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A new species and new host records of *Austrogoniodes* (Insecta: Phthiraptera: Philopteridae) from penguins (Aves: Sphenisciformes)

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Abstract We describe and illustrate *Austrogoniodes vanalphenae*, a new species of chewing louse from the yellow-eyed penguin (*Megadyptes antipodes*) in New Zealand. We amend the key to the species of the genus *Austrogoniodes* published in 1967 by Clay to incorporate this new species. We also report the following new host records: *Austrogoniodes bifasciatus* (Piaget, 1885) from *Spheniscus humboldti*, and *A. demersus* Kéler, 1952 from *Spheniscus mendiculus*.

Keywords *Austrogoniodes*; Phthiraptera; lice; *Megadyptes*; penguins; new species; new host records; New Zealand; Chile; Galápagos Islands

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INTRODUCTION

The chewing louse genus *Austrogoniodes* Harrison, 1915 comprises 15 species that are ectoparasitic on penguins and a duck (Clay 1967, 1971). Pilgrim & Palma (1982) listed two *Austrogoniodes* species from the yellow-eyed penguin (*Megadyptes antipodes*) in New Zealand: *A. concii* (Kéler, 1952) *sensu lato* and another species at the generic level only. We studied several samples of the latter species and compared them against material belonging to its morphologically closest species: *Austrogoniodes cristati* Kéler, 1952, *A. demersus* Kéler, 1952 and *A. bifasciatus* (Piaget, 1885). We concluded that those samples represent a hitherto undescribed species and we provide a description and a name for this new taxon.

We use louse terminology as provided by Clay (1967). For the nomenclature of the penguins, we follow the checklist of the Ornithological Society of New Zealand (1990) and del Hoyo et al. (1992).

SYSTEMATICS

Family Philopteridae Burmeister, 1838

Austrogoniodes Harrison, 1915

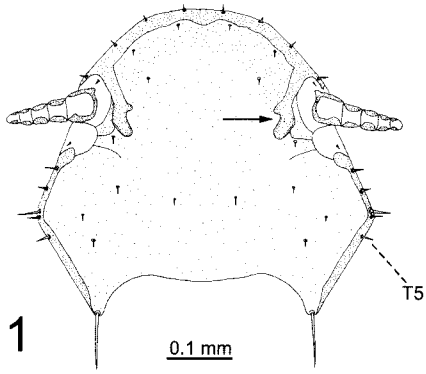
Austrogoniodes vanalphenae n. sp. (Fig. 1, 3–6, 7A, 8, 9)

Austrogoniodes sp.; Pilgrim & Palma, 1982: 4

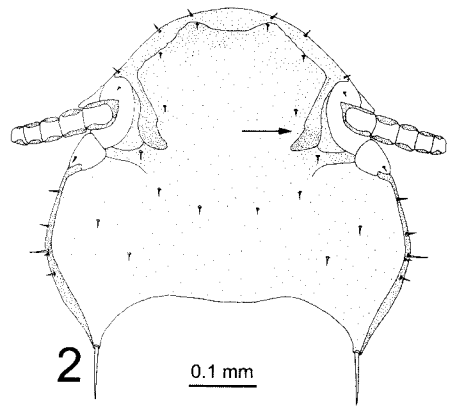
TYPE HOST: *Megadyptes antipodes* (Hombron & Jacquinot, 1841).

HOLOTYPE: ♀ in the Museum of New Zealand Te Papa Tongarewa (MONZ).

DIAGNOSIS: *Head*: shape and carinae as in Fig. 1, 2. Temple seta 5 (T5) long in males (Fig. 4) and short in females (Fig. 1). Small spine-like setae on preantennal margin and dorsal surface of head. *Thorax*: 6–8 long setae and 3–6 short spine-like setae (intercalated with long setae) on each side of posterior margin of pteronotum. *Abdomen* (Fig. 3, 6): tergal plates of segments II–VIII divided in midline, IX undivided; female vulval margin


T5
0.1 mm

1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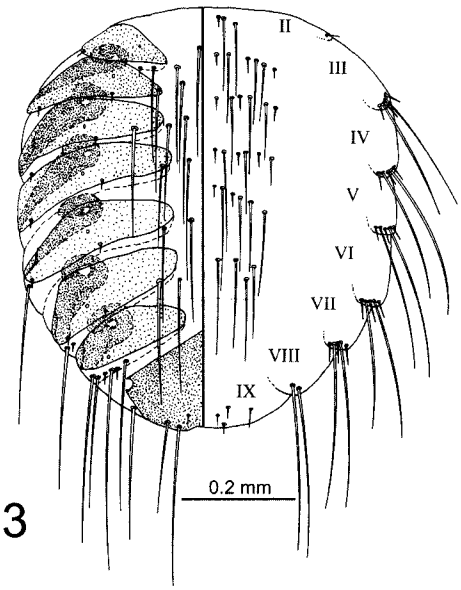
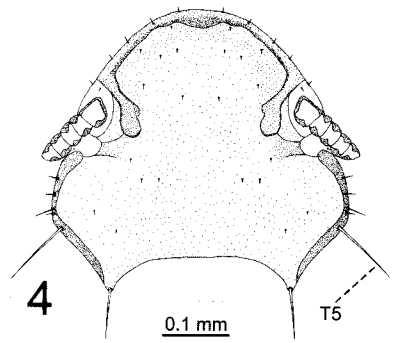
2


II
III
IV
V
VI
VII
VIII
IX
0.2 mm

3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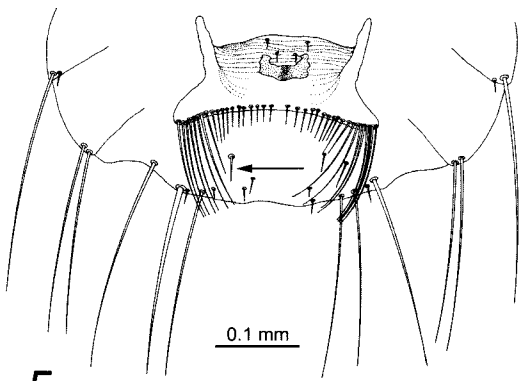
T5

4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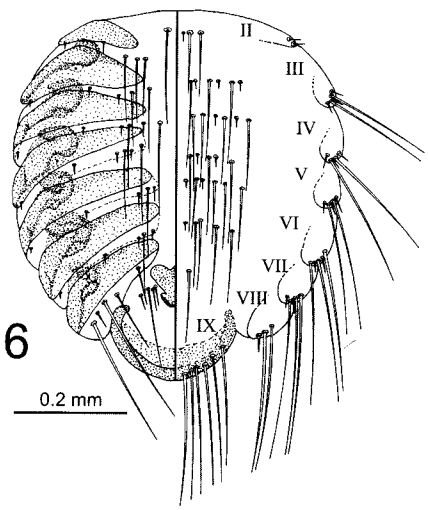
5


II
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6

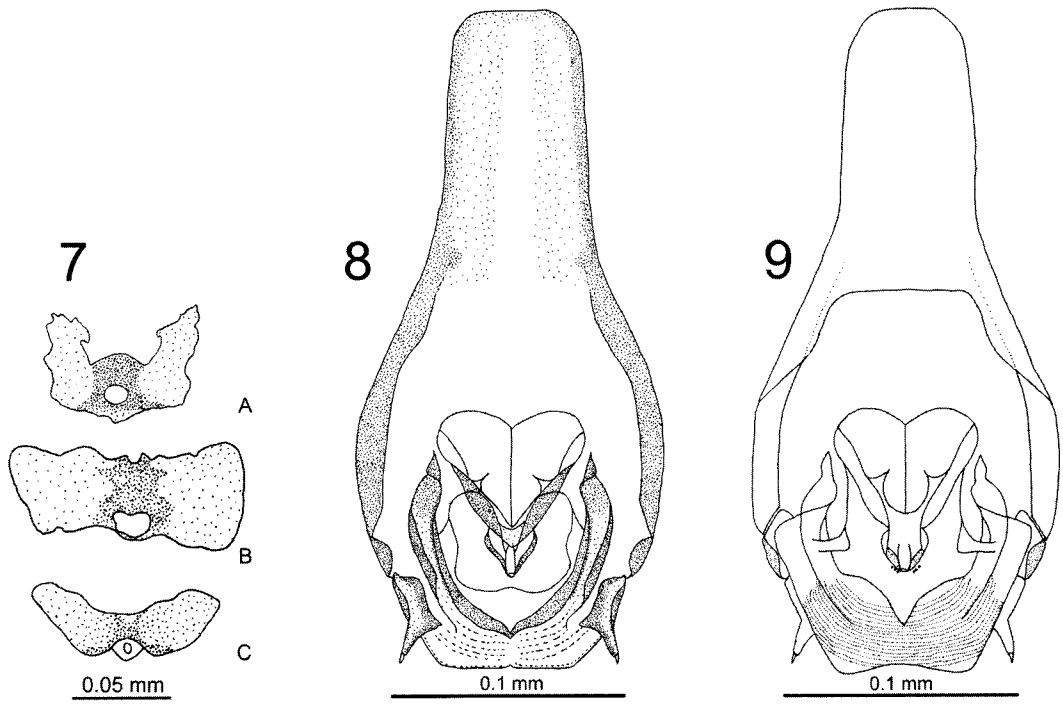

Fig. 7–9 *Austrogoniodes*. **7**, female spermathecal sclerites: **A**, *A. vanalphenae*; **B**, *A. bifasciatus* (ex *Spheniscus magellanicus*); **C**, *A. demersus* (ex *S. demersus*). Fig. 8, 9, male genitalia of *A. vanalphenae*; **8**, dorsal view; **9**, ventral view.

concave with outer setae much longer than inner setae (Fig. 5), spermathecal tube opening within spermathecal sclerite (Fig. 7A); male genitalia as in Fig. 8, 9.

Chaetotaxy of abdomen

Female: *Tergal setae*: comprise anterior, lateral and tergocentral setae (Fig. 3). *Anterior setae*: 2–3 long setae on segment II. *Lateral seta*: 1 minute, spine-like, on each side of segments II–VII. *Tergocentral setae*: 3–7 long setae on segments II–VII. *Sternal setae*: long setae intercalated by short setae, with total numbers as follows: segment II with 5 setae; III, 12–14; IV, 10–13; V, 10–13; VI, 10–11; VII, 6; VIII, 2; and IX, 3–5. Vulva with 32–38 setae, outer 6–7 setae on each side curved and much longer than inner setae. *Pleural setae* (on each side): segment II, 3–4 spine-like setae (SP); III, 3–4 SP, 2 long (L); IV, 3–4 SP, 1–2 L; V, 3–4 SP, 2 L; VI, 3–4 SP, 3 L, VII, 3–4 SP, 2–3 L; and VIII, 1–3 SP, 3 L. On segments II–VIII one spine-like pleural seta is laterodorsal and rest lateroventral; on VI–VIII, the additional long seta is laterodorsal.

Male: *Tergal setae*: comprise anterior, lateral and tergocentral setae (Fig. 6). *Anterior setae*: segment II with 2 long setae; segment IX with 2 long and 6–8 short setae. *Lateral setae*: 1–2 minute, spine-like setae on each side of segments II–VII; 5–6 long and short setae each side (total 11–12) on VIII. *Tergocentral setae*: 4–6 long setae and 1–2 medium length setae interspersed between the long setae, plus 0–2 minute setae on each side of row, on segments II–VI; 2 long and 1–2 short setae, plus 0–1 spine-like seta on each side, on VII; 2 medium length setae

◀ **Fig. 1–6** *Austrogoniodes*. **1**, *A. vanalphenae*: dorsal view of female head (arrow points to the notch in the pre-antennal node); **2**, *A. demersus* (ex *Spheniscus demersus*): dorsal view of female head (arrow points to the notch in the pre-antennal node). **3–6** *Austrogoniodes vanalphenae*; **3**, dorsal-ventral views of female abdomen (vulva omitted); **4**, dorsal view of male head; **5**, ventral view of female terminalia (arrow points to the mesoventral setae); **6**, dorsal-ventral views of male abdomen; T5, temple seta 5.

on VIII. *Sternal setae*: segment II with 5–6 setae; III, 12–14; IV, 11–13; V, 10–12; VI, 9–12; VII, 6–9; VIII, 2. *Pleural setae* (on each side): segment II, 3–4 spine-like setae (SP); III, 3–4 SP, 2 long (L); IV, 4 SP, 2 L; V, 4 SP, 2 L; VI, 4 SP, 3 L; VII, 3–4 SP, 3 L; and VIII, 2–3 SP, 3 L. Segment IX with 11–13 very long *submarginal setae* (shown on ventral side in Fig. 6).

Measurements (in mm; ranges in parentheses)

Males (n = 12): total length 1.135 (1.06–1.19); head length 0.366 (0.35–0.37); head width 0.443 (0.44–0.46); prothorax width 0.232 (0.22–0.25); pterothorax width 0.322 (0.31–0.33); abdomen length 0.614 (0.54–0.65); abdomen width 0.573 (0.52–0.61).

Females (n = 12): total length 1.384 (1.30–1.44); head length 0.408 (0.40–0.41); head width 0.502 (0.48–0.51); prothorax width 0.251 (0.25–0.26); pterothorax width 0.371 (0.35–0.38); abdomen length 0.783 (0.73–0.83); abdomen width 0.702 (0.68–0.74).

ETYMOLOGY: The species name recognises the efforts of Sonja van Alphen who assisted on, and financed, many louse collection expeditions.

MATERIAL EXAMINED: Ex *Megadyptes antipodes*: Holotype ♀, allotype ♂, paratypes 7 ♂, 2 ♀, Kaikoura, New Zealand, 26 April 1968. Other paratypes: 1 ♂, 1 ♀, Christchurch, New Zealand, 30 April 1968; 3 ♂, 5 ♀, St Clair Beach, Otago, New Zealand, 1 April 1970; 1 ♂, 1 ♀, Pareora Beach, South Canterbury, New Zealand, May 1972; 1 ♂, Ocean Island, Auckland Islands, New Zealand, 18 February 1973; 52 ♂, 47 ♀, Otaki Beach, New Zealand, 20 May 1976. All specimens deposited in the entomology collection of the Museum of New Zealand Te Papa Tongarewa. Samples collected from 1968 to 1973 are part of the R.L.C. Pilgrim Phthiraptera Collection donated to the Museum in 1985.

DISCUSSION

Among the lice known from Antarctic birds, the new species is included in the genus *Austrogoniodes* because it shares the following features: the marginal and the ventral carinae of the head are entire, the forecoxae are extended posteriorly as a pointed spine, the pteronotum lacks anterior setae, the male anogenital opening is dorsal and the female abdomen has eight apparent segments (*fide* Clay & Moreby 1967, p. 159).

Morphologically, *Austrogoniodes vanalphenae* belongs to a group of five closely related species which can be referred to as the "*bifasciatus* group". The dubious taxonomic status of one species of this group—*A. strutheus* Harrison, 1915—was discussed by Clay (1967, p. 153) and there has been no further change since that publication. Considering the remaining four species of this group, *A. vanalphenae* could be regarded as intermediate between *A. cristati* on the one hand and *A. demersus* plus *A. bifasciatus* on the other.

The male genitalia of *A. vanalphenae* (Fig. 8–9) are similar to those of *A. cristati* (Kéler 1952, p. 228, fig. 22a,b) but can be distinguished from them by the diameter of the distal end of the penis: in *A. vanalphenae* it is about half the diameter of that in *A. cristati*. Males of *A. vanalphenae* and *A. cristati* can also be separated by features of the head (see amended key below). Males of *A. vanalphenae* can be easily separated from males of both *A. bifasciatus* and *A. demersus* by features of their genitalia (see amended key below; also compare Fig. 8–9 with Kéler 1952, p. 235, fig. 28–29). Furthermore, males of *A. vanalphenae* differ from those of *A. bifasciatus* by the shape of the pre-antennal region and the thickness of the marginal carina of the head (compare Fig. 4 with Clay 1967, p. 173, fig. 26, and with Kéler 1952, p. 228, fig. 23). Males of *A. vanalphenae* can be further distinguished from those of *A. demersus* by a thinner marginal carina and a deeper notch in the pre-antennal node (compare Fig. 4 with Kéler 1952, p. 232, fig. 25).

Females of *A. vanalphenae* can be readily separated from those of *A. cristati* by the length of temple seta 5 (short in *A. vanalphenae*, T5 in Fig. 1), and by the greater number and length of vulval lateral setae (compare Fig. 5 with Clay 1967, p. 176, fig. 48). Females of *A. vanalphenae* differ from those of *A. bifasciatus* by the shape of the pre-antennal region and the thickness of the marginal carina of the head (compare Fig. 1 with Clay 1967, p. 173, fig. 26 and with Kéler 1952, p. 232, fig. 24).

Females of *A. vanalphenae* are morphologically closest to those of *A. demersus*, but they can be separated by the following combination of characters: pre-antennal node with a deeper notch in *A. vanalphenae* (Fig. 1) than in *A. demersus* (Fig. 2); a less convex anterior margin with a thinner marginal carina in the head of *A. vanalphenae* (Fig. 1) than in *A. demersus* (Fig. 2); shorter mesoventral setae in the terminalia of *A. vanalphenae* (mean 0.039 mm; range 0.029–0.054 mm) (Fig. 5) than in *A. demersus*

(mean 0.090 mm; range 0.059–0.173 mm); shape of spermathecal sclerites as in Fig. 7A (*A. vanalphenae*) and 7C (*A. demersus*).

Partial DNA sequences (JCB unpubl. data) of the cytochrome oxidase subunit I gene (GenBank accession numbers AF491754–AF491758) indicate that *A. vanalphenae* differs from *A. cristati* by 14%, from *A. bifasciatus* by 16%, and from *A. demersus* by 17%. *A. bifasciatus* differs from *A. demersus* by 7% for the same region. However, the phylogenetic position of *A. vanalphenae* within the genus *Austrogoniodes* and the "*bifasciatus* group" awaits further analysis.

The geographical distribution of *A. vanalphenae* is likely to reflect the distribution of its host within the New Zealand subregion, viz. South Island, Stewart Island, Auckland Island and Campbell Island (del Hoyo et al. 1992, p. 158).

AMENDMENTS TO CLAY'S (1967) KEY TO THE SPECIES OF *AUSTROGONIODES*

Clay's (1967) key is divided into a key to males and one to females. References to figures in the keys below are as follows: Fig. 1–9 from this paper; fig. 25, 26, 42, 43 from Clay (1967).

Males

In Clay's key to males, *A. vanalphenae* keys to couplet 9, having the genitalia with 2 medianly fused bladder-like lobes anterior to penis. Then, *A. vanalphenae* would key out to *A. cristati* by having the endomeral plate with distinct fine dentation and the penis distally blunt. The amended key to males—for ensuing couplets—should now read:

9 (8) Endomeral plate with distinct fine dentation; penis distally blunt (Fig. 8, Clay, fig. 42) 10
Endomeral plate without distinct fine dentation; penis distally pointed (Clay, fig. 43) 11

10 (9) Shape of pre-antennal region and marginal carina of head as in Clay, fig. 26. Genitalia as in Clay, fig. 42 ..... *cristati*
Shape of pre-antennal region and marginal carina of head as in Fig. 4. Genitalia as in Fig. 8, 9 ... . *vanalphenae*

11 (9) Shape of pre-antennal region and marginal carina of head as in Clay, fig. 26 ..... *bifasciatus*
Shape of pre-antennal region and marginal carina of head as in Fig. 2 and Clay, fig. 25 *demersus*

Females

In Clay's key to females, *A. vanalphenae* keys to couplet 10, having the dorsum of the pre-antennal region without a toothlike projection, the temple seta 5 short, and the vulval margin concave with many long curved lateral setae. Then, *A. vanalphenae* would key out to *A. demersus* by having the shape of the pre-antennal region of the head similar to the latter species. The amended key to females—for ensuing couplets—should now read:

10 (9) Shape of pre-antennal region and marginal carina of head as in Clay, fig. 26 ..... *bifasciatus*
Shape of pre-antennal region and marginal carina of head as in Fig. 1, 2 and Clay, fig. 25 11

11 (10) Shape of marginal carina and pre-antennal node of head as in Fig. 2 and Clay, fig. 25. Spermathecal sclerite as in Fig. 7C. Mesoventral setae of last segment ..... *demersus*
Shape of marginal carina and pre-antennal node of head as in Fig. 1. Spermathecal sclerite as in Fig. 7A. Mesoventral setae of last segment short (Fig. 5) ..... *vanalphenae*

NEW HOST–LOUSE RECORDS

Austrogoniodes bifasciatus (Piaget, 1885) from *Spheniscus humboldti* Meyen, 1834

Since its original description, *Austrogoniodes bifasciatus* has been known as a regular parasite of Magellanic penguins (*Spheniscus magellanicus* (Forster, 1781)). Clay (1967, p. 154) listed *A. bifasciatus* from an Adélie penguin (*Pygoscelis adeliae* (Hombron & Jacquinot, 1841)), but we regard that host–louse association as the result of straggling or contamination from *S. magellanicus*. On 9 September 2000, JCB collected 11 males, 12 females, and 18 nymphs of a species of chewing louse from four dead Humboldt penguins (*Spheniscus humboldti*) stored in the freezer of the Universidad Católica del Norte, Coquimbo, Chile. The four birds had been found dead on the coast of Coquimbo on

various dates, and had not been in contact with any specimen of *S. magellanicus* or with any other penguin species, after they were collected. We identified the adult lice as *A. bifasciatus* based on morphological characters and on partial sequences of the 12S and cytochrome oxidase I gene regions (JCB unpubl. data). The nymphs were identified by association with the adults. Four males and three females were slide-mounted following the technique described by Palma (1978) and have been deposited as voucher specimens in the entomology collection of MONZ.

Austrogoniodes demersus Kéler, 1952 from *Spheniscus mendiculus* Sundevall, 1871

Since its original description, *Austrogoniodes demersus* has been known as a regular parasite of Jackass penguins (*Spheniscus demersus* (Linnaeus, 1758)). Clay (1967, p. 155) listed *A. demersus* from a Macaroni penguin (*Eudyptes chrysolophus* (Brandt, 1837)) and from a Magellanic penguin but, as the lice had been collected from birds kept in a zoological garden, she regarded those host–louse associations as the result of straggling or contaminations from *S. demersus*. We agree with Clay's conclusion. In April and May 1992, RLP collected 225 males, 195 females, and 115 nymphs of a species of chewing louse from five Galápagos penguins (*Spheniscus mendiculus*) captured alive on Rábida and Isabela Islands, in the Galápagos Archipelago, and subsequently released. We identified the adults as *A. demersus* based on morphological characters. The nymphs were identified by association with the adults. A sample comprising 58 males and 55 females was slide-mounted following the technique described by Palma (1978) and has been deposited in the entomology collection of MONZ for voucher purposes.

OTHER MATERIAL EXAMINED: *Austrogoniodes bifasciatus* from *S. magellanicus*: 3 ♂, 2 ♀, Isla Hornos, Chile, 22 January 1985; 2 ♀, Gypsy Cove, East Falkland Island, Falkland Is, 15 February 1987; 1 ♂, Sea Lion Island, Falkland Is, 26 September 2000 (all in MONZ).

Austrogoniodes demersus from *S. demersus*: 3 ♂, 1 ♀, South Africa, February 1937; 6 ♂, 4 ♀, Dassen Island, South Africa, 15 August 1983; 5 ♂, 4 ♀, Dyer Island, Cape Province, South Africa, 5 November 1985 (all in MONZ).

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