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Diversity of Invertebrate Fauna of Schirmacher Oasis, East Antarctica

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Abstract

The present study was done during the 19th expedition. The invertebrate fauna collected from 32 sites (28 lakes, 2 swampy areas, one open land and one waste-water site) in Schirmacher Oasis were studied. Some physico-chemical parameters like soil temperature and relative humidity were also recorded in the field. In this study ten species of protozoa, one species of rotifera, two species of tardigrada, two species of nematoda, four species of collembola, one species of diptera and ten species of mite including several new records from Antarctica have been reported.

Introduction

The earliest account on Schirmacher Oasis was on the study of chemical characteristics of the Oasis by Bardin and Leflat (1965). The freshwater algae *Phormidium* of the area was first studied by Komarek and Ruzicka (1966). They reported that these blue green algae were highly productive even at low temperature of 0° to -5° C. In the first Indian, Matondkar and Gomes (1983) and Sengupta and Qasim (1983) made biological and chemical studies on the ice shelf and in freshwater lakes. They observed that the lake waters at Schirmacher Oasis contained high bacterial population. Later Ingole and Parulekar (1987,1990,1993), Ingole *et al.* (1987) and Verlecar *et al.* (1996) published comprehensive scientific reports on microfauna present in the water-moss communities, their composition, spatial distribution and influence of different physical and chemical factors on eco-biology of freshwater environment in lakes of Schirmacher Oasis during austral summer in Antarctica. Ingole and Parulekar *(op. cit.)* reported 7 microfaunal groups,*viz.,* Protozoa, Turbellaria, Nematoda, Oligochaeta, Tardigrada, Rotifera and Acarina. They identified only 8 species up to generic level. Dhargalkar (1988) reviewed the biological studies in the Antarctic waters and indicated discontinuity in the studies done so far. The first record of microfauna from moss-soil habitat on ice-free land areas near lakes in Schumacher Oasis was done by Richter *et al* (1990). They reported some unidentified mites and collemboles. Hazra (1994) studied the population of nematode specimens under 5 genera collected from soils at the Oasis in relation to some physico-chemical characteristics of soil. Arif (1995) recorded Earthworm, Nematode, Mite, Collembola, Diptera (adult and larvae) and Lepidoptera (moth) from moss and soil of lake area. The specimens were not identified up to species level but there were some groups of animal which were recorded for the first time from this area. Venkataraman (1998) recorded two species of Tardigrada, three species of Nematoda and only one species of Rotifera from the moss species *Bryum argenteum.* The next year Mitra (1999) in his technical report on the studies of moss inhabiting invertebrate fauna of Schirmacher Oasis reported 17 species of Protozoa, 1 species of Rotifera, 2 species of Tardigrada, 5 species of Nematoda, 2 species of mite and 2 families of collembola. Further studies on invertebrate fauna of moss-soil habitat at Schirmacher Oasis by Barman (2000) recorded 9 species of Protozoa, 1 new subfamily containing 1 new genus of Nematoda and 3 new species of mite. Personal communication with the author reported that the descriptions of new taxa of Nematoda will be published shortly. Besides the invertebrate fauna, birds like Penguin and South Polar Skua of Schirmacher Oasis were also studied by Chattopadhyay (1995) and Venkataraman (1998). The review of work as above shows that several workers have conducted studies on invertebrate fauna of Schirmacher Oasis but the knowledge is still fragmentary. In this context the comment made by Somme (1985) is still appropriate even after 15 years that more works on taxonomy, zoogeography, population and physiography of invertebrates are needed. Hence the present study was undertaken by the author during the 19th expedition for taking up taxonpmic and ecological programmes to add more knowledge to the faunal diversity particularly of invertebrates in the area.

Materials and Methods

A) Collection Sites : A total of 32 sites (28 lakes, 2 swampy areas, one open land and one waste-water site) were selected in between polar ice cap to shelf-ice located on eastern, western and northern sides of the Indian Station 'Maitri' (Map-1) Maximum number of samples were collected from, the: periphery of Priyadarshini Lake. Soil samples from a stagnant water pool outside the Maitri Station, which received kitchen water of Maitri, were also collected for ecological studies of soil inhabiting mites and also to find out their interrelationship with some physico-chemical parameters

SCHIRMACHER OASIS, EAST ANTARCTICA

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of soil. The result of the ecological study will be published in a separate paper.

B) Collection of Study Samples: During the Austral summer period (December, 1999 to February 2000) a total of 110 samples of floating algae, submerged mosses and lichens, mosses and soil were collected from the periphery of lakes and other areas and from the surroundings of the water course originated from the glaciers in the Schirmacher Oasis. The moss along with soil samples were collected from land with the help of metal shovel and primordial soil samples were drawn from a depth of 5 cm. with stainless steel corers. All the samples were kept in polythene bags and the same were properly closed with rubber bands. Most of the samples were extracted with the help of Tullgren Funnel apparatus in the field laboratory established in a summer hut of Maitri and the rest were kept in refrigerator of the ship to avoid evaporation of moisture in the samples. The extracted materials were sorted out under binocular microscope and the microfauna recovered were preserved in 70% alcohol. Some freshly collected moss and algal samples were kept for few hours in half-submerged condition in a beaker containing distilled water and were examined under binocular microscope for observation of behaviour of different microorganisms. They were counted and some were preserved in 70% alcohol and a number of slides were also prepared for further study. The moss and soil samples which were brought as such were processed for extraction of protozoa, collembola, mite and nematode in the laboratory of the Zoological Survey of India, Kolkata, following the standard extraction and preservation methods for different groups of animals described in the Hand book, "Collection and Preservation of Animals" published by Z.S.I.

Moreover, 32 wet and semi-wet soil samples from the kitchen waste-water pool site and 32 semi-wet soil samples from the periphery of

Priyadarshini lake were drawn from a depth of 15 cm with the help of stainless steel corers. Four samples were collected once in a week for a period of eight weeks from the two sites and extracted and preserved the fauna following the methods mentioned above. Soil temperature and Relative humidity (R/H) were recorded in the field by using soil thermometer and dial hygrometer.

Results

1. Studies on Protozoa: The protozoa fauna known from most of the habitats in the continent is quantitatively and qualitatively very rich. Richter (1907) first recorded terrestrial protozoa from the continent. Later several workers described and recorded a number of species inhabiting different habitats. Smith (1978) listed 124 species from the sub-Antarctic and maritime islands. On the other hand, protozoa of Schirmacher Oasis was totally unknown till the 4th expedition. In that expedition, Ingole and Parulekar (1987) studied the protozoa fauna of the Oasis and recorded only one species of Ciliata, *viz.,* Oxytricha fallax Stein and noted that protozoa was the most dominant fauna comprising 22.31% of the total lacustrine microfauna. Later Mitra (1999) and Barman (2000) reported 17 and 9 species of protozoa, respectively, from Schirmacher Oasis. Barman *(op. cit.)* reported Difflugia lucidaPenard for the first time from the continent. During the present study moss and algae samples were collected from 7 lakes and one swampy area and altogether 10 species of protozoa, which are already known from Schirmacher Oasis, have been recorded.

Table 1 shows that maximum number (7) of protozoan species are found to occur in lake No.28. Next to this comes lake No.2 which occupies second position in respect of dominance of number of protozoan species (6). The similar observation was also reported by Mitra (1999). The dominant species shown in table 1 are *Arcella* sp., *Assulina muscorum* and *Collopoda* sp. The species like *Diplochlamys* sp., *Centropyxis* sp., *Euglypha* sp. and *Assulina muscorum* are recorded both from lakes and swampy area. The genus *Parmulina* Penard recorded in the study and also earlier by Mitra (1999) are reported from maritime and sub-Antarctic zones and also from different parts of the globe including the Indian Himalayas.

Table 1: Protozoan species in study areas in Schirmacher Oasis

Protozoan species	Sites shown in Map 1							
	1	2	3	4	10	11	28	30
Arcella sp.		+		+	+		+	
Diplochlamys sp.	+	+						+
Parmulina sp.		+					+	
Centropyxis sp.	+			+			+	+
Difflugia sp.							+	
Nebela sp.			+					
Euglypha sp.			+				+	+
Assulina muscorum Greef		+		+	+	+	+	+
Collopoda sp.		+	+	+		+		
Oxytricha fallax Stein	+						+	

2. Studies on Rotifera : The rotifers are commonly called "rotatoria" or "wheel animalcules". Murray (1910) first recorded rotifers from Antarctic continent. Sudzuki (1964) recorded 13 species of rotifers from moss. Venkataraman (1998) first reported one species of rotifer *Philodina gregaria* from Schirmacher Oasis. Later Mitra (1999) recorded the same species from the Oasis. The same species has also been observed and collected during the present study (Table 4).

3. Studies on Tardigrada: These minute animals, less than one millimetre long, are commonly called as 'water bear'. According to Jennings (1976), 28 species of tardigrades under seven genera have so far been reported from Antarctica. Ingole and Paralekar (1987) reported *Echiniscus* sp. from Schirmacher Oasis. Later, from the same area, Venkataraman (1998) and Mitra (1999) recorded two species of tardigrada namely *Hypsibius chilensis* (Plate, 1988) and *Macrobiotus polaris* (Murray, 1910) from the Oasis. The same two species have also been recorded in the present study (Table 4).

4. Studies on Nematoda : de Mann (1904) and Jagerskjiold (1905) described terrestrial nematods from maritime and sub-Antarctic zones respectively. Later Steiner (1916) first recorded nematodes from continental Antarctica. Masten (1980) recorded the informations so far known on nematodes of sub-Antarctic, maritime Antarctic and continental Antarctic zones. The report included 22 species from sub-Antarctic, 40 species from maritime and 10 species from continental areas. Ingole and Paralekar (1987) reported a nematode species *Teratacephalus* sp. from the Oasis. Hazra for the first time (1994) recorded 5 genera of nematodes from Schirmacher

Oasis. Later Mitra (1999) reported 5 genera which were not known earlier from the Oasis. Barman (2000) mentioned in the technical report that examination of the soil and moss samples collected from Schirmacher Oasis revealed the presence of nematodes which have been identified as a new species under a new genus *Antarctilaimus* and new subfamily under the family Leptonchidae. The present study on the nematodes collected from moss and soil in Schirmacher Oasis reports two species, *viz., Helicotylenchus broadbalkiensis* Yuen, 1964 and *H. exallus* Sher, 1966. These species are known from other continents of the world.

5. Studies on Collembola: Willem (1901) first discovered collembola from the Antarctica and this was also the first record of insecta from the continent. Wise (1971) reviewed the Antarctic collembola. Wallwork (1973) opined that about 70% of collembolan fauna known from Antarctica were endemic. So far 37 species from maritime and 12 species from continental Antarctica were recorded. Mitra (1999) first reported two families, *viz.,* Isotomidae and Entomobryidae each with one species from Schirmacher Oasis. The present study records for the second time the collembolan species from the area. These include 4 species under 4 genera and 3 families (Table 4).

6. Studies on Diptera: It is recorded that insects except the species under the orders Collembola, Mallophaga, Anoplura, Siphonoptera and Coleoptera (one introduced species) are not found in the continental Antarctic zone (Hazra, 1990). Arif (1995) first reported adult and larval forms of Diptera and moths from Schirmacher Oasis. The present study records one dipteran specimen of *Forcipemyia* sp. (Ceratopogonidae : Forcypemyiini) found in the material extracted from moss collected at Schirmacher Oasis. The family is recorded for the first time from the Antarctica. The species is under study and expected to be new to science.

7. Studies on Mite (Acari): Extensive studies on mites of Antarctica have been done by different workers. *Oribata antarctica* a cryptostigmatid mite collected in the Belgica expedition during 1897-1899 was first described from the continent. Later many workers described and recorded mite species from different zones of Antarctica. All available data on the Antarctic mites have been collected by Pugh (1993) which included 524 species of mites comprising Mesostigmata (96), Prostigmata (238), Cryptostigmata (104) and Astigmata (86). Ingole and Parulekar (1987) reported mites from moss turf in the Oasis.

Mitra (1999) reported *Tyrophagus* sp. and an unidentified species under the family Scutacaridae. Barman (2000) recorded the genus *Haplochthonius* with 3 species, *viz., H. antarcticus, H. maitri* and *H.*

longisetosus as new to science. The family Haplochthoniidae has also been recorded for the first time from Antarctica. During the present study of mites 10 species under 10 genera and 9 families have been collected (Table 2). Of these one species under the genus *Nanorchestes* seemed to be new to science. All other species except *Acarus siro and Tyrophagus longior* are reported here for the first time from Antarctica. The families like Cheyletidae and Laelapidae and the species *Acarus siro* were not known earlier from continental Antarctica. It is also to be recorded that prostigmatida dominates the other groups of mite in the present study.

Table 2: Showing mite diversity in different sites of Schirmacher Oasis

Mite species	Sites shown in Map 1														
	1	2	3	4	5	8	10	12	13	20	22	28	30	31	32
Suidasia nesbitti Hughes		+		+						+			+	+	
Acarus siro Linn.	+		+		+		+		+		+			+	+
Tyrophagus longior (Gervais)		+		+		+		+				+		+	
Nanorchestes sp.		+			+							+		+	+
Chelacaropsis moorei Baker	+		+				+				+				
Pronematus sp.				+						+					+
Raphignathidae			+									+			
Hypoaspis sp.					+										+
Maudheimia sp.	+			+			+	+				+			+
Halozetes sp.			+								+				

Discussion

The review of the earlier works done on invertebrates of Schirmacher Oasis reveals that 6 groups of invertebrates, *viz.,* Protozoa, Nematoda, Tardigrada, Collembola, Mite and Rotifera have so far been recorded from the Oasis. The present study also recorded the same 6 microfaunal groups and also one dipteran species for the first time from the area (Figs 1-8).

Table 3 showing distribution of invertebrate groups in different sampling sites indicates that site 28 represents as the most suitable habitat for invertebrates as the site contains maximum number (6 Nos.) of invertebrate groups. The sites 7, 9, 17, 18, 21, 24, 31, 32 are found to represent by only one of the 6 faunal groups. It is also observed that mites were recorded from 15 different sites followed by rotifera which were encountered in 13 sites. On the other hand, collembolans and nematodes were collected from 4 and 9 different sites respectively.

Table 3: Showing distribution of invertebrates in different sites of Schirmacher Oasis

Faunal groups	Sites shown in Map 1																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	15	16	17	18	20	21	22	24	27	28	30	31	32
Protozoa	+	+	+	+						+	+												+	+		
Rotifera	+	+	+	+		+		+			+		+		+	+		+			+		+			
Tardigrada		+		+				+					+				+			+			+			
Nematoda	+						+		+			+	+	+					+			+	+			
Collembola						+								+	+								+			
Diptera						+																				
Mite	+	+	+	+	+			+		+		+	+					+		+			+	+	+	+

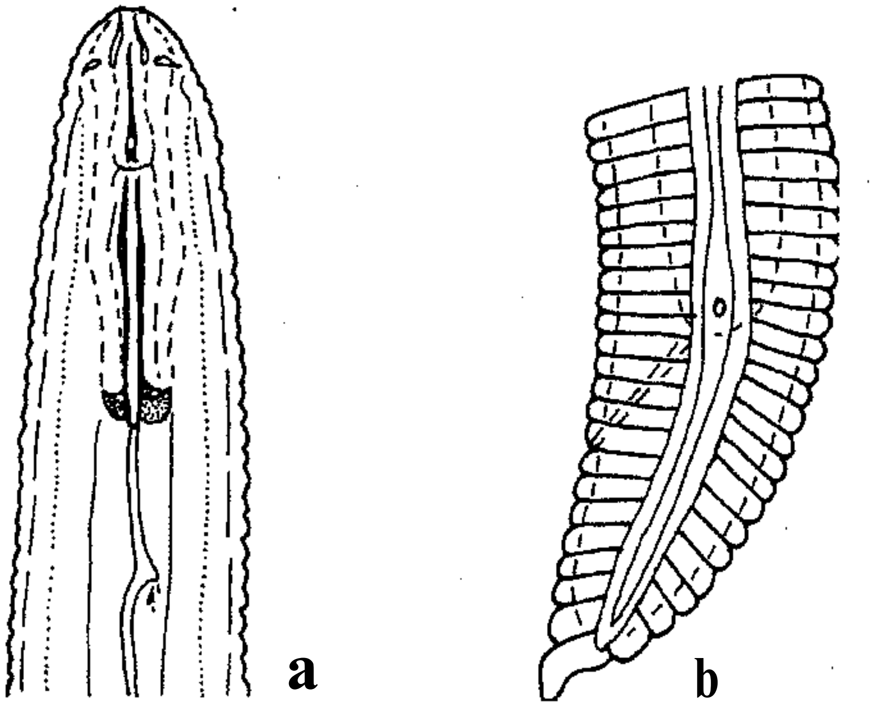

Fig. 1: Helicotylenchus exallus; (a) anterior end of female, (b) female tail

Fig. 2: Tardigrada

Table 4 shows the list of invertebrate fauna collected by the author during expedition. The list includes many specimens identified up to generic

Fig, 3:Xenylla sp.

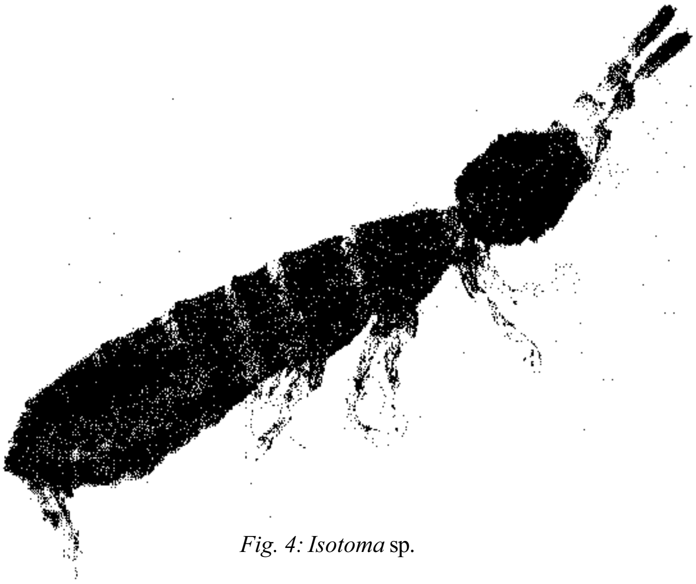

Fig. 4: Isotoma sp.

Fig. *5: Sphaeridia* sp.

Fig. 6: Acarus siro

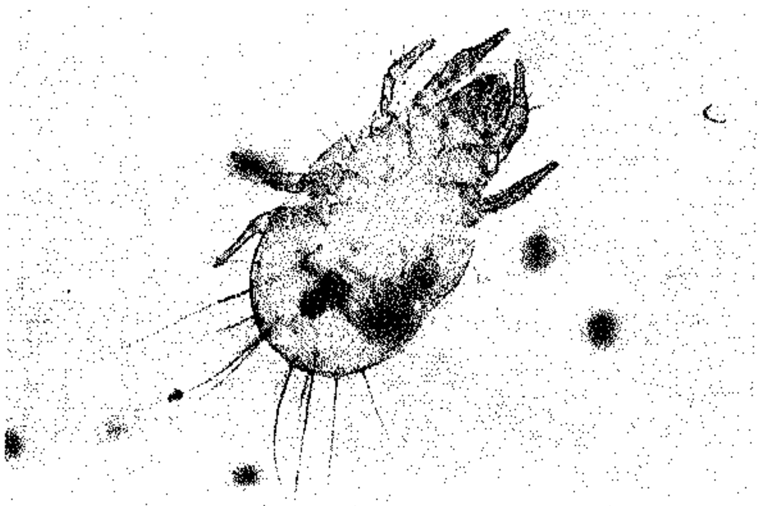

Fig. 7: suidasia nesbitti

level. These specimens appear to be new to science and are under study by the experts. In the present investigation the groups like mite, protozoa and nematoda were found to occur in many sites by immature forms. This indicates that the groups have several generations in their life cycle.

Fig. 8: Maudheimia sp.

Table 4: Showing list of invertebrate fauna recorded in the present study

Protozoa

1. *Arcella* sp.
2. *Diplochlamys* sp.
3. *Parmulina* sp.
4. *Centropyxis* sp.
5. *Difflugia* sp.
6. *Nebela* sp.
7. *Euglypha* sp.
8. *Assulina muscorum* Greef
9. *Collopoda* sp.
10. *Oxytricha fallax* Stein

Rotifera

1. *Philodina gregaria*

Tardigrada

1. *Hypsibius chilensis* (Plate)
2. *Macrobiotus polaris* (Murray)

Nematoda

1. *Helicotylenchus broadbalkiensis* Yuen
2. *H. exallus* Sher

Collembola

1. *Isotoma* sp.
2. *Cryptopygus* sp.
3. *Xenylla* sp.
4. *Sphaeridia* sp.

Diptera

1. *Forcipemyia* sp.

Mite

1. *Suidasia nesbitti* Hughes
2. *Acarus siro* Linn
3. *Tyrophagus longior* (Gervais)
4. *Nanorchestes* sp.
5. *Chelacaropsis moorei* Baker
6. *Pronematus* sp.
7. *Hypoaspis* sp.
8. **Raphignathidae**
9. *Maudheimia* sp.
10. *Halozetes* sp.

From the earlier and present investigations, no definite conclusion on diversity of invertebrate fauna in the area can be drawn. It is a fact that no in-depth study on invertebrate fauna of Schirmacher Oasis has yet been done. However, it may be inferred on the basis of data so far available that the groups like mite, rotifera, protozoa and nematoda have higher range of adaptability in Antarctica. Mitra (1999) recorded protozoa from 13 different sites, but mites were reported by him only from 2 sites. He also recorded nematodes as one of the dominant groups in the area.

Lastly, it is to be mentioned that the present study would certainly enrich the knowledge of the invertebrate fauna of Antarctica which in turn would help the future workers engaged in taxonomic and ecological investigations on faunal resources in the area.

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