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Parasites of the Southern silvery grebe *Podiceps occipitalis* (Aves, Podicipedidae) in Chile

Parasitas do mergulhão-de-orelha-amarela *Podiceps occipitalis* (Aves, Podicipedidae) no Chile

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Abstract

A total of 97 southern silvery grebes (*Podiceps occipitalis*), which died as the result of an oil spill on the coast of central Chile, were examined for ecto- and endoparasites. Two lice species including *Aquanirmus rollandii* (Philopteridae) and *Pseudomenopon dolium* (Menoponidae) were found from 6.2% (6/97) of birds. In 91.7% (89/97) of cases, grebes were infected with some kind of helminths. Three species of gastrointestinal helminths were detected: *Eucoleus contortus* (Nematoda), *Profilicollis bullocki* (Acanthocephala), and *Confluaria* sp. (Cestoda). In addition, *Pelecitus fulicaeatrae* (Nematoda) was removed from the tibiotarsal-tarsometatarsal articulation in 13.4% (13/97) of the specimens examined. To our knowledge, these are the first records of *A. rollandii*, *E. contortus*, and *Confluaria* sp. as parasites of *P. occipitalis*. In addition, these findings expand the distributional range of *A. rollandii*, *E. contortus*, *P. fulicaeatrae*, and *Confluaria* sp. to Chile.

Keywords: Acanthocephalans, cestode, nematode, ectoparasites, endoparasites, water birds.

Resumo

Um total de 97 mergulhões-de-orelha-amarela (*Podiceps occipitalis*), que morreram devido a um derramamento de óleo na costa do Chile central, foram examinados em busca de parasitos internos e externos. Parasitos externos foram encontrados em 6,2% (6/97) das aves, com a identificação de duas espécies de piolhos: *Aquanirmus rollandii* (Philopteridae) e *Pseudomenopon dolium* (Menoponidae). Em 91,7% (89/97) dos casos, os mergulhões apresentaram algum tipo de parasito interno. Foram detectadas três espécies de parasitos gastrointestinais: *Eucoleus contortus* (Nematoda), *Profilicollis bullocki* (Acanthocephala) e *Confluaria* sp. (Cestoda). Além disso, *Pelecitus fulicaeatrae* (Nematoda) foi isolado das articulação tibiotársica e tarsometatarsal em 13,4% (13/97) das aves examinados. Estes resultados correspondem ao primeiro relato de *A. rollandii, E. contortus* e *Confluaria* sp. associados com *P. occipitalis,* e expandem a distribuição destes parasitos e *P. fulicaeatrae* para o Chile.

Palavras-chave: Acantocéfala, cestoda, nematoides, parasitos externo, parasitos interno, aves aquáticas.

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Introduction

The southern silvery grebe *Podiceps occipitalis* Garnot, 1826 is widely distributed across South American countries, as it can be found in Argentina (including in the Falkland Islands/Malvinas), Bolivia, Peru, Paraguay, and Chile, although they rarely occur in Ecuador and Colombia (COUVE & VIDAL, 2003; MAILLARD et al., 2006). In Chile, grebes are represented by two subspecies, *P. occipitalis occipitalis*, which distributed from Atacama to Tierra del Fuego, and *P. occipitalis juninensis*, which inhabits lakes at higher altitudes (3500-4500 m) in the Andean plateau (JARAMILLO, 2005). In terms of its conservation status, this species has been categorized as of least concern (LC); however, the overall population appears to be decreasing overall (BIRDLIFE INTERNATIONAL, 2016). Furthermore, *P. occipitalis* is vulnerable to oil spill events due to their gregarious behavior during the winter, as they gather in large water bodies, sea bays, and lagoons to form flocks consisting of hundreds of individuals (JARAMILLO, 2005). Knowledge about parasite diversity and prevalence in *P. occipitalis* is quite limited (HINOJOSA-SÁEZ & GONZÁLEZ-ACUÑA, 2005; ATKINSON et al., 2008). To date, only a louse, *Pseudomenopon dolium* Rudow, 1896 (Phthiraptera: Menopodidae), and helminths, *Pelecitus fulicaeatrae* Diesing, 1861 (Nematoda: Filarioidea) and *Profilicollis bullocki* Perry, 1942 (Acanthocephala: Polymorphidae), have been described for *P. occipitalis* in Bolivia, Argentina, and Chile, respectively (PRICE et al., 2003; RIQUELME et al., 2006; ESCUDERO et al., 2007). The present study provides new data on the diversity and prevalence of ecto- and endoparasites in the southern silvery grebe that inhabits the coast of central Chile.

Materials and Methods

In May 2007, an oil spill event occurred along the coast of central Chile, near Lenga Town (36° 46' S, 73° 10' W). In order to protect local wildlife, different seabird species were captured and transported to the Wildlife Rehabilitation Center from the Universidad de Concepción, Chillán, so they could be rehabilitated. Unfortunately, 97 grebes (*P. occipitalis occipitalis*) died while being washed with detergent in order to remove the oil from their feathers. Their carcasses were moved to the Animal Science Department at the Universidad de Concepción and each bird was kept individually frozen at –12 °C for further analysis.

The grebes were externally inspected and their feathers were closely examined for ectoparasites. Following collection, the ectoparasites were preserved in 70% ethanol. Lice were mounted using Canada balsam following the technique of Price et al. (2003); they were identified under a light microscope based on the keys and descriptions of Castro & Cicchino (2000) and Price et al. (2003). Specimens were photographed via microscope and measured using Micrometrics® (Micrometrics Instrument Corporation, Norcross, GA, USA).

For endoparasites, the carcasses were necropsied using the protocols detailed in Kinsella & Forrester (1972). Endoparasites were identified following the descriptions provided by Betlejewska et al. (2002), Escudero et al. (2007), Vasileva et al. (1999a, b, 2000, 2001), and Mateo et al. (1982).

Results and Discussion

Lice including *Aquanirmus rollandii* Castro & Cicchino, 2000 (Phthiraptera, Ischnocera) (Figure 1A) (2 females, 1 male, and 2 nymphs) and *Pseudomenopon dolium* (Figure 1B) (5 females and 2 males) were found on 6.2% (6/97) of grebes (Table 1). Both parasite species were restricted to Podicipedidae. With respect to *A. rollandii*, it was only previously reported in *Rollandia rolland chilensis* (Lesson) in Argentina (CASTRO & CICCHINO, 2000). In contrast, *P. dolium* is a cosmopolitan species that parasitizes *Podiceps ruficollis*, *P. auritus, P. grisegena*, *P. cristatus*, *P. nigricollis*, *Podilymbus podiceps*, *Aechmophorus occidentalis*, and *Tachybaptus ruficollis* in Europe, Africa, India, Asia and North America (PRICE, 1974; MARTÍN MATEO, 2006; VAS et al., 2012; DIK & HALAJIAN, 2013; GALLOWAY et al., 2014; JAŁOSZYŃSKI et al., 2014). In South America, *P. dolium* has been described as a parasite of *P. podiceps* in Argentina, *R. rolland chilensis* in Chile and Argentina, *P. taczanowskii* in Peru, and *P. occipitalis* in Bolivia (PRICE, 1974; CICCHINO, 2011).

Only a small number of individuals from both species were collected. This could be explained by the fact that grebes were covered in oil and subsequently washed with detergent to remove it. For this reason, our study may be underestimating the intensity of infection in the examined birds. Nonetheless, this marks the first time that *A. rollandii* has been identified from *P. occipitalis*, and where its distributional range has expanded to Chile.

For the same reason, feather mites (Acari: Analgoidea and Pterolichoidea), the most abundant and diverse arthropods living on the plumage and bodies of birds, were not detected on the examined carcasses of *P. occipitalis*. Nevertheless, while taking into account the currently known data on feather mites associated with Podicipedidae, it is probable that representatives of at least three different feather mite families (Ptiloxenidae, Xolalgidae and Laminosioptidae) will be found on the southern silvery grebe in Chile. Thus, feather mites of the genus *Ptiloxenus* Hull, 1934 (Pterolichoidea: Ptiloxenidae) was associated with grebes of the genera *Podiceps* and *Rollandia* (DABERT & EHRNSBERGER, 1998). *Ingrassia colymbi* Gaud, 1974 (Analgoidea: Xolalgidae), the only

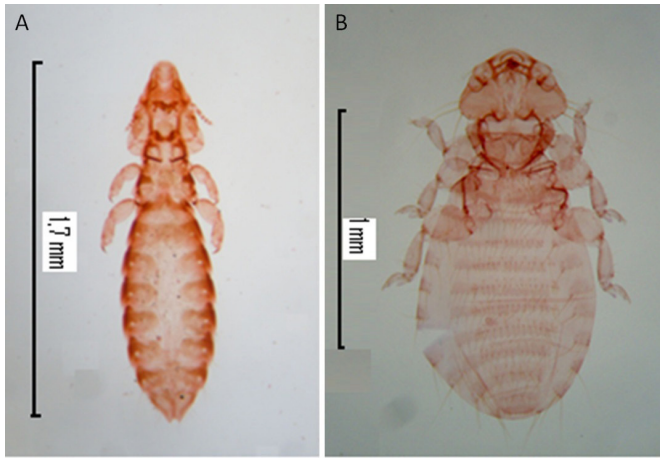

Figure 1. *Aquanirmus rollandii* female (A) and *Pseudomenopon dolium* female (B) (100× magnification).

Table 1. Summary of ecto- and endoparasites identified on the southern silvery grebe *Podiceps occipitalis* from Central Chile.

Parasite	Location	Prevalence (%)	Total parasites	Range	Mean Intensity	Mean Abundance
Endoparasites						
Eucoleus contortus	Small intestine	1.03	1	1	1	0.01
Confluaria sp.	Small intestine	46.39	708	1-141	15.7	7.30
Profilicollis bullocki	Small intestine	68.04	975	1-81	14.7	10.05
Pelecitus fulicaeatrae	Tibiotarsal-tarsometatarsal articulation	13.40	72	1-18	5.5	0.70
Ectoparasites						
Aquanirmus rollandii	Feathers	3.09	5	1-3	0.05	1.60
Pseudomenopon dolium	Feathers	3.09	7	1-3	0.07	2.30

representative of the family associated with grebes, was described from the covert feathers of the bodies of *Tachybaptus ruficollis* (GAUD, 1974). A quill-wall mite known as *Podicipedicoptes americanus* (LOMBERT et al., 1979) (Analgoidea: Laminosioptidae), the only representative of the genus *Podicipedicoptes*, was described from *Podilymbus podiceps* (LOMBERT et al., 1979). Species of the genus *Podicipedicoptes, Ptiloxenus* and *Ingrassia* were also expected to be found on the southern silvery grebe.

Gastrointestinal helminths were found from 91.7% of southern silvery grebe. In addition, *Pelecitus fulicaeatrae* (Figure 2) was removed from the tibiotarsal-tarsometatarsal articulation in a smaller number of birds (13.4% of cases) (Table 1). A female of *Eucoleus contortus* (syn. *Capillaria contorta*) was collected from the small intestine of a single grebe. This parasite is normally found in the upper digestive tracts of birds (BETLEJEWSKA et al., 2002) and, in some cases, in the proventriculus (MONTEIRO et al., 2011). It commonly affects domestic Galliformes, but it also parasitizes captive-raised wild birds (MILLÁN et al., 2002; CRUZ et al., 2016). For instance, *E. contortus* has been described in swans, ducks, gulls, bustards, and cormorants in Asia, Europe and South America (Brazil) (THRELFALL, 1982; FEDYNICH et al., 1997; BOSCH et al., 2000; BETLEJEWSKA et al., 2002; VILLANÚA et al., 2007; YOSHINO et al., 2009; MONTEIRO et al., 2011; SANTORO et al., 2011). This study is the first report of *E. contortus* from grebes (Podicipedidae), and it expands the parasite's distributional range to Chile. *E. contortus* is a generalist parasite and it has been reported to parasitize other seabirds. For this reason, it is likely that *P. occipitalis* plays a role as a natural host for *E. contortus*. However, it could also represent an accidental infectious event, as only a single *E. contortus* individual was collected from the 97 grebes examined. The feeding behavior of these birds (mostly insects and aquatic crustaceans) (ROTTMANN, 1995) strengthens the hypothesis for an accidental finding of *E. contortus*, which probably was ingested by this grebe within an invertebrate host. Additionally, one must consider that *P. occipitalis* coexists with different seabirds along the coast of central Chile, including birds that were previously indicated as hosts for *E. contortus* (e.g. *Phalacrocorax brasilianus*) (MONTEIRO et al., 2011). Furthermore, this parasite was identified as a possible threat for the conservation of wild species (VILLANÚA et al., 2007), mostly due to its negative effects on the body's overall condition (BOSCH et al., 2000) and its susceptibility to predation (MILLÁN et al., 2002). For these reasons, further studies assessing parasite prevalence and diversity should be performed in Podicipedidae to adequately elucidate their parasite fauna.

Figure 2. *Pelecitus fulicaeatrae* removed fron tibiotarsal-tarsometatarsal articulation.

Confluaria sp. Ablasov, 1953 (Cestoda: Hymenolepididae) were collected from the small and large intestines of grebes; the latter location is unusual for these parasites, and it may be the result of parasite movements following death. Vasileva et al. (1999a) indicate that the genus *Confluaria* is restricted to Podicipedidae, and that records in other avian families are erroneous. This genus has been reported in *P. ruficollis japonicus, P. nigricollis*, *Tachybaptus ruficollis*, *P. grisegena*, *P. cristatus* and *P. auritus* in Asia and Europe (VASILEVA et al., 1999a, b; BARUŠ et al., 2000; VASILEVA et al., 2000, 2001, 2008; HAUKISALMI, 2015; SITKO & HENEBERG, 2015). In South America, the genus *Confluaria* is only known to be from Northern Brazil, with *P. dominicus* serving as its host (VASILEVA et al., 1999a). Therefore, this is the first time that the *Confluaria* sp. is reported from *P. occipitalis*, thus extending its range to Chile.

In this study, specimens of *Profilicollis bullocki*, which were aligned with the characteristics of this parasite found in seabirds inhabiting the coast of Central and Northern Chile (OLIVA et al., 1992; RIQUELME et al., 2006), were reported to be highly prevalent in *P. occipitalis* (68.0%). Indeed, Riquelme et al. (2006) suggest that *P. occipitalis* may act as a natural reservoir for *P. bullocki* during the winter, thus playing a role in the maintenance of infections in seabird communities during that season. This parasite was previously

identified in various charadriiform birds, including *Calidris* sp., *Larus modestus*, *L. serranus*, *L. dominicanus*, *L. pipixcan*, and *Numenius phaeopus*, as well as in *P. occipitalis* on the Pacific Coast of South America (OLIVA et al., 1992; RIQUELME et al., 2006).

In addition, *Pelecitus fulicaeatrae* was detected in 13 grebes, which were located in the tibiotarsal-tarsometatarsal articulation. Chewing lice such as *P. dolium* act as intermediate hosts (BARTLETT & ANDERSON, 1987). In the definitive host, microfilariae inhabit the feathered skin of their hosts, and adults occur in the nodules in their legs (BARTLETT & ANDERSON, 1989). Different bird families have been reported as hosts of *P. fulicaeatrae*, including grebes (VANDERBURGH et al., 1984; BARTLETT & GREINER, 1986; BARTLETT & ANDERSON, 1989; ESCUDERO et al., 2007). In South America, the occurrence of *P. fulicaeatrae* was previously reported in the gray-necked wood-rail *Aramides cajanea* (Rallidae) and in the jabiru *Jabiru mycteria* (Ciconiidae) in Brazil (PINTO & NORONHA, 2003). Escudero et al. (2007) reported the first record of *P. occipitalis* from Argentina. Our findings represent a new record of this parasite in Chile.

Our study contributes to the current knowledge on the parasite prevalence and diversity in *P. occipitalis*, which includes the first records of *A. rollandii*, *E. contortus*, and *Confluaria* sp. for this host. In addition, it expands the distributional range for *A. rollandii*, *E. contortus*, *P. fulicaeatrae*, and *Confluaria* sp. to Chile.

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