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Relationship between plant density and population density of *Meloidogyne incognita* on eggplant

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Abstract

The effect of different densities of eggplant (*Solanum melongena* L.) on the reproduction and population density of root-knot nematode, *Meloidogyne incognita* was studied under screen house conditions. It was found that there is a positive correlation between eggplant density and population density of root-knot nematode, *M. incognita* in roots i.e., when number of plants in the same pot increased (1-4 plants/pot), a higher number of nematode juveniles in plant roots occurred. Thus, plant density, such as 4 plants if produced it promoted the number of the hatched juveniles, galls and egg-masses in roots as compared to the plant densities of 1, 2 and 3/pot. However, number of juveniles in soil decreased with increasing plant density.

Keywords: Plant density, eggplant, plant growth, *M. incognita*

Eggplant (*Solanum melongena* L.) is a species belonging to the Solanaceae botanical family, originating from countries of tropical eastern regions, such as China and India, presenting high economic importance due to its nutraceutical properties (Bardiviesso *et al*., 2014). *Meloidogyne incognita* root-knot nematode could cause severe damage in eggplant (Netcher & Sikora, 1990). Crop losses caused by root-knot nematode were estimated as 17-60% in the tropics (Sasser, 1979).

Yield of eggplant tended to decrease with increasing galls caused by *M. incognita* with correlation coefficient of -0, 72 (Youssef & Korayem, 2008). The same authors indicated that yield of eggplant was reduced by 51.7% when roots were infested at the early stage of vegetative growth by 13galls/plant. Noling & Ferris (1986) reported that plant size increased when plant population densities decreased. Also, when density of underground part of plant increased, the root biomass also increased and correspondingly nematode reduction in the multiplication and reproduction was found. Maintenance of root biomass allowed population of *Meloidogyne hapla* to gradually reach ceiling density. Khan *et al*., (1985) worked on cauliflower with *Tylenchorhynchus brassicae* and eggplant with *Meloidogyne incognita*. Further, Ismail (1994) reported that the population of nematodes increased with the increase in the amount of space (soil) around plants of cowpea infected with *Rotylenchulus reniformis*. Few studies have been carried out on the effect of plant density in relation to population density of nematodes (El-Sogheir & Abd El-Fattah, 2009; Dawuda *et al*., 2011; Viana *et al*., 2013). Hence, the influence of plant densities on the population of root-knot nematode, *M. incognita* and growth of eggplant was studied in this experiment.

Materials and Methods

Plant densities of 1-4 eggplants cv. Baladi were allowed to grow in each pot. Seeds of eggplant

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(*Solanum melongena* L.) were sown by drilling and seedlings were thinned, one month after germination to allow 1-4 plants at about 2-cm apart in each pot. At the same time, each pot was inoculated with 750 newly hatched second stage juveniles (J_2) of *M. incognita* reared on tomato plants. This was done by pipetting nematode suspension into 3-cm deep holes around root system of eggplant seedlings in six replicates for each treatment. The plants were harvested at 90 days after nematode inoculation. Soil samples were taken from each pot (replicate) and the number of root-knot juveniles in soil from each replicate was extracted by using sieving and decanting method (Barker, 1985). Assessment of the number of the hatched nematode juveniles in roots was done in one half of roots for each replicate by incubation method according to Young (1954). Number of galls and egg-masses were counted in remaining roots.

Statistical analysis: Statistically, data in this experiment were analyzed by LSD test. Duncan`s Multiple Range Test was used for comparison among treatments by using COSTAT program version 4.

Results

Effect of plant density on root-knot nematode: It was clearly noticed that there was a positive correlation between plant density and the number of root-knot nematode juveniles in roots. In other words, as the number of plants increased in the same area (pot), there were a higher number of the hatched nematode juveniles in roots. Thus, density of 4 plants produced more number of the hatched juveniles, galls and egg-masses in roots, than plant densities of 1, 2 and 3. However, number of juveniles in soil decreased with increasing plant density (Table1).

Effect of plant density on plant growth and yield criteria: In general, densities of 2 and 3 followed by 4 plants increased in plant growth criteria than that of 1 plant. On the other hand, density of 4 plants produced, in general, fewer values of plant growth criteria as indicated by length, fresh and dry weights of shoots and roots than densities of 2 and 3 plants. As for number of fruits, they increased at 1 and 2 plants more than those at 3and 4 plants (Table 2).

Table 1. Reproduction of *Meloidogyne incognita* in relation to different eggplant densities.

750j/treatment	Reproduction of *Meloidogyne incognita*			
	J_2 in soil/pot	J_2 in roots/plant	Galls/plant	Egg-masses/plant
T_1 (1 plant)	2213 a	303 d	48 b	39 b
T_2 (2 plants)	1283 b	807 c	34 c	21c
T_3 (3 plants)	910 c	1050 b	25 d	18 c
T_4 (4 plants)	880 d	1320 a	85 a	60 a

Values are averages of 6 replicates. Similar letter(s) of each column are not significantly different according to Duncan's Multiple Range test at probability 0.05.

Table 2. Plant growth of eggplant infected by *Meloidogyne incognita* in relation to different plant densities.

750j/treatment	Length (cm)	Wt. of shoots (g)/plant		Wt. of roots (g)/plant		Wt. of fruits (g)/plant
		Fresh	Dry	Fresh	Dry	
T_1 (1 plant)	41.8 b	27.0 c	5.5 d	12.3 c	1.8 c	8.0ab
T_2 (2 plants)	45.2 a	38.6 b	13.1 a	20.6 b	4.4 a	10.3 a
T_3 (3 plants)	39.3 c	57.1a	10.4 b	26.6 a	4.5 a	4.0 c
T_4 (4 plants)	32.5 d	38.8 b	8.1 c	19.9 b	2.9 b	6.0bc

Values are averages of 6 replicates. Similar letter(s) of each column are not significantly different according to Duncan's Multiple Range test at probability 0.05.

Discussion

In the present study, it was found that greater number of second stage juveniles (J_2) of *M.incognita* was found in roots of 2 and 3 plants than in roots of 1 plant / pot. This was explained on the basis that higher plant density produced greater feeder roots on which nematodes feed as reported by El-Sogheir & Abd El-Fattah (2009). Likewise, Seinhorst (1966) reported that there was a relationship between the space, food and population of certain nematodes (*Pratylenchus penetrans*, *P. crenatus*, *Tylenchorhynchus dubius* and *Rotylenchulus reniformis*).

In the present study, maximum nematode density was found in roots of 4 plants in spite of the moderate weight of roots compared to 2 and 3 plants. Moderate weight of roots may be due to competition of plants for the same area of light, water and nutrients which in turn, decreased roots (El-Sogheir & Abd El-Fattah, 2009).

Viana *et al*., (2013) reported that gall density induced by *Ditylenchus* spp., on leaves of *Miconia albicans* plant was positively correlated with host density. They added that plant length and fruit production were significantly reduced in the infected plants compared to healthy ones. However, Dawuda *et al*., (2011) stated that plant density did not affect root-knot nematode population and gall severity, but the lower plant density led to improved plant weight of roots.

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