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

POPULATION DENSITIES OF *MELOIDOGYNE INCOGNITA* AND GROWTH OF CABBAGE IN POTS

by

N. SASANELLI, M. DI VITO and G. ZACCHEO

Summary. The relationship between initial population densities (*Pi*) of *Meloidogyne incognita* host race 1 and growth of cabbage plants was investigated in a pot experiment. Pots were artificially infested with finely chopped nematode-infected tomato roots to give a range of population densities of 0, 0.062, 0.125, 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128 or 256 eggs and juveniles/cm^3 soil. The tolerance limit of cabbage to *M. incognita* was 0.5 eggs and juveniles/cm^3 soil and a minimum relative yield for top weight of 0.05 occurred at $Pi \geq 32$ eggs and juveniles/cm^3 soil. The maximum reproduction rate of the nematode was 68-fold and occurred at the lowest *Pi*.

Several phytoparasitic nematodes can infest and cause damage to cabbage (*Brassica oleracea* var. *capitata* L.). Among them are *Heterodera schachtii* Schmidt (Abawi and Mai, 1980), *Meloidogyne artiellia* Franklin (Di Vito *et al.*, 1985b) and *M. incognita* (Kofoid *et* White) Chitw. *Heterodera schachtii* is not widespread in southern of Italy while *M. artiellia*, although common, does not seem to be of economic importance for those crops which are planted in summer, such as cabbage (Di Vito, 1988). *Meloidogyne incognita* conversely is widespread in southern Italy and severe yield loss of cabbage may occur in sandy soils if the crop is planted in August. There is, however, no precise information on the effect of this root-knot nematode on cabbage, and therefore a glasshouse experiment was undertaken to ascertain the relationship between initial population densities of *M. incognita* and growth of cabbage in pots.

Materials and methods

Ninety-eight clay pots were filled each with 750 cm^3 of steam sterilized sandy soil (7% clay, 3.9% silt, 89.1% sand and 2.3% organic matter). An Italian population of *M. incognita* host race 1 (Taylor and Sasser, 1978) from sugarbeet (*Beta vulgaris* L.) (Castellaneta - Apulia), was reared on tomato (*Lycopersicon esculentum* Mill.) cv. Rutgers for two months in a glasshouse. Tomato roots infested by the nematode were finely chopped and the numbers of eggs and juveniles in the egg masses on the roots were estimated by shaking ten root samples of 10 g each with a 1% aqueous solution of sodium hypochlorite (Hussey and Barker, 1973). The roots were then thoroughly mixed with 4 kg of steam sterilized sandy soil and appropriate amounts of this soil mixture were incorporated into the soil of each pot to give population densities of 0, 0.062, ... 128 or 256 eggs and juveniles of the nematode/cm^3 soil (Table I). The pots were arranged in a randomized block design with seven replicates of each density on benches in a glasshouse at 24 °C ± 2. A two-month old cabbage seedling, cv. Precoce Mercato di Copenaghen, was transplanted into each pot on 28 April 1989. Irrigation, fertilization, and disease and pest control measures were applied as required. The cabbage plants were uprooted two months after transplanting and top and root fresh weights were recorded. The final population densities (*Pf*) and the reproduction rate (*Pf/Pi*) of the nematode in each pot were determined by processing 500 cm^3 of soil with the modified Coolen's method (Coolen, 1979; Di Vito *et al.*, 1985a), and by processing separately each cabbage root with a 1% aqueous solution of sodium hypochlorite (Hussey and Barker, 1973). Eggs and juveniles in the water suspension were then counted.

Results and discussion

Symptoms (stunting and yellowing) of nematode attack were evident two weeks after transplanting in pots infested with $\geq$ 64 eggs and juveniles/cm^3 soil. Two plants in pots with *Pi* = 128 eggs/cm^3 soil and four in those at *Pi* = 256 eggs/cm^3 were dead 40 days after transplanting.

Top and root weights of the plants were greatly affected by *M. incognita*. Top weight data were consistent with the equation $y = m + (1 - m)\, z^{P-T}$ (Seinhorst, 1965; 1979), where y is the ratio between the yield at *Pi* and that at $P \leq T$, m the minimum relative yield (y at very large *Pi*), z a constant < 1 with $z^{-T} = 1.05$, T the tolerance limit (*Pi* at which no yield is lost), and P initial population density. Fitting the data to the above equation (Fig. 1) gave a tolerance limit (T) of cabbage to the nematode of 0.5 eggs and juveniles/cm^3 soil and a minimum relative yield (m) of 0.05 at $Pi \geqslant 32$ eggs and juveniles/cm^3 soil. The root weight of cabbage seemed to increase with the increase of the nematode population up to $Pi = 1$ egg/cm^3 soil and declined with further increases of the nematode population (Tab. I).

The final population densities (Pf) of *M. incognita* increased with increasing Pi from 0.062 to 2 eggs/cm^3 but declined at $Pi \geqslant 4$ eggs/cm^3 soil (Table I). The maximum reproduction rate (Pf/Pi) was 67.7 at the lowest Pi and in general declined as Pi increased (Table I). An equilibrium density of the nematode of about 8 eggs/cm^3 soil (Table I) was also estimated.

These investigations demonstrate the pathogenic effect of *M. incognita* on cabbage and indicate that severe damage may occur if the crop is grown in fields heavily infested by this nematode. Seinhorst (1979) demonstrated that the damage caused by *M. incognita* infestation is more severe at the seedling stage and therefore to minimize yield losses it is suggested that nematode free transplants are used in cabbage plantations. Treating infested soil with nematicides before planting is also recommended to protect the crop from damage by the nematode.

TABLE I - *The effect of initial population densities (Pi) of* Meloidogyne incognita *race 1 on the final population densities (Pf) and reproduction rate (Pf/Pi) of the nematode, and on the fresh weight of roots of cabbage (cv. Precoce Mercato di Copenaghen) grown in pots for 60 days.*

Eggs and juveniles/cm^3 soil		Reproduction rate	Root weight (g)		
Pi	*Pf*	*(Pf/Pi)*			
0	–	–	1.56	cdefgh	BCD
0.062	4.2	67.70	1.97	cde	BCD
0.125	2.2	17.60	2.65	bc	AB
0.25	0.9	3.40	2.13	cd	BC
0.5	2.2	4.40	3.85	ab	A
1	3.3	3.30	3.95	a	A
2	32.5	16.20	2.62	bc	AB
4	6.7	1.70	1.65	cdefg	BCD
8	4.3	0.50	1.09	defgh	BCD
16	12.7	0.80	1.75	cdef	BCD
32	4.7	0.14	0.50	fgh	D
64	4.5	0.07	0.64	efgh	CD
128	13	0.10	0.30	gh	D
256	7.5	0.03	0.23	h	D

Figures in colum followed by the same letter are not significantly different according to Duncan multiple range test, (small letters for $P \leqslant 0.05$; capital letters for $P \leqslant 0.01$).

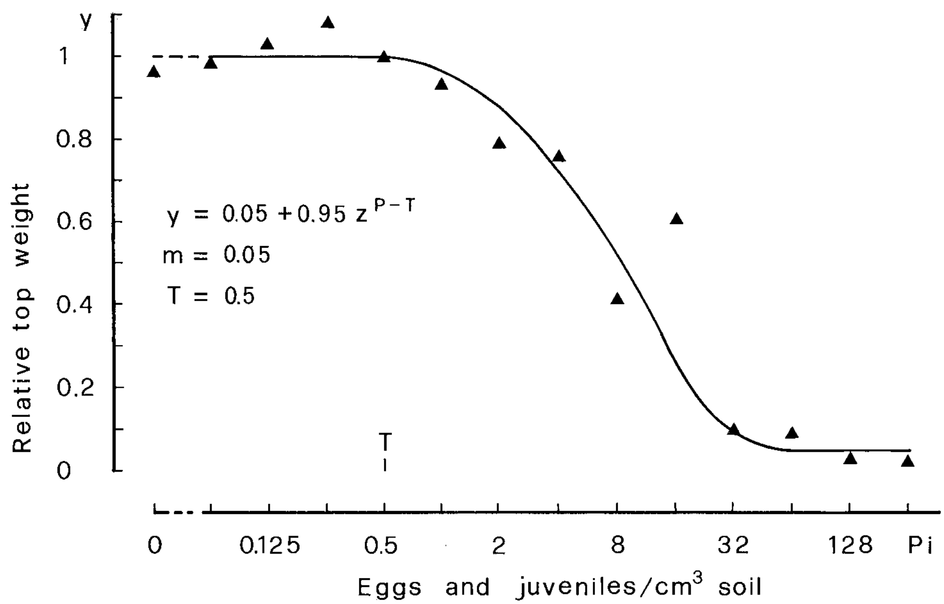

Fig. 1. Relationship between initial population densities (*Pi*) of *Meloidogyne incognita* host race 1 and relative fresh top weight (*y*) of cabbage (cv. Precoce Mercato di Cophenaghen) in pots.

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