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**THE INSECTS OF HEARD ISLAND**

by

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# THE INSECTS OF HEARD ISLAND

by

K. G. BROWN\*

## ABSTRACT

A collection of insects at Heard Island made by the author numbered twenty species or subspecies of which five were new to science. Seven out of nineteen non-parasitic insects are endemic, eight are restricted to the Kerguelen region and only three species, all collembolans, are circumpolar. The taxonomy and life history of the species collected are recorded and discussed, and comments are made on their known distribution in the subantarctic region. The environment and host plants of the insects are described. The fauna and flora of Heard Island still remain virtually unaffected by man, in contrast with those at Kerguelen, where the insect fauna has been affected during the past hundred years by the introduction of cosmopolitan species and the destruction of some host plants by rabbits. The discovery on Heard Island of a new lepidopterous species, comparable to similar species in two other groups of islands, points to morphological differences and an independent divergence from a common stock, all suggesting a very long period of geographical isolation.

## INTRODUCTION

The first collection of insects from Heard Island (lat. 53°S., long. 73½°E.) was made by H. N. Moseley, who visited the island with the "Challenger" Expedition in 1875. His specimens, notably of Diptera, were identical with species previously recorded from Iles de Kerguelen (Eaton, 1875; Waterhouse, 1875). Next, material collected by the Deutsche Sudpolar-Expedition in 1902 was described by Enderlein (1909), who listed seven species from Heard Island, including one new subspecies and two new varieties of forms already known from Iles de Kerguelen. A further collection was made by the British, Australian and New Zealand Antarctic Research Expedition (BANZARE) in 1929; in this, Womersley (1937) recorded twelve different insects including one new species and one new variety. At this time, however, the only insect known to be peculiar to Heard Island was one subspecies of beetle. Finally, Jeannel (1940), in a paper on the Coleoptera of the French subantarctic islands, included specimens collected at Heard Island in 1929 by E. Aubert de la Rue. He described as a new species specimens which were previously referred to a Kerguelen form.

The present author was a biologist with the Australian National Antarctic Research Expedition to Heard Island in 1951-52 and made a collection now held by the School of Public Health and Tropical Medicine, Sydney University. Twenty different insects are recorded in this paper, five being new to science, and one other being a new record for Heard Island. One collembolan and four species of Mallophaga, previously recorded from this locality, are not represented in the collection.

\* Biologist, Australian National Antarctic Research Expeditions, Heard Island, 1951-2. Died at Darwin, April, 1954.

The following is the complete list of insects recorded from Heard Island:—

**Order COLLEMBOLA**

Family **HYPOGASTRURIDAE**

*Tullbergia antarctica* Lubbock

*Tullbergia bisetosa* Börner

Family **ISOTOMIDAE**

*Cryptopygus antarcticus* Willem

\**Cryptopygus reagens* Enderlein

*Parisotoma octo-oculata* Willem

**Order COLEOPTERA**

Family **HYDRAENIDAE**

†*Meropathus chuni* Enderlein

Family **CURCULIONIDAE**

*Canonopsis sericeus sericeus* C. O. Waterhouse

*Canonopsis sericeus heardensis* Enderlein

*Ectemnorrhinus* (E.) *crassipes* Jeannel

*Ectemnorrhinus* (E.) *niger* n. sp.

*Ectemnorrhinus* (E.) *jelbarti* n. sp.

*Ectemnorrhinus* (Heardius) *hoseasoni* n. sp.

*Ectemnorrhinus* (H.) *forbesi* n. sp.

*Antarctonesiotes gracilipes* C. O. Waterhouse

*Mesembriorrhinus brevis* C. O. Waterhouse

**Order DIPTERA**

Family **CYPSELIDAE**

*Anatalanta aptera* Eaton

Family **TYLIDAE**

*Calcopteryx moseleyi minor* Enderlein

Family **EPHYDRIDAE**

*Amalopteryx maritima* Eaton

**Order SIPHONAPTERA**

Family **MALACOPSYLLIDAE**

*Parapsyllus magellanicus heardi* de Meillon

*Notiopsylla kerguelensis* Taschenberg

**Order MALLOPHAGA**

Family **PHILOPTERIDAE**

\**Cesareus macquariensis* Harrison

\**Cesareus hamiltoni* Harrison

\**Cesareus bicornutus* von Kéler

\**Austrogoniodes cristati* von Kéler

**Order LEPIDOPTERA**

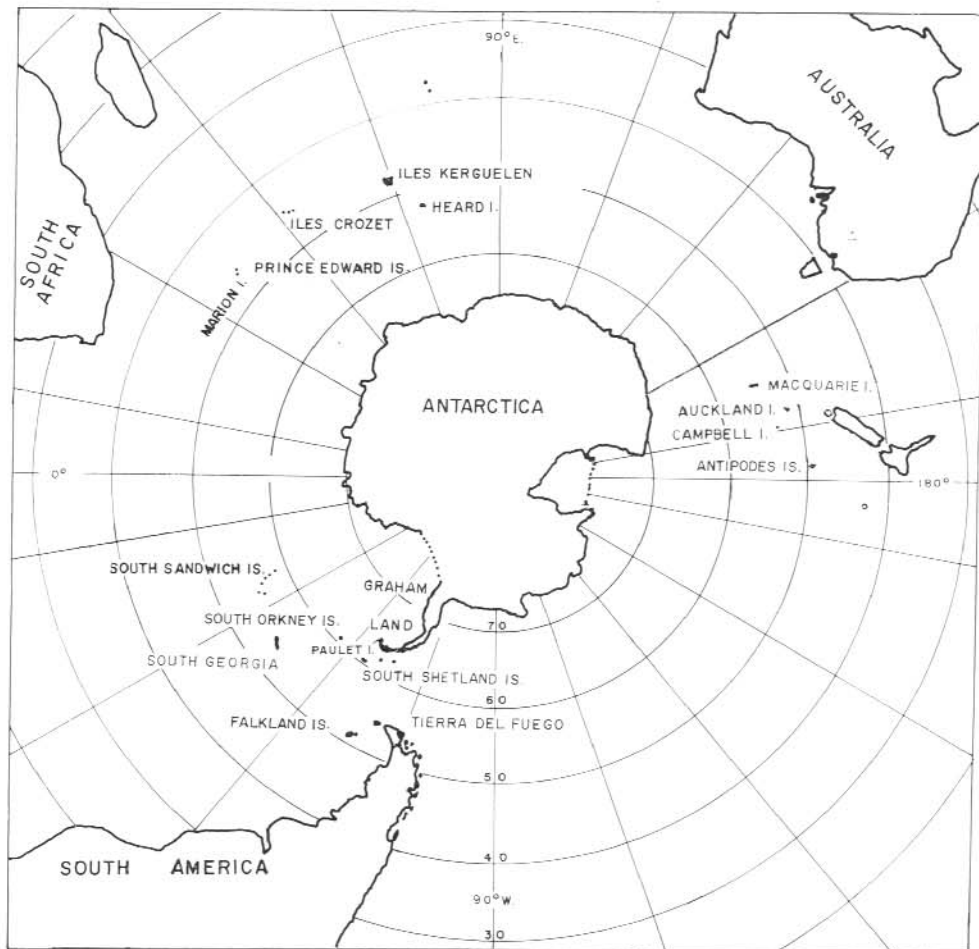
Family **TINEIDAE**

*Pringleophaga heardensis* n. sp.

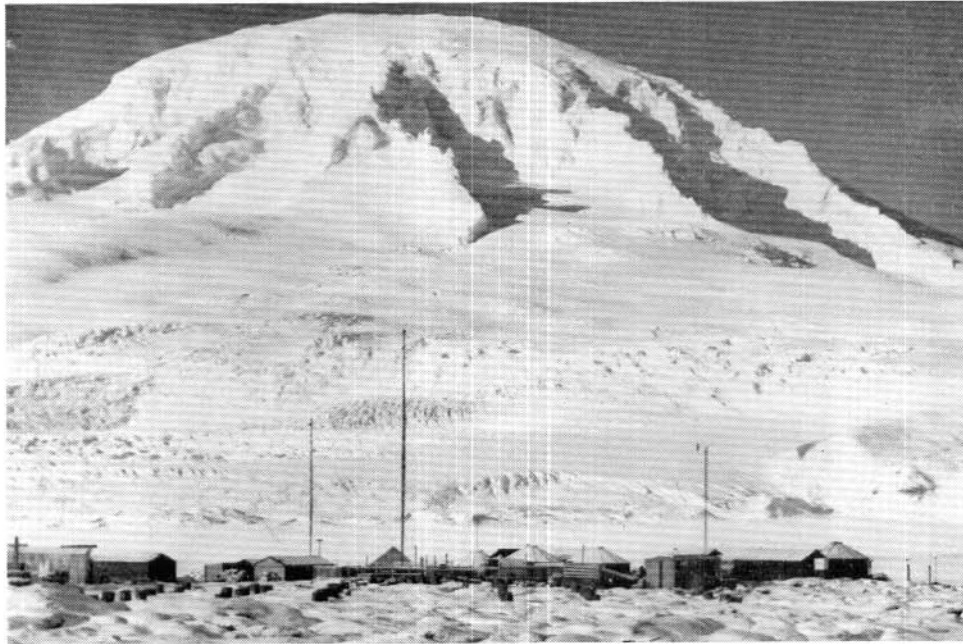
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\* Not represented in the present collection.

† New locality record.



Map showing location of Heard Island and other subantarctic islands mentioned in text.

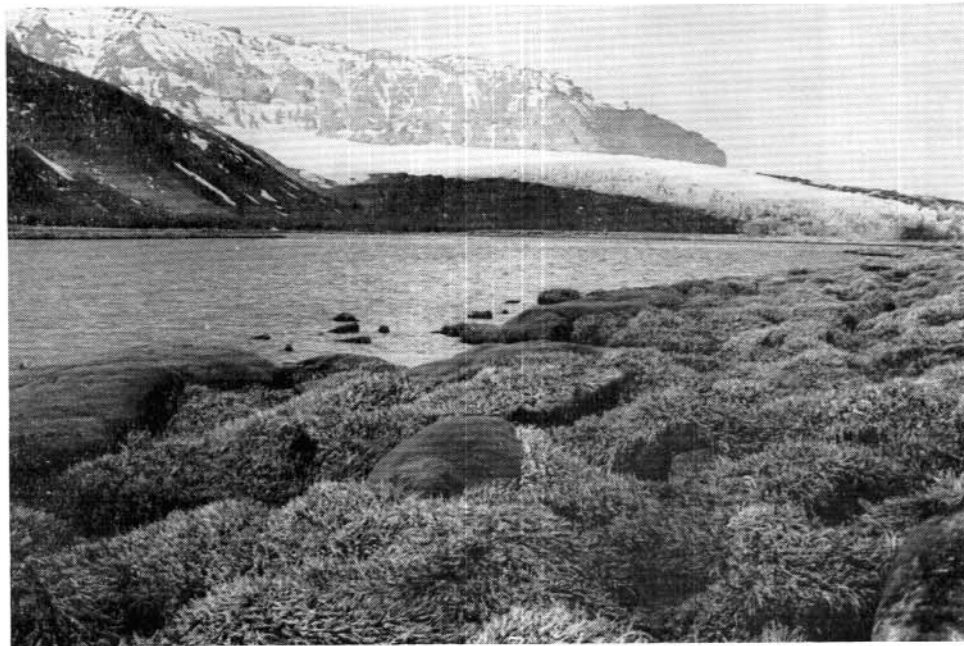


ANARE photo AI/12

J. Béchervaise

PLATE 1

ANARE station at Heard Island in winter of 1953, with summit of Big Ben in background.



ANARE photo 1496

A. Campbell-Drury

PLATE 2

The short tussock grass, *Poa cookii*, with some clumps of *Azorella selago*.



ANARE photo A/D5

J. Béchervaise

PLATE 3

Vegetation on slopes here dominated by *Azorella selago*, seen as closely packed and rounded clumps.



ANARE photo 1486A

D. Warden

PLATE 4

In centre foreground, Kerguelen cabbage, *Pringlea antiscorbutica*.





ANARE collections of Siphonaptera and Mallophaga have been described by de Meillon (1952) and von Kéler (1954) respectively. *Cryptopygus reagens* was recorded from Heard Island by Enderlein (1909) but has not been found by later collectors.

*Environment.* Heard Island is the southernmost island in the south Indian Ocean, and is well within the Antarctic Convergence. It consists of one mountain, the 9000-foot Big Ben, and is very largely ice-covered. All its insects are incapable of flight, the climax of a trend for the proportion of flightless insects in the Subantarctic to increase with latitude and severity of climate. The factors responsible are probably low temperatures, high winds and lack of vegetative cover.\*

Of these three, temperature is probably the least important. The lowest temperature recorded at Heard Island during 1948-50 was 13.0°F, and the mean daily maximum and minimum for August in these years were 32.0° and 24.8°F. This is not too low to prevent adults of *Anatalanta aptera* surviving under stones, and ectemnorhines around *Pringlea* roots.

The mean daily wind run over the same period was 380 miles, or an average wind speed of 16.1 m.p.h. (By contrast, the annual rainfall of nearly 50 inches was not excessive.) The high winds are especially dangerous as vegetation is limited in extent and too low-growing to provide much shelter for winged insects. Only seven vascular plants occur, of which the most common are *Azorella selago*, the short tussock grass *Poa cookii* and the Kerguelen cabbage *Pringlea antiscorbutica*. Nearly all the non-parasitic insects are associated with these three species, exploiting all the possible habitats: collembolans and *Meropathus* in decaying vegetation; *Canonopsis* and ectemnorhines sheltering around *Pringlea*; *Ectemnorhinus* and *Calcopteryx* larvae in *Pringlea* leaves and roots; *Canonopsis* larvae in *Azorella* roots; *Amalopteryx* and *Pringleophaga* on *Poa*. *Anatalanta aptera* is the only non-parasitic insect not strictly confined to plant matter, being most abundant in birds' nests, penguin rookeries and carcasses.

The absence from Heard Island of the kelp flies so numerous at Iles de Kerguelen, Macquarie Island, etc., may be related to the much less luxuriant growth of kelp (*Durvillea antarctica*), and to the exposed beaches which are less suitable for the accumulation of decaying kelp.

*Distribution and affinities.* Table 1 illustrates the distribution of the non-parasitic insects of Heard island. (Parasites are omitted as their distribution is governed by that of their hosts.) It shows the high degree of endemism typical of oceanic islands. Seven out of nineteen species are endemic and another eight are restricted to the Kerguelen region.† Only three species, all collembolans, are circum-polar.

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\* A more complete description of the environment is given in ANARE Interim Report No. 7, "Heard Island," by P. G. Law and T. Burstall (1953).

† Iles de Kerguelen, Heard Island, Iles Crozet and the Prince Edward Islands. The islands of St. Paul and Amsterdam, which are north of the Subtropical Convergence, have an entirely independent insect fauna.

As is to be expected, fewer species are present on Heard Island than on Iles de Kerguelen or Iles Crozet. For example, there are ten coleopterans and three dipterans on Heard, thirteen coleopterans and eight dipterans on Kerguelen, twelve and six respectively on the Crozets (Jeannel, 1940; Séguy, 1940).

TABLE 1  
DISTRIBUTION OF HEARD ISLAND INSECTS

	Heard Island	Iles de Kerguelen	Iles Crozet	Marion Island	Macquarie Island	Falkland Islands	South Georgia	South Orkneys	South Shetlands	Tierra del Fuego	Antarctic Continent
<i>Tullbergia antarctica</i>	×	×	×								
<i>Tullbergia bisetosa</i>	×	×		×	×	×	×			×	
<i>Cryptopygus antarcticus</i>	×	×						×	×		×
<i>Cryptopygus reagens</i>	×	×	×								
<i>Parisotoma octo-oculata</i>	×	×			×						
<i>Meropathus chuni</i>	×	×	×					×	×	×	×
<i>Canonopsis s. sericeus</i>	×	×									
<i>Canonopsis s. heardensis</i>	×										
<i>Mesembriorrhinus brevis</i>	×	×									
<i>Ectemnorhinus (E.) crassipes</i>	×										
<i>Ectemnorhinus (E.) niger</i>	×										
<i>Ectemnorhinus (E.) jelbarti</i>	×										
<i>Ectemnorhinus (H.) hoseasoni</i>	×										
<i>Ectemnorhinus (H.) forbesi</i>	×										
<i>Antarctonesiotes gracilipes</i>	×	×									
<i>Calycopteryx moseleyi minor</i>	×	×									
<i>Amalopteryx maritima</i>	×	×	×		×						
<i>Anatalanta aptera</i>	×	×									
<i>Pringleophaga heardensis</i>	×										

Of the Coleoptera, the Ectemnorhinae predominate in this region. Three species not belonging to this subfamily occur on Iles de Kerguelen, but only one of them, *Meropathus chuni*, is also found on Heard Island. A subspecies from Campbell Island is its only relative.

The Ectemnorhinae are a primitive group, of obscure affinities and all wingless, confined to the Kerguelen region. The typical genus *Ectemnorhinus* can be divided into three sub-genera: *Ectemnorhinus* with four species on Kerguelen and three on Heard Island; *Dusmoecetes* with two species on Marion Island and three on the Crozets; and *Heardius* with two species on Heard Island. The genus is highly differentiated and no species is found on more than one island group. Three other genera may be derived from *Ectemnorhinus*; they are *Antarctonesiotes* from Iles de Kerguelen and Heard Island, *Mesembriorrhinus* from Kerguelen, Heard and Marion Islands, and *Xanium* from Iles Crozet and Kerguelen. *M. brevis* is not well established on Heard Island, and *M. parvulus*, the species from Marion Island, is apparently very scarce. It appears that both are recent colonisations from Iles de Kerguelen, with speciation in one case. *Xanium*, on the other hand, has two abundant species at Iles Crozet and one

very rare species from the north-eastern part of Kerguelen; here the spread seems to have been to Kerguelen and not away from it.

The three species of Diptera on Heard Island show increasing modification from *Amalopteryx maritima*, with wings reduced to stalk-like processes, through *Calcopteryx moseleyi minor*, without wings but with halteres, to *Anatalanta aptera*, without either wings or halteres. Their relative adaptation may indicate the relative time each species has been established in the Antarctic. *A. aptera*, besides being the most modified, is often completely independent of plant life. It follows either that the factor limiting its distribution is temperature rather than food-supply, or that it was formerly associated with a plant that no longer exists in the area.

By contrast, both subspecies of *C. moseleyi* are completely dependent on *Pringlea* for food, so that the destruction of the plant by rabbits on the mainland of Kerguelen has been accompanied by the disappearance of this fly. *Calcopteryx* is restricted to Iles de Kerguelen and Heard Island, but *Anatalanta* extends to Iles Crozet, where it is represented by *A. crozetensis*.\* This, as well as its greater modification, may indicate that *Anatalanta* has been longer in the region than *Calcopteryx*.

The third dipteran, *A. maritima*, has a wider distribution than either of the others, but is less modified. Living close to the sea it is less exposed to the rigorous weather. It is not so isolated taxonomically, being related to two South American genera, and appears to be a much more recent immigrant to the Kerguelen region.

One of the most interesting results of the author's work on Heard Island has been the discovery of a new lepidopteran, *Pringleophaga heardensis*, comparable to *P. kerguelensis* and *P. crozetensis*. The genus is primitive and somewhat isolated taxonomically. Morphological differences between the three species suggest very long mutual isolation, and are consistent with independent divergence from a stock common to all three groups of islands, rather than with dispersal and differentiation from one group only.

*History of the insects of the Kerguelen region.* Geological evidence indicates the islands of this region were once larger and more closely connected, perhaps even part of a single land mass. Palaeontological evidence from Iles de Kerguelen suggests that the climate was mild, resembling that of present-day New Zealand. Such a region would have supported a large and varied insect fauna. Later, subsidence reduced the islands to their present extent and, at the same time or later, the climate became more severe. The insects of each island or group evolved separately into distinct but related faunas, the size of which was governed by each island's area, position and climate.

A limited amount of species transfer took place between islands, probably through the agency of birds, though wind dispersal may also have played a part.

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\* The author has not seen any specimens of *A. crozetensis*, which is closely related to *A. aptera* and may be a subspecies. Séguy (1940), however, considers it a true species.

Kerguelen, because of its large area and central position, has more species in common with each of the smaller islands than any two of the latter have with each other. At the same time there was a limited invasion of northern species, which was most marked in the Prince Edward and Crozet groups and less so at Iles de Kerguelen, but which did not reach Heard Island at all.

In the last hundred years the insect fauna of Kerguelen has been affected by man, both directly through the introduction of cosmopolitan species, and indirectly through the introduction of rabbits. These, by destroying *Pringlea*, have exterminated or altered the habits of its associated insects. Heard Island, however, has never suffered from introduced animals and its flora and fauna remain largely unaffected by man.

## Order COLLEMBOLA

Suborder ARTHROPLEONA

Superfamily PODUROIDEA

Family HYPOGASTRURIDAE

Subfamily TULLBERGIINAE

Genus TULLBERGIA Lubbock, 1876

Most of the collembolans present on Heard Island belong to the genus *Tullbergia*. They are usually found in great numbers among the decaying roots of *Azorella*, although they are also present among the fallen leaves of *Pringlea* and *Poa* grass.

*Tullbergia antarctica* Lubbock, 1876

- Tullbergia antarctica* Lubbock, J., 1876. Ann. Mag. nat. Hist., (ser. 4), **18**, 324.  
*Tullbergia antarctica* Studer, T., 1879. Arch. Naturges., **45**, 113.  
*Tullbergia antarctica* Lubbock, J., 1879. Philos. Trans., **168**, 249.  
*Tullbergia antarctica* Studer T., 1889. Forschungsgreise der S.M.S. "Gazelle," **3**, 125.  
*Tullbergia antarctica*, Chun, C., 1900. Aus den Tiefen des Weltmeeres, **1**, 245.  
*Tullbergia antarctica* Börner, C., 1902. Zool. Anz., **26**, 123.  
*Tullbergia antarctica* Enderlein, G., 1903. Wiss. Ergeb. dtsch. Tiefsee Exped., 1898-99, **3**, 241.  
*Tullbergia antarctica* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 457.  
*Tullbergia antarctica* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-30, Rep., Ser. B, **4**, 2.  
*Tullbergia antarctica* Denis, J., 1947. Mem. Mus. nat. Hist. Paris (n.s.), **20**, 31.  
*Tullbergia antarctica* Salmon, J., 1949. Cape Exped. Ser. Bull., **4**, 17.

*Distribution*: Heard Island; Iles de Kerguelen; Iles Crozet.

This species is not very common at Heard Island though there are large numbers at Iles de Kerguelen. Heard Island probably falls just within the southern limits of the species. It was not represented in the BANZARE collection from this island.

*Tullbergia bisetosa* Börner, 1902

- Tullbergia bisetosa* Börner, C., 1902. Zool. Anz., **26**, 128.  
*Tullbergia bisetosa* Enderlein, G., 1903. Wiss. Ergeb. dtsch. Tiefsee Exped. 1898-99, **3**, 242.  
*Tullbergia insularis* Wahlgren, E., 1906. Wiss. Ergeb. schwed. sudpolar Exped. 1901-03, **5**, (9), 8.  
*Tullbergia bisetosa* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 458.  
*Tullbergia insularis* Enderlein, G., 1912. K. Svensk. Vet. Akad. Handl., **48**, (3), 56.  
*Tullbergia insularis* Enderlein, G., 1930. Sitz Ber. Ges naturf. Fr. Berlin, **1930**, 242.  
*Tullbergia bisetosa* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Rec. Exped. 1929-31, Rep., Ser. B, **4**, 2.  
*Tullbergia bisetosa* Denis, J., 1947. Mem. Mus. nat. Hist. Paris, (n.s.) **20**, 31.  
*Tullbergia bisetosa* Salmon, J., 1949. Cape Exped. Ser. Bull., **4**, 17.

*Distribution:* Heard Island, Iles de Kerguelen; Marion Island; South Georgia; Falkland Islands; Tierra del Fuego; Macquarie Island.

This is the commonest of all subantarctic collembolans, and occurs in much larger numbers than the other species at Heard Island. It usually appears among *Azorella*, around the roots of *Pringlea* and in the dead leaves of *Poa* grass. Womersley has already recorded the species from the island.

Superfamily **MYDONIOIDEA**

Family **ISOTOMIDAE**

Subfamily **ANUROPHORINAE**

Genus **CRYPTOPYGUS** Willem, 1902

This genus was originally described from the Subantarctic, but is now also known from Australia and New Zealand. Although the species is well established on most subantarctic islands Heard Island is surprisingly lacking in numbers. *C. reagens* was recorded from Heard Island by Enderlein (1909) but no later expedition has collected it there.

*Cryptopygus antarcticus* Willem, 1901

- Cryptopygus antarcticus* Willem, V., 1901. Ann. Soc. ent. Belg., **45**, 261.  
*Cryptopygus antarcticus* Willem, V., 1902. Res. Voy. S.Y. "Belgica," 1897-99, Rapp. Sci., Zool., Insectes, 11.  
*Cryptopygus antarcticus* Wahlgren, E., 1906. Wiss. Ergeb. Schwed. sudpolar Exped. 1901-03, **5**, (9), 10.  
*Cryptopygus crassus* Carpenter, G., 1906. Proc. Roy. Soc. Edn., **26**, 473.  
*Cryptopygus antarcticus*, Carl., Ma., 1907. Exped. Ant. franc. 1903-05, Sci. nat., Collemboles, 3.  
*Cryptopygus antarcticus* Enderlein, G., 1909. Dtsch. sudpolar Exped., 1901-03, **10**, 500.  
*Cryptopygus antarcticus* Enderlein, G., 1912. K. Svensk. Vet Akad. Handl., **48**, (3), 139.  
*Cryptopygus antarcticus* Carpenter G., 1925. Mem. Manchester Lit. Phil. Soc., **69**, 88.  
*Cryptopygus antarcticus* Enderlein, G., 1930. Sitz Berg Ges. naturf. Fr. Berlin, **1930**, 244.  
*Cryptopygus antarcticus* Davies, M., 1935. "Discovery" Rep., **10**, 379.  
*Cryptopygus antarcticus* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 4.  
*Cryptopygus antarcticus* Denis, J., 1947. Mem. Mus. nat. Hist., Paris (n.s.), **20**, 33.  
*Cryptopygus antarcticus* Salmon, J., 1949. Proc. R. ent. Soc. Lond., **B**, **18**, 161.

*Distribution:* Heard Island; Iles de Kerguelen; South Sandwich Islands; South Georgia; South Orkney Islands; South Shetland Islands; Paulet Island; Graham Land.

The small numbers of *C. antarcticus* found usually occur among decaying *Azorella* roots in company with *Tullbergia* spp. A few specimens were also collected among *Poa* grass.



Subfamily **ISOTOMINAE**Genus **PARISOTOMA***Parisotoma octo-oculata* Willem, 1901

- Isotoma octo-oculata* Willem, V., 1901. Ann. Soc. ent. Belg., **45**, 262.  
*Isotoma octo-oculata* Willem, V., 1902. Res. Voy. S.Y. "Belgica" 1897-99, Rapp. Sci., Zool., Insects, 13.  
*Isotoma octo-oculata* Walgren, E., 1906. Wiss. Ergeb. schwed. sudpolar Exped. 1901-03, **5**, (9), 12.  
*Isotoma octo-oculata* Carl, M., 1907. Exped. Ant. fran. 1903-05, Sci. nat., Collemboles, 4.  
*Isotoma octo-oculata* Carpenter, G., 1908. Rep. Brit. Ass. Adv. Sci., **78**, 733.  
*Isotoma octo-oculata* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 478.  
*Isotoma octo-oculata* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 4.  
*Isotoma octo-oculata* Denis J., 1947. Mem. Mus. nat. Hist. Paris (n.s.), **20**, 33.  
*Parisotoma octo-oculata* Salmon, J., 1949. Cape Exped. Ser. Bull., **4**, 36.

*Distribution*: Heard Island; Iles de Kerguelen; Marion Island; South Orkney Islands; South Shetland Islands; Graham Land; Tierra del Fuego; Falkland Islands; Macquarie Island; Campbell Island; Auckland Islands.

This circumpolar species was previously recorded from Heard Island by Womersley (1937). Specimens of the present collection were found at various times of the year, but they are rare. Salmon has placed this species, along with two other antarctic ones, *borneri* and *punctata*, in the genus *Parisotoma*. Of these, *punctata* is also circumpolar and *borneri* has so far been recorded from Iles de Kerguelen and Iles Crozet only.

## Order COLEOPTERA

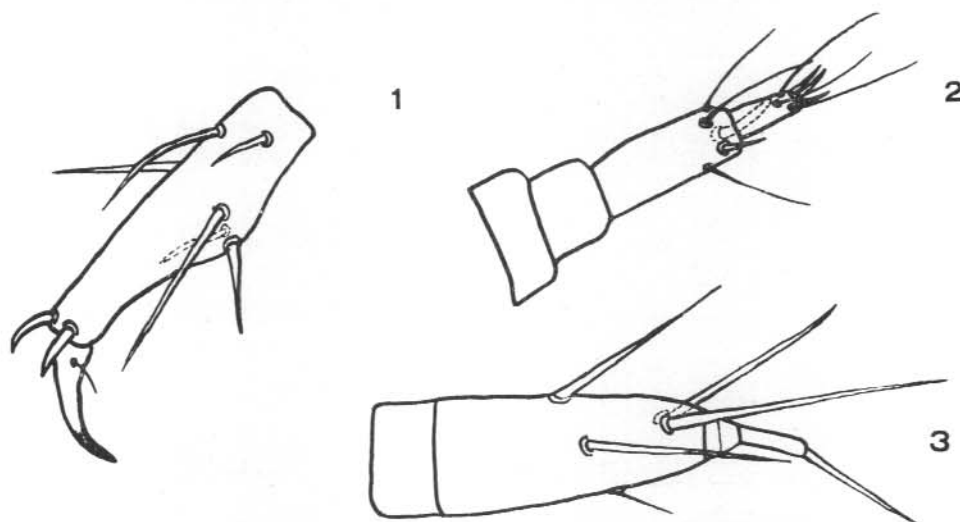
## Family HYDRAENIDAE

## Subfamily HYDRAENINAE

## Genus MEROPATHUS Enderlein, 1901

*Meropathus chuni* Enderlein, 1901

(Figs. 1-3)

*Ochthebius* sp. Kidder, 1876. Bull. U.S. nat. Mus., 3, 49.*Ochthebius* sp. Waterhouse, C. O., 1879. Philos. Trans., 168, 231.*Ochthebius* sp. Studer, T., 1889. Forschungsreise der S.M.S. "Gazelle," 3, 124.*Meropathus chuni* Enderlein, G., 1901. Zool. Anz., 24, 122.*Meropathus chuni* Enderlein, G., 1903. Wiss. Ergeb. dtsh. Tiefsee Exped. 1898-99, 3, 207.*Meropathus chuni* Enderlein, G., 1909. Dtsch. sudpolar Exped., 1901-03, 10, 412.*Meropathus chuni* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B., 4, 26.*Ochthebius* (*Meropathus*) *chuni* d'Orchymont, A., 1938. Rev. franc. Ent., 5, 79.*Meropathus chuni* Jeannel, R., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), 14, 134.FIGS. 1-3—*Meropathus chuni*. 1, leg 3; 2, antenna; 3, caudal appendage.

*Description of larva.* Length 3 mm. Colour dark brown. Head: Antennae 200  $\mu$  long (Fig. 2). Mandibles strongly chitinised with prominent teeth. Maxillae with a row of very strong setae. Maxillary palp five-segmented, the last segment very small; two setae on the second segment stretch to the end of the third segment. Five ocelli on each side.

Femur length, 269  $\mu$ . Tibia 192  $\mu$  long, armed with six strong proximal setae, four long and two shorter, and with two stout spines near its apex. Tarsus



77  $\mu$  long, with a single weak seta and without teeth on the anterior margin (Fig 1). Two caudal appendages, each 192  $\mu$  long and with a terminal spine 80  $\mu$  long; armed with four setae about 100  $\mu$  and one about 35  $\mu$  long (Fig. 3).

Adults collected at Heard Island show no differences from those figured by Jeannel from Iles de Kerguelen.

*Distribution:* Heard Island, Iles de Kerguelen; Iles Crozet.

*Life history.* Information on the life history of this species is scarce. Jeannel collected adults in November and large numbers were found at Heard Island in January. As no adults were collected during the winter the life cycle may be completed in a year, with the adults dying off in the autumn. The larvae may prey on mites and collembolans, but the adults almost certainly feed on decaying organic matter. No pupae have so far been discovered.

It is interesting that, though Jeannel collected his specimens close to high-water-mark at Heard Island, *M. chuni* was found in the driest available habitat, half a mile from the sea among the volcanic lava of the west coast. In spite of an extensive search, none was found near the sea.

The systematic position of *Meropathus* has occasioned some speculation in the past. It was first recorded as *Ochthebius* sp. (Kidder, 1876) but Enderlein (1901) erected a new genus for it, placing it in the family Hydrophilidae. D'Orchymont (1938) considered that the relationship between *chuni* and members of the genus *Ochthebius* (particularly *O. (Neochthebius) vandykei* Knisch, from California) was close enough for the former to be placed in a monotypic subgenus of this genus. Jeannel (1940), after examining large numbers of adults and larvae and dissecting the adults, decided that, although d'Orchymont's morphological appraisal had been correct, the character of the male genitalia should give *Meropathus* generic rank. The aedeagus of *M. chuni* is of the same type as that of *Hydraena* and is without the parameres present in *Ochthebius*. The species therefore belongs to the family Hydraenidae.

So far it has proved difficult to establish a possible origin or even proper affinities for *M. chuni*, and the writer agrees with Jeannel that, like the Ectemnorhinae, it is probably a relic of an ancient antarctic insect fauna.

Brookes (1951) has described a subspecies, *M. chuni campbellensis*, from Campbell Island, south of New Zealand. No other related forms have been described from anywhere else in the Subantarctic.\* Because Brookes' specimens were collected round the nests of black-browed albatrosses he believes that the subspecies may be sub-parasitic. If this is true, it represents a very clear case of subspeciation following bird-borne dispersal.

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\* The writer visited Macquarie Island in March, 1953, but found neither *M. chuni* nor an appropriate subspecies, though he searched for them specially.

Family **CURCULIONIDAE**  
Subfamily **ECTEMNORRHININAE**

For some time this subfamily was represented by two genera, *Canonopsis* C. O. Wat. and *Ectemnorrhinus* G. R. Wat., which were confined to the Iles de Kerguelen, Iles Crozet, the Prince Edward Islands and Heard Island. Enderlein in 1909 erected another genus, *Xanium*, and finally in 1940 Jeannel divided the known species of *Ectemnorrhinus* into this and two other genera, and described a single new species belonging to a new genus *Bothrometopus*.

The following key separates the genera of *Ectemnorrhininae* present at Heard Island:

1. Rostrum with pterygia. Pronotum with a distinct longitudinal medial groove and with distinct protuberances. Sizes 12-15 mm  
..... Gen. *Canonopsis* C. O. Waterhouse
- Rostrum without pterygia. Pronotum with protuberances.  
Size 2-10 mm ..... 2
2. Antennal tubercles approaching one another. Mandibles obtuse. Elytra covered with pointed scales and/or hairs. Size 6-10 mm  
..... Gen. *Ectemnorrhinus* G. R. Waterhouse
- Antennal tubercles separated by a large surface. Mandibles pointed. Size 2-5 mm ..... 3
3. Scales pointed, long and slender. Elytra oblong without distinct shoulders  
..... Gen. *Antarctonesides* Jeannel
- Scales short and enlarged distally. Elytra short and broad  
..... Gen. *Mesembriorrhynchus* Jeannel

Genus **CANONOPSIS** C. O. Waterhouse, 1875

*Canonopsis sericeus sericeus* C. O. Waterhouse, 1875

- Canonopsis sericeus* Waterhouse, C. O., 1875. Ent. mon. Mag., **12**, 55.  
*Canonopsis sericeus* Studer, T., 1879. Arch. Naturges., **45**, 112.  
*Canonopsis sericeus* Waterhouse, C. O., 1879. Philos. Trans., **168**, 232.  
*Canonopsis sericeus* Studer, T., 1889. Forschungsreise der S.M.S. "Gazelle", **3**, 124.  
*Canonopsis sericeus* Enderlein, G., 1903. Wiss. Ergeb. dtsch. Tiefsee Exped. 1898-99, **3**, 209.  
*Canonopsis sericeus* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 413.  
*Canonopsis sericeus* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 30.  
*Canonopsis sericeus* Jeannel, R., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), **14**, 158.

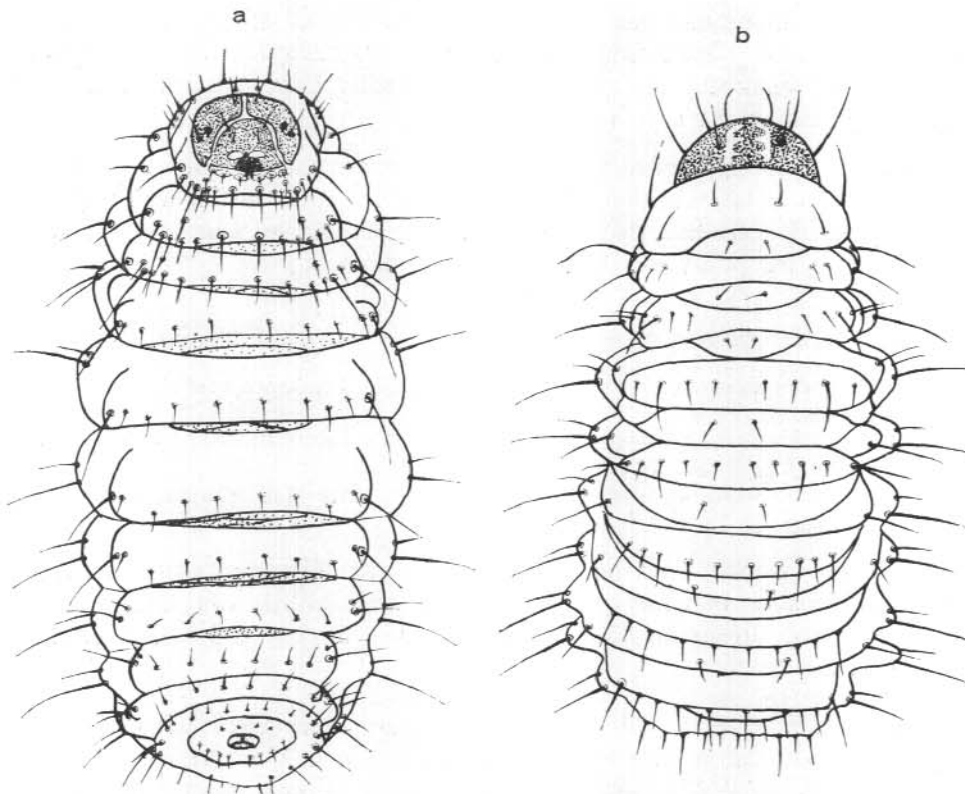


FIG. 4.—*Canonopsis sericeus sericeus* larva. a, ventral view; b, dorsal view.

The adults have been figured by Enderlein (1909) and Jeannel (1940), and the pupa by Womersley (1937), but the larva has hitherto been undescribed.

*Description of larva.* Length, 10 mm. Colour, white to cream. Head: light-brown with mouthparts almost black.

The abdominal segments have ten setae ventrally, situated as follows: laterally one long seta with a much smaller one medial and anterior to it, and a row of six medium-length setae on the posterior margin of each segment. The positions of all setae, dorsal and ventral, are given in Fig. 4.

*Distribution:* Heard Island, Iles de Kerguelen.

*Life history:* This species, which is easily distinguished by its size and by the medial longitudinal groove on its thorax, is abundant. Adults are found throughout the year either on *Pringlea* or *Azorella*, but the population is considerably reduced during winter. The survivors are usually found associated with *Ectemnorhinus* adults around the roots of *Pringlea*, whose leaves shelter the insects most effectively. Although the adults prefer *Pringlea* the larvae are

most plentiful among the roots of *Azorella*, and at Heard Island this must form their primary food. Specimens collected on Iles de Kerguelen were taken from *Pringlea* only; apparently the species, unlike the other *Ectemnorrhinae*, has not secondarily adapted itself to *Acaena*.

The life cycle appears to take two years, since larvae both five and ten mm long are found in late winter. The over-wintering stage is larval, with pupation occurring at any time from November onwards. Pre-adults were collected soon afterwards, so the pupation period is of short duration.

*Canonopsis sericeus* Waterhouse subsp. *heardensis* Enderlein, 1909

*Canonopsis sericeus heardensis* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 468.

*Canonopsis sericeus heardensis* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B. **4**, 31.

*Canonopsis sericeus heardensis* Jeannel, R., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), **14**, 158.

Although Jeannel does not consider that two subspecies exist on Heard Island, examination of large numbers of adults reveals that two sibling species may be present. Enderlein's description is hardly adequate and a re-description is given below.

*Description of adult.* Elongate, black. Pubescence black but fawn areas may be present. Head with much fewer scales than in *C.s. sericeus*; these are generally black, particularly on the posterior lateral regions. Eyes, pitch black. Antennae: terminal third of first segment black; segments two to six also dark with a gradual lightening in colour towards the club. Prothorax with distinct medial longitudinal and anterior transverse grooves, sparse black hairs. Posterior and anterior edges of the thorax have a row of regularly spaced short fawn hairs. Elytra rough but shiny black with deep longitudinal grooves and rounded interstices. Shoulders distinct. Legs: femora black, strongly clavate with fawn hairs; tibia black, moderately clavate with fawn hairs becoming denser towards the apex.

The subspecies is easily distinguished from the typical form by the deep black colour of the eyes, thorax and elytra and by the reduction in the number of scales. Some of the specimens have very few or no hairs on the thorax and elytra.

*Distribution:* Heard Island.

*Life history.* Both *C. sericeus sericeus* and *C. sericeus heardensis* are found together throughout the year, although no copulation was noted between the two at any time. *C.s. heardensis* is the less numerous, though still quite common. It is assumed that the life histories are similar. All the *Canonopsis* larvae examined were similar to that figured for the typical form.

Genus *Ectemnorrhinus* G. R. Waterhouse, 1853

This is the dominant coleopterous genus of Iles de Kerguelen, Iles Crozet and Heard Island and, with the new species here described, has fourteen representatives. The genus is divided into three subgenera on the form of the scales (Fig. 5).

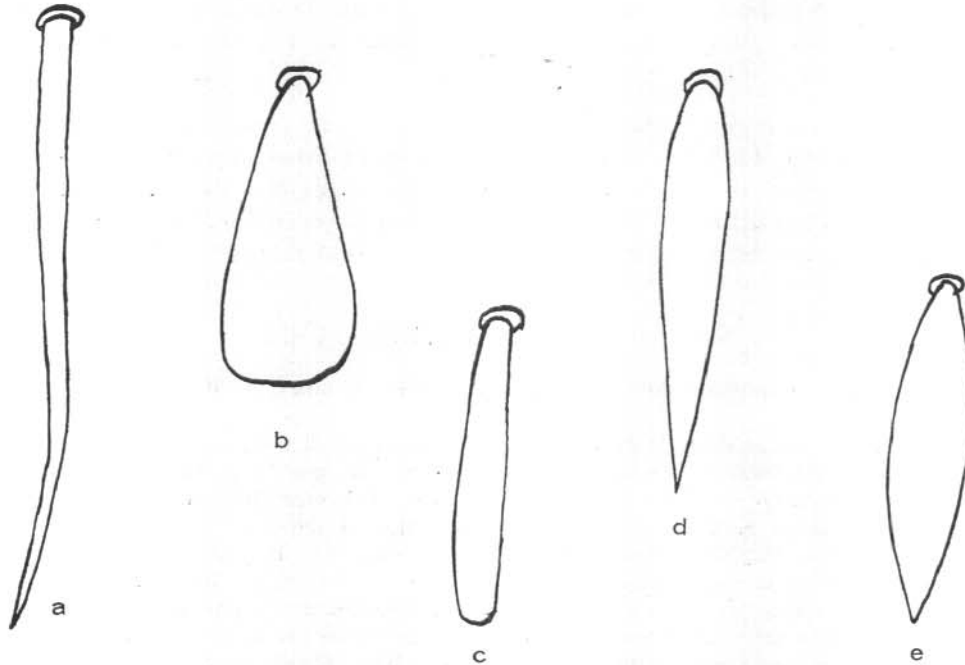


FIG. 5—Elytral scales. a, *Ectemnorrhinus* s. str.; b, *Xanium*; c, subgenus *Dusmoecetes*; d, subgenus *Heardius*; e, subgenus *Heardius*.

1. Scales long and pointed, resembling flattened hairs, and coloured (Iles de Kerguelen and Heard Island) ..... Subgen. *Ectemnorrhinus* s. str.  
Scales not hair-like but short and plate-like ..... 2
2. Scales pointed and spear-like, usually coloured. Hair-like scales also present but few in number. Elytra not very broad. Heard Island)  
..... Subgen. *Heardius* nov.  
Scales blunt and short. Elytra always very swollen. (Prince Edward Islands and Iles Crozet) ..... Subgen. *Dusmoecetes* Jeannel

*Life history.* Since adults of all species of *Ectemnorrhinus* congregate together, it is difficult to separate their life histories. The following observations relate to the group as a whole on Heard Island.

The eggs are laid on the leaves or roots of *Pringlea* during December and January; the larvae hatch out in January and February and tunnel into the plant.

The majority of the larvae are present in the roots of the plant, particularly at the base of the leaves, until May, when they move out into the soil. The overwintering stage is completely larval, for pupation does not commence until November. The pupation period is apparently short, since the adult population increases suddenly in mid-December.

During the winter months the adult population is reduced, but does not completely disappear. The adults survive around *Pringlea* plants and are occasionally seen moving around on snow when the terrestrial temperature is as low as 20°F.

Although *Pringlea* is the main host plant, larvae and pupae were taken from among *Poa* and *Azorella* roots. Attempts to breed these stages through were unsuccessful, so it is not possible to attribute the stages to a particular species. At Iles de Kerguelen *Ectemnorhinus* is found mainly on *Acaena*. Consequently, the group cannot be as dependent on *Pringlea* as *Calcopteryx*.

Sub. gen. ECTEMNORRHINUS, s. str.

*Ectemnorhinus* (s. str.) *crassipes* Jeannel, 1940

- Ectemnorhinus viridis* Waterhouse, G. R., 1853. Trans R. ent. Soc., Lond., **2**, 185.  
*Agonelytra longipennis* Waterhouse, C. O., 1875. Ent. mon. Mag., **12**, 56.  
*Ectemnorhinus viridis* Waterhouse, C. O., 1876. Ent. mon. Mag., **13**, 52.  
*Phillobius* sp. Kidder, 1876. Bull. U.S. Nat. Mus., **3**, 49.  
*Agonelytra longipennis* Studer, T., 1879. Arch. Naturges., **45**, 112.  
*Ectemnorhinus viridis* Waterhouse, C. O., 1879. Philos. Trans. **168**, 232.  
*Ectemnorhinus viridis* Studer, T., 1889. Forschungsreise der S.M.S. "Gazelle," **3**, 124.  
*Ectemnorhinus viridis* Chun, C., 1900. Aus den Tiefen des Weltmeeres, **1**, 245.  
*Ectemnorhinus viridis* Enderlein, G., 1903. Wiss. Ergeb. dtsh. Tiefsee Exped., 1898-99, **3**, 212.  
*Ectemnorhinus viridis* var. *fusca* Enderlein, G., 1903. *ibid.*, 213.  
*Ectemnorhinus viridis* Enderlein, G., 1904. Zool. Anz., **27**, 673.  
*Ectemnorhinus viridis* var. *fusca* Enderlein, G., 1904. *ibid.*, 673.  
*Ectemnorhinus viridis* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 414.  
*Ectemnorhinus viridis* var. *fusca* Enderlein, G., 1909. *ibid.*, 415.  
*Ectemnorhinus viridis* var. *grisescens* Enderlein, G., 1909. *ibid.* 416.  
*Ectemnorhinus viridis* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 33.  
*Ectemnorhinus viridis* var. *fusca*. Womersley, H., 1937. *ibid.*, 34.  
*Ectemnorhinus viridis* var. *grisescens* Womersley, H., 1937. *ibid.* 34.  
*Ectemnorhinus crassipes* Jeannel, R., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), **14**, 168.

The following details may be added to Jeannel's description. Pronotum just a little longer than broad, always with a distinct carina. Antennae equal in length to the pronotum. Second segment slightly swollen, segments three to six equal with seventh and eighth segments slightly flattened.

Elytra oval and elongate. Striations fine but distinct. Interstices flattened.



Scales thicker than in *Ectemnorhinus viridis*, particularly on the pronotum, but still long and hair-like. The scales are moderately dense on the elytra and usually arranged in regular rows on the interstices. Colours of the scales usually green or brown (both types frequently present on one specimen) but sometimes greyish.

*Distribution*: Heard Island.

Enderlein and Womersley both recorded *E. viridis* and its varieties from Heard Island but Jeannel, after examining specimens collected by Aubert de la Rue, described *crassipes* as a new species. Judged from specimens of *E. (E.) viridis* collected at Iles de Kerguelen, the Heard forms are undoubtedly separate species.

*Ectemnorhinus (s.str.) niger* n.sp.

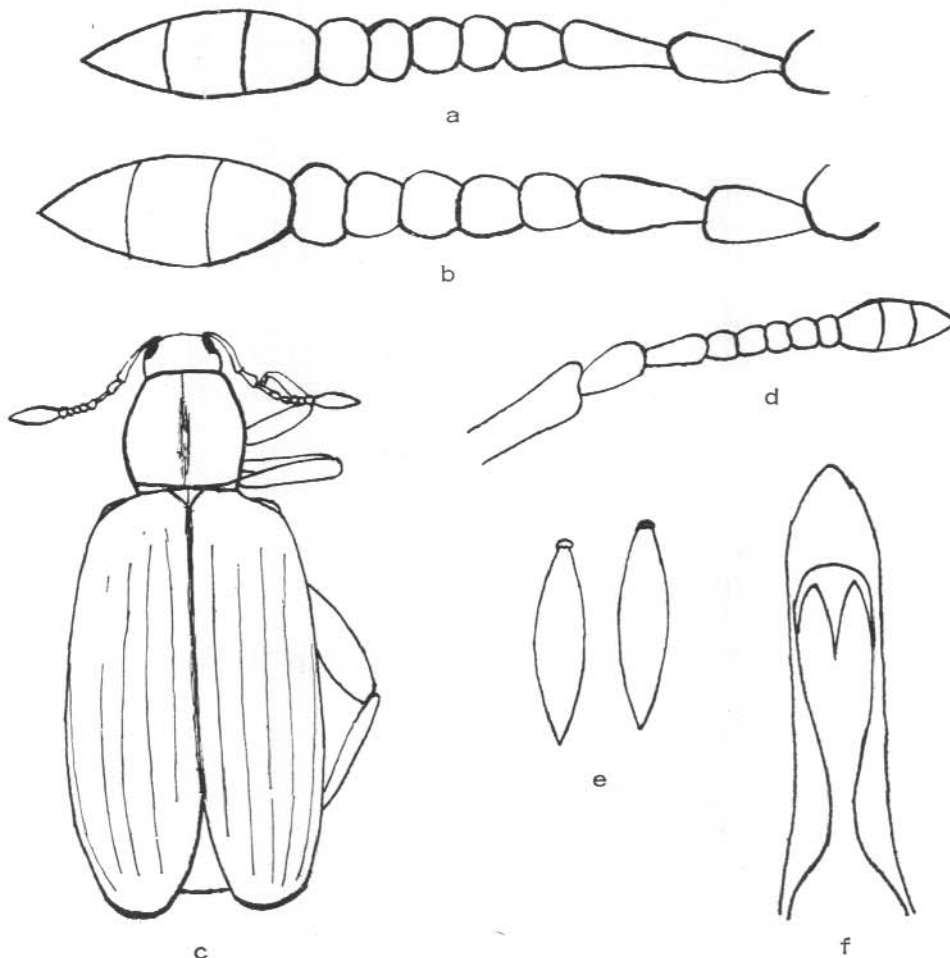


FIG. 6—*Ectemnorhinus niger*, left antenna; b, *E. jelbarti*, left antenna; c, *E. hoseasoni*, imago; d, right antenna; e, scales; f, end of penis.

*Description of Adult.* Black, moderately shiny insect of elongate and slender form. Length 5-6 mm.

Antennae red-brown, longer than the thorax. Ratio of second to third segments in length 1:1, with second a little stouter. Segments four to eight, gradually shorter and wider. Club fairly long and slender (Fig. 6a).

Prothorax variable in size from medium to small. Wider posteriorly than anteriorly and without a carina, well rounded at the sides. Surface rough with a slightly dull finish.

Abdomen slender, widest about the middle. Interstices flat, striations very indistinct. Elytra black, with scales reduced to a few scattered slender brown hairs. Shoulders right-angled and elytra weakly embracing the abdomen at the posterior end.

Legs very dark brown with the femur weakly clavate.

*Distribution:* Heard Island.

This is a fairly common species at Heard Island, usually found among the volcanic lava and *Azorella* rather than on *Pringlea*.

Types in the School of Public Health and Tropical Medicine, Sydney University.

Paratypes in the South Australian Museum.

*Ectemnorhinus (s.str.) jelbarti* n.sp.

*Description of adult.* A shiny black robust insect, 8-10 mm long.

Antennae moderately long, ratio of second to third segments 1:1.4. Eighth segment slightly enlarged. Club much stouter than in *niger* (Fig. 6b).

Prothorax large, as long as wide with a distinct carina. Surface rough but shiny.

Abdomen stout, widest at the posterior end. Interstices flat and striations indistinct. Scales almost absent; a few slender brown ones arranged in rows over the elytra.

Legs red-brown in colour with femur weakly clavate.

*Distribution:* Heard Island.

The species is not very common. It is usually found in *Pringlea*.

Types in the School of Public Health and Tropical Medicine, Sydney University.

Paratypes in the South Australian Museum.

This species is named in honour of J. E. Jelbart, Australian observer with the Norwegian-British-Swedish Antarctic Expedition, who was accidentally drowned off the Antarctic Continent on 23 February 1951.

Subgen. *Heardius* nov.

*Ectemnorhinus (Heardius) hoseasoni* n.sp.

*Description of adult.* Robust insects usually light fawn in colour but often greenish. Length consistent at about 10 mm (Fig. 6c).



Antennae short, with second segment much stouter than third to eighth segments. Club of only moderate size (Fig. 6d).

Prothorax a little wider than long, and widest just posterior of the centre. Carina variable in strength, usually very distinct but sometimes very weak.

Abdomen robust, almost rectangular in shape. Elytra covered with light fawn scales, sometimes with bronzy-green areas. Interstices faintly convex and punctations very deep and distinct. Copulatory organ of the male of the *E. (E.) viridis* form (Fig. 6f).

Scales very broad, of spear-head shape; very dense on thorax and elytra; usually arranged in regular rows similar to those of *E. richtersi* (Fig. 6e).

Legs brown to black, moderately long, with the femur distinctly clavate.

*Distribution*: Heard Island.

This common species is always found on *Pringlea*.

Types in the School of Public Health and Tropical Medicine, Sydney University.

Paratypes in the South Australian Museum.

This species is named in honour of R. J. Hoseason, who was accidentally drowned at Heard Island on 26 May 1952.

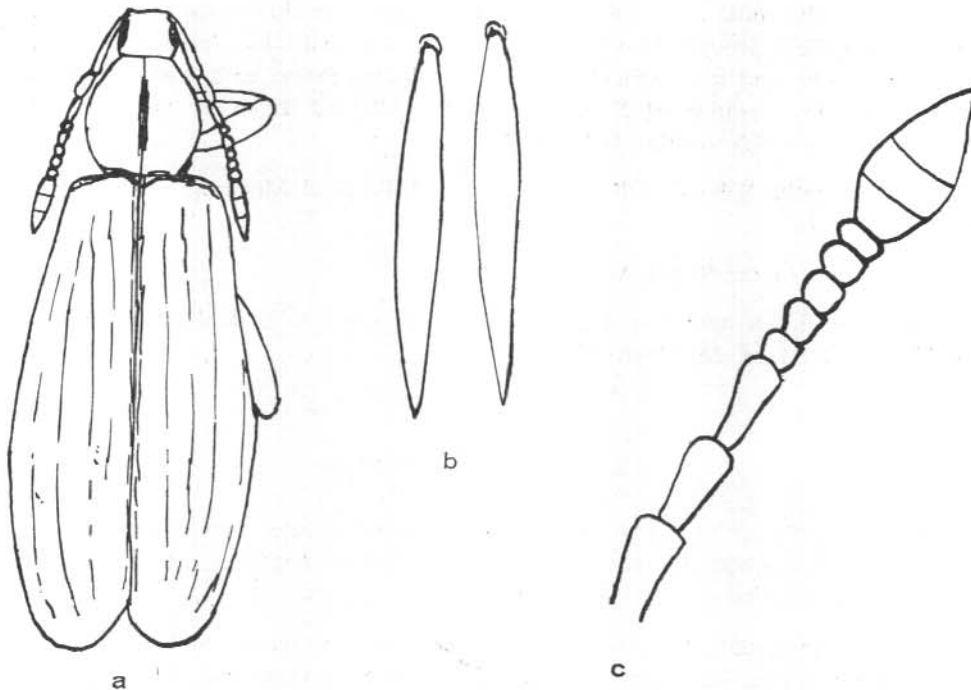


FIG. 7—*Ectemnorhinus forbesi*. a, imago; b, scales; c, right antenna.

*Ectemnorhinus (Heardius) forbesi* n.sp.

*Description of adult.* A slender species usually green in general appearance but also brown, reddish green with distinct brown patterns, or light brown with dark brown patterns. Length 6-8 mm (Fig. 7a).

Antennae much longer than the thorax. Second and third segments together a little longer than fourth to eighth combined. Ratio of second to third segments 1:1. Club fairly broad and large (Fig. 7c).

Prothorax very round, narrower at the anterior than the posterior end. Carina usually strong though weak or absent in some cases.

Abdomen slender, just a little wider at the posterior end. Elytra with interstices convex and punctations not too distinct.

Scales much slenderer than those of *E. hoseasoni* though still spear-head shaped. Variable in length. Colour usually green or bronzy though grey at times; up to three different scale colours may be present on one insect, but individual scales have one or two colours only (Fig. 7b).

Legs moderately long, only weakly clavate.

*Distribution:* Heard Island.

This is the most common coleopterous species on the island and is found in large numbers around *Pringlea* plants. It is very variable, both macro- and microscopically, and it is difficult to give a full description embracing all of the variations. The position of *E. forbesi* at Heard Island seems to correspond to that held by *E. viridis* on Iles de Kerguelen.

Types in the School of Public Health and Tropical Medicine, Sydney University.

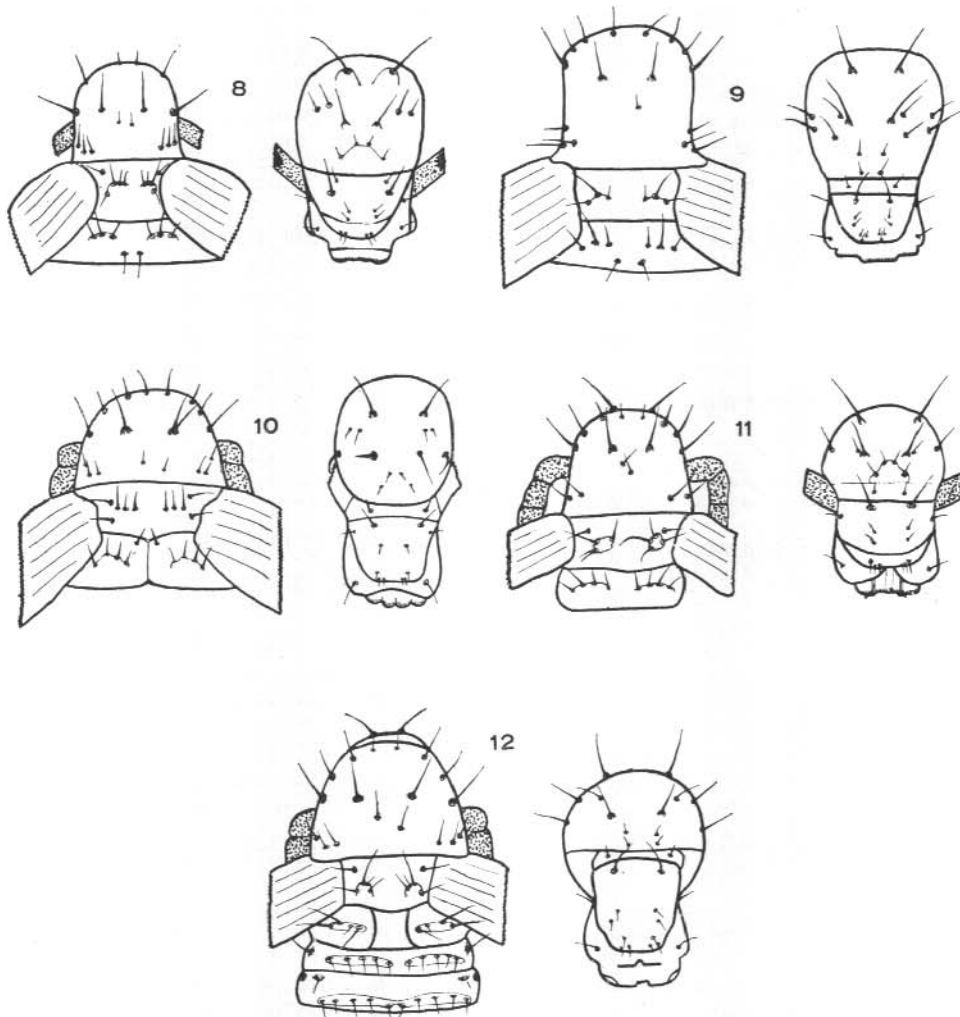
Paratypes in the South Australian Museum.

This species is named in honour of A. G. Forbes, who died from exposure on Heard Island on 26 May 1952.

Pupae of *Ectemnorhinus* spp.

A large number of pupae were collected, divisible into a number of groups. The numerous attempts to breed them through were unsuccessful. It is therefore impossible to correlate the groups with particular species.

The arrangement of the setae varies from group to group, and within some of the groups minor variations are common. Figs. 8-12 show five different dorsal and ventral arrangements.



Figs. 8-12—Various types of *Ectemnorhinus* sp., pupae undifferentiated.

Genus ANTARCTONESIOTES Jeannel, 1940

*Antarctonesiotes gracilipes* (Waterhouse, C. O., 1875)

*Agonelytra gracilipes* Waterhouse, C. O., 1875. Ent. mon. Mag., **12**, 56.

*Agonelytra gracilipes* Studer, T., 1879. Arch. Naturges., **45**, 112.

*Ectemnorhinus gracilipes* Waterhouse, C. O., 1879. Philos. Trans., **168**, 233.

*Ectemnorhinus gracilipes* Studer, T., 1889. Forschungsreise der S.M.S. "Gazelle," **3**, 124.

*Ectemnorhinus gracilipes* Enderlein, G., 1903. Wiss. Ergeb. dtsh. Tiefsee Exped., 1898-99, **3**, 214.

*Ectemnorhinus gracilipes* Enderlein, G., 1904. Zool. Anz., **27**, 673.

- Ectemnorhinus gracilipes* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-05, **10**, 417.  
*Ectemnorhinus gracilipes* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 33.  
*Antarctonesiotes gracilipes* Jeannel, R., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), **14**, 183.

*Distribution*: Heard Island; Iles de Kerguelen.

This species has previously been recorded from both Iles de Kerguelen and Heard Island. Jeannel erected a new genus for this and one other species found at Kerguelen. The specimens collected at Heard Island were usually found in rocky areas, though occasional specimens were collected on *Pringlea*. At Kerguelen, representatives of the species have all been taken from *Acaena*, which is, no doubt, an adaptation from either *Pringlea* or *Poa*.

#### Genus MESEMBRIORRHINUS Jeannel, 1940

##### *Mesembriorrhinus brevis* (Waterhouse, C. O., 1875)

- Agonelytra brevis* Waterhouse, C. O., 1875. Ent. mon. Mag., **12**, 57.  
*Agonelytra brevis* Studer, T., 1879. Arch. Naturges., **45**, 112.  
*Ectemnorhinus brevis* Waterhouse, C. O., 1879. Philos. Trans., **168**, 233.  
*Ectemnorhinus brevis* Studer, T., 1889. Forschungsreise der S.M.S. "Gazelle," **3**, 124.  
*Ectemnorhinus brevis*, Enderlein, G., 1903. Wiss. Ergeb. dtsh. Tiefsee Exped. 1898-99, **3**, 210.  
*Ectemnorhinus brevis* Enderlein, G., 1904. Zool. Anz., **27**, 673.  
*Ectemnorhinus brevis* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 419.  
*Ectemnorhinus crozetensis* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 32.  
*Mesembriorrhinus brevis* Jeannel, R., 1940. Mem. Mus. His. nat. Paris, (n.s.), **14**, 187.

*Distribution*: Heard Island; Iles de Kerguelen.

This species is common on the island, though usually only found in small numbers. Specimens collected by BANZARE and identified by Womersley as *Ectemnorhinus crozetensis* have proved on examination to be *Mesembriorrhinus brevis*. The figure given on page 32 of his report as the pupa of *crozetensis* therefore becomes the pupa of *M. brevis*. *Xanium crozetensis* is confined to the Iles Crozet and must be a comparatively rare species.

## Order DIPTERA

## Family CYPSELIDAE

## Subfamily LEPTOCERINAE

## Genus ANATALANTA Eaton, 1875

This genus is represented by two species so closely related that in fact they may only be geographical subspecies (*A. aptera* on Iles de Kerguelen and Heard Island, and *A. crozetensis* on Iles Crozet). Enderlein described another species, *A. formiciformis*, but these are newly hatched adults of *A. aptera* which are pale brown and almost transparent, with very bright red eyes. The insects darken rapidly and are indistinguishable from normal adults after twenty-four hours.

*Anatalanta aptera* Eaton, 1875

- Anatalanta aptera* Eaton, A. E., 1875. Ent. mon. Mag., **12**, 59.  
*Anatalanta aptera* Osten-Sacken, C. R., 1876. Bull. U.S. nat. Mus., **3**, 51.  
*Anatalanta aptera* Studer, T., 1879. Arch. Naturges., **45**, 112.  
*Anatalanta aptera* Verrall, G. H., 1879. Philos. Trans., **168**, 244.  
*Anatalanta aptera* Studer T., 1889. Forschungsreise der S.M.S. "Gazelle," **3**, 125.  
*Anatalanta aptera* Enderlein, G., 1903. Wiss. Ergeb. dtsh. Tiefsee Exped. 1898-99, **3**, 225.  
*Anatalanta formiciformis* Enderlein, G., 1903. *ibid.* 226.  
*Anatalanta aptera* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 429.  
*Anatalanta formiciformis* Enderlein, G., 1909. *ibid.*, 430.  
*Anatalanta aptera*. Loranchet, M., 1910. Bull. Mus. Hist. nat. Paris, **16**, 96.  
*Anatalanta aptera* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep. Ser. B, **4**, 67.  
*Anatalanta aptera* Seguy, E., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), **14**, 248.

*Distribution*: Heard Island; Iles de Kerguelen.

*Life history*. This species is extremely common at Heard Island and is the most predominant insect species during the winter months.

Adults and all immature stages were found in any situation where there was decaying organic matter. Breeding sites in their order of preference are as follows:

- (i) under rocks or plants in penguin rookeries;
- (ii) in all types of carcass\*;
- (iii) in the majority of birds' nests, whether exposed or underground;
- (iv) around *Pringlea* or other vegetation where there is a lot of decomposition.

\* These insects were quick to take advantage of human occupation of the island: quantities of eggs were laid on an uncovered dressed turkey; rusted tins of meat, in field dumps, were invaded.

The larvae hatch out in about fourteen days. In the spring or early summer they quickly develop and pupate, the imagos emerging about four weeks after the eggs were laid. From November to April a number of generations of adults emerge and some of these survive throughout the winter. During midwinter, when terrestrial temperatures are very low, they seek refuge under stones, etc., and are seldom seen. Larvae and pupae are also found from June to October, the latter being much more common. Development of the immature stages is slow during winter, but they quickly hatch out in the spring. This species, therefore, has no set overwintering stage.

Family **TYLIDAE**

Subfamily **TYLINAE**

Genus **CALYOPTERYX** Eaton, 1875

*Calycopteryx moseleyi* Eaton subsp. *minor* Enderlein, 1909

*Calycopteryx moseleyi* var. *minor* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 469.

*Calycopteryx moseleyi* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 70.

*Calycopteryx moseleyi* var. *minor*. Seguy, E., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), **14**, 259.

Enderlein described the specimens collected by the German South Polar Expedition as a variety of the Kerguelen species but Womersley, in discussing the BANZARE collection from Heard Island, refers to the typical form only. Séguy records five var. *minor* specimens from Iles de Kerguelen, but the writer does not know whether these are similar to Heard Island ones. The writer is satisfied that the Heard Island insect belongs to a separate subspecies and has elevated the variety to that rank. The description given by Enderlein is very brief; the following table demonstrates the difference between the two types.

TABLE 2  
DIFFERENCES BETWEEN THE SUBSPECIES OF *C. MOSELEYI*

	<i>C. moseleyi moseleyi</i>	<i>C. moseleyi minor</i>
Length	9 mm.	6 mm.
Eyes	Yellow	Dark brown
Halteres	Yellow	Dark brown
Legs	Dark brown	Nearly black
Head	Yellow medial longitudinal stripe	No stripe; frons dark red-brown
Body	Silky pubescence cream coloured	Silky pubescence dark brown

*Distribution:* Heard Island; Iles de Kerguelen.

*Life history.* The first eggs of *C. moseleyi minor* are laid in mid-January, numbers reaching a peak by mid-February. They are laid on leaves in the heart of *Pringlea* plants. At this time adults of both sexes congregate around the heart of the plant, though copulation generally occurs on the ground.

Eggs collected on 25 January and kept at air temperature began to hatch on 10 February, and were all hatched four days later. This shows that the time required for normal hatching is about 20 days. The newly hatched larvae migrate to the outer leaves, particularly the lower ones, where they act as leaf-miners. In early May, when they are ten mm long, they drop to the ground or move out of fallen leaves into the earth. As ground temperatures fall the larvae move well underground and spend the winter among the roots of the plant.

Some experiments carried out on the island showed that, when ten larvae were exposed to temperatures of  $-2^{\circ}$  and  $-3^{\circ}$  C, four and ten respectively died within 15 minutes. Considering the low atmospheric temperatures in winter, this lethal temperature is surprisingly high, and in fact the larvae need a certain depth of soil in order to winter successfully. When eggs were laid on plants growing from cracks in bare lava, the larvae did not survive the approach of winter.

Pupation occurs from mid-November onwards, but before this the larvae move up nearly to ground level. The imagos first appear in late December, which implies a pupation period of from five to six weeks. Most adults emerge by January, although a few appear as late as mid-February. After copulation, on the ground or on *Pringlea*, and egg-laying, the adults begin to die off and by April it is almost impossible to find one alive.

The adult flies are very sensitive to vibration, and on an observer's approach they roll up their legs and fall into the heart of the cabbage, where they lie still as if dead. However, they seem to have no natural enemies, not being preyed upon by either birds or spiders. Larvae were eaten by spiders but not birds.

Individuals do not usually move far from their "home" plant, though adults have been seen walking over *Azorella*. They are probably dispersed by the wind.

At Heard Island this species is completely dependent on *Pringlea*. No eggs or larvae were collected from any other plant, and the concentration of adults was always determined by the quantity and quality of *Pringlea* growth. *Pringlea* at Heard Island compares unfavourably with that on Iles de Kerguelen, particularly in size, and many small stands at Heard Island do not support *C. moseleyi minor* populations.

As a genus, *Calcopteryx* is unadaptable. On Iles de Kerguelen the destruction of *Pringlea* by rabbits and the subsequent spread of *Acaena* has almost completely eradicated *C. moseleyi moseleyi* from the mainland, although both *Pringlea* and *Calcopteryx* are plentiful on the smaller islands (Jeannel, 1940).



Family **EPHYDRIDAE**Genus **AMALOPTERYX** Eaton, 1875

The genus *Amalopteryx* is monotypic, but it is closely related to two other genera, *Scatophila* and *Synhoplos*, which are found on the Falkland Islands and Tierra del Fuego. It is difficult to decide on a place of origin for the genus, but the available evidence seems to point to South America.

*Amalopteryx maritima* Eaton, 1875

- Amalopteryx maritima* Eaton, A. E., 1875. Ent. mon. Mag., **12**, 58.  
*Amalopteryx maritima* Osten-Sacken, C. R., 1876. Bull. U.S. nat. Mus., **3**, 51.  
*Amalopteryx maritima* Verrall, G. H., 1879. Philos. Trans., **168**, 241.  
*Amalopteryx maritima* Studer, T., 1879. Arch. Naturges., **45**, 112.  
*Amalopteryx maritima* Enderlein, G., 1903. Wiss. Ergeb. dtsh. Tiefsee Exped. 1898-99, **3**, 220.  
*Amalopteryx maritima* Studer, T., 1889. Forschungsreise der S.M.S. "Gazelle," **3**, 125.  
*Amalopteryx maritima* Chun, C., 1900. Aus den Tiefen des Weltmeeres, **1**, 244.  
*Amalopteryx maritima*, Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 434.  
*Amalopteryx maritima* Loranchet, M., 1910. Bull. Mus. Hist. Nat., Paris, **16**, 96.  
*Amalopteryx maritima* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 75.  
*Amalopteryx maritima* Seguy, E., 1940. Mem. Mus. Hist. nat. Paris, (n.s.), **14**, 260.

This little ephydrid, with its stalk-like wings, seems to be among the most widespread of subantarctic Diptera, but specimens from the different localities show no morphological variation. The larvae and pupae of the species have been described by Womersley, and Séguy has figured the adults, but so far no description of the egg has been given.

*Description of egg.* Length 2 mm; slender and oval in shape; colour, cream. Fairly prominent operculum at one end and the whole egg covered with irregular striations running longitudinally.

*Distribution:* Heard Island; Iles de Kerguelen; Iles Crozet; Macquarie Island.

*Life history.* Although this species was previously represented from Heard Island only by a single specimen collected in 1929, large numbers were collected in 1951. All stages are found near the high-tide mark, usually but not always associated with seaweed. The most satisfactory habitat seems to be where the *Poa* grass extends in hummock form to the edge of the sea. Where thin layers of seaweed grow between the tussocks the larvae were usually found underneath the leaves, where they apparently feed. When only moss is found between the tussocks the larvae are still present, though in reduced numbers.

The first larvae were collected in late October (they may have been present earlier) but pupation occurs from November onwards. Adults are present all



the year round, becoming very numerous about April. They appear much better able to cope with the low terrestrial temperatures than the other two dipterous species: during the winter it is quite common to see them hopping around on the snow close to the sea shore. They are very susceptible to vibration, and on the approach of an animal will fall from the tussock grass into the hollows, where they hop around for some time. They use their specialised wings to propel themselves in a series of hops, in much the same way as *Pringleophaga* uses its hind legs.

From the data available it is impossible to say whether there is one or there are more than one generation of adults during the year. The ability of the adults to survive the winter may be due to a habitat close to the sea for, in the winter, cyclonic seas throw spray for considerable distances inland and cause almost permanent thaw conditions.

## Order SIPHONAPTERA

## Family MALACOPSYLLIDAE

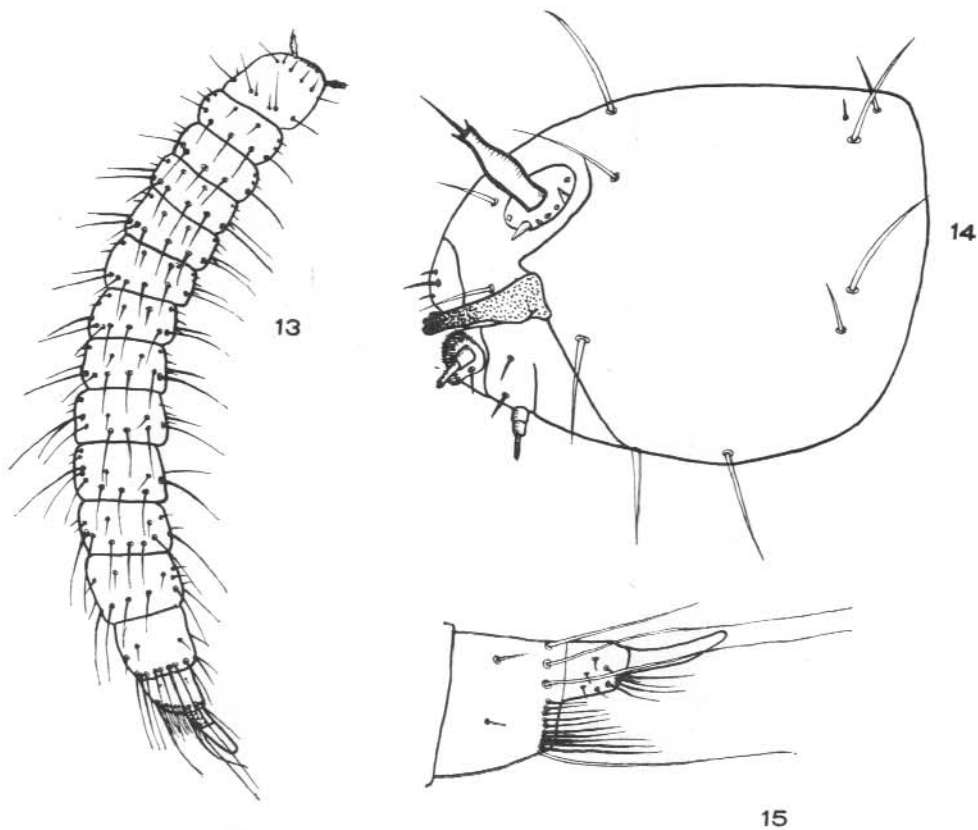
## Subfamily PARAPSYLLINAE

## Genus PARAPSYLLUS Enderlein, 1903

All species of *Parapsyllus* are parasites of birds in southern regions. Jordan (1942) revised the genus and considered the relationships between the various species; de Meillon (1952) has since described two new subspecies.

*Parapsyllus magellanicus heardi* de Meillon, 1952

*Parapsyllus magellanicus heardi* de Meillon, B., 1952. Aust. Nat. Ant. Res. Exped. Rep., Ser. B, 1, 4.



FIGS. 13-15—*Parapsyllus magellanicus heardi* larva. 13, entire larva; 14, head; 15, anal segment.

De Meillon described the adult of this subspecies from both Heard and Macquarie Islands. The larva is now described for the first time, using Elbel's (1952) terminology.

*Description of Larva* (see Fig. 13). Head: Anterior row of four large setae, and posterior row of three large, two small setae, and one very small seta. One small seta above the mandible and one just anterior to the antenna. Three very small setae above the labial palp (Fig 14).

Body segments with two rows of setae dorsally; the anterior of two small and the posterior of four large setae: laterally three small anterior setae and two very large posterior ones. Anal comb a single row of long setae; one seta stretching to end of larva and three stretching well beyond it. Anal strut of four inner small setae and five outer long ones (Fig. 15). Two setae anterior to the anal comb, one very small and one stretching almost to the beginning of the longest setae of the comb.

Hosts: *Pygoscelis papua*;\* *Diomedea melanophris*; *Phoebetria palpebrata*; *Macronectes giganteus*; *Daption capensis*; *Pachyptila desolata*; *Pelecanoides georgicus*;\* *Catharacta skua lonnbergi*.

*Distribution*: Heard Island, Macquarie Island.

In two comparatively recent papers (Jordan, 1942; de Meillon, 1952) it has been suggested that the speciation of the genus *Parapsylla* might afford some evidence about such a controversial matter as the origin of penguins. Evidence has been given to support the hypothesis that the present-day subspecies of *Parapsyllus longicornis* and *Parapsyllus magellanicus* arose through dispersal and subsequent isolation of these fleas with their penguin or protopenguin hosts; and that the origin of both fleas and hosts was the South American continent.

Now, there is no doubt that the Parapsyllidae are derived from South American rodent fleas, but there may be doubt whether penguins are their primary avian hosts and, consequently, whether their speciation has any bearing on penguin evolution.

Although penguin hosts predominate in the records, this may be, and probably is, no more than a reflection of the attention paid by past expeditions to penguins rather than petrels, and to infrequent searches for parasites in nesting burrows. By contrast, ANARE collectors have found *P. magellanicus heardi* on a number of hosts, only one of which is a penguin, and another of which, *Macronectes giganteus*, ranges very widely over the Southern Ocean (Downes, Gwynn and Howard, 1954; Howard, 1956, etc.). The identical populations of *P.m. heardi* at Heard and Macquarie Islands, the nearest relative of which is found in the Falkland Islands, suggests distribution by wide-ranging flying hosts, which could carry parasites with less risk to the parasites than penguins could.

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\* New host record.

In conclusion, it must be emphasised that the story of the fleas of Southern Ocean birds is by no means complete. There are a number of islands (e.g. South Georgia and Bouvetya) from which no fleas have yet been recorded and others (e.g. Iles de Kerguelen and Macquarie Island) where collecting and host records are far from satisfactory.

Subfamily **PYGIOPSYLLINAE**

Genus **NOTIOPSYLLA** Jordan and Rothschild, 1914  
(Syn. *Goniopsyllus* preoccupied)

Only one species so far has been referred to this interesting circumpolar genus. The parasite was first elevated to a separate genus by Baker in 1905 (*Goniopsyllus*) but, since this name was preoccupied, Jordan and Rothschild changed it to *Notiopsylla*.

*Notiopsylla kerguelensis* (Taschenberg, 1880)

- ? *Pulex* sp. Eaton, A. E., 1875. Proc. Roy. Soc., **23**, 355.  
 ? *Pulex* sp. Eaton, A. E., 1875. Ent. mon. Mag., **12**, 2.  
*Pulex kerguelensis* Taschenberg, O., 1880. Die Flohe, 68.  
*Pulex kerguelensis* Rothschild, N. C., 1895. Nov. Zool., **2**, 66.  
*Pulex kerguelensis* Baker, C. F., 1895. Canad. Ent. **27**, 65.  
*Pulex kerguelensis* Baker, C. F., 1904. Proc. U.S. nat. Mus., **27**, 437.  
*Goniopsyllus kerguelensis* Baker, C. F., 1905. Proc. U.S. nat. Mus., **29**, 128.  
*Goniopsyllus kerguelensis* Jordan, K. and Rothschild, N. C., 1908. Parasitology, **1**, 93.  
*Goniopsyllus kerguelensis* Enderlein, G., 1909. Dtsch. sudpolar Exped. 1901-03, **10**, 440.  
*Notiopsylla kerguelensis* Jordan, K. and Rothschild, N. C., 1914. Nov. Zool., **21**, 220.  
*Notiopsylla kerguelensis* Womersley, H., 1937. Brit. Aust. N.Z. Ant. Res. Exped. 1929-31, Rep., Ser. B, **4**, 82.  
*Notiopsylla kerguelensis* Jordan, K., 1942. Eos, Madrid, **18**, 7.  
*Notiopsylla kerguelensis* de Meillon, B., 1952. Aust. Nat. Ant. Res. Exped. Rep., Ser. B, **1**, 7.

This species has been identified by de Meillon in material collected at Heard Island in 1949, and more specimens were collected in 1951.

Hosts: *Macronectes giganteus*; *Pachyptila desolata*; *Pelecanoides urinatrix*; *Larus dominicanus*; *Cyanorhamphus unicilor* (? accidental host).

*Distribution*: Heard Island; Iles de Kerguelen; South Georgia; Antipodes Island.

*N. kerguelensis* is circumpolar and, though specimens collected from the different localities exhibit no differences, there are still some interesting gaps in its distribution. Since the insect is a parasite of the host itself and does not usually remain in the nests like *Parapsyllus*, the possibility of geographical subspeciation is very slight. So far there is no record of a penguin as a host, and

the nature of the life history would prevent its being more than a very occasional parasite on them.

The subfamily Pygiopsyllinae, to which the species belongs, is the predominant group of Siphonaptera in the Australian region and *N. kerguelensis* may have originated on that continent, although it has not been recorded from Australian sea birds. (This may be due to lack of systematic search.) The species or a precursor could have been picked up and distributed in the Subantarctic and Antarctic by such birds as giant petrels, which are fairly common visitors to Australian shores. The intermediate link between the mammal Pygiopsyllinae and *N. kerguelensis*, if it exists, should occur on Australian sea birds.\*

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\* Dr. G. M. Dunnet informs the editors that a pygiopsylline has recently been found in a collection from a "bird's nest," Tasmania.

## Order LEPIDOPTERA

## Family TINEIDAE

Genus PRINGLEOPHAGA Enderlein, 1906

*Key to the Known Species of Pringleophaga:*

1. Hind legs much longer than fore legs ..... 2  
 Hind legs and fore legs almost equal in length ..... *P. crozetensis*  
 End. (Iles Crozet)
2. Antennae with approximately 85 segments ..... *P. kerguelensis*  
 End. (Iles de Kerguelen)
- Antennae with approximately 43 segments ..... *P. heardensis*  
 n.sp. (Heard Island)

*Pringleophaga heardensis* n. sp.

*Description of Adult* (Fig. 26). Head much broader than long. Eyes black; widely separated and prominent. Antennae about three-quarters of the length of the body; filiform, tapering gently, composed of about 43 segments all longer than broad; distal segment strongly oval in shape (Fig. 22). Maxillae well developed but maxillary palps small and four-segmented (Fig. 23). Labial palps long and prominent, composed of three segments, the last of which is about  $1\frac{1}{4}$  times the length of the first and second together.

Wings reduced; fore wing not reaching to end of body in either sex but almost as long as body in male. Hind wing very small, one-third of length of fore wing and reaching only to end of abdominal segment 1.

General coloration dark brown; body and wings compactly covered with brown to grey scales.

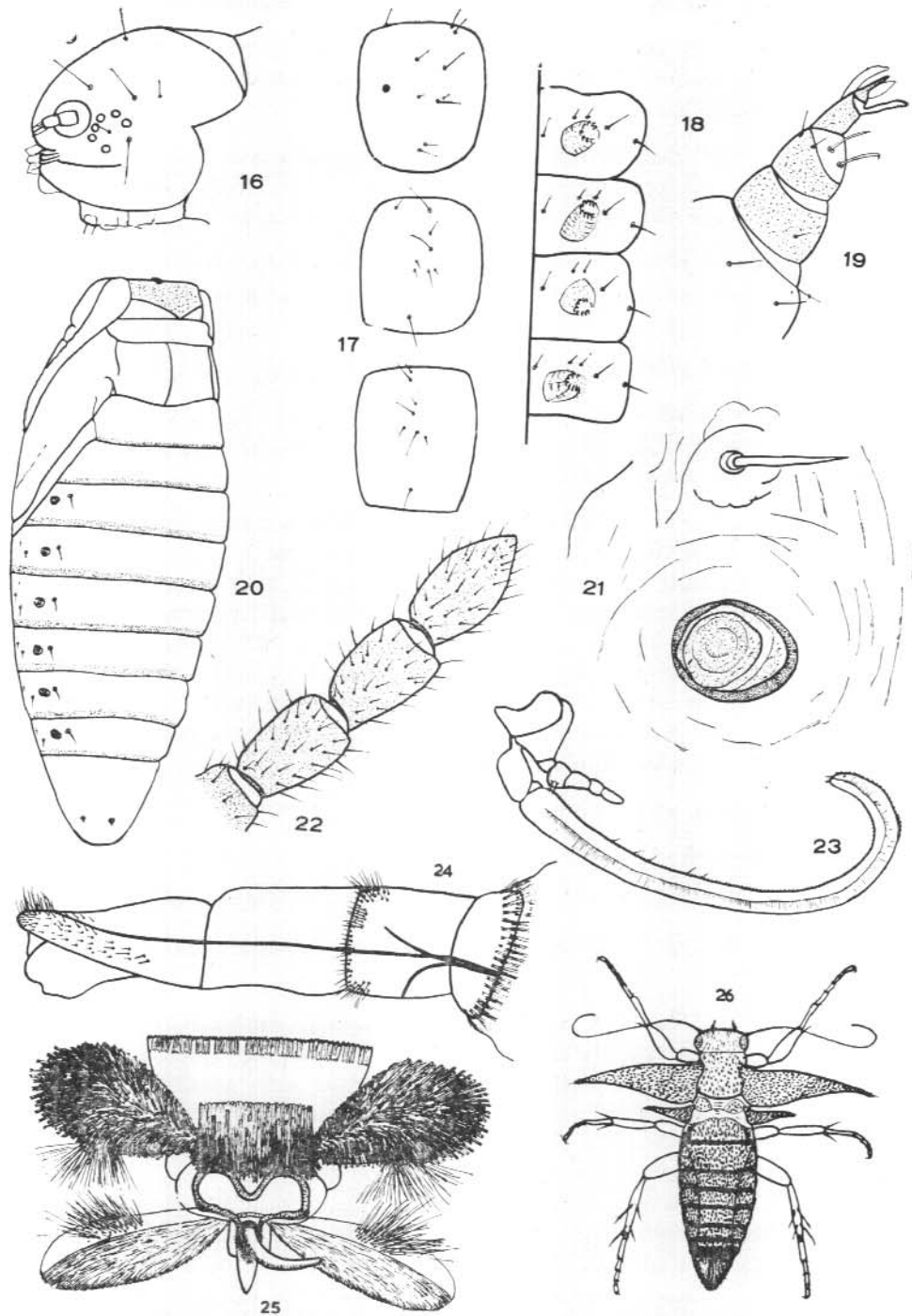
Ratio of leg-length, fore : mid : hind, 1 :  $1\frac{1}{2}$  :  $1\frac{3}{4}$ . One tibial spur on fore, two on mid, and four on hind legs.

Male 5 mm long. Genitalia sacculi red-brown and prominent. Gnathos strongly chitinised with short backwardly-directed hairs on margin (Fig. 25).

Female 7 mm long. Genitalia not strongly sclerotized. Well marked ring of hairs on the posterior margin of abdominal segment 8 (Fig. 24).

*Description of egg.* Creamy white in colour and oval in shape. Length 0.9 mm. Greatest width 0.45 mm. Shell fairly smooth, no visible operculum.

*Description of Larva.* Length 7 mm; shape subcylindrical, last two segments much narrower than the others. Colour cream with four longitudinal light brown



FIGS. 16-26—*Pringleophaga heardensis*. 16, larval head; 17, thoracic chaetotaxy of larva; 18, prolegs of abdominal segments 3-6; 19, larval leg 3; 20, pupa; 21, pupal spiracle; 22, adult antenna, terminal segments; 23, maxilla; 24, female genitalia; 25, male genitalia; 26, imago.



stripes. Head dark brown. Prothoracic shields dark brown, separated by a medial line of cream. Abdominal segment 9 with two dark brown areas and segment 10 almost completely brown.

Head medium sized, ocelli six on each side arranged as in Fig. 16. Antennae two-segmented, with prominent terminal sensory organ, arising from a cream, almost circular area (Fig. 16). Spiracles completely circular.

Thoracic legs (Fig. 19) normal. Abdominal prolegs situated on segments 3, 4, 5, 6 and 10, each with from eight to ten crochets arranged in a three-quarter circle (Fig. 18).

Chaetotaxy of thoracic segments as in Fig. 17. Prothoracic spiracle circular.

*Description of Pupa* (Fig. 20). Only one pupa of the species was found and that, unfortunately, was slightly damaged on the ventral side. All the characters, however, are discernible.

Length 7 mm. Colour almost black. Head with a central frontal tubercle clearly visible. Antennae reaching to abdominal segment 5, these and the labial palps exhibiting clearly the characteristics of the imago. Fore-wings folded under body from first abdominal segment and reaching to third segment. Hind-wings larger than corresponding structure in adult. Abdomen with six distinct segments and one final segment probably consisting of segments 7 and 8 fused. Lateral spiracles situated on abdominal segments 1 to 6, normal, with three associated setae as in Fig. 21. No other setae on abdominal segments but last segment with a row of six ventral and two dorsal spines.

Cuticle covered with an irregular tessellation.

*Distribution:* Heard Island.

Types in the School of Public Health and Tropical Medicine, Sydney.

Paratypes in the South Australian Museum, Adelaide, and the Macleay Museum, Sydney.

*Life history.* The eggs are laid early in January on blades of *Poa* grass. The larvae hatch out towards the end of the month and move down to the low-lying leaves and roots, on which they feed. Larvae were collected on various dates from April to October, i.e. the overwintering stage is larval. The single pupa was taken on 30 November so that, as in other Heard Island insects, pupation probably occurs during November. The first adult was found just before Christmas. The adult population increases rapidly, and at the end of the first week in January is very large. By the end of January it is impossible to find a single specimen, so that the life of the adult can not be more than four, but generally, three weeks. Adults do not fly but use their elongated hind-legs to propel themselves in a series of long hops which may be up to a foot in length. During the short periods of sunshine they become very active and it is then that copulation usually occurs.



Of the other two species of *Pringleophaga*, the life history of *P. kerguelensis* is known, and differs from that of *P. heardensis* in several ways (Viette, 1948; Paulian, 1953). The most striking is that the larval stage appears to last several years. Pupation is longer, lasting from December to April, but the adult life is much the same, being 20 days. These differences can be related to differences in climate between the two islands. In contrast to *P. heardensis*, which is confined to *Poa*, *P. kerguelensis* is found on *Pringlea*, *Acaena*, *Azorella* and *Cotula*, having probably adapted itself to the three latter species after most of the *Pringlea* on the main island of Kerguelen was destroyed by rabbits. Whether the original host plant of *Pringleophaga* was *Poa* or *Pringlea* is not clear.

*P. kerguelensis* is preyed upon by the Kerguelen tern, *Sterna virgata*, but *P. heardensis* appears to have no natural enemies.

### INTRODUCED SPECIES

Three introduced species have been collected on Heard Island since establishment of the base in 1948.

#### Order THYSANURA

##### *Ctenolepisma longicaudata* Esch.

This is the common silverfish in Australian houses, and was introduced to the country from overseas (originally recorded from South Africa). Only one specimen was collected on Heard Island, and that from a prefabricated section of a hut on 20 February 1951, a few weeks after the departure of the relief ship.

#### Order DIPTERA

##### *Musca domestica*, Linn.

Three specimens have been collected, all flying in the huts some time after the departure of the relief ship. They are as follows:

One on 26 June 1949, four months after the ship's departure;

One on 1 March 1951, some weeks after the ship's departure;

One on 16 January 1952, almost twelve months after the ship's departure.

The last record is an interesting one, for it indicates that some stage of the insect survived the winter, even though the huts (the most favourable habitat) were not always heated. Probably some adults present on the ship were transported ashore and a number of larvae managed to survive and pupate, so that the adult hatched out the following summer.

It is reported that *Musca domestica* has succeeded in establishing itself at Iles de Kerguelen in fair numbers.

**Order LEPIDOPTERA***Tineola bisselliella*

One specimen of the common webbing clothes moth was collected in one of the station huts on 10 January 1952, almost a year after the ship's departure.

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\* This list only includes papers mentioned in the Introduction and referred to in the discussion of individual species. It does not include papers listed in the taxonomic bibliographies preceding the descriptions of species.

