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The Role of Different Inoculum Levels of *Meloidogyne javanica* Juveniles on Nematode Reproduction and Host Response of Peanut Plant

A.G. El-Sherif, A.R. Refaei and S.B. Gad
Nematology Research Unit, Department of Agricultural Zoology, Faculty of Agriculture, Mansoura University, Dk., Egypt

Abstract: A pot experiment was conducted to determine the influence of three of inoculum levels (1000, 2000 and 3000 J_2 pot^{-1}) of *Meloidogyne javanica* on nematode reproduction and host response of peanut plant cv. Giza 4 under greenhouse conditions at 30±5°C. In general, nematode reproduction and host damage were both affected by the initial inoculum levels. The greater reduction percentage of plant fresh (57.7%), shoot dry (38.82) and pods weights (52.59%) and nodules numbers (73.33%) were recorded at inoculum level 2000 J_2/peanut plant, when rate of nematode build-up reached the maximum value of 1.64. Regression analysis of Pi vs. rate of nematode build-up on peanut plants gave value of R^2 amounted to 0.3193. On the other hand, when the initial inoculum level added increased up to 3000 J_2/peanut plant, the percentage reduction of whole plant fresh weight (47.07%) and other growth parameters as well as nematode build-up (0.8) also obviously decreased.

Key words: Peanut plant, inoculum level, *Meloidogyne javanica*, growth parameters

INTRODUCTION

Peanut, *Arachis hypogaea* L. is one of the most important legume and oil crops for human consumption and animal feeding. Peanut was listed as one of the twenty crop plants that stand between man and starvation. It is self-pollinating, cultivated annually and improves soil by fixing atmospheric nitrogen through the nodules on its root system. The total cultivated area reached to 23573590 ha for the season of 2005 all over the world. In Egypt peanut is grown in light soils as well as in newly reclaimed sand areas, where cultivated area recorded to be 60330 ha for the season of 2005 (FAOSTAT, 2005). Several plant parasitic nematodes were recorded as pathogens of peanut plants all over the world. A world survey of nematologists, annual losses caused by all nematodes to peanut were approximately 12% (Sasser and Freckman, 1987). Moreover, nematodes damage peanuts in all production area of the world and cause significant yield reduction in peanut (Holbrook and Noe, 1992). The root-knot nematode, *Meloidogyne javanica* is the major nematode species that parasitize peanuts in Egypt (Ibrahim and El-Saedy, 1976). The present investigation was carried out to study the impact of *M. javanica* infection at three levels of inoculation on growth of peanut plant cv. Giza 4 under greenhouse conditions.

MATERIALS AND METHODS

Source of nematodes: Second stage juveniles (J_2) of the root-knot nematodes, *Meloidogyne javanica* (Kofoid and white) chitwood were obtained from a pure culture of *M. javanica* that was previously initiated by a single eggmass and propagated on coleus plants, *Coleus blumei* in the greenhouse of Nematology Research Unit, Agriculture Zoology Department, Faculty of Agriculture, Mansoura University, Egypt.

In this pathogenicity test, sixteen plastic pots 30 cm diameter. were filled with 3 kg pot^{-1} of steam-sterilized sandy-loam soil (2:1) (v:v). Seeds of peanut (*Arachis hypogea* L.) cv. Giza 4 were grown in pots. Twenty days from seeds germination, the tested three levels of *M. javanica* (J_2) i.e., 1000, 2000 and 3000 second stage juveniles were separately monitored, four pots each and left another four pot with one peanut seedling each without nematodes which served as control. Each treatment was replicated four times. Pots were arranged in a randomized complete block design at the greenhouse at 30±5°C. Plants were watered and regularly receiving conventional pesticides to control mites and insects as needed. After 60 days from *M. javanica* (J_2) inoculation, plants were harvested and number of galls and egg-masses/root system was recorded. Plant growth criteria i.e., shoot and root lengths

Corresponding Author: A.G. El-Sherif, Nematology Research Unit, Department of Agricultural Zoology, Faculty of Agriculture, Mansoura University, Dk., Egypt

and fresh weights, as well as shoot dry weight were also recorded. Number of pods and their weights as well as nodule numbers for each plant per treatment were determined and recorded. Number of *M. javanica* second stage juveniles in 250 g soil pot^{-1} were extracted by sieving and modified Baermann-technique (Goodey, 1957), then calculated for the soil of each pot counted by Hawksely counting slide under x10 magnification and recorded. Infected roots of each plant were washed with tap water, fixed in 4% formalin for 24 h and stained in 0.01 lactic acid-fuchsin (Byrd *et al*., 1983) and then examined for the number of galls, developmental stages, females and egg-masses. Data were subjected to analysis of variance (ANOVA) (Gomez and Gomez, 1984), followed by Duncan's multiple range tests to compare means (Duncan, 1955).

RESULTS AND DISCUSSION

It was evident that the highest reduction percentage of shoot dry and whole plant fresh weights was achieved by 2000 J_2 pot^{-1} (plant), since their values were amounted to 57.17 and 38.82%, respectively, whereas their least values resulted by inoculation level of 1000 J_2 per pot which were amounted to 35.27 and 9.62%, respectively (Table 1).

Table 2 shows that highest reduction percentage on pods number and weight and nodules number was achieved by 2000 J_2 pot^{-1}, since their values were amounted to 36.11, 32.59 and 73.33%, respectively. Meanwhile, the least values of reduction percentage of pods and nodules number resulted by the inoculation level of 1000 J_2 pot^{-1} that averaged 8.33 and 43.58%, respectively. On the other hand, the least value of reduction percentage of the pods weight obtained by the inoculation level of 3000 J_2 per pot which was amounted to 28.61%.

Table 3 and Fig. 1 show that the rate of build-up of *M. javanica* infecting peanut plants, number of galls, developmental stages females and egg-masses were positively affected by three levels of second stage juvenile inoculation under greenhouse conditions at 30±5°C. The highest rate of nematode reproduction on peanut plants was recorded by the level of 2000 J_2 per pot with value of 1.64. However, the lowest values for rate of

Table 1: Impact of *Meloidogyne javanica* infection at three levels of inoculation on growth of peanut plant cv. Giza 4 under greenhouse conditions (30±5°C)

	*Plant growth response							
	Length (cm)		Fresh weight (g)					
Inoculum level	Shoot	Root	Shoot	Root	Fresh weight of whole plant (g)	Reduction (%)	Shoot dry weight	Reduction (%)
1000 J_2	41.00a	21.0b	17.70b	5.29b	22.99b	35.27	5.54ab	09.62
2000 J_2	31.50b	21.75ab	12.26d	2.95c	15.21c	57.17	3.75b	38.82
3000 J_3	36.75b	20.5b	14.00b	4.15bc	18.8b	47.07	3.86b	37.03
Plant free of N	43.25a	30.5b	27.10a	8.42a	35.52a	----	6.13a	-----

N: J_2 of *M. javanica*, *Each value is a mean of four replicates. Mean values in each column followed by the same letter(s) did not differ at $p<0.05$ according to Duncan's multiple-range test

Table 2: Pods yield and nodules number of peanut plant cv. Giza 4 infected with *Meloidogyne javanica* at three levels of nematode inoculation under greenhouse conditions (30±5°C)

Inoculum level	No. of pods	Reduction (%)	Pods weight	Reduction (%)	No. of nodules	Reduction (%)
1000 J_2	3.3a	08.33	6.43a	28.95	5.5b	43.58
2000 J_2	2.3a	36.11	6.10a	32.59	2.6c	73.33
3000 J_3	3.0a	16.6	6.46a	28.61	3.0bc	69.23
Plant free of N	3.6a	----	9.05a	---	9.75a	---

N: J_2 of *M. javanica*., Each value is a mean of four replicates. Mean values in each column followed by the same letter(s) did not differ at $p<0.05$ according to Duncan's multiple-range test

Table 3: Rate of build-up of *Meloidogyne javanica* infecting peanut plant cv. Giza 4 at three levels of inoculation as well as number of galls and eggmasses under greenhouse conditions (30±5°C)

	Nematode population in								
		Root			Rate of build-up			No. of	
Inoculum level	Soil/pot	Develop stages	Females	Total	Pf/Pi	No. of galls	RGI*	egg masses	EGI*
1000 J_2	1048.0c	3.5a	8.5a	1060.0	1.06	9.25b	2	2.0a	1
2000 J_2	3259.0a	10.0a	16.5a	3285.5	1.64	31.25a	4	16.5a	3
3000 J_2	2413.0b	12.25a	15.0a	2440.25	0.80	22.75ab	3	15.0a	3

N: J_2 of *M. javanica*, Each value is a mean of four replicates. Mean values in each column followed by the same letter(s) did not differ at $p<0.05$ according to Duncan's multiple-range test. *Root gall index (RGI) or eggmass index (EGI): 0 = No. galling or eggmasses, 1 = 1-2 galls or eggmasses; 2 = 3-10 galls or eggmasses; 3 = 11-30 galls or eggmasses; 4 = 31-100 galls or eggmasses and 5 = More than 100 galls or eggmasses (Talyor and Sasser, 1978). **RGI or EGI = The average of four replicates

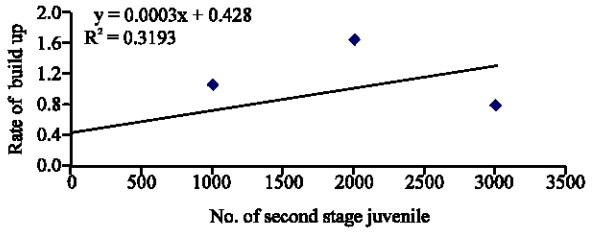

Fig. 1: Rate of build-up of *Meloidogyne javanica* infecting peanut plant at three levels of second stage juvenile inoculation under greenhouse conditions

nematode reproduction resulted by either 3000 or 1000 J_2 pot^{-1} that were recorded to be 0.8 and 1.06, respectively. It was also evident that as the level of *M. javanica* second stage juveniles increased, number of nematode galls and egg-masses was significantly increased with root gall and egg-masses indices values of 3 and 1; 4 and 3; 3 and 3, for 1000, 2000 and 3000 J_2 inoculation levels, respectively. Regression analysis of nematode build-up reached the maximum value of R^2 amounted to 0.3193 (Table 3, Fig. 1). The present study agree with the finding of McSorley *et al.* (1992), who conducted microplot experiments to determine the relationship between yield of peanut and inoculum density of *M. arenaria* race 1. McSorley *et al.* (1992) reported that of nine inoculum densities ranging from 0-200 eggs/100 cm soil (1989) or from 0-100 eggs/100 cm (1990), the higher final densities were obtained in plots inoculated with 0.5-50 eggs/100 cm^3 than in plots inoculated with 100 to 200 eggs/100 cm^3. Meanwhile, the present results are also in accordance with those reported by El-Sherif *et al.* (2007) in respect to *M. incognita* reproduction and host damage that were both affected as the initial inoculum levels increased from 250 to 1000 eggs/tomato plant as well as 2000 eggs per pepper plant.

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