

A revision of the genus *Perineus* (Phthiraptera: Philopteridae)*

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Abstract Six species of the genus *Perineus* Thompson, 1936 are recognised, including one new species. These, together with their hosts, are: *P. nigrolimbatus* (Giebel, 1874) on *Fulmarus glacialis glacialis*, *F. glacialis auduboni*, *F. glacialis rogersii*, and *F. glacialisoides*; *P. concinnus* (Kellogg & Chapman, 1899) on *Diomedea albatrus*, *D. immutabilis*, and *D. nigripes*; *P. concinnoideus* Kéler, 1957 on *Diomedea exulans exulans*, *D. exulans chionoptera*, *D. epomophora epomophora*, and *D. epomophora sanfordi*; *P. oblongus* Kéler, 1957 on *Diomedea irrorata*; *P. circumfasciatus* Kéler, 1957 on *Diomedea melanophrys melanophrys*, *D. melanophrys impavida*, *D. cauta cauta*, *D. cauta salvini*, *D. cauta eremita*, *D. chrysostoma*, *D. chlororhynchus*, *D. bulleri*, *Phoebetria palpebrata*, and *P. fusca*; *Perineus macronecti* new species on *Macronectes halli* (type host) and *Macronectes giganteus*.

A key and illustrations are provided to both male and female adults of all the species. Lectotypes are designated for two species already synonymised; these are *Lipeurus mutabilis* Piaget, 1880 and *Lipeurus celer* Kellogg, 1896.

Keywords Phthiraptera; Philopteridae; *Perineus*; revision; new species; lectotype; systematics

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INTRODUCTION

The genus *Perineus* Thompson, 1936 includes slender-bodied lice of medium size, found regularly on species of the family Diomedidae (albatrosses and mollymawks) and of the genera *Macronectes* (giant petrels) and *Fulmarus* (fulmars) in the family Procellariidae.

Hopkins & Clay (1952) listed 13 species under *Perineus*, but of these, only 2 now remain in the genus, viz: *P. nigrolimbatus* (Giebel, 1874) and *P. concinnus* (Kellogg & Chapman, 1899). Kéler (1956, 1957a, 1958) transferred to *Harrisoniella* (as he interpreted that genus) the species *confidens* (synonym *macropleuralis*), *diomedea* (synonym *enderleini*), *giganticola*, *hyalinus*, *miriceps*, and *obscurus* (synonym *miconodalis*). However, Kéler's interpretation of *Harrisoniella* was challenged by Clay & Hopkins (1961) (see Palma & Pilgrim 1984 for details); as a consequence the species allocated to it by Kéler were made the subject of the new genus *Paraclisis* by Timmermann (1965). Timmermann (1966) erected *Haffneria* to receive *grandis* and *laculatus*, as well as *Perineus piratae* Timmermann, 1955.

In the meantime, Kéler (1957b) described three new species in *Perineus* — *concinnoideus*, *oblongus*, and *circumfasciatus* — and in 1958 a further species, *tenuipennis*. Timmermann (1965) accepted six species in *Perineus* and provided the first key for their separation. In 1979, Pilgrim & Palma reduced *tenuipennis* to a synonym of *concinus*.

Since the publication of Timmermann (1965) there appears to have been no comprehensive review of the genus *Perineus*. Our work has revealed more extensive collections, including new host records and one new species which we describe in this paper bringing the total number of recognised species to six.

Specimens of *Perineus* are found especially on the feathers of the wings; after death of the host they are often found on the body feathers. They are relatively abundant (some samples in the order of tens per host) but always in smaller quantities than specimens belonging to the synhospitalic and related wing-louse genus *Paraclisis*.

In all our previous papers on lice, we have used the term Mallophaga as an ordinal or subordinal name in the traditional manner. However, following the publication by Lyal (1985) of an excellent

analysis on the phylogeny and classification of the lice, we now adopt his conclusions and reject the name Mallophaga, using instead the term Phthiraptera as an ordinal name for all parasitic Psocodea (lice).

The nomenclature of the hosts follows that given by Jouanin & Mougins (1979).

ABBREVIATIONS USED FOR INSTITUTIONS AND COLLECTIONS

| | |
|-------|---|
| AMNZ | Auckland Institute and Museum, Auckland, New Zealand. |
| AMSA | Australian Museum, Sydney, Australia. |
| ANIC | Australian National Insect Collection, C.S.I.R.O., Canberra, Australia. |
| BMNH | British Museum (Natural History), London, England. |
| BPBM | Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A. |
| CISC | California Insect Survey, Division of Entomology and Parasitology, University of California, Berkeley, California, U.S.A. |
| CMNZ | Canterbury Museum, Christchurch, New Zealand. |
| KCEC | K. C. Emerson Collection, Sanibel, Florida, U.S.A. |
| MAMU | Macleay Museum, University of Sydney, Sydney, Australia. |
| NMNZ | National Museum, Wellington, New Zealand. |
| NZAC | New Zealand Arthropod Collection, D.S.I.R., Auckland, New Zealand. |
| QVTA | Queen Victoria Museum and Art Gallery, Launceston, Tasmania, Australia. |
| REEC | R. E. Elbel Collection, Salt Lake City, Utah, U.S.A. |
| RLCP | R. L. C. Pilgrim Collection, housed in NMNZ. |
| SAIMR | South African Institute for Medical Research, Johannesburg, South Africa. |
| TMTA | Tasmanian Museum and Art Gallery, Hobart, Tasmania, Australia. |
| USNM | United States National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A. |
| ZMHU | Zoologisches Museum, Humboldt Universität, Berlin, East Germany (D.D.R.). |
| ZMKD | Zoologisk Museum, København, Denmark. |
| ZMON | Zoologisk Museum, University of Oslo, Oslo, Norway. |

SYSTEMATICS

Genus *Perineus* Thompson, 1936

Perineus Thompson, 1936: 41.

Type species. *Lipeurus nigrolimbatus* Giebel, 1874 (by original designation).

The authorship of *Perineus* has been variously cited as:

"Thompson, 1936" (Kéler, 1957b: 511).

"Harrison in Thompson, 1936" (Timmermann, 1965: 106; Clay & Moreby, 1967: 162).

"Harrison, 1936 (in Thompson 1936)" (Pilgrim & Palma, 1979: 172).

"Harrison, 1936" (Clay, 1939: 176; Hopkins & Clay, 1952: 276; Watson, 1967: 73).

The reasons behind these discrepancies are outlined in Clay (1939) and Clay & Hopkins (1961); the matter has been resolved by the International Commission on Zoological Nomenclature (1963: 178); the correct citation is "*Perineus* Thompson, 1936".

Diagnosis. Medium-sized, elongate, pale to dark-brown lice. Head: longer than broad; anterior marginal carina continuous, clypeal suture absent, clypeal signature not sharply defined (Fig. 1-14); antennae dimorphic.

MALE as in Fig. 15, 29, 30. Antenna: segment I swollen, fusiform, occupying at least $\frac{1}{3}$ of total length of antenna; segment III with a distal sclerotised knob; segments IV and V slender and filiform (Fig. 1-7). Abdomen: second visible segment longest, 3rd-7th of different lengths: last 2 segments (8th and 9th visible) together forming a roughly equilateral triangle (Fig. 17-22); 8th visible segment with a group of 6 central sternal setae surrounded by 1 or more clear areas of cuticle; 9th segment very small, with 1 pair of long terminal setae. Genitalia elongate, slender, weakly chitinised; parameres united, with 4 pairs of distal pores, and a longitudinally striated area towards the tip (Fig. 23-28).

FEMALE as in Fig. 16, 54, 55. Antenna: filiform, segment I somewhat stouter than remainder (Fig. 8-14). Abdomen: second to 7th visible segments approximately the same length; last 2 segments (8th and 9th visible) weakly sclerotised; subgenital plate well defined laterally, occupying median regions of 7th and 8th segments and bearing a posterior transverse row of 8 long setae (Fig. 31-37); 9th segment very small, bilobed, with 2 pairs of long terminal setae (Fig. 38-43).

Measurements of head length (including hyaline margin), head width, and total body length of slide-mounted specimens of the six species are given in Table 1.

Remarks. The dorsal carinae of the head are subject to considerable variation in both sexes, in the extent of their sclerotisation and pigmentation. Their median portions are especially variable in the shape of the backward extension, as shown by Kéler (1957b, his "clypeale Muskelansatzleisten", figs 16, 17) for *P. nigrolimbatus* (Giebel, 1874); nevertheless these backward extensions are, within each species, sufficiently consistent in the features used in the key given below.

Table 1 Measurements (in mm) of *Perineus* spp. (means; ranges in parentheses).

| | Head width* | Head length** | Total length |
|--|-------------------|-------------------|-------------------|
| <i>Perineus nigrolimbatus</i> | | | |
| ex <i>Fulmarus glacialis glacialis</i> | | | |
| 5 ♂♂ | 0.420 (0.40–0.45) | 0.644 (0.62–0.67) | 3.068 (2.97–3.16) |
| 3 ♀♀ | 0.453 (0.43–0.47) | 0.693 (0.67–0.71) | 3.397 (3.21–3.51) |
| ex <i>Fulmarus glacialis auduboni</i> | | | |
| 35 ♂♂ | 0.447 (0.41–0.47) | 0.683 (0.65–0.72) | 3.297 (2.95–3.52) |
| 35 ♀♀ | 0.486 (0.45–0.52) | 0.715 (0.68–0.75) | 3.542 (3.35–3.85) |
| ex <i>Fulmarus glacialis rogersii</i> | | | |
| 19 ♂♂ | 0.482 (0.45–0.50) | 0.743 (0.71–0.76) | 3.559 (3.31–3.71) |
| 18 ♀♀ | 0.521 (0.50–0.55) | 0.764 (0.73–0.81) | 3.765 (3.62–3.93) |
| ex <i>Fulmarus glacialoides</i> | | | |
| 35 ♂♂ | 0.475 (0.43–0.51) | 0.695 (0.66–0.73) | 3.399 (3.14–3.63) |
| 35 ♀♀ | 0.507 (0.48–0.55) | 0.721 (0.67–0.77) | 3.586 (3.23–3.87) |
| <i>Perineus concinnus</i> | | | |
| 40 ♂♂ | 0.385 (0.36–0.41) | 0.636 (0.61–0.66) | 2.927 (2.79–3.04) |
| 46 ♀♀ | 0.420 (0.40–0.44) | 0.664 (0.62–0.70) | 3.421 (3.28–3.61) |
| <i>Perineus concinnoides</i> | | | |
| 38 ♂♂ | 0.481 (0.46–0.51) | 0.756 (0.73–0.79) | 3.806 (3.55–4.00) |
| 32 ♀♀ | 0.520 (0.50–0.55) | 0.784 (0.74–0.81) | 4.143 (3.91–4.30) |
| <i>Perineus oblongus</i> | | | |
| 29 ♂♂ | 0.379 (0.37–0.39) | 0.625 (0.61–0.64) | 2.941 (2.82–3.03) |
| 22 ♀♀ | 0.410 (0.39–0.43) | 0.657 (0.64–0.69) | 3.412 (3.28–3.50) |
| <i>Perineus circumfasciatus</i> | | | |
| 72 ♂♂ | 0.428 (0.40–0.45) | 0.651 (0.62–0.68) | 3.273 (3.06–3.48) |
| 90 ♀♀ | 0.450 (0.42–0.49) | 0.679 (0.62–0.71) | 3.538 (3.24–3.80) |
| <i>Perineus macronecti</i> | | | |
| 15 ♂♂ | 0.483 (0.46–0.50) | 0.734 (0.70–0.75) | 3.599 (3.39–3.77) |
| 21 ♀♀ | 0.507 (0.48–0.53) | 0.761 (0.73–0.79) | 3.934 (3.73–4.05) |
| Holotype ♂ | 0.47 | 0.70 | 3.50 |

*, taken at temples; **, maximum, from hyaline margin to posterior limit of temple.

A few males were found to have 4, 5, 7, or 8 central sternal setae on the 8th (visible) sternite instead of the usual 6; a few females were found to have 7, 9, 10, 11, 12, or 13 long setae forming the posterior transverse row on the subgenital plate instead of the usual 8; we consider all these to be atypical specimens.

KEY TO SPECIES OF *PERINEUS* THOMPSON, 1936 (ADULTS ONLY)

- 1 Genitalia as in Fig. 23–28 MALES 2
 - 1' Genitalia with subgenital plates as in Fig. 31–37 FEMALES 7
- 2 Head as in Fig. 1, 2; antenna as in Fig. 45; ventral terminalia as in Fig. 17; and genitalia as in Fig. 25 *nigrolimbatus*
 - 2' Without above combination of characters 3
- 3 Head: dorsal carinae with strongly pigmented median portion extending markedly backward well beyond level of third anterior marginal setae (a.m.s.3), often reaching level of a.m.s.4 (Fig. 3, 4, 6); antenna: segment III without a proximal knob (Fig. 44, 46, 47) 4
 - 3' Head: dorsal carinae with strongly pigmented median portion reaching only about level of a.m.s.3 (Fig. 5, 7); antenna: segment III with a proximal knob bearing minute curved ridges (Fig. 48, 49) 6
 - 4 Antenna: distal sclerotised knob on segment III minute, not extending beyond the articulation of segment IV; segments IV+V not set at an angle (Fig. 3, 44). Abdomen: ventral aspect of last 2 segments as in Fig. 20: a single clear area containing the 6 central sternal setae completely dividing the pigmented area of the 8th (visible) sternite into anterior and posterior portions *concinnooides*
 - 4' Antenna: distal sclerotised knob on segment III pronounced, extending beyond the articulation of segment IV; segments IV+V set at an angle (Fig. 4, 6, 46, 47). Abdomen: ventral aspect of last 2 segments as in Fig. 18, 19: clear area(s) containing the 6 central sternal

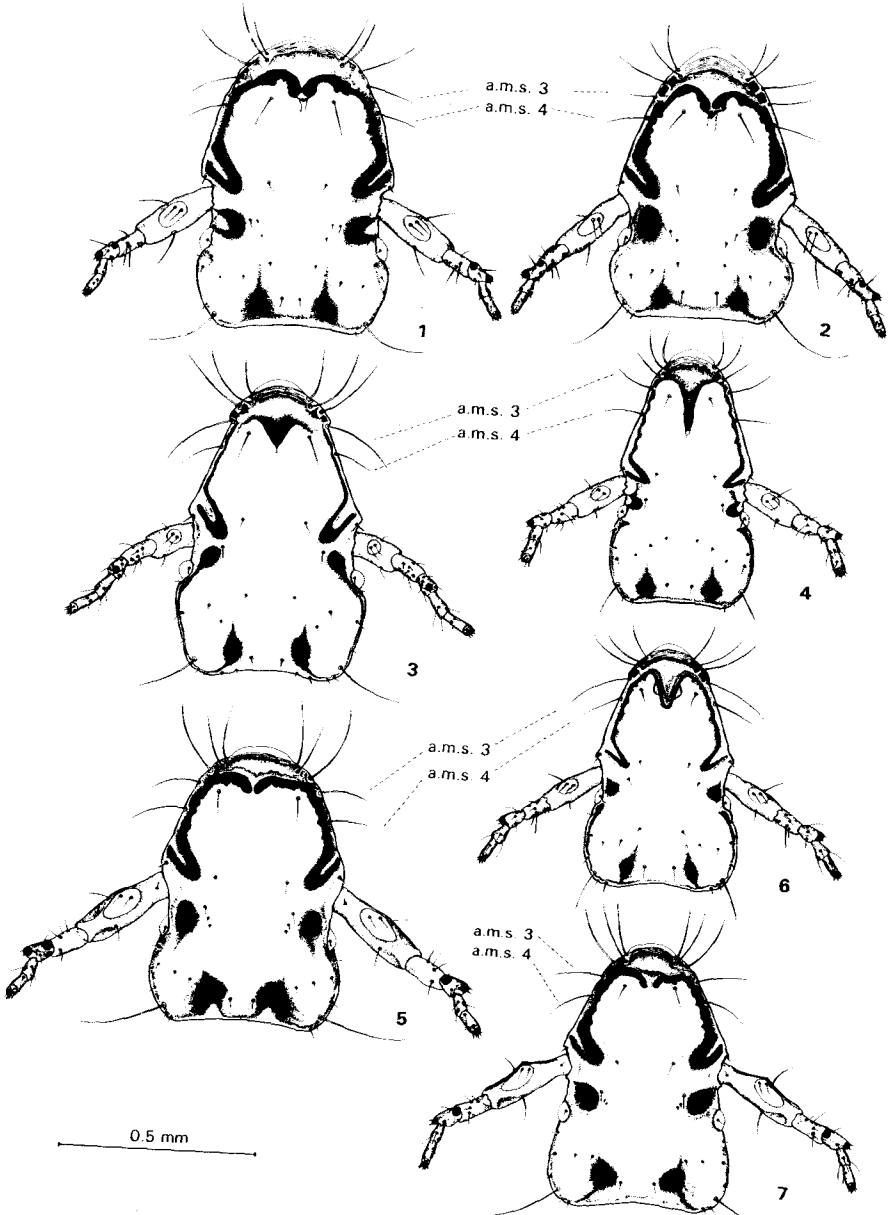


Fig. 1-7 Male heads, dorsal view: 1, *Perineus nigrolimbatus* (ex *Fulmarus glacialoides*); 2, *P. nigrolimbatus* (ex *F. glacialis auduboni*); 3, *P. concinnoides*; 4, *P. concinnus*; 5, *P. macronecti*; 6, *P. oblongus*; 7, *P. circumfasciatus* (a.m.s. 3, third anterior marginal setae; a.m.s. 4, fourth anterior marginal setae).

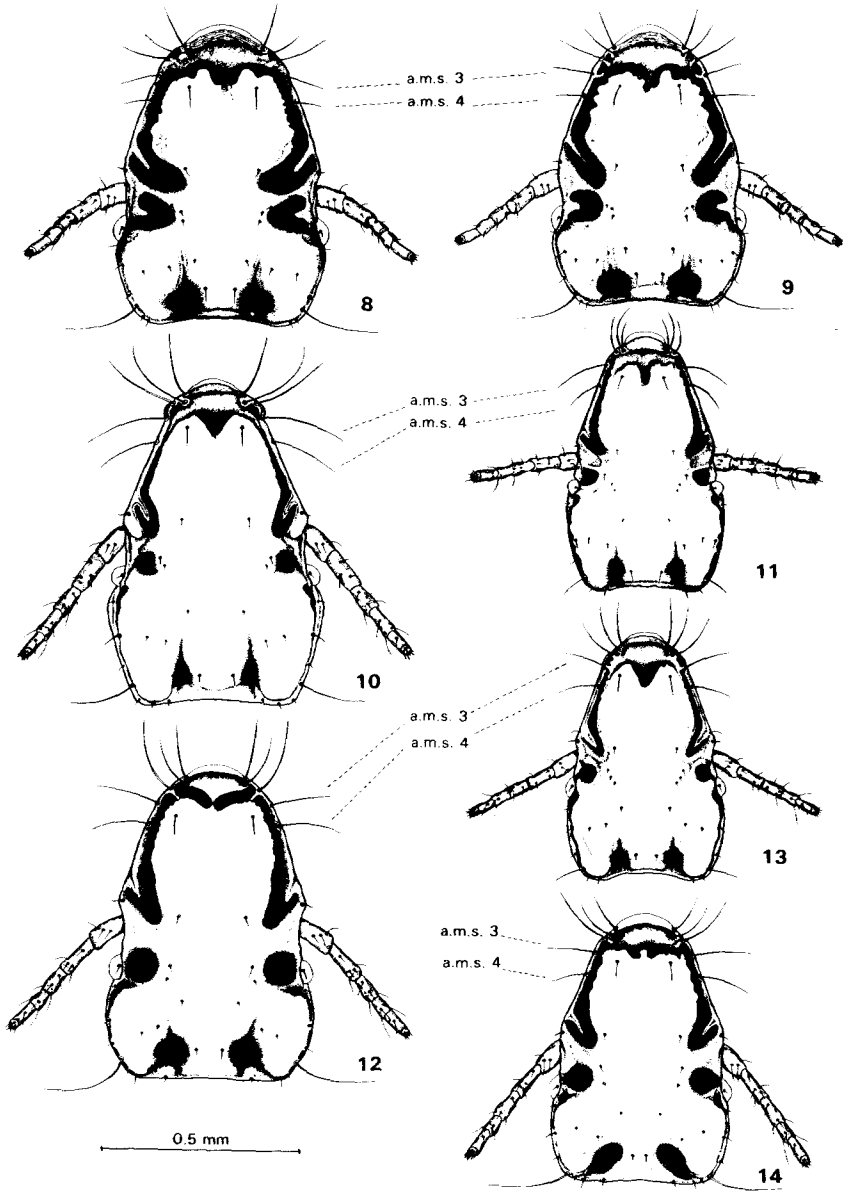


Fig. 8-14 Female heads, dorsal view: 8, *Perineus nigrolimbatus* (ex *Fulmarus glacialoides*); 9, *P. nigrolimbatus* (ex *F. glacialis audubonti*); 10, *P. concinnoides*; 11, *P. concinnus*; 12, *P. macronecti*; 13, *P. oblongus*; 14, *P. circumfasciatus* (a.m.s. 3, third anterior marginal setae; a.m.s. 4, fourth anterior marginal setae).

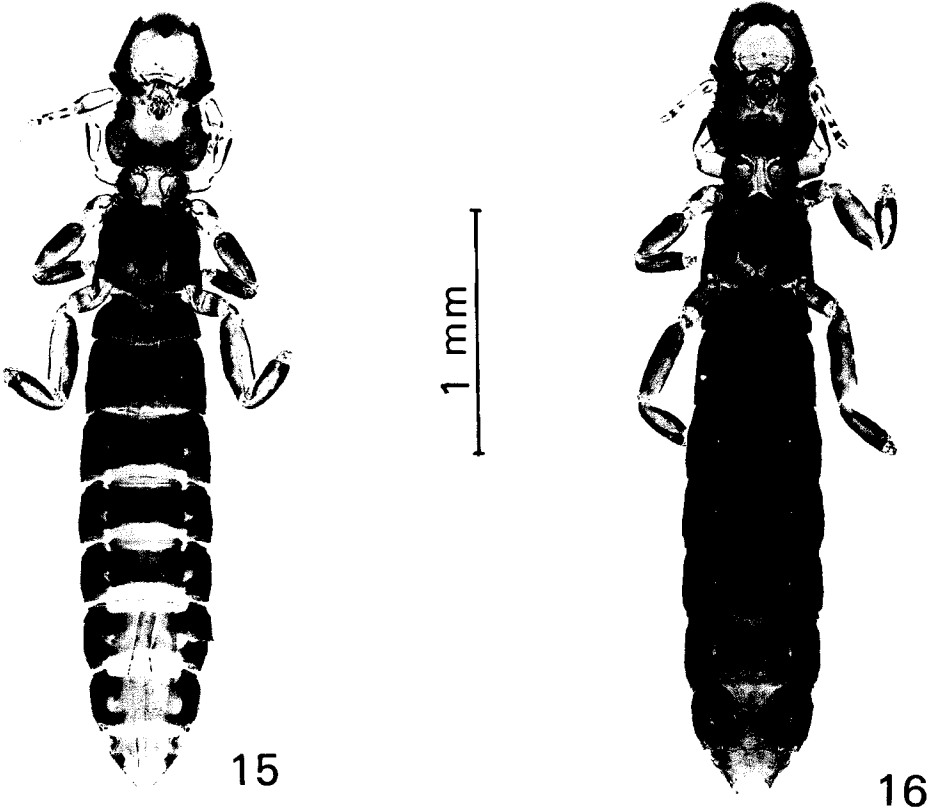


Fig. 15, 16 *Perineus nigrolimbatus* (ex *Fulmarus glacialisoides*); 15, male; 16, female.

- setae not completely dividing the pigmented area of the 8th visible sternite 5
- 5 Abdomen: lateral margins of 2nd to 5th visible sternites strongly sclerotised (Fig. 50); 8th (visible) sternite with 2 clear areas each containing 3 long central setae (Fig. 18); genitalia as in Fig. 24 *concinus*
- 5' Abdomen: lateral margins of 2nd to 5th visible sternites not strongly sclerotised (Fig. 51); 8th visible sternite with one clear area containing the 6 long central setae (Fig. 19); genitalia as in Fig. 23 *oblongus*
- 6 Head and antenna as in Fig. 7. Abdomen: 8th visible sternite with the long central setae of at least one side contained within a common clear area (Fig. 22); pair of central postero-marginal setae on 7th visible tergite shorter than 15 μ m *circumfasciatus*
- 6' Head and antenna as in Fig. 5. Abdomen: 8th visible sternite usually with each of the long central setae contained within a separate clear area (Fig. 21), or (less usually) either the anterior or the posterior pair of long setae contained within a common clear area (Fig. 53b-c); pair of central postero-marginal setae on 7th visible tergite longer than 15 μ m .. *macronecti*
- 7 Head as in Fig. 8, 9. Abdomen: position and length of setae on 8th and 9th visible segments as in Fig. 40 *nigrolimbatus*
- 7' Head as in Fig. 10-14. Abdomen: position and length of setae on 8th and 9th (visible) segments not as above 8

- 8 Head: dorsal carinae with strongly pigmented median portion extending markedly backward well beyond level of third anterior marginal setae (a.m.s.3), often reaching level of a.m.s.4 (Fig. 10, 11, 13) 9
- 8' Head: dorsal carinae with strongly pigmented median portion reaching only about level of a.m.s.3 (Fig. 12, 14) 11
- 9 Head as in Fig. 10. Head length more than 0.72 mm; total body length more than 3.80 mm *concinoides*
- 9' Head as in Fig. 11, 13. Head length less than 0.72 mm; total body length less than 3.80 mm 10
- 10 Head: outer borders of strongly pigmented median portion of dorsal carinae varying from almost parallel to an angle of c. 30° (Fig. 11). Subgenital plate as in Fig. 32 *concinus*
- 10' Head: outer borders of strongly pigmented median portion of dorsal carinae forming an angle of more than 40° (Fig. 13). Subgenital plate as in Fig. 34 *oblongus*
- 11 Abdomen: subgenital plate as in Fig. 35, its posterior row of setae with outer two on each side approximately equal in length; pair of central postero-marginal setae on 7th visible tergite shorter than 12 μ m *circumfasciatus*
- 11' Abdomen: subgenital plate as in Fig. 37, its posterior row of setae with, on at least one side, the second seta from outside approximately half the length of the outermost; pair of central postero-marginal setae on 7th visible tergite longer than 12 μ m *macronecti*

Perineus nigrolimbatus (Giebel, 1874)

(Fig. 1, 2, 8, 9, 15, 16, 17, 25, 31, 33, 40, 45)

Lipeurus nigrolimbatus Giebel, 1874: 233. (Type host: *Fulmarus glacialis* (? *auduboni* Bonaparte, 1857)). Neotype ♂ in Deutsche Entomologische Institut, Berlin-Friedrichshagen; designated by Kéler, 1957b: 517.

Lipeurus mutabilis Piaget, 1880: 324, pl.27, fig. 1. (Type host: *Fulmarus glacialis* (Linnaeus, 1761), in error?, see discussion below). Lectotype ♂ in BMNH, slide No. 1928–325 (Piaget Collection No. 459), designated below.

Lipeurus varius Kellogg, 1896: 116, pl.7, figs 3.4. (Type host: *Fulmarus glacialis rogersii* Cassin, 1862). Lectotype nymph in CISC, slide No. 29b2, designated by Carriker, 1957: 103.

Lipeuru (sic) *celer* Kellogg, 1896: 117, pl.7, figs 5.6. (Type host: *Fulmarus glacialis rogersii* Cassin, 1862). Lectotype ♂ in USNM, slide No. 64973, designated below.

Esthiopterum nigrolimbatus (Giebel, 1874); Harrison, 1916: 138.

Perineus nigrolimbatus (Giebel, 1874); Thompson, 1936: 42.

Diagnosis. a heavily pigmented species; head, thorax, and abdomen dark brown with black margins. Head: dorsal carinae with strongly pigmented median portion reaching only about level of third anterior marginal setae (a.m.s.3) (Fig. 1, 2, 8, 9). MALE as in Fig. 15. Head as in Fig. 1, 2; greatest width midway between antennae and hind margin; temples lightly rounded. Antenna as in Fig. 1, 2; segment I about ½ of total length of antenna; segment III with a medium-sized distal sclerotised knob extending beyond the articulation of segment IV, and a small rugose proximal swelling (Fig. 45). Abdomen: lateral margins of 2nd–5th sternites with a strongly sclerotised thickening along their anterior half; ventral aspect of terminalia as in Fig. 17; 8th visible segment with the 6 central sternal setae surrounded by 1 to 6 clear areas of cuticle (cf. *P. circumfasciatus*, Fig. 52), the setae of equal length. Genitalia as in Fig. 25; basal plate occupying slightly less than ½ of the total length, slightly curved towards the right; distal pores rather irregularly situated in a single group.

FEMALE as in Fig. 16. Head as in Fig. 8, 9; greatest width shortly behind the eyes; temples slightly flatter than in the males. Antenna as in Fig. 8, 9. Abdomen: position and length of setae on 8th and 9th visible segments as in Fig. 40; subgenital plate with shape and setation as in Fig. 31, 33.

Material examined

Ex *Fulmarus glacialis*: 1♂, 1♀, Strait of Magellan, Chile, 26 May 1915 (RLCP); 4♂, 4♀, Pacific Ocean (66°55'S, 112°00'W), 13 May 1947 (USNM); 4♂, 9♀, Pacific Ocean (66°51'S, 112°05'W), 28 May 1947 (USNM); 2♀, same locality, 2 Jul 1947 (USNM); 1♂, 3♀, Port Stanley, Falkland Is., 25 May 1957 (BMNH); 4♂, 2♀, Foveaux Strait, N.Z., 28 Sep 1959 (RLCP); 14♂, 14♀, Petone, Wellington, N.Z., 18 Oct 1959 (NMNZ; AMNZ; CISC); 1♂, 3♀, Haswell Islet (66°31'S, 93°00'E), Antarctica, 14 Dec 1962 (BMNH; BPBM); 3♂, 2♀, off Balleny Is., 9 Mar 1964 (NMNZ); 1♂, 2♀, Southern Pacific Ocean, Apr 1965 (USNM); 1♀, Larsen I., South Orkney Is., 7 Feb 1966 (USNM); 4♂, 6♀, Weddell Sea, 12 Feb 1966 (USNM); 13♂, 13♀, Perth, Australia, 1968 (BMNH; NMNZ; ANIC); 7♂, 5♀, Foveaux Strait, N.Z., Oct 1970 (RLCP; NMNZ); 4♂, 3♀, Bahía Buen Suceso, Staten I., Argentina, 23 Apr 1971 (USNM; RLCP); 4♂, 5♀, New

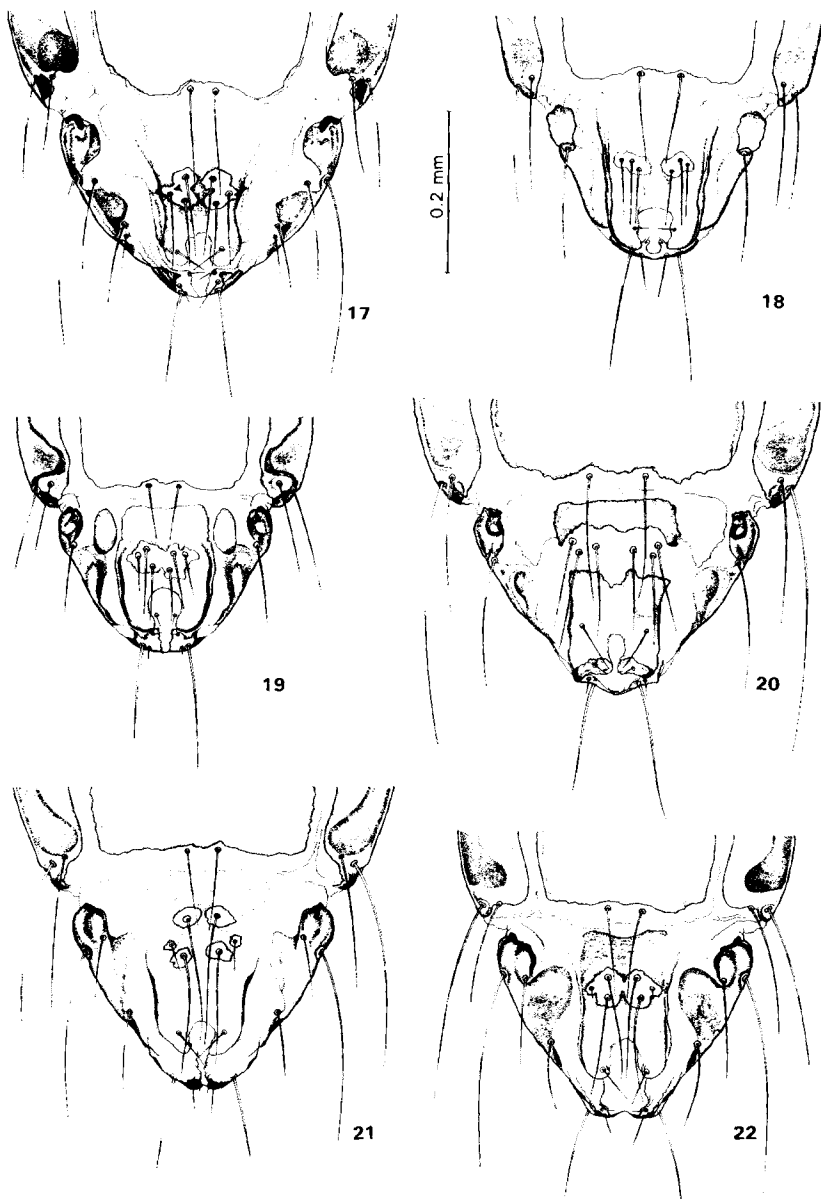


Fig. 17-22 Male terminalia, ventral view: 17, *Perineus nigrolimbatus*; 18, *P. concinnus*; 19, *P. oblongus*; 20, *P. concinnoides*; 21, *P. macronecti*; 22, *P. circumfasciatus*.

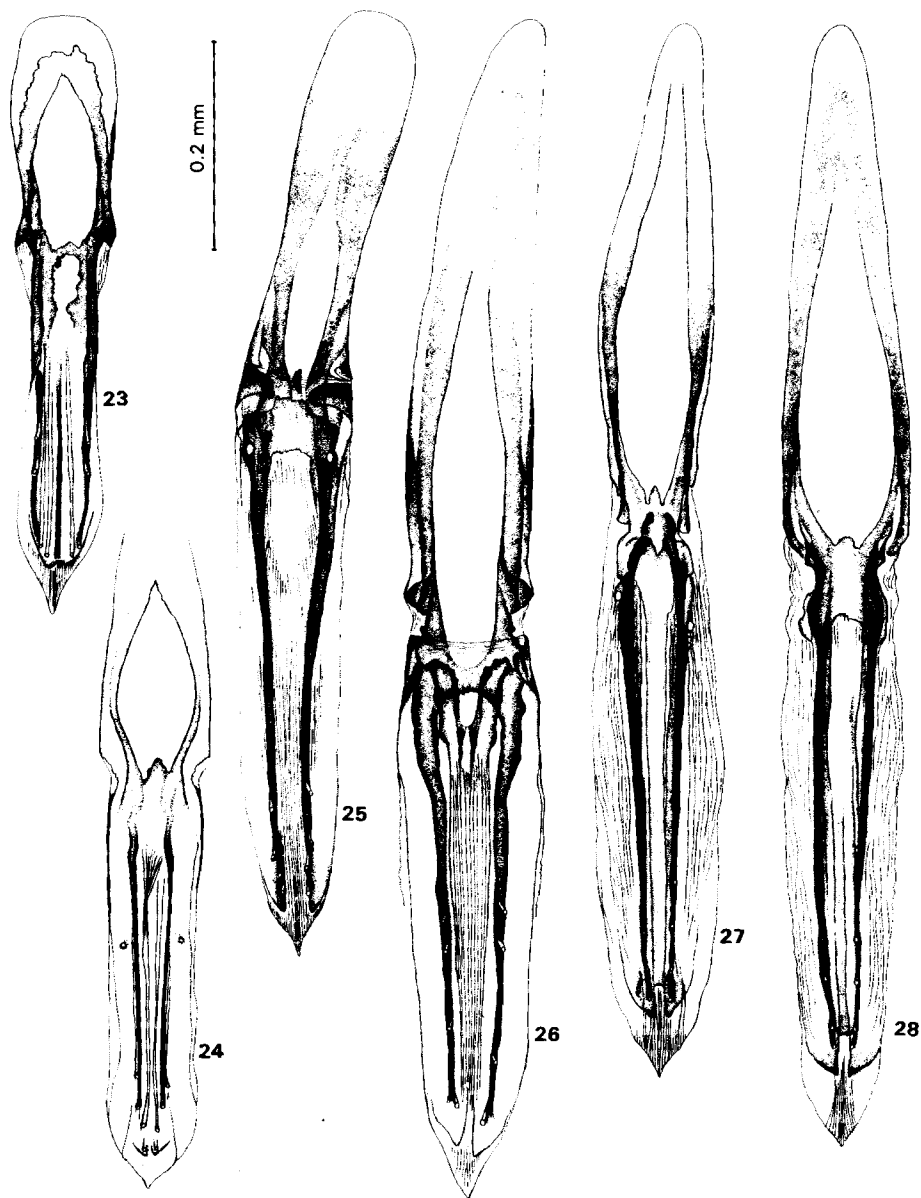


Fig. 23–28 Male genitalia: 23, *Perineus oblongus*; 24, *P. concinnus*; 25, *P. nigrolimbatus*; 26, *P. concinnoides*; 27, *P. circumfasciatus*; 28, *P. macronecti*.

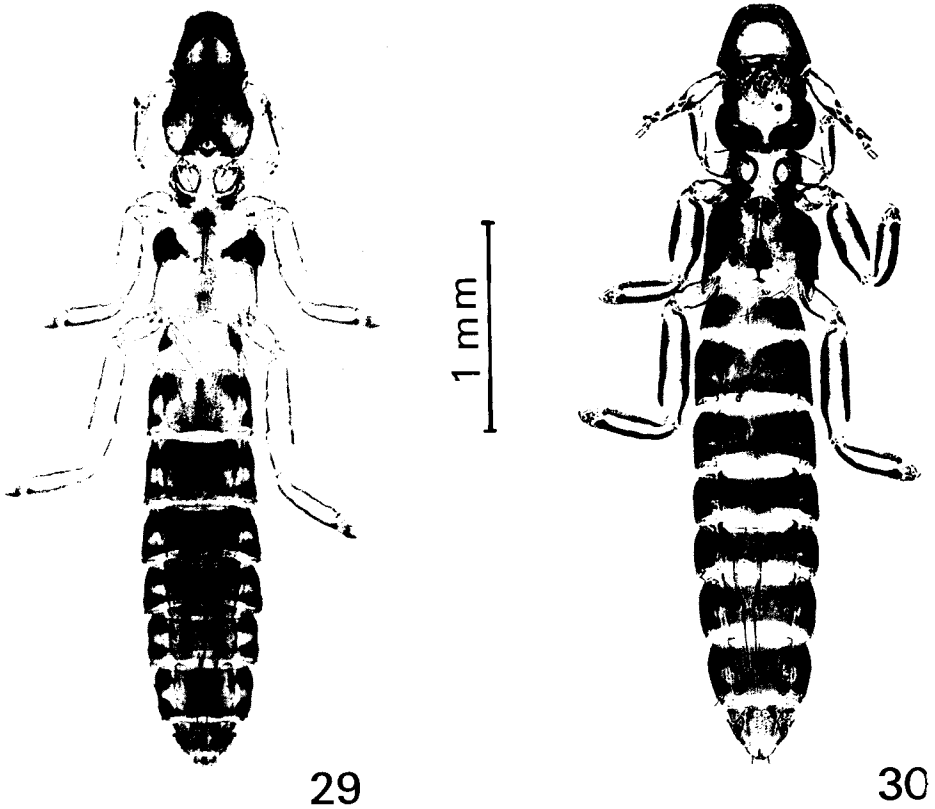


Fig. 29, 30 Males: 29, *Perineus concinnoides*; 30, *P. macronecti* (Holotype).

Brighton, Canterbury, N.Z., 4 Jul 1971 (RLCP); 1♂, 1♀, Newtown, Wellington, N.Z., 9 Jun 1972 (NMNZ); 1♂, Ohau Beach, Manawatu, N.Z.; 16 Sep 1973 (NMNZ); 4♂, 4♀, New Plymouth, N.Z., 23 Oct 1973 (RLCP); 1♂, 1♀, Nelson Airport, N.Z., 2 Nov 1973 (NZAC); 1♂, 1♀, Strahan, Tasmania, Australia, 11 Nov 1973 (QVTA); 1♂, 1♀, Petone, Wellington, N.Z., 25 Aug 1974 (NMNZ); 1♂, 1♀, Strahan, Tasmania, Australia, 22 Sep 1974 (QVTA); 2♂, 5♀, Auckland, N.Z., Jan 1975 (NZAC); 8♂, 8♀, Kaikoura, N.Z., 17 Sep 1975 (RLCP; NMNZ); 3♂, 3♀, Rahotu, Taranaki, N.Z., 17 Sep 1975 (RLCP); 4♂, 4♀, Himatangi Beach, Manawatu, N.Z., 28 Sep 1975 (NMNZ); 6♂, 6♀, Waitarere Beach, Manawatu, N.Z., 27 Aug

1978 (NMNZ); 6♂, 4♀, Santoft Beach, Manawatu, N.Z., 2 Sep 1978 (NMNZ); 4♂, 4♀, Tangimoana Beach, Manawatu, N.Z., 2 Sep 1978 (NMNZ); 10♀, Makara Beach, Wellington, N.Z., 17 Sep 1978 (NMNZ; AMNZ); 5♂, 5♀, Waitarere Beach, Manawatu, N.Z., 22 Sep 1978 (NMNZ); 3♂, 2♀, Waikanae Beach, Wellington, N.Z., 3 Oct 1981 (NMNZ); 1♀, Stillwell I. (66°50'S, 144°E), Antarctica, no date (AMSA); 1♀, New Zealand, no date (RLCP); 3♂, 1♀, Antarctica, no date (Meinertzhagen Collection, BMNH); 1♂, 2♀, no locality, no date (ZMHU).

Ex *Fulmarus glacialis*: 1♀, Cape Harrison, Labrador, Canada, 31 Jul 1926 (USNM); 1♂, 1♀, Massachusetts, U.S.A., 7 Oct 1930 (USNM);

2♂, 6♀, Scotland, Mar 1934 (BMNH); 1♀, Button Is., NW Territories, Canada, 13 Jul 1934 (USNM); 1♂, 2♀, Gibraltar Point, Lincs., England, 14 Sep 1953 (BMNH); 2♂, Scarborough, Yorkshire, England, Apr 1954 (BMNH); 1♀, Cheshire, England, 30 Sep 1954 (NMNZ); 2♂, 1♀, West Greenland, Jul 1955 (ZMHU); 4♂, 2♀, Spurn, Yorkshire, England, 17 Sep 1956 (BMNH); 1♂, Hornsea, Yorkshire, England, 17 Feb 1960 (BMNH); 2♂, 2♀, Aberdeen, Scotland, 3 Oct 1962 (BMNH); 2♂, 2♀, London Zoo, England, 1976 (BMNH); 1♂, 1♀, no locality, no date (ZMHU); 1♂, 1♀, no locality, no date (Piaget Collection slide No. 459, BMNH slide 1928–325. The male is herewith designated as the **lectotype**, and the female as paralectotype, of *Lipeurus mutabilis* Piaget, 1880. The host given on the slide label may be in error; see discussion below).

Ex *Fulmarus glacialis glacialis*: 1♂, Red Bay, Labrador, Canada, 21 Jul 1931 (NMNZ); 4♂, 3♀, Baffin Bay, 10 Jul 1946 (USNM).

Ex *Fulmarus glacialis auduboni*: 1♂, Faeroes Is., 11 Aug 1912 (BMNH); 8♂, 9♀, Hoy I., Orkney Is., Scotland, 5 Aug 1938 (BMNH; USNM); 2♂, 2♀, same locality, 8 Aug 1938 (BMNH); 34♂, 35♀, Orkney Is., Scotland, Aug 1938 (BMNH); 2♂, 3♀, Westman Is., SW Iceland, 28 Mar 1950 (BMNH); 1♀, Fair Isle, Scotland, 28 Aug 1958 (BMNH); 4♂, 2♀, Jan Mayen I. (71°N, 8°30'W), 19 Jul 1972 (ZMKD); 5♂, 4♀, St Pierre Bank, Newfoundland, Canada, 28 Sep 1978 (RLCP; NMNZ); 11♂, 15♀, Yell I., Shetland Is., Scotland, Jul 1981 (NMNZ); 13♂, 11♀, Ailsa Craig I., Scotland, 17 Aug 1985 (NMNZ); 1♀, St Kilda I., Scotland, no date (BMNH).

Ex *Fulmarus glacialis rogersii*: one third instar nymph (**lectotype** of *Lipeurus varius* Kellogg, 1896), Pacific Grove, California, U.S.A., 1895 (CISC); 1♂, 1♀, Oregon, U.S.A., 26 Sep 1920 (NMNZ); 7♂, 10♀, Tillamook, Oregon, U.S.A., 18 Nov 1921 (USNM); 4♂, 4♀, Nelarts, Oregon, U.S.A., 20 Feb 1924 (USNM); 2♂, same locality, 16 Dec 1929 (USNM); 11♂, 8♀, Alaska, no date (Meinertzhagen Collection, BMNH); 3♂, 9♀, Bering Sea, no date (Meinertzhagen Collection, BMNH); 4♂, 4♀, Pacific Grove, California, U.S.A., no date (BMNH); 1♂, 1♀, no locality, no date (BMNH); 1♂, 1♀, Monterey Bay, California, U.S.A., no date (USNM slide No. 64973. The male is herewith designated as the **lectotype**, and the female as paralectotype, of *Lipeurus celer* Kellogg, 1896).

Stragglers and contaminants

Ex *Thalassoica antarctica*: 1♀, Atlantic Ocean (62°45'S, 28°00'W), Feb 1947 (USNM); 1♂, Atlantic Ocean (62°00'S, 22°40'W), 1 Apr 1947 (BMNH).

Ex *Daption capense*: 1♀, Atlantic Ocean (62°45'S, 28°00'W), 23 Feb 1947 (USNM); 1♀, Atlantic Ocean (61°25'S, 22°40'W), 7 Apr 1947 (BMNH); 1♂, 1♀, Haswell Islet (66°31'S, 93°00'E) Antarctica, 1 Dec 1962 (BPBM); 5♂, 7♀, Chile, no date (Meinertzhagen Collection, BMNH).

Ex *Ptychoramphus aleuticus*: 1♀, Tillamook, Oregon, U.S.A., 18 Nov 1921 (USNM).

Discussion. The differences found among populations of *Perineus nigrolimbatus* (268♂, 285♀) are here not considered sufficient to justify dividing the species. This is in agreement with the opinions of previous authors.

Specimens from *Fulmarus glacialis glacialis* and from *F. glacialis auduboni* are a little smaller in their average body measurements than those from *F. glacialis rogersii* and from *F. glacialisoides* (see Table 1); however, we find a considerable overlap in the range of measurements (see Table 1), as already shown by Kéler (1957b: 516). Clay (1940: 299) found the head of specimens from *F. glacialis* to be "smaller and narrower" than those from *F. glacialisoides*, but remarked that conclusions would need to be based on larger samples. Kellogg (1914: 85) noted that the front of the clypeus in specimens from *F. glacialisoides* was more flattened than in those from *F. glacialis rogersii*; we find a consistent difference between populations from *F. glacialisoides* and *F. glacialis* spp. in respect of the shape of the pigmented clypeal front margin and of the hyaline margin beyond (see Fig. 1, 2, 8, 9; cf. Kéler, 1956, fig. 4 and 1957b, figs 13, 14). As already mentioned above (p. 564) the dorsal carinae of the head are variable in several respects. The material examined by us exhibits a variation similar to that shown by Clay (1940: 299) and Kéler (1957b: 515, figs 16, 17).

Kéler (1957b: 516, fig. 18) drew attention to variation in the lateral abdominal thickenings, and the fact that their greater development might be related to larger specimens from *F. glacialis rogersii* and *F. glacialisoides*. We find these structures to be unreliable, as they vary considerably with maturity of the specimens and their appearance is to some extent dependent of preparatory treatments.

The group of six central sternal setae on the 8th visible segment of the male shows very considerable variation in the relation of setae to the clear areas of cuticle in which they stand. We have found almost every conceivable combination, ranging from that where each seta is surrounded by its own

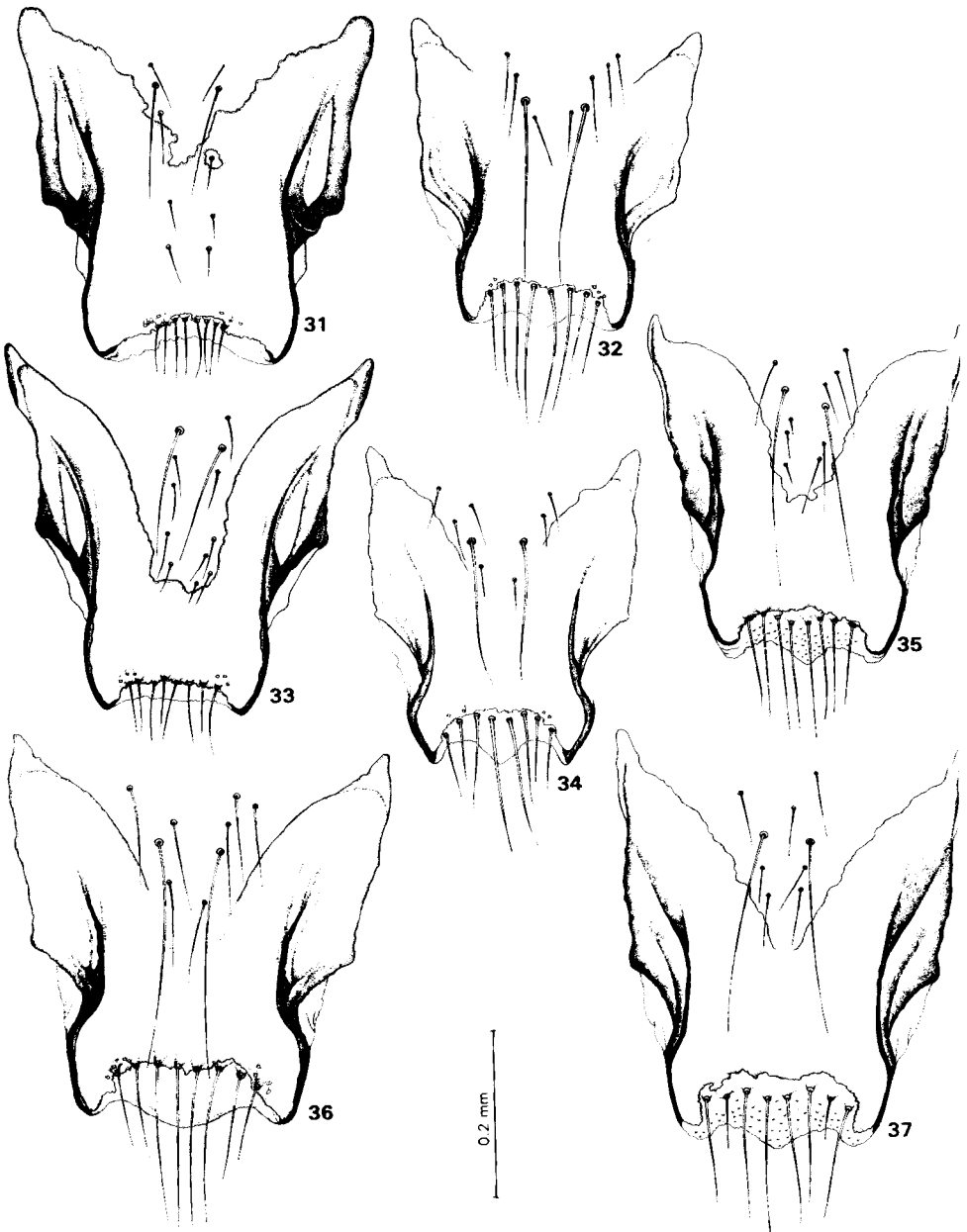


Fig. 31-37 Female subgenital plates: 31, *Perineus nigrolimbatus* (ex *Fulmarus glacialisoides*); 32, *P. concinnus*; 33, *P. nigrolimbatus* (ex *F. glacialis auduboni*); 34, *P. oblongus*; 35, *P. circumfasciatus*; 36, *P. concinnoides*; 37, *P. macronecti*.

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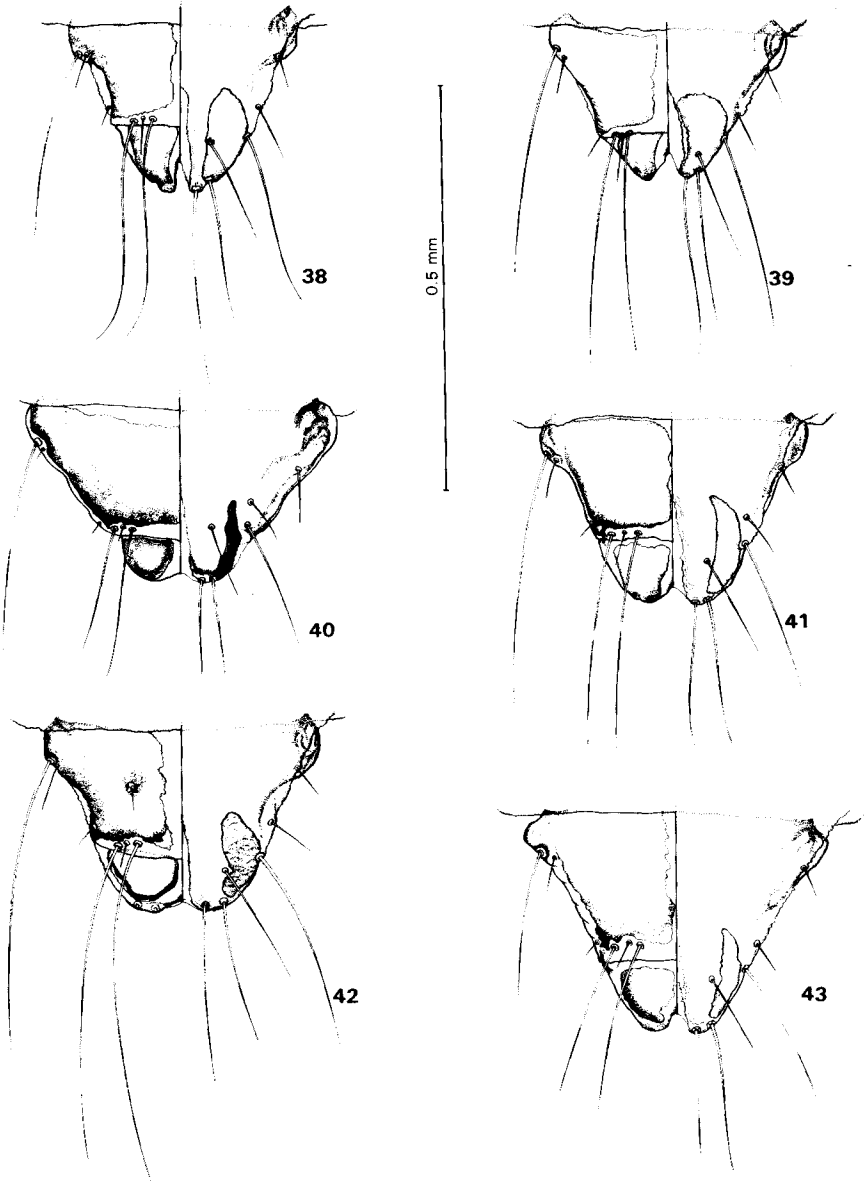


Fig. 38–43 Female terminalia, dorsal/ventral views (subgenital plate omitted): 38, *Perineus oblongus*; 39, *P. concin-nus*; 40, *P. nigrolimbatus*; 41, *P. circumfasciatus*; 42, *P. concin-noides*; 43, *P. macronecti*.

clear area to that in which all setae were enclosed in one common area. In the female, the posterior transverse row of eight long setae on the subgenital plate varies in length from about $\frac{1}{2}$ of the maximum width of the plate to about $\frac{1}{2}$ of that width (Fig. 31, 33).

We agree with Harrison (1937: 30) that the species is variable, and we also agree with his conclusion that there are no good grounds for regarding it as more than one taxon.

Taschenberg (1882: 133) first synonymised specimens of *P. mutabilis* (Piaget, 1880) with the types (subsequently lost) of *P. nigrolimbatus* (Giebel, 1874). Clay (1940: 299) drew attention to the fact that, on the basis of the female type measurements, the type host of *P. mutabilis* may have been *Fulmarus glacialisoides* (as *Priocella antarctica*) rather than *Fulmarus glacialis*. However, also on measurement basis, Kéler (1957b: 517) was of the opinion that the female type of *P. mutabilis* belongs among the material from *F. glacialis rogersii*. We have examined this female (now a paralectotype) and in our view the shape of the pigmented clypeal front margin and of the hyaline margin beyond, together with the size of the head, indicate its inclusion in the population of *P. nigrolimbatus* from *F. glacialisoides*. Confirmatory evidence is also provided by the male specimen (now the lectotype) mounted on the same slide. This male is, as Kéler (1957b: 517) pointed out, teneral and its body measurements are not significant; the clypeal front margin is, however, flattened as in specimens from *F. glacialisoides* (Fig. 1).

P. varius (Kellogg, 1896) and *P. celer* (Kellogg, 1896) were both synonymised with *P. nigrolimbatus* by Harrison (1916), but Waterston (1915: 36) had already suggested that Kellogg's species were both "... equal to *L. mutabilis* P.". Carriker (1957: 103) designated a lectotype of *P. varius* without reference to its synonymy. Carriker's account includes "... Slide No. 296 (♀-♀ im.) The adult female is selected as the lectotype". We have examined this same slide, which is in fact numbered 29b2; it bears a third instar nymph containing a pharate female (the lectotype), and a smaller, second instar nymph (a paralectotype), not an immature female. We have also examined the following three slides of *P. varius*, all labelled "Type" and all from *Fulmarus glacialis rogersii* (as *F. g. glupischka* (sic)): slide 29b1 with one second instar and two third instar nymphs; slide 25b with three third instar nymphs; slide 2058 with two third instar nymphs (CISC collection). These specimens are all paralectotypes, although they do not appear to have been examined by Carriker (1957).

Considering the above synonymy, together with Kellogg's descriptions and our examination of the

type specimens, we deduce that those of *P. varius* are nymphs of *P. celer*; in this we agree with Harrison (1937: 30) and Kéler (1957b: 512).

Our material shows clearly that the regular hosts of *P. nigrolimbatus* are the species and subspecies of *Fulmarus* in both hemispheres. Piaget (1880: 325) included *Daption capense* as a host for this louse species; in this he was followed by Kellogg (1908: 42), Harrison (1916: 138), Thompson (1936: 42), Clay (1940: 299), and Clay & Moreby (1970: 217). However, our examination of numerous specimens of *D. capense* has not yielded any examples of *P. nigrolimbatus* and we regard all records from this host as those of stragglers or contaminants. We also concur with Kéler (1957b: 513) and Timmermann (1965: 109) that records from *Oceanodroma furcata*, *Sula bassana*, and *Phalacrocorax olivaceus* are to be placed in the same categories.

P. nigrolimbatus is very distinct and stands apart from the remaining species of the genus; its hosts have a non-overlapping, bipolar distribution. It is therefore likely that it parasitised the ancestral *Fulmarus* stock before the present widely separated north-south isolation of *F. glacialis* ssp. and *F. glacialisoides* came about.

The known lice on the species and subspecies of *Fulmarus* belong to the genera *Ancistrona*, *Austromenopon*, *Saemundsonia*, and *Perineus* (see Timmermann 1965, Pilgrim & Palma 1982); the first three of these genera include species widespread within the Procellariidae, but species of *Perineus* are predominantly found on members of the Diomedidae (see Table 2). It is suggested that *Fulmarus* hosts acquired their ancestral *Perineus* infestation from diomedeid host(s).

Perineus concinnus (Kellogg & Chapman, 1899)

(Fig. 4, 11, 18, 24, 32, 39, 47, 50)

Lipeurus concinnus Kellogg & Chapman, 1899: 97, pl. VII, fig. 2 (Type host: *Diomedea albatrus* Pallas, 1769). Lectotype ♂ in CISC, slide No. 452c, designated by Pilgrim & Palma, 1979: 173.

Esthiopterum concinnum (Kellogg & Chapman, 1899); Harrison, 1916: 132.

Perineus concinnus (Kellogg & Chapman, 1899); Thompson, 1936: 42.

Perineus tenuipennis Kéler, 1958: 384, fig. 1A (Type host: *Diomedea immutabilis* Rothschild, 1897). Holotype presumed lost.

Diagnosis. A moderately pigmented species; head, thorax, and abdomen medium brown with darker margins. Head: dorsal carinae with strongly pigmented portion extending backward well beyond

Table 2 HOST-PARASITE LIST (Hosts listed following Jouanin & Mougin (1979)).

| Family Diomeidae | |
|--|---------------------------------|
| Genus <i>Diomea</i> Linnaeus, 1758 | |
| <i>D. exulans exulans</i> Linnaeus, 1758 | <i>Perineus concinnoides</i> |
| <i>D. exulans chionopectera</i> Salvin, 1895 | <i>Perineus concinnoides</i> |
| <i>D. epomophora epomophora</i> Lesson, 1825 | <i>Perineus concinnoides</i> |
| <i>D. epomophora sanfordi</i> Murphy, 1917 | <i>Perineus concinnoides</i> |
| <i>D. irrorata</i> Salvin, 1883 | <i>Perineus oblongus</i> |
| <i>D. albatrus</i> Pallas, 1769 | <i>Perineus concinnus</i> |
| <i>D. nigripes</i> Audubon, 1839 | <i>Perineus concinnus</i> |
| <i>D. immutabilis</i> Rothschild, 1893 | <i>Perineus concinnus</i> |
| <i>D. melanophrys melanophrys</i> Temminck, 1828 | <i>Perineus circumfasciatus</i> |
| <i>D. melanophrys impavida</i> (Mathews, 1912) | <i>Perineus circumfasciatus</i> |
| <i>D. cauta cauta</i> Gould, 1841 | <i>Perineus circumfasciatus</i> |
| <i>D. cauta salvini</i> (Rothschild, 1893) | <i>Perineus circumfasciatus</i> |
| <i>D. cauta eremita</i> (Murphy, 1930) | <i>Perineus circumfasciatus</i> |
| <i>D. chrysoptoma</i> Forster, 1785 | <i>Perineus circumfasciatus</i> |
| <i>D. chlororhynchus</i> Gmelin, 1789 | <i>Perineus circumfasciatus</i> |
| <i>D. bulleri bulleri</i> Rothschild, 1893 | <i>Perineus circumfasciatus</i> |
| <i>D. bulleri platei</i> Reichenow, 1898 | <i>Perineus circumfasciatus</i> |
| Genus <i>Phoebetria</i> Reichenbach, 1853 | |
| <i>P. fusca</i> (Hilsenberg, 1822) | <i>Perineus circumfasciatus</i> |
| <i>P. palpebrata</i> (Forster, 1785) | <i>Perineus circumfasciatus</i> |
| Family Procellariidae | |
| Genus <i>Macronectes</i> Richmond, 1905 | |
| <i>M. giganteus</i> (Gmelin, 1789) | <i>Perineus macronecti</i> |
| <i>M. halli</i> Mathews, 1912 | <i>Perineus macronecti</i> |
| Genus <i>Fulmarus</i> Stephens, 1826 | |
| <i>F. glacialisoides</i> (Smith, 1840) | <i>Perineus nigrolimbatus</i> |
| <i>F. glacialis glacialis</i> (Linnaeus, 1761) | <i>Perineus nigrolimbatus</i> |
| <i>F. glacialis auduboni</i> Bonaparte, 1857 | <i>Perineus nigrolimbatus</i> |
| <i>F. glacialis rogersii</i> Cassin, 1862 | <i>Perineus nigrolimbatus</i> |

level of third anterior marginal setae (a.m.s.3), its outer borders varying from almost parallel to an angle of c. 30° (Fig. 4, 11).

MALE. Head as in Fig. 4; greatest width midway between antennae and hind margin; temples smoothly rounded. Antenna as in Fig. 4; segment I slightly shorter than segments II-V combined; segment III with the distal sclerotised knob well developed and reaching to mid-length of segment IV; segments IV+V set at an angle on segment III (Fig. 47). Abdomen: lateral margins of 2nd–5th visible sternites with a strongly sclerotised thickening along their anterior half (Fig. 50); ventral aspect of terminalia as in Fig. 18; 8th visible sternite with two clear areas each containing three long central setae of equal length. Genitalia as in Fig. 24; basal plate occupying approximately half the total length; distal pores situated towards the tip of the parameres, with approximately equal spacing between them.

FEMALE. Head as in Fig. 11; greatest width shortly behind the eyes. Antenna as in Fig. 11. Abdomen: position and length of setae on 8th and 9th visible segments as in Fig. 39; subgenital plate with shape and setation as in Fig. 32.

Material examined. The specimens listed as material examined in Pilgrim & Palma (1979) are

included in this revision but not listed again. The following specimens have been examined since the publication of that paper:

Ex *Diomea albatrus*: 1♀, Ulak I., Alaska, 31 Jul 1937 (KCEC).

Ex *Diomea immutabilis*: 9♂, 8♀, Sand I., Midway Atoll, Hawaiian Is., 23 Apr 1957 (USNM; SAIMR); 1♀, same locality, 9 Apr 1959 (BPBM); 2♀, Midway Atoll, Hawaiian Is., 2–16 Dec 1959 (BPBM); 3♂, 3♀, Honolulu, Hawaiian Is., 27 Feb 1962 (USNM; BPBM); 2♂, Midway Atoll, Hawaiian Is., 19 Feb 1963 (USNM); 1♂, 1♀, same locality, 15 Apr 1969 (NMNZ); 1♂, same locality, no date (NMNZ).

Ex *Diomea nigripes*: 1♀, Sand I., Midway Atoll, Hawaiian Is., 10 Jan 1960 (BPBM); 1♀, Honolulu, Hawaiian Is., 10 Mar 1962 (BPBM); 6♂, 7♀, Midway Atoll, Hawaiian Is., 14 Jan 1964 (USNM; REEC); 9♂, 11♀, same locality, 4 Feb 1964 (USNM; REEC; NMNZ); 1♀, Pacific Ocean, 8 Apr 1964 (USNM); 1♀, Midway Atoll, Hawaiian Is., 19 Dec 1980 (NMNZ).

Stragglers

Ex *Diomea exulans*: 2♀, no locality, 1906 (BMNH).

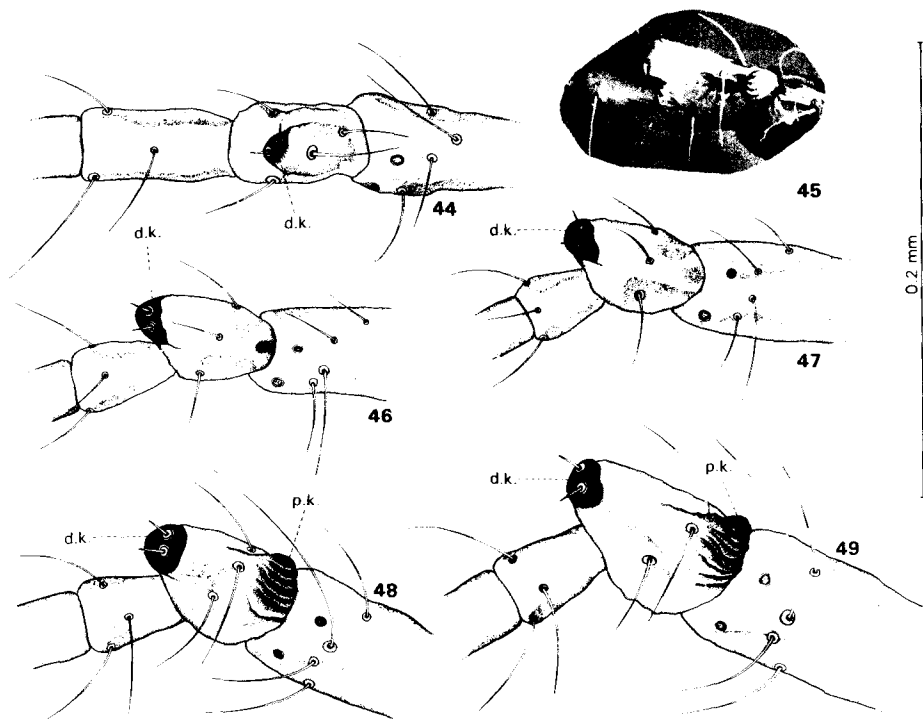


Fig. 44-49 Male antennal segments II-V, dorsal view: 44, *Perineus concinnoides*; 45, *P. nigrolimbatus*; 46, *P. oblongus*; 47, *P. concinnus*; 48, *P. circumfasciatus*; 49, *P. macronecti* (d.k., distal knob; p.k., proximal knob).

Discussion. Minor variations in some morphological features among populations from the three host species were discussed in Pilgrim & Palma (1979); the additional material now examined falls within the same range of variability.

In Pilgrim & Palma (1979: 175) we examined 5♂ and 9♀ ex *D. immutabilis*, Laysan Island, J. O. Snyder, 1902. In our discussion (1979: 177) we said that the report by Kellogg & Paine (1910: 125) of *D. immutabilis* as a host for *P. concinnus*, was likely to be correct. It is now clear that, in fact, the Snyder specimens we examined in 1979 derive from among those published by Kellogg & Paine (1910); we therefore confirm their report.

***Perineus concinnoides* Kéler, 1957**

(Fig. 3, 10, 20, 26, 29, 36, 42, 44)

Ethiopterum concinnum Waterston, 1923: 289 (not *Lipeurus concinnus* Kellogg & Chapman, 1899).

Perineus concinnoides Kéler, 1957b: 521, fig. 26
(Type host: *Diomedea exulans* Linnaeus, 1758).
Holotype ♂ in BMNH, slide No. 8010/1.

Diagnosis. Dorsal carinae of head with strongly pigmented median portion extending backward well beyond level of third anterior marginal setae (a.m.s.3) (Fig. 3, 10).

MALE as in Fig. 29. Head and abdomen, except first visible segment, moderately pigmented, medium brown; thorax and first visible abdominal segment pale, with 3 pairs of dark brown lateral thickenings. Head as in Fig. 3; greatest width shortly behind the eyes; temples lightly convex. Antenna as in Fig. 3; segment I about half as long as segments II-V combined; segment III with the distal sclerotised knob minute, not extending beyond articulation of segment IV; segments IV+V not set at an angle on segment III (Fig. 44). Abdomen: lateral margins of 2nd-5th visible sternites with a moderately sclerotised thickening along their anterior half (Fig. 29); ventral aspect of terminalia as

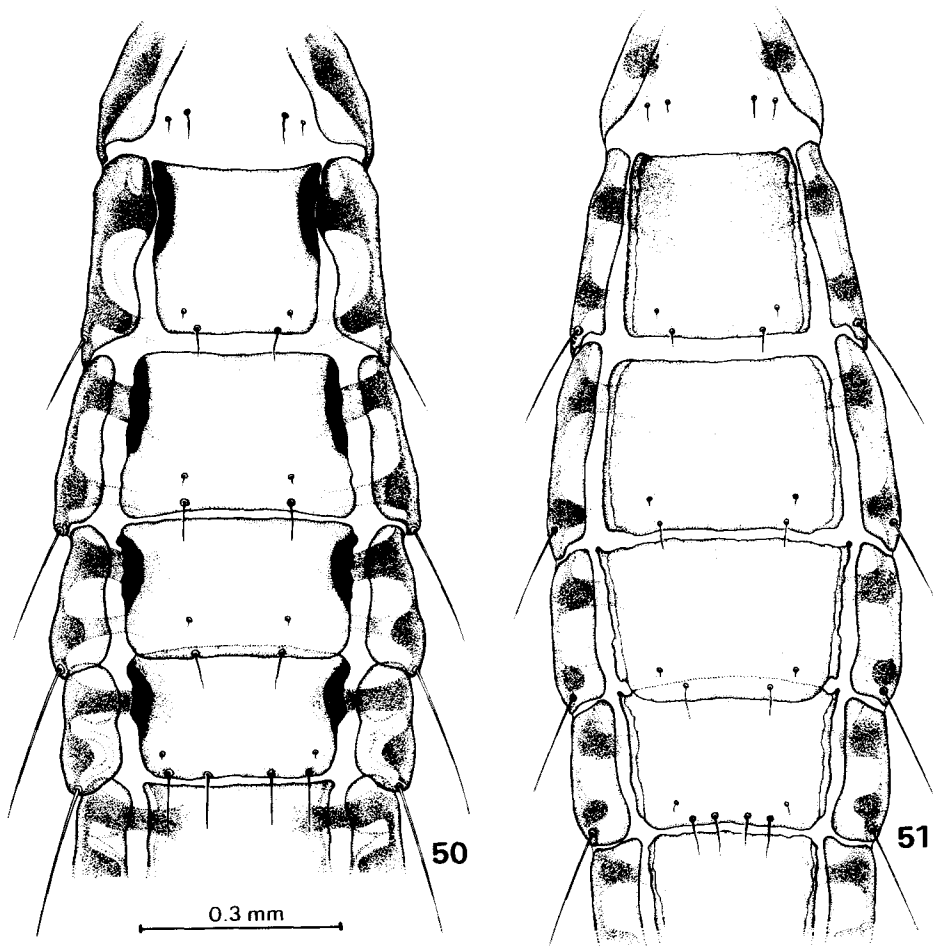


Fig. 50, 51 First to sixth male abdominal segments, ventral view: 50, *Perineus concinnus*; 51, *P. oblongus*.

in Fig. 20; 8th visible sternite with a single clear area containing 6 central sternal setae of equal length, this area completely dividing the pigmented area of this sternite into anterior and posterior portions. Genitalia as in Fig. 26; basal plate occupying approximately half the total length; distal pores somewhat variably situated within their group.

FEMALE. Head, thorax, and abdomen pale brown with darker lateral thickenings. Head as in Fig. 10; greatest width immediately behind the eyes. Antenna as in Fig. 10. Abdomen: position and

length of setae on 8th and 9th visible segments as in Fig. 42; subgenital plate with shape and setation as in Fig. 36.

Material examined

Ex *Diomedea exulans*: 1♀, St Paul's Rocks, Atlantic Ocean, 8 Nov 1921 (Shackleton—Rowett Expedition, BMNH); 1♀, Sydney, Australia, 1 Sep 1968 (ANIC); holotype ♂ and paratypes 5♂, 3♀, Cape, no date (Meinertzhagen Collection, BMNH; ZMHU).

Ex *Diomedea exulans chionoptera*: 14♂, 11♀, Bird I., South Georgia Is., 19 Jun 1963 (BPBM; NMNZ; BMNH); 7♂, 6♀, same locality, 26 Jun 1963 (BPBM; BMNH; SAIMR); 4♂, 1♀, same locality, 18 Jul 1963 (BPBM); 5♂, 2♀, Taumutu, Canterbury, N.Z., 10 Oct 1974 (RLCP).

Ex *Diomedea epomophora*: 2♂, 3♀, Arahura River mouth, Westland, N.Z., 29 Jul 1974 (RLCP).

Ex *Diomedea epomophora epomophora*: 3♂, 2♀, Wairarapa Coast, N.Z., 11 Jul 1976 (NMNZ); 1♀, Kaikoura, N.Z., 27 Sep 1976 (NMNZ); 6♂, 4♀, Lake Ferry, Wairarapa, N.Z., Jun 1978 (NMNZ).

Ex *Diomedea epomophora sanfordi*: 1♂, Forty Fours Rocks, Chatham Is., N.Z., 1 Dec 1983 (NMNZ); 1♂, Taiaroa Head, Otago, N.Z., 13 Feb 1984 (NMNZ).

Host unknown: 2♂, 1♀, no locality, no date (ZMHU); 1♀, Marion I., no date (ZMHU). These 4 specimens were identified and listed by Kéler (1957b: 521).

Discussion. No significant differences were found among populations of *P. concinnoides* (49♂, 35♀) from the four species/subspecies of hosts.

We have examined one female in the BMNH collection with the following data: "*Esthiopterum concinnum* Kell. & Chap. Compared with type, G. F. F. *Diomedea exulans*, St Paul's Rocks [Atlantic Ocean], 8.xi.1921, G. H. Wilkins coll., Shackleton-Rowitz Exped." This specimen was recorded by Waterston (1923: 289) as such, but our examination shows it to be *Perineus concinnoides*; in this we confirm Kéler's supposition (1957b: 523). The female specimens listed by Clay (1964: 231) as "*Perineus sens. str.*" from *Diomedea epomophora epomophora*, Campbell Island, are presumably *P. concinnoides*.

Perineus oblongus Kéler, 1957

(Fig. 6, 13, 19, 23, 34, 38, 46, 51)

Perineus oblongus Kéler, 1957b: 523, figs 27–28 (Type host: *Diomedea irrorata* Salvin, 1883).

Holotype ♂ in Meinertzhagen Collection, BMNH, No. 8179.

Diagnosis. A moderately pigmented species; head, thorax, and abdomen medium brown with darker margins. Head: dorsal carinae with strongly pigmented median portion extending backward well beyond level of third anterior marginal setae (a.m.s.3), its outer borders forming an angle of more than 40° (Fig. 6, 13).

MALE. Head as in Fig. 6; greatest width midway between antennae and hind margin; temples

smoothly rounded. Antenna as in Fig. 6; segment I about as long as segments II–V combined; segment III with the distal sclerotised knob well developed and reaching to mid-length of segment IV; segments IV+V set at an angle on segment III (Fig. 46). Abdomen: sternites uniformly but not strongly sclerotised (Fig. 51); ventral aspect of terminalia as in Fig. 19; 8th visible sternite with one clear area containing 6 long central setae (Fig. 19). Genitalia as in Fig. 23; basal plate occupying approximately one-third the total length; distal pores in 2 groups, the posterior 2 pairs crowded towards the tip of the parameres, the anterior 2 pairs well separated from them and from each other. **FEMALE.** Head as in Fig. 13; greatest width shortly behind the eyes. Antenna as in Fig. 13. Abdomen: position and length of setae on 8th and 9th visible segments as in Fig. 38; subgenital plate with shape and setation as in Fig. 34.

Material examined

Ex *Diomedea irrorata*: 29♂, 18♀, Hood I., Galápagos Is., 27 Apr 1925 (NMNZ); 2♀, Galápagos Is., 19 May 1974 (BMNH); **holotype** ♂ and paratypes 1♂, 3♀, Galápagos Is., no date (Meinertzhagen Collection, BMNH; ZMHU).

Contaminant

Ex *Diomedea nigripes*: 1♂, British Columbia, Canada, 3 Jul 1941 (NMNZ).

Perineus circumfasciatus Kéler, 1957

(Fig. 7, 14, 22, 27, 35, 41, 48, 52, 54)

Perineus concinnus Harrison, 1937: 29 (not *Lipeurus concinnus* Kellogg & Chapman, 1899).

Perineus circumfasciatus Kéler, 1957b: 525, figs 29–30 (in part) (Type host: *Diomedea melanophrys* Temminck, 1828). **Holotype** ♂ in Meinertzhagen Collection, BMNH, No. 8182.

Perineus sens. str.; Clay, 1964: 231 (in part).

Perineus sp.; Watson, 1967: 73.

Diagnosis. A fairly heavily pigmented species; head, thorax, and abdomen medium brown with darker margins. Head: dorsal carinae with strongly pigmented median portion reaching only about level of third anterior marginal setae (a.m.s.3) (Fig. 7, 14).

MALE. Head as in Fig. 7; greatest width at two-thirds distance from antenna to hind margin. Antenna as in Fig. 7; segment I about as long as segments II–V combined, its anterior margin distinctly angled at mid length; segment III with a proximal knob bearing minute curved ridges, distal

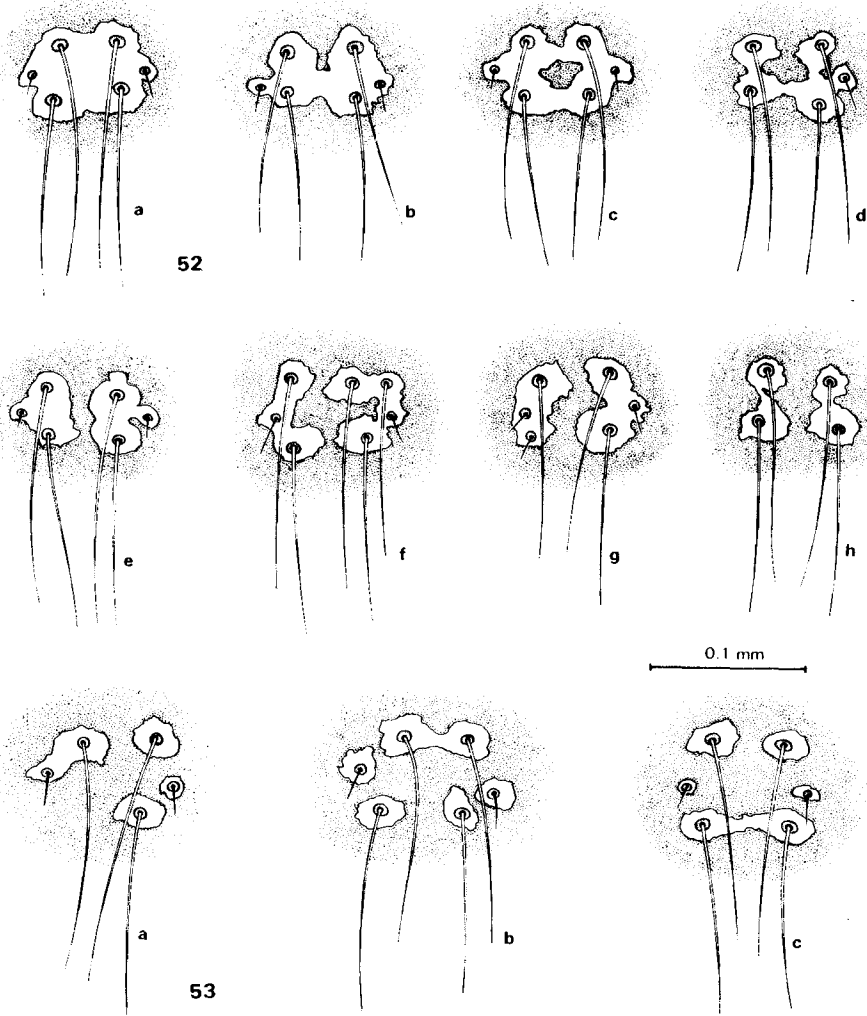


Fig. 52, 53 Males, variation observed in the number of central setae on the 8th visible sternite, and in the clear areas within which they are contained: 52 a-h, *Perineus circumfasciatus*; 53 a-c, *P. macronecti*.

knob reaching to about one third the length of segment IV; segments IV + V set at an angle on segment III (Fig. 48). Abdomen: lateral margins of 2nd-5th visible sternites with a moderately sclerotised thickening along their anterior half; pair of central postero-marginal setae on 7th visible tergite

shorter than 15 μ m; ventral aspect of terminalia as in Fig. 22; 8th visible sternite with central setae of two different lengths, usually (90%) 4 long and 2 short, the long setae of at least one side being contained within a common clear area (Fig. 52). Genitalia as in Fig. 27; basal plate occupying

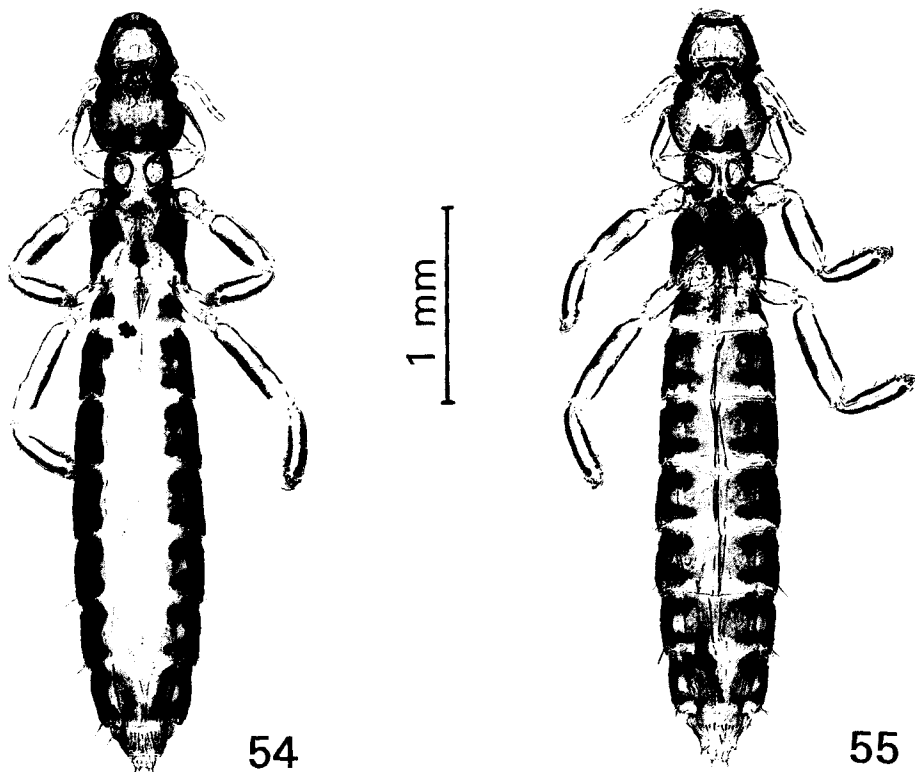


Fig. 54, 55 Females: 54, *Perineus circumfasciatus*; 55, *P. macronecti*.

approximately one-half the total length; distal pores situated towards the tip of the parameres, with approximately equal spacing between them.

FEMALE as in Fig. 54. Head as in Fig. 14; greatest width midway between antenna and hind margin. Antenna as in Fig. 14. Abdomen: pair of central postero-marginal setae on 7th visible tergite shorter than 12 μ m; position and length of setae on 8th and 9th visible segments as in Fig. 41; subgenital plate as in Fig. 35, its posterior row of setae with outer 2 on each side approximately equal in length.

Material examined

Ex *Diomedea melanophrys*: 1 σ , 2 ϕ , Akaroa, Banks Peninsula, N.Z., 14 Aug 1933 (RLCP); 1 ϕ , South West Africa, May 1949 (Meinertzhagen Collection, BMNH); 1 σ , Tristan da Cunha I., 16 Aug 1951 (BMNH); 1 σ , Perth, Australia,

1970 (BMNH); **holotype** σ and allotype ϕ , Valparaíso, Chile, no date (Meinertzhagen Collection, BMNH); 5 σ , 3 ϕ , no locality, no date (BMNH).

Ex *Diomedea melanophrys melanophrys*: 2 ϕ , Macquarie I., Australia, 6 Oct 1961 (ANIC); 2 ϕ , South Georgia Is., 9 Oct 1963 (BPBM); 1 ϕ , Bird I., South Georgia Is., 25 Oct 1963 (BPBM); 1 σ , Belfast, N.Z., 28 Mar 1971 (RLCP); 2 σ , 1 ϕ , Bahía Capitán Cánepa, Staten I., Argentina, 3 May 1971 (USNM); 1 σ , 1 ϕ , Puerto Celular, Staten I., Argentina, 5 May 1971 (USNM); 1 ϕ , Wellington, N.Z., 18 Jun 1974 (NMNZ); 1 σ , 3 ϕ , Bollons I., Antipodes Is., N.Z., 29 Nov 1978 (NMNZ); 1 σ , Gonzalo I., Diego Ramírez Is., Chile, 26 Jan 1981 (NMNZ); 1 σ , paratype ϕ , South Georgia Is., no date (Meinertzhagen Collection, BMNH); 1 σ , 1 ϕ , no locality, no date (BMNH).

- Ex *Diomedea melanophrys impavida*: 22♂, 22♀, Campbell I., N.Z., 2 Dec 1975 (NMNZ; CISC).
- Ex *Diomedea cauta*: 1♀, Port Elizabeth, Cape Province, South Africa, 5 Feb 1960 (BMNH); 2♀, Palliser Bay, N.Z., 28 Nov 1976 (NMNZ); 1♂, 1♀, Bass Strait, Australia, 26 Oct 1977 (KCEC).
- Ex *Diomedea cauta cauta*: 6♂, 5♀, Wellington, N.Z., 12 Jul 1954 (NMNZ; RLCP); 1♂, Grey-mouth, N.Z., 14 Dec 1957 (CMNZ); 1♂, 1♀, Albatross I., Bass Strait, Australia, 29 Jan 1973 (QVTA); 1♀, Disappointment I., Auckland Is., N.Z., 15 Feb 1973 (RLCP); 4♂, 6♀, SW Cape, Auckland I., N.Z., 21 Feb 1973 (NZAC; NMNZ); 1♂, 2♀, Petone, Wellington, N.Z., 16 Jun 1975 (NMNZ); 10♂, 9♀, Auckland West Coast, N.Z., 7 Jul 1975 (RLCP; NMNZ); 4♂, 4♀, Bruny I., Tasmania, Australia, 14 Oct 1980 (TMTA; NMNZ); 8♂, 9♀, Albatross I., Bass Strait, Australia, Jan 1981 (NMNZ; AMNZ); 2♂, 1♀, same locality, 22 Nov 1981 (NMNZ); 2♂, 1♀, Wellington, N.Z., 10 May 1983 (NMNZ); 2♂, 1♀, Disappointment I., Auckland Is., N.Z., 18 Feb 1985 (NMNZ).
- Ex *Diomedea cauta salvini*: 1♂, Kaikoura, N.Z., 23 Dec 1974 (RLCP); 1♀, Palliser Bay, N.Z., 21 Oct 1975 (NMNZ); 1♂, 3♀, same locality, 28 Nov 1976 (NMNZ); 1♀, Invercargill, N.Z., 29 Mar 1977 (NMNZ); 2♂, 2♀, Moa Point, Wellington, N.Z., 28 Aug 1977 (NMNZ); 1♂, 3♀, Proclamation I., Bounty Is., N.Z., 13 Nov 1978 (NMNZ); 3♂, 1♀, same locality, 14 Nov 1978 (NMNZ); 10♂, 10♀, same locality, 19 Nov 1978 (NMNZ); 1♂, 1♀, Hawkes Bay, N.Z., no date (NMNZ).
- Ex *Diomedea cauta eremita*: 1♀, Karekare, Auckland, N.Z., Jan 1934 (RLCP); 2♂, 4♀, Long Beach, Chatham I., N.Z., 23 Dec 1978 (NMNZ).
- Ex *Diomedea chrysostoma*: 1♂, 1♀, Palliser Bay, N.Z., 30 May 1948 (NMNZ); 1♀, Courejoilles Point, Campbell I., N.Z., 13 Feb 1963 (BPBM); 1♂, 2♀, South Georgia Is., 17 Sep 1963 (BPBM); 3♀, Bird I., South Georgia Is., 27 Oct 1963 (BPBM); 2♂, Dargaville, N.Z., 22 Sep 1974 (NMNZ); 7♂, 7♀, Campbell I., N.Z., 2 Dec 1975 (NMNZ); 1♂, 1♀, same locality, 3 Dec 1975 (NMNZ); 1♀, Cape Horn, Chile, no date (Meinertzhagen Collection, BMNH).
- Ex *Diomedea chlororhynchos*: 2♂, 4♀, Middle Sister I., Chatham Is., N.Z., 10 Sep 1976 (NMNZ); 1♂, 1♀, off South Africa, Indian Ocean, no date (Hopkins Collection, BMNH); 4♀, Gough I., no date (Meinertzhagen Collection, BMNH).
- Ex *Diomedea bulleri*: 10♂, 10♀, Ohope Beach, Bay of Plenty, N.Z., 2 Jul 1980 (NMNZ); 2♂, 1♀, Otago, N.Z., no date (BMNH).
- Ex *Diomedea bulleri bulleri*: 1♂, 1♀, Snares Is., N.Z., 5 Feb 1967 (RLCP); 1♀, Ho Ho Bay, Snares Is., N.Z., 22 Feb 1975 (RLCP); 4♂, 4♀, Mollymawk Bay, Snares Is., N.Z., 27 Feb 1975 (NMNZ); 1♂, 1♀, Ho Ho Bay, Snares Is., N.Z., 22 Dec 1976 (NMNZ); 5♂, 8♀, Mollymawk Bay, Snares Is., N.Z., 26 Feb 1977 (NMNZ).
- Ex *Diomedea bulleri platei*: 1♂, Middle Sister I., Chatham Is., N.Z., 8 Jun 1976 (NMNZ); 1♂, Palliser Bay, N.Z., 3 Aug 1985 (NMNZ).
- Ex *Phoebetria fusca*: 1♂, 2♀, Nightingale I., South Atlantic Ocean, 25 May 1922 (NMNZ); 3♀, South Atlantic Ocean, no date (Meinertzhagen Collection, BMNH).
- Ex *Phoebetria palpebrata*: 2♂, Macquarie I., Australia, 5 Nov 1912 (AMSA); 1♀, no locality, 2 Jan 1949 (ANARE Collection, BMNH); 2♀, Crozier Point, Auckland I., N.Z., 30 Dec 1962 (BPBM); 4♂, 6♀, Weddell Sea, 12 Feb 1966 (USNM; BMNH); 1♂, 2♀, Davis Point, Campbell I., N.Z., 12 Dec 1975 (NMNZ); paratype ♀, Antipodes Is., N.Z., no date (Meinertzhagen Collection, BMNH); 1♂, New Zealand, no date (Meinertzhagen Collection, BMNH); 1♂, no locality, no date (BMNH).
- Host unknown: ♀, South Indian Ocean, no date (MAMU).

Stragglers and contaminants

Ex *Morus capensis*: paratype ♀, Table Bay, 20 Oct 1954 (ZMHU).

Ex *Catharacta skua chilensis*: 2♀, Lemaire I., South Atlantic, 19 Jan 1966 (USNM).

Discussion. No significant differences were found among populations of *P. circumfasciatus* (152♂, 181♀) from the 11 species/subspecies of hosts.

Kéler (1957b: 525) had at his disposal only 10 specimens on which he based his description, but he drew attention to the possibility of occurrence of subspecies, in view of the several hosts involved. On the basis of the above "Material examined", we confirm *Diomedea melanophrys* and *Phoebetria palpebrata* as true hosts of *P. circumfasciatus*. We find, however, that specimens from *Macronectes giganteus* (as well as those from *M. halli*) are sufficiently and consistently different to be regarded as a new species, which we describe below. We are unaware of any additional specimens of *Perineus* taken from *Morus capensis*, and we therefore do not regard the latter as a true host of *P. circumfasciatus*. We have examined the two males ex *Phoebetria palpebrata* from Macquarie Island recorded by Harrison (1937: 29) as *P. concinnus*, and have identified them as *P. circumfasciatus* (see Pilgrim & Palma 1979: 177); these specimens are listed in Watson (1967: 73) as *Perineus* sp. Also,

we have examined and identified as *P. circumfasciatus* one female ex *Diomedea chrysostoma* from Campbell I., listed by Clay (1964: 231) as "*Perineus sens. str.*".

In the male, a few specimens have one or three central postero-marginal setae on the 7th visible abdominal tergite instead of the usual pair. The central setae on the 8th visible sternite show considerable variation both in the number of long and short setae and with respect to the clear area(s) within which they are contained. Of 114 specimens (228 sides) examined for these features, 208 sides had 2 long and 1 short setae (Fig. 52a,b,c,e); the remaining 20 sides showed variations of 1-3 long and 0-2 short setae, in several combinations (Fig. 52d,f,g,h). These abnormalities were on one or both sides. The clear cuticle surrounding the central setae varies from one area containing all the setae of both sides, to two areas each containing the three setae of a side or only the two long setae (Fig. 52).

***Perineus macronecti* n. sp.**

(Fig. 5, 12, 21, 28, 30, 37, 43, 49, 53, 55)

Type host: *Macronectes halli* Mathews, 1912.
Holotype ♂ in NMNZ.

Perineus circumfasciatus Kéler, 1957b: 525 (in part).

Perineus sp. n.; Clay, 1957: 2.

Perineus sp. nov.; Watson, 1967: 73.

Perineus circumfasciatus sens. lat.; Clay & Moreby, 1967: 163.

Diagnosis. A heavily pigmented species; head, thorax, and abdomen medium brown with darker margins (Fig. 30, 55). Head: dorsal carinae with strongly pigmented median portion reaching only about level of third anterior marginal setae (a.m.s.3) (Fig. 5, 12).

MALE. Head: greatest width at two-thirds distance from antenna to hind margin (Fig. 5). Antenna as in Fig. 5; segment I about as long as segments II-V combined, its anterior margin slightly angled at mid length; segment III with a proximal knob bearing minute curved ridges, distal knob reaching about one third length of segment IV; segments IV+V set at an angle on segment III (Fig. 49). Abdomen: lateral margins of 2nd-5th visible sternites with a moderately sclerotised thickening along their anterior half; pair of central postero-marginal setae on 7th visible tergite longer than 15 µm; ventral aspect of terminalia as in Fig. 21; 8th visible sternite with central setae of two different lengths, usually (90%) 4 long and 2 short, each seta usually surrounded by a separate clear area of cuticle (rarely, 2 anterior or 2 posterior setae within a common clear area; Fig. 53). Genitalia as in Fig. 28; basal plate occupying approximately one-half

the total length; distal pores in 2 groups, the posterior 2 pairs close together towards the tips of the parameres, the anterior 2 pairs more separated from each other and from the posterior pairs.

FEMALE. Head as in Fig. 12; greatest width midway between antenna and hind margin. Antenna as in Fig. 12. Abdomen: pair of central postero-marginal setae on 7th visible tergite longer than 12 µm; position and length of setae on 8th and 9th visible segments as in Fig. 43; subgenital plate as in Fig. 37, its posterior row of setae with, on at least one side, the second seta from the outside approximately half the length of the outermost.

Type specimens

Ex *Macronectes halli*: Holotype ♂ and allotype ♀, Antipodes I., N.Z., 24 Nov 1978 (NMNZ). Paratypes: 1♀, Lyall Bay, Wellington, N.Z., 11 Apr 1968 (NMNZ); 2♂, 2♀, Kaikoura, N.Z., 4 Aug 1971 (NMNZ; BMNH); 3♂, 3♀, Mollymawk Bay, Snares Is., N.Z., 30 Aug 1972 (NMNZ); 2♀, Makara, Wellington, N.Z., 18 Oct 1977 (NMNZ); 1♀, Bird I., South Georgia Is., 7 Aug 1985 (NMNZ).

Ex *Macronectes giganteus*: Paratypes: 1♀, 62°50'S, 10°55'W, 20 Jan 1947 (BMNH); 6♀, Wellington Harbour, N.Z., 7 Oct 1957 (NMNZ; NZAC; BPBM); 4♂, 3♀, Macquarie I., Australia, 25 Sep 1961 (NMNZ; BMNH; ANIC); 3♂, Kaikoura, N.Z., 28 Feb 1966 (NMNZ; NZAC; BPBM); 1♀, Greenpark, Canterbury, N.Z., 28 Jan 1974 (NMNZ); 1♀, Chile, no date (Meinertzhagen Collection, BMNH); 3♂, 2♀, Falkland Is., no date (Meinertzhagen Collection, BMNH; ZMHU). The latter five specimens from Falkland Is., were designated a paratypes of *Perineus circumfasciatus* by Kéler (1957b: 525).

Other specimens examined (not types)

Ex *Macronectes giganteus*: 1♂, Tristan da Cunha I., 4 Jan 1938 (ZMON).

Ex *Macronectes* sp.: 1♂, Oakura, Taranaki, N.Z., Jul 1975 (NMNZ).

Discussion. No significant differences were found among populations of *P. macronecti* (18♂, 24♀) from the two species of hosts. The minor morphological variations noted (see Diagnosis, and below) were found in specimens from both of the hosts; we therefore have no hesitation in including all this material in our new species and in designating paratypes obtained from both hosts.

Kéler (1957b: 526) evidently suspected that a subdivision of *P. circumfasciatus* might be considered but he refrained from doing so in the absence of more extensive collections. Clay (1957: 2) listed "*Perineus* sp. n." ex *Macronectes giganteus* from

Tristan da Cunha and added "The description of this species by E. L. Edwards is in the press."; we are unaware that any such description has been published. We have examined one unidentified male from the Tristan da Cunha collection reported by Clay (1957) and have identified it as *P. macronecti*. Timmermann (1965: 108) referred to the larger size, especially of the head, of specimens from *M. giganteus* and suggested that subspecific separation should be considered for populations from that host. Watson (1967: 73) listed material ex *M. giganteus* from Macquarie I. as "*Perineus* sp. nov. (T. Clay 1962, pers. comm.)"; however, Clay & Moreby (1967: 162) wrote "... specimens from *Macronectes* differ somewhat in proportions but can be included as *P. circumfasciatus sens. lat.*".

Examination of the many specimens available to us shows that those taken from *Macronectes* spp. differ significantly from *P. circumfasciatus* taken from *Diomedea* spp. and from *Phoebastria* spp., and should be considered as a distinct species. In addition to those characters mentioned in the Key to Species, *P. macronecti* differs from *P. circumfasciatus* in being larger (both sexes, see Table 1). The anterior margin of segment I of the male antenna in *P. macronecti* is not so angled as in *P. circumfasciatus* (Fig. 5, 7). The sclerotisation of the female abdominal tergites is more pronounced in *P. macronecti* than in *P. circumfasciatus*, giving an overall darker, banded, appearance to the whole abdomen; this is sufficiently striking to be visible to the naked eye (Fig. 54, 55).

In *P. macronecti*, the central setae on the 8th visible sternite of the male show some variation in the number of long and short setae and in the clear areas of cuticle within which they are contained. Of 18 specimens examined (36 sides), 34 sides had 2 long and 1 short setae (Fig. 21, 53b,c); the remaining 2 sides (different individuals) had 1 long and 1 short setae (Fig. 53a). Each of the six setae is usually surrounded by its own clear area of cuticle, but in a small number of specimens, two setae were surrounded by a common clear area (Fig. 53).

In the posterior row of setae on the subgenital plate of the female, the second seta from the outside is approximately half the length of the outermost on both sides of c. 90% of the specimens examined; the remainder show this feature asymmetrically, on either left or right side.

As shown above, *P. macronecti* is morphologically closest to *P. circumfasciatus*; the distribution of the several hosts of both these species is entirely in the Southern Hemisphere (mostly circumpolar, in high latitudes). However, *P. circumfasciatus* is widespread on smaller albatrosses of the family Diomedidae, whereas *P. macronecti* is confined to members of the genus *Macronectes* of the family Procellariidae (see Table 2).

The known lice on the two species of *Macronectes* belong to the genera *Austromenopon*, *Docophoroides*, *Paraclisis*, *Saemundssonina*, and *Perineus* (see Pilgrim & Palma 1982); of these, *Austromenopon* and *Saemundssonina* include species widespread not only within the Procellariidae, but also on other orders of birds (see Pilgrim & Palma 1982), whereas species of the remaining three genera are found predominantly on members of the Diomedidae (see Palma & Pilgrim 1984, table 3).

One possibility arising from a consideration of these host-lice relationships is that *Macronectes* hosts acquired their ancestral infestations of *Docophoroides*, *Paraclisis*, and *Perineus* from diomedeid host(s); further, in *Perineus*, the close affinity of *P. macronecti* and *P. circumfasciatus* implies a relatively recent acquisition.

Alternatively, the taxonomic position of *Macronectes* might be reconsidered: the sharing of the genera *Docophoroides*, *Paraclisis*, and *Perineus* may indicate a closer relationship with the Diomedidae than is currently accepted.

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Figures 11, 24, 32, and 34 have been reprinted from *Pacific Insects* (21: 174-175) by permission of the Editor, Dr JoAnn M. Tenorio.

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