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# POPULATION FLUCTUATION OF *HELICOTYLENCHUS* STEINER, 1945 IN RELATION TO SOIL TEMPERATURE, MOISTURE AND pH IN GUAVA ORCHARD AT SOUTH 24 PARGANAS, WEST BENGAL, INDIA.

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## INTRODUCTION

Since the nematodes inhabit the soil microenvironment, the soil factors like temperature, moisture and pH have an important role to influence them, even in managing the nematode population. Jairajpuri *et al.* (1974) studied the effect of pH and salt concentration on the survivality of different nematodes. Rao and Swarup (1975) reported the factors those affect the reproduction, population development and survivality of *Helicotylenchus dihystera.* Jairajpuri and Azmi (1978) showed the aggregation and repulsiveness of nematodes at pH gradient. Shukla *et al.* (1986) studied the population dynamics of *Helicotylenchus* related to soil temperature and moisture. Kamra and Sharma (2000) recorded the distribution of some plant parasitic nematodes in different states of India depending upon the temperature. Influence of soil temperature, moisture and pH on nematodes in various fruit orchards have been studied by Dwivedi *et al.* (1987), Dwivedi, Malhotra and Mishra (1987), Khan and Sharma (1990). Seasonal population fluctuation of nematodes have been reported by Khan *et al.* (1980), Chowdhury and Phukan (1990) and Srivastava *et al.* (2000).

In the present study, the monthly population fluctuation of *Helicotylenchus* Steiner, 1945 was observed in relation to soil temperature, moisture and pH in a guava (*Psidium guajava* L.) orchard, the fruit with immense economic importance in the area of work. The objective of the study is to understand the influence and effect of these soil abiotic factors on the population of this plant parasitic nematodes.

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## MATERIALS AND METHODS

The study was carried out in a guava orchard of Experimental Agricultural Farm of Calcutta University, situated at Baruipur Subdivision, South 24 Parganas district. Five soil samples of 250 gm each from five different fixed spots were collected at a depth of 5 to 20 cms from the rhizosphere at monthly interval from May 2004 to April, 2006. The soil samples were processed by sieving and decanting and nematodes were extracted by modified Baermann's funnel technique (Christie and Perry, 1951). Among other different nematodes, the numbers of juveniles and adults of *Helicotylenchus* were counted under low power binocular microscope in a counting dish. Monthly variations of soil temperature, moisture and pH were also recorded for the same period by soil thermometer, moisture meter and pH meter respectively. The average of population obtained from five samples were statistically analysed to determine the correlation between *Helicotylenchus* and the mentioned soil factors.

## RESULTS

The most abundant population densities of *Helicotylenchus* occurred in the months of June and July when the soil temperature, moisture and pH were ranging between 31–36°C, 15–30% and 5.6–5.8 respectively. They reached the lowest level of their abundance in September, April and May when the soil factors ranged between 31 to 37°C, 11.2 to 27.5% and 5.7 to 6.2 respectively (Fig. 1). In the other months the population fluctuated without following any definite pattern with an abrupt peak in November, 2004, '05 and January, 2005, '06 with low temperature and moisture but comparatively high pH. In rest of the months the population fluctuated without any abrupt increase or decrease in presence of comparatively lower temperature, and moisture with higher pH.

The relationship of *Helicotylenchus* with soil temperature, moisture and pH can be represented by the following regression equations in the total period of study: $Y = -0.0162X + 31.421$ ($r = -0.155$; $P > 0.10$), $Y = 0.0328X + 14.828$ ($r = 0.188$; $P > 0.10$) and $Y = -0.0025X + 6.2528$ ($r = -0.33$; $P > 0.10$) respectively (Fig. 2 A-C).

## DISCUSSION

The maximum abundance of *Helicotylenchus* in June and July may be due to their active breeding, substantiated by the presence of huge number juveniles in these months indicating a suitable soil temperature of 31 to 36°C, soil moisture of 15 to 30% and that of soil pH 5.6 to 5.9. On the contrary, the minimum population abundance occurred in September, 2004, '05 and April, 2005, '06 in the presence of higher soil temperature and pH but with lower soil moisture which is undoubtedly overlapping, except the range of pH with the conditions of maximum population density. But an abrupt population peak in November, 2004, '05 and in January, 2005, '06 can not be explained

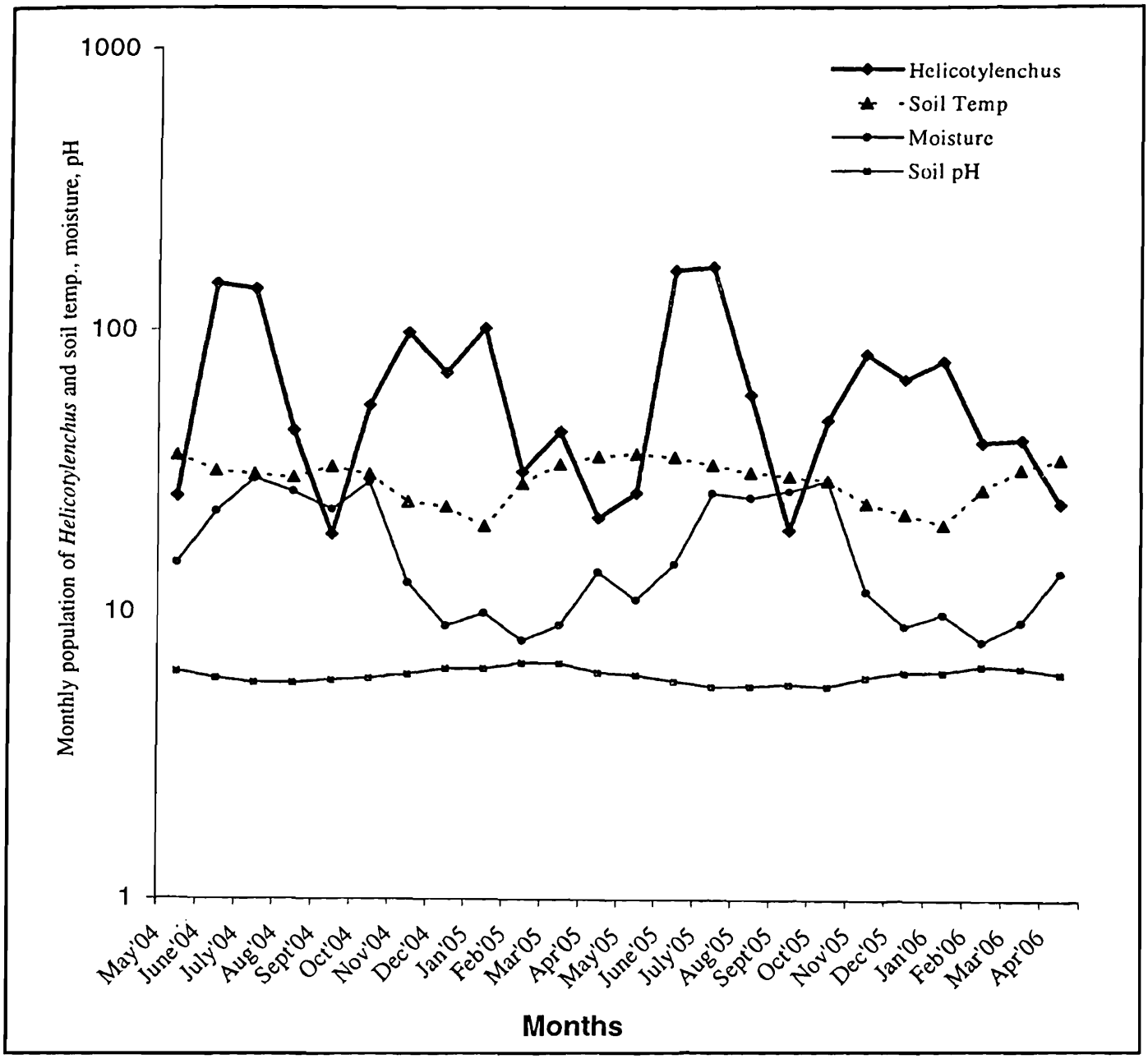
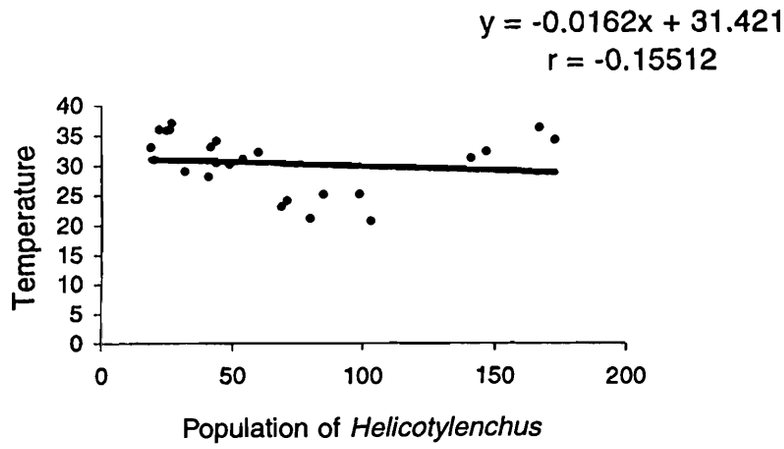


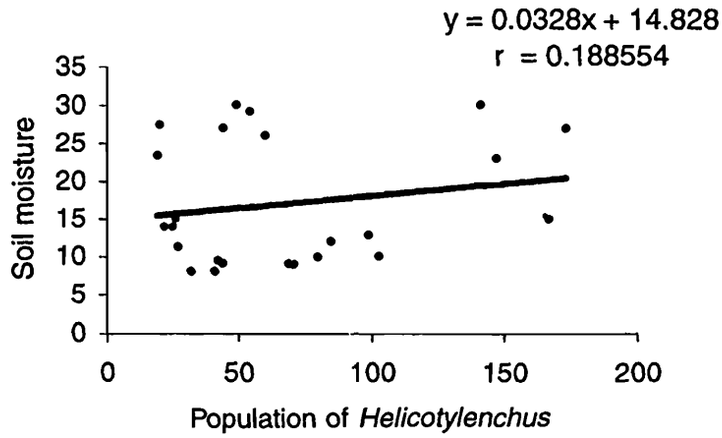

**Fig. 1 :** Monthly population fluctuation of *Helicotylenchus* Steiner, 1945 in relation to soil temperature, moisture and pH.

when the soil temperature and moisture remained low with higher soil pH. This may be due to their active breeding twice a year.

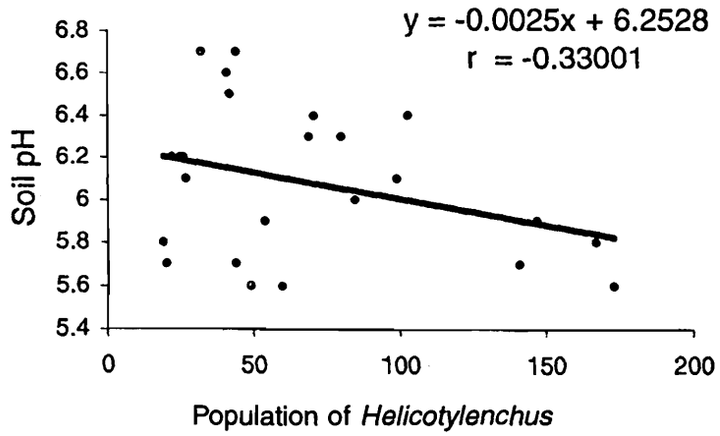
In the present investigation, high population density was observed in higher soil temperature and moderate to higher soil moisture with an exception in January, 2005, 06 and November, 2004, 06 but Khan *et al.* (1971) reported the optimum temperature of 25°C for population growth of nematodes with no significant effect of rainfall on population change. Ramana *et al.* (1978) also showed 21 to 26°C soil temperature to be most favorable for lance nematodes in monsoon areas which contradicts the present investigation. Chawla and Sharma (1984) also reported 20°C as optimum temperature for the maximum recovery of second stage larva of *Tylenchulus semipenetrans.*




A




B




C

**Fig. 2 (A-C) :** Relation between population of *Helicotylenchus* and soil abiotic factors. (A) with soil temperature, (B) with soil moisture and (C) with soil pH.

Khan and Sharma (1990) correlated the fluctuation of population densities of *Helicotylenchus dihystera* and *Meloidogyne incognita* more with the temperature than with soil moisture, whereas, the variation in the population densities of Tylenchorhynchus *mashhoodi* and *Pratylenchus pratensis* was not explained by the variation in temperature and moisture which is also somewhat true in case of the present study. Sabir (2000) reported the maximum population density of some ecto- and endoparasitic nematodes during the monsoon time (July-August) with a maximum ambient temperature of around 24-37°C, which shows consistency with the present investigation.

The nematodes generally prefer soil pH between 5.0–6.0 and cannot survive in extreme acidic or alkaline soil (Naseem and Jairajpuri, 1982), which is consistent with the present finding. Jairajpuri *et al.* (1974) observed that *Hoplolaimus indicus* and *Helicotylenchus indicus* have a wide range of optimum pH (5.8 to 9.0) for survivality, which can not be substantiated by the present study, done in natural field condition with available pH range in the soil. Chowdhury and Phukan (1995) recorded the maximum population density of some plant parasitic nematodes at a pH level of 5.0 to 5.9, which is logically compatible with the present study.

The regression analyses (Fig. 2 A-C) show a trend of inverse relationship between fluctuations of population density of *Helicotylenchus* with that of soil temperature and pH in the total period of study with an insignificant negative correlation (in both the cases $P > 0.10$). On the other hand, a directly proportional relation found between the population abundance and soil moisture with insignificant positive correlation ($r = 0.188$; $P > 0.10$). Although, some insignificant relationships have been estimated by statistical analysis for the total period of investigation, yet no definite, consistent and constant pattern of monthly population fluctuation of *Helicotylenchus* was observed in relation to the mentioned soil abiotic factors in guava orchard.

## SUMMARY

The pattern of monthly population fluctuation of *Helicotylenchus* Steiner, 1945 was observed for two years from May, 2004 to April, 2006 in a guava orchard at South 24 Parganas, West Bengal to explore the influence and effect of some soil abiotic factors on this plant-parasitic nematode. Monthly soil temperature, moisture and pH were recorded to correlate these with the population abundance of the spiral nematode. The highest population was observed in June and July and that of the lowest in April and September. There was no definite, consistent and constant pattern of monthly population fluctuation in relation to these soil abiotic factors. The regression analysis showed insignificant negative correlation between the population of *Helicotylenchus* with soil temperature and pH. An insignificant positive correlation was found with soil moisture.

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