-3 of *M. incognita* to produce galls and egg-masses on resistant ('Gulla') and susceptible ('Erengere') brinjal cultivars.

Material and Methods

In screening studies, 'Gulla', a local cultivar was found to be highly resistant to race-1 and race–2 of *M. incognita* but slightly susceptible to race–3 and *M. javanica*. 'Erengere' was highly susceptible to all the four nematode populations (Ravichandra, 1987). Hence these two cultivars were selected for the present study. Seedlings of cv. 'Gulla' and 'Erengere' were raised in 6" pots filled with 1000g sterilised soil. Two weeks later, 500 freshly hatched larvae of *M. javanica*, race-1, race-2 and race–3 of *M. incognita* were inoculated separately into the seedlings.

Invasion studies—Seventy-two hours later the root system of each plant was taken out, washed and stained according to the technique described by McBeth *et al.* (1941). The stained roots were placed between two microscopic slides, crushed and examined under a stereobionocular microscope. The number of nematodes in roots were counted and the rate of penetration was calculated.

Studies on reproduction—After 20 days, at every 24 hour, the seedlings were uprooted, washed and observed for the formation of galls and egg-masses. Ovservations were recorded on the number of days required by each nematode population to produce galls and egg-masses on both the cultivars, numbers of galls and egg-masses per root-system and number of eggs per egg mass.

Results and Discussion

Invasion studies—It is obvious from the data that *M. javanica* and all the three races of *M. incognita* invaded both the cultivars (Table 1). Although 'Gulla' was shown to be highly resistant to race-1 and 2 of *M. incognita* in the screening experiment, it was also invaded by the larvae. It was shown to be slightly susceptible to *M javanica* and race-3 of *M. incognita*. However, large number of these two populations invaded 'Gulla' roots compared to race-1 and 2 of *M. incognita*.

Results were highly significant with respect to the number of larvae invading the 'Gulla' roots, with all the populations studied. However, maximum number was that of *M. javanica* (311.66) followed by race-3 of *M. incognita* (281.33), race-2 (274.33) and race-1 (165.60). All the populationss differred significantly among themselves.

Even in case of 'Erengere' statistically significant results were obtained with regard to the invasion by various populations of root-knot nematode. Maximum number of *M. javanica* invaded the roots (382.66) followed by race-3 of *M. incognita* (301.33), race-1 (181.30) and race-2 (163.40). There was a significant difference among all the populations.

The invasion of both the resistant and susceptible brinjal cultivars by the *Meloidogyne* spp. juveniles has been reported (Verma *et al.*, 1979) which is in confirmity with the present findings. Invasion of a susceptible root by larvae of *Meloidogyne* spp. usually causes major changes in plant cells surrounding the nematode. Near the head of the nematode, normal vascular tissue is replaced by giant cells and hypertrophy and cell proliferation occur. Once feeding begins, larvae become sedentary and develop to maturity. In resistant roots, larvae may either fail to enter, in reduced numbers with little or no development, or enter in large numbers with varying degrees of development (Stephan, 1983).

Table 1. Number of larvae of two species and three races of root-knot nematode invading 'Gulla' (resistant) and 'Erengere' [susceptible] brinjal cultivars, 72 hours after inoculation.

Species and races	'Gulla'	'Erengere'
M. Incognita		
Race 1	165.60	181.30
Race 2	274.33	163.40
Race 3	281.33	301.33
M. javanica	311.66	382.66
Mean	258.23	257.17
C. D. 0.05	120.54	141.72

Number of larvae inoculated per plant=500

Hypersensitivity is a common type of response of resistant plants (Rohde, 1965). The larvae may enter the roots of resistant plants in large number but hypersensitive cells quickly die and wall-off the pathogens so that injury to the host is confined to a few cells. Reynolds *et al.* (1970) also observed the invasion by *M. incognita acrita* larvae into the roots of alfalfa resistant cultivars, which confirms the present findings.

Studies on reproduction--M. javanica took more number of days (28.66) to produce galls (that are easily visible to the nacked eye) on 'Erengere' roots which differred significantly from other populafions (Table2).Race 3 of *M. incognita* took about 25.33 days followed by race-2 and race-1 (23.00 and 21.66 respectively), which were at par with one another.

With respect to the numer of days required by the populations for egg-mass production, again *M. javanica* took more number of days (40.70) which differred significantly, from rest of the populations. Race-2 of *M. incognita* took 36.74 days followed by race-3 (35.65 days) and race-1 (34.33 days). All the three races of *M. incognita* were at par among themselves with regard to egg-mass production.

Race-3 of *M. incognita* recorded maximum number of eggs per egg-mass (276.64) compared to other populations and was significantly different from others. However, the results were statistically highly significant

Table 2. Reproduction of two species and three races of root-knot nematode on 'Gulla' (resistant) and 'Erengere' (susceptible) brinjal cultivars.

Species and Races	'Gulla' No. of days taken for		No. of eggs/ egg mass	'Erengere' No. of days taken for		No. of eggs/ egg mass
	Gall formation	Egg-mass production		Gall formation	Egg-mass production	
M. incognita						
Race 1	—	—	—	21.66	34.33	233.61
Race 2	—	—	—	23.00	36 74	215.90
Race 3	38.40	53.00	56.61	25.33	35.65	276 64
M. javanica	46.20	58.64	84.00	28.66	40.70	178.66
Mean	42.30	55.82	70.30	24.66	36.85	226.20
CD 0.05	1.91	NS	11.13	7.00	1.34	91.74

with the remaining populations too, wherein, race-1 recorded 233.61 eggs per egg-mass, followed by race-2 215.90) and *M. javanica* (178.66), *M. javanica* recorded least number of cggs per egg-mass.

No gall formation was observed in 'Gulla' roots, when inoculated with race-1 and race-2 of *M. incognita* which suggested its resistance to these two populations. However, with race-3 of *M. incognita* and *M javanica* populations, slight gall formation was observed after 38.40 and 46.20 days, respectively. The results were found to be statistically significant.

With regard to the number of days required for the production of egg-mass also, *M. javanica* took more days (58.64) followed by race–3 of *M. incognita* (53.00). However, the differences were statistically non-significant. *M. javanica* produced maximum number of eggs per egg-mass (84.00) followed by race-3 of *M. incognita* (56.61), which were statistically highly significant with each other.

Studies on the reproduction potential of several species of root-knot nematode have been carried out on tomato (Dement'eva and Sadykin, 1982; Stephan, 1983; Prot, 1984 and Stele, 1971 with *M. incognita, M. hapla M. arenaria* and *M.incognita acrita*,respectively).In most of the studies,reproduc tion potential was found to be higher in susceptiblec ultivars than in rasistat/tolerant ones. Resistant/tolerant cultivars needed longer duration for the production of eggs per egg-mass, than susceptible cultivars, which is in confirmity with the present findings.

Dropkin (1959) while suggesting a bioassay system for separating races of root-knot nematodes, reported the variability in varietal responses of soybean to *Meloidogyne* spp.

Variability in reproduction of several populations of root-knot nematode on other crops has been reported by several workers. Swanson and Van Gundy (1984) observed that races 1, 3 and 4 of *M. incognita* produced less number of eggs per root system in resistant 'Centennial' soybean cultivar (300 to 600), whereas, more number was produced in susceptible 'Pickett-71' (500 to 15,000). Similarly, race-2 produced 8000 eggs per root system on 'Centennial' and 1,200 eggs on 'Pickett-71'. They concluded that the resistanc to *M. incognita* in soybean was race-specific. The results obtained in the present investigation seem to suggest the face-specific resistance of brinjal cultivar 'Gulla'.

Races 1 and 3 of *M. incognita* also varied in their reproduction on cultivars of soybean, as observed by Windham and Barker (1986). They observed reproduction of both the races on resistant variety 'Centennial' was lowest compared to susceptible variety 'Lee 68'. Differences in nematode population densities in the roots of different cultivars is an important

criterion to be considered while assessing the reproduction potentialities of various populations in several cultivars (Huang, 1986). During the development of plants the population density of the nematode has been shown to be diluted because of fast growth of the root system which is a very important factor while comparing the numbers of the nematode in different cultivars of the host.

It may be said that resistance in 'Gulla' to race-1 and race-2 of *M. incognita* and tolerance to race-3 and *M. javanica* may be associated with retarded nematode penetration, development and maturity, egg-production and fast growth of the plant resulting in a low nematode population density. Consequently relatively less number of nematodes completed their life cycle in 'Gulla' compared to 'Erengere' and slow rate of juvenile penetration was also observed in case of 'Gulla'. Because of the differences in the numbers of juveniles penetrating roots, the differences in numbers of galls and egg-masses might have occurred.

Accepted August, 1988

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