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Influence of atmospheric conditions and soil temperature on the prevalence of the lance nematode (*Hoplolaimus indicus* Sher, 1963) in rice fields

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Abstract. Studies on the prevalence of *Hoplolaimus indicus*, the lance nematode in rice fields revealed 4 distinct peaks of population viz., during the second fortnight of February, first fortnight of August and in the second fortnights of October and December during 1971-72. Average soil temperatures of 20·1° to 25·6°C at 5 cm depth were found optimum for the nematode activity. Low atmospheric temperatures of 22·1° to 23·2°C, high relative humidity (83 to 90%) and dew deposition on foliage were found to be conducive for the migration of the nematode from the soil to foliage of standing crops. The migratory behaviour was further confirmed in inoculations to soils with growing rice plants in pot cultures under green house conditions.

Keywords. Peak period prevalence; lance nematode; *Hoplolaimus indicus;* rice soils.

1. Introduction

An obscure disease of rice causing leaf drying in Bihar (Birat 1965) and complete failure of crop for two successive years in the State Agricultural Farm, Berhampore (West Bengal) (Banerji and Banerji 1966) were associated with the prevalence and incidence of the lance nematode, *Hoplolaimus indicus* in rice. The nematode has established as a pest of rice in uplands and well drained soils (Ramana 1969; Das and Rao 1970). Earlier investigations on the activity of this nematode in relation to soil temperature showed 25° C (Khan *et al* 1971) or 30° C (Gupta and Atwal 1971) to be most favourable. The influence of soil temperature and atmospheric conditions on the behaviour of the lance nematode in rice soils was investigated under studies on the population dynamics of this nematode.

2. Materials and methods

2.1. *Prevalence of H. indicus in soils*

3 upland rice fields under continuous rice cultivation were selected and 3 soil cores (25 cm depth × 2·5 cm dia) per 5 M^2 area were drawn from each field at intervals of 15 days (Rao 1970). Each field was stratified into 6 areas (5M × 5M) for sampling purposes. Aliquots of 100 g soil were processed from the soil of 3 cores for extraction

and enumeration of *H. indicus* population. The mean weekly soil temperature at 5 cm depth in the field was correlated with the prevalence of the nematode during February 1971 till January 1972.

2.2. *Prevalence of H. indicus on foliage of rice plants*

Routine surveys were made for foliar nematodes from seedlings and growing plants by sampling 1% of plant population and extracting nematodes from sheaths and blades of leaves (Rao 1970). To confirm the migratory ability of *H. indicus* to foliage, inoculations were made to soil a cm away from the base of plant in pot cultures. The soil surface was covered with a thin layer of sand and the plants were individually covered with bell jars to ensure 92% relative humidity by the method of Radewald *et al* (1971). The drops of water that settled on leaves were collected at intervals of 24 hr and examined for the prevalence of the nematodes.

3. Results and discussion

Prevalence of H. indicus in soils

Nematodes prevailed during the entire period of study with 4 distinct peaks viz., second fortnight of February, first fortnight of August, second fortnights of October and December 1971 (figure 1). During these periods, the mean temperature ranged from 17·4° to 27·1°C. Maximum nematode population prevailed in the second fortnight of October when the maximum temperature was 27·2°, minimum 22·8° and the

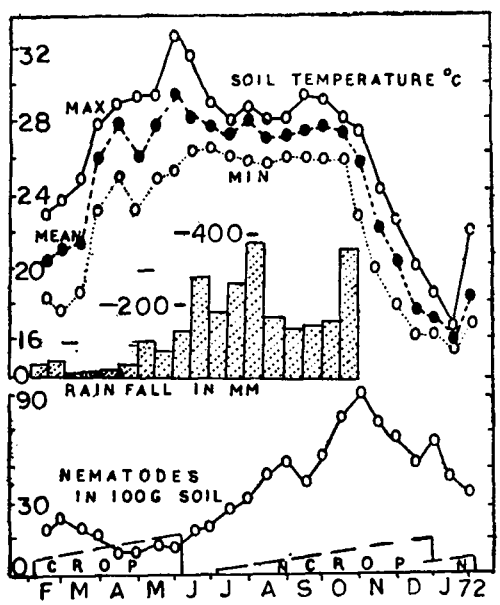

Figure 1. Influence of soil temperature and rainfall on the prevalence of *Hoplolaimus indicus* in rice fields. *N*-Nursery.

mean 25·6°C. During this period, there was 340 mm rainfall after which, there was no rain.

Decrease in the mean temperature to 16·4°C in the first fortnight of January 1972 and increase in 26·1°C in March 1971 resulted in a decline in population (figure 1). High maximum temperature of 32·8°C and 31·7°C during second fortnight of May and first fortnight of June were not conducive for the build up of the nematode. The average soil temperature of 25·6°C obtained during the second fortnight of October was optimum for the nematode activity.

From the first fortnight of August to that of October, the maximum temperature ranged from 27·2° to 28.1°C and the minimum from 25·6° to 26·1°C with an average of 27·1° to 27·6°C during which time, the rice crop was in the active tillering stage. The low fluctuation in the temperature and the wet conditions of soil due to precipitation were favourable for the activity of the nematode. From the first fortnight of November when dry weather prevailed, the temperatures dropped and the nematode population declined (figure 1). Thus, not only the soil temperature but also the soil moisture and availability of root tissue influenced the prevalence of this nematode. The results confirmed the earlier observations of Khan *et al* (1971) who stated that temperatures by themselves do not cause sudden drastic changes in nematode populations.

Meteorological data collected on dates prior to sampling foliage in fields showed a range of 27·7° to 29·3° C in the mean air temperature while the soil temperature at 5 cm depth ranged from 26·9° to 28·6°C (table 1). The grass minimum temperature ranged from 23·2° to 23·9° C. There was dew deposition of foliage, of 0·21 mm at 25 cm and 0·16 to 0·27 mm at 50 cm height of crop. The humidity ranged from 83 to 92%. The low soil temperature, high humidity and dew deposition on foliage were conducive for the migration of 11·1% of soil population of *H. indicus* from soil to the aerial parts of the rice plant (table 2).

Table 1. Meteorological data in fields and pot cultures.

	Dates of observation			
A. *Field*	1-10-73	10-10-73	16-10-73	22-10-73
Air temp. °C				
Maximum	34·0	31·1	31·6	32·3
Minimum	24·6	24·4	24·3	24·4
Mean	29·3	27·7	27·9	27·8
Relative humidity %	92·0	89·0	88·0	85·0
Soil temp. at 5 cm depth °C	28·6	26·9	27·6	27·3
Grass min. temp. °C	23·9	23·5	23·4	23·2
Dew deposition in mm:				
at 25 cm ht of crop	—	0·21	0·21	0·21
at 50 cm ht of crop	—	0·16	0·27	0·16
Rainfall in mm	47·4	—	1·6	—
B. *Pot cultures*	27-10-73	28-10-73	29-10-73	30-10-73
Air temp. °C maximum	27·3	29·6	29·6	29.8
minimum	23·2	23·2	23·8	21.8
Mean	25·2	26·4	26·7	24.9

Table 2. Migration of *H. indicus* from soil to the aerial parts of rice plant in fields and in pot cultures (means of six replications).

	Dates of observation			
A. *Field sampling*	1-10-73	10-10-73	16-10-73	22-10-73
Nematodes in 100 g soil	88	84	56	72
Foliage/plant	11	4	3	9
B. *Pot cultures*	27-10-73	28-10-73	29-10-73	30-10-73
Nematodes in 100 g soil	40	36	34	48
Foliage/plant	4	5	4	6

In the inoculations to pot cultures under green house conditions, 4 to 6 nematodes were recorded on foliage on the four dates of observation (table 2). The maximum temperature ranged from 27·3° to 29·8° C and minimum from 21·8° to 23·8° C with an average of 24·9° and 26·7° C respectively (table 1). The relative humidity was over 90%. The deposition of dew on foliage enabled a thin film of moisture to persist, which together with high humidity persumably facilitated the movement and migration of the nematodes from soil to foliage. Recently, Nandakumar and Rao (1974) reported on the migration of soil inhabiting forms of parasitic nematodes to aerial parts of rice plant under the environmental conditions described above.

These results had proved that in the monsoon areas where the soil temperatures in uplands range from 21 to 26° C the lance nematode prevails as a threat to rice culture. The migration of *H. indicus* from the soil phase to the foliage is a new report on the behaviour of the nematode and offers scope for further studies on its behaviour on foliage and methods for control.

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