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ENTOMOLOGICAL INVESTIGATIONS IN ANTARCTICA[1]

By J. L. Gressitt, R. E. Leech and K. A. J. Wise

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Abstract: During the Antarctic summer seasons of 1959-60, 1960-61, 61-62 entomological studies have been carried out on the Antarctic continent and some neighboring islands by teams from Bishop Museum, on the U. S. Antarctic Research Program. Work was done in Victoria Land, Beardmore area, Ross I., Little America, Thurston I., Antarctic Peninsula, South Shetland Is., Macquarie I., Campbell I. and elsewhere. About 20 free-living and about 18 ectoparasitic species of arthropods were found in Antarctica proper, and larger numbers on subantarctic islands and in the air-borne trapping program, largely at sea.

INTRODUCTION

This report concerns work done on the Antarctic continent and nearby islands during the 1959–60, 1960–61, and 1961–62 southern summer seasons. Work in progress during the 1962–63 season will be reported upon later. Also, work done by Dr. H. Janetschek will be reported separately. One of the major objectives of work to date has been the study of natural dispersal of arthropods by air currents. Preliminary reports on this work have already been published (Gressitt, Leech & O'Brien, 1960; Gressitt, Sedlacek, Wise & Yoshimoto, 1961; Gressitt, R. E. Leech, T. S. Leech, Sedlacek & Wise, 1961; Yoshimoto, Gressitt & Mitchell, 1962). Also, some general treatments of antarctic and subantarctic zoogeography, bibliography and ecology have been prepared (Gressitt & Weber, 1960; Gressitt & Pryor, 1961; Gressitt & Leech, 1961; Gressitt, 1960, 1961a, 1961b, in press; Gressitt & Yoshimoto, in press).

Much of the work reported here consists of preliminary surveys to determine the occurrence or absence of arthropods, to identify species present, to learn the types of environments inhabited, and to select sites for future more detailed surveys and ecological studies, which have been partly commenced by Janetschek and Wise during the preceding and current seasons.

A summary of collectors and areas concerned is on the next page.

During the 1962–63 season, participants are H. Clagg, C. Fearon, J. L. Gressitt, E. Holzapfel, J. Mather, K. Rennell, H. Saiki, O. Wilkes, and K. A. J. Wise, working in Victoria Land, Ross I., Campbell I., Auckland Is., South Georgia, and the South Pacific and South Atlantic portions of the Southern Ocean. This work will be reported upon at a later time.

The taxonomic reports on the assembled arthropod collections have been only partly published (Domrow, 1962; Salmon, 1962a, 1962b; Wallwork, 1962a, 1962b, 1962c). Other

1. Partial results of work on the U. S. Antarctic Research Program, supported by grants from the Office of Antarctic Programs, National Science Foundation.

Collector	Ship-trapping	Victoria Land	Ross I.	Antarctic Peninsula	South Shetlands	Mac-quarie	Camp-bell
J. L. Gressitt	1959–62	1959–60	1959–60			1960	1961
H. Janetschek		1961–62	1961–62				
R. E. Leech	1959–61	1959–60	1959–60	1960, 1960–61	1960, 1960–61		
T. S. Leech	1960–61			1960–61	1960–61		
C. W. O'Brien	1959–60	1959–60	1959–60				
K. Rennell							1961–62
J. Sedlacek	1960–61		1960–61				
W. A. Steffan	1961–62						
K. A. J. Wise	1960–62	1960–62	1960–62				1961

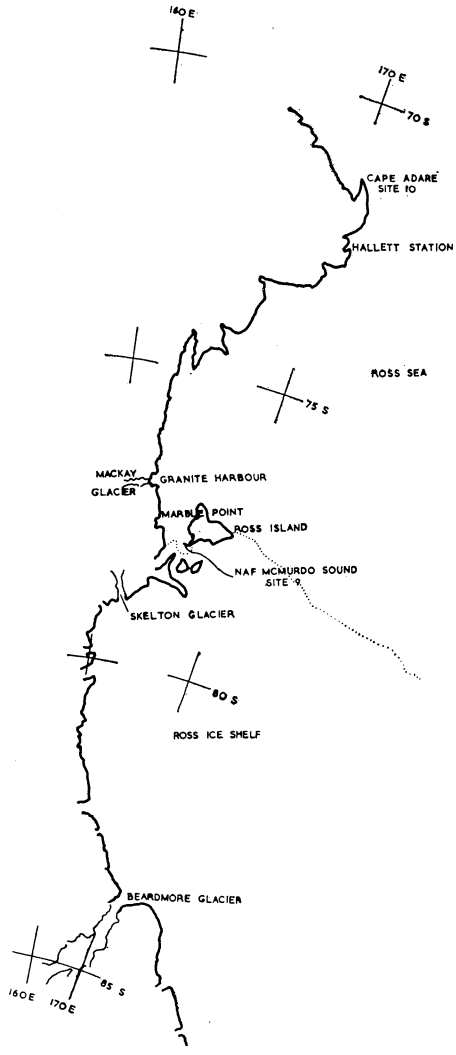

Fig. 1. Ross Sea (Wise).

studies are in progress, and some groups are waiting availability of specialists (partly occasioned by the death of H. Womersley). A series of papers on the Macquarie Island fauna appeared in the preceding issue of "Pacific Insects" (Gressitt, 1962, and 16 following articles, pp. 905–975). Also, an ecological study from another project has been recently published (Pryor, 1962),

For the following notes, Gressitt is responsible for part of the field work in southern Victoria Land and Ross Island, as well as Little America. Leech is responsible for part of the work in S. Victoria Land and Ross I., for Thurston I. and the work in the South Shetlands in early 1960, and jointly with his brother T. S. Leech for the main work in the South Shetlands and on the Antarctic Peninsula, 1960–61. Wise is responsible for much of the work in Victoria Land, and a little on Ross I. Others who contributed are listed in the preceding table.

Acknowledgements: We are indebted to many individuals and organizations for their assistance in connection with the field work. We wish to mention particularly many members of the U. S. Antarctic Research Program, the U. S. Naval Support Force Antarctica, the New Zealand Antarctic Research Program, the Chilean Antarctic Research Program, the Chilean Navy, and others. We are particularly indebted to Dr. J. T. Salmon and Dr. J. Wallwork for identifications; and to E. Zeller, J. Mulligan, George Meyer

and Martin Halpern, U. S. A. R. P., for collecting in various areas, and to B. Reid and C. Bailey, N. Z. A. R. P., for collecting at Cape Adare. We are indebted to C. J. Mitchell and N. Wilson for sorting most of the mites and for arranging their study. Wise assisted Dr. Salmon in the sorting of the Collembola. Dr. H. Womersley had partially studied some of the trombidiform mites, at the time of his death.

VICTORIA LAND

Cape Adare (71° S.; 170° E.; Jan. 1960). This is the northernmost point of the Ross

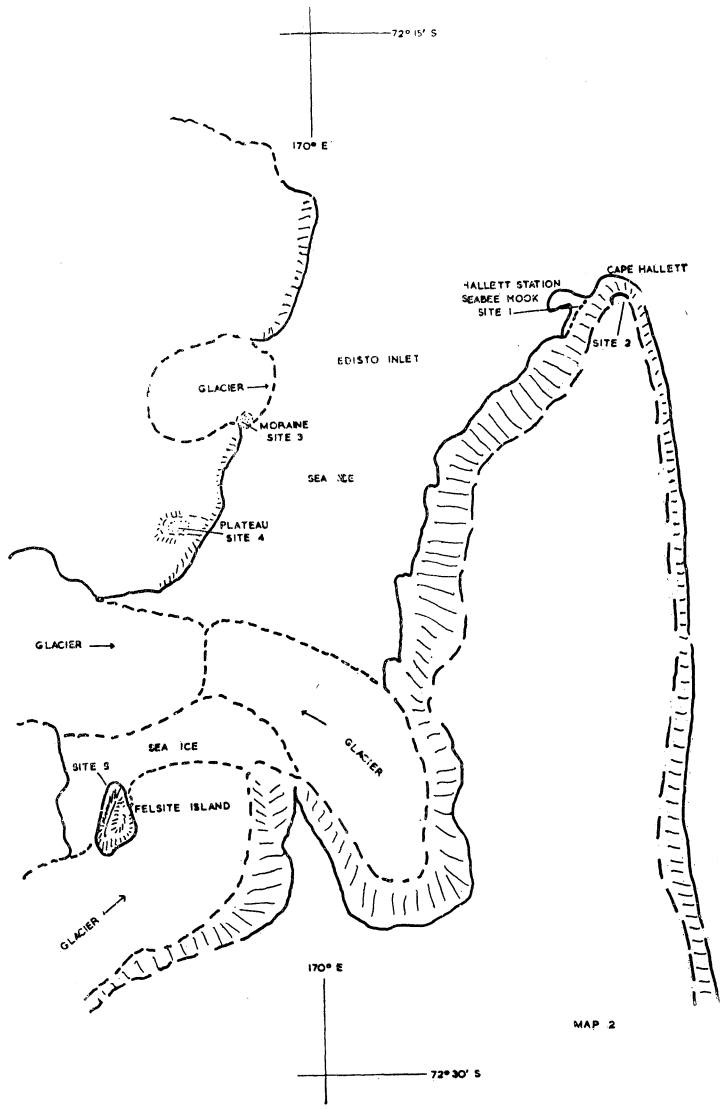

Fig. 2. Hallett area (Wise).

Sea coast (fig. 1, site 10). Mites were collected but no Collembola were seen.

Hallett Station, Seabee Hook, Cape Hallett (72°18′S.; 170°18′E.; 30 Oct.–23 Nov. 1960). This area has recently been described from an ecological point of view (Pryor, 1962). In the present study Collembola and mites were found in the skua rookery area and on scree slopes at the foot of Cape Hallett cliffs (fig. 2, site 1), and Collembola on top of Cape Hallett, ca. 300 m (fig. 2, site 2), but neither Collembola nor mites were found in the Adelie penguin rookery.

The Collembola collected were *Friesea grisea* Schaeffer, *Cryptopygus antarcticus* Willem and *Isotoma klovstadi* Carpenter (Salmon, 1962 b). It should be noted that *Gomphiocephalus hodgsoni* Carp. has been recorded at Hallett by Pryor (1962) but not by Salmon (1962b). The species recorded by Pryor (1962) as a new species, possibly belonging to *Colonavis*, is presumably *Friesea grisea* Schaeffer as recorded by Salmon (1962b). Mites taken in the skua rookery included *Coccorhagidia* (Rhagididae).

Both Adelie and Emperor penguins were searched for parasites without success and nets of various sizes were flown on bamboo frames, 1–2 m above the ground, but without result. A new species of *Maudheimia* was taken near Hallett Glacier by a New Zealand party (Wallwork, 1962a).

The following summary of aerological records will help to define the environment at Hallett Station and serve for comparison with other areas studied.

Hallett Station, monthly weather data (1957–1959)

	Days of snow per month			Average wind velocity (knots)			Prevailing wind direction			Average temperature °C.		
	1957	1958	1959	1957	1958	1959	1957	1958	1959	1957	1958	1959
Jan.		9	8		6.2	9.1		SW	S		−1	−1
Feb.	9	12	22	8.2	7.3	14.4	SSW	SSW	SSW	−4	−2	−3
March	16	22	23	8.2	8.4	15.0	SSW	SSW	SSW	−12	−8	−9
April	16	19	17	5.4	10.1	4.9	SW	SSW	SW	−19	−14	−18
May	10	10	21	7.4	6.3	7.3	SW	SW	SSW	−22	−24	−23
June	10	23	14	16.1	14.0	9.9	SSW	SSW	S	−20	−22	−23
July	14	13	17	9.2	3.9	8.3	SSW	SSW	S	−25	−29	−23
Aug.	9	13	11	6.2	5.7	3.1	SW	S	SSW	−27	−26	−31
Sept.	5	17	16	3.0	6.8	5.8	SW	SSW	SSW	−23	−26	−27
Oct.	19	13	13	10.0	4.8	4.6	SSW	SSW	SW	−17	−19	−23
Nov.	7	12	12	5.9	4.5	8.3	SSW	SSW	SSW	−7	−9	−10
Dec.	10	18	6	6.3	5.3	5.6	SSW	SSW	S	−1	−3	−2

West Coast of Edisto Inlet (72°22′S.; 169°55′E., 7–9 Nov. 1960). Southwest of Seabee Hook, at the top of scree slopes and about an ice lake on a plateau, ca. 152–300 m above sea-level, Collembola and mites were taken. This area (fig. 2, site 4) has an easterly exposure.

In the coastal cliffs north from there snow petrels nest in crevices in the cliffs. Two Mallophaga were taken from snow petrels collected here.

A little further north the cliffs are interrupted by a glacier with an apparently old and

stable moraine at its southern edge (fig. 2, site 3). Lichen growth was more extensive here than was seen elsewhere in the Hallett area. Only mites *Rhagidia* n. sp., *Stereotydeus belli* (Trt.) were found.

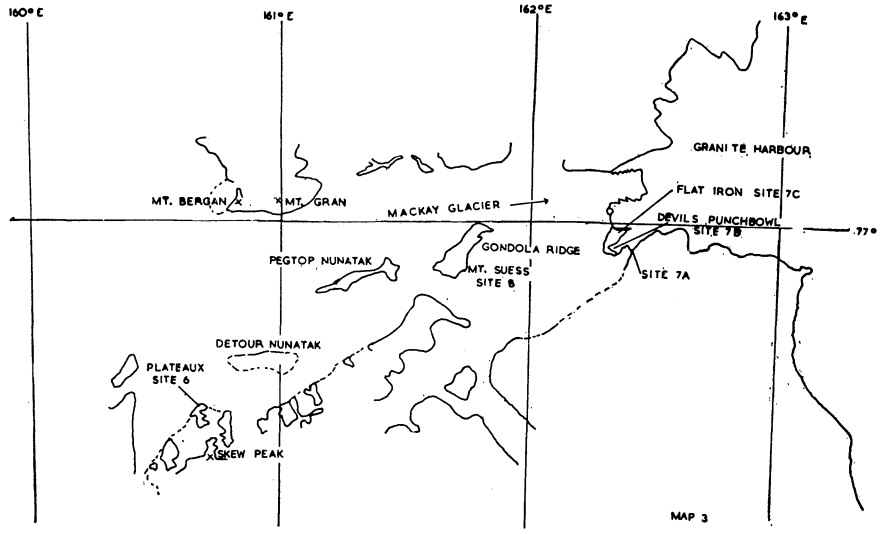

Fig. 3. Mackay Glacier - Granite Harbor area (Wise).

Felsite Island (72°26′ S.; 169°49′ E., 16 Nov. 1960). Approximately 18 km SSW from Seabee Hook, Felsite Island lies at the head of Edisto Inlet. Only the northern end of the island, at the foot of the cliffs, was examined. At the NW corner, a small area of scree slope with westerly exposure (fig. 2, site 5) yielded numerous Collembola (*Isotoma klovstadi* Carp.). This scree is a coarse rock rubble with very little soil. A mite was found on rock nearby.

Springtail Point, Rosemary Plateau** (77 10′07″ S.; 160 43′26″E.; 12–22 Dec. 1960). Collembola and mites were discovered on a bare rocky area, on the south side of the upper Mackay Glacier (fig. 3, site 6), forming a flat-topped hill joined only to the northern slopes of Skew Peak by a narrow ridge (figs. 4, 5). It is ca. 45 km from the coast at Granite Harbor and is bounded on the north and west by the glacier, on the south and east by valleys. Springtail Point on the northern side is topped by a small plateau, ca. 305 m above the glacier, which is the site of a 1961–1962 U. S. Geological Survey station, the altitude for which has been given as 1740±50 m. Approximately 45 m higher, Rosemary Plateau extends over the remaining hill area. These two plateaux have been previously recorded as 1830 m, 1865 m respectively (Postcript to Gressitt & Leech, 1961). The Rosemary Plateau hill is mostly composed of weathered dolerite while an outcrop of Beacon sandstone occurs on the eastern portion of the plateau and debris of the same material occurs on the western slopes. The dolerite weathers to a very fine soil (see Janetschek, 1963, this issue).

White Collembola and trombidiform mites were first found beside snow patches on a

* Preliminary names.

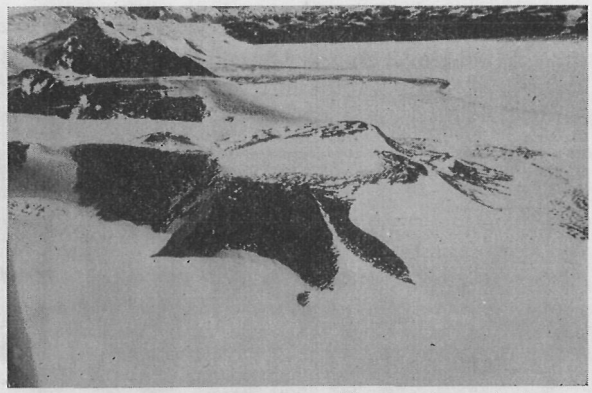

Fig 4. View of Rosemary Plateau (center) from north-east Springtail Point in center foreground. Ridge to Skew Peak at middle left (Wise).

Fig. 5. Springtail Point plateau in foreground, Rosemary Plateau at right above, Skew Peak top center. Highest Collembola site at bluff on ridge indicated by arrow (Wise).

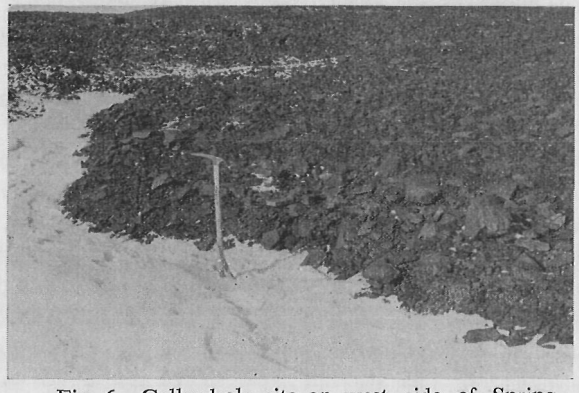

Fig. 6. Collembola site on west side of Springtail Point (Wise).

northwesterly exposed area, on the west side of Springtail Point plateau and 38–56 m lower (fig. 6). Subsequently the white species, and also a dark species, of Collembola, together with mites, were found on the steep northern slopes just below Springtail Point plateau, mainly below or close to snow patches. Mites were also discovered on the eastern portion of Rosemary Plateau beside snow patches. Nothing was found on the lowest slopes of the hill or in the adjacent valleys.

Weather was mainly fine with light-fresh NE winds. Light snow fell for four days. A series of temperatures, recorded at a Collembola site on 15 December, are given below. Weather was fine with up to 5/10 scattered cloud, with winds light to fresh changing from NE through NW to W.

Temperatures (°C, to nearest 0.5° C) recorded at Collembola site, Springtail Point.

Time	Air, 1 m*		Air within 25 cms of soil		Soil	
	Shade	Sun	Shade	Sun	Shade	Sun
1030	-9.0	-7.5	+0.5	+6.0	-	+3.0
1230	-6.0	-5.5	-0.5	+5.0	-	+12.0
1430	-10.0	-9.0	+2.0	+9.0	-	{+10.0 {+10.5
1630	-11.0	-9.5	+3.5	+1.0	-	+9.0
1830	-9.0	-6.0	-5.0	+4.5	-	+5.5

* Air temperatures stationary, not whirling. Tests indicate that a correction of -0.5°C should be applied.

In January 1962, this area was again examined and observations showed that Collembola were more numerous and spread over most of the Springtail Point plateau. The dark collembolan was also taken on the crest leading to Skew Peak at an altitude of ca. 1850 m. One specimen was seen running on a rock and others were collected nearby at the base of a solid rock bluff (fig. 5) which probably collects and maintains heat more than the surrounding area.

Mt. Suess (77° S.; 161°40′ E.: 23–26 Dec. 1960). A nunatak (fig. 3, site 8) in the Mackay Glacier, ca. 12 km west of Granite Harbor (see Janetschek, 1963, this issue). Two species of Collembola have been collected, one similiar to the dark species occurring on Springtail Point and the other *Gomphiocephalus hodgsoni* which occurs abundantly in the Granite Harbor area.

Granite Harbor (77° S.; 162°20′ E.; 22–26 Dec. 1960). Three areas in the SW corner of Granite Harbor were examined, one site (fig. 3, site 7a) being on the same stretch of coast as Cape Geology, the type locality for the collembolan *Gomphiocephalus hodgsoni* Carp. This species was collected at this site as well as in the Devil's Punchbowl (fig. 3, site 7b) and on the Flat Iron (fig. 3, site 7c) (Salmon, 1962b). The last site is a triangular point rising to ca. 335 m with several pond areas. *G. hodgsoni* had been originally collected from the surface of a pool and is recorded as associated with algal ponds (Gressitt & Weber, 1960). However, a survey of the Flat Iron showed that Collembola occur almost over the whole area except in the zone of macroscopic algae around existing ponds or in dried pond basins. Similar observations in other areas since then have confirmed the absence of Collembola in such zones. Occurrences on water surfaces are presumably accidental.

Trombidiform mites were taken at sites 7a, 7c, and three were found within a zone of macroscopic algae, but were scarce in comparison to Collembola.

Taylor Dry Valley: The floor of this large ice-free valley was found to be negative for arthropods as examined at several points by Leech. It is a desert with no vegetation. Apparently very little snow reaches the floor of the valley, being largely dissipated before reaching the bottom. However, on the south side of the valley Leech (23 Dec. 1959) found mites (eupodids) and springtails (*Gomphiocephalus*) below the terminus of one of the several small glaciers (77°40′) coming part way down the valley walls (Gressitt, 1961b, fig. 23e). The location was in an area of small streams feeding 3 small ponds just below the eastward 2 terminal lobes of the 3rd glacier from the mouth of the valley on the south side. This is not far from the Kukri Hills, particularly Mt. Nussbaum and the altitude of the site was about 900 m. There are both scoria and granitic rock in the area, and the springtails appeared to prefer the latter, and the less saturated areas, while mites were found under flat rocks nearly submerged in water.

Victoria Valley: This valley is not far to the north of Taylor Valley. Gressitt (30–31 Dec. 1959) had a brief stop in the floor of the northernmost upper branch of the valley (77°18′). The site proved negative, even though at times of maximum melting, quite a stream comes from the glacier into the small frozen lake, and many small frozen ponds are in the area. Probably the moisture supply is not sufficiently consistent to support arthropods.

Ricky Glacier (77°55′ S.; 164°20′E.; Dec. 1960). West of McMurdo Sound, between the Koettlitz and Blue Glaciers, is a stretch of bare ground ca. 66 km long. Towards the northern end of this area, near the foot of Ricky Glacier, ca. 463 m above sea-level and ca. 5 km from the coast, Collembola of the species *Gomphiocephalus hodgsoni* Carp. were collected (Salmon, 1962b). The collector reported (Report on the Victoria University of Wellington Antarctic Expedition, 1960–61, cycl.) the same insects at the south end of the same area near Lake Penny, which is ca. 1.5 km south of the Walcott Glacier at an altitude of ca. 305 m. The occurrence of *G. hodgsoni* has been confirmed by collecting during November 1962.

Lake Penny (78°15′ S.; 163°30′ E.) is consequently the southernmost point known at present for *G. hodgsoni*.

Foot of Mt. Discovery: The southernmost collection made by Bishop Museum personnel was by Gressitt at 78°24′ S. near the SE foot of Mt. Discovery, not far from Minna Bluff, in early February 1960. The collection consisted only of a species of trombidiform mite (?Eupodidae). The mites were running between loose rocks in the sunshine on a protected slope, on a large area of moraine, on ice a few meters above the level of the iceshelf and near the end of a small nameless glacier which goes down the SE side of Mt. Discovery and turns northward from the base of Minna Bluff. The moraine was moving northward and being pushed up into small hills by pressure from the glacier and from the iceshelf. A line of disconformity was close-by, between the collecting site and an under-ice stream draining from the glacier and passing near the extreme foot of Mt. Discovery. Thus the environment was in motion, as further evidenced by frequent noises under the moraine or ice. This strongly suggests recent colonization by wind dispersal (Gressitt, 1960, 1961b).

Halfway Nunatak (78° 25′ S.; 161° E.; 30 Nov.–7 Dec. 1960). A nunatak in the middle of the Skelton Glacier (see fig. 1) ca. 71 km from the coast where the glacier meets the

Ross Ice Shelf. Only the most northern rock outcrop was examined as steep ice slopes prevented movement by foot. The area examined is ca. 1524 m in altitude and ca. 300 m above the glacier. Soils were present in the bare area which had all-round exposure but sloped mainly to the north. Nothing was found except one small piece of lichen. Weather was mainly fine with westerly winds. The highest soil temperature recorded was ca. –2.2°C in the late afternoon.

BEARDMORE AREA

Hood Glacier: The southernmost known records for arthropods (or any permanent free-living animal inhabitants) is from the Hood Glacier area. The discovery was made by H. C. Tyndale-Biscoe and colleagues on the New Zealand Alpine Club Expedition in late 1959 (Tyndale-Biscoe, 1960). The general area is shown in color in Gressitt, 1961b, fig. 23 f. Two new species of springtails were described from this collection (Salmon, 1962a), and a small reddish trombidiform mite is awaiting description. The collecting sites extended to 83°55′ S. and ranged from 300–600 m in altitude.

Plunket Point, Upper Beardmore: This is the southernmost area (85° 12′ S.) investigated by an entomologist. It proved negative (Janetschek, 1963).

ROSS ISLAND

This large island (77° 10′–77° 52′ S.; 166° 11′–169° 20′ E.) is volcanic, and has only a few non-volcanic rocks, presumably brought across McMurdo Sound from Victoria Land by a great Pleistocene glacier. The island is dominated by Mt. Terror and active Mt. Erebus. Work was done at McMurdo U. S. headquarters by participants, but only a trombidiform mite (eupodid) was taken in the immediate area. This was on the slopes of Observation Hill, near Cape Armitage on Hut Point Peninsula, the southernmost part of the island. The spots populated by the mite were at altitudes of about 30–50 m, under fairly loose rocks near snow patches which last through much of the summer (fig. 1, site 9). Records are for Dec. 1959, Jan. 1961, and other times.

McMurdo Station, monthly weather data (1956–1961)

	Snow % of hourly obs.	Mean wind veloc. (knots)	Wind direction	Mean temperature °C
Jan.	10.1	10.2	E	- 3.2
Feb.	13.1	13.2	E	- 9.1
March	12.3	15.5	E	-18.2
April	18.2	12.0	E	-21.1
May	14.6	13.0	E	-21.9
June	15.6	11.8	E	-24.2
July	11.1	12.2	E	-26.9
Aug.	12.9	10.5	E-ENE	-28.1
Sept.	15.7	13.6	E	-22.6
Oct.	11.9	11.9	E	-19.8
Nov.	9.5	9.9	E	- 9.2
Dec.	12.0	10.1	E	- 3.7
Annual	12.4	12.1	E	-17.7

The preceding meteorological data summary will help to define the environment at McMurdo base and serve for comparison with other areas studied.

Mallophaga were taken from skuas, Adelie and Emperor penguins in the neighborhood of McMurdo and Scott bases, both on the same peninsula. The penguin lice were scarce in numbers. Proctophyllodid and analgesid feather mites were taken from skuas in abundance. Sucking lice (*Antarctophthirus*) were found on Weddell seals, in the fur or in cracks around the genital openings or under the flippers. This is one of the southernmost areas where these vertebrates occur (see Little America), so the parasites obviously extend as far south as their hosts.

Cape Crozier: This is the easternmost tip of Ross I., and proved to be a fairly rich site for arthropods. The springtail (*Gomphiocephalus hodgsoni*) was quite abundant, and at least one species of trombidiform mite (eupodid) was present. The area was studied particularly by Leech, Janetschek and Wise, and briefly by Gressitt. The arthropods were found mostly in skua breeding areas away from the immense Adelie penguin rookery (Gressitt, 1961b, fig. 22f). They were mostly on protected northward facing slopes. This area will be discussed further in Janetschek's reports.

Cape Royds: This prominent point on the middle of the west side of Ross I. was visited many times, by various participants. It is the site of Shackleton's base, where Murray's studies were principally made, and where New Zealand zoologists have been studying skuas and Adelie penguins. The immediate area of the camp and the Adelie penguin rookery did not produce any free-living arthropods. These were found farther up the ridge at various sites in the general area of widely spaced skua nests. In general, the sites were below snow banks which lasted through the summer and provided occasional melt streams feeding some of the various ponds: some frozen and some ice-free in mid and late summer.

Springtails (*Gomphiocephalus hodgsoni*) were fairly widespread and in some spots quite abundant. They were found under loose rocks, or crawling about on crustaceous or foliose lichens on boulders besides snow banks (Gressitt, 1961b, fig. 22, c–e). They were also found under mosses on slopes fed by snow melt. A species of trombidiform mite (eupodid: *Stereotydeus* sp.) was quite abundant, running about on the undersides of rocks on the surface. Another more minute mite (*Nanorchestes* sp.), bright red with stout body and shorter legs could barely be seen with the naked eye. Only a few were found and they were mostly in cavities of the porous kenyite rocks in damp areas of snow melt drainage. Most of the areas positive for these arthropods were on northward facing slopes with relative protection from the strong south winds and maximum exposure to the sun and often with added radiation from nearby snow patches. Janetschek's ascent of Mt. Erebus, and the interesting results, negative for mites and springtails, is mentioned in the following article.

Cape Barne: This is just south of Cape Royds, and is also largely bare of ice in the summer. In some of the small protected valleys or near some of the frozen ponds, large populations of *Gomphiocephalus* were found. On some small rocks entirely encrusted with bright yellow lichens, as many as 100 or more springtails were found, or even close to 50 per sq. cm. The trombidiform mites were also abundant.

Cape Evans: This is south of Cape Barne and separated from it by Barne Glacier. This is the site of the more northern of Scott's huts, and biological studies have been made here on several occasions. This cape was positive for mites.

LITTLE AMERICA

Kainan Bay: A brief stop was made by Gressitt in mid-December 1959 on the USS Arneb. There is nothing but iceshelf here and no moraine except as sunken into the iceshelf. Thus no terrestrial arthropods could exist here. A skua and an Adelie penguin were shot. Two species of Mallophaga were found on the skua, but none on the penguin. This is one of the southernmost areas (78°+S.) where birds normally occur.

THURSTON ISLAND

Near Cape Palmer: Two very brief stops ashore were made by Leech in January 1960 from the USS Glacier at about 72° S. and about 99° W. A little vegetation was present, but no arthropods were found.

ANTARCTIC PENINSULA (Palmer Pen.; Graham Land)

Work was concentrated at the Chilean base, Camp Gabriel Gonzales Videla (64°49′24″ S.; 62°51′30″ W.) on the Danco Coast in the area of Gerlache Straits. Work was done here between the end of December 1960 and the middle of March 1961, with visits to various South Shetland isles during this period, as well as preceding and following it.

The average weather conditions for a year's cycle at this base are presented here to help characterize the environment and to contrast it with other areas studied.

Camp G. G. Videla, average monthly weather data

	Month	Days of snow per month	Wind velocity	Wind direction	Temperature °C
1960	Jan.	1	4.9	S	+1.9
	Feb.	7	2.1	S	+1.9
	March	18	5.0	S	-1.0
	April	11	3.5	N	-4.8
	May	19	5.0	S	-5.0
	June	10	4.3	S	-9.0
	July	16	6.0	S	-8.4
	Aug.	23	8.4	S	-7.8
	Sept.	21	7.6	S	-2.9
	Oct.	19	4.7	NE	-1.6
	Nov.	17	5.6	SW	-1.5
1959	Dec.	9	4.0	N	+1.2

The base is on a small island (a peninsula at low tide) largely occupied by a penguin rookery, which has been reduced from about 3000 to about 1500 penguins. The earth consists primarily of decomposed penguins rather than decomposed rock. On 31 Dec. large numbers of springtails (*Friesea grisea*, *Cryptopygus antarcticus*) were seen under rocks, but only a few mites. The next day wingless chironomid midges (*Belgica antarctica*) were found in the rookery, even on the penguins. On 1 Jan. about 10,000 springtails and some midges were taken, but no mites, in about 3 hours. Springtails (*Cryptopygus antarcticus*) were under almost all rocks, on slopes of any direction. On 2 Jan. about 1,200 midges were taken in 4 hours, including larvae, puparia and adults. A number of mating pairs

were found. The air temperature was 5°C and ground and water were 6°C. The collecting site was a small fault line, with a low almost vertical face at upper edge. Snow was 2/3 of a meter deep. The upper edge of the rock face was potted so that water collected in small puddles, and penguin feathers and guano also accumulated. The resulting decomposition material, including some decomposed rock, formed a rich, smelly black earth in which the midge larvae crawled. Mites and springtails were also crawling in this material to some extent. Sometimes springtails would hang onto the bodies and legs of the midges, preventing their locomotion. The mites were mostly oribatids, with a few trombidiform mites present.

Vegetation here consisted of mosses, algae, liverworts and lichens (orange, green, black, yellow) in profusion. Springtails and mites were found in abundance in the mosses, liverworts and thicker lichens. The oribatid mites were found in extremes of environment, from quite dry to very wet. This particular area was well sheltered from wind, and received considerable sunshine, so was probably warmer than other nearby spots. On 3 Jan. mites were taken from *Larus dominicanus* and lice from *Phalacrocorax atriceps*.

At Punta Canela (64°48′ S.; 62°49′ W.) 3 species of mites as well as springtails and *Belgica* midges were found in much smaller numbers than above. There was less protection from wind here, and most of the soil was blown away. No liverworts were seen, and lichens (red, crustaceous) and mosses grew on perpendicular rock faces. Pinkish yellow eggs of oribatid mites were abundant under rocks where mites were observed, which was only where organic material had accumulated. This was mostly in rock cracks and basins. Several nest sites were examined for parasites or other inhabitants, but none were found.

After an absence in the South Shetland Is. from about mid-January to mid-February, it was found that at Camp G. G. Videla the midge populations had decreased greatly. In a spot of former dense population, only 6 adults and a few larvae were found after a several hours hunt. However, springtails were found in numbers on the surface of the ground, apparently eating moulted feathers of penguins. Some small areas of a few square centimeters were black with springtails. On 23 Feb. few midges were found—only one mating pair but many mature larvae. It seems likely that the midges overwinter in the final larval stage, or as puparia. Of the oribatid mites [*Ceratozetes*, *Alaskozetes* (2 pp.), *Pertorgunia*], 3 stages were present: eggs, crawling forms, and dull colored hibernating stages. The latter was usually found in clusters of from 5–30 individuals. Some would move when disturbed and others would not, and some were already dead.

On 2 March about 100 nasal mites (*Halarachne miroungae*) were found in a female elephant seal which was shot (see Domrow, 1962). By this time the ice formed at night did not melt by day, so the season of insect activity appeared to be nearly over. On 7 March 350 midge larvae were collected. Most of them appeared to be mature, and were in the drier mud. Some had constructed small cavities in the mud and were coiled in these. Ground temperature was 0° C, and water temperature was the same. Most of the larvae were motionless, but those within 2 mm of the surface were moving slowly. Only one adult midge was seen, a rather fat female (fig. 7).

SOUTH SHETLAND ISLANDS

Isla de la Fuenta (62°29.8′ S.; 59°39.2′ W.; 26 Dec. 1960). This island, near Greenwich

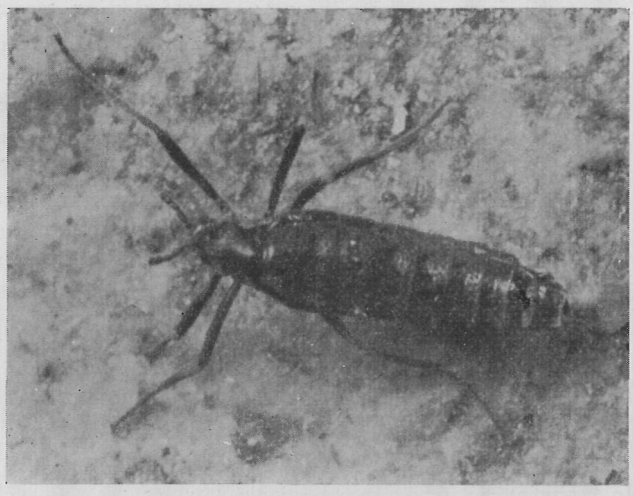

Fig. 7. Apterous chironomid, *Belgica antarctica*, Base G. G. Videla, Danco Coast, Antarctic Peninsula, March 1961 (R. E. Leech).

I., was a site for both mite and springtail catches. The island was barren except for limited small mosses and encrusting lichens. The springtails (*Friesea grisea*, *Cryptopygus antarcticus*) and mites were found by brushing away snow and turning over the surface rocks. Also, Collembola and larger predatory mites (*Rhagidia* n. sp.) were found in crevices where guano and limpet shells dropped by birds accumulated. The islet is only about 120×60 m in size and about 3 m in altitude, and is of igneous conglomerate.

Gonzales Island (62°29′+S.; 59°38′W.; 26 Dec. 1960). This islet is just a few hundred meters from Arturo Prat Base on Greenwich I. It is about 400×150 m in size, 20 m in altitude, and consists of a basaltic flow. Several kinds of mites, including oribatids (*Alaskozetes antarcticus*) and trombidiforms (*Stereotydeus*, *Rhagidia*), were taken, as well as springtails (*Friesea grisea*, *Cryptopygus antarcticus*). They seemed to occur on all parts of the island, which had rich growth of moss, with extensive soil from rock decomposition and bird nesting. Skuas, and probably gulls also, were nesting on the higher points. Nests were made of moss. This was the thickest moss growth observed in our experience in the Antarctic. Numerous species of lichens were present, but no grass or herbs were seen. Liverworts grew adjacent to some of the moss patches. Much of the island was covered with snow, supplying ample moisture. As the snow melts away, starting at the higher points of the island, the arthropods apparently move downward with the retreating snow margins, and become restricted to the damper areas. This islet and Isla de la Fuenta are sheltered by other islands.

Two species of Mallophaga and one species of feather mite were taken from a skua, and one mallophagan from an Arctic tern.

Greenwich Island (62°29′S.; 59°38′W.: 26 Dec. 1960). At Base Arturo Prat, 3 species of springtails (*Friesea grisea*, *Cryptopygus antarcticus*, *Tullbergia mixta*) were taken, as well as several species of mites (*Stereotydeus*, *Alaskozetes*), in environments similar to those mentioned for the preceding islets.

Islet to immediate NW of Torre Island (62°25′ S.; 59°43′ W.; 27 Dec. 1960). This islet lies between Roberts and Greenwhich isles, and consists of quartz gabro intrusive in columnar basalt. The soil is largely derived from glacial moraine from breakdown of the gabro. This and nearby isles were completely glaciated in the Pleistocene. Most of the collecting was done in a westward facing rocky basin at the base of a columnar basalt face. Lichen growth is similar to that on Deception I., being quite rich and varied. Mites (*Stereotydeus, Alaskozetes*) and springtails (*Friesea grisea, Cryptopygus antarcticus*) were abundant near the chinstrap penguin rookeries. The arthropods occur under stones lying on damp smelly earth at bases of large or small rock piles. Penguin guano covers many of the rocks and hundreds of oribatid mites (*Alaskozetes antarcticus*) cluster on some of the rocks, even in layers 3 or 4 deep. Some of the mites appeared to be dead, and some as if they were still hibernating. Air temperature was +3.5° C and ground temperature was +1°C. Mites were abundant everywhere, but springtails were more abundant on the northward facing slopes, and absent from the flat areas. Some larger, gray oribatids were less abundant than the black species (latter probably *Alaskozetes antarcticus*). Eupodid mites were much scarcer than in most other places. The black oribatids appeared to occupy drier niches than the springtails and other mites. From casual observations, it appears that the *Alaskozetes* hibernate in large clusters near the surface, and the springtails and trombidiform mites, at least, penetrate more deeply in the rocks and soil, both for hibernation and for seeking moisture supply in drier periods of summer. At this time snow remained only in the more sheltered areas. About 100 mites were taken from a sheathbill (*Chionis alba*) here.

Deception Island (62°52?′ S.; 60°32?′ W.; 10 March 1960, 13–20 Jan. 1961). This island is largely covered with soft cinder and ash. Near the British base is one of the apparent few areas of rock to provide shelter for arthropods. The ash is too unstable, and does not retain moisture sufficiently to support life to any extent. Near the British base, numerous mites of the genus *Rhagidia* (red, orange, yellow and green) were found, but rather few springtails (*Tullbergia mixta, Cryptopygus antarcticus*). This was the reverse of the situation at Base Gonzales Videla (many Collembola, few mites). Apparently 5 species of mites (including *Rhagidia gerlachei, Stereotydeus villosus, Alaskozetes antarcticus, Pertorgunia*), and 4 of springtails (*Hypogastrura antarctica, Friesea grisea, Tullbergia mixta, Cryptopygus antarcticus*) were taken on Deception. Generally there were no mites where the springtails were found. In general, both were most abundant in both years on the beach near the large whale-oil storage tanks, and at the base of the cliffs at the tops of the talus slopes.

Many of the smaller trombidiform mites (penthalodids or eupodids) were found under mosses (?*Polytrichum*) beginning to grow beside lichens where the rock was crumbling away more rapidly. Larger trombidiform mites (*Rhagidia* or *Noerneria*) were found under damp stones at the bases of solid rock outcrops. Here none of the oribatids were found, which were so abundant both years at the British Base, and in 1961 at Gonzales Videla. The type of rock may have much to do with this difference, as here it was largely ash or cinder, whereas it was primarily solid basalt or granite at the other places. Moisture retention may be the more important factor, however. Many dead *Rhagidia* mites were found among the moss roots against the exposed rock. This might suggest that the mites do not hibernate as adults, or die shortly after ovipositing in spring. Perhaps they have only one generation per year. There was an average of at least 3 dead adult mites per sq. cm. Temperatures both at ground level and 4 cm below the surface were +1° C.

On more sheltered slopes, where thick moss patches occurred, the fauna was richer, including the larger more active mites (*Rhagidia*), the numerous smaller trombidiform mites (mostly *Stereotydeus*) and a few of the reddish hard-shelled oribatid mites (*Alaskozetes* or *Pertorgunia*). Collembola were scarce in comparison to mites. However, near the shore, well above the tidal zone, some remains of dead penguins harbored many springtails. There were over 300 on one skeleton, more than had been found under the rocks during the few days of work in the area. Few arthropods were found above the mossy areas. No flies were found.

Near the Argentine base, Collembola (*Tullbergia*, *Cryptopygus*) proved very numerous, and thousands were taken, mostly 30 m or so away from the penguin rookery. The pale yellow eggs were present in great numbers of rocks where they touched the ground. This seems to suggest a single generation per season, but in fact adults and nymphs were found all through the summer, so there may not be a strict seasonal periodism in their cycle. Eggs were again observed here on 20 February. This area is of old moraine, with abundant lichens and mosses. Nets were also flown on this island (fig. 9).

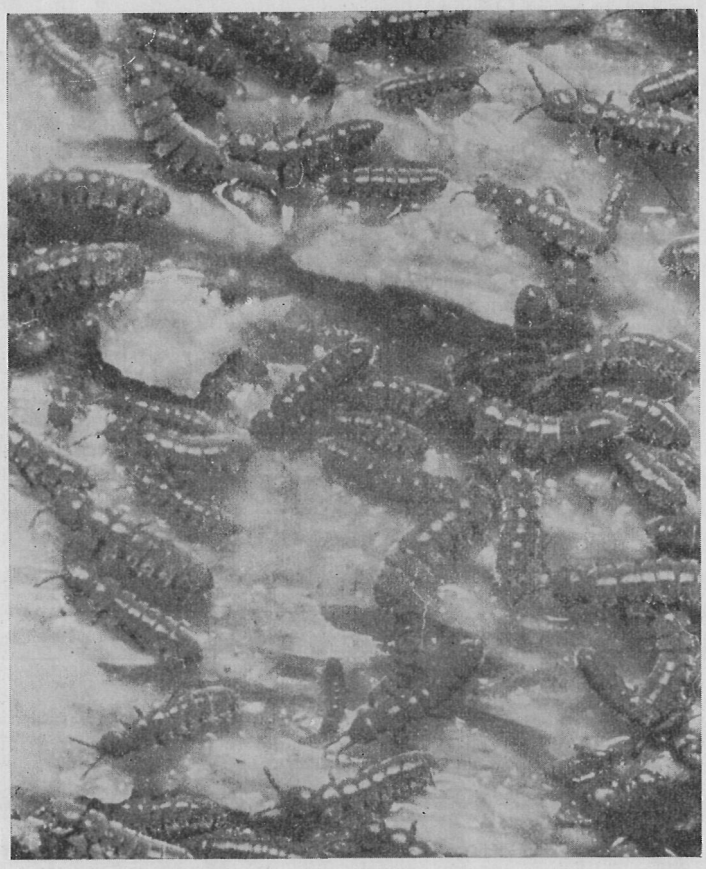

Fig. 8. Collembola, *Cryptopygus antarcticus*, Admiralty Bay, King George I., S. Shetland Is., March 1961 (R. E. Leech).

Livingston Island (62°42′ S.; 60°26′ W.; 22 Jan. 1961). A stop of 20 minutes in mid-afternoon at Notable Rock, False Bay, produced about 5 species of mites (including *Rhagidia*, *Stereotydeus villosus*, *Alaskozetes*) and 2 species of springtails (*Friesea grisea*, *Cryptopygus antarcticus*). The area was rich in vegetation, including lichens, mosses, liverworts, and grass. The exposure was southern and the glacial ice-front to the immediate rear provided ample moisture. The vegetation and loose surface boulders provided shelter. Arthropods were more abundant on slopes away from the ocean, which were more protected, but there seemed to be no clear habitat preferences, and several species were often found under the same rock. No flies were found.

Penguin Island (62°04′ S.; 57°56′ W.; 11 March 1960, 18 March 1961). A short time was spent on this islet. It had been visited briefly also earlier in the season the previous year. At that time a number of winged midges (*Parochlus steineni*) had been taken here, but on this occasion only 1 ♀ specimen. The pond, which had been ice free on the previous visit, was now covered with about 15 cm of ice, and ice and snow were at the shore line. At least 3 species of oribatid mites (*Halozetes* or *Alaskozetes*) were taken, as well as at least one eupodid (*Stereotydeus villosus*). Four chinstrap penguins were examined for ectoparasites, but none were found.

King George Island (59°29′ S.; 62°08′ W.; March 1960, 17 March 1961). This island was visited late in the season, for only 2 hours. About 1,000 mites and springtails were found, of about 4 kinds of mites (*Rhagidia*, *Stereotydeus*, *Alaskozetes*), and 2 of springtails

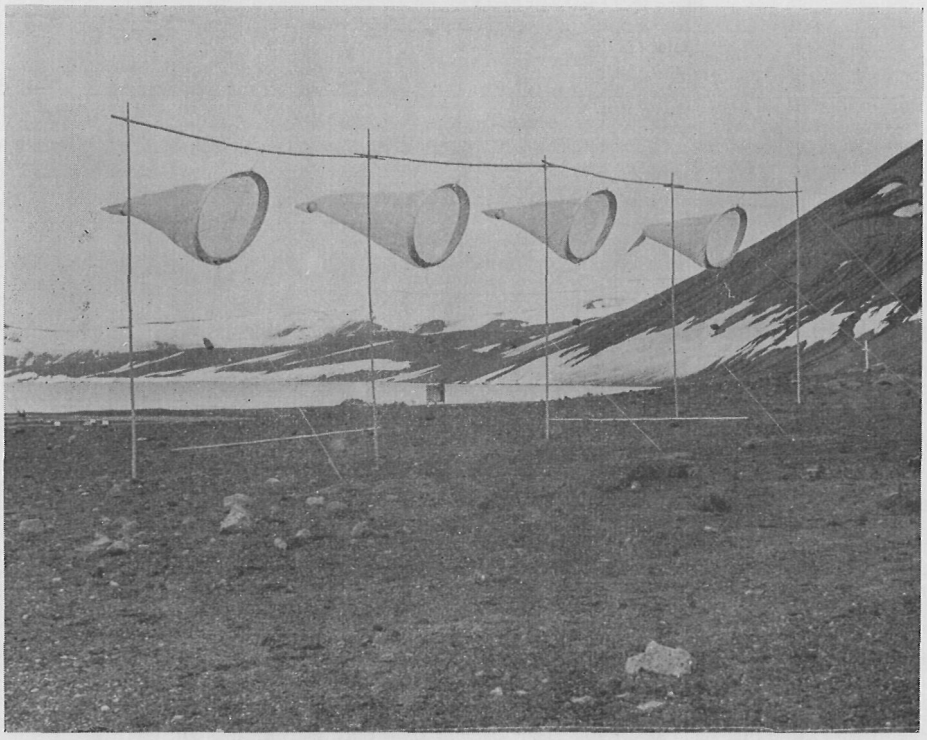

Fig. 9. Nets on Deception I., S. Shetland Is., January 1961 (R. E. Leech).

(*Cryptopygus antarcticus*, fig. 8; *Friesea grisea*).

COLLECTION RECORDS OF COLLEMBOLA

We are indebted to Dr. J. T. Salmon for the identifications of the following species, not included in his recent paper (Salmon, 1962b).

Tullbergia mixta Wahlgren

S. SHETLAND IS. Deception I.: Base Cerda, 18. I. 1961, 4. II. 1961, R. E. & T. S. Leech. King George Isle: FIDS Base, 17. III. 1961, R. E. & T. S. Leech. Greenwich I.: Base Arturo Prat, 26. XII. 1960, R. E. & T. S. Leech.

Cryptopygus antarcticus Willem

HALLETT STATION: under stone, skua rookery, 14. XI. 1960, Wise. PALMER PENINSULA: Danco Coast, G. G. Videla Base, 64°47′ S., 62°49′ W., 1–5. I. 1961, 4, 7. III. 1961; nets, 1. III. 1961, 8. I. 1961, R. E. & T. S. Leech. S. SHETLAND IS.: Danco Coast: Punta Canelo, 64°48′ S., 63°49′ W., 5. I. 1961, R. E. & T. S. Leech. Deception I.: in penguin rookery, Argentine Base, 10. II. 1961, R. E. & T. S. Leech; British Base, 16. I. 1960, R. E. & T. S. Leech; Base Cerda, 13 or 18. II. 1961, R. E. & T. S. Leech; Chilean Base, 4. II. 1961, R. E. & T. S. Leech. Greenwich I.: 26. XII. 1960, R. E. Leech; Base Arturo Prat, 26. XII. 1960, R. E. Leech; Torre I., nr. Greenwich I., 26. XII. 1960, R. E. Leech; Isla de la Fuenta, nr. Greenwich I., 26. XII. 1960, R. E. Leech. Penguin I.: 62°06′ S., 57°56′ W., under stones & grass roots, 11. III. 1960, R. E. Leech. King George I.: British Base (F. I. D. S.), Admiralty Bay, 17. III. 1961, R. E. & T. S. Leech.

Isotoma klovstadi Carpenter

HALLETT STATION: Under stones, scree slope, 2, 5, 14. XI. 1960, Wise; under stone on plateau above Cape Hallett, 300 m, 17. XI. 1960, Wise; under stones scree slopes below Pryor Plateau and about shore of Pryor Pond, 150 m, SW coast of Edisto Inlet, 10 km from Hallett Sta., 7. XI. 1960, Wise; under stones scree slopes W. coast of Felsite I., head of Edisto Inlet, 16. XI. 1960, Wise; 8 km W of Cape Hallett, under rocks, dry, no snow, ground tem. –5° C, 19. XI. 1959, G. Meyer; E. side of Hallett Glacier, nr. Hallett Bay, Victoria Land, 300 m, ex lichen from warm rock, 2 m above ice, 1. I. 1958, E. B. Fitzgerald; Hallett Station, 4. II. 1960, C. W. O'Brien.

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