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PATHOGENICITY OF THE BURROWING NEMATODE, *RADOPHOLUS SIMILIS* TO YOUNG TEA AT DIFFERENT INITIAL DENSITY

Nalini C. Gnanapragasam and U. B. Herath

(Tea Research Institute of Sri Lanka, Talawakele, Sri Lanka)

Young TRI 2025 plants inoculated with different initial densities (500, 1000, 2000 and 3000) of the burrowing nematode *Radopholus similis* revealed a clear linear reduction in shoot and root weight with increasing inoculum level at 10 months from inoculation. At all infestation levels, typical symptoms of nematode damage was observed in the form of stunted growth, pale leaves and pre-mature flowering and fruiting. The reduction in growth was found to be significantly different from the uninfested control at all treatments receiving an initial density of 1000 nemas and above/3600 cc of soil (28 nemas and above/100 cc soil) thus establishing the fact that within a short span of 10 months severe damage to tea plants could occur when the plants are exposed to an initial density of 28 nemas/100 cc of soil affecting establishment in the field.

INTRODUCTION

One of the factors that affects the field establishment of young tea is the initial population level (PI) of plant pathogenic nematodes. A heavy initial population of *Pratylenchus loosi* was found to suppress the root growth of tea plants throughout the entire early, growing period, whilst such suppression was completely averted by an initial reduction of the nematode population (Sivapalan, Gnanapragasam and Jebamalai, 1980). The influence of the initial nematode population on subsequent damage to crops has been well established for several other crops (Lownsberry and Peters, 1955 ; Wallace, 1963 ; Seinhorst, 1965 ; Oostenbrink, 1966 ; Olthof and Potter, 1972 ; Ferris, 1974 ; Sasser, Barker and Nelson, 1975).

The slow mobility and the low reproductive potential are one of the main reasons why pre-plant population density of nematodes play a significant role in determining the crop damage (Oostenbrink, 1972).

The initial population density that could cause significant crop damage at any particular time depends upon the environmental condition (type of soil, moisture, temperature), the particular variety of the host plant and the relevant species of nematode.

This threshold level for *P. loosi* on tea has been determined to be 80 nemas/100 g soil at a temperature range of 18-24°C, whilst at a lower temperature of 12°C this initial density has been estimated to be as much as 640 nemas/100 g soil (Gnanapragasam and Manuelpillai, 1984).

The present experiment was carried out to estimate the pre-plant density level of the burrowing nematode, *Radopholus similis*, that causes economic damage to a susceptible cultivar of young tea. Since *R. similis* favours warmer temperatures of 25-30°C this experiment was carried out under controlled soil temperatures maintained at 26° ± 1°C.

MATERIALS AND METHODS

Thirty plastic pots (18.5 cm in diameter x 16.5 cm height) were each filled with about 3600 cc of fumigated clayey loam soil (fumigated with Methyl bromide at the rate of 0.5 kg/2.83 cm^3). Uniform, one-year-old healthy TRI 2025 plants (susceptible to *R. similis*) were each transplanted into the above pots and maintained in the glass-house for a period of 2 weeks, prior to transferring into a large thermostatically controlled water bath. The temperature of this water bath (described by Sivapalan and Gnanapragasam, 1975) was adjusted to maintain the soil temperature at 26° ± 1°C, which temperature is favourable for the build-up of this species of nematode.

Having stabilized the temperature of the potted soil at 26° ± 1°C for a period of one month, a set of six replicates each was inoculated with the following number of nematodes : 500, 1000, 2000 and 3000 respectively. The source of inoculum for this experiment was obtained from carrot culture. An uninoculated group of six plants served as controls to estimate the degree of pathogenicity. The pots inoculated with the different levels of nematodes were then arranged in a completely randomised block design in the water bath and maintained thus for a period of 10 months during which period they were watered and fertilised regularly. At the end of 10 months from inoculation the plants were carefully removed from the pots, washed and the fresh weights of both shoots as well as the roots were determined. The washed feeder roots of each plant were cut into one cm pieces, mixed thoroughly and duplicate samples of 5 g each were processed for nematode recovery by the method described by Hutchinson (1962).

RESULTS AND DISCUSSION

All the inoculated plants, including those which received the lowest level of inoculum (PI = 500 nemas/3,600 cc of soil), manifested the typical symptoms of nematode damage in the form of stunted growth with pale leaves, pre-mature flowering and fruiting and reduced root growth (Fig. 1).

The results of analysis of variance of the mean shoot and root weight as well as the root infestation density at 10 months from inoculation, is presented in Table 1. A clear linear reduction in shoot and root weights was observed with increase in the initial inoculum level of nematodes. Although a decrease in growth was evident even at the lowest inoculum level (equivalent to 500 nemas/3600 cc of soil or 14 nemas/100 cc of soil) the shoot and root weight of plants exposed to this level of infestation were not significantly different from that of the uninfested controls.

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Fig. 1 — Young tea plants (TRI 2025) inoculated with varying levels of *Radopholus Similis* showing typical symptoms of damage in the form of reduced shoot and root weight as well as pre-mature flowering (Number of nematodes/plot–T_1—O; T_2=500; T_3=1000; T_4=2000 and T_5=3000).

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TABLE I—*Mean shoot and root weight and mean nematode/g root of young tea plants inoculated with varying levels of burrowing nematode, (Radopholus similis).*

Inoculum level * (*PI*)	*Shoot weight* (*g*)	*Root weight* (*g*)	*Nematode/g root* $\sqrt{n+1}$
T_1 = 0	31.0 a	27.0 a	1.0 c
T_2 = 500	26.3 ab	21.0 ab	3.4 b
T_3 = 1000	21.6 bc	21.2 ab	4.1 b
T_4 = 2000	22.6 bc	19.1 b	8.2 a
T_5 = 3000	19.4 c	17.3 b	8.1 a

Mean followed by same letter (P = 0.05) not significantly different from each other—Duncan's multiple range test.

*Number of nematodes per 3600 cc of soil.

This may be because, at the lowest infestation level, only certain portions of the roots gets infested and the plant would still be able to perform its normal functions with the remaining healthy roots, thus well tolerating nematode attack. However, as the population increases, more and more roots get affected, resulting in a proportionate weakening of the plant.

This is seen in plants receiving an initial population level of 1000 nematodes and above (28 nemas and above/100g soil) where there was a significant reduction in shoot (T_3, T_4 and T_5) and root weight (T_4 and T_5) respectively.

The results of this experiment clearly establishes the fact that, within the short span of 10 months, an initial population level of 28 nemas/100g soil could cause severe damage to the tea plant and affect establishment in the field.

This study has revealed that *R. similis* causes a greater damage to young tea plants than the corresponding population level of the meadow eelworm, *Pratylenchus loosi* under comparable soil conditions (Gnanapragasam and Manuelpillai, 1984).

It should be noted that this experiment was carried out under controlled conditions by growing the host plant in good soil and applying regular fertilizer, etc. However, if the plants were to be exposed to some stress factor in the field, such as by exposing them to poor soil conditions, drought or attack by other pests and diseases, then under this weakened condition, the threshold level could be even lower and even a smaller initial population level could cause severe damage and affect their establishment in the field.

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