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EFFECT OF POPULATION DENSITIES OF *MELOIDOGYNE ARTIELLIA* ON YIELD OF WHEAT

by
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Summary. A microplot experiment was undertaken to study the effect of initial population densities of *Meloidogyne artiellia*, in the range 0 to 128 eggs and juveniles/cm^3 soil, on the yield of durum wheat. Tolerance limits of wheat of 0.39, 0.43 and 0.227 eggs and juveniles/cm^3 soil were derived for top and grain weights and number of spikes, respectively. Minimum yields were 0.2, 0.1 and 0.55, for top and grain weight and number of spikes, respectively. The maximum reproduction rate and the equilibrium density of *M. artiellia* were 188.7 and 114.05, respectively. In the absence of a host plant the nematode population declined to 48% of that at sowing.

Meloidogyne artiellia Franklin was first reported from England on cabbage (Franklin, 1961). The nematode has since been reported from Greece and associated with decline of wheat (Kyrou, 1969), from France on cabbage, cereals and legumes (Ritter, 1972), from Spain on barley, wheat and chickpea (Tobar-Jimenez, 1973) and from Syria on stunted chickpea (Greco *et al.*, 1984). *Meloidogyne artiellia* has been found on chickpea in Italy (Greco, 1984), often in association with severe decline of durum wheat in the South. The pathogenicity of *M. artiellia* has not been investigated under field conditions and therefore an experiment was undertaken in 1986-1987 in Italy to assess yield losses of durum wheat (*Triticum durum* Desf.) caused by the nematode.

Materials and methods

One hundred forty concrete microplots 30 cm square section and 50 cm deep were placed in the field at Bari at 45 cm depth, contiguous along the rows and spaced 30 cm between rows. The microplots were filled to 5 cm from the top, with sandy loam soil fumigated with 300 l/ha of 92% 1,3 dichloropropene 6 months before.

Meloidogyne artiellia was reared on wheat in microplots under natural conditions. The infested soil was then thoroughly mixed and 500 cm^3 soil samples were processed by Coolen's modified method (Coolen, 1979; Di Vito *et al.*, 1985) to determine the nematode population. Soil from each microplot was then separately and thoroughly mixed with 10 g of fertilizer (10% N and 10% P_2O_5) and appropriate amounts of infested soil, using a concrete mixer, to give population densities of the nematode ranging from 0 to 128 eggs and juveniles/cm^3 soil. Each population density of the nematode was replicated 7 times in a randomized block design. Ten more microplots infested with 15.9 eggs and juveniles/cm^3 soil were left without plants to ascertain the decline of the nematode population in the absence of a host.

Two grammes (approximately = 45 seeds) of durum wheat cv. Creso were sown in each microplot on 12 December 1986. During the experiment 2 g/microplot of a nitrogen fertilizer containing 26% N, were applied on 20 February and 25 March 1987. At harvest (18 June 1987) straw and grain yield from each microplot were weighed. A soil sample, composed of 20 cores was then collected from each microplot to a depth of 30 cm using an auger. Eggs and juveniles of the nematode were then extracted as before and counted. All data were fitted to Seinhorst equations (Seinhorst, 1965; 1970).

Results and discussion

The effect of *M. artiellia* attack (yellowing and stunting) on the growth of durum wheat was evident in February and March 1987 at $Pi \geq 16$ eggs and juveniles/cm^3 soil. At lower population densities of the nematode these symptoms became obvious later. Emergence, flowering and earing time of wheat were not affected by the nematode infestation.

Data of the top plant (straw and grain) and grain weights and number of spikes per microplot agreed with

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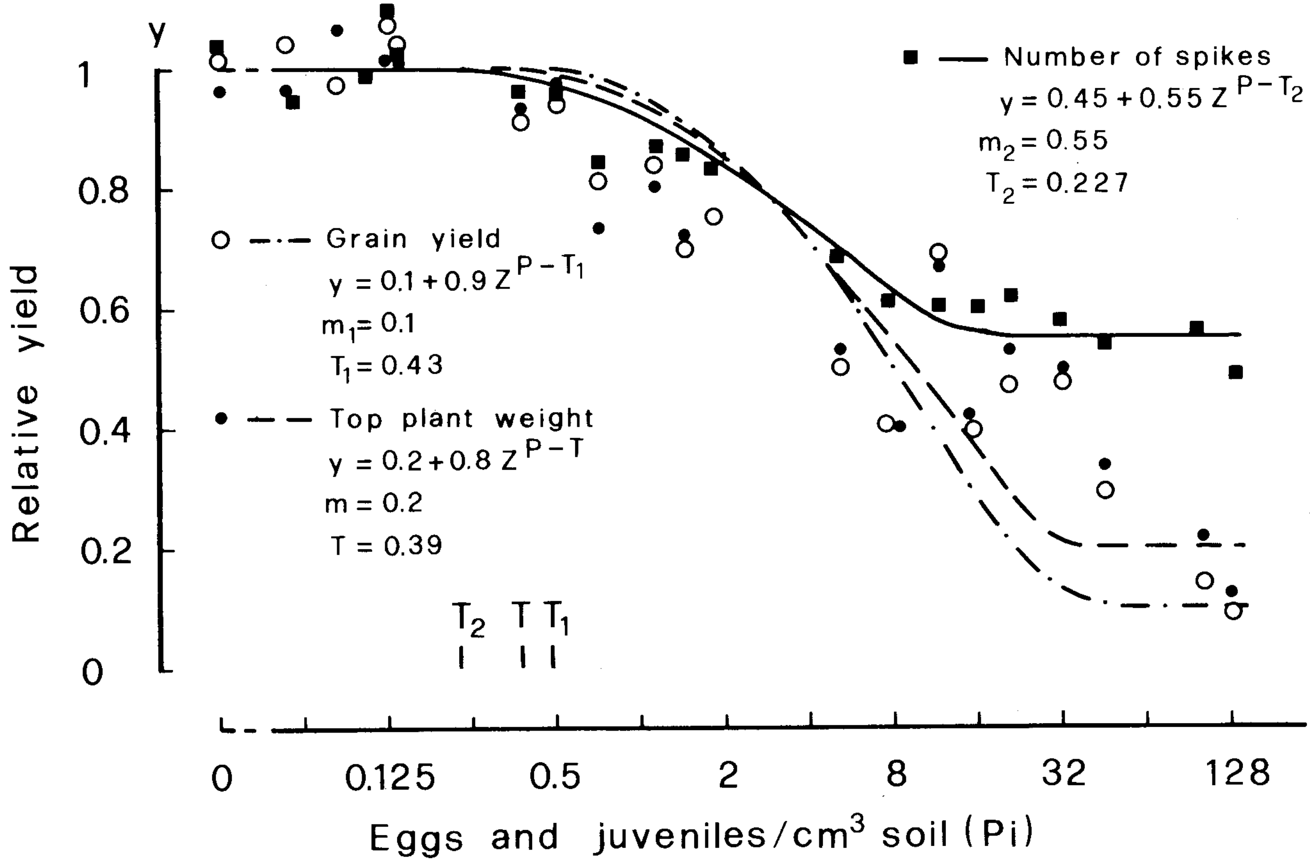

Fig. 1 - Relationship between initial population densities (*Pi*) of *Meloidogyne artiellia* and relative top and grain weight, and number of spikes of durum wheat.

the equation $y = m + (1\text{-}m)z^{P\text{-}T}$ (i) proposed by Seinhorst (1965). Fitting the data to this equation gave a tolerance limit (*T*) for wheat of 0.39, 0.43 and 0.227 eggs and juveniles/cm^3 soil for top plant and grain weights and number of spikes, respectively (Fig.1). The minimum relative yields (*m*) were 0.2 and 0.1 at 32 eggs/cm^3 soil for top plant and grain weights, respectively, and 0.55 at 16 eggs/cm^3 soil for number of spikes (Fig.1).

The relationship between nematode population densities of *M. artiellia* before sowing (*Pi*) and at harvest (*Pf*), is adequately described by the equation $Pf = rfa\,(^{e}\text{-} \log q)^{-1} (1\text{-}q^{Pi}) + rb(1\text{-} y)Pi + b(1\text{-} r)\, Pi$ (ii) (Seinhorst, 1970; 1986). However, a maximum reproduction rate (*Pf/Pi*) of 188.7 was estimated at the lowest initial population density by fitting the equation (ii) to the data (Fig.2). The equilibrium density was 114.05 eggs and juveniles/cm^3 soil. While in the absence of the host plant the population of *M. artiellia* at harvest was 48% of that at sowing. The highest final population density (*Pf*) of 389.1 eggs and juveniles/cm^3 was attained in microplots with $Pi = 32$ eggs/cm^3 soil.

These results confirm the destructive effect of *M. artiellia* on wheat in Italy.

The tolerance limit of durum wheat to *M. artiellia* is the same as that reported for wheat and *Heterodera avenae* Woll. in Australia (Meagher and Brown, 1974), but higher than that of chickpea and *M. artiellia* (Di Vito and Greco, 1988), which suggests that durum wheat is less susceptible to the nematode than chickpea. The rate of reproduction of *M. artiellia* on wheat was higher (188.7) than that found, in the same conditions, on winter (55.5) and spring chickpea (3.38) (Di Vito *et al.*, 1988). In southern Italy, and more generally in the Mediterranean basin, cereals are continuously and intensively cultivated and therefore severe damage must be expected in fields with *M. artiellia*. In this area cereals are commonly rotated with leguminous crops, which are also good hosts for *M. artiellia*. Unfortunately no cultivars resistant to *M. artiellia* are available (Di Vito and Zaccheo, 1987). However, appropriate crop rotations with non host plants, assuming an annual decline of *M. artiellia* population densities of 50%, would drastically reduce yield losses of host crops.

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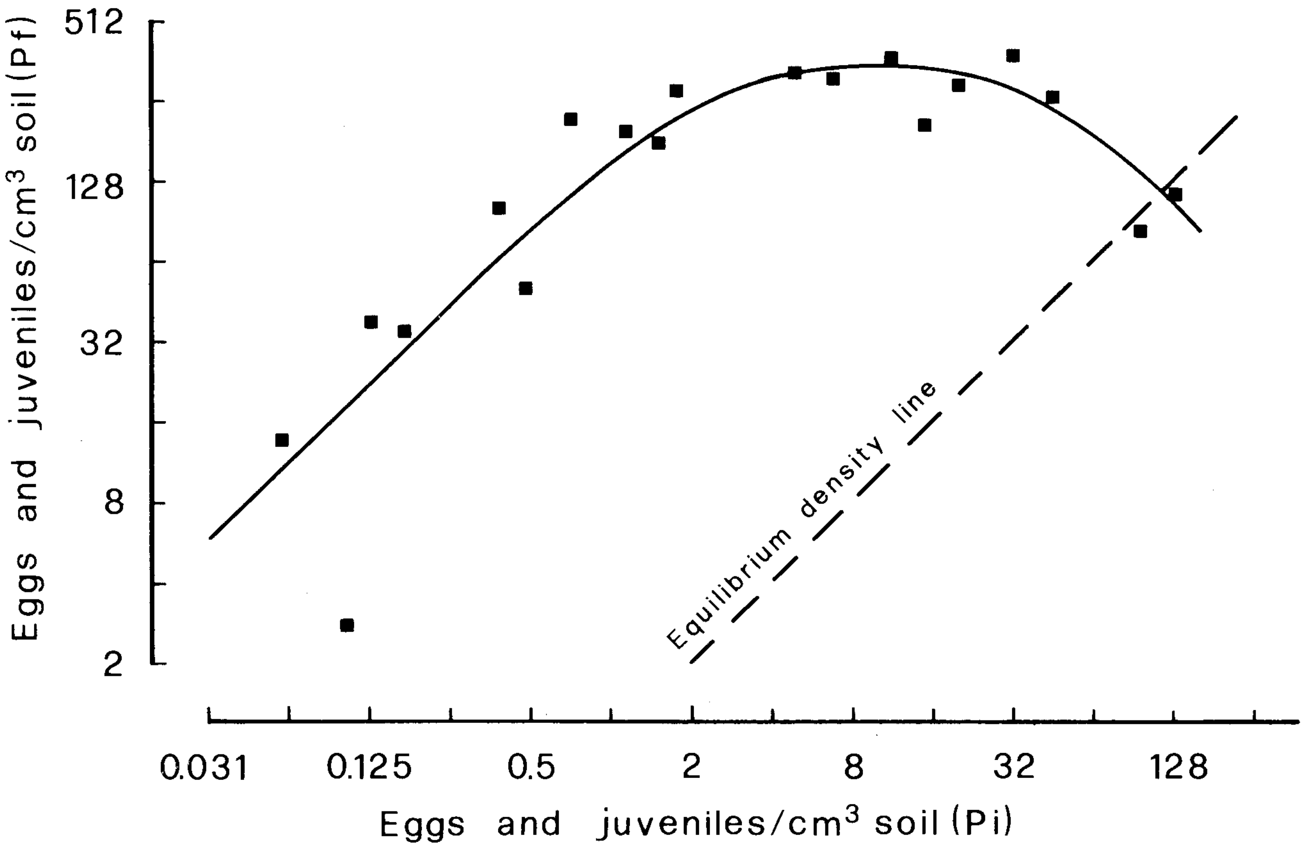

Fig. 2 - Relationship between initial (*Pi*) and final (*Pf*) population densities of *Meloidogyne artiellia* on durum wheat.

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