Brazilian Journal of Veterinary Parasitology
ISSN 1984-2961 (Electronic)
www.cbpv.org.br/rbpv
Braz. J. Vet. Parasitol., Jaboticabal, v. 27, n. 2, p. 161-168, apr.-june 2018
Doi: http://dx.doi.org/10.1590/S1984-296120180013

Original Article

Gastrointestinal and external parasitism in the Magellanic Horned Owl *Bubo magellanicus* (Strigiformes: Strigidae) in Chile

Parasitos gastrointestinais e externos da coruja-orelhuda *Bubo magellanicus* (Strigiformes: Strigidae) do Chile

Alexandra Grandón-Ojeda[1]; José Osvaldo Valdebenito[2]; Lucila Moreno[3]; John Mike Kinsella[4]; Sergey Mironov[5]; Armando Cicchino[6]; Carlos Barrientos[7]; Daniel González-Acuña[1]*

[1] Facultad de Ciencias Veterinarias, Universidad de Concepción, Chillán, Chile

[2] Biodiversity Laboratory, Department of Biology and Biochemistry, University of Bath, Bath, United Kingdom

[3] Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile

[4] Helm West Lab, Missoula, Montana, United States of America

[5] Zoological Institute, Russian Academy of Sciences, Universitetskaya Embankment 1, Saint Petersburg, Russia

[6] Universidad Nacional de Mar del Plata, Mar del Plata, Argentina

[7] Escuela de Medicina Veterinaria, Universidad Santo Tomás, Concepción, Chile

Received October 23, 2017
Accepted February 7, 2018

Abstract

To describe the parasitic community of the Magellanic Horned Owl, *Bubo magellanicus* (Aves, Strigiformes), 19 carcasses from central Chile were analyzed. Ectoparasites were collected through plumage inspection, while endoparasites were collected through traditional techniques of parasitological necropsy. Sixteen owls were infected with at least one species of ectoparasite (84.21%) or endoparasite (31.58%). Eleven of 19 birds (57.89%) harbored feather mites of the three species *Pandalura cirrata* (42.11%), *Glaucalges attenuatus* (47.37%), and *Kramerella* sp. (10.53%), whereas 16 individuals (84.21%) harbored the chewing louse *Strigiphilus chilensis*. Only six birds (31.58%) were infected with helminths; the nematodes *Capillaria tenuissima* (26.32%) and *Dispharynx nasuta* (5.26%); the acanthocephalan *Centrorhynchus spinosus* (5.26%); and the trematode *Neodiplostomum* sp. (5.26%). Apart from *S. chilensis*, all parasites comprised new records for *B. magellanicus*.

Keywords: Birds, parasites, Phthiraptera, Acari, helminths.

Resumo

Para descrever a comunidade parasitária de coruja-orelhuda *Bubo magellanicus* (Aves, Strigiformes), foram analisados 19 carcaças das aves do centro do Chile. Os ectoparasitos foram coletados inspecionando-se a plumagem e os endoparasitas extraídos por meio de técnicas tradicionais de necropsia parasitaria. Dezesseis corujas estavam infectadas com pelo menos uma espécie de ectoparasito (84,21%) ou endoparasito (31,58%). Onze de 19 aves (57,89%) abrigavam nas penas ácaros de três espécies: *Pandalura cirrata* (42,11%), *Glaucalges attenuatus* (47,37%) e *Kramerella* sp. (10,53%), enquanto que 16 indivíduos (84,21%) estavam parasitados pelo piolho *Strigiphilus chilensis*. Apenas seis aves (31,58%) estavam infectadas com helmintos; os nematoides *Capillaria tenuissima* (26,32%) e *Dispharynx nasuta* (5,26%); o acantocéfalo *Centrorhynchus spinosus* (5,26%); e o trematódeo *Neodiplostomum* sp. (5,26%). Excetuando-se *S. chilensis*, todos os parasitos incluíam novos registros para *B. magellanicus*.

Palavras-chave: Pássaros, parasita, Phthiraptera, Acari, helmintos.

***Corresponding author:** Daniel González-Acuña. Facultad de Ciencias Veterinarias, Universidad de Concepción, Casilla 537, Chillán, Chile.
e-mail: danigonz@udec.cl

Introduction

The Magellanic Horned Owl, *Bubo magellanicus* (Lesson, 1828), is the largest of the five owl species that inhabit Chile. Its distribution in Chile extends from the Arica and Parinacota region (18°28'30" S, 70°18'52" W) to Tierra del Fuego and Cape Horn (Magallanes region, 54°56'00" S, 67°37'00" W), although these limits are not well defined (FIGUEROA et al., 2015). This owl species inhabits a wide range of habitats, including semi-open forests abundant in *Nothofagus* and semi-arid areas, which has an altitude of up to 4,500 meters above sea level (KÖNIG et al., 2008). The owl's main prey includes rodents, birds, and arthropods (FIGUEROA et al., 2015). The Magellanic Horned Owl was previously considered as a subspecies of the Great Horned Owl, *B. virginianus* (Gmelin, 1788), until König et al. (1996) showed differences between these two birds based on vocal, morphologic, and genetic evidence, which confirmed that this bird was a separate species (KÖNIG et al., 2008).

Only two studies have previously focused on the parasites of this bird. *Strigiphilus chilensis* Carriker, 1966 was described from specimens collected in Santiago, and González-Acuña et al. (2006) found this species on *B. magellanicus* from central and south-central Chile. The aim of this study is to analyze ecto- and endoparasites from this host in central and southern Chile.

Methods

Between 2010 and 2017, 19 specimens of *B. magellanicus* were collected. The causes of death were mainly attributed to collisions with vehicles, poaching, and poisoning. Eight birds came from Chillán (36°36' S, 72°07' W), two from Bulnes (36°44' S, 72°18' W), and one from each of the following localities: Concepción (36°50' S, 73°03' W); Cobquecura (36°08' S, 72°47' W); Los Ángeles (37°28' S, 72°21' W); Parral (36°09' S, 71°50' W); Talca (35°26' S, 71°40' W); and Trehuaco (36°26' S, 72°40' W) (Figure 1). The animals used were frozen in bags and then necropsied. The ectoparasites were collected by visually inspecting feathers and they were subsequently preserved in 70% ethanol. Lice were cleared and mounted in Canada balsam, as described by Palma (1978) and Price et al. (2003). Mites were cleared in Nesbitt's solution for 72 hours at sub-boiling temperature, and they were finally mounted in Berlese's medium (KRANTZ & WALTER, 2009). The collection and preparation of helminths followed the technique proposed by Kinsella & Forrester (1972). Nematodes and acanthocephalans were cleared in temporary mounts of lacto-phenol; they were then identified and returned to the preservative.

The taxonomical keys used to identify feather lice followed Clayton and Price (1984) and Price et al. (2003); those for feather mites followed Gaud (1980), Atyeo & Philips (1984), Gaud & Atyeo (1996), Krantz & Walter (2009), and Mironov (2011); and those for helminths followed Goble & Kutz (1945), Mettrick (1959), Yamaguti (1963), Skrjabin (1969), Hong & Shoop (1994), Richardson & Nickol (1995), and Gómez-Puerta et al. (2009).

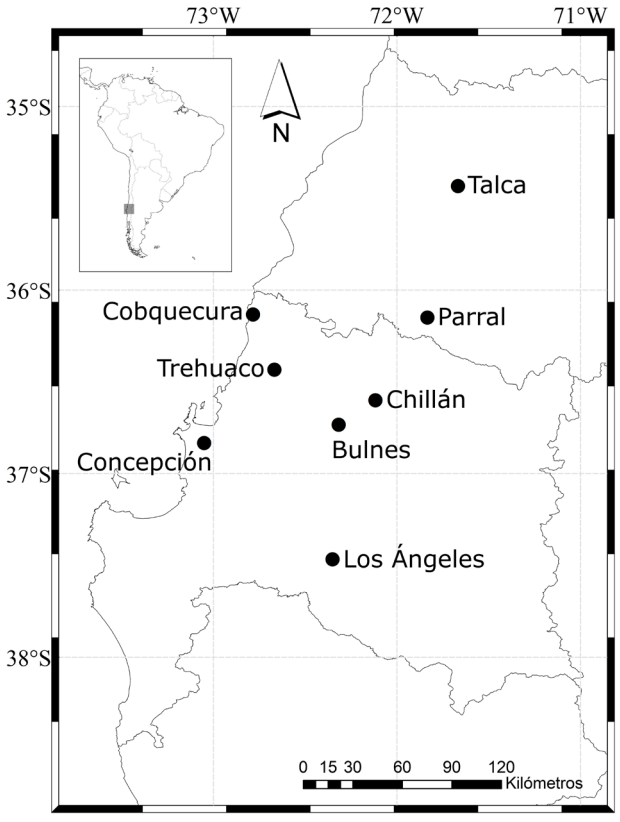

Figure 1. Map of Chile showing the sampling locations.

All collected specimens were stored in the collection at the Laboratory of Zoology, Faculty of Veterinary Science, University of Concepción.

Results and Discussion

All the analyzed birds presented at least one species of parasite. A total of 16/19 (prevalence of 84.21%) of the owls were found infected with ectoparasites and a total of 6/19 (prevalence of 31.57%) were found infected with endoparasites (Table 1). Except for *S. chilensis*, all of the parasites that were found represented new records for *B. magellanicus*.

Acari

A total of 87 specimens of *Pandalura cirrata* (MÜLLER, 1860) (Figures 2 and 3) were collected; they had a prevalence of 42.11% (8/19). This mite belongs to a genus that contains four species, two of which are exclusive to Strigiformes, whereas the other two are associated with Caprimuliformes (MIRONOV, 2011), as well as with the families Podargidae and Steatornithidae. The ectoparasite *P. cirrata* was originally described from the Eurasian Eagle-Owl *Bubo bubo* Linnaeus, 1758 by Müller (1860) as *Dermaleichus cirratus*, and later reassigned to the genus *Pandalura* Hull, 1934. Like all representatives of the family Psoroptoididae, *P. cirrata* have the typical appearance of the inhabitants of feathers, which are characterized

Table 1. Summary of external and gastrointestinal parasites found in 19 Magellanic Horned Owls, from central Chile.

Species	Prevalence (%)	Range	Mean intensity	Mean abundance	Total
Acari: Psoroptoididae					
Pandalura cirrata	42.11	0 - 16	10.88	4.57	87
Acari: Xolalgidae					
Glaucalges attenuatus	47.37	0 - 19	14.56	6.89	131
Acari: Kramerellidae					
Kramerella sp.	10.53	0 - 6	5.5	0.57	11
Phthiraptera					
Strigiphilus chilensis	84.21	0 - 47	19.69	16.58	315
Nematoda: Capillariidae					
Capillaria tenuissima	26.32	0 - 6	2.4	0.63	12
Nematoda: Acuariidae					
Dispharynx nasuta	5.26	0 - 6	6	0.32	6
Acantocephala: Centrorhynchidae					
Centrorhynchus spinosus	5.26	0 - 9	9	0.47	9
Trematoda: Diplostomidae					
Neodiplostomum sp.	5.26	0 - 2	2	0.11	2

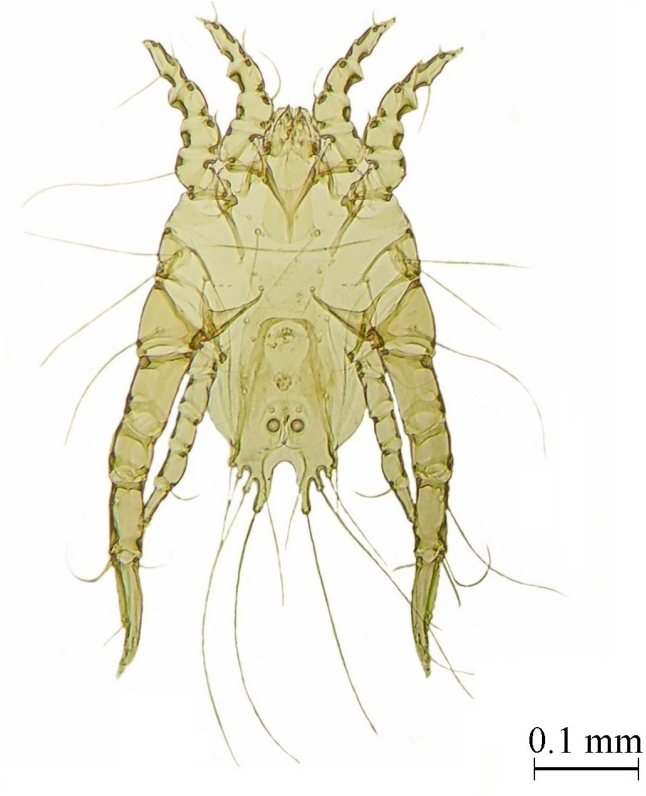

Figure 2. *Pandalura cirrata*. Male. Ventral view. Magnification 100X.

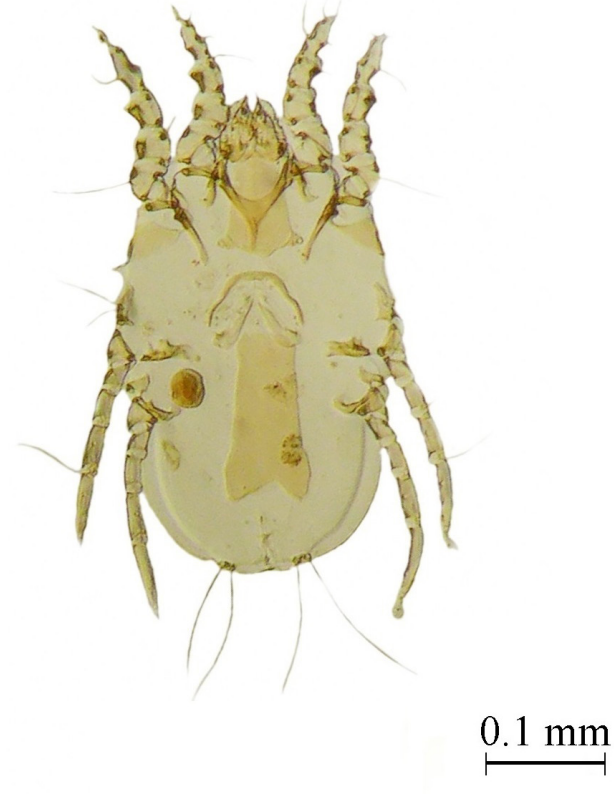

Figure 3. *Pandalura cirrata*. Female. Ventral view. Magnification 100X.

by having a flattened and moderately widened idiosome, two pairs anterior legs with spines and hook-like structures to join the feathers (DABERT & MIRONOV, 1999). To date, this mite was recently redescribed based on samples obtained from *B. bubo* in Spain, and it was also reported from *B. virginianus* in Canada (MIRONOV, 2011).

Glaucalges attenuatus (Buchholz, 1869) (Figures 4 and 5) had the highest prevalence, mean intensity, and mean abundance among mites, with 131 individuals collected, and being present in half of the birds analyzed (9/19) (47.37). This genus includes the species *G. attenuatus* and *G. tytonis* Dabert et al. 2008 that infect Strigiformes, and *G. pteropus* Gaud et Mouchet, 1959, which was found parasitizing the family Musophagidae (PHILIPS, 2000). *Glaucalges attenuatus* are characterized by having a flattened and moderately widened idiosome, lateral setae and relatively long caudal, with the previous pairs of legs provided with hooks and spines (DABERT & MIRONOV, 1999). Besides, it is apparently a generalist in host (DABERT et al., 2008); it can occupy both the primaries and secondaries of the wings and the

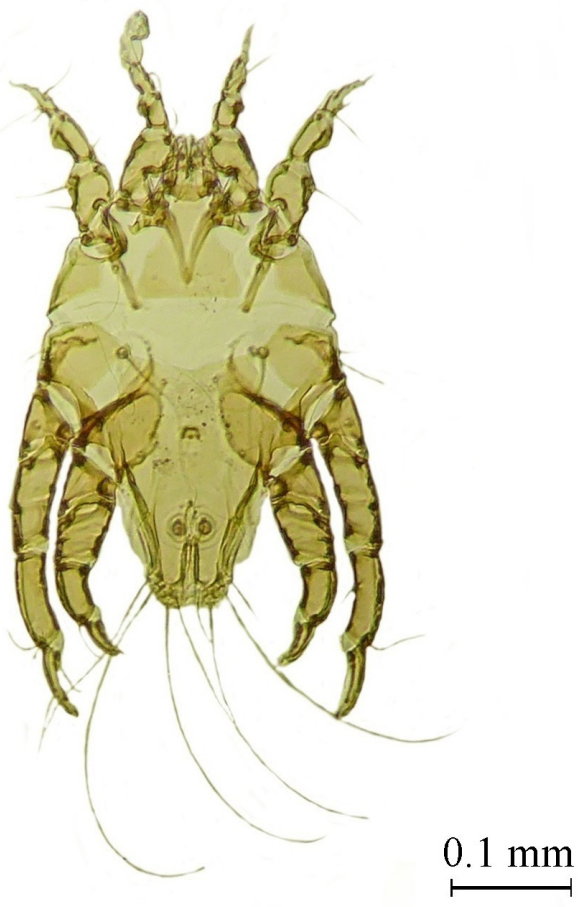

Figure 4. *Glaucalges attenuatus*. Male. Ventral view. Magnification 100X.

Figure 5. *Glaucalges attenuatus*. Female. Dorsal view. Magnification 100X.

body feathers, presumably explaining the high population parameters that were documented.

Kramerella sp. (Figures 6 and 7) presented the lowest population parameters of the mites; only 11 mites were collected and they had a prevalence of 10.53% (2/19). The genus *Kramerella* Trouessart, 1916 is presently composed of 14 known species that exclusively affect the bird orders Falconiformes and Strigiformes (KRANTZ, 1978; GAUD, 1980; SOHN & NOH, 1994). Contrary to our findings, mites of this genus are usually abundant on their hosts and primarily infect only the primary feathers of wings (PHILIPS, 2000). The small number of mites collected likely hampered thorough taxonomic identification.

Phthiraptera

Strigiphilus chilensis Carriker, 1966 (Figures 8 and 9) is the only feather louse known to infect *B. magellanicus* and it has only been reported from this owl to date. This louse presented with a prevalence of 84.21% (16/19), with 315 lice collected. Within the order Phthiraptera, three genera infect owls but, interestingly, the genus *Strigiphilus* Mjöberg, 1910, which currently includes 52 species, has been exclusively found on Strigiformes (CLAYTON, 1990). In this genus, males and females of *S. chilensis* present a longer head comparatively to other species (CARRIKER, 1966). In other hand, besides the original description documented by Carriker (1966), where this mite was found from this owl in Santiago (Metropolitan Region), the only records of this louse on this host was made by González-Acuña et al. (2006) in central and southern Chile (a detailed description of the provenance of the birds is given in that study).

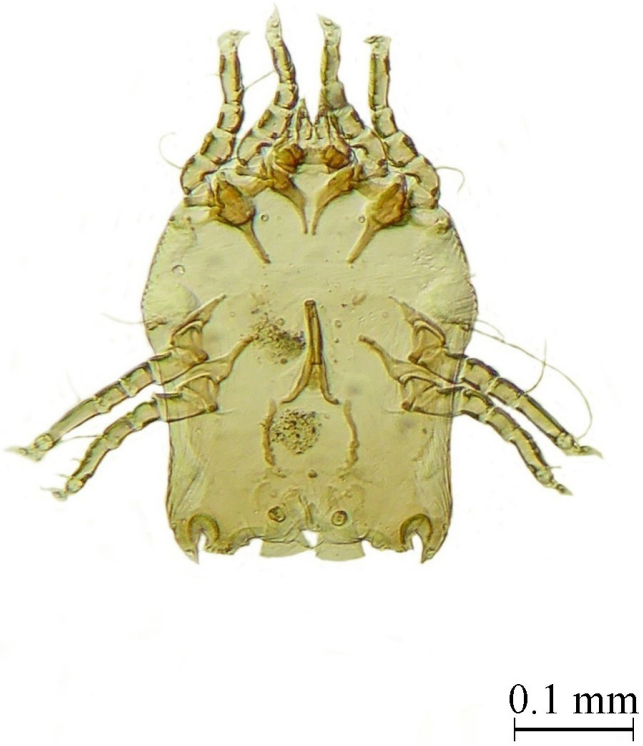

Figure 6. *Kramerella* sp. Male. Ventral view. Magnification 100X.

Figure 7. *Kramerella* sp. Female. Ventral view. Magnification 100X.

Figure 8. *Strigiphilus chilensis*. Male. Ventral view. Magnification 100X.

Figure 9. *Strigiphilus chilensis*. Female. Ventral view. Magnification 100X.

Nematoda

Capillaria tenuissima Rudolphi, 1803 (Figures 10 and 11) had a prevalence of 26.32% (5/19), with 12 individuals collected. This parasite has an indirect life cycle with earthworms as intermediate hosts and small rodents as definitive or paratenic hosts (RUBILAR et al., 1996). Some of the important characteristics of this species is that in males the spicule sheath is finely striated transversally and in the case of females its cuticle is covered by a characteristic high pattern (METTRICK, 1959). This parasite is common in owls, including the closely related *B. virginianus* Gmelin, 1788 and it always infects the intestine (BORGSTEEDE et al., 2003). *Capillaria falconis* Goeze, 1782 has also been found in *B. virginianus* (KINSELLA et al., 2001). In Chile, *C. tenuissima* was recorded in Chimango Caracara *Milvago chimango* Vieillot, 1816 sampled in Chillán, Ñuble region (SAN MARTÍN et al., 2006).

Dispharynx nasuta Rudolphi, 1819 had a prevalence of 5.26% with six parasites collected. This parasite is a generalist with an indirect life cycle of 57 days (SCHOCK & COOPER, 1978). This nematode is characterized by a whitish color with a cuticle with finely transverse striations (OYARZÚN-RUIZ et al., 2016) with a

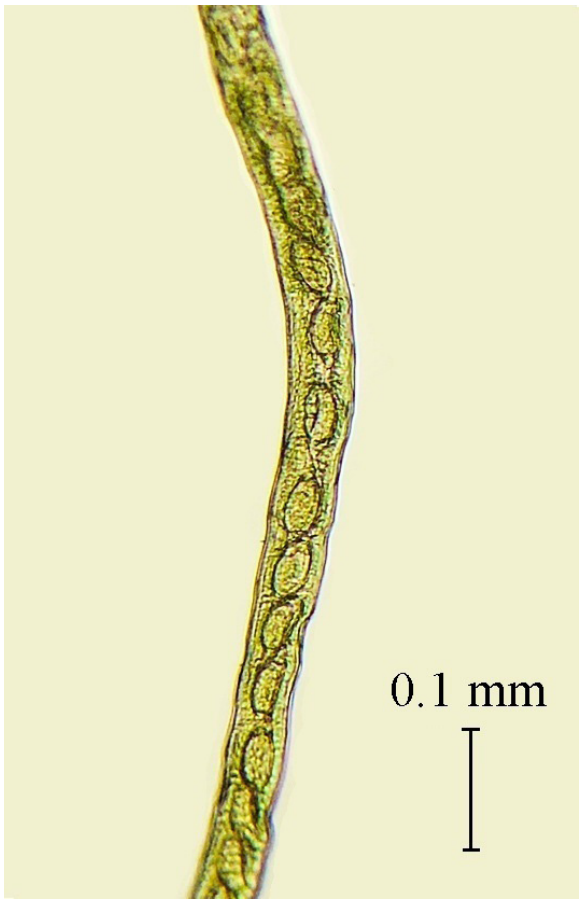

Figure 10. *Capillaria tenuissima*. Gravid female with eggs visible. Magnification. 100X.

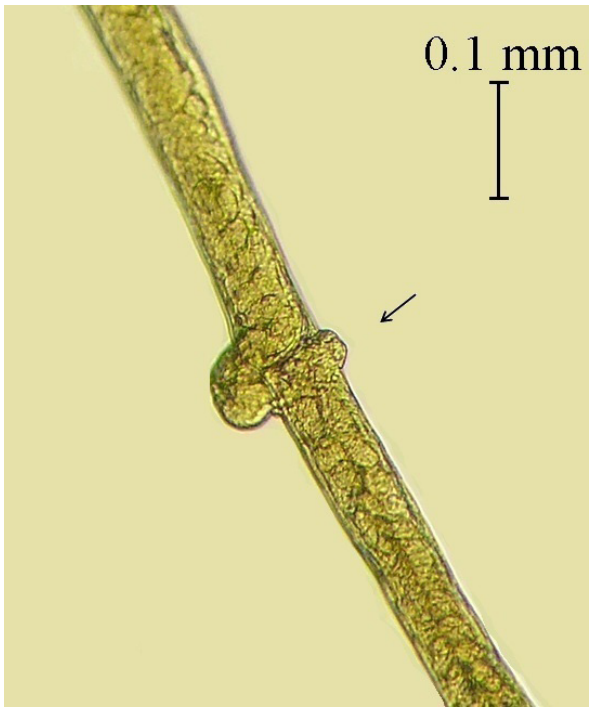

Figure 11. *Capillaria tenuissima*. Magnification 100X. Arrows shows genital apparatus of female.

muscular and glandular esophagus (GÓMEZ-PUERTA et al., 2009). The life cycle of *D. nasuta* commonly requires an intermediate host from the order Isopoda; however, other invertebrates can also be used (MOORE et al., 1988). According to Yamaguti (1961), the Common Rough Woodlouse (*Porcellio scaber* Latreille, 1804) is the principal intermediate host for this parasite. Once it reaches the definitive host, it can be found in the proventriculus, esophagus, or small intestine. This parasite was found in phylogenetically distant hosts, as represented by Galliformes, Columbiformes (BAKER, 2008), and Strigiformes. In this last order, examples of hosts come from both the Old and New World, with Little Owl *Athene noctua* from Spain (ILLESCAS GOMEZ et al., 1993) and Eastern Screech Owl, *Megascops asio* Linnaeus, 1758 from Florida (United States) (KINSELLA et al., 2001), respectively. In Chile, this parasite has also been collected from a wide range of hosts: the Rock Pigeon *Columba livia* Gmelin, 1789 (TORO et al., 1999), the California Quail *Callipepla californica* Shaw, 1798 (GONZÁLEZ-ACUÑA et al., 2000), the Southern Lapwing *Vanellus chilensis* Molina, 1782 (GONZÁLEZ-ACUÑA et al., 2008), and the diurnal raptor *M. chimango* (OYARZÚN-RUIZ, 2013).

Acanthocephala

Centrorynchus spinosus Kaiser, 1893 had a prevalence of 5.26% (1/19) with nine individuals collected. Regarding the distinctive characteristics of *C. spinosus* they present a proboscis with 8-11 (usually 9 in female, 10 in male) longitudinal anterior hooks in each row and a trunk with anterior constriction, but with a lack of visible inflation (RICHARDSON & NICKOL, 1995). The life cycle of this parasite has cockroaches and other arthropods as intermediate hosts, while amphibians, reptiles, and rodents are paratemic hosts; when it reaches the small intestine of birds, the birds become definitive hosts (OYARZÚN-RUIZ et al., 2016).

This acanthocephalan has been reported in the USA (VAN CLEAVE, 1916), Ecuador (VAN CLEAVE, 1940), and Russia (BYKHOVSKAIA, 1948), in various species of birds, however, among the Strigiformes that have been recorded as hosts of *C. spinosus* are Barred Owl, *Strix varia* Barton, 1799, *M. asio* and, more frequently, *B. virginianus* (KINSELLA et al., 2001) all these records made only in USA. Therefore, the present finding means that the parasite can find suitable environmental conditions for its development, including in intermediate hosts, all along the Americas.

Trematoda

Neodiplostomum sp. was the helminth that presented with the lowest population parameters; two parasites were found in one bird (5.26%). Species of the genus *Neodiplostomum* Railliet, 1919 infects both mammals and birds (HONG & SHOOP, 1994). Nevertheless, some parasite species within the genus appear to be specific to a certain group of hosts; for instance, Richardson & Kinsella (2010) noted that *Neodiplostomum delicatum* Chandler & Rausch, 1947 is restricted to avian hosts from the order Strigiformes. The species of *Neodiplostomum* recorded from the genus *Bubo* included *N. americanum* (CHANDLER & RAUSCH,

1947; WOODYARD et al., 2017), *N. reflexum* (CHANDLER & RAUSCH, 1947; GALLAS & SILVEIRA, 2013), and *N. delicatum* (KINSELLA et al., 2001). The poor condition of these two collected specimens makes species identification impossible.

Conclusion

Bubo magellanicus presents a wide parasitic diversity. Of the eight species of parasites found the following species: *Glaucalges attenuatus*, *Pandalura cirrata*, *Kramellera* sp., *Strigiphilus chilensis*, *Dispharynx nasuta*, *Capillaria tenuissima*, *Centrorhynchus spinosus* and *Neodiplostomum* sp.; all correspond to new records for this bird in Chile, with the exception of *S. chilensis*.

Acknowledgements

We are deeply grateful for the support granted by members of the National Forest Corporation, CONAF, and the Agricultural and Livestock Service, SAG, of Chile. We also thank Karen Ardiles, Carolina Silva, Sebastián Muñoz, Daniela Doussang, Karolina Araya, Marescla Martínez, Danny Fuentes, Felix Varas, Ignacia Najle, Nicolás Fernández, Pablo Olmedo, Diego Barrientos and Sofia González for all their support in the field and laboratory. This research study was funded by FONDECYT, Projects 1130948 and 1170972.

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