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PARASITES OF THE AMERICAN KESTREL (*FALCO SPARVERIUS*) IN SOUTH-CENTRAL CHILE

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Both external and internal parasites may have negative effects on various aspects of the fitness of their hosts, such as decreasing thermoregulatory capacity, reducing nest-

lings' body masses, which may negatively affect viability and productivity, and influencing sexual selection (Clayton 1990, Cicchino and Castro 1998). Parasite numbers often increase when their hosts are stressed, debilitated, or sick, (Krone and Cooper 2002) and are of major importance in terms of conservation and management of threatened mammal and bird species (e.g., Smith and Belthoff 2001). In addition, because most species of ectoparasites

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are restricted to particular host taxa and because some species parasitize only one host species or a number of subspecies (Clayton 1990, Hahn et al. 2000), they can be useful in understanding ecological, coevolutionary, or phylogenetic relationships (Hafner et al. 1994, Hahn et al. 2000, Clayton and Drown 2001).

Presently there are few data on parasites from birds in southern South America (González-Acuña et al. 2008). Although some ectoparasites (lice) associated with owls and diurnal raptors in Chile have been recently reported (González-Acuña et al. 2008), little information is available for other parasites of these hosts.

The subspecies of the American Kestrel most widely distributed in Chile is *Falco sparverius cinnamominus*, which is not globally threatened and is included in CITES II (Araya and Millie 2000, Pavéz 2004). *Falco sparverius* is ubiquitous in both North and South America, and is perhaps the most common New World falcon (Bierregaard 1994, Pavéz 2004). Its habitats range from tropical lowlands and deserts to near tree-line in mountains, as high as 3700 m in North America and 4300 m in South America (Bierregaard 1994). In Chile, its distribution extends from Arica (18°S) to Tierra del Fuego (56°S; Johnson 1965, de Schauensee 1970, Araya and Millie 2000). Although the American Kestrel is an abundant species in southern South America (Jaksic and Jiménez 1986, Narosky and Barbarskas 2000), its gastrointestinal and external parasites have not been documented. The aim of our study was to describe the external and internal parasites of American Kestrels collected in southern Chile.

METHODS

Between March 2001 and December 2009 we obtained 15 American Kestrels from different localities in the Biobío region of south-central Chile. The birds were delivered to the Wildlife Rehabilitation Center of the Veterinary Faculty of Concepción University. Causes of injury were collisions with vehicles, collisions with wires, poisoning, dog attacks, and gunshot wounds. When injuries were too severe to be treated, the birds were euthanized. Carcasses were frozen until they could be examined. Lice and mites were collected from feathers and preserved in 70% alcohol. Lice were subsequently mounted in Canada balsam following the technique in Palma (1978) and Price et al. (2003). Mites were cleared in Nesbitt solution (40 g chloral hydrate, 25 ml distilled water, and 2.5 ml of concentrated HCL) for 72 hr and mounted in Berlese solution (Krantz 1978). For the identification of the mites, the papers of Vasilev (1958) and Mironov (2003) and the keys of Krantz (1978) and Gaud and Atyeo (1996) were used. For the Phthiraptera we used the descriptions by Price and Beer (1963), Cicchino (1979), Tendeiro and Mendes (1994), Mey and González-Acuña (2000) and the synonymy of Price et al. (1997).

Each bird carcass was dissected to isolate endoparasites, and the organs were examined under a stereoscopic microscope in the laboratory. Helminths collected were preserved in 70% ethanol or 10% formalin. Cestodes and

trematodes were stained with carmine or hematoxylin, dehydrated and mounted in Canada balsam (Prichard and Kruse 1982). Nematodes were studied in temporary mounts of lactophenol (Kinsella and Forrester 1972). For identification we used the following works: Yamaguti (1958, 1959, 1961) and Khalil et al. (1994). Terminology follows Bush et al. (1997), with prevalence defined as the number of individuals of a host species infected with a parasite species divided by the number of host examined, mean intensity defined as the total number of individuals of a parasite species divided by the number of hosts infected with that species, and abundance defined as the number of individuals of a particular parasite in or on a single host regardless of whether the host is infected. Parasite specimens were stored in the collection of the Laboratory of Zoology of the Veterinary Faculty, Concepción University.

RESULTS

Five species of endoparasites (one trematode, one cestode, and three nematodes) and four species of ectoparasites (one mite, and three chewing lice) representing a total of 165 individuals were found in or on the 15 American Kestrels (Table 1).

Two specimens of *Ascocotyle felippeii* (Travassos 1928; syn. *A. tenuicollis* [Price 1935]; Trematoda: Heterophyidae) were found in the small intestine of one American Kestrel.

Cestodes were extremely rare in our sample, restricted to single infection of one specimen belonging to the genus *Cladotaenia* sp. (Cohn 1901; Cestoda: Taeniidae) in one kestrel. The specimen was fragmented and missing rostellar hooks, making species identification impossible.

One immature female of *Physaloptera*, (Rudolphi 1819; Nematoda: Physalopteridae) was found in the proventriculus of one bird and three *Baruscapillaria falconis* (Goeze 1782; Capillariidae) were found in the intestine of two hosts. Six nematodes of the genus *Procyrnea* (Chabaud 1958; Nematoda: Habronematiade) were collected from the ventriculus of three (20%) kestrels.

A feather mite *Epoplichus minor* (Megnin and Trouessart 1884; Pterolichidae) was the most prevalent ectoparasite, occurring on 26.6% of hosts and accounting for 43.6% of all parasite individuals. The prevalence, intensity and abundance of the Phthiraptera *Degeeriella carruthi* (Emerson 1953; Philopteridae), *Laemobothrion tinnunculi* (Linnaeus 1758; Laemobothriidae) and *Colpocephalum subzerafae* (Tendeiro 1988; Menoponidae) are shown in Table 1.

DISCUSSION

All species of helminths collected were classified as "raptor generalists" by Kinsella et al. (1995, 2001), as they have been recorded only from Strigiforms and Falconiforms. The helminth community in the American Kestrels in the Biobío region was characterized by low species richness (5 species, mean 1.5 per infected bird) and all helminths showed both low prevalence and intensities of infection. Similar results were reported by Kinsella et al. (1995) who found only 1.7 species per infected bird in 22 *F. sparverius* from Florida, and Taft et al. (1993), who documented only

Table 1. Parasites from 15 American Kestrels collected in south-central Chile.

PARASITE SPECIES	LOCATION IN HOST ¹	PREVALENCE		INTENSITY		ABUNDANCE	
		NUMBER INFECTED	%	MEAN	RANGE	MEAN	TOTAL
Helminths							
Trematoda							
<i>Ascocotyle felippei</i>	SI	1	6.7	2	2	0.13	2
Cestoda							
<i>Cladotaenia</i> sp.	SI	1	6.7	1	1	0.06	1
Nematoda							
<i>Baruscapillaria falconis</i>	SI	2	13.3	1,5	1–2	0.2	3
<i>Physaloptera</i> sp.	P	1	6.7	1	1	0.06	1
<i>Procyrnea</i> sp.	E, P	3	20.0	2	2–4	0.4	6
Acari							
<i>Epoplichus minor</i>	F (tail, wing)	4	26.7	18	2–50	4.8	72
Phthiraptera							
<i>Degeeriella carruthi</i>	F	3	20.0	15,3	5–31	3.06	46
<i>Laemobothrion tinnunculi</i>	F	3	20.0	7	3–12	1.4	21
<i>Colpocephalum subzeratae</i>	F	1	6.7	13	—	0.86	13

¹ E = esophagus, P = proventriculus, SI = small intestine, F = feather.

three species of helminths in nine *F. sparverius* from Minnesota and Wisconsin. Although our sample size is small, it appears that American Kestrels in Chile have a very light helminth burden.

The biological cycle of *A. felippei* includes two intermediate hosts, snails and fish or frogs (Soulsby 1987). In southern Chile these hosts have not been documented in the American Kestrel's diet based on stomach contents (Greer and Bullock 1966) and pellets (Figueroa and Corales 2004), but in a study based on direct observations, frogs accounted for 3–4% of all recorded prey items (R. Figueroa and S. Corales unpubl. data). The metacercariae of this parasite were found encysted in the heart bulb and gills of fish from a coastal lagoon and adult parasites were recorded in the intestine of Least Bitterns (*Ixobrychus exilis*) in Rio de Janeiro, Brazil (Travassos 1928, 1930). Coincidentally, among major prey items of the Least Bitterns are small fish, frogs, and slugs (Gibbs et al. 1992).

The life cycles of members of the genus *Cladotaenia* are indirect, using rodents as intermediate hosts (Krone and Cooper 2002). Studies of rodents in North America have reported a low prevalence of infective metacestodes of *Cladotaenia* spp. (Freeman 1959, Kinsella 1974, 1988, 1991). We also assume that prevalence in rodents in southern Chile may be low because consumption of rodents by the American Kestrel in this region is high during winter (80% of all prey) and account for 8–12% by number during summer (Figueroa and Corales 2002, 2004).

The nematode *B. falconis* is a cosmopolitan capillariid found in the small intestine of both strigiforms and falconiforms, often in mixed infections with a related species *Capillaria tenuissima* (Rudolphi 1809; Richardson and Kin-

sella 2010). Threadworms of the subfamily Capillariinae are the most commonly diagnosed helminths in raptors (Frey and Kutzer 1982, Smith 1993, Krone 2000). However, in the present study, only three specimens were found in the small intestine of two kestrels. In Chile, various species of capillariids have been diagnosed in wild birds (González et al. 1974, Torres et al. 1974, Rubilar et al. 1996, Toro et al. 1999, González-Acuña et al. 2000, 2004). In raptors, San Martín et al. (2005) reported *Capillaria tenuissima* in *Milvago chimango*. Kinsella et al. (1995) reported *B. falconis* from *F. sparverius* in Florida, U.S.A., but Richardson and Kinsella (2010) found no infections in *F. sparverius* in Connecticut, U.S.A.

Parasites of the genus *Physaloptera* are detected in many mammals and birds tightly attached to the mucous membrane in the upper alimentary tract. In heavy infections, they may cause irritation and inflammation of the mucous membrane. Although the life cycle of species that infect birds is still unknown, insects are believed to act as intermediate hosts (Krone and Cooper 2002). In Florida, Kinsella et al. (1995) isolated species of *Physaloptera* from the proventriculus of five different raptors, one of them *F. sparverius*. They found many larvae and immature adults, which could represent more than one species.

Pinto et al. (1994) reported *Procyrnea leptoptera* in the Brazilian subspecies of the American Kestrel (*F. sparverius caerae*) and an unidentified species of *Procyrnea* in the subspecies *F. s. cinnamominus*. Kinsella et al. (1995) also found a *Procyrnea* sp. in *F. sparverius* in Florida, U.S.A. In Chile, *Cyrnea spinosa* (Gendre, 1923) was reported from *Milvago chimango* in Chillán (San Martín et al. 2006). Species of *Procyrnea* have an indirect biological cycle and can use

cockroaches and other insects as intermediate hosts (Soulsby 1987). Other studies in Chile have documented insects of the order Coleoptera of the families Carabidae and Scarabidae in the diet of American Kestrels (Greer and Bullock 1966, Yañez et al. 1980, Simonetti et al. 1982, Figueroa and Corales 2004), which could be intermediate hosts of this parasite.

The nematode *Contraecacum caballeroi* (Bravo-Hollis 1939), and the louse *Nosopon lucidum* (Rudow 1869) were found in previous studies in Brazil and Argentina respectively. Pinto et al. (1994) reported *C. caballeroi* in the Brazilian American Kestrel (*F. sparverius cearae*) and Cicchino and Castro (1998) *N. lucidum* from *F. sparverius cinnamominus* in Argentina (Cicchino and Castro 1998); however, both parasites were absent in our study. A larger sample size may be necessary to determine whether this and other species of parasites are present in Chile.

The acari *E. minor*, originally known from the Eurasian Hobby (*Falco subbuteo*) in Europe, were recently described by Chirov and Mironov (1988) under the name *E. falconis* based on the material collected from Eurasian Kestrels (*Falco tinnunculus*). Another feather mite species reported from *F. sparverius* is *Dubininia* sp. (Xolalgidae; Philips 1990); Heteromorphic deutonymphs (hypopi) of *Tytodectes cerchneis* (Hypoderaridae) were found in subcutaneous tissues (Philips and Dindal 1979, Philips 1990); larvae of *Blankaartia velascoi* (Trombiculidae) were recorded on the skin and in nests (Wharton and Fuller 1952); and *Boyaia falconis* (Ereynetidae) and *Ptilonyssus cerchneis* (Rhinyssidae) were found in the nasal cavity (Strandtmann 1962, Pence and Casto 1976).

Degeeriella carruthi (Emerson 1953; Philopterae) has previously been reported from *F. sparverius* in North America (Malcomson 1960, Price et al. 2003) and *F. s. cinnamominus* in Argentina (Cicchino and Castro 1998) and Chile (González-Acuña et al. 2008).

Laemobothrion tinnunculi (Linnaeus 1758; Laemobothriidae) is a cosmopolitan species of chewing lice that has been found on many species of *Falco*, including *F. ardosiaceus*, *F. biarmicus*, *F. columbarius*, *F. eleonora*, *F. femoralis*, *F. jugger*, *F. longipennis*, *F. mexicanus*, *F. peregrinus*, *F. ruficularis*, *F. rupicoloides*, *F. severus*, *F. subbuteo*, and *F. sparverius* (Pérez et al. 1996, Price et al. 2003). Cicchino and Castro (1998) and González-Acuña et al. (2008) found it on *F. sparverius cinnamominus* in Argentina and Chile respectively.

Colpocephalum subzerafae (Tendeiro 1988; Menoponidae) is also a cosmopolitan parasite of *Falco* spp., including *F. amurensis*, *F. biarmicus*, *F. abyssinus*, *F. cencheroides*, *F. columbarius*, *F. concolor*, *F. naumanni*, *F. peregrinus*, *F. rupicoloides*, *F. tinnunculus*, *F. vespertinus*, and *F. sparverius* (Price et al. 2003). It was found on *F. s. cinnamominus* in Argentina by Cicchino and Castro (1998). This is the first report of this species from Chile.

The nine parasites collected from the American Kestrel all represent new records for Chile and two helminths (*A. felippeii*, *Cladotaenia* sp.) and one mite (*E. minor*) are new host records.

PARÁSITOS DE *FALCO SPARVERIUS* EN EL SUR DE CHILE

RESUMEN.—Durante 9 años, desde marzo de 2001 hasta diciembre de 2009, colectamos los parásitos externos y gastrointestinales de 15 halcones *Falco sparverius cinnamominus* de un centro de rehabilitación en la Región del Biobío en el centro-sur de Chile. Los helmintos colectados incluyeron una especie de trematodo (*Ascocotyle felippeii*), una especie de cestodo (*Cladotaenia* sp.), y tres especies de nematodos (*Baruscapillaria falconis*, *Physaloptera* sp. y *Procyrnea* sp.). Los ectoparásitos colectados incluyeron una especie de ácaro (*Epoplichus minor*) y tres especies de piojos (*Degeeriella carruthi*, *Laemobothrion tinnunculi* y *Colpocephalum subzerafae*). Seis de las nueve especies de parásitos descritos son nuevos registros para Chile, así mismo las especies *A. felippeii*, *Cladotaenia* sp. y *E. minor* son nuevos registros para el *F. sparverius cinnamominus*.

[Traducción del equipo editorial]

LITERATURE CITED

- ARAYA, M.B. AND G.H. MILLIE. 2000. Guía de campo de las aves de Chile. Editorial Universitaria, Santiago, Chile.
- BIERREGAARD, R.O., JR. 1994. Neotropical Accipitridae species accounts. Pages 106–205 in J. del Hoyo, A. Elliott, and J. Sargatal [Eds.], Handbook of the birds of the world, Vol. 2: New World Vultures to Guinea Fowl. Lynx Edicions, Barcelona, Spain.
- BUSH, A., K. LAFFERTY, J. LOTZ, AND A. SHOSTACK. 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *Journal of Parasitology* 83:575–583.
- CICCHINO, A. 1979. Contribución al estudio de los malófagos Argentinos IV. Consideraciones sobre *Acutifrons chimango* (Eichler 1948) y *Acutifrons connectens* (Carriker 1956) (Mallophaga, Philopterae). *Revista de la Sociedad Entomológica Argentina* 38:29–36.
- AND D. DEL C. CASTRO. 1998. Amblycera. Capítulo 8. Pages 84–104 in J.J. Morrone and S. Coscarón [Eds.]. Biodiversidad de Artrópodos Argentinos, Buenos Aires, Argentina.
- CHIROV, P.A. AND S.V. MIRONOV. 1988. New species of feather mites of the fauna of Kirgizia. *Izvestia Akademii Nauk Kirgizskoi SRR, Seria khimiko-tehnologicheskikh nauk* 3:48–51. (In Russian.)
- CLAYTON, D.H. 1990. Mate choice in experimentally parasitized rock doves: lousy males lose. *American Zoologist* 30:251–262.
- AND D.M. DROWN. 2001. Critical evaluation of five methods for quantifying chewing lice (Insecta: Phthiraptera). *Journal of Parasitology* 87:1291–1300.
- DE SCHAUENSEE, R.M. 1970. A guide to the birds of South America. Livingstone Publishing Co., Wynnewood, PA U.S.A.
- FIGUEROA, R.A. AND E.S. CORALES. 2002. Winter diet of the American Kestrel (*Falco sparverius*) in the forested Chilean Patagonia, and its relation to the availability of prey. *International Hawkwatcher* 5:7–14.

- AND ———. 2004. Summer diet comparison of the American Kestrel (*Falco sparverius*) and Aplomado Falcon (*Falco femoralis*) in an agricultural area of Araucanía, southern Chile. *Hornero* 19:53–60.
- FREEMAN, R.S. 1959. On the taxonomy of the genus *Cladotaenia*, the life histories of *C. globifera* (Batsch, 1786) and *C. cerci* Yamaguti, 1935, and a note on distinguishing between the plerocercoids of the genera *Paruterina* and *Cladotaenia*. *Canadian Journal of Zoology* 37:317–340.
- FREY, H. AND E. KUTZER. 1982. Zur Diagnostik heimischer Greifvogel- und Eulenparasiten. *Der Praktische Tierarzt* 10:894–902.
- GAUD, J. AND W.T. ATYEO. 1996. Feather mites of the world (Acarina, Astigmata): The supraspecific taxa. Part 1 (text). *Annales du Musée Royal de l'Afrique Centrale, Sciences Zoologiques* 277:1–193.
- GIBBS, J.P., F.A. REID, AND S.M. MELVIN. 1992. Least Bittern (*Ixobrychus exilis*). In A. Poole, P. Stettenheim, and F. Gill [EDS.], The birds of North America, No. 17. The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington DC U.S.A.
- GONZÁLEZ, E., V. DÍAZ, L. YAÑEZ, AND P. TORRES. 1974. *Capillaria obsignata* (Madsen, 1945) (Nematodo, Trichuroidea) en *Gallus gallus domesticus* de Chile. *Boletín Chileno de Parasitología* 29:49–50.
- GONZÁLEZ-ACUÑA, D., K. ARDILES, R. FIGUEROA, C. BARRIENTOS, P. GONZÁLEZ, AND L. MORENO. 2008. Lice of Chilean diurnal raptors. *Journal of Raptor Research* 42:281–286.
- , G. CASTILLO, J. LÓPEZ, L. MORENO, S. DONOSO, O. SKEWES, AND J. CABELLO. 2004. Parásitos gastrointestinales y externos de la paloma doméstica (*Columba livia*) en la ciudad de Chillán, Chile. *Agrociencia* 20:107–112.
- , O. SKEWES-RAMM, L. RUBILAR-CONTRERAS, A. DAUGZHIES, AND K. POHLMAYER. 2000. Endoparásitos de Codorniz (*Callipepla californica*) en Ñuble (Chile). *Boletín Chileno de Ornitología* 7:23–25.
- GREER, J.K. AND D.S. BULLOCK. 1966. Notes on stomach contents and weights of some Chilean birds of prey. *Auk* 83:308–309.
- HAFNER, M.S., D.S. PHILIP, F.X. VILLABLANCA, T.A. SPRADLING, J.W. DEMASTES, AND S.A. NADLER. 1994. Disparate rates of molecular evolution in cospeciating hosts and parasites. *Science* 265:1087–1090.
- HAHN, D.C., R.D. PRICE, AND P.C. OSENTON. 2000. Use of lice to identify cowbird hosts. *Auk* 117:943–951.
- JAKSIC, F.M. AND J.E. JIMÉNEZ. 1986. The conservation status of raptors in Chile. *Birds of Prey Bulletin* 3:95–104.
- JOHNSON, A.W. 1965. The birds of Chile and adjacent regions of Argentina, Bolivia and Perú. Vol. I. Platt Establecimientos Gráficos, Buenos Aires, Argentina.
- KAHLIL, L.F., A. JOHNES, AND R.A. BRAY. 1994. Keys to the cestode parasites of vertebrates. CAB International, The Natural History Museum, London, U.K.
- KINSELLA, J.M. 1974. A comparison of the helminth parasites of the cotton rat, *Sigmodon hispidus*, from several habitats in Florida. *American Museum Novitates* 1240:1–12.
- . 1988. Comparison of the helminth parasites of rice rats, *Oryzomys palustris*, from freshwater and saltwater marshes in Florida. *Proceedings of the Helminthological Society of Washington* 55:275–280.
- . 1991. Comparison of helminths of three species of mice, *Peromyscus floridanus*, *Peromyscus gossypinus*, and *Peromyscus polionotus*, from southern Florida. *Canadian Journal of Zoology* 69:3078–3083.
- AND D.J. FORRESTER. 1972. Helminths of the Florida duck, *Anas platyrhynchos fulvigula*. *Proceedings of the Helminthological Society of Washington* 39:173–176.
- , G.W. FOSTER, AND D.J. FORRESTER. 1995. Parasitic helminths of six species of hawks and falcons in Florida. *Journal of Raptor Research* 29:117–122.
- , ———, AND ———. 2001. Parasitic helminths of five species of owls from Florida, U.S.A. *Comparative Parasitology* 68:130–134.
- KRANTZ, G.W. 1978. A manual of acarology, Second Ed. Oregon State University Bookstores Inc., Corvallis, OR U.S.A.
- KRONE, O. 2000. Endoparasites in free-living birds of prey from Germany. Pages 101–116 in J.T. Lumeij, J.D. Remple, P.T. Redig, M. Lierz, and J.E. Cooper [EDS.], Raptor biomedicine III. Zoological Education Network Inc., Lake Worth, FL U.S.A.
- AND J.E. COOPER. 2002. Parasitic disease. Pages 105–120 in J.E. Cooper [ED.], Birds of prey: health and diseases, Third Ed. Iowa State Press, Ames, IA U.S.A.
- MALCOMSON, R.O. 1960. Mallophaga from birds of North America. *Wilson Bulletin* 72:182–197.
- MEY, E. AND D. GONZÁLEZ-ACUÑA. 2000. A new genus and species of Ischnocera (Insecta, Phthiraptera) of Chimango Caracara *Milvago chimango* from Chile with annotated checklist of chewing lice parasitizing caracaras (Aves, Falconiformes, Falconidae). *Rudolstädter Naturhistorische Schriften* 10:59–73.
- MIRONOV, S. 2003. On some problems in the systematics of feather mites. *Acarina* 11:3–29.
- NAROSKY, T. AND M. BABARSKAS. 2000. Aves de la Patagonia. Guía para su reconocimiento. Vásquez Mazzini Editores, Buenos Aires, Argentina.
- PALMA, R. 1978. Slide-mounting of lice: a detailed description of the Canada balsam technique. *New Zealand Entomologist* 6:432–436.
- PAVÉZ, E. 2004. Descripción de las aves rapaces chilenas. Pages 29–104 in A. Muñoz-Pedrerros, J. Rau, and J. Yañez [EDS.], Aves Rapaces de Chile. CEA Ediciones, Valdivia, Chile.
- PENCE, D.B. AND S.D. CASTO. 1976. Nasal mites of the subfamily Speleognathinae (Ereynetidae) from birds in Texas. *Journal of Parasitology* 62:466–469.
- PÉREZ, J.M., I. RUIZ-MARTÍNEZ, AND J.E. COOPER. 1996. Occurrence of chewing lice on Spanish raptors. *Ardeola* 43:129–138.
- PHILIPS, J.R. 1990. What's bugging your birds? Avian parasitic arthropods. *Wildlife Rehabilitation* 8:155–203.

- AND D.L. DINDAL. 1979. The acarine community of nest of birds of prey. Pages 559–562 in J.G. Rodriguez [Ed.], Recent advances in acarology, Vol. I. Academic Press, New York, NY U.S.A.
- PINTO, R.M., J.J. VICENTE, AND D. NOROJNA. 1994. Nematode parasites of Brazilian Accipitrid and Falconid birds (Falconiformes). *Memorias do Instituto Oswaldo Cruz* 89:359–362.
- PRICE, R. AND J. BEER. 1963. Species of *Colpocephalum* (Mallophaga: Menoponidae) parasitic upon the Falconiformes. *Canadian Entomology* 95:731–763.
- , R.A. HELLENTHAL, R.L. PALMA, K.P. JOHNSON, AND D.H. CLAYTON. 2003. The chewing lice: world checklist and biological overview. Illinois Natural History Survey Special Publication 24. Illinois Natural History Survey, IL U.S.A.
- , R.L. PALMA, AND R. HELLENTHAL. 1997. New synonymies of chewing lice (Phitiraptera: Amblycera, Ischnocera) described from Falconiformes (Aves). *European Journal of Entomology* 94:537–545.
- PRITCHARD, M.H. AND G.O. KRUSE. 1982. The collection and preservation of animal parasites. University of Nebraska Press, Lincoln, NE U.S.A.
- RICHARDSON, D.J. AND J.M. KINSELLA. 2010. New host and distribution records for gastrointestinal parasites of raptors from Connecticut, U.S.A. *Comparative Parasitology* 77:72–82.
- RUBILAR, L., E. BERTOSSI, AND O. SKEWES. 1996. Parasitismo gastrointestinal en la perdiz común (*Nothoprocta perdicaria*) en la zona de Ñuble, Chile. *Boletín Chileno de Parasitología* 51:35–37.
- SAN MARTÍN, J., C. BREVIS, L. RUBILAR, O. KRONE, AND D. GONZÁLEZ-ACUÑA. 2006. Parasitismo gastrointestinal en tiuque común *Milvago chimango chimango* (Vieillot, 1816) (Falconidae, Aves) en Ñuble, Chile. *Parasitología Latinoamericana* 61:63–68.
- , ———, ———, R. SCHMASCHKE, A. DAUGSCHIES, AND D. GONZÁLEZ-ACUÑA. 2005. Ectoparasitismo en tiuque común *Milvago chimango chimango* (Vieillot, 1816) (Aves, Falconidae) en la zona de Ñuble, Chile. *Lundiana* 6:49–55.
- SIMONETTI, J., H. NUÑEZ, AND J. YAÑEZ. 1982. *Falco sparverius* L.: rapaz generalista en Chile central (Aves: Falconidae). *Boletín del Museo Nacional de Historia Natural (Chile)* 39:119–124.
- SMITH, B.W. AND J.R. BELTHOFF. 2001. Identification of ectoparasites on Burrowing Owls in southwestern Idaho. *Journal of Raptor Research* 35:159–160.
- SMITH, S.A. 1993. Diagnosis and treatment of helminths in birds of prey. Pages 21–27 in P.T. Redig, J.E. Cooper, J.D. Remple, and D.B. Hunter [Eds.], Raptor biomedicine. University of Minnesota Press, Minneapolis, MN U.S.A.
- SOULSBY, E.J.L. 1987. Parasitología y enfermedades parasitarias en los animales domésticos, Seventh Ed. Editorial Interamericana, México City, México.
- STRANDTMANN, R.W. 1962. A ptilonyssid mite from the sparrow hawk, *Falco sparverius* (Acarina: Rhinonyssidae). *Proceedings of the Entomological Society of Washington* 64:100–110.
- TAFT, S.J., K. SUCHOW, AND M. VAN HORN. 1993. Helminths from some Minnesota and Wisconsin raptors. *Journal of the Helminthological Society of Washington* 60:260–263.
- TENDEIRO, J. AND L.F. MENDES. 1994. Estudos sur les *Colpocephalum* (Mallophaga, Menoponidae), parasites des Falconiformes. III Vuelques observations sur le “golpe polybori” Price and Beer, avec description de tríos espèces nouvelles. *Garcia de Orta Série de Zoologia* 20: 137–140.
- TORO, H., C. SAUCEDO, C. BORIE, R.E. GOUTH, AND H. ALCAINO. 1999. Health status of free living pigeons in the city of Santiago. *Avian Pathology* 28:619–623.
- TORRES, P., R. FRANJOLA, L. YAÑEZ, V. DÍAS, E. GONZÁLEZ, AND M.I. MONTECINOS. 1974. Estudio preliminar sobre helmintos y artrópodos del *Gallus gallus domesticus* en la provincia de Valdivia, Chile. *Boletín Chileno de Parasitología* 29:115–117.
- TRAVASSOS, L. 1928. Deux nouvelles espèces du genre *Ascocotyle* Looss, 1899. *Comptes Rendues de la Société Biologique de Paris* 100:939–940.
- . 1930. Revisão do gênero *Ascocotyle* Looss, 1899. *Memorias do Instituto Oswaldo Cruz* 23:61–97.
- VASILEV, I.D. 1958. Eine neue Akarinengattung und art der Analgesoidea – *Dubininia dobrivelikovi* sp. n. *Izvestiya na Bulgurskata Akademiya na Naukite* 2:77–82.
- WHARTON, G.W. AND H.S. FULLER. 1952. A manual of the chiggers. *Memoirs of the Entomological Society of Washington* 4:1–185.
- YAMAGUTI, S. 1958. Systema helminthum, Vol. 1. The digenetic trematodes of vertebrates-Part 1. Interscience Publishers, Inc., New York, NY U.S.A.
- . 1959. Systema helminthum, Vol. II. The cestodes of vertebrates. Interscience Publishers Inc., New York, NY U.S.A.
- . 1961. Systema helminthum, Vol. III. The nematodes of vertebrates. Interscience Publishers, Inc., New York, NY U.S.A.
- YAÑEZ, J., H. NUÑEZ, R.P. SCHLATTER, AND F.M. JAKSIC. 1980. Diet and weight of American Kestrel in central Chile. *Auk* 97:629–631.

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