Nematol. medit. (1983), *11*: 169-174.

Istituto di Nematologia Agraria, C.N.R., 70126 Bari, Italy

THE EFFECT OF POPULATION DENSITIES OF *MELOIDOGYNE INCOGNITA* ON THE YIELD OF CANTALOUPE AND TOBACCO

by
M. DI VITO, N. GRECO and A. CARELLA

The relationship between population densities of *Meloidogyne incognita* (Kofoid *et* White) Chitw. and yield of host crops has been studied by a number of investigators to predict yield losses and for better control of the nematode. Hanounik *et al.* (1975) found a tolerance limit of a susceptible cultivar of tobacco (*Nicotiana tabacum* L.) to *M. incognita* of 0.66 eggs/ml of soil, and Barker *et al.* (1981) stated that tobacco yield was reduced at 1.5 eggs/ml of soil. In southern Italy, root-knot nematode greatly reduces the yield of tobacco (Lamberti, 1979) and cantaloupe (*Cucumis melo* L.) but information on the effect of population densities of *M. incognita* on the yield of these crops is lacking. Therefore two experiments were done in microplots at Ginosa Marina (Taranto) in 1982 to study the effect of *M. incognita* on the yields of tobacco cv. Erzegovina and cantaloupe cv. Gusto.

Materials and Methods

Concrete pipes, 30 cm diameter × 50 cm long, were placed in the soil to a depth where 5 cm of the edge remained above ground to serve as microplots. They were spaced at 0.9 × 3 m and each was filled with 36 l of field soil that had been treated with 300 l/ha EDB seven months earlier. The population of *M. incognita* race 1 (determined according to Taylor and Sasser, 1978) was reared for 3 months on pepper, in 14 cm diam clay pots, in a greenhouse maintained at 25-27°C. Pepper roots were washed free of adhering soil, chopped, and thoroughly mixed. The average number of eggs and juveniles in the roots was estimated from thirteen 10 g root samples processed by the sodium hypochlorite method of Hussey and Barker (1973). The roots were thoroughly mixed with 70 kg of steam sterilized soil and the mixture used as inoculum. The population densities tested in both experiments were 0, 0.125, 0.25, 0.5, 1, ... 256 eggs and juveniles/ml soil and each inoculum level had 10 replicates. A randomized block design was used for each experiment. Decline of the nematode population in the absence of the hosts was examined in 10 microplots in each experiment inoculated with 14.3 (tobacco expt.) and 21 (cantaloupe expt.) eggs and juveniles/ml soil and left without plants. Microplots were inoculated on April 21 (cantaloupe) and May 6 (tobacco). by mixing the soil in each of them with the appropriate amount of the inoculum. Five seeds of cantaloupe cv. « Gusto » were sown in each microplot on April 22 and thinned to one plant per microplot at plant emergence. Tobacco cv. « Erzegovina » was transplanted on May 6 using one two-month old seedling per microplot. Routine cultural practices were followed during the experiments and tobacco leaves were harvested on June 16, 29, July 16 and August 6, 25, and cantaloupe fruits on July 14, 20 and 28. Twenty soil cores were collected from each microplot using a soil sampler of 2.5 cm diam and 25 cm long, on August 20 for cantaloupe and August 26 for tobacco. The samples were processed by the method of Coolen (1979) and eggs and juveniles counted.

Results

Soil temperatures at 20 cm depth ranged from 16-27°C during the experiment and were suitable for plant growth and nematode infestation. The effect of nematode attack on cantaloupe was noticeable from plant emergence onwards, and at harvest all plants had died in the microplots inoculated with $\geq$ 16 eggs and juveniles/ml soil and 7 died in the microplots inoculated with 8 eggs/ml soil.

Reduction of plant growth was seen on tobacco from 2 weeks after transplanting and the plants died in the microplots inoculated with $\geq$ 64 eggs and juveniles/ml soil. The yields of cantaloupe and the weights of green tobacco leaves were greatly reduced in the inoculated microplots, and tolerance limits (T) of 0.19 and 2 eggs and juveniles/ml soil for cantaloupe and tobacco respectively (Fig. 1)

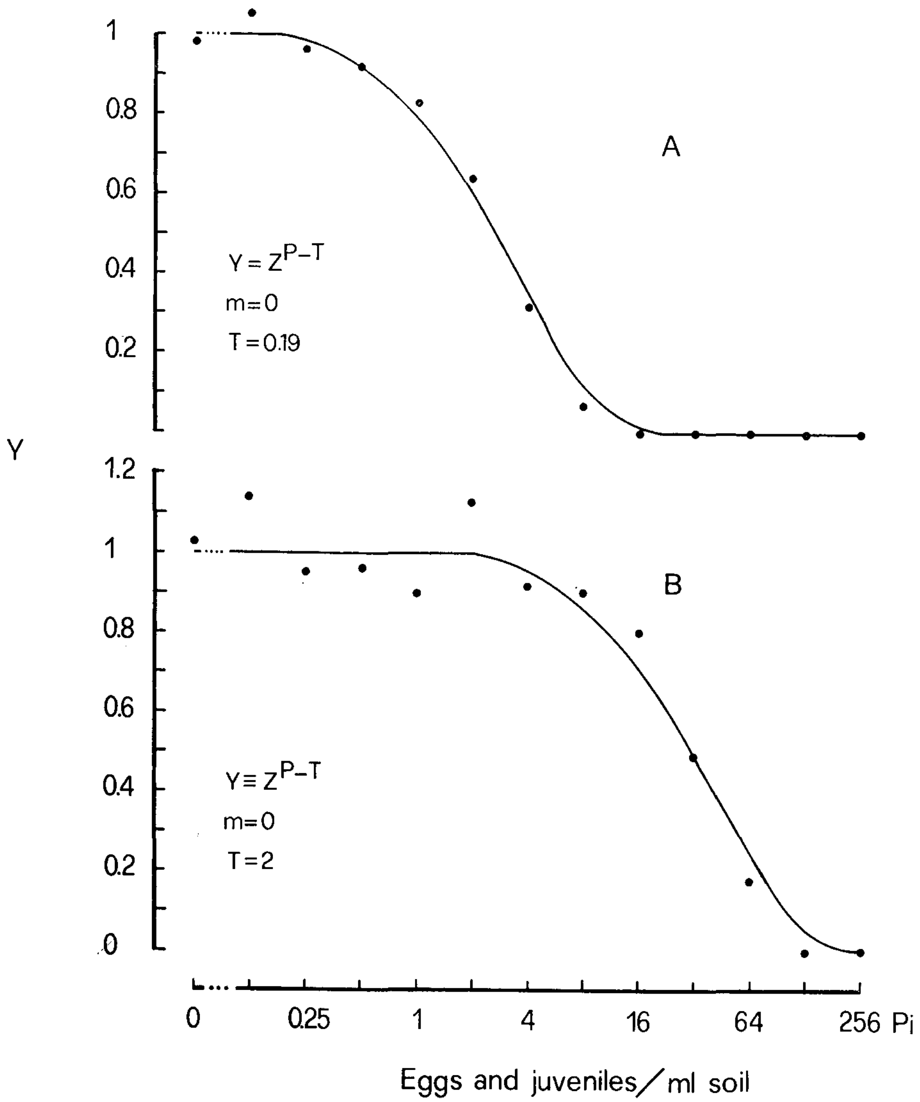

Fig. 1 - Relationship between initial population densities (*Pi*) of *Meloidogyne incognita* and relative yield (y) of cantaloupe (A) and tobacco (B).

were derived by fitting the data with a curve according to the equation $y = m + (1 - m) z^{P-T}$ for $P \geq T$ and $y = 1$ for $P \leq T$ with $z^{-T} = 1.05$ and $m = 0$. Tolerance limits for total weight of tobacco plants and weight of green leaves were the same. However, death of plants at initial nematode densities of $\geq$ 40 T for cantaloupe and $\geq$ 32 T for tobacco indicates that a mechanism similar to Seinhorst's (1981) « second mechanism of growth reduction » affected the plants. In that case $m = 0$ is an understimation for that applying to growth reduction by « the first mechanism of growth reduction » operating at initial nematode densities $\geq T$. However, without further information (water consumption/G/plant day, dry matter content) it is impossible to estimate the proportions of the weight reduction due to either of the two mechanisms. The estimates of T are not affected by assuming either one or two growth reducing mechanisms.

Final populations of the nematode (Table I) were not as large as expected, in both experiments, and they could not be fitted with the Seinhorst's equation (Seinhorst, 1970).

Table I - *Population changes of* Meloidogyne incognita *on cantaloupe cv «Gusto» and tobacco cv «Erzegovina».*

Eggs and juveniles/ml soil		
Initial Population	Final Population (Pf)	
(Pi)	Cantaloupe	Tobacco
0.125	10.9	15.6
0.25	20.1	16.5
0.5	10.1	31.5
1	8.3	24.7
2	7.9	43.5
4	6.5	38.4
8	7.5	35.6
16	4.6	41.6
32	4.1	33.3
64	6.3	7.9
128	7.5	7
256	5.3	6.6

Discussion

These investigations confirmed that yields of tobacco and of cantaloupe are greatly affected by *M. incognita*, the cultivar of cantaloupe being more susceptible than that of tobacco. Infested roots, instead of nematodes alone, were used in these experiments, therefore other microorganisms may have also been added to the microplots.

Nevertheless, the relationship between population densities of the root-knot nematode and the yields of these crops was well fitted by the Seinhorst's equation, indicating that other organisms may have had only a slight effect on the yield of the host crops. The tolerance limit of the tobacco cultivar to the nematode was higher than those found by Hanounik *et al* (1975) and Barker *et al* (1981), but crop practices and tobacco cultivars probably account for these differences. Final population densities and reproduction rates were not as large as might be expected for this nematode. At larger initial population densities the host plant was more severely damaged by the nematode resulting in much reduced root systems which were unable to support large populations of the nematode. Therefore, late in the season, many juveniles probably died in the soil because they were unable to enter viable host roots and in senescing roots before completing their development. In the cantaloupe experiment a decline of the population may also have occurred because of delay in soil sampling. Therefore, these experiments do not provide information on the actual maximum reproduction rate of the nematode, but the results obtained suggest that farmers should be aware of the preplanting soil population density of *M. incognita*, to predict yield losses and accordingly to choose an appropriate pest management programme to reduce the population density at $\leq T$.

SUMMARY

Two experiments were done in microplots to relate population densities of *M. incognita* race 1 and yield of a cultivar of tobacco and of cantaloupe. Tolerance limits of 2 and 0.19 eggs and juveniles/ml soil were respectively derived by fitting the data with the equation $y = m + (1 - m)\, z^{P-T}$ proposed by Seinhorst. Final population and multiplication rates of the nematode were smaller than expected.

LITERATURE CITED

Barker K. R., Todd F. A., Shane W. W. and Nelson L. A., 1981 - Interrelationship of *Meloidogyne* species with flue-cured tobacco. *J. Nematol.*, *13*: 67-79.

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 » (Lamberti F. and Taylor C. E., eds.), Academic Press, London, pp. 317-329.

Hanounik S. B., Osborne W. W. and Pirie W. R., 1975 - Relationship between the population density of *Meloidogyne incognita* and growth of tobacco. *J. Nematol.*, 7: 352-356.

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.

Lamberti F., 1979 - Economic importance of *Meloidogyne* spp. in subtropical and mediterranean climates. In: « Root-knot Nematodes (*Meloidogyne* Species), Systematics, Biology and Control ». (Lamberti F. and Taylor C. E., eds.), Academic Press, London, pp. 341-357.

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

Seinhorst J. W., 1970 - Dynamics of populations of plant parasitic nematodes. *Ann. Rev. Phytopathol.*, *8*: 131-156.

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

Accepted for publication on 5 July 1983.