Population Density of Free-Living Mites in the Ice-Free Areas around Syowa Station, East Antarctica

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露岩地帯における自由生活性ダニの分布密度

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要旨: 南極の昭和基地付近の露岩地帯には，一見植生のない砂地にも3種の自由生活性のダニが分布している．1976年の1月と2月に東・西オングル島，ラングホブデ，スカルブスネスの各露岩地帯で，直径6cm，深さ1cmのシャーレに一杯の砂を採取し，floatation法によりダニを分離し個体密度を調査した．出現したダニはほとんど *Nanorchestes antarcticus* であり，これはすべて砂地で採取したためと考えられる．他の2種は *Tydeus erebus* がラングホブデの雪鳥沢の下流で9個体，*Protereunetes minitus* が西オングル島で2個体発見されたにすぎない．各露岩地帯での最高個体密度は東オングル島でシャーレ一杯の砂から57個体，西オングル島で75個体，スカルブスネスで82個体であった．またダニの個体密度と棲息場所の水分との関係を調べるため，沢の岸で水ぎわから1m間隔で採集を行った結果，水ぎわから2～3m離れた岸で，最高の個体数が観察された．

Abstract: Population density of free-living mites was surveyed in the ice-free areas of Ongul Islands, Langhovde and Skarvsnes in the vicinity of Lützow-Holm Bay, Antarctica. Sampling of mites was carried out on the sandy ground without macrophytic vegetation quantitatively using a petri dish of 6cm in diameter and 1cm in depth in January and February 1976. Mites were isolated from the sand by the floatation method. The highest density of mite population in each ice-free area was as follows: 57 mites in a petri dishful of sand in East Ongul Island, 75 mites in West Ongul Island and 82 mites in Skarvsnes. A preliminary observation on the relationship between the population density and the habitat moisture was made along the margin of the Yukidori Valley in Langhovde. Sampling was made at 1m intervals from the waterside. The highest density of mite population was observed at the sampling point 2–3m away from the waterside.

1. Introduction

There are two types of terrestrial ecosystems in the ice-free areas of Antarctica (JANETSCHEK, 1963). The one is bryosystem, which is composed of

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macrophytic vegetation such as some mosses, lichens and algal covers. Mosses especially play an important role biocenotically in forming a moss cushion and supporting microfauna such as protozoans, nematodes, rotifers, tardigrades and so on in interstitial water of the cushion (SUDZUKI, 1964). Some mites are also found on the moss cushions and algal covers (MATSUDA, 1977). The other is called chalikosystem, which is a naked ground of gravel or sand without visible vegetation. However, some sorts of algae and fungi occur in these naked grounds under certain environmental conditions, and these microphytes support mites or collemborans.

Three species of free-living prostigmatic mites, *Nanorchestes antarcticus*, *Tydeus erebus* and *Protereunetes minitus*, were found in the ice-free areas around Syowa Station, Antarctica (OHYAMA and MATSUDA, 1977). The present author collected these mites in the chalikosystem of the ice-free areas in the vicinity of Lützow-Holm Bay in January and February 1976. This paper deals with the population density of those mites obtained in the present survey and also the preliminary observation on the relationship between the number of mites and the moisture content of sand.

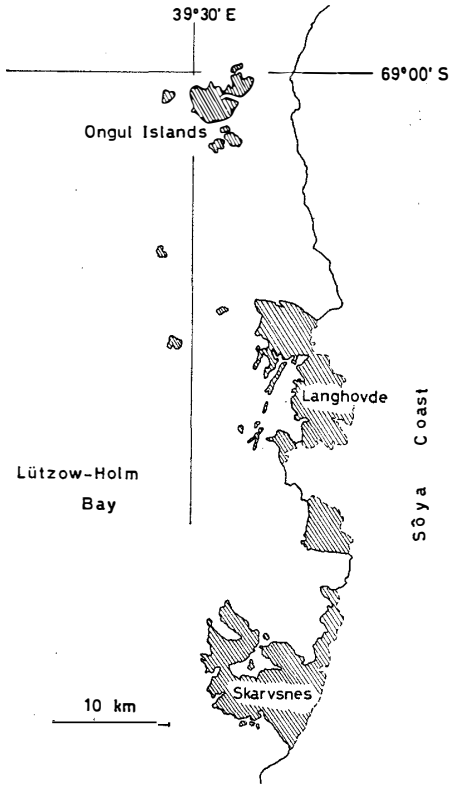

Fig. 1. Ice-free (shaded) areas in the vicinity of Lützow-Holm Bay.

2. Method

Fig. 1 shows a part of ice-free areas in the vicinity of Lützow-Holm Bay. The survey was made in Ongul Islands (East and West Ongul Islands), Langhovde and Skarvsnes.

Surface sand was quantitatively sampled using a petri dish of six cm in diameter and one cm in depth. The sand was taken from the sites near snow patches, ponds or water courses so that the sand holds moisture. Mites were extracted from the sand by the floatation method using water. Population density of mites were expressed by the number of mites per petri-dishful sand.

3. Results and Discussion

3. 1. Population density of mites in several ice-free areas

East Ongul Island (69°S, 39.5°E) is a small island less than 3 km², where the Japanese Antarctic Station, Syowa, is located. Its highest point is more than 40 m above sea level, and most of the sampling sites in the present survey were between 10 and 30 m in elevation. Sampling of mites was done on

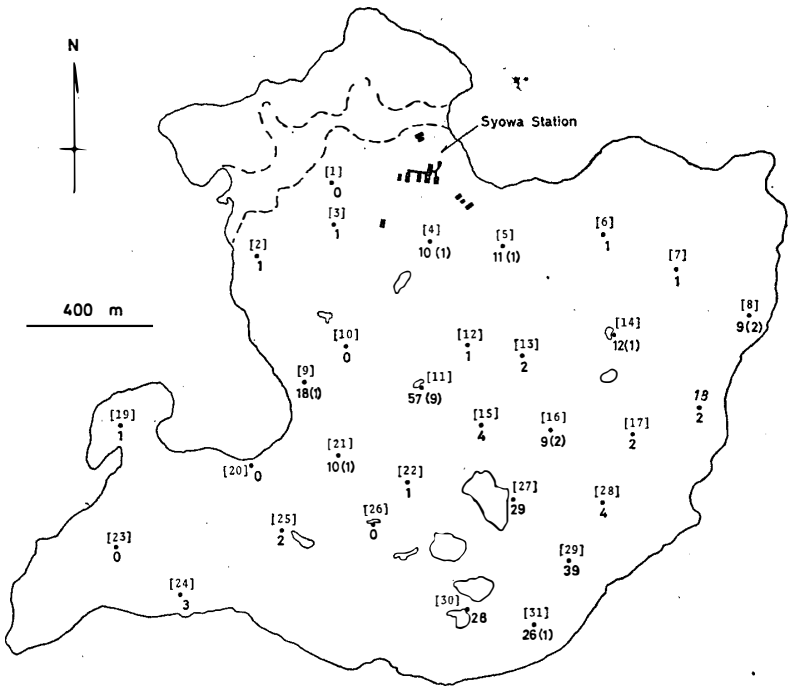

Fig. 2. Distribution of mites in East Ongul Island. Number in brackets indicates sampling site. Population density including larvae, which are shown by numbers in parentheses, is indicated by number under dot.

February 13 and 14 at 31 sites at appropriate intervals from each other. The sampling sites are indicated by the number in brackets in Fig. 2.

The species of mites found in the island was exclusively *N. antarcticus*. Population density of mites at each sampling site is shown by the number under dot in Fig. 2. Larval number included in the population is given in parentheses. High density of population, more than 20 mites, was recorded at 5 sites. The site with 18 mites followed them. The highest density of population attaining to 57 mites was recorded at site No. 11 located in the central part of the island. This site was made up of fine sand accumulated beside a pond. Sites No. 14, 26, 27 and 30 were also the sandy habitats beside ponds. These sites showed a relatively high density of mite population, except site No. 26 where no mite was found. The sand sampled at site No. 26 seemed to be somewhat more moist than other sites. Although sampling of mites was made mostly on the sandy habitats beside snow patches in the island, the sites that recorded a relatively large number of mites were only Nos. 9, 29 and 31.

As shown in Fig. 2, the mite population density was high in the southern part (Nos. 27, 29, 30 and 31) and in the central part (Nos. 9 and 11) of the island. It was observed as a common feature of these sites that they were soft deposit of fine sand probably drifted by wind and not affected by streaming water.

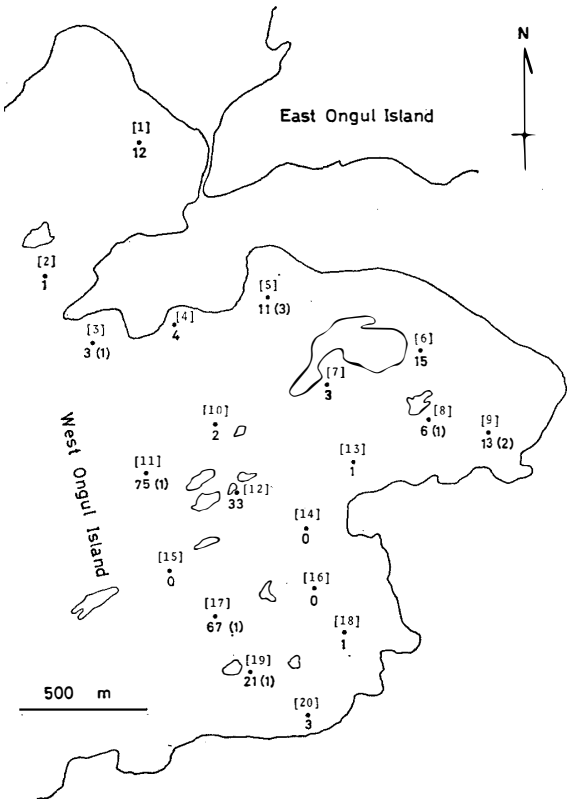

Fig. 3. Distribution of mites in West Ongul Island. Number in brackets indicates sampling site. Population density including larvae, which are shown by numbers in parentheses, is indicated by number under dot.

West Ongul Island is located just southwest of East Ongul Island, separated by a very narrow strait. The island is slightly larger than East Ongul Island, but the area surveyed this time was only the east half of the island. Sampling of mites was done at 20 sites at appropriate intervals from each other on February 10 as shown in Fig. 3. Most of the sampling sites were between 10 and 30 m above sea level as in the case of East Ongul Island.

Almost all the mites found in the island were *N. antarcticus*, except two individuals of mites found at sites No. 11 and 12 where *P. minitus* occurred. Population density of mites is indicated by the number under a dot in Fig. 3. One individual of *P. minitus* was included in the mite number of sites No. 11 and 12 respectively. The high density of over 20 mites was observed at four sites, No. 11, 12, 17 and 19. The highest density of mite population reaching 75 mites in a petri dishful of sand occurred at site No. 11, which was the sandy habitat beside a snow patch. Site No. 17 was also the sandy habitat beside a snow patch, and showed the second largest number of population reaching 67 mites. Sites No. 12 and 19 were the sandy ground beside a pond, and large numbers of mites attaining to 33 and 21 respectively were observed. Site No. 15 was the sandy ground containing small gravels and encircled by a large snow field, where no mite was found. Sites No. 14 and 16 were the ground of consolidated sand containing small gravel on the bottom of valley. Snow cover during winter might disappear in the summer season in some years. No mite was found in these sites.

Skarvsnes is the largest ice-free area of about 60 km^2 in the vicinity of Lützow-Holm Bay, and located about 50 km south of East Ongul Island. The east edge of the ice-free area is bordered by the continental ice sheet. The ice-free area of Skarvsnes is far more vast and various in topographical feature than the above-mentioned islands. In the summer season there are many water courses supplied by melt water from snow drifts. The altitude of sampling sites was various ranging from −30 to more than 250 m above sea level (Table 1). The ice-free area was so vast that sampling of mites was done at 34 sites merely along the surveying routes from January 21 to 25 as shown in Fig. 4.

The mite species found was exclusively *N. antarcticus*. The population density at each sampling site is listed in Table 1. In this ice-free there were eight sites where more than 20 individuals of mites were found in a petri dishful of sand. The sites were sandy ground except sites No. 8 and 34 where a few small gravels were included. Of the above eight sites, No. 5, 8, 17, 32 and 34 were beside streams, No. 13 and 29 were beside ponds, and No. 33 was beside a snow patch.

Table 1. Population density of mites at Skarvsnes.

Sampling sites		Number of mites	Sampling sites		Number of mites
No.	Elevation (m)		No.	Elevation (m)	
1	120	15	18	80	8
2	100	5	19	150	4
3	90	6	20	90	0
4	80	4	21	70	1
5	50	22	22	5	6
6	5	0	23	180	14
7	5	7	24	260	4
8	10	30(10)	25	220	4
9	5	8 (2)	26	150	5
10	10	7 (1)	27	100	2
11	10	0	28	−30	0
12	50	11	29	130	22 (1)
13	100	33 (3)	30	140	2
14	40	1	31	150	0
15	10	11	32	40	42
16	5	3	33	40	82 (8)
17	40	41 (1)	34	30	31 (1)

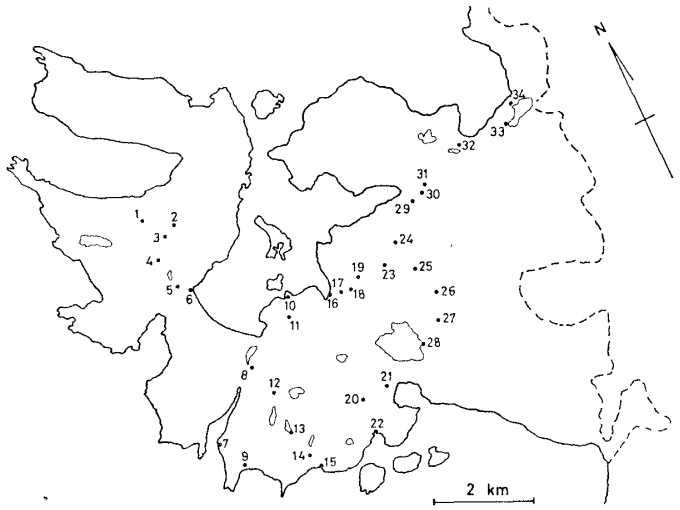

Fig. 4. Sampling sites in Skarvsnes. Number indicates sampling site.

The largest number attaining to 82 mites in a petri dishful of sand was observed at site No. 33, and this value was the highest density of mite population not only in Skarvsnes but also in the other areas of the present survey. Site No. 17 where 41 mites were found was a small sand deposit beside a

swift stream. This stream gathered the melt water in the drainage of Nos. 23, 24, 25 and so on, and flowed down rapidly from No. 19 in the inlet near No. 16. Site No. 5 was also a small sand deposit on the steep slope beside a swift stream where 22 mites were found. The water course running beside site No. 8 flowed gently from No. 12 to a lake. Large proportion of larvae was observed in the mite population sampled at site No. 8.

Site No. 6 was beside the outlet of a stream which gathered melt water from snow drifts around sites No. 2, 3 and 4, and poured into the inlet near No. 6 through No. 5. This site was a deposit of sand containing fine fragments of garnet. It seemed that no organic matter was contained in the sand judging from the result of isolation procedure of mite by floatation. No mite was found there.

Site No. 28 was on the shore of Lake Suribati. Since the lake water was supplied only by a small quantity of melt water from snow drifts, the level of lake water was lowered about 30 m below sea level by evaporation. The chlorinity of the lake water was, therefore, about twice that of ordinary sea water (AKIYAMA, 1974), and sand of the shore seemed to hold more salts than other sites. The sampling was made at a small stream, but no mite was found.

It was observed in the mite population at site No. 33 that an average body length of mites was small in comparison with the other mite populations. The mean body length without larvae was more than 200 μ in most of mite populations in which a significant number of mites on the average was obtained. On the other hand, the body length at site No. 33 merely 178 μ on the average. The mites in the nymphal stage seemed to occupy a large proportion in the population at site No. 33, though their life cycle is not clear yet. Another population composed of small individuals in Skarvsnes was No. 13 and the mean body length was 187 μ. In East Ongul Island, the population composed of small sized individuals was observed at site No. 11, their average body length being 181 μ. These three sites had a high density of mite population exceeding 30 individuals.

Langhovde is the ice-free area located about 25 km south of East Ongul Island, and is next to Skarvsnes in size. The east edge of the land is also bordered by the continental ice sheet. A permanent water course, Yukidori Valley, rising from the snow field contiguous to the glacier flows in the east-west direction through the central part of the ice-free area (Fig. 5). The sampling of mites was done at the sandy ground along the water course from January 13 to 15, keeping away from the waterside moss community.

The species of mites found in the ice-free area were *N. antarcticus* and *T. erebus*. Population density at each sampling site is shown as the sum of the

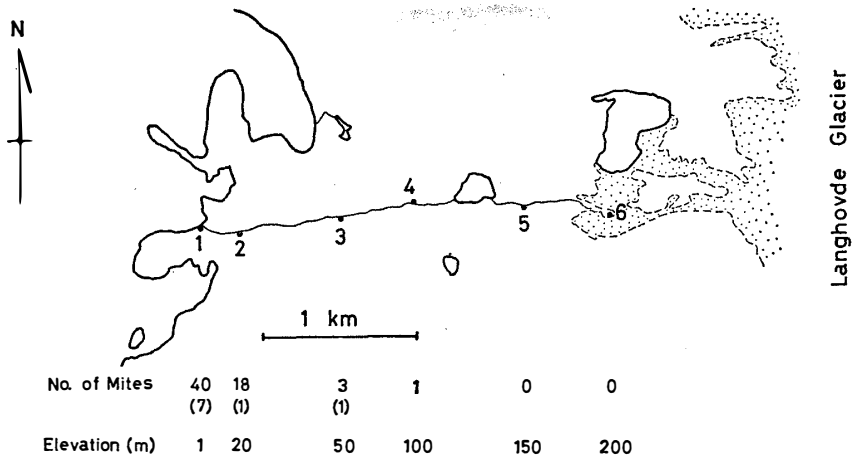

Fig. 5. Distribution of mites in Yukidori Valley, Langhovde. Numerals indicate sampling site number. T. erebus is shown as number in parenthesis.

both species in Fig. 5, in which the number of *T. erebus* is given in parentheses. Sites No. 2 and 4 were the hardened sandy ground containing small gravel. They seemed apparently affected by inundation of melt water at the peak of the thaw. Sites No. 1, 3 and 5 were fine loose sand. Site No. 6 was small gravel at the edge of the snow field, and was soaked in melt water.

As seen in Fig. 5, the mite number decreased in accordance with the increment of altitude of sampling site. This fact, however, may not be attributable to the effect of altitude of mite habitat, because in the Skarvsnes area the mites were found in the habitats at altitudes higher than 200 m and in the Victoria Land *N. antarcticus* was found at 2,000 m above sea level (STRANDTMANN, 1967). The reason of the decrease of mites toward upper stream was not clarified yet, but it might be related to the quantity of microphytes in sand.

Almost all mites found in the present survey were *N. antarcticus*. This was probably ascribed to that the sampling was done on the sandy ground lacking macrophytic vegetation, although this species is widely distributed in the antarctic region. The other two mites were frequently in association with macrophytic vegetation.

3. 2. Preliminary observation of mite number and habitat moisture

Although the sampling of the present survey was made on the sandy ground holding some moisture, the moisture content of sand sampled was not measured. However, in order to investigate the relation between the mite number and the habitat moisture, the sampling was made at one meter intervals from waterside along the line set at a right angle to a stream in some selected sites.

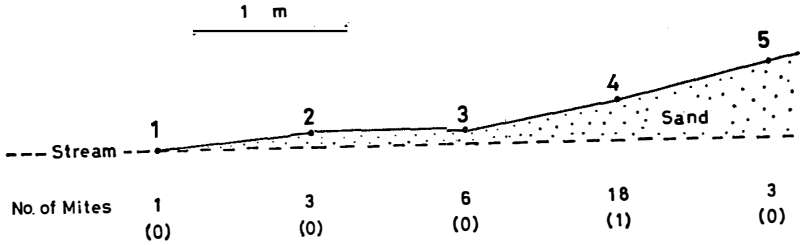

Fig. 6. Distribution of mites at site No. 2 of Yukidori Valley, Langhovde. T. erebus is shown as number in parenthesis.

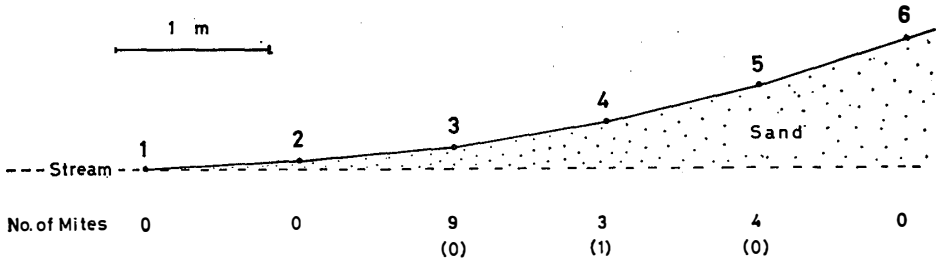

Fig. 7. Distribution of mites at the site about 10 m upstream of the site in Fig. 6. T. erebus is shown as number in parenthesis.

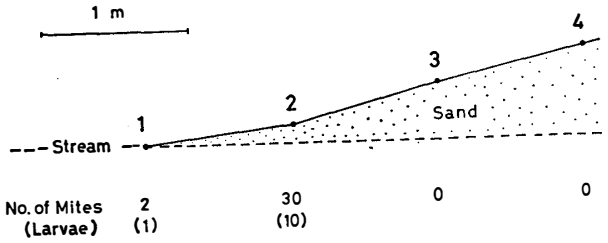

Fig. 8. Distribution of mites at site No. 8 of Skarvsnes (Fig. 4).

The number of mites at site No. 2 of the Yukidori Valley (Fig. 5) is shown in Fig. 6. Fig. 7 shows the distribution of mites at about 10 m upstream of the above-mentioned site. The number of mite at site No. 8 of Skarvsnes (Fig. 4) is given in Fig. 8. Observations of these three sites revealed the following facts in common: A very small number or nothing of mite was found at the waterside. The waterside is apparently too damp for mite to inhabit. The density of mite population reached a peak at the point a few meters away from the waterside, but further away from the waterside the mites then decreased again and disappeared, which is certainly due to the dryness of sand.

The mite population is affected by the dryness of sand which allows the rise of habitat temperature by solar radiation. It was pointed out by MATSUDA (1977) that the optimum temperature for the movement of *Tydeus* sp. was about 15°C. The temperature of moist sand at site No. 1 of the Yukidori Valley was about 18°C, whereas the temperature of dry sand close the habitat

of mites rose to about 35°C. This temperature was thought to be lethal according to the result of MATSUDA (1977).

References

AKIYAMA, M. (1974): A preliminary note on some algae found in the ice-free area of the coastal region of Lützow-Holm Bay, Antarctica. Mem. Fac. Educ. Shimane Univ., **8**, 37–50.

JANETSCHEK, H. (1963): On the terrestrial fauna of the Ross-sea area, Antarctica (Preliminary report). Pac. Insect, **5**, 305–311.

MATSUDA, T. (1977): Ecological investigations on free-living mites near Syowa Station, Antarctica. Adaptations within Antarctic Ecosystems, ed. by G. LLANO, 3rd SCAR Symposium on Antarctic Biology (in press).

OHYAMA, Y. and MATSUDA, T. (1977): Free-living prostigmatic mites found around Syowa Station, East Antarctica. Nankyoku Shiryo (Antarct. Rec.), **59**, 172–176.

STRANDTMANN, R. W. (1967): Terrestrial prostigmata (Trombidiform mites). Entomology of Antarctica, ed. by J. L. GRESSITT. Washington, Am. Geophys. Union, 51–80 (Antarct. Res. Ser., **10**).

SUDZUKI, M. (1964): On the microfauna of the antarctic region. I. Moss-water community of Langhovde. JARE Sci. Rep., Ser. E (Biology), **19**, 1–41.

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