Chewing lice (Phthiraptera: Amblycera, Ischnocera) from Red Sea gulls with new host-parasite records

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Abstract

Knowledge about chewing lice from marine birds of the Red Sea is minimal. Five species of gulls were examined for chewing lice in three different localities of the Saudi Arabian Red Sea coast. Two gull species were examined for lice for the first time (Larus armenicus Buturlin, 1934 and Larus michahellis Naumann, 1840) and their lice represent new host-louse associations. Four species and two subspecies of lice were identified from 159 specimens collected. Actornithophilus piceus lari (Packard, 1870) and Austromenopon transversum (Denny, 1842) (suborder: Amblycera), and Quadraceps punctatus (Burmeister, 1838) and Saemundssonia lari (O. Fabricius, 1780) (suborder: Ischnocera) were recorded for the first time from Saudi Arabia and Red Sea birds. Taxonomic and ecological notes, type hosts, data on specimens examined, collecting localities, an identification key, and photographs of each species and subspecies are given.

Key words: chewing lice, Phthiraptera, Amblycera, Actornithophilus, Austromenopon, Ischnocera, Saemundssonia, Quadraceps, Red Sea, Saudi Arabia, gulls, new host-parasite records

Introduction

Ectoparasites from Middle East marine birds are poorly known, especially those from the Red Sea (Negm et al. 2013). Among them, chewing lice are one of the most diverse parasites of avian hosts, with over 4,000 species recognized as valid worldwide (Price et al. 2003: 3). There are few available publications dealing with chewing lice associated with birds in the Middle East especially for marine species, e.g. Hafez and Madbouly (1966, 1968a,b), Abu Yaman (1978), Aldryhim (1991), Taula & Hussain (1999), El-Ahmed et al (2012).

Gulls (Charadriiformes: Laridae) are relatively well-known marine birds around the world, and are known for their opportunistic feeding habits and long life span (Anonymous 2008; Martin 2004: 249). There are 11 species and one subspecies of gulls reported from the Red Sea (Table 1). Most of these species have affinities with the Mediterranean Sea and the Indian Ocean, while the white-eyed gull is the only endemic species (Shobrak et al. 2003: iii; Porter & Aspinall 2010: 144). The Red Sea is the main passage for many European gulls species migrating to their winter ranges in Africa. Gulls are ground-nesting birds, and during the breeding seasons they constitute multispecies colonies on remote islands and rocky cliffs on the sea shore (Welty & Baptista 1990). Most gulls have a shared niche not only during the breeding season but also through their entire life (Fig. 1).

There are several species in four genera of chewing lice known to infest gulls. The genera are: Actornithophilus and Austromenopon in the suborder Amblycera, and Quadraceps and Saemundssonia in the suborder Ischnocera. Some publications dealing with these lice from gulls are: Timmermann (1949a,b; 1951; 1952a,b; 1954), Clay (1959; 1962), Broek (1967), Lafuente et al. (2000), and González-Acuña et al. (2006; 2011). However, no lice had been previously recorded on gulls from the Red Sea. Therefore, the aim of this work was to collect and identify lice from gulls from this area for the first time, and to publish the results including their taxonomy, host-parasite records, illustrations, and an identification key to the genera and species.
<table>
<thead>
<tr>
<th>Gull common name</th>
<th>Gull scientific name</th>
<th>Species of chewing lice</th>
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<tr>
<td>White-eyed gull</td>
<td><em>Ichthyaeus leucophthalmus</em> (Temminck, 1825)</td>
<td><em>Actornithophilus piceus lari</em> (Packard, 1870) <strong>&lt;br&gt;<em>Quadraceps punctatus clayae</em> Timmermann, 1952</strong>&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Sooty gull</td>
<td><em>Ichthyaeus hemprichii</em> (Bruch, 1853)</td>
<td><em>Actornithophilus piceus lari</em> (Packard, 1870) <strong>&lt;br&gt;<em>Quadraceps punctatus clayae</em> Timmermann, 1952</strong>&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Common black-headed gull</td>
<td><em>Chroicocephalus ridibundus</em> (Linnaeus, 1766)</td>
<td><em>Actornithophilus piceus lari</em> (Packard, 1870) **&lt;br&gt;<em>Austromenopon transversum</em> (Denny, 1842) **&lt;br&gt;<em>Quadraceps punctatus punctatus</em> (Burmeister, 1838) **&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Slender-billed gull</td>
<td><em>Chroicocephalus genei</em> (Brême, 1839)</td>
<td><em>Actornithophilus piceus lari</em> (Packard, 1870) **&lt;br&gt;<em>Quadraceps punctatus pallidus</em> Timmermann, 1952 **&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Great black headed gull</td>
<td><em>Ichthyaeus ichthyaeus</em> (Pallas, 1773)</td>
<td><em>Quadraceps punctatus punctatus</em> (Burmeister, 1838) **</td>
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<td>Herring gull</td>
<td><em>Larus argentatus</em> Pontoppidan, 1763</td>
<td><em>Actornithophilus piceus lari</em> (Packard, 1870) **&lt;br&gt;<em>Austromenopon transversum</em> (Denny, 1842) <strong>&lt;br&gt;<em>Quadraceps punctatus regressus</em> Timmermann, 1952</strong>&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Yellow-legged gull</td>
<td><em>Larus michahellis</em> Naumann, 1840</td>
<td><em>Actornithophilus piceus lari</em> (Packard, 1870) **&lt;br&gt;<em>Austromenopon transversum</em> (Denny, 1842) **&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Armenian gull</td>
<td><em>Larus armenicus</em> Buturlin, 1934</td>
<td><em>Austromenopon transversum</em> (Denny, 1842) <strong>&lt;br&gt;<em>Quadraceps punctatus regressus</em> Timmermann, 1952</strong>&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Caspian gull</td>
<td><em>Larus cachinnans</em> Pallas, 1811</td>
<td>No records</td>
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<td>Heuglin's gull</td>
<td><em>Larus heuglini</em> Bree, 1876</td>
<td>No records</td>
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<td>Baltic gull</td>
<td><em>Larus fuscus fuscus</em> Linnaeus, 1758</td>
<td><em>Actornithophilus piceus lari</em> (Packard, 1870) **&lt;br&gt;<em>Austromenopon transversum</em> (Denny, 1842) **&lt;br&gt;<em>Quadraceps punctatus regressus</em> Timmermann, 1952 **&lt;br&gt;<em>Saemundssonia lari</em> (O. Fabricius, 1780) **</td>
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<td>Steppe gull</td>
<td><em>Larus fuscus barabensis</em> Johansen, 1960</td>
<td>No records</td>
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**FIGURE 1.** Shared colonies of gulls: **a,** Baltic gull, herring gull and yellow-legged gull; **b,** Armenian gull, sooty gull and white-eyed Gull.
Material and methods

Five species of gulls were examined along the Red sea coast of Saudi Arabia (Fig. 2). The birds were trapped alive using standard mist nets or found with broken wings on the ground in the study areas. Examined birds were released in the same place of capture and handled under permission of the Saudi Wildlife Committee. Collection sites included the northern islands near the coast of Tabuk “Umm Al-Malik Island”, the coasts of Jeddah and Jazan, and the Jazan fish market. Lice were collected with forceps, through visual examination of the birds. All samples were preserved on 96% alcohol. All the specimens collected divided into two groups, some samples were mounted on microscopic slides, while other samples were preserved at -20°C for further molecular investigation. Lice were cleared using concentrated lactic acid, then they were passed through different concentration of alcohols, and finally slide-mounted using Puri’s Medium.

All the birds were identified using bird catalogues and field guides for the Middle East (Cottridge 2006; Porter & Aspinall 2010), and through personal communication with some European ornithologists. Lice were identified using Ferris (1916), Timmerman (1952a), Clay (1959), Clay (1962), Bei-Bienko (1964), and Lafuente et. al. (2000), and photographed with a Panasonic Lumix FT2 camera 14 mp fixed on a Nikon microscope eclipse 80i. The photos were edited using Adobe Photoshop Lightroom version 4 to produce high quality clear images. Line drawings were made with the aid of Photo to Sketch version 4 to maintain the original proportions of the objects. Field photos were taken using Canon Sx50 Hs and Nikon d5200 cameras. The diagrammatic map of collection sites was produced using DIVA GIS free software.

All louse specimens are deposited in the collection of the King Saud University Museum of Arthropods (KSMA).

Results

The following numbers and species of gulls were captured alive in four different localities along the Saudi Arabian coast of the Red Sea (Fig. 2): one Armenian gull (Larus armenicus Buturlin, 1934); one yellow-legged gull (Larus
michahellis Naumann, 1840); one herring gull (Larus argentatus Pontoppidan, 1763); two sooty gulls (Ichthyaetus hemprichii (Bruch, 1853)); and three white-eyed gull (Ichthyaetus leucophthalmus (Temminck, 1825)). One hundred and fifty nine chewing lice belonging to four genera, four species and two subspecies were collected and identified from those eight gulls, all being new species records for the Saudi Arabia louse fauna.

Suborder: Amblycera

Family: Menoponidae

*Actornithophilus piceus lari* (Packard, 1870)
(Figs 3a, 4a)

*Colpocephalum lari* Packard, 1870: 96, pl. 1, fig. 1.

*Actornithophilus piceus lari* (Packard, 1870); Price *et al.* 2003: 84.

**Type host:** *Larus marinus* Linnaeus, 1758—Great black-backed gull.

**Material examined** (n = 14). Ex *Larus argentatus* Pontoppidan, 1763: 2♂, 4♀, 1 Nymph (N), Jazan Fish Market (16°54′12″N, 42°32′40″E), 24 Nov. 2012.

Ex *Larus michahellis* Naumann, 1840: 3♂, 3♀, 1N, Jazan Coast (16°56′22″N, 42°32′35″E), 12 Dec. 2013.

**Remarks.** Species of the genus *Actornithophilus* are exclusively parasitic on members of the order Charadriiformes (Price *et al.* 2003: 82). The best available revision of this genus is by Clay (1962). Specimens of *Actornithophilus* are usually found on wing feathers, and characterized by a “trilobed” head with conspicuous preocular slits. *Actornithophilus piceus* (Denny, 1842) infests birds of the families Laridae and Sterniidae, but the subspecies *A. piceus lari* (Figs 3a, 4a) is found only on gulls (Laridae). This species is characterized by: one very short seta on the labial palp base; a single seta on the mesosternal plate; latero-ventral seta of third tibia very fine and thin; and abdomen distally with two long seta arising from the last abdominal tergum. This is the first record of *A. piceus lari* from the yellow-legged gull (*Larus michahellis*).

*Austromenopon transversum* (Denny, 1842)
(Figs 3b, 4b)

*Menopon transversum* Denny, 1842: 201, 226, pl. 21, fig. 7.

*Austromenopon transversum* (Denny, 1842); Price *et al.* 2003: 93.

**Type host:** *Rissa tridactyla* (Linnaeus, 1758)—Black-legged kittiwake.

**Material examined** (n = 47). Ex *Larus argentatus* Pontoppidan, 1763: 5♂, 11♀, 3N, Jazan Fish Market (16°54′12″N, 42°32′40″E), 24 Nov. 2012.

Ex *Larus armenicus* Buturlin, 1934: 4♂, 6♀, 1N, Jazan Fish Market (16°54′9″N, 42°32′40″E), 23 Nov. 2012.

Ex *Larus michahellis* Naumann, 1840: 4♂, 7♀, 6N, Jazan Coast (16°56′22″N, 42°32′35″E), 12 Dec. 2013.

**Remarks:** Species of the genus *Austromenopon* are parasitic on members of three bird orders, including Charadriiformes (Price *et al.* 2003: 90). The best available revision of the species from Charadriiformes is by Clay (1959). Specimens of *Austromenopon* are usually found on body feathers and near the host skin. *Austromenopon transversum* (Figs 3b, 4b) is the species which parasitizes most species of gulls in different parts of the world (Price *et al.* 2003: 93). Some of our specimens were found with the abdomen full of host blood. This species is characterized by: a reduction of the epipharyngeal pestle and hypopharyngial sclerites; the marginal prothoracic seta long, which may exceed the thoracic segments; and very long mesothoracic seta. These are the first records of *A. transversum* from the Armenian (*Larus armenicus*) and the yellow-legged gulls (*Larus michahellis*).
FIGURE 3. a, male Actornithophilus piceus lari; b, male Austromenopon transversum; c, male Quadraceps punctatus clayae; d, male Quadraceps punctatus regressus; e, male Saemundssonia lari; f, female Saemundssonia lari.
FIGURE 4. a, male genitalia *Actornithophilus piceus lari*; b, prothorax *Austromenopon transversum*; c, male genitalia *Quadraceps punctatus*; d, male genitalia *Saemundssonia lari*. Prothorax pigmentation: e, *Quadraceps punctatus pallidus*; f, *Quadraceps punctatus clayae*; g, *Quadraceps punctatus regressus*.

**Suborder: Ischnocera**

**Family: Philopteridae**

*Quadraceps punctatus clayae* Timmermann, 1952
(Figs 3c, 4f)

*Quadraceps punctatus clayi* [sic] Timmermann, 1952a: 212, fig. 2b.
*Quadraceps punctatus clayae* Timmermann, 1952; Price *et al.* 2003: 226.

**Type host:** *Ichthyaetus hemprichii* (Bruch, 1853)—Sooty gull.


Remarks. Species of the genus Quadraceps are exclusively parasitic on members of the order Charadriiformes (Price et al. 2003: 222). Quadraceps punctatus (Burmeister, 1838) is a well-known species recorded from almost all species of gulls (Price et al. 2003: 226). It is characterized by: a delicate and elongated white body with black spots; head longer than wide; generally colourless male genitalia with broad and sharply bent parameres (Fig. 4c). Based on the gradation in size, shape and distribution of the black spots, Timmermann (1952a) recognized and described eight subspecies within Q. punctatus, from the palest to the darkest form. Quadraceps punctatus clayae is one of the darkly pigmented subspecies (Fig. 3c), characterized by the prothorax with connected spots (Fig. 4f), and the female first abdominal tergal plate not pigmented.

Quadraceps punctatus regressus Timmermann, 1952
(Figs 3d, 4g)

Quadraceps punctatus regressus Timmermann, 1952a: 215.

Type host. Larus argentatus Pontoppidan, 1763—Herring gull

Material examined (n = 4). Ex Larus argentatus Pontoppidan, 1763: 3♂, Jazan Fish Market (16°54′12″N, 42°32′40″E), 24 Nov. 2012.
Ex Larus armenicus Buturlin, 1934: 1♂, Jazan Fish Market (16°54′9″N, 42°32′40″E), 23 Nov. 2012.

Quadraceps punctatus regressus is characterized by: a marked reduction of its black spots (Fig. 3d); the prothorax having four clearly separated spots (Fig. 4g); and the first abdominal segment of the male with a dark anterior spot, but not in the female. This is the first record of Q. punctatus regressus from the Armenian gull (Larus armenicus).

Saemundssonia (Saemundssonia) lari (O. Fabricius, 1780)
(Figs 3e,f, 4d)
Saemundssonia (Saemundssonia) lari (O. Fabricius, 1780); Price et al. 2003: 234.

Type host. Larus hyperboreus Gunnerus, 1767—Glaucous gull

Material examined (n = 53). Ex Larus argentatus Pontoppidan, 1763: 2♂, 8♀, 3N, Umm Al-Malik Island, Red Sea (25°13′48″N, 37°8′37″E), 12 Nov. 2011.
Ex Ichthyaetus leucophthalmus (Temminck, 1825): 5♂, 10♀, 5N, Jazan Fish Market (16°54′12″N, 42°32′40″E), 24 Nov. 2012.
Ex Larus michahellis Naumann, 1840: 3♂, 1♀, 1N, Jazan Coast (16°56′22″N, 42°32′35″E), 12 Dec. 2013.

Species of Saemundssonia live primarily on the head and neck of the host. They are highly pigmented and are characterized by male genitalia, female subgenital plate and clypeal signature. Saemundssonia (S.) lari parasitises a great number of gull species (Price et al. 2003: 234), and is distinguished from other Saemundssonia species by the male genitalia (Fig. 4d), as other characters may be confusing (Palma 2000; 2012). These are the first records of S. (S.) lari from the Armenian (Larus armenicus) and the yellow-legged gulls (Larus michahellis).

Key to adults of the species and subspecies of lice infesting Red Sea gulls

1. Maxillary palps well developed, antenna capitate ................................................................. Amblycerana...
- Maxillary palps absent, antenna filiform ........................................................................ Ischnocera...
2. Head semilunar, without preocular slits (Fig. 3b) ............................................................... Austromenopon
   Absence of internal plural thickening and characteristic prothoracic dorsal setae in male (Fig. 4b)........
Discussion

Chewing lice are known for their host specificity and narrow host range, especially those of the suborder Ischnocera (Clayton et al. 2008: 515). However, gull lice parasitise a very wide range of hosts, through different ecosystems and habitats. A species such as Saemundssonia (S.) lari has been recorded from almost all gulls searched for lice (Price et al. 2003: 234) and from all continents, even Antarctica (Clay & Moreby 1967: 165). A similar distribution pattern also applies to the other three louse species identified in this paper. The relatively close phylogenetic relationship of gulls may be one explanation for the lack of speciation among gulls lice (Timmermann 1952a and other authors (e.g. Price et al. 2003: 226).

This paper reports the first study of chewing lice infesting gulls in the Middle East. Four species and two subspecies belonging to two families and two suborders of chewing lice were recorded for the first time from five gull species in Saudi Arabia and the Red Sea: Actornithophilus piceus lari and Austromenopon transversum in the family: Menoponidae (suborder: Amblycera), and Quadraceps punctatus and Saemundssonia lari in the family Philopteridae (suborder: Ischnocera). Also during this study, two gull species were examined for chewing lice for the first time: Larus armenicus and Larus michahellis, resulting in six new host-louse associations (see Table 1).

Acknowledgments

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