

A new species of the genus *Anatoecus* (Phthiraptera: Philopteridae) from the black swan, *Cygnus atratus*

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A new species of louse, *Anatoecus singhi*, is described and illustrated from specimens collected from black swans, *Cygnus atratus*, in New Zealand. The shape of the head places *A. singhi* in a group with three other species exclusively parasitic on swans (*Cygnus* spp.). A list of the species/subspecies of *Anatoecus* recorded from swans worldwide is also included.

Keywords: *Anatoecus*; black swan; *Cygnus atratus*; lice; new species; New Zealand; Philopteridae

Introduction

The genus *Anatoecus* Cummings, 1916 includes oval-bodied chewing lice of small size (adult total length 1.2–2 mm) found regularly on the head and neck of ducks, geese, swans (Anseriformes) and flamingos (Phoenicopteriformes) worldwide (Price et al. 2003: 144).

The New Zealand bird fauna includes two species of swan introduced by human agency: the mute swan, *Cygnus olor* (Gmelin, 1789), and the black swan, *Cygnus atratus* (Latham, 1790) (Checklist Committee 2010: 32). The species of *Anatoecus* recorded from these swans in this country were listed by Pilgrim and Palma (1982: 16), who recognised three species/subspecies of *Anatoecus* living on black swans: *Anatoecus dentatus magnicornutus* Złotorzycka, 1970, *Anatoecus icterodes oloris* Złotorzycka, 1970 and an undetermined species, whereas only *A. icterodes oloris* was recorded from the mute swan.

Three other *Anatoecus* species have been described from swans outside New Zealand: *Anatoecus cygni* (Denny, 1842), *Anatoecus musicus* Eichler, 1947 and *Anatoecus penicillatus* Kéler, 1960.

The main purpose of this paper is to describe and name the undetermined taxon listed under *Cygnus atratus* as '*Anatoecus* sp.' by Pilgrim and Palma (1982) and by Murray et al. (1990) from New Zealand. Although the list by Murray et al. (1990) includes both Australian and New Zealand records, the entry for *Anatoecus* sp. on page 1374 refers to New Zealand only, because no material of the new species is available from Australia.

In addition, a list of the species/subspecies of *Anatoecus* recorded from swans worldwide is included.

Systematics

Order Phthiraptera Haeckel, 1896

Suborder Ischnocera Kellogg, 1896

Family Philopteridae Burmeister, 1838

Genus *Anatoecus* Cummings, 1916

***Anatoecus singhi* sp. nov.**

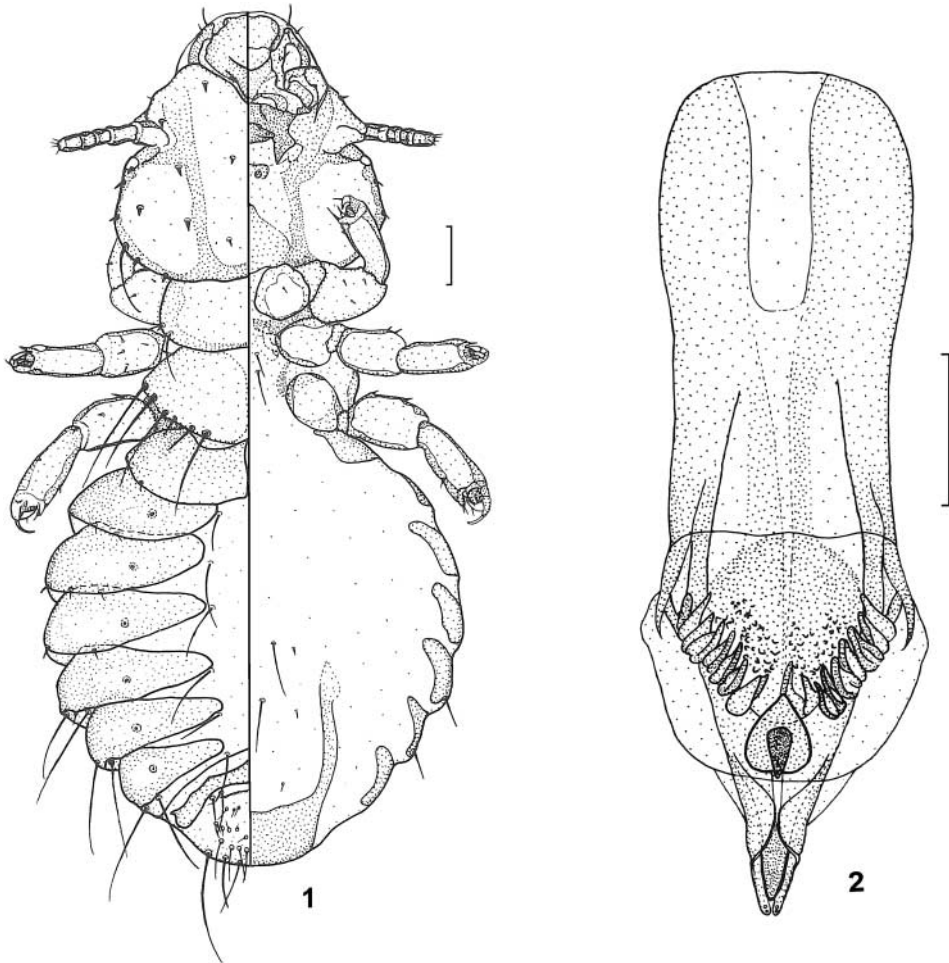
Anatoecus sp.; Pilgrim and Palma, 1982: 16.

Anatoecus sp.; Murray et al., 1990: 1374.

Type host: *Cygnus atratus* (Latham, 1790)

Type locality: Lake Whangape, Waikato, New Zealand.

Holotype: ♂ in the entomological collection of the Museum of New Zealand Te Papa Tongarewa (MONZ).



Figures 1–2. *Anatoecus singhi*. 1. Dorsal view (left side) and ventral view (right side) of male. 2. Male genitalia. Scales = 0.1 mm. (Redrawn from Singh 1970: plate 30, with permission.)



Figures 3–4. *Anatoecus singhi*. 3. Habitus of holotype male (total length 1.46 mm). 4. Habitus of paratype female (AI.015332; total length 1.68 mm).

Description

Male as in Figures 1, 3; female as in Figure 4. Clypeal signature as long as wide. Male genitalia as in Figure 2, with a wide, sub-oval effractor and a comb of 18 to 20 teeth of same length. Female abdominal tergite IX as in Figure 4.

Measurements: in mm (averages; ranges within parentheses).

Males ($n = 15$): Head width 0.45 (0.43–0.46); head length 0.44 (0.43–0.47); total length 1.45 (1.40–1.48); length of genitalia 0.51 (0.48–0.53).

Females ($n = 15$): Head width 0.48 (0.47–0.50); head length 0.48 (0.47–0.50); total length 1.67 (1.60–1.70).

Diagnosis

A feature shared by all *Anatoecus* taxa exclusively parasitic on swans, i.e. *A. cygni* spp., *A. penicillatus*, *A. musicus* and *A. singhi* – is the shape of the head with a reduced, shorter clypeal signature and a thin hyaline margin (see Cummings 1916: fig. 9; Eichler 1947: fig. 1; Złotorzycka 1970: figs 51, 52, photo 12; this paper: Figures 1, 3, 4).

Anatoecus singhi is characterised by a combination of head features, the male genitalia and the female terminalia. The shape of the head, in particular the anterior region having a shorter clypeal signature and a reduced hyaline margin, clearly distinguishes both sexes of *A. singhi* from those of all species and subspecies of the *A. icterodes* and *A. dentatus* complexes (compare Figure 1 with Kéler 1960: figs 20–30). In addition, the male genitalia of *A. singhi* differ from those of *A. icterodes* spp. by having an effractor and a comb of teeth, and from those of *A. dentatus* spp. by the shape of the effractor and the number and size of the teeth.

Males of *A. singhi* differ from male *A. cygni* by the shape of the head (compare Figures 1, 3 with Złotorzycka 1970: photo 12), and by having a well-developed effractor with teeth in the genitalia (Figure 2), which is not present in *A. cygni* (see Cummings 1916: fig. 11.2). They also differ from males of *A. penicillatus* by having very different type of teeth in the genitalia (compare Figure 2 with Kéler 1960: fig. 8 and with Złotorzycka 1970: fig. 49).

Females of *A. singhi* differ from those of *A. cygni* and *A. penicillatus* by the shape of the clypeal signature (compare Figure 4 with Cummings 1916: fig. 9, and with Złotorzycka 1970: figs 51, 52), and by the shape of abdominal tergite IX.

Both sexes of *A. singhi* differ from *A. musicus* by having a longer clypeal signature (compare Figure 1 with Eichler 1947: fig. 1), and the male by having an effractor and larger teeth in the genitalia (compare Figure 2 with Eichler 1947: fig. 2).

Etymology

The species epithet is a noun in the genitive case honouring Mr Gurchan Singh (Malaysia), who discovered the new species during the 1960s, while researching the louse fauna of New Zealand Anatidae for his Master of Science degree at Victoria University of Wellington (Singh 1970: 148).

Material examined

All samples are from *Cygnus atratus* and from New Zealand, and are deposited in MONZ. Registration numbers are given in parentheses.

Type series: Holotype: ♂, Lake Whangape, Waikato, Jun. 1978, Wildlife Service (AI.022065). Paratypes: 6♂, 7♀, same data as for the holotype (AI.015331–2); 9♂, 7♀, Tiki Tiki Arm, Lake Whangape, Waikato, 8 Jun. 1977, I. McFadden (AI.015327).

Additional material: ♀, Lake Rotorua, 29 Sep. 1964, G. Singh (AI.015318); 1♂, 2♀, Karaka, 3 Nov. 1964, G. Singh (AI.015319); 3♀, Lake Rotorua, 17 Feb. 1965, G. Singh (AI.015320); 4♂, 1♀, Christchurch, May 1965, R.L.C. Pilgrim (AI.015321); 1♂, Lake Rotorua, 29 Aug. 1965, G. Singh (AI.015322); 1♂, 3♀, Lake Ellesmere, 7 May 1967, P. Lummis (AI.015323); 2♂, 5♀, Woodend, 31 Oct. 1969, N. Rose (AI.015324); 2♀, Lake Wairarapa, 3 May 1970, J. Tenquist (AI.015325); 1♀, Marlborough, 1976 (AI.015326); 1♀, Lake Whangape, Waikato, 22 Sep. 1977, I. McFadden (AI.015328); 2♀, Lake Wairarapa, 9 May 1978, B. Wrigley (AI.015329); 4♂, 1♀, Lake Waikare, Waikato, Jun. 1978, Wildlife Service (AI.015330).

Discussion

Both the concept of *Anatoecus* and the number of species and subspecies included in this genus have been contentious. For example, Kéler (1960) subdivided this taxon into three genera containing seven species and over 30 subspecies from all hosts worldwide. Złotorzycka (1970) recognised one genus, two subgenera, five species and over 45

List of species of *Anatoecus* recorded from swans

Scientific and vernacular names of birds and their sequence follow Dickinson & Remsen (2013: 9). References to host-louse records published after the original descriptions have been added.

<i>Cygnus melancoryphus</i> (Molina, 1782)*	Black-necked swan
<i>Anatoecus icterodes</i> (Nitzsch 1818); González-Acuña et al. (2010: 63).	
<i>Anatoecus penicillatus</i> Kéler, 1960; González-Acuña et al. (2010: 63).	
<i>Cygnus atratus</i> (Latham, 1790)	Black swan
<i>Anatoecus dentatus magnicornutus</i> Złotorzycka, 1970; Pilgrim and Palma, (1982: 16).	
<i>Anatoecus icterodes oloris</i> Złotorzycka, 1970; Pilgrim and Palma, (1982: 16).	
<i>Anatoecus singhi</i> Palma, 2015; this paper.	
<i>Cygnus olor</i> (J.F. Gmelin, 1789)	Mute swan
<i>Anatoecus dentatus magnicornutus</i> Złotorzycka, 1970.	
<i>Anatoecus icterodes oloris</i> Złotorzycka, 1970; Pilgrim and Palma (1982: 16).	
<i>Anatoecus penicillatus</i> Kéler, 1960; Złotorzycka (1970: 52).	
<i>Cygnus buccinator</i> Richardson, 1832	Trumpeter swan
<i>Anatoecus cygni cygni</i> (Denny, 1842); Kéler (1960: 232).	
<i>Cygnus columbianus columbianus</i> (Ord, 1815)	Tundra swan
<i>Anatoecus cygni emersoni</i> Kéler, 1960.	
<i>Cygnus columbianus bewickii</i> Yarrell, 1830**	Tundra swan
<i>Anatoecus cygni cygni</i> (Denny, 1842); Kéler (1960: 229).	
<i>Cygnus cygnus</i> (Linnaeus, 1758)	Whooper swan
<i>Anatoecus cygni bracteatus</i> Kéler, 1960; Złotorzycka (1970: 55, photo 12).	
<i>Anatoecus musicus</i> Eichler, 1947; Kéler (1960: 229).	

*Two records of *Anatoecus keymeri* Clay, 1974 from *Cygnus melancoryphus* in González-Acuña et al. (2010: 63) are most likely the result of (1) contamination in a zoological garden and (2) an instance of natural straggling in a lagoon where flamingos (the original hosts of *A. keymeri*) and black-necked swans have been recorded (Weller 1968).

**Two records, one of *Anatoecus cygni bracteatus* and one of *Anatoecus penicillatus* ? [sic], both from *Cygnus columbianus bewickii* in Kéler (1960: 231–232, respectively) are likely to be the result of contaminations from other swan taxa, considering that the two samples originated from birds captive in zoological gardens (Złotorzycka 1970: 57–58, respectively).

subspecies for the Central European anseriform fauna only. The most recent world checklist by Price et al. (2003: 144) listed 10 valid species only, regarded all subspecies as junior synonyms, and placed them all under a single genus for all hosts worldwide.

Five species of *Anatoecus* have been recorded as parasitic on swans (genus *Cygnus* Bechstein, 1803): *A. dentatus* (Scopoli, 1763), *A. icterodes* (Nitzsch, 1818), *A. cygni*, *A. musicus* and *A. penicillatus*, but there is disagreement with regard to their validity and subspecific subdivision. Kéler (1960: 227) recognised *A. musicus* as valid and divided *A. cygni* into three subspecies. Złotorzycka (1970: 56) doubted the validity of *A. musicus*, and recognised subspecies within *A. dentatus*, *A. icterodes* and *A. cygni*. However, Price et al. (2003: 144) did not recognise any subspecies as valid and regarded *A. musicus* as a junior synonym of *A. cygni*.

In my opinion, the concept of subspecies is useful in some louse genera to distinguish taxonomically louse populations from related host taxa showing subtle but consistent differences, such as the subspecies of *Quadraceps ornatus* (Grube, 1851) and *Quadraceps punctatus* (Burmeister, 1838) parasitising gulls (see Price et al. 2003: 226). Regarding the species of *Anatoecus* parasitic on swans, I agree with Kéler (1960) and Złotorzycka (1970) in subdividing *A. dentatus*, *A. icterodes* and *A. cygni* into subspecies.

The black swan and the mute swan are unusual among swans in that they are parasitised by three species/subspecies of *Anatoecus*. In contrast, other *Cygnus* species/subspecies have only one or two *Anatoecus* species recorded from them (see 'List of species' below), but potentially more species may be found through further collecting.

Kéler (1960: 221) included a line reading: '*Chenopsis* [sic] *atrata* . . . *cygni*' in a list of anseriform hosts and the *Anatoecus* species recorded from them. The name '*Chenopsis atrata*' is a synonym of *Cygnus atratus* (Checklist Committee 2010: 32). My detailed search of Kéler's (1960) publication failed to find additional information to justify that host–louse association, either published by other authors or from the examination of specimens by Kéler himself. The only logical conclusion is that the citation by Kéler (1960: 221) of *A. cygni* from *Cygnus atratus* is an inadvertent error.

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