



LETTER TO THE EDITOR

Endoparasites of the kodkod, *Oncifelis guigna* (Carnivora, Felidae) in ChileEndoparásitos de la güiña *Oncifelis guigna* (Carnivora, Felidae) en ChileDANIEL GONZÁLEZ-ACUÑA^{1, *}, LUCILA MORENO¹, KAREN ARDILES¹, MARCELO FLORES²,
MELANIE DUCLOS³ & MIKE KINSELLA⁴¹ Facultad de Ciencias Veterinarias, Universidad de Concepción, Av. Vicente Méndez 595, Chillán, Chile² Facultad de Ciencias del Mar y Recursos Naturales, Universidad de Valparaíso, casilla 5080, Reñaca, Viña del Mar, Chile³ Escuela de Ciencias Agropecuarias, Universidad de Viña del Mar, Agua Santa 7055, Sector Rodelillo, Viña del Mar, Chile⁴ Helm West Laboratory, 2108 Hilda Avenue, Missoula, MT 59801, USA

*Corresponding author: danigon@udec.cl

The kodkod, *Oncifelis guigna* o *Felis guigna* (Molina 1782), is one of the smallest and least known felids of the world. They are found in southwest Argentina, and central and southern Chile (Redford & Eisenberg 1992). Although it is found from sea level to 1900 m in rainforest, savanna, scrubs and mountains (Quintana et al. 2000), *O. guigna* prefers forest habitats connected by corridors containing free-ranging domestic fowl (Sanderson et al. 2002), and thicket-forest and dense bush cover far from roads and close to large patches of native forest, being almost exclusively restricted to these types of habitats (Dunstone et al. 2002, Acosta-Jamett & Simonetti 2004). The kodkod is distributed in a total area of approximately 160000 km² (33°-50° S and 70°-75° W), one of the smallest geographic distributions known for any felid, and therefore information that can improve their conservation is of high priority (Nowell & Jackson 1996).

Information on the endoparasites of neotropical felids is scarce, especially from Chile. In Argentina, Flueck & Jones (2006) warned that kodkod could be a host for the potential existence of a sylvatic cycle of *Taenia ovis krabbei* Moniez in Patagonia. In Chile, Wolfhügel (1949) reported *Spirometra mansonioides* Mueller (named as *Diphyllobothrium decipiens* [Diesing]) in kodkod from Valdivia forest. Alvarez (1963) found three kodkod negative for echinococcosis, and Alvarez et al. (1970) found two kodkod negative for trichinellosis. Fernández & Villalva (1984) examined one kodkod from Chaimavida (36°50'

S; 73°03' W) and found the helminths: *Uncinaria stenocephala* Railliet, *Toxocara cati* Shrank, *Taenia taeniaformis* Batsch, *S. mansonioides* and *Taenia* sp. Since the kodkod is known to be a species in decline (Muñoz-Pedreros & Yañez 2000), the purpose of this study is to extend our knowledge of helminth parasites in this endangered wild feline.

We necropsied one specimen from San Antonio (33°37' S; 71°37' W) and another from Pemuco (36°59' S; 71°58' W), Chile. Both kodkod were found run over on the highway. Each kodkod was dissected and the organs examined under a stereoscopic microscope for endoparasites. In addition, 14 fecal samples were examined from Laguna San Rafael National Park (46°40' S; 73°52' W). Helminths collected were preserved in 70 % ethanol and studied in temporary mounts of lacto-phenol. Skeletal muscle samples were also examined for *Trichinella* larvae. Taxonomy for helminths follows Sprent (1968) for *Toxascaris leonina* (Von Linstow) and *T. cati*, Quentin (1970) and Rojas & Digiani (2003) for *Mastophorus muris* (Gmelin). Voucher specimens were deposited at the United States National Parasite Collection at Beltsville, Maryland, USA and the collection of the Laboratory of Zoology of the Faculty of Veterinary of the University of Concepción.

The two kodkod necropsied were negative for trichinellosis. Three species of helminths representing 98 individuals were found.

T. leonina (Ascaridida, Ascarididae): a total of 18 adult specimens were collected from the

small intestine of the kodkod from San Antonio. This ascaridid has been isolated in many different wild and domestic felids of the world (Torres et al. 1998), including *Lynx pardinus* (Temminck) in Spain (Torres et al. 1998), *Panthera tigris altaica* Temminck and *Felis bengalensis euptylurus* Kerr from Eastern Siberia (González et al. 2007), and *Panthera onca* Linnaeus in Bolivia (Beltrán-Saavedra et al. 2009). In Chile, it has been reported in domestic dogs and cats (Tagle 1966, López et al. 2006) however the present report is the first in wild animals.

T. cati (Ascaridida, Ascarididae): 72 specimens were collected from the small intestine of the kodkod from Pemuco. This ascarid is a cosmopolitan parasite of felids, including domestic cats and wild felids in the subfamilies Felinae and Pantherinae (Anderson 2000). *T. cati* is commonly encountered in felines in zoo collections (Fowler & Theobald 1978, Garden et al. 1978). This parasite has been reported in *P. t. altaica*, from Eastern Siberia (González et al. 2007), *Panthera leo* Linnaeus of Northern Tanzania (Bjork et al. 2000), *Panthera pardus sexicolor* Pocock in Iran (Esfandiari et al. 2010), *P. onca* in Bolivia (Beltrán-Saavedra et al. 2009), *Puma concolor* Linnaeus in Belize (Central America) and North America (Patton et al. 1986, Rickard & Foreyt 1992), *Leopardus pardalis* Linnaeus in Bolivia (Fiorello et al. 2006), and *Oncifelis geoffroyi* d'Orbigny et Gervais in central Argentina (Beldomenico et al. 2005). It has been reported in domestic animals in southern Chile with a prevalence of 70 % (Torres et al. 1972a), and in populations from the Valdivia river with a prevalence of 19 % and 65.1 % in dogs and cats respectively (Torres et al. 1995), besides in Santiago in 10 % of the cats (López et al. 2006). It has been also detected in *P. concolor* in Chile (Torres et al. 1972b).

There are two main paths of infection of *T. cati* and *T. leonina*, either by direct transmission or indirect involving a paratenic host, usually rodents or earthworms (Anderson 1992). We suspect that infection of the kodkod occurs through the consumption of rodents which are its principal food source (Correa & Roa 2005).

M. muris (Spiruroidea, Spirocercidae, Mastophorinae): 8 specimens of this spirurid were found in one of the 14 fecal samples from

Laguna San Rafael. This is a cosmopolitan nematode parasite of rodents (Prokopic & Genov 1974, Zagicek 1987, Torres et al. 2001). However, it has also been reported in marsupials and carnivores (Baylis 1927, Smales 1995, Feliu et al. 1991, Torres et al. 1996, 1997, 1998, 2001). Smales (1995) postulated that *M. muris* was introduced into the continents of Australia, and North and South America with its most common hosts, *Rattus norvegicus* Linnaeus and *Rattus rattus* Linnaeus. Vicente et al. (1997) reported *M. muris* in *Rattus* spp. in different urban localities of Brazil. Rojas & Digiani (2003) reported the first record of *M. muris* from South America in a wild host, the leaf-eared mouse (*Graomys griseoflavus* [Waterhouse]), from Argentina.

In the National Park of Lago San Rafael, kodkod are sympatric with other wild felids such as puma, Geoffroy's cat and the pampas cat; various species of rodents (*Oligoryzomys longicaudatus* [Bennett], *Akodon olivaceus* Waterhouse, *A. longipilis* [Waterhouse], *Phyllotis darwini* [Waterhouse], *Geoxus valdivianus* [Philippi], *Irenomys tarsalis* [Philippi]); and mustelids (*Lutra provocax* [Thomas], *L. feline* [Molina], *Conepatus humboldtii* Gray, *Galictis cuja* Molina, and the introduced *Mustela vison* Schreber).

M. muris has an indirect life cycle, which requires insects (mainly coleopterans) as intermediate hosts (Quentin 1970, Anderson 1992, Rojas & Digiani 2003). Since the principal diet of kodkod consists of rodents (Housse 1953, Greer 1965, Correa & Roa 2005), it is common to speculate that the nematodes were simply ingested when the predator ate a rodent. However, since there are so many records of this species from various species of carnivores, it is more likely that this is just a case of a nematode developing in an abnormal host. This represents the first report of the species in Chile, and constitutes the first record of *M. muris* in *O. guigna*.

ACKNOWLEDGMENTS

Our thanks to José Luis Brito of the San Antonio Museum and Carlos Benavente of the Servicio Agrícola y Ganadero (SAG) Bulnes, for provide the corpses of Kodkod, one of San Antonio and the other from Pemuco respectively.

LITERATURE CITED

- ACOSTA-JAMETT G & J SIMONETTI (2004) Habitat use by *Oncifelis guigna* and *Pseudalopex culpaeus* in a fragmented forest landscape in central Chile. *Biodiversity and Conservation* 13: 1135-1151.
- ÁLVAREZ V (1963) Echinococcosis silvestre en Chile. *Archivos Internacionales de la Hidatidosis* 21: 156-159.
- ÁLVAREZ V, G RIVERA, A NEGhme & H SCHENONE (1970) Triquinosis en animales en Chile. *Boletín Chileno de Parasitología* 25: 83-86.
- ANDERSON R C (1992) Nematode parasites of vertebrates. Their development and transmission. Wallingford, CAB International.
- BAYLIS HA (1927) Some new parasitic nematodes from Australia. *Annals and Magazine of Natural History* 20: 215-225.
- BELDOMENICO P, J KINSELLA, M UHART, G GUTIÉRREZ, J PEREIRA, H DEL V FERREYRA & C MARULL (2005) Helminths of Geoffroy's cat, *Oncifelis geoffroyi* (Carnivora, Felidae) from the Monte desert, central Argentina. *Acta Parasitológica* 50: 263-266.
- BELTRAN-SAAVEDRA LF, S ANGULO & JL GONZALES (2009) Uso de metodologías de censos muestrales indirectos de fecas para evaluar endoparásitos en mamíferos silvestres: Un ensayo en la Reserva Privada de San Miguelito, Santa Cruz, Bolivia. *Ecología en Bolivia* 44: 56-61.
- BJORK K, A GARY, MS AVERBECK & BE STROMBERG (2000) Parasites and parasite stages of free-ranging wild lions (*Panthera leo*) of Northern Tanzania. *Journal of Zoo and Wildlife Medicine* 31: 56-61.
- CORREA P & A ROA (2005) Relaciones tróficas entre *Oncifelis guigna*, *Lycalopex culpaeus*, *Lycalopex griseus* y *Tyto alba* en un ambiente fragmentado de la zona central de Chile. *Mastozoología Neotropical* 12: 57-60.
- DUNSTONE N, L DURBIN, I WYLLIE, R FREER, G ACOSTA-JAMETT, M MAZZOLLI & S ROSE (2002) Spatial organization, ranging behaviour and habitat use of the kodkod (*Oncifelis guigna*) in southern Chile. *Journal of Zoology* 257: 1-11.
- ESFANDIARI B, MR YOUSSEFI & M ABOUHOSSEINI (2010) First report of *Toxocara cati* in Persian leopard (*Panthera pardus saxicolor*) in Iran. *Global Veterinaria* 4: 394-395.
- FELIÚ C, J TORRES, J MIQUEL & JC CASANOVA (1991) Helminthofauna of *Mustela erminea* Linnaeus, 1758 (Carnivore: Mustelidae) in the Iberian Peninsula. *Research and Reviews in Parasitology* 51: 57-60.
- FERNÁNDEZ JB & CS VILLALBA (1984) Helminths parasites of *Felis guigna* Molina, 1782. *Boletín de la Sociedad de Biología de Concepción (Chile)* 55: 161-164.
- FIGLIORIO C, R ROBBINS, L MAFFEI & SE WADE (2006) Parasites of free-ranging small canids and felids in the Bolivian Chaco. *Journal of Zoo and Wildlife Medicine* 37: 130-134.
- FLUECK WT & A JONES (2006) Potential existence of a sylvatic cycle of *Taenia ovis krabbei* in Patagonia, Argentina. *Veterinary Parasitology* 135: 381-383.
- FOWLER E & J THEOBALD (1978) Carnivores: Immunizing procedures. In: Fowler ME (ed) *Zoo and wild animal medicine*: 613-617. WB Saunders Co, Philadelphia.
- GARDEN J, JA HAMMOND & PD LERICHE (1978) The epidemiology of ascariasis in Felidae at Edinburgh Zoological Gardens. *Royal Society of Tropical Medicine and Hygiene* 72: 641.
- GREER JK (1965) Mammals of Malleco Province, Chile. *Publications of the Museum, Michigan State University Biological Series* 3: 49-152.
- GONZÁLEZ P, E CARBONELL, V URIOS & VV ROZHNOV (2007) Coprology of *Panthera tigris altaica* and *Felis bengalensis euphilurus* from the Russian far east. *Journal of Parasitology* 93: 948-950.
- HOUSSE PR (1953) *Animales salvajes de Chile*. Ediciones Universidad de Chile, Santiago, Chile.
- LÓPEZ JD, KV ABARCA, PM PAREDES & ET INZUNZA (2006) Parásitos intestinales en caninos y felinos con cuadros digestivos en Santiago, Chile. *Consideraciones en Salud Pública*. *Revista Médica de Chile* 134: 193-200.
- MUÑOZ-PEDREROS A & J YÁÑEZ (2000) Mamíferos de Chile. Centro de Estudios Agrarios & Ambientales (CEA) & Museo Nacional de Historia Natural de Chile Ediciones. Valdivia, Chile.
- NOWELL K & P JACKSON (1996) Status survey and conservation plan. *Wild Cats*. IUCN. Gland, Switzerland.
- PATTON S, AR RABINOWITZ, S RANDOLPH & S STRAWBRIDGE-JOHNSON (1986) A coprological survey of parasites of wild Neotropical felidae. *Journal of Parasitology* 72: 517-520.
- PROKOPIC J & T GENOV (1974) Distribution of helminths in micromammals (Insectivora and Rodentia) under different ecological and geographical conditions. *Ceskoslovenska Akademie, Praha, Czechoslovakia*.
- QUENTIN JC (1970) Morphogenese larvaire du Spiruride *Mastophorus muris* (Gmelin, 1790). *Annales de Parasitologie Humaine et Comparee* 45: 839-855.
- QUINTANA V, J YÁÑEZ & M VALDEBENITO (2000) Orden Carnivora. In: Muñoz P & J Yáñez (eds) *Mamíferos de Chile*: 155-188. CEA, Santiago.
- RICKARD L & W FOREYT (1992) Gastrointestinal parasites of cougars (*Felis concolor*) in Washington and the first report of *Ollulanus tricuspis* in a sylvatic felid from North America. *Journal of Wildlife Diseases* 28: 130-133.
- REDFORD KH & JF EISENBERG (1992) *Mammals of the Neotropics: The southern cone*. University of Chicago Press, Chicago, Illinois.
- ROJAS M & MC DIGIANI (2003) First records of *Mastophorus muris* (Gmelin, 1790) (Nematoda: Spiruroidea) from a wild host in South America. *Parasite* 10: 375-378.
- SANDERSON J, ME SUNQUIST & AW IRIARTE (2002) Natural history and landscape-use of guignas (*Oncifelis guigna*) on isla grande de Chiloé, Chile. *Journal of Mammalogy* 83: 608-613.
- SMALES LR (1995) *Mastophorus muris* (Nematoda: Spirocercidae) from the musky rat-kangaroo, *Hybospirymnodon moschatus*. *Transactions Royal Society of South Australia* 119: 95.
- SPRENT JFA (1968) Notes on *Ascaris* and *Toxascaris*, with a definition of *Baylisascaris* gen. nov. *Parasitology* 58: 185-198.

- TORRES J, C FELIÚ, J MIQUEL, JC CASANOVA, R GARCÍA-PEREA & J GISBERT (1996) Helminthofauna de *Mustela putorius* Linnaeus, 1758 (Carnivora: Mustelidae) en la península Ibérica. Boletín de la Sociedad de Historia Natural de Baleares 39: 155-165.
- TORRES J, J MIQUEL, C FELIÚ, M MOTJÉ & JC CASANOVA (1997) Helminthological investigation of *Mustela novalis* Linnaeus, 1766 in Spain. A Mustelid broadly spread all over western Europe and little studied from a parasitic viewpoint. Parasitologica Hungarica 29-30: 55-56.
- TORRES J, R GARCÍA-PEREA, J GISBERT & C FELIÚ (1998) Helminth fauna of the Iberian lynx, *Lynx pardinus*. Journal of Helminthology 72: 221-226.
- TORRES J, J MIQUEL & M MOTJE (2001) Helminth parasites of the eurasian badger (*Meles meles* L.) in Spain: A biogeographic approach. Parasitology Research 87: 259-263.
- TORRES P, A HOTT & H BOEHMWALD (1972a) Protozoos, helmintos y artrópodos en gatos de la ciudad de Valdivia y su importancia para el hombre. Archivo de Medicina Veterinaria 4: 20-29.
- TORRES P, N GALLARDO & N ESPINOZA (1972b) *Felis concolor puma*, reservorio de *Toxocara cati* en Chile. Archivo de Medicina Veterinaria 4: 1-3.
- TORRES P, R FRANJOLA, J PÉREZ, S AUAD, C HERMOSILLA, et al. (1995) Geohelminthosis intestinales en el hombre y animales domésticos de sectores ribereños de la cuenca del río Valdivia, Chile. Boletín Chileno de Ornitología 50: 57-66.
- VICENTE JJ, HO RODRIGUES, DC GOMES & RM PINTO (1997) Nematoides do Brasil. Parte V: Nematoides de Mamíferos. Revista Brasileira de Zoologia 14 (Suppl 1): 1-452.
- WOLFFHUGEL K (1949) ¿Es autóctono el *Diphyllobothrium* en Chile? Boletín de la Sociedad de Biología de Concepción (Chile) 24: 85-89.
- ZAGICEK D (1987) Laboratory diagnosis of parasites in the Czech Socialist Republic in the period 1976-1986. Veterinarstvi 37: 549-550.

Recibido el 5 de agosto de 2010; aceptado el 22 de diciembre de 2010