

VERTICAL DISTRIBUTION AND DIVERSITY OF PREDATORY SOIL NEMATODES IN AGRICULTURAL CROPS

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Abstract: *The present work is taken out to study the vertical distribution and diversity of predatory nematodes from agricultural crops in and around Jodhpur, Rajasthan during the year Nov 2009 to Oct 2011. The vertical distribution of soil nematodes is closely related to the distribution of plant root, new emerged roots, moist soil, crops, soil type, pH, temperature and other environmental factors. Total nematode population from 0-5 cm of soil depth was found to be significantly increased, than at 20-25 cm depth of soil, the numbers of nematodes were slightly decreases.*

Key words: Vertical Distribution, Agricultural Crops, Temperature, pH.

Introduction

Nematodes are extremely widespread and to be found in most unexpected places, they are also inconceivably abundant according to Cobb (1914). Generally, nematodes are cylindrical, unsegmented, bilaterally symmetrical pseudocoelmates (Reven *et al.*, 1986). They are also known as 'eelworms' and 'roundworms'. Nematodes are found in a wide variety of habitats, from the Antarctic to the hot springs in New Zealand. In soil they are important components of nutrient turn over. Most nematodes live in the interstitial spaces between soil particles, or other substratum. Nematodes associated with seasonal functional and vertical distribution of plant-feeding nematodes in grasslands by Verschoor *et al.*, (2000). Vertical distribution in Bacteriovorous nematodes under different land uses was studied by Liang *et al.* (2005). Qualitative and quantitative study on plant and soil nematodes associated with crops of economic importance in Rajasthan has been done by Bohra (2008). The movement of nematodes in the soil by their own activities is limited at most to a 5cm to 25cm depending upon the plant root and moisture. It is obvious that the number of nematodes is greater in soil containing plant roots than in soil without plant roots.

Material and Methods

To study the vertical distribution of soil nematodes in the agriculture field samples were collected from different depth (0.5, 5-10, 10-15, 15-20, or 20-25cm) from single selected fields cultivated with wheat, bajra, onion and cauliflower (table 1). Nematodes were extracted from composite soil samples in the laboratory by COBB (1918) modified Sieving and decantation techniques. The nematodes were fixed in hot 4 percent formalin and stored for analysis. The species and genera of nematodes were identified using standard text (NORTON, D.C., 1978). The population of nematodes in each sample was counted using stereoscopic zoom microscope and the statistical analysis of the vertical distribution was done by analysis of variance (ANOVA) and chi square test as shown in the table 2, 3 and 4.

Table 1: Vertical Distribution of Soil Nematodes (100g soil)

Nematodes	0-5 cm (soil depth)	5-10 cm (soil depth)	10-15 cm (soil depth)	15-20 cm (soil depth)	20-25 cm (soil depth)
Bathyodontus	5	6	9	21	10
Mononchulus	7	9	12	28	15
Oionchus	2	3	5	11	7
Iotonchus	3	5	7	19	11
Mylonchulus	6	7	9	24	14
Mononchus	4	8	10	26	13

RESULTS**Total Nematode Population**

From table 1 the vertical distribution of soil nematodes population from 0-5 cm to 15-20 cm was found to be significantly increase, than at 20-25cm depth, the number of nematodes was slightly decrease. More than 90 percent of soil nematodes were present in 0-20 cm soil depth.

At the Depth of 0-5 cm Soil

Fewer than 5 cm soil total 27 nematodes were found from the host plant of wheat, bajra, onion and cauliflower. The maximum number of nematodes was found in *Mononchulus* i.e., 7 and minimum number of nematodes were found in *Oionchus* and 5, 3, 6 and 4 number of nematodes were found from the *Bathyodontus*, *Iotonchus*, *Mylonchulus* and *Mononchus* respectively. The highest percentage of nematodes Population were found in *Mononchulus* with 23 percent and minimum percentage of nematodes were found in *Oionchus* with 8 percent.

At The Depth of 5-10 cm Soil

Under 0-10 cm soil total 52 nematodes population were found from the four soil samples of host plant. The highest percentage of nematodes *Mononchulus* was 23 percent and minimum percentage of nematodes *Oionchus* was 9 percent. *Bathyodontus*, *Iotonchus*, *Mylonchulus* and *Mononchus* were 17 percent, 13 percent, 17 percent and 19 percent respectively.

At the Depth of 10-15 cm Soil

Less than 15cm soil the population of nematodes was 52 from 4 soil samples. The maximum number of nematodes was found in *Mononchulus* i.e.12 and minimum number of nematodes was found in *Oionchus*. Out of 52 number of nematodes 9 were present in *Bathyodontus* with 17 percent, out of 52, 7 number of nematodes with 13 percent were present in *Iotonchus*, out of 52, 9 nematodes with 17 percent were present in *Mylonchulus* and out of 52, 10 nematodes with 19 percent were present in *Mononchus*.

At the Depth of 15-20 cm Soil

Under the depth of 20cm of soil the total number of nematodes population was 129. Out of which 21 were present in *Bathyodontus* with 16 percent, out of 129, 28 with 21 percent of nematodes were present in *Mononchulus*, out of 129, 11 with 8 percent of nematodes were present in *Oionchus*, out of 129, 19 with 14 percent nematodes were present in *Iotonchus* out of 129, 24 with 18 percent of nematodes and 26 with 20 percent of nematodes were present in *Mylonchus* and *Mononchus* respectively.

At the Depth of 20-25 cm Soil

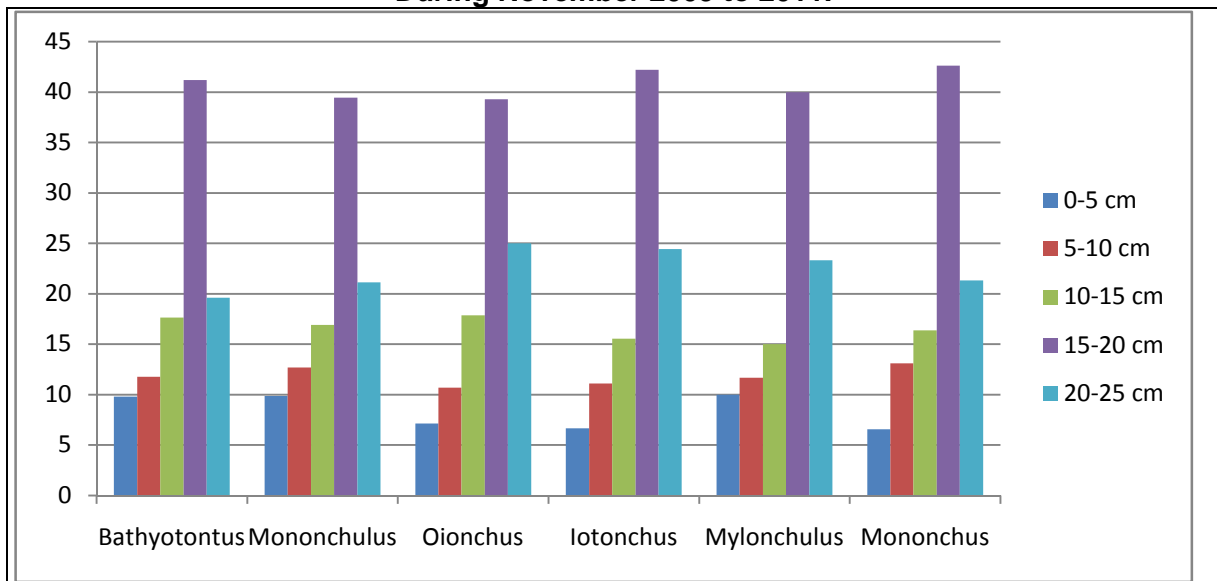
Under the depth of 0-25cm of soil the number of nematodes population was decreases as compare to 0-20cm of soil depth. The total number of nematode population i.e. 70 was present at the depth of 0-25cm of soil. The maximum number of nematodes was present in

Mononchulus i.e. 15 with 21 percent of nematodes and minimum number of nematodes was present in *Oionchus* i.e. 7 with 10 percent nematodes. 10 with 14 percent, 11 with 15 percent, 14 with 20 percent, and 13 with 18 percent of nematodes were present in *Bathyodontus*, *Iotonchus*, *Mylonchus* and *Mononchus* respectively.

Percentage of Soil Nematodes from the Depth of 0-5 to 20-25 cm of Soil

From the table 4, under the depth of 5-25cm of soil nematodes population was occupied by the member of genera *Bathyodontus* was 51 percent, *Mononchulus* was 71 percent, *Oionchus* was 28 percent, *Iotonchus* was 45 percent, *Mylonchulus* was 60 percent and *Mononchus* was 61 percent. The maximum percentage of nematodes was found to be in *Mononchulus* genera (71 percent) and the minimum percentage of nematodes was found to be in *Oionchus* (28 percent) (Graph 1)

Graph 1: Percentage of Soil Nematodes in Vertical Distribution of Different Soil Depth, During November 2009 to 2011.



The Average Values of Nematodes from 0-5 to 0-25 cm Depth of Soil

The maximum average mean values were found under the depth of 0-20 cm of depth soil i.e. 21.5 percent and the minimum average mean values were found under the depth of 0-5 cm of depth soil i.e. 4.5 percent. At the depth of 10cm soil 6.3 percent, at the depth of 15cm of soil 8.6 percent and at the depth of 25cm of soil 11.6 percent average mean values were obtained. According to the table 2, 3 and 4, vertical distribution of soil nematodes under different depth of soils, **two-way analysis of variance** and **chi-square test** was applied as a tool for the statistical verification. It reveals significant results and the value of chi-square test was 1.85 obtained.

Table 2: Analysis of Variance of Vertical Distribution of Soil Nematodes in Different Depth of Soil During Year November 2009 to October 2011

Source of variation	SS	df	MS	F
Between Nematodes	225.8667	5	45.17333	12.35369
Between vertical depth	1074.467	4	268.6167	73.45943
Error	73.13333	20	3.656667	
Total	1373.467	29		

Table 3: Analysis of Variance of Vertical Distribution of Soil Nematodes in Different Depth of Soil during Year November 2009 to Oct 2011.

Source of variation	SS	Df	MS	F
Between Group	1074.46	4	268.62	22.45
Within group	299	25	11.96	
Total	1373.46	29		

Table 4: The Chi-Square Test in Vertical Distribution of Soil Nematodes in Different Depth of Soil during the Year 2009-2011. (Cm. & percent)

	0-5	%	5-10	%	10-15	%	15-20	%	20-25	%	Total
<i>Bathyodontus</i>	5	9.80	6	11.76	9	7.65	21	41.18	10	19.61	51
Percent	18.52		15.79		17.31		16.28		14.29		
<i>Mononchulus</i>	7	9.86	9	12.68	12	16.90	28	39.4	15	21.13	71
Percent	25.93		23.68		23.08		21.71		21.43		
<i>Oionchus</i>	2	7.14	3	10.71	5	17.86	11	39.29	7	25.0	28
Percent	7.41		7.89		9.62		8.53		10.0		
<i>Iotonchus</i>	3	6.67	5	11.11	7	15.56	19	42.22	11	24.44	45
Percent	11.11		13.16		13.46		14.73		15.71		
<i>Mylonchulus</i>	6	10.0	7	11.67	9	15.00	24	40.00	14	23.33	60
Percent	22.22		8.42		17.31		18.60		20.0		
<i>Mononchus</i>	4	6.56	8	13.11	10	16.39	26	42.62	13	21.31	61
Percent	14.81		21.05		19.23		20.16		18.57		
Total	27		38		52		129		70		

Chi.- Square 1.85

Discussion

The differences detected in vertical distribution above could be related to factors of soil type (Yeates, 1980), root wag pattern (Penmouratove *et al.*, 2004), anthropogenic distribution (Yeates and King, 1997). Sampling seasons (Liang *et al.*, 1999) and so on. Differences in distribution of nematodes under soil in different strata may be due to the difference in food (Sohlenius and Sandor, 1987). Total carbon and nitrogen in soil also affect the availability and distribution of soil nematodes (Yeates, 1980). Vertical distribution is also related with the pH of the soil as hydrogen ion concentration is a limiting factor for the survival, of the dominant genera. Similar studies have been done for Bactereovores nematodes by Liang (2005). Wei Ou *et al.* (2004) analyzed the vertical distribution of soil nematodes under different land use types in an aquic brown soil and all the data were subjected to statistical analysis of variance (ANOVA) in the SPSS statistical package. It revealed significant results. Meng Fan-Ziang *et al.* (2006) evaluate vertical distribution and seasonal fluctuation of nematode tropic groups as affected by land use, all data were also subjected to statistical analysis of variance (ANOVA). Differences with $p < 0.05$ were considered significant. Hou Xuekun *et al.* (2010) studied vertical distribution of soil nematode communities and used two-way ANOVA for all tests, statistically significant result were found ($p < 0.05$). All statistical analysis was performed by SPSS software package. This work will be helpful in field of parasitology as ecology of soil nematodes.

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