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A Study on the Population Ecology of Soil Nematode Fauna in Relation to Some Edaphic Factors in Schirmacher Oasis, Antarctica

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Abstract

Investigations relating to ecology of terrestrial invertebrate fauna of Antarctica are mainly confined to the Sub-Antarctica and maritime zones. The effects of some physico-chemical soil factors on the distribution of soil nematode fauna have not been attempted so far in Schirmacher Oasis of Antarctic Continental zone. Only ten species, representing six genera of nematodes, have so far been recorded from the Continental Antarctic zone (Maslen, 1979). Five genera of nematodes viz., *Tylenchorhynchus, Drylaimellus, Aporcelaimellus, Dorylaimoides,* and *Paramylonchulus* were recorded for the first time from this area. Altogether 30 stations among 15 study sites were chosen for sampling during the study period from 3.1.90 to 30.2.90.

The population of nematodes, including juveniles, was maximum (22.27%) on 27th January and minimum (2.38%) on 25th February, The sitewise maximum population was obtained from the site 15 (11,62%). Nematode genus *Tylenchorhynchus* was most dominant taxa comprising 41.45% of the total population. The vertical distribution study for all the four genera revealed that maximum faunal composition was in the upper 0.5 cm. depth.

The physico-chemical factors of soil viz., temperature, relative humidity, nitrate, pH and organic carbon were also studied. Peak population was associated with the higher levels of temperature, nitrate, organic carbon and relative humidity.

The statistical analysis revealed that a significant correlation exists between soil nematode population and soil factors.

Introduction

The terrestrial animal life of Antarctic is dominated by the invertebrates, such as Protozoa, Insects and Mites (Somme, 1985). A review of earlier literature reveals that the ecological studies of the Antarctic invertebrate fauna is very scanty, and is mostly confined to sub-Antarctic and maritime zones.

The first ecological account of nematodes was made available by Bunt (1954a) who worked on the Macquarie Island — a sub-Antarctic island. Another important contribution on the ecology of nematodes from Signy Island of Antarctica was made by Spaull (1972, '73a, '73b). In addition to this, there are some fragmentary reports on the taxonomy of nematode from the Antarctic continent (Maggenti, 1961; Holdgate, 1970; Ingole and

Parulekar 1987). However, no serious attempts have been made to study the ecology of soil nematode in the Antarctic continent. Inview of this, an attempt has been made to study the distribution patterns of nematode in relation to some physico-chemical parameters of the soil at the Schirmacher Oasis areas of Antarctic Continental Zone.

Materials and Methods

Location and characteristics of sampling sites .

The sampling sites were located at Schirmacher Oasis, in eastern Antarctica, where the Indian Station "Maitri" is located (Lat. 10°44'30" - 70°46'30" S and Long. 11°22'40" - 11 °54'00" E). There are over 25 fresh water lakes of different sizes within this oasis. Fifteen such lakes (embankment) were chosen for the present study (Fig.l). Each sampling plot measured 5 m x 5 m in moss-turf or moss-carpet areas in the periphery of the lakes.

Soil samples were drawn at random, at the rate of 3 samples per site on eight different dates during the period from 3rd January to 25th February, 1990. Samples were drawn by using stainless steel corers (cross sectional diameter 8.55 cm) from adepth of 5 cm. Separate sample units were taken on several dates from 7 different sites to study the vertical distribution of nematodes. Three samples per plot were drawn from a depth of 10 cm and subdivided into two 5 cm sub-samples as per method described by Curry (1971). The soil samples thus collected were kept in polythene packets and properly closed with rubber bands and stored in fridge in the ship to avoid evaporation. The extraction of soil samples were made in the laboratory of Dr. Q.H. Baquri, Z.S.I. and major part of the work was completed in the Neonatology research unit of the Department of Zoology, Burdwan University. The methodology followed for sieving was after Cobb's (1918),while for decantations, the Bearmann funnel technique of Christie and Perry (1951) was used.

Soil factor viz. organic carbon was determined by rapid titration method of Walkley and Black (1934), nitrate was estimated colorimetrically by Sprengell method, temperature was taken with a telethermometer using thermistor probe with thermocouple bridge, pH was determined by pH meter (Cambridge pH meter, model PI 014) and relative humidity was

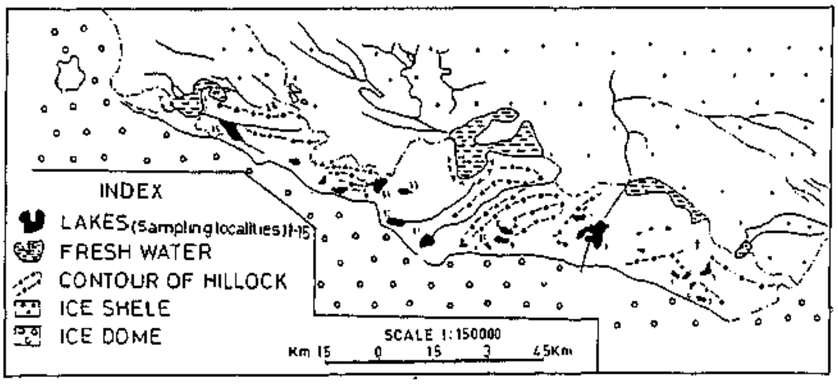


Fig. 1. Map of Schirmacher Oasis showing the sampling sites.

Table 1: Mechanical Analysis of Soil Samples of Schirmacher Oasis

Sites	Coarse sand (%)	Silt (%)	Clay (%)
1	90.00	7.50	2.50
2	86.90	12.50	0.60
3	84.85	14.15	1.00
4	78.90	16.00	5.10
5	92.34	5.32	2.34
6	96.36	3.20	0.44
7	96.40	3.00	0.60
8	85.90	13.00	1.10
9	95.25	4.30	0.45
10	96.80	3.10	0.60
11	82.50	15.35	2.15
12	83.20	15.70	1.10
13	97.32	2.00	0.68
14	75.80	16.25	7.95
15	70.50	18.30	11.70

determined by using a dial hygrometer. Mechanical analysis of soil samples were performed by hydrometer method.

Soil analysis

Mechanical analysis of soil sampled showed high percentage of coarse sand and low percentage of clay (Table 1). The soil was blackish brown to greyish black in colour. pH of soil ranged between 4.95 and 6.85. In February the mean values of other soil factors such as organic carbon, nitrate, temperature and pH were 2.42%, 0.76 ppm, 0.60°C and 5.26 respectively at all the sites (see Table 2). The amount of mean values of temperature of soil, organic carbon and nitrate were found to be maximum on 27.1.90 (see Table 2). The mean values for all the physico-chemical parameters of soil were comparatively low at site 7 and high at site 15 (see Table 3 and Figs 2 and 3).

Faunal composition

The soil nematode fauna obtained from all the sites of Schirmacher Oasis areas are given in Figure 4. The genus *Tylenchorhynchus* was most dominant and its representation was 41.45% of the total fauna obtained from all the sites. The genera *Dorylaimoides* contributed 27.87%, *Drylaimellus* contributed 18.83%, *Paramylonchulus* contributed 12.52%. In addition another genus *Aporceaimellus* and order Rhabditida were also recorded during this study. However, they have not been included in discussion because of their irregular occurrence. A maximum of 11.62% population of Nematodes was recorded at site 15 and minimum of 3.04% population of nematodes at site 7. However, the predominant genus *Tylenchorhynchus* were maximum at site 12 (4.76%). The percentage representation of nematodes observed maximum during January and this coincided with the maximum concentrations of the soil factors (see Table 4).

Table 2: Date Wise Values of Different Soil Factors in Each **Site of Schirmacher Oasis Area**

Relative humidity (%)

Sites			**3**			6	7	8	9	10	11	12	13	14	15
Date															
January, 1990															
3rd	17.50	17.54	17.58	17.65	17.20	17.40	17.00	17.25	17.45	17.35	17.52	17.68	17.50	18.10	18.30
6th	15.20	15.10	15,50	15.54	15.40	15.35	14.70	14.90	14.85	14.80	15.45	15.55	15.10	15.60	15.80
12th	16.20	16.50	16.65	16.55	16.40	15.90	15.60	16.20	16.10	16.00	16.68	16.90	16.30	16.40	16.25
27th	20.50	20.70	20.75	21.00	20.40	20.35	20.00	21.20	20.80	20.30	21.30	21.50	21.00	21.40	22.00
February, 1990															
1st	14.30	14.20	14.50	14.70	14.25	14.40	14.00	14.45	14.32	14.49	14.75	14.80	14.55	14.90	15.00
8th	13.50	13.55	13.65	13.70	13.60	13.30	13.28	13.60	13.32	13.34	13.72	13.75	13.44	13:80	13.90
16th	13.40	13.20	13.55	13.60	13.30	13.45	13.00	13.58	13.57	13.46	13.78	13.80	13.60	13.85	13.88
25th	11.50	11.30	11.55	11.53	11.58	11.10	11.00	11.44	11.32	11.07	12.10	11.90	11.85	11.65	12.00
							pH.								
January, 1990															
3rd	6.50	6.55	6.58	6.59	6.52	6.54	6.01	6.45	6.43	6.41	6.43	6.40	6.49	6.62	6.65
6th	6.30	6.04	6.32	6.35	6.08	6.20	5.98	6.03	6.04	6.06	6.07	6.10	6.31	6.35	6.40
12th	590	6.01	5.98	5.88	5.85	5.80	5.70	6.05	6.08	6.05	6.06	6.08	6.04	6.05	6.10
27th	6.66	6.68	6.69	6.71	6.73	6.70	6.30	6.45	6.53	6.59	6.66	6.72	6.80	6.82	6.85

Contd.

Table 2: *Contd.*

Sites	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
February, 1990															
1st	5.60	5.62	5.66	5.41	5.35	5.37	5.02	5.13	5.77	5.41	5.33	5.56	5.59	5.62	5.70
8th	5.32	5.34	5.37	5.33	5.12	5.10	5.00	5.22	5.32	5.21	5.35	5.37	6.29	5.34	5.40
16th	5.20	5.22	5.25	5.08	5.12	5.03	5.21	5.17	5.19	5.21	5.26	5.19	5.23	5.26	5.30
25th	5.12	5.10	5.14	5.11	5.04	5.06	4.95	5.02	5.07	5.12	5.03	5.15	5.17	5.14	5.20
Temperature (°C)															
January, 1990															
3rd	1.38	1.28	1.40	1.50	1.52	1.48	1.00	1.54	1.42	1.58	1.55	1.65	1.53	1.60	1.68
6th	1.34	1.22	1.30	1.38	1.44	1.45	1.20	1.46	1.33	1.52	1.50	1.60	1.48	1.53	1.56
12th	1.26	1.20	1.28	1.30	1.34	1.32	1.16	1.43	1.25	1.50	1.42	1.55	1.39	1.46	1.52
27th	2.54	2.60	2.68	2.70	2.69	2.65	2.50	2.72	2.70	2.66	2.79	2.85	2.90	3.00	3.80
February, 1990															
1st	1.17	1.27	1.19	1.21	1.25	1.27	1.30	1.31	1.20	1.48	1.35	1.52	1.40	1.49.	1.43
8th	1.30	1.05	1.10	1.15	1.18	1.01	1.02	1.00	1.25	1.20	1.15	1.03	1.05	1.25	1.22
16th	1.19	1.01	1.15	1.11	1.15	1.25	1.04	1.33	1.21	1.40	1.31	1.41	1.32	1.33	1.28
25th	-0.01	-1.52	-1.25	-1.20	-1.10	-1.54	-1.95	-1.40	-1.08	-1.90	-1.00	-1.21	-1.11	-1.07	-1.04
Nitrate (ppm)															
January, 1990															
3rd	1.50	1.53	1.55	1.55	1.51	1.52	1.49	1.54	1.53	1.48	1.56	1.58	1.56	1.62	1.60

Contd.

Table 2: *Contd.*

Sites	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
6th	1.20	1.18	1.22	1.23	1.20	1.21	1.16	1.24	1.15	1.14	1.25	1.27	1.23	1.29	1.28
12th	1.05	1.07	1.09	1.06	1.05	1.04	1.02	1.12	1.07	1.03	1.14	1.17	1.11	1.13	1.18
27th	1.70	1.75	1.80	1.86	1.73	1.65	1.68	1.77	1.74	1.71	1.81	1.84	1.72	1.87	1.85
February, 1990															
1st	1.00	0.97	1.01	1.05	1.02	1.03	0.95	1.03	0.99	0.95	1.04	1.09	1.06	1.13	1.11
8th	0.98	0.99	1.02	1.02	1.00	0.94	0.95	1.03	0.95	0.92	1.01	1.04	1.01	1.00	1.02
16th	0.70	0.63	0.73	0.71	0.72	0.68	0.64	0.59	0.66	0.69	0.72	0.74	0.69	0.66	0.70
25th	0.38	0.33	0.40	0.32	0.39	0.31	0.31	0.34	0.32	0.30	0.37	0.32	0.38	0.37	0.36
Organic carbon (%)															
January, 1990															
3rd	4.30	4.20	4.80	5.10	4.70	5.00	4.60	4.80	4.90	4.80	5.20	5.30	4.70	4.40	5.50
6th	4.45	4.30	4.50	4.52	4.45	4.46	4.39	4.42	4.44	4.33	4.54	4.60	4.48	4.62	4.65
12th	4.32	4.41	4.45	4.38	4.34	4.30	4.28	4.39	4.31	4.25	4.50	4.55	4.43	4.52	4.47
27th	6.80	5.90	6.10	6.20	6.00	5.90	5.70	5.80	5.90	5.60	5.70	5.90	5.40	6.00	6.30
February, 1990															
1st	3.42	3.33	3.47	3.49	3.33	3.44	3.27	3.42	3.35	3.29	3.52	3.57	3.38	3.51	3.58
8th	2.40	2.60	2.80	2.90	2.50	2.10	2.30	2.50	2.00	2.20	2.90	3.20	3.00	3.10	3.20
16th	2.18	2.15	2.22	2.17	2.19	2.12	2.14	2.04	2.15	2.13	2.24	2.30	2.20	2.26	2.23
25th	1.30	1.20	1.80	1.40	1.50	1.30	1.10	1.60	1.20	1.00	1.80	1.40	1.60	1.50	1.70

Table 3: Site Wise Mean Nematode Population and Soil Factors of all the Periods Together at Schirmacher Oasis

Site Nos.	Population (%) (Mean±SD)	Relative humidity (%) (%) (Mean±SD)	Organic carbon (Mean±SD)	Nitrate (ppm) (Mean±SD)	Temperature (°C)	pH (Mean±SD)
1.	0.53 ±0.27	15.26 ±2.80	3.55 ±1.72	1.06 ±0.45	1.03	5.83 ± .61
2.	0.57 ±0.41	15.24 ±2.94	3.51 ±1.50	1.06 ±0.45	1.01	5.82 ±.60
3.	1.01 ±0.41	15.47 ±2.87	3.77 ±1.59	1.10±0.44	1.11	5.87 ±.61
4.	1.01 ±0.70	15.53 ±2.91	3.77 ±1.59	1.10 ± 0.47	1.14	5.81 ±.67
5.	0.65 ±0.26	15.27 ±2.74	3.63 ±1.51	1.08 ±0.42	1.18	5.73 ±.67
6.	0.43 ±.31	15.16 ±2.23	3.58+1.61	1.05 ± .43	1.11	5.66 ±.67
7.	0.37 + .20	14.82 ±2.76	3.47 ± 1.54	1.03 ±.44	0.90	5.52 ±.54
8.	0.71 ±0.39	15.88 ±2.70	3.63 ±1.48	1.08 ±.46	1.17	5.62 ±.62
9.	0.48 ±0.34	15.22 ±2.91	3,53 ±1.63	1.04 ±.45	1.16	5.74 ±.59
10.	0.44 ±0.17	15.10± 2.81	3.45 ±1.57	1.03 + .44	1.18	5.76 ±.59
11.	1.17 ± .51	15.66 ±2.86	3.80+ 1.41	1.11 ±.45	1.26	5.77 ±.60
12.	1.34 ±0.65	15.74 ±2.97	3.60 ±1.41	1.13 ±.47	1.30	5.82 ±.59
13.	0.81 ±0.32	15.42 ±2,86	3.65 ±1.32	1.101.43	1.25	5.99 ±.60
14.	1.43 ±0.77	15.64 ±3.06	3.74± 1.44	1.13 ±.48	1.32	5.90 ±.65
15.	1.45 ±0.93	15.92±3.10	3.95 ±1.58	1.14 ±.47	1.43	5.95 ±.64

Table 4: Date Wise Nematode Population and Soil Factors in all the Sites Together at Schirmacher Oasis Area

Date	Population (%) Mean ±SD	Relative humidity (%) Mean ±SD	Organic carbon (%) Mean ± SD	Nitrate (ppm) Mean ±SD	Temperature (°C) Mean±SD	pH Mean ±SD
3.1.90	1.13 ±0.52	17.50 ±0.31	4.82 ±0.36	1.54 ±0.04	1.47 ±0.17	6.49 ±0.15
6.1.90	1.00 ±0.53	15.26 ±0.33	4.48 ± 0.09	1.22 ±0.05	1.43 ±0.13	6.20 ±0.15
12.1.90	1.00 ±0.45	16.31 ±0.33	4.40 ±0.09	1.09 ±0.05	1.35 ± 0.12	5.98 ±0.12
27.1.90	1.47 ±0.69	20.84 ±0.52	5.66 ±0.36	1.77 ±0.07	2.78 ±0.30	6.66 ± 0.14
1.2.90	0.83 ± 0.54	14.51 ±0.28	3.42 ±0.10	1.03 ±0.05	1.32±0.12	5.44 ±0.20
8.2.90	0.57 ±0.30	13.56 ±0.20	2.65±0.40	0.99 ±0.04	1.13 ± 0.10	5.33 ± 0.27
16.2.90	0.47 ±0.20	14.85 ±5.26	2.18 ±0.06	0.68 ±0.04	1.23 ±0.12	5.19 ±0.07
25.2.90	0.18 ±0.09	11.55 ±0.34	1.43 ±0.25	0.35 ±0.03	-1.29 ± 0.31	5.09 ±0.07

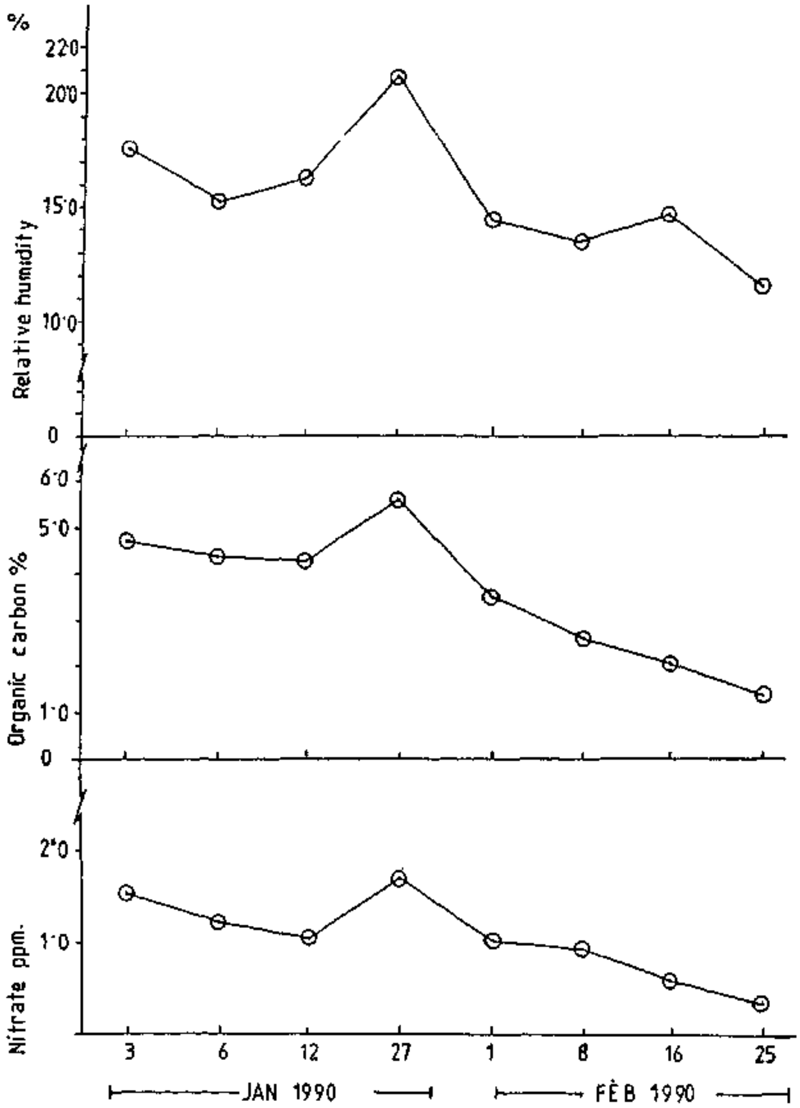
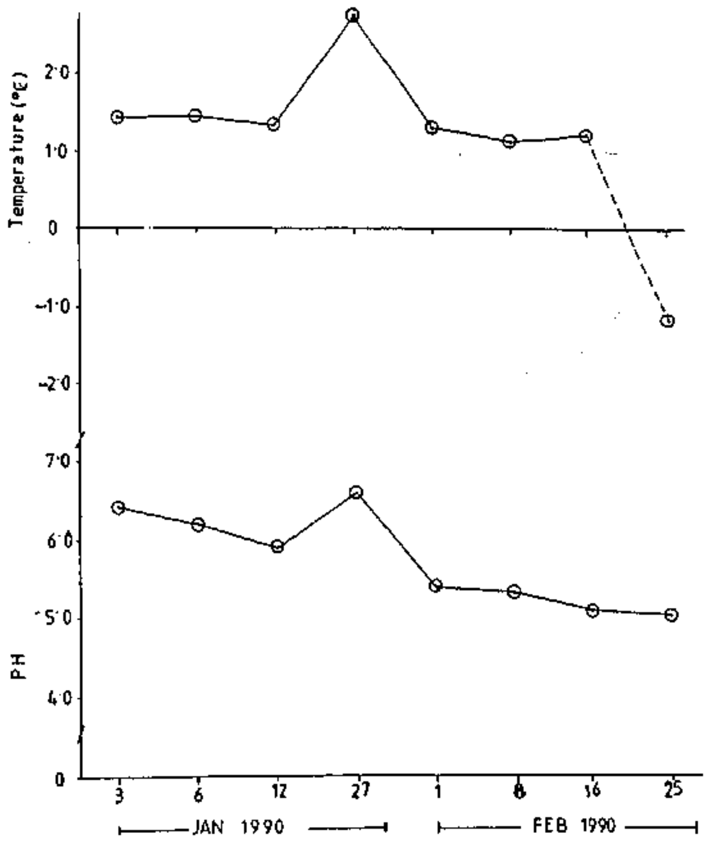


Fig.2. Showing fluctuations of mean values of relative humidity (%), organic carbon (%) and nitrate (ppm) of all sites together in Schimiacher Oasis.

Population fluctuations

Figures 5-8 show the date wise monthly changes in number of each genera of nematode recorded from all the sites. *Tylenchorhynchus* sp. had its peak on 27th January and second highest peak on 3rd January. *Drylaimellus* sp. showed its second highest peak on 6th and 12th January. The maximum population peaks of other genera were also recorded on 27th January and minimum on 25th February. The population of each genera when considered



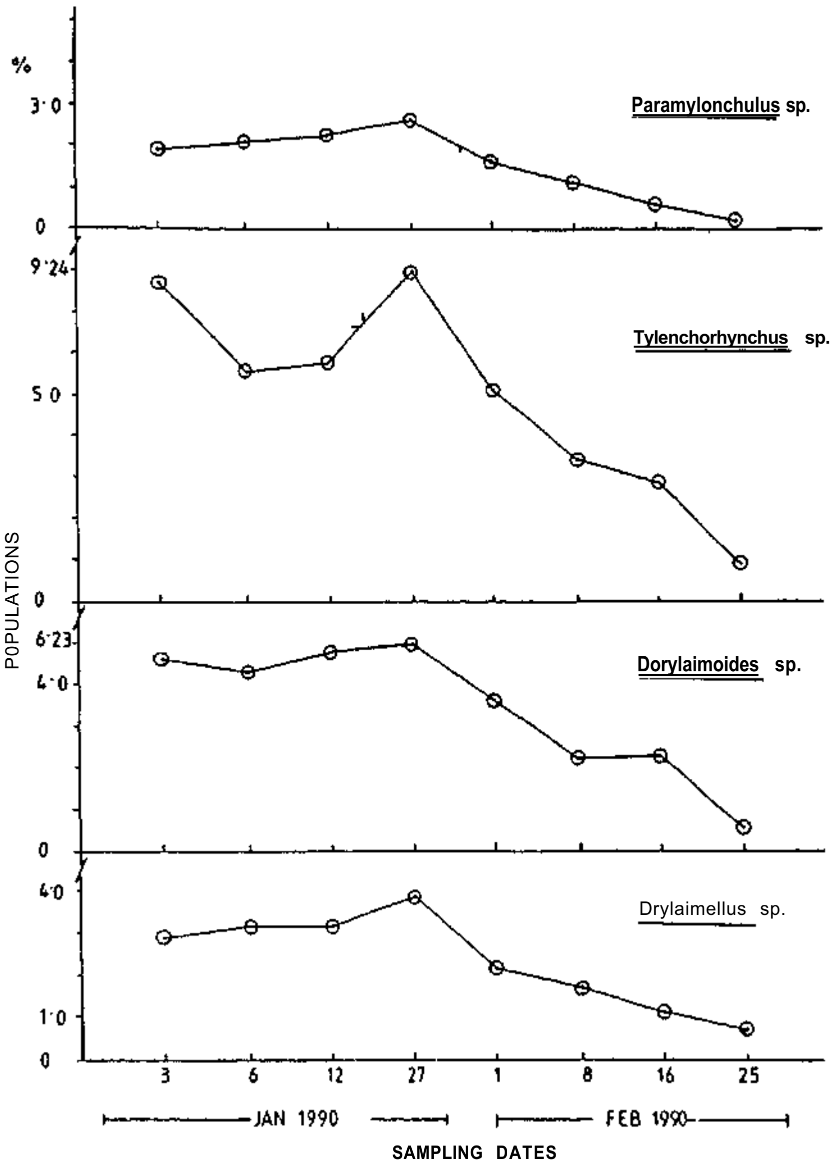
Sampling dates

Fig.3. Showing fluctuations of mean values of temperature (°C) and pH of all the sites together at Schirmacher Oasis.

site wise, showed an irregular trend of fluctuations and this varied among sites, months as well as dates of observation.

Vertical distribution

Depth wise distribution of mean population of nematodes obtained from different study sites reveals that maximum nematode fauna (76.65%) was recorded from the upper most layer (0-5 cm). Monthly variations in the vertical distribution of nematodes showed maxima in the upper most layer during the months of January and February. *Paramylonchulus* was absent on 15.1.90 from both the layers. *Dorylaimoides* sp. and *Drylaimellus* sp. were not found in 5-10 cm layer and the genus *Tylenchorhynchus* was absent from 5-10 cm layers on 3.1.90, 15.2.90 and 26.2.90. The maximum population was found in both the layers in month of January. It was interesting to note that the relative abundance of nematodes in the upper layer was associated with preponderance of immature forms (Figs 9-11).



Fig, 4. Monthly fluctuations of each nematode genus (%) of all the sites together at Schirmacher Oasis.

Regression and correlation between nematode population and edaphic factors

Data pertaining to soil factors and population density were subjected to statistical analysis for regression equation for correlation and dependence of number of nematodes (Y) on each of the five variables (soil factors) considered in this study.

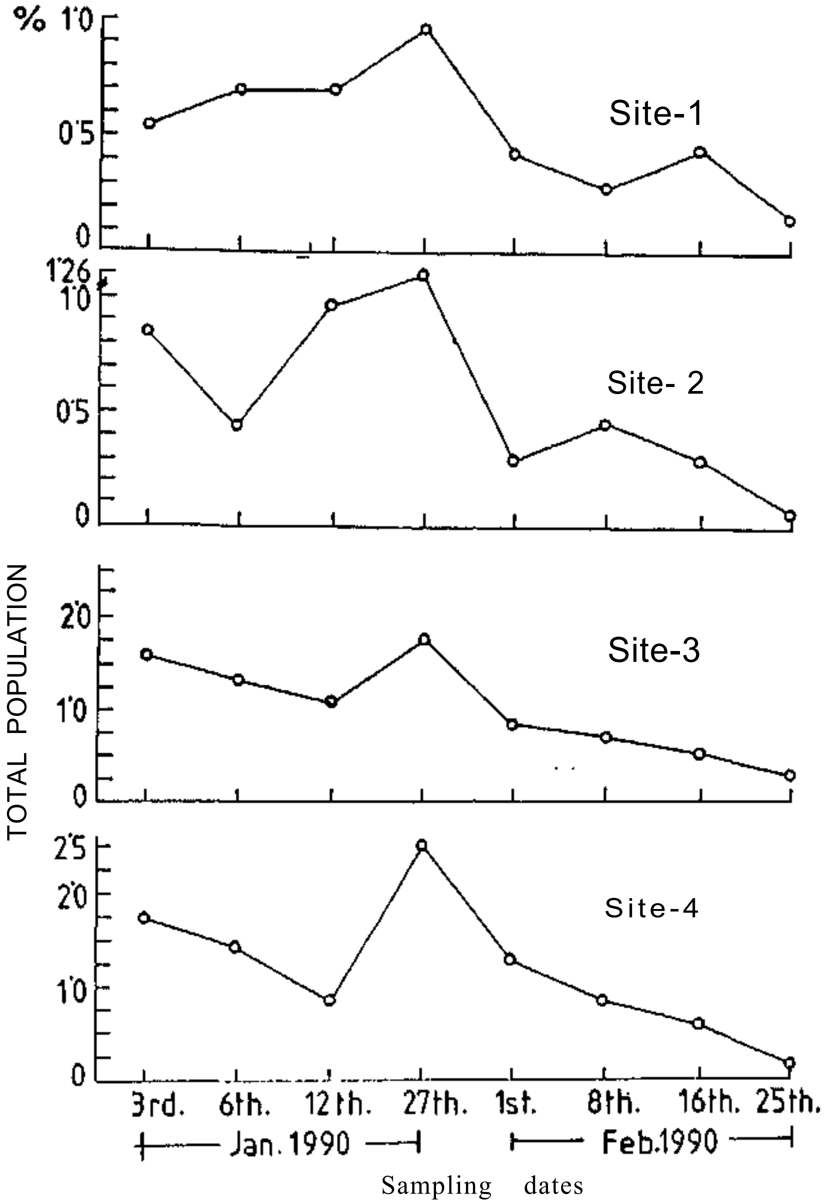


Fig.5. Site wise (1-4) fluctuations of total population of nematode (%) at Schirmacher Oasis.

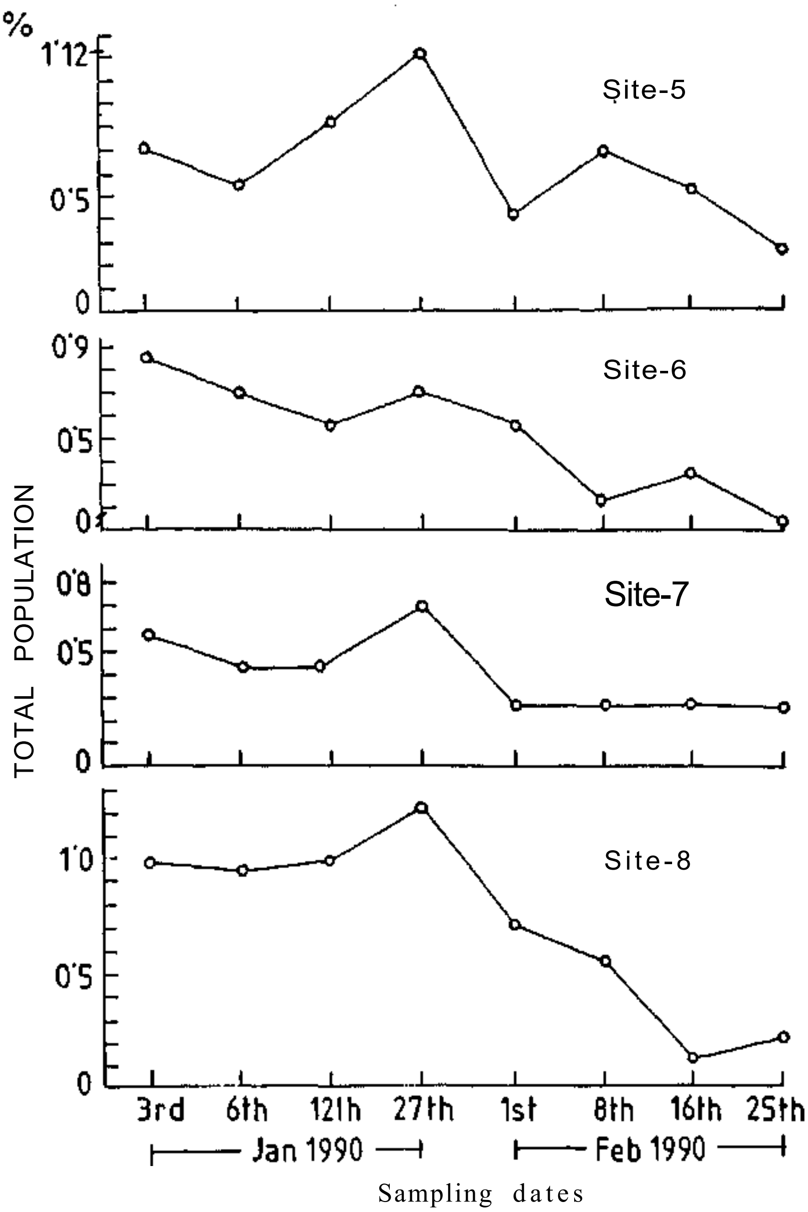


Fig.6. Sitewise (5-8) fluctuations of total population of nematode (%) at Schumacher Oasis.

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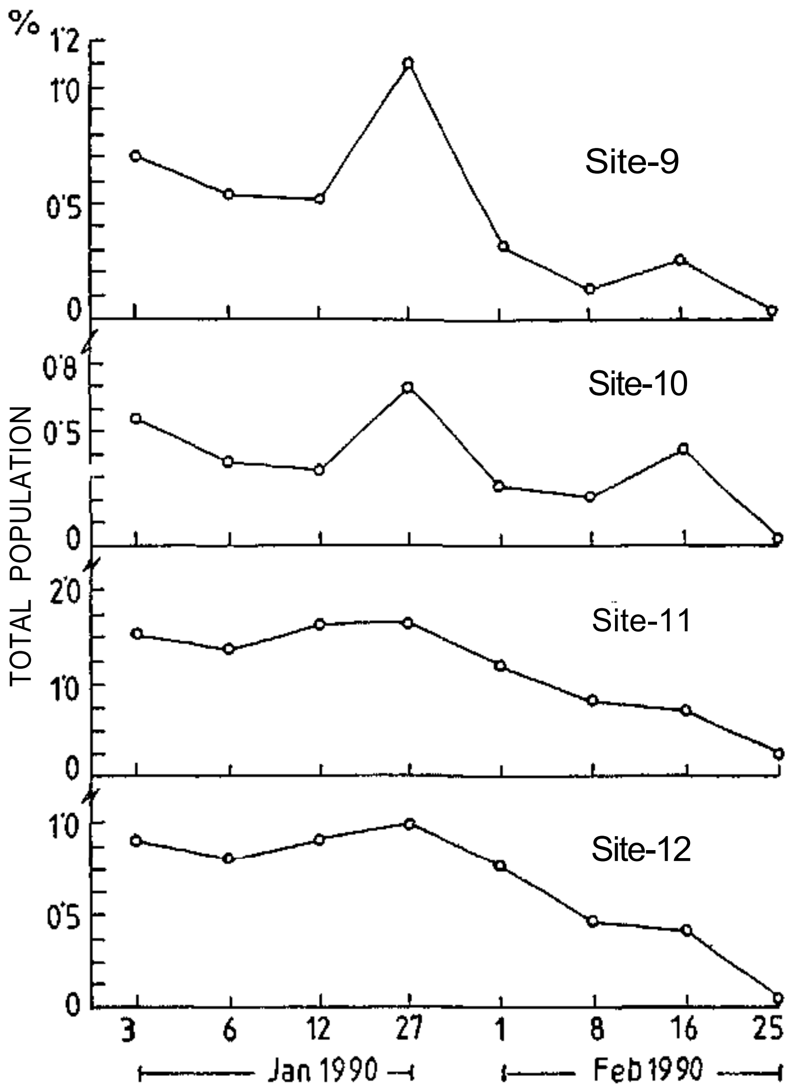

Sampling dates

Fig. 7. Site wise (9-12) fluctuations of total population of nematode (%) at Schirmacher Oasis.

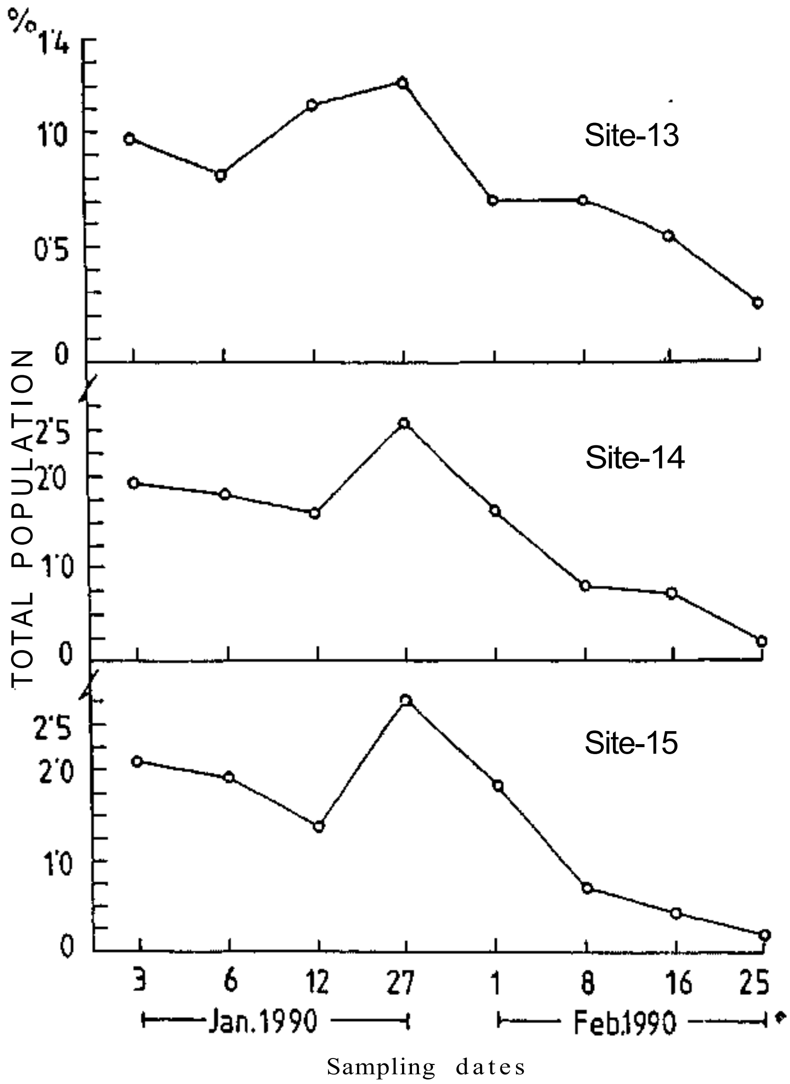

Fig.S. Site wise (13-15) fluctuations of total population of nematode (%) at Schirmacher Oasis.

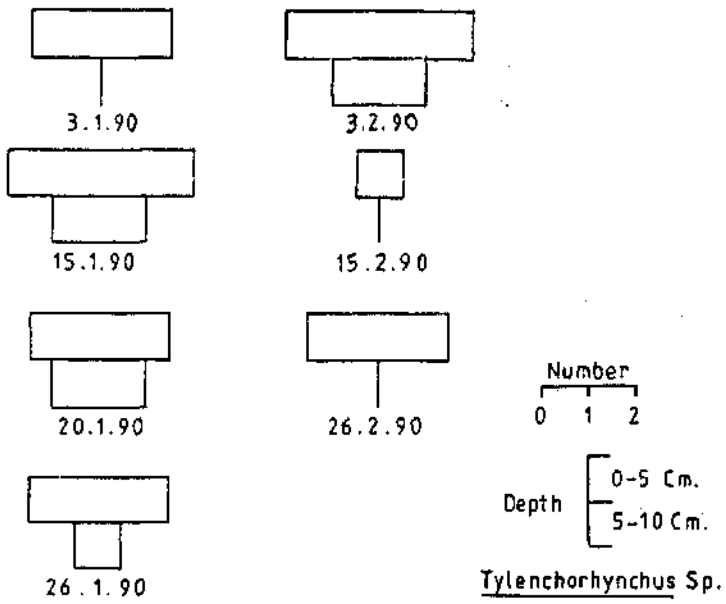

Fig.9. Showing date wise vertical distribution of Tylenchorhynchus sp. at Schirmacher Oasis.

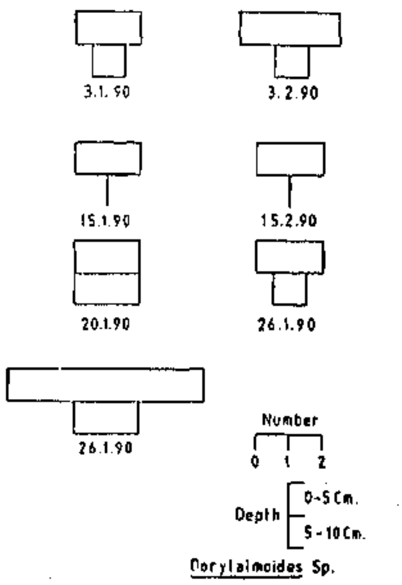

Fig. 10. Showing date wise vertical distribution of Dorylaimaides sp. at Schirmacher Oasis.

This test revealed that more or less identical relationship exist between the nematode population (Y) and different variables at all the 15 sampling sites during the period of investigation. The correlation between nematode populations and the variables showed strong positive significant correlations with all the variables in all the sites, except at site 1 where soil temperature did not show any significant correlation with the nematode population. The regression lines were obtained by pooling up the data for all sites together during the sampling periods. These combined regression lines drawn along with respective scattered diagrams are shown in Figures 12-15. Study of correlation coefficient (Third column of Table 5) indicated that all the five variables in all the sites showed positive correlation with the population density.

Discussion

The results presented in this investigation were based on sample survey of 30 stations from 15 sampling sites of Schirmacher Oasis area of the Antarctic continent. The nematode fauna, encountered in this study, belonged to 4 genera of the families Tylenchorhyncludae, Belondiridae, Leptonchidae and Mylonchulidae. *Tylenchorhynchus* sp. was most dominant soil fauna in the present study. It is interesting to note that so far only six genera and ten species of nematodes have been reported from the Continental Zones by Maslen (1979). These included *Plectus, Monhystera, Panagrolaimus, Scottnema, Eudorylaimus* and *Mesodorylaimus* but all the four genera (viz. *Drylaimellus, Dorylaimoides, Tylenchorhynchus* and *Paramylonchulus)* obtained in the present study have not been reported so far from this continent, therefore it seems to be the additions to the nematode fauna in the Antarctic Continental Zone.

Some genera markedly differed in their abundance from one site to another. The total population extracted in the site 7 was significantly low (2.99%) in comparison to those extracted from the other adjacent sites (Fig. 16). These variations in the faunal distribution might be due to the difference in ecological conditions. Similar results were obtained by Ghilarov (1973). According to him the decrease in the density of the soil forms in some fields are due to a marked decrease or increase of some of the soil factors. In this study also, low content of organic carbon, nitrate, RH and significantly low soil temperature supported a smaller population. Banage (1966) reported lowest densities of soil nematodes in summer and highest in autumn in a British moorland site and in an English Beech wood. Phillipson et al., (1977) found low density in spring and maximum in early winter, from India. Das et al., (1984) found minimum population of soil nematode during summer. While in Antarctic region contrasting results have been reported by workers like Spaull (1973) and Maslen (1979, '81) from Signy island. They observed the maximum population densities of nematode in summer and low in winter. These findings are compatible with the observations in the present study, that maximum population of nematode is associated with the higher temperature in January while minimum population occurred in the month of February when temperature recorded is low (Figs 3 & 17). As to the role of other soil factors, it might be assumed that the factors analysed in this study exerted significant effects either singly or in a cumulative way. It could be substantiated, if an analysis was made as to the extent of importance of the different factors by taking into consideration the values of the edaphic factors during maximum and minimum population peaks at all the sampling sites. The data

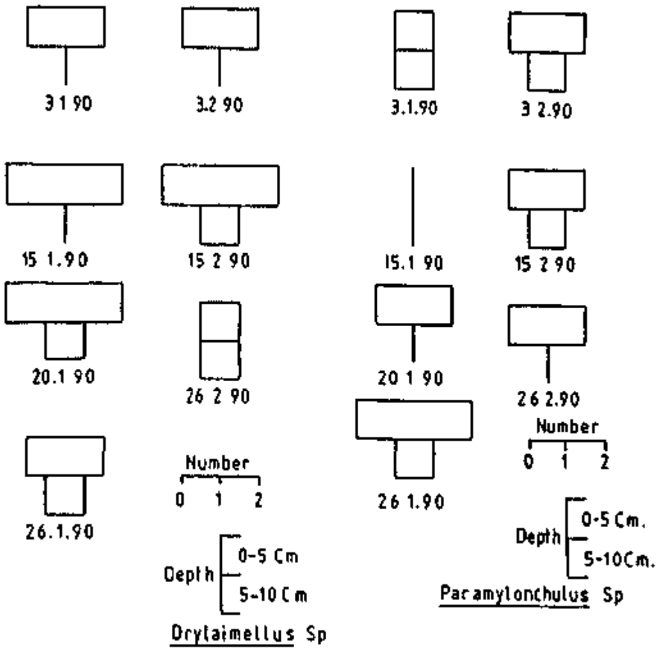

Fig.11. Showing date wise vertical distribution of Drylaimellus sp. and Paramylonchules sp. at Schirmacher Oasis.

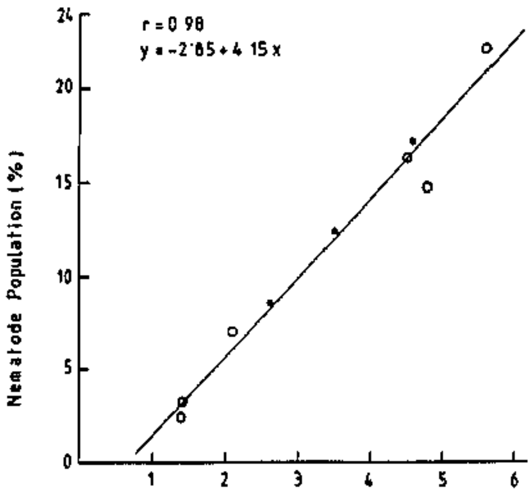

Fig. 12. Showing relationship between total population of soil nematode and organic carbon content of soil in Schirmacher Oasis.

Table 5: Showing Relationship between Nematode Population and Edaphic Factors

Parameters	MeaniS.D.	"r" value	Regression equation Y= a + bx
SITE - 1			
Y: Nematode Population	0.53+ .27		
Organic Carbon (%)	3.65±1.72	0.96**	Y=-0.02 + 0.15x
Nitrate (ppm)	1.06 ±0.42	0.84**	Y=-0.04 + 0.53x
Soil temperature (°C)	1.27 ±0.51	0.46	Y=0.14 + 0.33x
Relative humidity (%)	15.26 + 2.80	0.91**	Y=-0.81+0.09x
PH	5.83 ±.61	0.8?**	Y=1.70 + 0.38x
SITE-2			
Y: Nematode Population	0.57 ±.41		
Organic Carbon (%)	3.51 ±1.50	0.85**	Y=-0.29 + 0.24x
Nitrate (ppm)	1.06 ±.45	0.85	Y=-0.25 + 0.77x
Soil temperature (°C)	1.53 ±.63	0.75 *	Y=-0.08 + 0.53x
Relative humidity (%)	14.48 + 2.10	0.95**	Y=-1.47 + 0.13x
PH	5.92 + .68	0.87**	Y=-2.91+0.60x
SITE-3			
Y: Nematode Population	1.01		
Organic Carbon (%)	3.77 ±1.45	0.96**	Y=-0,02 + 0.27x
Nitrate (ppm)	1.10±.44	0.97**	—
Soil temperature (°C)	1.42 ± 0.52	0.74**	Y=0.51+0.41x
Relative humidity (%)	15.46 + 2.85	0.93**	Y=-1.06 + 0.13x
pH	5.95 + 0.62	0.95**	Y=-2.76 + 0.64x
SITE-4			
Y: Nematode Population	1.12±66		
Organic Carbon (%)	4.00+1.73	0.95**	Y=-0.36 + 0.39x
Nitrate (ppm)	1.10 + .47	0.98	Y=-0.37+1.35x
Soil temperature (°C)	1.44+ .52	0.94**	Y= 0.23 + 0.76x
Relative humidity (%)	15.53 ±2.91	0.92**	Y=-2.10 + 0,21x
pH	5.81±.67	0.87**	Y=-3.87 + 0.86x
SITE - 5			
Y: Nematode Population	0.65+ 26.		
Organic Carbon (%)	3.63 + 1.51	0.79**	Y=0.16 + 0.14x
Nitrate (ppm)	!.08±.42	0.80**	Y=0.12 + 0.49x
Soil temperature (°C)	1.46 ±0.52	0.82**	Y=0.17 + 0.35x
Relative humidity (%)	15.27 ±2.74	0.89**	Y= -0.63 + 0.08x

Contd.

TableS: *Contd.*

Parameters	Mean± S.D.	"r" value	Regression equation Y= a + bx
PH	5.73 + 0.67	0.72*	Y=-0.94 + 0.28x
SITE-6			
Y: Nematode Population	0.48+ 28		
Organic Carbon (%)	3.58 ±1.61	0.93**	Y=-0.11+0.16x
Nitrate (ppm)	1.05 ±0.43	0.87**	Y=-0.12 + 0.57x
Soil temperature (°C)	1.50 ±.49	0.53*	Y=0.17 + 0.25x
Relative humidity (%)	13.91 ±5.66	0.78**	Y=-0.06 + 0.04x
PH	5.65 ± .68	0.89**	Y=-1.63 + 0.37x
SITE - 7			
Y: Nematode Population	0.37 ±21		
Organic Carbon (%)	3.47 ±1.54	0.92**	Y=-0.02 + 0.11x
Nitrate (ppm)	1.03 ±0.44	0.94**	Y=-0.07 + 0.43x
Soil temperature (°C)	1.66 ±0.45	0.86**	Y=-O.05 + 0.29x
Relative humidity (%)	14.82 ±2.76	0.98**	Y=-O.57 + 0.06x
PH	5.63 ±0.51	0.93**	Y=-1.18 + 0.28x
S1TE-8			
Y: Nematode Population	0.71 ±39		
Organic Carbon (%)	3.68 ±1.48	0.97**	Y=-0.22 + 0.26x
Nitrate (ppm)	1.08 ±0.45	0.94**	Y=-0.16 + 0.81x
Soil temperature (°C)	1.52±0.51	0.69**	Y=0.09 + 0.45x
Relative humidity (%)	15.33 ±2.95	0.89**	Y=-1.08 + 0.12x
pH	5.69 ± .62	0.88**	Y=-2.45 + 0.55x
SITE - 9			
Y: Nematode Population	0.48 ± 34		
Organic Carbon (%)	3.57 ±1.60	0.96**	Y=0.22 + 0.20x
Nitrate (ppm)	1.04 ±0.45	0.91	Y=-0.23 + 0.68x
Soil temperature (°C)	1.43 + 0.52	0.86**	Y=-0.20 + 0.50x
Relative humidity (%)	15.22 ±2.91	0.98**	Y=-1.24 + 0.11x
PH	5.74 ±0.59	0.90**	Y=-2.48 + 0.52x
SITE- 10			
Y: Nematode Population	0.39 ± 22		
Organic Carbon (%)	3.45 ±1.57	0.84**	Y=0.04 + 0.11x
Nitrate (ppm)	1.03 ±.44	0.81"	Y=0.01+0.38x

Contd.

Table S: *Contd.*

Parameters	Mean+S.D.	"r" value	Regression equation Y=a + bx
Soil temperature (°C)	1.52+0.48	0.74"	Y= 0.07 + 0.25x
Relative humidity (%)	14.36 ±2.02	0.86"	Y= -0.46 + 0.06x
PH	5.76 + .59	0.88"	Y=-1.04 +0.25 x
SITE - 11			
Y: Nematode Population	1.17+51		
Organic Carbon (%)	3.80 ±1.47	0.95"	Y=-0,14 + 0.34x
Nitrate (ppm)	1.11 ±.45	0.89* +	Y=0,05 + 1.01x
Soil temperature (°C)	1.50 ±.52	0.59*	Y= 0.59 + 0.45x
Relative humidity (%)	15.66 ±2.86	0.84"	Y=-1.20 +0.15x
pH	5.77 ±.60	0.88"	Y=-3.16 + 0.75x
SITE-12			
Y: Nematode Population	1.34 ±65		
Organic Carbon (%)	3.85 + 1.52	0.95"	Y=-0.23+0.41 x
Nitrate (ppm)	1.13 ±.47	0.92"	Y=-0.10+1.28x
Soil temperature (°C)	1.60 ±0.55	0.66"	Y= 0.66 + ,52x
Relative humidity(%)	15.74 ±2.97	0.84"	Y=-1.56 + 0.18x
pH	5.85+0.62	0.86"	Y=-3.97 + 0.91x
SITE- 13			
Y: Nematode Population	0.81 ±32		
Organic Carbon (%)	3.65 ±1.32	0.95"	Y=-0.02 + 0.23x
Nitrate (ppm)	1.11 ±0.43	0.94"	Y=0.05 + 0.68x
Soil temperature (°C)	1.52 ±0.58	0.73*	Y=0.40 + 0.31x
Relative humidity (%)	14.62+1.89	0.92**	Y=-0.76 + 0.10x
pH	5.95 ±0.63	0.84"	Y=-1.84 + 0.44x
SITE - 14			
Y: Nematode Population	1.43 ±77		
Organic Carbon (%)	3.74+1.44	0.97**	Y=-0.49 + 0.51x
Nitrate (ppm)	1.14±,47	0.96**	Y=-0.34+1.56x
Soil temperature (°C)	1.59 ±,59	0.77"	Y=0.24 + 0.81x
Relative humidity (%)	18.84 ±7.26	0.92**	Y=-2.28 + 0.24x
PH	5.28 ±2.11	0.93"	Y=-5.04+1.10x
SITE-15			
Y: Nematode Population	1.45 ±93		

Table 5: *Contd.*

Parameters	Mean± S.D.	"r" value	Regression equation Y= a + bx
Organic Carbon (%)	3.95 ±1.58	0,94	Y=-0,74 + 0.56x
Nitrate (ppm)	1.13 ± .48	0.95**	Y= -0.62 + 1,53x
Soil temperature (°C)	1.69 ±,88	0.78**	Y= 0.29 + 0.75x
Relative humidity (%)		0.91**	Y= -2.90 + 0.27x
pH	5.95 ±.64	0.93**	Y=-6.59 + 1.35x
TOTAL POPULATION AND SOIL FACTORS IN ALL SITES TOGETHER:			
Y; Total Population	12.52 ±6.32		
Organic Carbon (%)	3.70 ±1.49	0.98**	Y=-2.85+4.15x
Nitrate (ppm)	1.08 ±0.45	0.97**	Y=-1.66 + 13.19x
Temperature (°C)	1.50 ±.53	0.82**	—
Relative humidity (%)	15.55 ±2.78	0.93**	Y=-20.35 + 2.11x
pH	5.80 ±0.61	0.94**	Y=-43.43+9.65x

Significant at 1% level.

Significant at 5% level.

at all the sites revealed that the population was maximum on 27th January when the factors like relative humidity, organic carbon and nitrate content were significantly high and the contents of these parameters were low on 25th February and consequently a lean population was obtained when approaching towards Antarctic winter.

The changes in vertical distribution in present study showed the higher proportion of nematode population on the upper 5 cm layer of soil (see Table 6 and Figures 9-11), this is in consistence with the results of the earlier work on a sub-Antarctic island (Spaull, 1973b and Maslen, 1981), but it was not possible to ascertain in the present study whether the vertical distribution pattern was same throughout the year or not as this study has been conducted in a limited period of summer months only. However, the previous observations of some workers in the sub-Antarctic islands revealed that the higher proportions of nematode fauna in the upper layer was formed during summer and the proportion in this layer was less during autumn, winter and late spring (Spaull 1973b, Maslen 1981). The reason for the maximum aggregation of population in the upper layer during summer in the Antarctic region might be related with the density and texture of moss which act as the source of food for nematode population (Maslen, 1981) and the numerical variations of nematodes in different strata in different dates might be due to the effects of temperature as is evident in Tables 3 and 4 in the present study.

In this study the relative humidity content of soil was found to be significantly and positively correlatable with the nematode population (see Table 5 and Figures 12-15). This is in agreement with the observations of Spaull (1973a) and Maslen (1981). The content of organic carbon also exhibited a strong positive correlation with the increase of organic matter at all the sites. Similar results were reported from other uncultivated fields of Europe

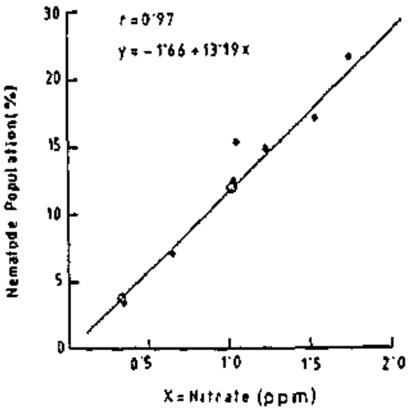

Fig. 13. Showing relationship between total population of soil nematode and nitrate content of soil in Schirmacher Oasis.

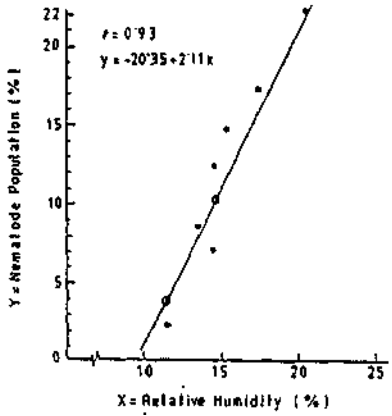

Fig. 14. Showing relationship between total population of soil nematode and relative humidity of soil surface in Schirmacher Oasis.

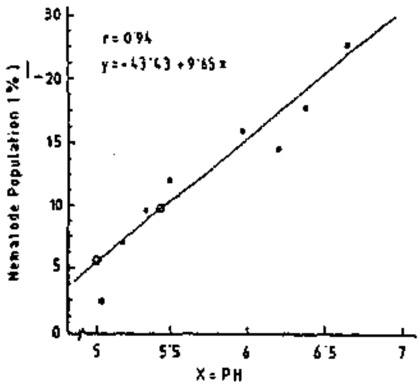

Fig. 15. Showing relationship between total soil nematode population and pH content of soil in Schirmacher Oasis.

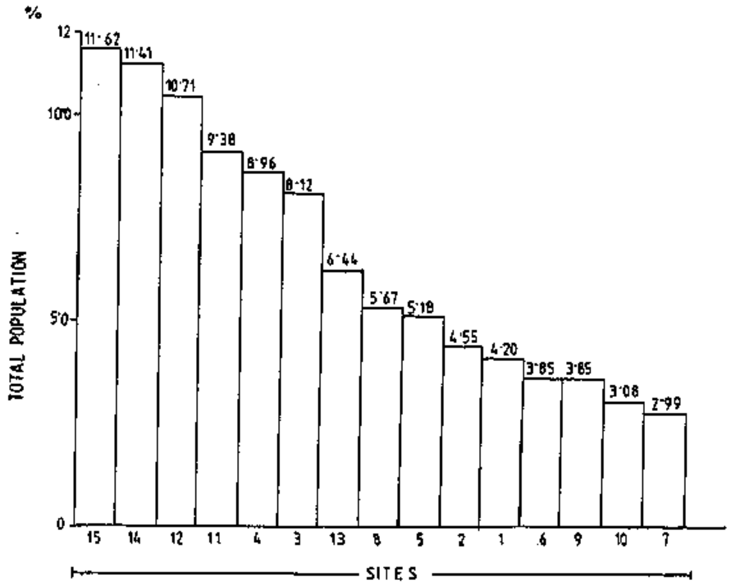

Fig. 16. Histogram showing total nematode population (%) in each site of Schirmacher Oasis.

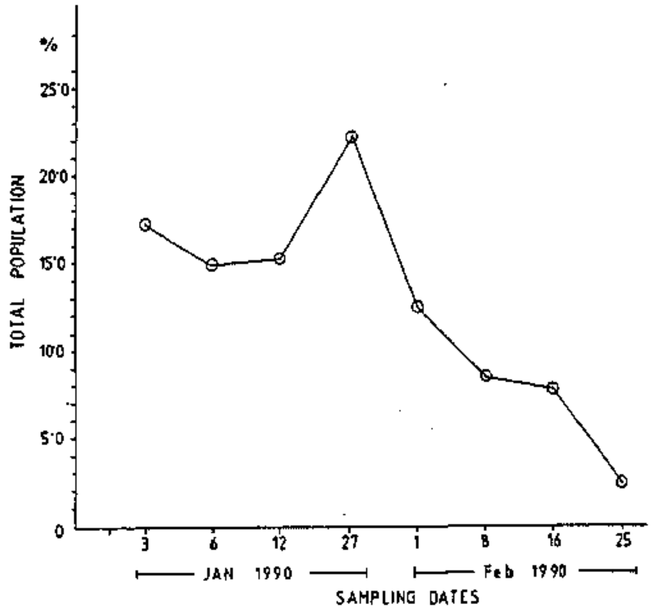

Fig. 17. Showing fluctuations of total nematode population in all the sites together at Schirmacher Oasis (%).

Table *6:* Changes in the Vertical Distribution of Different Nematode Genera in Schirmacher Oasis (expressed in percentage)

	3.1.90		15.1.90		20.1.90		26.1.90		3.2.90		15.2.90		26.2.90	
	0.5	5.10	0.5	5.10	0.5	5.10	0.5	5.10	0.5	5.10	0.5	5.10	0.5	5.10
A. *Tylenchorhynchus* sp.	3.33	—	4.44	2.22	3.33	2.22	3.33	1.11	4.44	2.22	1.11	—	3.33	—
B. *Dorylaimoides* sp.	2.22	1.11	2.22	—	2.22	2.22	6.66	2.22	3.33	1.11	2.22	—	2.22	1.11
C. *Drylaimellus* sp.	2.22	—	3.33	—	3.33	1.11	2.22	1.11	2.22	—	3.33	1.11	1.11	1.11
D. *Paramylonchulus* sp.	1.11	1.11	—	—	2.22	—	3.33	1.11	2.22	1.11	2.22	1.11	2.22	—
	8.88	2.22	10.00	2.22	11.11	5.55	15.5	5.55	12.2	4.44	8.88	2.22	8.88	2.22

and India (Haarlov 1960, Christiansen 1964, Choudhuri and Roy 1972, Hazra 1978, '84 and Hazra and Choudhuri 1983) while studying the soil microarthropod fauna.

The concentration of nitrate in all the sampling sites under this study were correlated with the nematode population. This was compatible with the findings of Hazra and Choudhuri (1983) and Hazra (1984) in the Indian conditions on soil collembolan fauna. In the Antarctic increased level of temperature and relative humidity during summer stimulated ammonification and nitrification, through the activities of some bacteria in moss carpet areas and thus resulted in higher nitrate value (Maslen, 1981). It might be assumed that the content of nitrate brought appreciable changes in both macro and microclimates and thus lead to population fluctuations in the present study. Further work in this field is required to produce qualitative and quantitative informations on the factors causing seasonal variations in nematode population in the Antarctic Continental zone.

It might be referred that the abiotic components evaluated here in conjunction with other biotic/abiotic components not considered in this study collectively constituted to the population fluctuations and distribution of soil invertebrate fauna with reference to soil nematode in the adverse climatic conditions of the Antarctic Continent.

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