THE EFFECT OF MELOIDOGYNE INCognITA ON GROWTH OF SUNFLOWER IN POTS

by

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Summary. The effect of Meloidogyne incognita host race 1 on the growth of sunflower was investigated in a glasshouse experiment. Pots were 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, 256 or 512 eggs and juveniles/cm³ soil. Tolerance limits (T) of 1.85, 2.37 and 2 eggs and juveniles of M. incognita/cm³ soil were estimated for top weight, height and number of nodes of sunflower plants, respectively. Minimum relative yield (y) were 0.25, 0.3 and 0.5 for top weight, height and number of nodes of sunflower plants, respectively. The maximum rate of nematode reproduction on sunflower, about 81, occurred at the lowest initial population of the nematode.

Sunflower (Helianthus annuus L.) crop is of worldwide importance with 15,000,000 ha under cultivation yielding 21,000,000 t of seed. In Italy production of this crop has increased rapidly to 155,000 ha and 330,000 t during the last decade (FAO, 1989). Among several pests that attack sunflower in Italy, root-knot nematodes (Meloidogyne spp.) are the most common. However, information on the relationship between initial population density of Meloidogyne incognita (Kofoid et White) Chitw. and yield loss of sunflower is lacking. Therefore, a pot experiment was undertaken to ascertain the growth of sunflower at different infestation levels of an Italian population of M. incognita.

Materials and methods

The population of M. incognita host race 1 (Taylor and Sasser, 1978) was reared on tomato (Lycopersicon esculentum Mill.) cv. Rutgers. Tomato roots infested by the nematode were finely chopped and the number of eggs and juveniles in the egg masses on the roots were estimated by processing ten root samples of 10 g each with 1% aqueous solution of sodium hypochlorite (Hussey and Barker, 1973). The roots were then thoroughly mixed with 3 kg of steam sterilized sandy soil and used as inoculum. Appropriate amounts of this inoculum were thoroughly mixed with the steam sterilized sandy soil in each pot (750 cm² soil) to give population densities of 0, 0.062, 0.125, 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512 eggs and juveniles of M. incognita/cm³ soil. Two pregerminated seeds of sunflower cv. Rossun HS 301 were sown in each pot on 15 March 1990 and thinned to one plant per pot five days later. The pots were arranged in a randomized block design with 9 replicates on benches in a glasshouse at 26 °C ± 2.

The sunflower plants were harvested 45 days after sowing and the height, number of nodes and fresh and dry top weights were recorded. Final nematode soil density was determined by processing 500 cm³ of soil per pot by a modified Coolen’s method (Coolen, 1979; Di Vito et al., 1985). The roots were processed in 1% aqueous solution of sodium hypochlorite (Hussey and Barker, 1973) to count eggs and juveniles.

Results

Meloidogyne incognita race 1 negatively affected the growth of sunflower plants. Symptoms (stunting) of the nematode attack were evident 15 days after sowing in pots infested with ≥ 128 eggs/cm³ soil and 10 days later in pots infested with ≥ 32 eggs/cm³ soil. Fresh and dry top weights, height and number of nodes of plants were greatly affected by M. incognita; and the data were consistent with the equation \( y = m + (1 - m) z P - T \) (Seinhorst, 1965; 1979), where \( y \) is the ratio between the yield (fresh and dry weight, height and number of nodes of plants) at \( P_i \) and that at \( P < T \), \( m \) the minimum relative yield (yield at very large \( P_i \)), \( z \) a constant < 1 with \( z P - T = 1.05 \), \( T \) the tolerance limit (at which no yield is lost), and \( P \) initial population density. Fitting the data to the above equation (Figs. 1, 2) gave tolerance limits of 1.85, 2.37 and 2 eggs/cm³ soil for top fresh weight, height, and number of nodes of sunflower plants, respectively. The minimum relative yields (\( m \)), for the same parameters, were 0.25, 0.3 and 0.5 at \( P_i \) ≥ 128, 256 and 256 eggs/cm³ soil, respectively (Figs. 1, 2). The value of the tolerance limit (\( T \) ) and relative minimum yield (\( m \)) for the dry top weight of the plants were the same as for the fresh top weight.
The reproduction rate \( (P_f/P_i) \) of *M. incognita* race 1 was greater (80.7) at \( P_i = 0.062 \) and decreased with increasing \( P_i \) (Fig. 3). The equilibrium density of the nematode was estimated at 231.4 eggs and juveniles/cm\(^3\) soil (Fig. 3).

**Discussion**

The results of our experiment demonstrate that *M. incognita* can severely affect the growth of sunflower, whereas in Florida, Rich and Green (1981) found that *M. javanica* did not. Although root-knot nematode species may differ in their pathogenicity, we consider that this apparent discrepancy may be due to the density and type of inoculum used. In Florida the nematodes used were obtained by the sodium hypochlorite method (Hussey and Barker, 1973). Previous pathogenicity tests (O’Bannon *et al.*, 1965; Vrain, 1977; Di Vito *et al.*, 1986) have demonstrated that the use of eggs and juveniles of *M. incognita* from dissolved egg masses is much less suitable than entire egg masses. Moreover, the nematode densities used in Florida (5, 25 and 125 eggs and juveniles/100 cm\(^3\) soil) were rather low and probably close to the tolerance limit of sunflower to the nematode and were, therefore, not potentially capable of causing any yield loss.

Our findings indicate that sunflower plants can be severely damaged if grown in root-knot nematode infested soils, particularly in sandy soil which are conducive to nematode infection. However, damage by *M. incognita* could be reduced by sowing as early as possible, when soil temperatures are still relatively low, and therefore unfavorable for nematode reproduction.

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**Fig. 1** - Relationship between initial population density \( (P_i) \) of *Meloidogyne incognita* host race 1 and relative fresh and dry top weight of sunflower (cv. Romsun HS 301) grown (for 45 days) in pots in a glasshouse.
Fig. 2 - Relationship between initial population density ($P_i$) of *Meloidogyne incognita* host race 1 and relative height and number of nodes of sunflower (cv. Romsun HS 301) grown (for 45 days) in pots in a glasshouse.

Fig. 3 - Relationship between initial ($P_i$) and final ($P_f$) population density of *Meloidogyne incognita* host race 1 on sunflower (cv. Romsun HS 301) grown (for 45 days) in pots in a glasshouse.
Literature cited


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