

STUDIES ON THE POPULATION FLUCTUATIONS OF *RADOPHOLUS SIMILIS* IN COCONUT AND ARECANUT ROOTS

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ABSTRACT : *Radopholus similis* population in coconut and arecanut roots were found to fluctuate between samples, trees, groves, months and years. However, there were definite periods for occurrence of maximum and minimum populations within a year. Highest populations were recorded during October or November and lowest or nil during May to July. Though populations were low during August to September and January to February, they were around the detectable level of 4/g of root. All infested trees within the same field did not record the maximum populations in the same months in a year. Ecological conditions such as rainfall, temperature, and availability of susceptible roots play their own roles in the population build-up but temperature was found to have a more decisive effect as compared to others.

Population levels of nematode species may vary with the type of host crop, density of root system and other environmental factors. The life cycle of a banana population studied on *Tephrosia candida* took 20—25 days at 24—32°C (Loos, 1962). In citrus the life cycle was completed in 18—20 days at 24—27°C (DuCharme and Price, 1966). DuCharme and Suit (1967) recorded the highest populations of burrowing nematode in citrus from October to December, lowest from January to July and also disappearance of population from known infested areas in spring. Similar population fluctuations were recorded by Vilardebo in 1976 at Cameroon in banana.

Preliminary studies by the authors indicated that certain infested coconut palms (*Cocos nucifera* L.) on the farm, which yielded very high populations of *Radopholus similis* during November, 1972 did not yield even a single specimen on repeated sampling during May to July of 1973. However, on teasing, the older root lesions yielded a few desiccated specimens and eggs. The virtual disappearance of nematode population from roots of the infested palms during a particular part of the year appeared interesting and worth investigating. Therefore, studies were initiated to determine the seasonal fluctuations of the nematode population in coconut roots by periodic sampling of infested palms on the farm.

MATERIAL AND METHODS : Root samples were collected from 7—10 year old infested coconut palms in Central Plantation Crops Research Institute (CPCRI) farm, Kayangulam. During 1973—76, monthly samples were collected from 2 trees in 1973—74; 3 trees in 1974—75; and 4 trees in 1975—76. Care was taken to sample only semi-hard orange coloured portion of main roots which were found to harbour maximum number of *R. similis*. The root samples of 50 g each collected from the base of the palm at 15—30 cm depth, washed and cut into 2.5 cm bits after peeling off the epidermis, were sliced into 8 longitudinal pieces and left in 15 cm petri plates containing 150 ml of tap water for 72 hr at 10—14°C in a refrigerator for nematode

Received for publication June 30, 1977.

extraction (Koshy *et al.*, 1975). No separate counts were made for different stages (eggs, juveniles and adults) of the nematode present in the roots. However, the shrunken forms (dehydrated specimens) expelled from the cut surfaces during slicing of roots were counted. These studies were initiated in June 1973 and therefore the increase and decrease in population are shown with the peak in the middle.

At Kayangulam, there are two rainy seasons, (1) South West monsoon during June—August and, (2) the North East monsoon during October-November with an average rainfall of 224 mm and 96 mm, respectively. The soil temperature at 15 cm depth was recorded daily at 7 A.M. The temperature varied from 25—33°C.

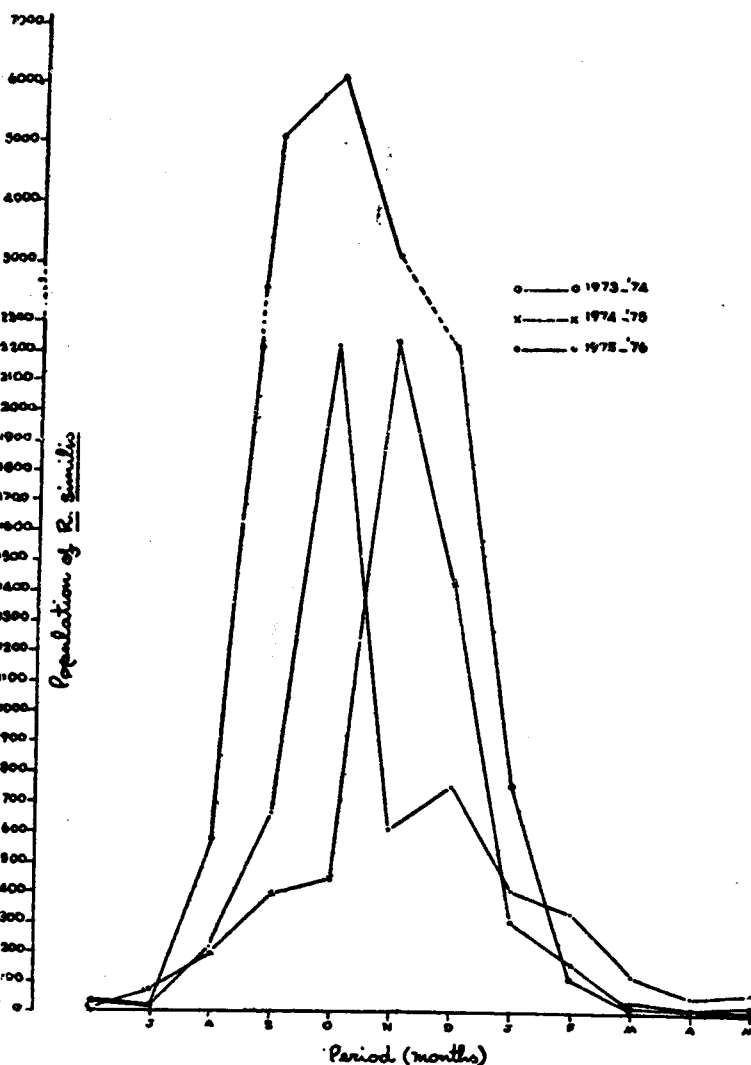


Fig. 1. Average monthly population of *Radopholus similis* in coconut roots during 1973-74, 1974-75 and 1975-76.

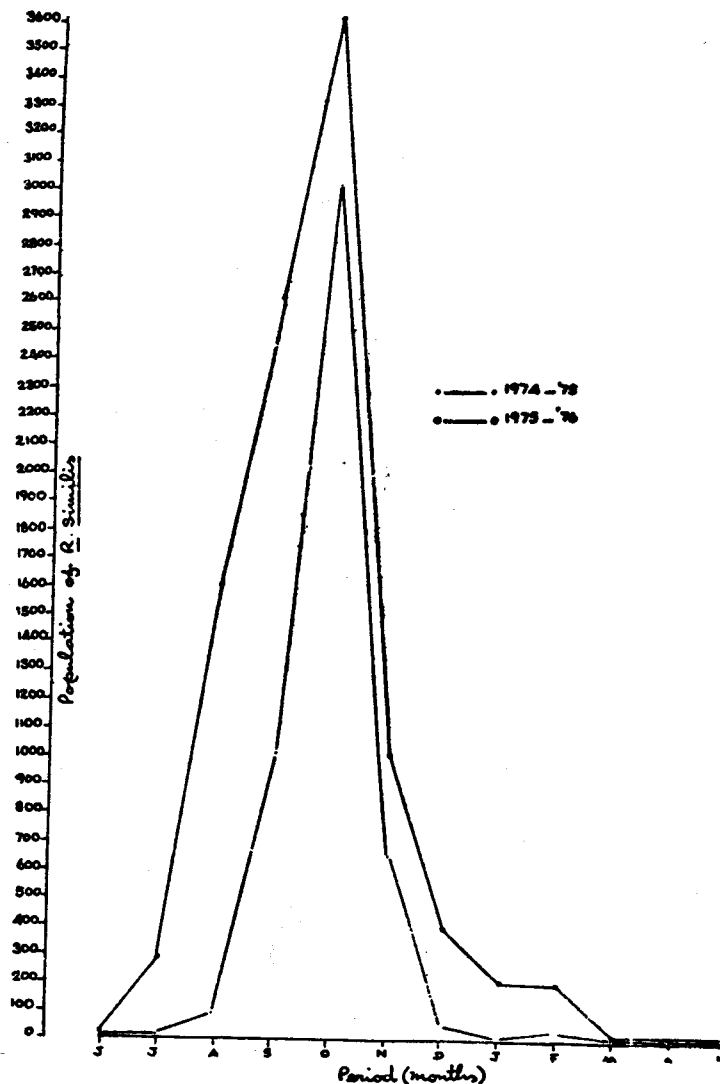


Fig. 2. Population of *Radopholus similis* in arecanut roots during June 1974—May 1975 and June 1975—May 1976.

The same procedures as above were followed for the burrowing nematode population of arecanut (*Areca catechu* L.) at CPCRI, Research Centre, Palode. Root samples were collected from two 15 year-old infested palms about 50 cm away from the bole and at 15—30 cm depth during 1974—76. Main feeder roots, white to creamy white in colour with lesions, were collected and sent to CPCRI, Kayangulam by post in polythene bags, and therefore the samples could only be processed on the third day of their collection.

RESULTS: In coconut, very low (0.2—0.6/g) population was recorded in June-July of 1973-74. However, it started increasing in August with maximum

(120/g) in October. Subsequently there was a continuous decreasing trend till February, with nil or non-detectable level (0.1—0.6/g) of population from March through June. In 1974-75 the increase in population was recorded in July, with the maximum (45/g) in November. In 1975-76, however, the population fluctuation was similar to 1973-74 pattern. In 1975-76 unusually large numbers of burrowing nematodes were isolated from an individual tree which kept the average population high during March to June compared to the previous years. During the season three trees recorded their peak in October whereas the fourth tree recorded its peak only in November.

Burrowing nematode population in arecanut roots (Fig. 2) showed the same trend of fluctuations as in coconut with regard to increase in population in July or August, peak in October and then declining trend till February. Lowest or nil number of nematodes was recorded from March to June in 1974 and 1975. The maximum population of 60 and 72 per gram was recorded in October 1974 and 1975, respectively.

It may be seen from Figs. 1 and 2 that despite variability in populations between groves, trees, samples and months, there were definite periods for occurrence of maximum and minimum populations of burrowing nematodes annually in coconut and arecanut roots.

When the average population for a month is looked into, it is seen that during 1973 the maximum per gram population recorded in October for a sample of 50 g was 120 whereas it was only 44 per gram during November, 1974 and in October, 1975. The maximum population that was recorded during these studies, from an individual palm was 150 per gram of root for a sample size of 50 g. It was also seen that the number of shrunken forms increased with decrease in population from January till June. These specimens retained the cuticle, stylet, and spicules with dried up body contents.

DISCUSSION : The annual periodicity of burrowing nematode populations existing in Florida citrus groves on Lakeland fine sand has been reported by DuCharme and Suit (1967). They recorded the highest populations from October to December, lowest from January to July and also disappearance of population from known infested areas in spring. Variations from the general pattern of occurrence of peak and low populations existed between trees, groves etc. The present studies on the burrowing nematode populations of coconut at Kayangulam in sandy loam soil and arecanut at Palode in laterite soil also have shown a similar trend.

In a similar study Vilardebo (1976) recorded minimum population of *R. similis* in March, at the end of the dry season and the maximum in December in banana at Cameroon. He also recorded that the population was always found to be maximum in roots of plants which have flowered.

Suit *et al.* (1955) considered 75 nematodes from a gram of fresh feeder roots of rough lemon as average and 150 to 175 as large. Later DuCharme and Price (1966) recorded an average of 50 *R. similis* per gram of citrus rootlets with a range of 7 to 152. Cassidy (1930) recorded 2500 burrowing nematodes from 3 cm of sugarcane roots. In the present studies it varied from 44 to 120 per g in coconut and 60 to 72 per gram in arecanut for a sample size of 50 gram during the peak periods whereas Koshy *et al.* (1975) had reported the total population of 3941 including eggs from a 5 cm root bit. This clearly shows that the population build up of *R. similis* would greatly vary depending upon the type of host, type of roots, season and other ecological conditions.

The minimum soil temperature during June—January was 26.5—28.5°C as against 29—33°C during February—May. Rainfall was not found to have any direct impact on population build up. However, it may have an indirect influence in bringing down the soil temperature and providing soil moisture. Increase or decrease in the quantity of rain did not correspondingly affect the population. New flushes of roots were always produced after the commencement of monsoon. According to Suit and DuCharme (1967) the citrus burrowing nematode does not enter the maturing roots which have developed hardened or suberised epidermis or senesing roots in which have started decaying as they mainly attack healthy young, succulent feeder roots. The data in Figs. 1 to 4 indicate that the nematode population increases gradually soon after the heavy monsoon coupled with low temperature, availability of continuous soil moisture and young, succulent, non-suberised feeder roots, reaching its peak in October/November when all these conditions prevail even though for a short period of time. The other reason for the rapid fall of the population is the root decomposition and the resultant migration of nematodes from the root. In the absence of production of fresh feeder roots throughout the year the nematodes do not have suitable roots for reinfestation and multiplication.

It is also seen that populations in individual trees varied considerably and all the trees did not record their peak in the same period. The per gram population recorded by individual trees in their peak period varied considerably from 44 to 150. This is in conformity with the finding of DuCharme (1967) that *R. similis* population vary with tree conditions.

During the year 1973-74 and 1975-76 South West monsoon had started around 15th of June and most of the heavy showers were received before 15th July whereas in 1974-75 the rains were delayed and heavy showers were received only after 1st August. This possibly had delayed the root production and also unlike the other two years under study during 1974-75 there was a dry spell of 15 days in October and prevailed high temperature (29°C) in the later half of October. The non-availability of susceptible roots and lack of soil moisture and high temperature during October 1974 must be the reason for the shift of the population peak to November in 1974-75 compared to its occurrence in October in the other two years.

The occurrence of large numbers of shrunken forms of males and females of *R. similis* seem to be the first record in infested roots. Further studies regarding the role of root sap and ecological conditions causing this dehydration need further investigations.

The authors are grateful to Dr A. R. Seshadri, Dean and Joint Director, Post-Graduate School, I.A.R.I., New Delhi for the advices given during these studies and to Dr. Gopal Swarup, Head Division of Nematology, I.A.R.I., New Delhi for critical reading of the manuscript. Regular supply of arecanut root samples by the staff of CPCRI, Research Centre, Palode is also gratefully acknowledged.

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