A PRELIMINARY STUDY ON POPULATION DYNAMICS OF THE CITRUS NEMATODE, *TYLENCHULUS SEMIPENETRANS* COBB, IN KHAFR AN IMPORTANT CITRUS GROWING REGION OF FARS.

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Introduction

The citrus nematode is a plant-parasitic nematode which occurs in various levels in many citrus groves of the world (1,3,5,16,20,23), and can be of economic importance in some citrus growing regions (3,8,12,17,22). It has been found to have a widespread distribution in southern Iran, with a potential power for involvement in the serious citrus decline of this area (1,10).

Investigations conducted in Iran (1,10), do not give any information about the population dynamics of this nematode under our conditions. Although there have been a few studies on population fluctuations of the citrus nematode in some other countries (11,16), application of the results of these investigations to our region is not recommended. Because, the population changes are the results of biotic and non-biotic factors (14); which may vary from one area to another area. Therefore, this type of studies should be made in the region for which the information is needed. This study not only provides some knowledge on control possibilities but also supply data of fundamental importance.

The purpose of this study was to determine the population, sex ratio, and egg laying activity of the citrus nematode on a monthly basis for one year.

Materials and Methods

In April 1970, citrus trees of three infested orchards in Khafr, an important citrus growing country of Fars province, were surveyed for this study. Population studies on different samples processed by the Baermann funnel method (2,9) and Cobb seiving technique (6,9), revealed the presence of very high

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fluctuations in population levels of the nematode in different citrus trees. To save time and to reduce possible errors encountered in this study, only the most highly infested tree which was a 35-years old sweet orange tree scioned on Bakrayee, an Iranian variety of *Citrus reticulata* Blanco was selected for this purpose. The tree was located almost in the center of the orchard. It had a canopy of a diameter of about 4 meters; and the soil had the following characters:

1. Bulk density = 1.38
2. Texture = Silty Clay
3. PH = 8.25
4. O.M. = 1.1 %
5. Total N = 0.1 %
6. Available P = 4 ppm
7. Available K = 180 ppm

Three soil and root samples were taken at random to a depth of 25 cm from underneath the orange tree for 12 months; and the sites of samplings were marked by wooden sticks digged into the soil. These were used as landmarks to avoid resamplings from the sampled areas. Each sample containing about ½ Kg soil, including several grams feeder roots, were placed in a polyethylene bag. The samples were transported to laboratory in an insulated box to prevent overheating; they were thoroughly mixed and processed within one day.

Baermann funnel method was followed in essential details for separation of the males and larvae from one hundred-cc portion of each sample (2,9).

To separate females, the previous method was used (1).

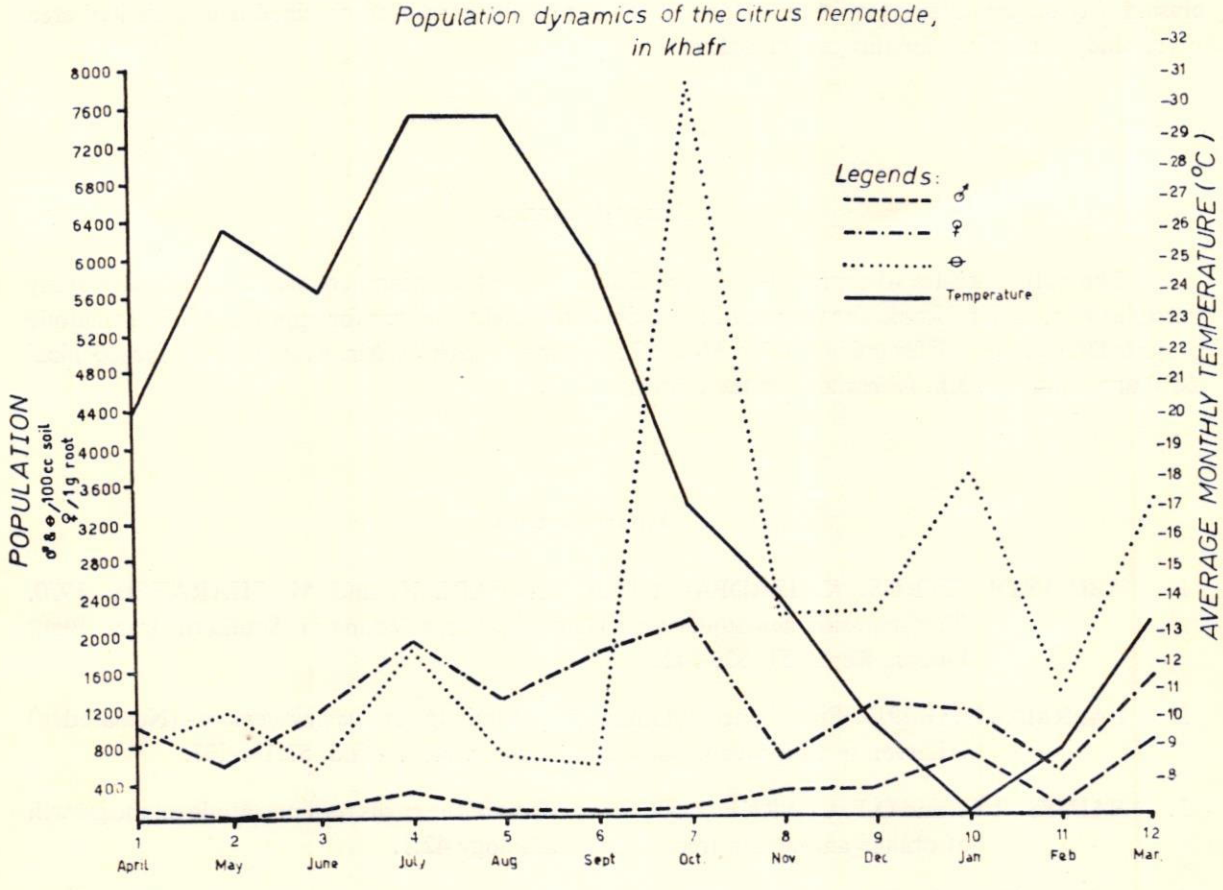
To obtain the sex ratio, the nematode suspensions were kept in vials for one month on a laboratory bench, under the room temperature conditions (23 ± 3 c). This period was ample for transformation of the male larvae to adult males. Then, the nematodes which were already settled at the bottom of the vials were concentrated by taking the supernatant, with a medicine dropper. The ratio of the male larvae to the female larvae was obtained by counting the first 50 nematodes from each sample. To do this, several drops of the concentrated suspension were put on a microscopic slide, and examined under a microscope (X 100). The female larvae did not develop further, without feeding on the host roots.

Results and Discussion

The results of this study and temperature data are given in figure 1. As shown in the figure, the monthly temperatures and female and larval populations follow more or less the same trend. The decline of larval population had occured in June, when the monthly mean temperature had been about 32.5 c. This is believed to be due to inhibition of egg hatch at this temperature. According to O' Bannon (11), no hatching occured when the air temperature was 35 c; and the eggs did not recover when it lasted for three days. As reported by Stolz *et al.* (18), population of this nematode also was reduced at 30 c soil temperature. The mean maximum air temperature in our studies for this month (June), and the

following month had been 39.8 and 40.0 c, respectively; which corresponds to about 35 c soil temperature. Some larval mortality during these maximum temperatures is possible. For, according to Christie (5), an exposure of 10 minutes is enough to control the citrus nematode in bare-rooted nursery stocks.

As the soil samplings were made at the beginning of each month, the effect of monthly mean temperatures should be seen after the succeeding month. Therefore, the most optimum temperature, among the monthly mean temperatures encountered during this experiment, seems to be 25-35 c (in September), which has resulted in the maximum larval and female population in the succeeding month. Drop of the monthly mean temperature in October (17-35 c) has resulted in drop in female and larval population. This, is in accordance with the findings of O' Bannon (11), in his laboratory experiments on egg development and hatching of the citrus nematode as affected by the temperature. Increase in the rate of larval population in January, although not significant, needs more evidence for speculation. In general, the gap between female and larval populations (Fig. 1) may be used as a criterion for evaluating oviposition and hatching activities. The more the gap is pronounced, in favor of larval population, the more the activities are supposed to be. Number of adult males recovered from Baermann funnels, throughout the year, was negligible, therefore, no count was made for their determination.



Gravid females were common in all months, except in February at which they were rare. Therefore, oviposition in this nematode is believed to be a continuous process.

As shown in Fig. 1, the larvae and females were recovered in throughout the year. Therefore, the nematodes have apparently continued their feeding activities continuously. Because, the second stage female larvae cannot develop without feeding on the host (20); and consequently, the presence of newly formed females indicates this activity.

The sex-ratio obtained in this investigation ranged from O to 22.6% males: 77.4% to 100 females. This shows that the sex ratio in natural conditions, in contrast to that found in laboratory conditions (21), may change in time. Considering Fig. 1, neither temperature nor population density have shown any considerable effect on this ratio. Therefore, the sex ratio, in this nematode, is believed to be governed by several factors. In the root-knot nematode, *Meloidogyne spp.* ; and some other nematodes, this is considered to be a population dependent phenomenon (7,15).

Considering the semi-endoparasitic activity of the citrus nematode and difficulty in killing the eggs of this nematode, the best time for soil fumigation against *Tylenchulus semipenetrans,* under our conditions, is believed to be in October; when most of the eggs have hatched and the larvae have started their ectoparasitic activities. Considering the meteorological data of this region, in the previous years, the temperature during our study is believed to be a good sample for the other years; therefore, the conclusion may be generalized for future. However, as our results have been obtained from a limited area more study is required for this generalization.

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