

# The Diptera of the Antipodes and the Bounty Islands.

By ROY A. HARRISON,

Plant Diseases Division, Department of Scientific and Industrial Research,  
Auckland, New Zealand.

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## Summary

THIS paper gives notes on a collection of Diptera adults and larvae collected in 1950 from the Antipodes and Bounty Islands. Descriptions are given of a new genus *Australimyza* and its type species *A. ausotomac* (Fam. Milichiidae) and another new species *Macrocanace antipoda* (Fam. Canaceidae).

## INTRODUCTION

THE 1950 Antipodes-Bounty Islands Expedition per M.V. "Alert," under the leadership of Dr. R. A. Falla, collected 156 specimens of Diptera. In this collection were thirteen species, including three new species, one of which belongs to a new genus, and four undetermined but possibly new species. One of these undetermined species (1 specimen) will be discussed in conjunction with a series from other sub-Antarctic Islands in a future paper. The number of species now recorded from the Antipodes Island is fourteen, and from the Bounty Islands, three. Prior to this expedition only five species were known to occur on the Antipodes Island and two on the Bounty Islands (Miller, 1950).

Antipodes Island, which is about five miles long and three miles wide, is situated in latitude 49° 41' S. and longitude 178° 43' E. It is considered to be entirely volcanic in origin. Falla (1948) described the island thus: "The surface is a rough, undulating plateau bounded by remarkably even perpendicular cliffs. It rises to 1,320 feet, and has a few other cones of lesser height. The whole surface is peaty and water-logged, with extensive swamps in some of the depressions and shallow tarns on the upland. Streams run in most gullies." Penguins breed on the shore rocks and slopes leading up to the plateau, and the plateau is a breeding ground of the wandering albatross. The vegetation of the plateau and slopes consists mainly of tussock grasses, ferns and herbaceous plants, but there is a small quantity of low shrub.

The Bounty Islands are a group of bare granite rocks about 490 miles east of Stewart Island, New Zealand, and about 120 miles north of Antipodes Island. There is no vegetation other than a blue-green alga forming a thin film on the rocks. Penguins and other sea birds breed on the islands.

## LIST OF SPECIES

The complete lists of Diptera known to occur on the Antipodes and Bounty Islands are given below. Those species which were collected by the 1950 expedition and which are new records are distinguished by an asterisk, new species are indicated and the number of specimens collected in 1950 is given.

## ANTIPODES ISLAND DIPTERA

## Family TIPULIDAE

\**Erioptera* sp. sp. nov. 3

## Family CHIRONOMIDAE

\**Chironomus* sp. 1

\*Undetermined sp. 1

## Family PSYCHODIDAE

\**Psychoda spatulata* Satchell. 3

\**P. acutipennis* Tonnoir. 6

## Family MYCETOPHILIDAE

\**Sciara* sp. 1

## Family CANACEIDAE

*Macrocanace littorea* (Hutton). 76

\**M. antipoda* sp. nov. 1

## Family MILICHIIDAE

\**Australimyza anisotomae* sp. nov. 31

## Family MUSCIDAE

*Fannia canicularis* (Linnaeus)

*Limnophora aucklandica* Hutton

*Paralimnophora depressa* Lamb. 1

## Family CALLIPHORIDAE

*Calliphora antipodea* Hutton. 2

\**C. viridiventris* Malloch. 1

## BOUNTY ISLAND DIPTERA

## Family PSYCHODIDAE

*Psychoda acutipennis* Tonnoir

## Family DOLICHOPODIDAE

*Aphrosyloopsis lineatus* Lamb

## Family CANACEIDAE

\**Macrocanace littorea* (Hutton). 28

## NOTES AND DESCRIPTIONS OF SPECIES

## Family TIPULIDAE

Three crane flies, all subapterous, were collected by the expedition. They have been examined by Dr. C. P. Alexander, University of Massachusetts, Amherst, Mass., United States of America, who reported (in litt.) that the three specimens belong to a new species of the sub-genus *Trimicra*, genus *Erioptera*. Dr. Alexander is describing the species in Part 95 of his series of papers on Crane Flies being published in the *Annals and Magazine of Natural History*, London.

The three specimens were taken on the tussock slopes above Ringdove Bay, Antipodes Island, one each by R. K. Dell, R. A. Falla and E. G. Turbott.

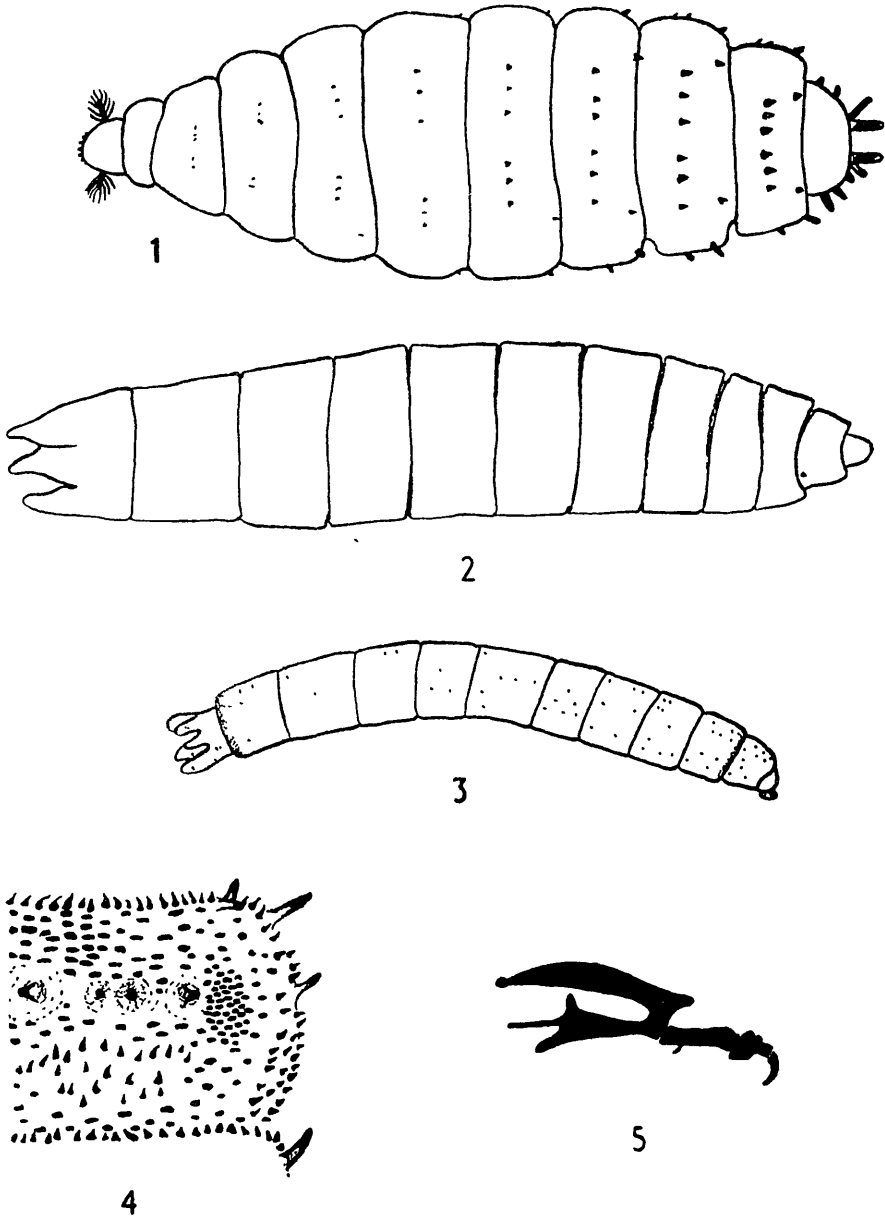
The type of the new species is deposited in the Auckland Museum, one paratype is in the Dominion Museum, Wellington, and the other is retained by Dr. Alexander.

## Family CHIRONOMIDAE

Two specimens of this family were collected at Ringdove Bay, Antipodes Island, on 7/11/1950 by E. G. Turbott. One, in excellent condition, belongs

to the genus *Chironomus* Meig., and is possibly a new species of that genus. The other, preserved in alcohol and in poor condition, has not yet been determined.

As so little is known of the Chironomid fauna of the New Zealand sub-region, it appears inadvisable to describe these individual specimens as new species. Their relationships may be better understood when larger series are collected. Both specimens are in the collection of the Auckland Museum.



TEXT-FIG. 1.

FIG. 1.—Larva A  $\times 12$ . FIG. 2.—Larva B  $\times 15$ . FIG. 3.—Larva C  $\times 15$ . FIG. 4.—One half of a posterior segment of Larva A  $\times 30$ . FIG. 5.—Bucco-pharyngeal skeleton of Larva A  $\times 30$ .

## Family PSYCHODIDAE

Dr. G. H. Satchell, Zoology Department, University of Otago, Dunedin, New Zealand, identified the specimens of Psychodidae and kindly supplied the following notes:—

**Psychoda spatulata** Satchell.

Satchell, G. H., 1950, *Trans. R. Ent. Soc. Lond.* 101, 166.

This species is the most common and widespread of the Psychodidae within New Zealand, and it also occurs in Australia. It breeds readily in decaying vegetables and rubbish and may well have been introduced to the Antipodes Island by the occasional ship that has called there.

Three specimens, all females, were collected on tussock slopes above Ringdove Bay by E. G. Turbott, and they are in the Auckland Museum.

**Psychoda acutipennis** Tonnoir.

Tonnoir, A. L., 1920, *Ann. Soc. Ent. Belg.*, 60, 149.

Satchell, G. H., 1950, *Proc. R. Ent. Soc. Lond. B.* 19, 42-6.

Six specimens (2 ♂, 4 ♀) of this species were collected on penguin dung under stones. The record is of the greatest interest since the species was previously known only from the Bounty Islands, and was collected in 1903 in precisely the same type of habitat—i.e., on penguin dung under stones. There appears to be complete specific identity between the Bounty Islands and the Antipodes Island specimens. As the species is semiapterous and probably cannot fly, its occurrence on two of the sub-Antarctic islands leads inevitably to speculation as to its method of dispersal. The larvae are small and almost certainly live in penguin dung, so the possibility of them being carried on birds' feet has to be borne in mind.

The specimens were collected by E. G. Turbott and 3 ♀ and 1 ♂ are in the collection of the Auckland Museum.

## Family MYCETOPHILIDAE

One specimen belonging to this family was taken from leaf mould collected from tussock at the top of the slopes above Ringdove Bay, Antipodes Island, on 10/11/1950, by E. G. Turbott. It is a female belonging to the genus *Sciara*, and appears to be a new species. It is preserved in alcohol and is in the collection of the Auckland Museum. The wing is figured in Text-fig. 3, Fig. 15.

## Family CANACEIDAE

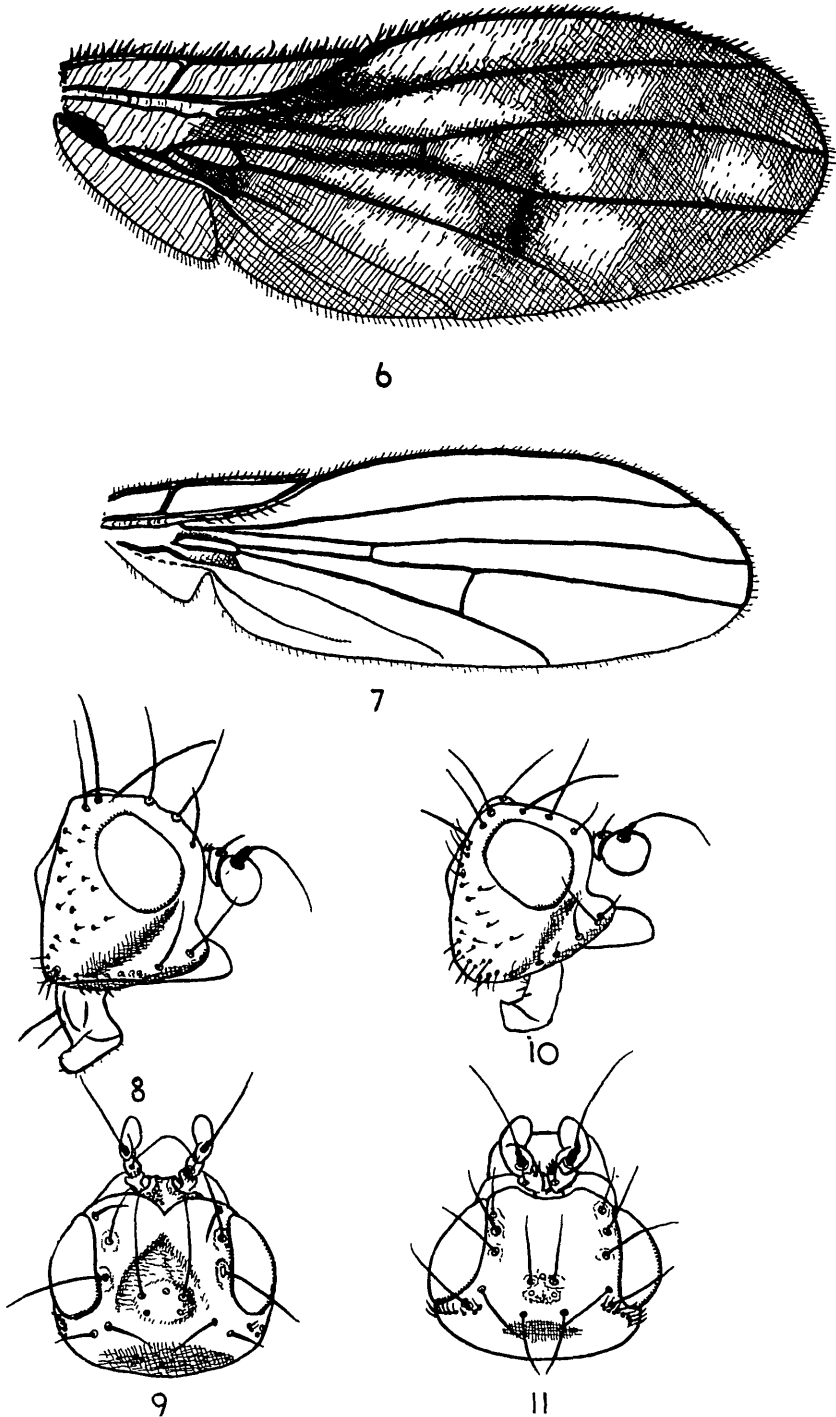
One hundred and five specimens of flies belonging to this family were collected. They belong to two species which are described below.

Although in the past New Zealand Canaceids have been regarded as belonging to a sub-family of the Ephydriidae (Tonnoir and Malloch, 1926), the group is here regarded as of true family rank because of several important characters which separate it from the rest of the Ephydriidae. Chief among these characters are: absence of a costal break near the humeral cross vein, presence of an anal cell, separation of the second basal and discal cells and separation of the auxiliary and first longitudinal vein.

Genus *Macrocanace* Tonnoir and Malloch

Tonnoir and Malloch, 1926, *Rec. Cant. Mus.* 3, 5.

Genotype: *Macrocanace littorea* Tonnoir and Malloch 1926 = *Milichia littorea* Hutton 1901.



TEXT-FIG 2.

FIG. 6.—Wing of *Macrocanace littorea*  $\times 25$ . FIG. 7.—Wing of *M. antipoda*  $\times 25$ . FIG. 8.—Head (profile) of *M. littorea*  $\times 25$ . FIG. 9.—Head (dorsal view) of *M. littorea*  $\times 25$ . FIG. 10.—Head (profile) of *M. antipoda*  $\times 35$ . FIG. 11.—Head (dorsal view) of *M. antipoda*  $\times 35$ .

The genus *Macrocanace*, known only from the sub-Antarctic islands of New Zealand, contains only two described species. They are *M. littorea* from Antipodes Island and *M. australis* (Hutt.) from Campbell Island. One new species was collected by the 1950 expedition, and this is described below under the name of *M. antipoda*.

The three known species of the genus *Macrocanace* can be separated readily by the following key.

KEY TO SPECIES OF *Macrocanace* TONNOIR AND MALLOCH

- |   |                          |
|---|--------------------------|
| 1. Post verticals present; wings without clear spots .. .. .                | 2                        |
| Post verticals absent; wings with clear spots .. .. .                       | <i>littorea</i> (Hutt.)  |
| 2. Second antennal segment with strong bristles; legs greyish black .. .. . | <i>antipoda</i> sp. nov. |
| Second antennal segment without strong bristles; legs reddish brown .. .. . | <i>australis</i> (Hutt.) |

**Macrocanace littorea** (Hutton). (Text-fig. 2, Figs. 6, 8, 9.)

A more complete description than that given by either Hutton or Tonnoir and Malloch is given below. It is based on the type specimen and the 104 specimens collected by the expedition.

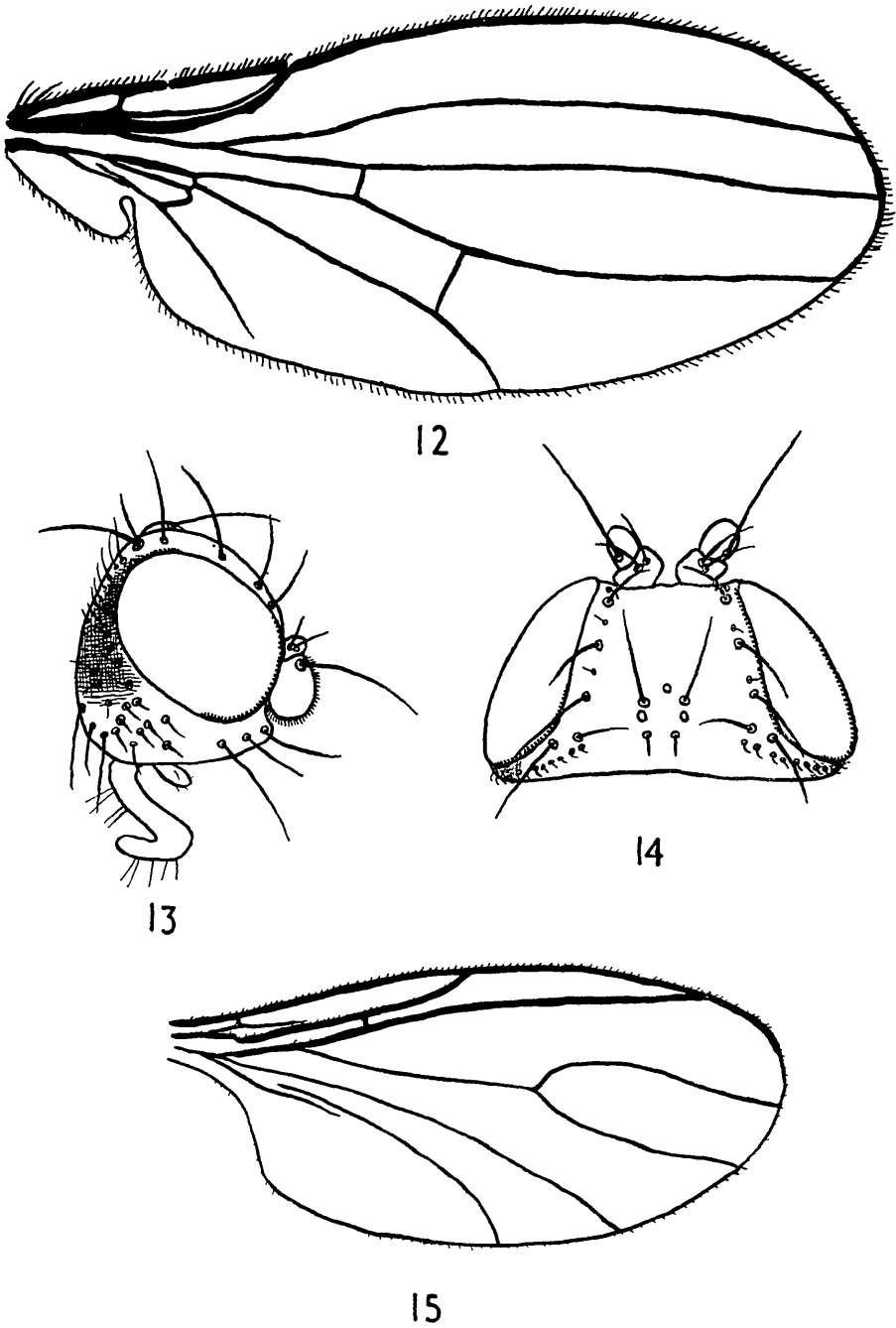
Male and Female.

*General.* A dark grey fly having brown wings with lighter areas. Body length 4-6 mm. Wing length 3.5-5.0 mm.

*Head.* Antennae black; third segment disc-shaped and covered with fine black pile; second segment with one distinct bristle and accompanying short, stout hairs on distal margin of segment; first segment with few short hairs. Front half or over half width of head at vertex; predominantly black but bronze in some lights. Ocelli present. Ocellar triangle slightly raised above level of frontalia and with several small hairs. Post verticals absent. Parafrontals black merging to light grey at orbits. The three fronto-orbital bristles evenly spaced, anterior bristle the shortest, posterior bristle directed somewhat laterally over the eye. Few short black hairs lateral to fronto-orbitals. Two verticals. Face grey, sometimes reddish but light grey in some lights. Parafacials bare. Strong vibrissa present and two or occasionally one or three other strong bristles posterior to vibrissa and directed more dorsally. A row of small hairs extending from vibrissa and associated bristles to posterior ventral region of head, which is much swollen and where two or three long but slender bristles occur. Occiput grey, slightly concave dorsally and with small scattered hairs laterally. Bucca bare and reddish. Eyes bare. Proboscis reddish grey, palps darker.

*Thorax.* Dark grey dorsally, lighter ventrally. Five indistinct brown longitudinal bands on mesonotum. Four strong dorsocentrals; one humeral, two notopleurals; one supra-alar; two post-alars; mesopleural bristle with two or three small hairs about it, a row of hairs extending from sternopleural ventrally and ending in four or five large hair-like bristles situated anteriorly to the mesothoracic coxa. Legs grey. Distinct apical bristles absent on tibia. Wings brown with clear areas. First longitudinal vein with strong setulose hairs commencing near junction of Rs and extending to costa. Halteres yellow with proximal region grey.

*Abdomen.* General colour dark grey. Hairs on all segments but more numerous and larger on posterior segments.



TEXT-FIG. 3.

FIG. 12.—Wing of *Australimyza anisotomae*  $\times 45$ . FIG. 13.—Head (profile) of *A. anisotomae*  $\times 45$ . FIG. 14.—Head (dorsal view) of *A. anisotomae*  $\times 45$ . FIG. 15.—Wing of *Sciara* sp.  $\times 45$ .

This species is very common on both Antipodes and Bounty Islands. Most were captured swarming on rocks in penguin colonies either on the East coast of Antipodes Island near Leeward Island or from one of the Bounty Islands. Four specimens were taken from leaf mould, collected from tussock on the plateau above Ringdove Bay. The mould was brought back to New Zealand and these flies had apparently emerged in transit. All were collected by E. G. Turbott and R. K. Dell, and are in the Auckland and Dominion Museums.

**Macrocanace antipoda** sp. nov. (Text-fig. 2, figs. 7, 10, 11.)

Female.

*General.* A slender black fly with turbid wings. Body length 3 mm. Wing length 3.5 mm.

*Head.* Antennae black; third segment bulbous and covered with fine grey tomentum; second segment with one strong dorsal bristle and some short hairs; first segment with one short hair. Insertion of antennae and frontal lunule grey. Front, over half width of head at vertex; dark brownish black. Ocelli present. Ocellar triangle raised above level of frontalia and with some small hairs. Post verticals convergent. Frontalia with some short hairs mostly anteriorly placed. Parafrontals almost black and raised slightly above level of frontalia. The three fronto-orbital bristles evenly spaced; posterior bristle the longest. Some short black hairs lateral to fronto-orbitals. Two verticals. Face grey. Parafacials bare. Vibrissa present and two other strong bristles posterior to vibrissa along oral margin directed slightly dorsally; some few smaller hairs along oral margin. Head swollen at posterior ventral corner and with scattered hairs at this region. Eyes bare. Occiput concave with strong hairs laterally. Cheeks and occiput blackish grey. Proboscis dark brownish grey.

*Thorax.* Thorax dark brownish-black dorsally, merging to dark grey ventrally. Five dorsoventrals; one humeral; two notopleurals; one supra-alar; two post-alars, anterior one the stronger; a strong hair either side of the mesopleural and small hairs anterior to and ventral to sternopleural. Legs greyish black. Small apical bristle on mesothoracic tibia. Wings turbid, with browner areas between anterior and posterior cross veins, at apex of first longitudinal vein and along course of most longitudinal veins. First longitudinal vein with strong setulose hairs commencing near junction of Rs and extending about half way to costa. Halteres light grey, lighter basally and apically.

*Abdomen.* General colour dark brownish-black. All tergites with lateral hairs; anterior tergites bare dorsally but posterior tergites hairy.

*Type Locality.* Shore, Ringdove Bay, Antipodes Island.

*Type.* Female. Taken in spider's web, 5/11/1950. (Coll. E. G. Turbott).

*Location of Type.* Auckland Museum.

This species is apparently not as common as *M. littorea*, at least during the spring season, when the collection was made. Only one specimen was obtained as compared with 99 specimens of *M. littorea*.

The three species of the genus are closely related, and *M. antipoda* and *M. australis* in particular are superficially very similar. However, there are distinctive characteristics in each species and the key given above readily separates them.



## Family MILICHIIDAE

Thirty-one specimens of one species were collected. They belong to a new genus and constitute the first record of the family in the New Zealand sub-region.

*Genus. Australimyza* gen. nov.

*Generic Characters.* Head rounded. Frontal vittae without bristles. Upper occiput slightly concave. Post verticals small and parallel or slightly convergent or divergent. Anterior fronto-orbitals convergent. Proboscis normal, not geniculate or elongate. Palpi normal. Strong vibrissa present. Cheek consists of orbit (gena) bucca and lower occiput. No presutural dorsocentrals; four scutellars, posterior pair cruciate; no pleural or mesopleural bristles, these sclerites entirely bare; two sternopleurals. Costa, twice broken, humeral cross vein break not as distinct as distal break; costa extending to tip of fourth vein but weakened after third vein; auxiliary vein extending to costa, weakened and very close to first vein at its extremity; fourth vein not weakened; first posterior cell not narrowed; discal cell separated from second basal cell; anal cell present; anal vein present.

*Genotype. Australimyza anisotomae* sp. nov.

The genus *Australimyza* shows some resemblance to the genus *Hemeromyia* Coquillet 1902 and *Euchlorops* Malloch 1913. However, it is distinguished from the former by the absence of pleural bristles and bristles on the frontal vittae and from the latter by having a strong sternopleural, strong vibrissae and by the absence of bristles on the frontal vittae.

Its family position is open to some doubt, as are several other genera of the Agromyzidae-Milichiidae complex. It cannot be readily placed in the Agromyzidae, since the pleural bristles are totally absent and the post verticals are small and not distinctly divergent. The genus also does not have a geniculate and elongate proboscis nor bristles on the frontal vittae, two characters which are highly typical of the Milichiidae. However, the following characters are typical of the Milichiidae: the costa is twice broken; the cheek is typical of the Milichiidae, being composed of an extended portion of the occiput, the orbit and bucca; the foremost orbitals are convergent and the prothoracic and mesothoracic bristles are absent. It would thus appear most satisfactory to place the genus in the Milichiidae.

The phylogeny of *Australimyza* is not clear and it does not appear to be closely related to any described genus. This may be expected because of the isolated region from which the species was taken and the lack of knowledge about New Zealand representatives of the Milichiidae and related families.

***Australimyza anisotomae* sp. nov.** (Text-fig 3, figs. 12, 13, 14.)

Male and female.

*General.* A small species. Body blackish. Wings clear. Veins of wings and legs light yellow. Body length, 2.0 mm. Wing length, 2.5 mm.

*Head.* Arista bare, black. Antennae yellowish or light reddish-brown; third segment rounded and covered with thick, brownish pile, arista arising proximally near dorsal surface; second segment with two dorsal bristles and some few short hairs. Front dark grey, pollinose; about half width of head at vertex. Ocellar triangle not differentiated in colour and only slightly raised above level of front. Three dark red ocelli. Frontal vittae not clearly differentiated. Frontal orbits a shade lighter than vittae. Pair of divergent proclinate ocellars. Two verticals,

inner pair anterior and convergent, outer pair divergent. Three fronto-orbital bristles, anterior pair convergent, middle and posterior pairs both divergent and somewhat reclinate; all approximately equal length; middle bristle closer to anterior bristle. About seven very small hairs on either side of frontal vittae. One small hair on either side of middle fronto-orbital, directed towards the eye, and one similar hair anterior to anterior orbital directed away from the eye. Face yellowish brown. No carina. Oral margin produced slightly but clearly differentiated from face. No hairs on facial orbits. Two and sometimes three strong bristles between vibrissa and posterior corner of head; two near vibrissa and equal to it in length and third if present weaker. Hairs on post-cranium. Occiput, grey or black, pollinose. Eyes dark red and covered with short, thick hairs. Vertical diameter of eye about three times width of cheek in same axis. Cheeks yellowish-brown but grey or black posteriorly. Proboscis yellowish or light reddish brown; palpi lighter coloured, covered with fine white pile and with a few small hairs apically.

*Thorax.* Dark grey or black pollinose dorsally and dark brownish grey laterally and ventrally. Scutellum flat dorsally. Four or five irregular rows of acrostichal hairs and one pair of differentiated prescutellar acrostichal bristles; three pairs dorsocentrals, all post sutural; anterior scutellars parallel or slightly divergent; one strong humeral; one strong presutural; two notopleurals; two supra-alars, anterior bristle weaker; two post-alars, anterior bristle stronger. Legs yellowish, hind femora darker. One apical bristle on ventral surface of mesothoracic tarsi. Halteres light yellow.

*Abdomen.* Dark brownish black.

*Type Locality.* Tussock slopes above Ringdove Bay, Antipodes Island.

*Type.* Male, 7/11/1950. (Coll. E. G. Turbott.)

*Paratypes.* 6 ♂, 6 ♀ from type locality, 7/11/1950 (Coll. E. G. Turbott). 3 ♂, 3 ♀. Beating *Anisotome antipoda* and tussock above Ringdove Bay, Antipodes Island, 6/11/1950 (Coll. E. G. Turbott). 3 ♂, 4 ♀, and 5 other specimens from plateau above Ringdove Bay, 8/11/1950 (Coll. R. K. Dell).

*Location of Type.* Auckland Museum.

*Location of Paratypes.* Auckland and Dominion Museums.

*A. anistomae* is the sole representative of the genus so far known. It is so named because of its association with *Anisotome antipoda*, a member of the family Umbelliferae which was in flower at the time of the expedition's visit.

#### Family MUSCIDAE

##### ***Paralimnophora depressa* Lamb, 1909.**

One specimen was collected on the slopes above Ringdove Bay, Antipodes Island, on 7/11/50, by E. G. Turbott. It is in the collection of the Auckland Museum.

#### Family CALLIPHORIDAE

##### ***Calliphora antipodea* Hutton, 1901.**

One male and one female were captured on the Antipodes Island by E. G. Turbott. The female was taken on the slopes above Ringdove Bay on 9/11/1950, and the male was netted in the same locality on flowers of *Anisotome antipoda* on 6/11/1950. The specimens were identified by Dr. David Miller, Cawthron Institute, Nelson, New Zealand, and they are in the Auckland Museum.

Only one specimen, a female, has previously been collected, so the capture of this pair will be of great value for any future work on New Zealand Calliphorids.

**Calliphora viridiventris** (Malloch), 1930.

One female was taken at flowers of *Anisotome antipoda* on 6/11/1950 by E. G. Turbott. This Calliphorid was identified by Dr. Miller and the specimen is in the Auckland Museum. Only one other specimen, also a female, is known.

DIPTEROUS LARVAE FROM THE ANTIPODES AND BOUNTY ISLANDS

Berlese funnel extracts of leaf mould, penguin nesting litter and like material, produced several species of dipterous larvae. None of these larvae have been definitely identified. Some notes on them, however, are given below.

**Larva A.** (Text-fig. 1, Figs. 1, 4, 5.)

Length, 8–9 mm. Breadth, 2 mm. Colour, yellowish-brown. Integument with numerous dark brown spines, processes and scale-like thickenings of the cuticle giving the larva a general brown appearance. Processes on dorsal surface only, strongest on posterior three or four segments. Anterior spiracles comparatively large branching filaments. Posterior respiratory tubes black or dark red.

Six specimens examined from Bounty Islands. Collected by E. G. Turbott, 11/11/1950.

They are probably the larvae of *Macrocanace littorea*.

**Larva B.** (Text-fig. 1, Fig. 2.)

Length, 7.0 mm. Width, 1.5 mm. Colour, cream. Segments 4–10 with well developed, minutely spinose, creeping welts. Each mandible with four teeth. Anterior spiracles minute. Posterior spiracles without protruding respiratory tubes and surrounded by five lobes.

Two specimens examined from Bounty Islands. Collected by E. G. Turbott, 11/11/1950.

**Larva C.** (Text-fig. 1, Fig. 3.)

Length, 6–7 mm. Width, 1.0 mm. Colour, brown, due to covering of exceedingly fine silky brown pubescence. Posterior spiracles surrounded by five lobes.

Two specimens examined. One taken from penguin nest material and associated litter near sea level, Ringdove Bay, Antipodes Island, 10/11/1950 (Coll. E. G. Turbott). The other taken from leaf mould about tussock at top of slopes above Ringdove Bay, 10/11/1950 (Coll. E. G. Turbott).

**Larva D.**

Length 1–1.5 mm. Colour, white. Numerous small larvae were taken in leaf mould samples from surface layer under the tussock on the plateau and seaward slopes of Antipodes Island. Coll. E. G. Turbott.

DISCUSSION

There are several interesting points which emerge from the present state of our knowledge of the Diptera fauna of the Antipodes and Bounty Islands. The first is the presence of two subapterous species. This state is generally regarded as being correlated with the barren, wind swept and hence unsheltered nature of the habitat (Hesse, Allee and Schmidt, 1937; Satchell, 1950 B). Thus it would

appear that the subapterous condition in these flies is one which could have developed since the arrival of the species on these islands. In apposition to this is the occurrence of many Diptera, especially the Calliphorids and Muscids, which are robust insects and undoubtedly strong fliers.

Secondly, large numbers of species are dependent for their survival on decaying animal matter. The presence of large colonies of penguins and of other nesting birds on the islands, especially in spring and summer, would supply a source of suitable breeding material in the form of dung or dung-saturated debris. The Psychodidae, Canaceids, Calliphorids and Muscids may all breed in this material. *Psychoda acutipennis* is known to breed in penguin dung (Satchell, 1950) and *Macrocanace littorea* almost surely breeds similarly for adults have always been found in association with penguin colonies.

Although several specimens of this latter species were collected from leaf mould samples, it is probable that they were inadvertently collected with the mould as adults rather than that they emerged from pupae present in the mould. On the Bounty Islands, where this species is also common, the only available breeding medium is some form of animal matter, as there is no vegetation present.

Species other than these suspected dung breeders could probably be dependent on the vegetation either fresh or in decaying state to complete their life cycle. The peat on the plateau and slopes of Antipodes Island is always moist and surfaced with fresh rotting vegetation and could form an ideal breeding ground for some Diptera.

An examination of the Diptera fauna of the Antipodes Island shows that the following species are endemic:

*Erioptera* sp.

*Macrocanace antipoda*

*Australimyza anisotomae*

*Calliphora antipoda*

Except for *Australimyza*, which may yet be recorded from other localities, all these genera occur elsewhere. *Erioptera* and *Calliphora* are particularly widespread.

The following species from the Antipodes Island are confined to the sub-Antarctic islands of the New Zealand sub-region. The other islands concerned are given in parentheses.

*Psychoda acutipennis* (Bounty Is.)

*Macrocanace littorea* (Bounty Is.)

*Paralimnophora depressa* (Auckland Is.)

*Limnophora aucklandica* (Auckland Is.)

*Calliphora viridiventris* (Campbell I.)

The two remaining Antipodes Island species (omitting the undetermined Chironomids and Mycetophilids) are of wider distribution. They are:

*Psychoda spatulata*

*Fannia canicularis*

The Diptera of the Antipodes, as well as those of other sub-Antarctic islands of the New Zealand sub-region are probably of New Zealand origin, and in accounting for the present distribution of species, various theories can be advanced.

In his note above (Page 272) Dr. Satchell has suggested that transference of larvae on birds' feet may be a reason for the occurrence of *Psychoda acutipennis* on both the Antipodes and Bounty Islands. The relative closeness of these two land masses makes this suggestion feasible. Seabirds, however, are known to keep to their own breeding grounds almost exclusively. Thus it would be only stray birds which would be capable of transferring flies in this way. If this happened for *P. acutipennis* it could conceivably happen for other dung breeders and thus account for the occurrence of *Macrocanace littorea* on both islands. For the more widely separated islands such as the Antipodes and Campbell or Auckland Islands such a theory for the occurrence of the same species is less likely.

There is a strong possibility that all or the majority of the Diptera reached the islands as a result of their migration by flight. As suggested above, the sub-apterous species were almost certainly fully winged when they first entered the sub-Antarctic island environment. Thus all Diptera of the Antipodes Island, for instance, could have arrived by flight, and such flight may have been greatly assisted and possibly entirely directed by wind. If the Diptera populated the Antipodes Island in this way, they may have originated either from New Zealand or from other sub-Antarctic islands, or both. If they came from New Zealand then by now the species have disappeared from the mainland or may not yet have been discovered there. Alternatively, they may have arrived on the islands sufficiently long ago to allow evolutionary changes at least at specific level to have taken place.

The theory that the Diptera of the Antipodes and other sub-Antarctic islands could be regarded as remnants of populations which have been isolated by the disappearance of land bridges is not upheld to any extent by the present geological knowledge of the area.

The two widespread species of Antipodes Diptera—viz., *Psychoda spatulata* and *Fannia canicularis* are almost certainly recent immigrants. Both are found in association with man and could have been introduced from ships visiting the area.

The Antipodes and Bounty Islands may not support a very much larger Dipterous fauna than is now known. Undoubtedly, more species will be found but of greater interest at the present would be a better knowledge of the breeding habits of those Diptera already known.

#### ACKNOWLEDGMENTS

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