Nematol. medit. (1984), 12: 1-6.

Istituto di Nematologia Agraria, C.N.R., Bari, Italy

EFFECT OF POPULATION DENSITIES OF *MELOIDOGYNE INCOGNITA* ON GROWTH OF SUSCEPTIBLE AND RESISTANT TOMATO PLANTS

by
H. M. R. K. EKANAYAKE and M. DI VITO [1]

Meloidogyne incognita (Kofoid *et* White) Chitw., poses a serious threat to tomato (*Lycopersicon esculentum* Mill.) cultivations in Italy, especially in sandy soil (Di Vito, 1979).

Investigations carried out under field and glasshouse conditions in Apulia showed tolerance limits of a susceptible and a resistant tomato cultivar to *M. incognita* of 4 and 3.3 eggs and juveniles/ml soil and a minimum relative yield of 0 and 0.77 respectively (Di Vito *et al.*, 1981; Di Vito and Ekanayake, 1983). Similar results were obtained by Barker *et al.* (1976) in USA.

In Italy tomato is either transplanted or sown. This study was undertaken to investigate the effect of population densities of *M. incognita* on yield losses of resistant and susceptible varieties of tomato transplanted and sown in soil artificially infested with the nematode.

Materials and Methods

Four series of 91 clay pots were filled with 350 ml of steam sterilized sandy soil (sand 89.1%, clay 7%, silt 3.9%, organic matter 2.3%), and inoculated with a local population of *M. incognita* race 1

[1] Part of the work submitted as a thesis for a post-graduate degree in Zoology-Nematology at the University of Peradeniya, Sri Lanka.

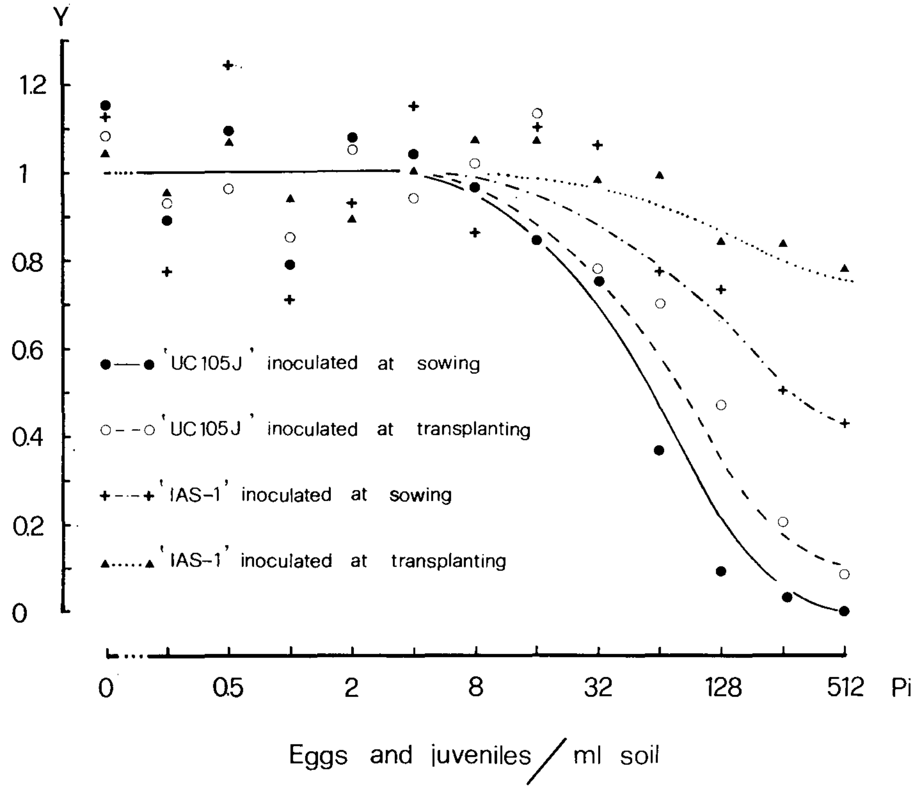

Fig. 1 - Relationship between initial population densities (*Pi*) of *Meloidogyne incognita* race 1 at sowing and at transplanting and relative weight of top (*y*) of susceptible (U.C. 105J) and resistant (line IAS-1) tomato.

(Taylor and Sasser, 1978), at increasing densities according to a geometric progression of 0, 0.25, 0.5, 1, 2, ..., 512 eggs and juveniles/ml soil. A pure culture of the nematode was reared in the glasshouse on tomato cv. « Rutgers » and the eggs and juveniles obtained by the sodium hypochlorite method (Hussey and Barker, 1973). On 15 February 1983 the pots were planted with a 30 day old seedling or sown with five seeds per pot of either the susceptible cv. U.C. 105J or the resistant line IAS-1 of the University of Sassari, Istituto di Agronomia. After germination the seedlings were thinned to one per pot. There were seven replicates for each inoculum level of each cultivar. Pots were arranged according to a randomized block design on benches in a glasshouse maintained at 24-27° C, and watered daily. At the end of the experiment, 28 March 1983, the top of each plant was weighed, and numbers of eggs and juveniles of the nematode, in the soil and in the egg masses on the roots, respectively were determined after extraction by Coolen's (1979) or sodium hypochlorite methods.

Results and Discussion

More than 98% of the seeds of both varieties had germinated 5 days after sowing. The effect of *M. incognita* was very evident on the growth of the susceptible cv. U.C. 105J. Galls were observed also on stems and leaves of some plants grown at an initial population of $\geq$ 64 eggs and juveniles/ml soil. In pots sown with seeds, the number of dead plants was two, three and three after five weeks and four, five and six at the end of the experiment, at initial population densities of 128, 256 and 512 eggs and juveniles/ml soil respectively. Conversely, only two of the transplanted plants of this cultivar had died at the end of the experiment, in pots with an initial population of 512 eggs and juveniles/ml soil.

There was negligible growth reduction of IAS-1 plants, whether sown or transplanted, even at highest inoculum level.

Figure 1 shows the relation between initial population densities (*Pi*) of *M. incognita* and weight of above ground parts of U.C. 105J and IAS-1 plants. Data fit the equation $y = m + (1 - m) z^{P-T}$ (Seinhorst, 1965), where y = the ratio between the weight of the plants at P and that at $P \leq T$; m = the minimum relative yield; P = the initial population density; T = the tolerance limit for $P \geq$ T; and $y = 1$ for $P \leq T$; and z = constant with $z^{-T} = 1.05$ and suggest a tolerance limit (T) of 4 eggs and juveniles/ml soil for both the resistant line and the susceptible cultivar whether sown or transplanted. Minimum relative yields (m) were 0 and 0.1, for the susceptible cv. U.C. 105J, and of 0.4 and 0.75 for the resistant line IAS-1, respectively for sowing and transplanting.

Nematode populations increased in the pots in which U.C. 105J plants were grown in soil infested with $\leq$ 32 and $\leq$ 128 eggs and juveniles/ml soil respectively at sowing and at transplanting, and declined in the pots with higher initial population densities and in those planted with IAS-1 (Table I).

Tolerance limit obtained in this experiment was the same for all cultivars whether sown or transplanted and susceptible or resistant.

Table I - *Population changes of* Meloidogyne incognita *on susceptible U.C. 105J and resistant line IAS-1 tomato sown or transplanted in infested soil.*

Initial population eggs and juveniles/ml soil at sowing and transplanting (*Pi*)	Final population eggs and juveniles/ml soil at harvest (*Pf*)				Multiplication rate (*Pf/Pi*)			
	Sown		Transplanted		Sown		Transplanted	
	U.C. 105J	IAS-1	U.C. 105J	IAS-1	U.C. 105J	IAS-1	U.C. 105J	IAS-1
0.25	6.1	0.2	13.1	0.2	24.4	0.8	52.4	0.8
0.5	15.7	0.14	31.1	0	31.4	0.28	62.2	0.001
1	11.7	0.22	25.9	0.72	11.7	0.22	25.9	0.72
2	33.4	0.06	48	0.24	16.7	0.03	24	0.12
4	25.7	0.28	100.6	0.14	6.4	0.07	25.1	0.03
8	40.5	6.6	129.4	0.18	5	0.8	16.2	0.02
16	48	15.4	171.9	6.9	3	0.9	10.7	0.4
32	55.4	8.5	181.2	5.2	1.7	0.26	5.6	0.16
64	20.5	5.6	254.7	9.9	0.3	0.08	3.9	0.15
128	11.1	5.1	225.7	10.4	0.1	0.04	1.7	0.08
256	42.6	13.9	127.7	28.1	0.2	0.05	0.5	0.1
512	69	21.3	48.8	36.9	0.1	0.04	0.1	0.07

However, values of minimum relative yield (m) were larger with the resistant variety and late infestation of plant roots (transplanting).

The decline of the population of the nematode observed in the pots at the higher initial densities cropped with U.C. 105J may have been due to the shortage or lack of food supply for the nematode, because of the poor growth of the plants following the nematode attack.

The initial population of *M. incognita* decreased dramatically in all the pots transplanted or sown with the resistant line IAS-1. In fact, most of the juveniles which had penetrated the roots were unable to complete their development.

The results of this experiment indicate that *M. incognita* race 1 causes large yield losses in susceptible varieties of tomato, whether the crop is sown or transplanted, but losses are greater when the crop is sown. However, losses should also be expected with resistant cultivars, especially when directly sown in heavily infested soil; these are attributable to damage caused by the penetration into the roots of the infective stage of the nematode.

SUMMARY

The effect of initial densities of *Meloidogyne incognita* (Kofoid *et* White) Chitw. race 1 on the growth of tomato was investigated in a glasshouse experiment using susceptible U.C. 105J, and resistant line, IAS-1, plants. Seeds or 30 day old seedlings were planted in clay pots, containing 350 ml of steam sterilized sandy soil, artificially infested with 0, 0.25, 0.5, 1, 2, ... 256 and 512 eggs and juveniles/ml soil. The weights of the above-ground portion of plants in relation to initial nematode densities, are in agreement with the equation $y = m + (1 - m)\, z^{P-T}$ and suggest a tolerance limit of 4 eggs and juveniles/ml soil for U.C. 105J and IAS-1 either sown or transplanted in infested soil. Minimum relative yields were 0 and 0.1 for U.C. 105J and 0.4 and 0.75 for IAS-1 for sown and transplant treatments respectively. Final population densities of the nematode were low at higher initial population densities with U.C. 105J, especially in the pots that were sown, and at all initial densities with IAS-1. The nematode reproduced actively only at low initial population densities on U.C. 105J.

LITERATURE CITED

Barker K. R., Shoemaker P. B. and Nelson L. A., 1976 - Relationship of initial population densities of *Meloidogyne incognita* and *M. hapla* to yield of tomato. *J. Nematol.*, *8*: 232-239.

Coolen W. A., 1979 - Methods for the extraction of *Meloidogyne* spp. and other nematodes from roots and soil. *In*: Root-knot Nematodes (*Meloidogyne* Species) Systematics, Biology and Control (F. Lamberti and C. E. Taylor, eds.) Academic Press, London, pp. 317-329.

Di Vito M., 1979 - Status of research on biology and control of the root-knot nematodes in Italy. Proc. II Planning Conference on Root-knot Nematodes, *Meloidogyne* spp. Athens, Greece, Nov. 26-30, 1979, pp. 135-137.

Di Vito M. and Ekanayake H. M. R. K., 1983 - Relationship between population densities of *Meloidogyne incognita* and growth of resistant and susceptible tomato. *Nematol. medit.*, *11*: 151-155.

Di Vito M., Greco N. and Carella A., 1981 - Relationship between population densities of *Meloidogyne incognita* and yield of sugarbeet and tomato. *Nematol. medit.*, *9*: 99-103.

Hussey R. S. and Barker K. R., 1973 - A comparison of methods of collecting inocula of *Meloidogyne* spp., including a new technique. *Pl. Dis. Reptr.*, *57*: 1025-1028.

Seinhorst J. W., 1965 - The relation between nematode density and damage to plants. *Nematologica*, *11*: 137-154.

Taylor A. L. and Sasser J. N., 1978 - Identification and control of root-knot nematodes (*Meloidogyne* species). Raleigh, North Carolina State University Graphics, pp. 111.

Accepted for publication on 30 July 1983.