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ORIGINAL PAPER

Helminth parasites of the European starling (*Sturnus vulgaris*) (Aves, Sturnidae), an invasive bird in Argentina

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Abstract The aim of this work is to contribute to the knowledge of gastrointestinal parasites of the European starling *Sturnus vulgaris*, an invasive bird from Argentina. Seventy-six birds were collected during the spring of 2007 and were examined for helminths. Six parasite species were found: one trematoda of the *Echinostoma revolutum* "group," four nematodes (*Synhimantus nasuta*, *Microtetrameres* sp., *Pterothominx exilis*, and *Ornithocapillaria ovopunctata*), and one acanthocephalan (*Plagiorhynchus cylindraceus*). All species found have been recorded in Eurasia and/or North America previously, although present reports enlarge their geographical distribution. As expected in an invasive host, the parasite community shows much lower species richness (n=6) than those observed in their native area (79 and 35 in the Eurasia and North America, respectively).

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Introduction

The European starling *Sturnus vulgaris* L. (Aves, Sturnidae) is a native species of Eurasia and North Africa. It is considered one of the worst invasive bird species (Lowe et al. 2004) with successful widespread introductions around the world. The species is well established in North America, New Zealand, Australia, and South Africa, as well as Pacific and Caribbean Islands (Feare 1984). The first record in Argentina was in Buenos Aires city in 1987 (Pérez 1988), and starlings were observed breeding in a wooded area of Buenos Aires city the following summer (Schmidtutz and Agulián 1988). Its subsequent dispersal in Argentina was summarized by Peris et al. (2005) and Jensen (2008). Large populations of starlings can cause significant economic losses in agriculture, because they eat a wide range of seeds, grains, and fruits, both natural and cultivated (Pimentel et al. 2005). Starling also feeds on a variety of invertebrates such as leatherjackets (Diptera), earthworms (Lumbricidae), caterpillars (Orthoptera), pillbugs (Isopoda), and Lepidoptera (Westerterp et al. 1982; Moore 1986).

Parasitism can play a very important role in the impact of invasive species (Blackburn et al. 2009). The introduced species can either transport parasites that can infect the local birds or can serve as a reservoir for pathogenic species already present in the area where it was introduced (Poulin and Morand 2004). If the introduced species escape from the native parasite, it may increase the likelihood that an exotic population will be able to grow from initial low numbers (Blackburn et al. 2009). The "lost enemy hypothesis" suggests that invasive species are favored by a lack of natural enemies such as parasites (Torchin and Mitchell 2004).

Starlings have been associated with numerous disease organisms transmissible to humans and livestock. These include bacterial diseases such as salmonellosis (Salmonella food poisoning), chlamydiosis and transmissible gastroenteritis of swine (hog cholera), paratuberculosis, *Escherichia coli*, the fungal diseases blastomycosis and histoplasmosis, the protozoan diseases toxoplasmosis and coccidiosis, and viral diseases including Newcastle disease and West Nile virus (Clark and Mclean 2003; Linz et al. 2007; Dubley 2008). Starlings are generally a more serious disease vector to livestock, especially poultry and egg producers, than to humans (Kern 2001).

A total of 79 helminth species have been recorded in the Eastern hemisphere parasitizing European starlings, while in North America only 35 species have been reported (Hair and Forrester 1970; Cooper and Crites 1976). Bernard (1987) found a prevalence of 97.1 % of helminths in European starling from Belgium and North Africa. In North America, Boyd (1951) found 90 % of prevalence of helminths in starlings.

To date, there have been no records of helminths in the European starling in the Neotropical region. The aim of the present study is to describe the helminth fauna of *S. vulgaris* from Argentina, taking into account its rapid expansion and its potential role as a reservoir and dispersing agent for several pathogen species.

Materials and methods

The study was carried out on 76 European starlings of *S. vulgaris* (juveniles and adults of both sexes) collected in Bernal (34° 41′ 44″ S, 58° 16′ 0″ W) in November 2007 (permission no. 347/07, Ministerio de Asuntos Agrarios de la Provincia de Buenos Aires) and immediately transported to the laboratory. The birds were sexed by gonadal examination and classified as juveniles (less than 1 year old) or adults. Viscera were removed and fixed in 10 % formalin or 96 % alcohol. The gastrointestinal tract was separated into the esophagus, proventriculus, gizzard, and intestine; the last organ was divided into eight equal parts of 5 cm. The koilin lining of the gizzard was removed and was examined in detail. The body cavity, liver, pancreas, biliary vesicle, gall bladder, gonads, lungs, heart, bursa of Fabricius, and kidneys were also examined for parasites. Helminths were collected under a stereomicroscope, fixed in 5 % hot formalin, and preserved in 70 % ethanol.

Nematodes were cleared in 25 % glycerine ethanol and acanthocephalans in lactophenol. Trematodes were stained with acetic carmine. Drawings were made with the aid of a camera lucida. Some specimens of each species collected were dehydrated, dried by the critical point method, gold-coated, and observed using a scanning electron microscope (JEOL/JSMT 6360 LV, Tokyo, Japan) from the Museo de La Plata (Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata), Argentina. Measures are given in micrometers.

The terms prevalence (*P*), mean intensity (MI), and community parameters were interpreted and calculated according to Bush et al. (1997). The MI is followed by range.

Voucher specimens were deposited in the Helminthological Collection of the Museo de La Plata (MLP) (Appendix 1).

Results

A total of 141 specimens of helminths were recovered, belonging to six parasite species (Table 1): one species of trematode of the *Echinostoma revolutum* “group” (Echinostomatidae) in the intestine; four nematode species, *Synhimantus* (*Dispharynx*) *nasuta* Chabaud, 1975 (Acuariidae) in the esophagus, proventriculus, and gizzard, *Microtetrameres* sp. (Tetrameridae) in the proventriculus, *Pterothominx exilis* (Dujardin, 1845), and *Ornithocapillaria ovopunctata* (Linstow, 1873) (Capillarinae) (Figs. 1 and 2) in the first 3 portions of the intestine; and one acanthocephalan species, *Plagiorhynchus* (*Prosthorhynchus*) *cylindraceus* (Goeze, 1782) (Gigantorhynchidae) all along the intestine, most frequently in the middle portions. Of the total examined (n=76), 52.6 % were parasitized by at least one of the six species identified in the community (MI=3.5). There were no cestodes in the specimens examined. Both males and females and juveniles as adults had parasites.

Synhimantus nasuta and *P. cylindraceus* were the most common in the community studied (P=31.6 %, MI=3.4, 1–21 and P=31.6 %, MI=1.6, 1–7, respectively). *Microtetrameres* sp. and the echinostomatid species were found with very low prevalence and intensities (P=2.6 %, MI=1.5 and P=1.3 %, MI=2, respectively). Capillariid species (*P. exilis* and *O. ovopunctata*) were found in two host specimens. However, since females of these species were difficult to distinguish, data from both were combined (P=2.6 %, MI=7.5, 3–12).

Discussion

The *E. revolutum* “group” includes species of *Echinostoma* with 37 collar spines that qualify as cryptic due to the interspecific homogeneity of characters used to differentiate species (Chantima et al. 2013; Georgieva et al. 2013). Species of this group have an indirect life cycle and are found in birds around the world (Sorensen et al. 1997; Woon-Mok et al. 2011). The first intermediate host is a snail of the family Lymnaeidae and the second (infective) intermediate are freshwater snails, mussels, and frogs. The trematodes feed on epithelial tissues, causing mucosal damage (Kanev 1994).

Table 1 Helminths found in the digestive tract of European starlings *Sturnus vulgaris* (n=76) in Argentina compared with those found in other regions

Groups	Eurasia (E)[a,b]	North America (N)[a,b]	Argentina (A)[c]	Number of species shared between E and N[a,b]	Number of species shared between N and A[a,b,c]
Trematoda	27	8	1	2	1
Cestoda	12	8	–	3	–
Nematoda	29	15	4	7	4
Acanthocephala	11	4	1	1	1
Total	79	35	6	11	6

[a] From Hair and Forrester (1970)
[b] From Cooper and Crites (1976)
[c] Present work

Members of this group have been previously reported in Argentina (Martínez and Binda 1993; Lunaschi et al. 2007).

Synhimantus nasuta is a cosmopolitan parasite of the proventriculus in a wide variety of birds (Rickard 1985; Gornatti Churria et al. 2011). It is considered one of the most pathogenic species in the genus (Carreno 2008). Its life cycle is indirect, with intermediate hosts such as the pillbug (*Armadillidium vulgare*) and the sowbug (*Porcellio scaber*) (Isopoda). Pillbugs are found in large numbers in Buenos Aires province (Cuartas and Petriella 2001), and nestlings of the European starling are known to feed on them (Moore 1986). There is evidence that *Synhimantus* infection, also known as dispharynxiasis, can cause mortality in wild birds (Goble and Kutz 1945; Zhang et al. 2005), and controlling outbreaks of dispharynxiasis in captive birds is dependent on elimination of the isopod intermediate hosts (Carreno 2008).

Species in the genus *Microtetrameres* are common parasites of birds (Anderson 2000). Females live inside the lumen of the stomach glands, and compression of the glands can result in an inflamed mucosa and atrophy. Their life cycle is indirect, and birds become infected by consuming arthropods

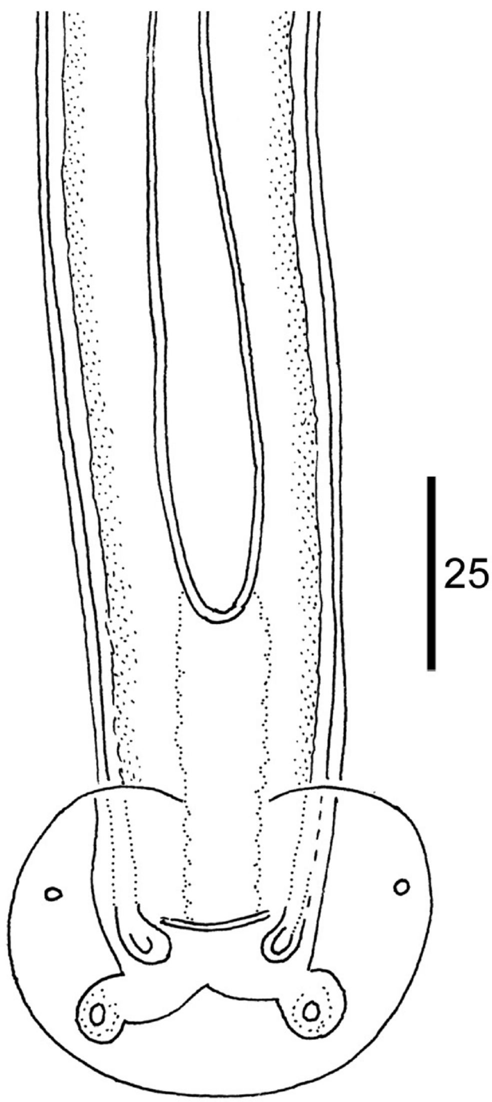

Fig. 1 *Ornithocapillaria ovopunctata*, detail of posterior end

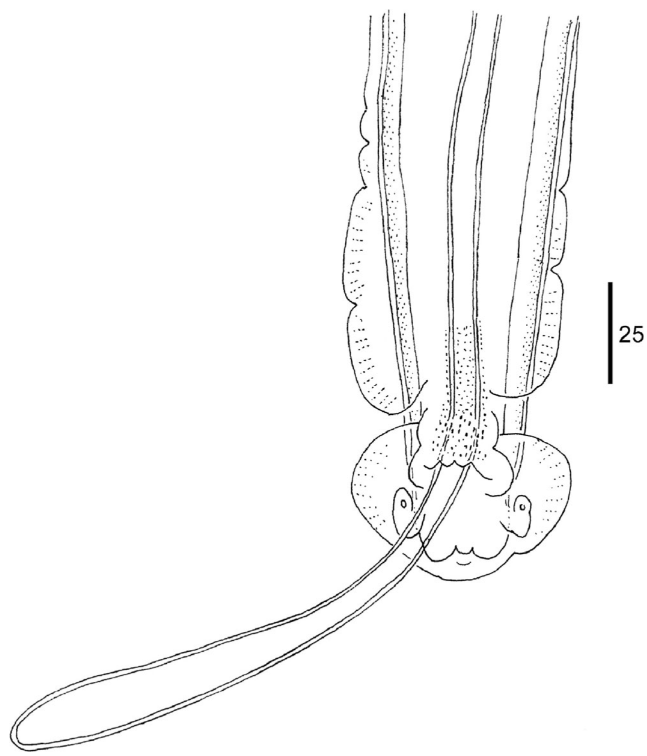

Fig. 2 *Pterothominx exilis*, detail of posterior end

such as grasshoppers and orthopterans (Anderson 2000). Species of the genus *Microtetrameres* were recorded previously in the European starling in North America (e.g., Boyd 1951; Hair and Forrester 1970).

The ecology of capillariid nematodes that infect wild birds is poorly understood. The life cycle of many of them is direct, so there is a high risk of transmission and disease among poorly maintained captive birds where worm burden can be high (Carreno 2008). Life cycle of *O. ovopunctata* has not yet been completely studied, but it was mentioned that gravid females lay eggs which get into the external environment along with host's feces; under favorable conditions, a larva develops within 13–14 days at 27.5 °C and 34 days at a room temperature (Moravec 2001). In other cases, eggs must first be ingested by earthworms, in which they hatch (Anderson 2000). It was stated that development of some species of the genus *Pterotominx* occurs with the participation of an intermediate host (e.g., earthworms) (Skrjabin et al. 1970).

Plagiorhynchus cylindraceus is a common parasite of passerine birds, apparently originating from Europe (Skuballa et al. 2010). Isopods of the genus *Armadillium* and *Porcellium* were reported as intermediate hosts of this parasite (Schmidt and Olsen 1964; Carreno 2008). It was demonstrated that *P. cylindraceus* has an important detrimental effect on the flow of food energy through infected European starlings (Connors and Nickol 1991).

European starlings are truly omnivorous. Approximately half of the diet of the starling is made up of crustaceans, insects, especially moths and butterflies (and their caterpillars), beetles (especially their larvae, grubs in lawns), crickets, and grasshoppers. Starlings are also fond of earthworms (Kern 2001). Some of the species that the starling consumes were registered as intermediate hosts of the parasites found in the present work (Feare 1984; Moore 1986); therefore, they could become infected during feeding.

The two most prevalent parasite species found in this work use isopods as intermediate hosts (i.e., the nematode *S. nasuta* and the acanthocephalan *P. cylindraceus*). It is possible that the same isopoda specimens harbor the larvae of these two parasite species. Isopods were found in the stomach content of starling nestlings in Berazategui, a locality next to the area where the starlings for the present study were collected (Ibañez, unplished data).

The trematode *E. revolutum* and species of the nematode genus *Microtetrameres* have been reported in the starling only in the Nearctic region (Cooper and Crites 1976). The other species identified have been recorded from starlings both in the Palearctic and Nearctic regions (Hair and Forrester 1970; Vincent 1972; Cooper and Crites 1976) (Table 1).

The number of helminth species found in Argentina (n=6) is much lower than the 79 and 35 helminth species found in European starlings in Eurasia and North America, respectively (Hair and Forrester 1970; Cooper and Crites 1976). Several possible factors may impact this variation. The different food resources in the colonized habitat could contribute to the low parasite richness, particularly when indirect life cycles are involved (Vincent 1972). Other causes could be found in the nature of the introduction processes. If a low number of specimens are introduced or if they come from a narrow geographic area, they should have a low number of parasites (Blackburn et al. 2009). Torchin et al. (2003) showed that introduced populations had roughly half the number of parasite species of native populations. Some exotic populations are apparently entirely free of at least some types of parasites (Steadman et al. 1990).

Møller and Cassey (2004) found that introduced bird species with stronger T cell responses were more successful in becoming established. This ability to deal with new parasites via the immune system may be more important than the loss of previous parasites (Blackburn et al. 2009).

The starling has been established for approximately 120 years in North America, a relatively short period of time in ecological terms, but still four times as long as they have been present in Argentina. This could explain the low parasite richness found here. The westward spreading of this species from Europe to North America was accompanied by a further loss of parasites, mainly trematodes (Vincent 1972). The new southward colonization seems to be associated with still additional losses, notably the cestodes.

Moreover, when an invasive species is accompanied by its parasites, these can be transmitted to new host species. For example, it is known that transcontinental introductions of the European starling and other passerine birds have played a major role in the establishment of the acanthocephalan *P. cylindraceus* in different parts of the world (Skuballa et al. 2010).

On the other hand, some avian parasites native to North America switched to use the starling as a host after its introduction on that country (Hair and Forrester 1970). It is probable that, over the course of time, and taking account that founding birds were lightly parasitized, the starling population from South America acquired new helminth parasites from native birds as a result of utilizing the same food and habitats.

The most straightforward and intuitively appealing explanation for the rapid establishment and proliferation of invasive species like the starlings is that they are released from the effects of their natural enemies (the enemy release hypothesis) (Torchin et al. 2003; Torchin and Mitchell 2004). However, some authors have argued caution against the acceptance of this hypothesis without critical examination (Colautti et al. 2004).

For the moment, there is no evidence that the European starling has been a source of parasites to native species in Argentina. The great loss of parasite species and the lack of acquisition of new species could benefit the establishment and expansion of the European starling in Argentina.

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Appendix

Helminth species with their collection numbers where they are stored at the Museo de La Plata, La Plata, Argentina, are as follows: *Echinostoma revolutum*, MLP He 6732; *Synhimantus* (*Dispharynx*) *nasuta*, MLP He 6733; *Microtetrameres* sp., MLP He 6734; *Pterothominx exilis*, MLP He 6735; *Ornithocapillaria ovopunctata*, MLP He 6736; and *Plagiorhynchus* (*Prosthorhynchus*) *cylindraceus*, MLP He 6737.

References

Anderson RC (2000) Nematode parasite of vertebrates: their development and transmission. CAB International, Wallingford

Bernard J (1987) Parasitic helminths of flying starlings (*Sturnus vulgaris* L.) in their nesting area. Arch Inst Pasteur Tunis 64:477–499

Blackburn TM, Lockwood JL, Cassey P (2009) Avian invasions: the ecology and evolution of exotic birds. Oxford Avian Biology Series. Oxford University Press, Oxford

Boyd EM (1951) A survey of parasitism of the starling *Sturnus vulgaris* in North America. J Parasitol 37:56–84

Bush A, Lafferty K, Lotz J, Shostak A (1997) Parasitology meets ecology on its own terms: Margolis et al. revisited. J Parasitol 83:575–583

Carreno RA (2008) *Dispharynx*, *Echinuria*, and *Streptocara*. In: Atkinson CT, Thomas NJ, Hunter B (eds) Parasitic diseases of wild birds. Blackwell Publishing Ltd., Ames, Iowa, pp 326–342

Chantima K, Chai J, Wongsawad C (2013) *Echinostoma revolutum*: freshwater snails as the second intermediate hosts in Chiang Mai, Thailand. Korean J Parasitol 51:183–189

Clark L, Mclean RG (2003) A review of pathogens of agricultural and human health interest found in blackbirds. In Linz GM (ed) Proceedings of symposium on management of North American blackbirds U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center, Fort Collins, Colorado, pp 103-108

Colautti RI, Ricciardi A, Grigorovich IA, MacIsaac HJ (2004) Is invasion success explained by the enemy release hypothesis? Ecol Lett 7: 721–733

Connors VA, Nickol BB (1991) Effects of *Plagiorhynchus cylindraceus* (Acanthocephala) on the energy metabolism of adult starlings, *Sturnus vulgaris*. Parasitology 103:395–402

Cooper C, Crites J (1976) Additional checklist of helminths of starlings (*Sturnus vulgaris*). Am Midl Nat 95:191–194

Cuartas E, Petriella AM (2001) Historia natural de una población de *Armadillidium vulgare* Latr. (Crustacea, Isopoda, Oniscidea) en la laguna de Los Padres (Buenos Aires, Argentina). Neotropica 47:41–47

Dubley JP (2008) Toxoplasma. In: Atkinson, Thomas, Hunter (eds) Parasitic diseases of wild birds. Wiley-Blackwell, Iowa, pp 204–222

Feare C (1984) The starling. Oxford University Press, Oxford

Georgieva S, Selbach C, Faltýnková A, Soldánová M, Skírnisson K (2013) New cryptic species of the '*revolutum*' group of *Echinostoma* (Digenea: Echinostomatidae) revealed by molecular and morphological data. Parasit Vectors 6:64

Goble F, Kutz L (1945) The genus *Dispharynx* (Nematode: Acuariidae) in galliforme and passeriform birds. J Parasitol 31:323–333

Gornatti Churria D, Spinsanti E, Origlia J, Marcantoni H, Piscopo M, Herrero Loyola M, Petruccelli M (2011) *Dispharynx nasuta* (Nematoda: Acuariidae) infection causing proventricular lesions and death in three captive rosellas (Psittaciformes: Psittacidae). J Zoo Wildl Med 42:164–165

Hair JD, Forrester DJ (1970) The Helminth parasites of the starling (*Sturnus vulgaris*): a checklist and analysis. Am Midl Nat 83:555–564

Jensen RF (2008) Nuevos registros de estornino pinto (*Sturnus vulgaris*) para el sureste de la provincia de Entre Ríos, Argentina. Nuestras Aves 53:22

Kanev I (1994) Life-cycle, delimitation and redescription of *Echinostoma revolutum* (Frölich, 1802) (Trematoda: Echinostomatidae). Syst Parasitol 28:125–144

Kern WJ Jr (2001) European starling. Univ. Florida SS-WEC 118:1-7

Linz GM, Homan HJ, Gaukler SM, Penry LB, Bleier WJ (2007) European starlings: a review of an invasive species with far-reaching impacts. In: Witmer GW, Pitt WC, Fagerstone KA (eds) Proceedings of an international symposium on managing vertebrate invasive species, Fort Collins, pp. 378-386

Lowe S, Browne M, Boudjelas S, De Poorter M (2004) 100 of the world's worst invasive alien species: a selection from the global invasive species database. The Invasive Species Specialist Group (ISSG) a specialist group of the Species Survival Commission (SSC) of the World Conservation Union (IUCN). www.issg.org/booklet.pdf

Lunaschi LI, Cremonte F, Drago F (2007) Checklist of digenean parasites of birds from Argentina. Zootaxa 1403:1–36

Martínez FA, Binda JL (1993) Presencia de *Echinostoma revolutum* (Froelich, 1802) Looss, 1899 (Trematoda, Echinostomatidae) en *Myocastor coypus*. Universidad Nacional del Nordeste (UNNE), Argentina. Centro de Información Bioagropecuaria Forestal (CIBAGRO) 10:247-250

Møller AP, Cassey P (2004) On the relationship between T-cell mediated immunity in bird species and the establishment success of introduced populations. J Anim Ecol 73:1035–1042

Moore J (1986) Dietary variation among nestling starlings. Condor 88: 181–189

Moravec F (2001) Trichinelloid nematodes parasitic in cold-blooded vertebrates. Academia, Praha

Pérez J (1988) Estornino pinto en la Capital Federal. Nuestras Aves 17:14

Peris S, Soave G, Camperi A, Darrieu C, Aramburu R (2005) Range expansion of the European starling *Sturnus vulgaris* in Argentina. Ardeola 52:359–364

Pimentel D, Zuniga R, Morrison D (2005) Update on the environmental and economic costs associated with alien-invasive species in the United States. Ecol Econ 52:273–288

Poulin R, Morand S (2004) Parasite biodiversity. Smithsonian Institution, USA, pp 125–131

Rickard LG (1985) Proventricular lesions associated with natural and experimental infections of *Dispharynx nasuta* (Nematoda: Acuariidae). Can J Zool 63:2663–2668

Schmidt G, Olsen O (1964) Life cycle and development of *Prosthorhynchus formosus* (van Cleave 1918) (Travassos 1926) an acanthocephalan parasite of birds. J Parasitol 50:721–730

Schmidtutz C, Agulián C (1988) Nidificación del estornino pinto. Nuestras Aves 17:14

Skrjabin KI, Shikhobalova NP, Orlov IV (1970) Trichocephalidae and Capillariidae of animals and man and the diseases caused by them. In: Skrjabin (ed) Essentials of Nematodology. US Department of Agriculture and the National Science Foundation, Washington DC by the Israel Program for Scientific Translations

Skuballa J, Taraschewski H, Petney T, Pfäffle M, Smales L (2010) The avian acanthocephalan *Plagiorhynchus cylindraceus*

(Palaeacanthocephala) parasitizing the European hedgehog (*Erinaceus europaeus*) in Europe and New Zealand. Parasitol Res 106:431–437

Sorensen R, Kanev I, Friedt B, Minchella D (1997) The occurrence and identification of *Echinostoma revolutum* from North American *Lymnaea elodes* snails. J Parasitol 83:169–170

Steadman DW, Ellis CG, Wood CS (1990) Absence of blood parasites in indigenous and introduced birds from the Cook Islands, South Pacific. Conserv Biol 4:398–404

Torchin ME, Mitchell CE (2004) Parasites, pathogens, and invasions by plants and animals. Front Ecol Environ 2:183–190

Torchin M, Lafferty K, Dobson A, McKenzie V, Kuris A (2003) Introduced species and their missing parasites. Nature 421:628–630

Vincent AL (1972) Parasites of the starling, *Sturnus vulgaris*, in San Diego Country, California. J Parasitol 58:1020–1022

Westerterp K, Gortmaker W, Wijngaarden H (1982) An energetic optimum in brood-raising in the starling *Sturnus vulgaris*: an experimental study. Ardea 70:153–162

Woon-Mok S, Jong-Yil C, Tai-Soon Y, Keeseon S, Cheong-Ha Y, Muth S, Duong S, Soon-Hyung L (2011) *Echinostoma revolutum* infection in Children, Pursat Province, Cambodia. Emerg Infect Dis 17: 117–119

Zhang LP, Liu F, Song J (2005) Spiruroid nematodes of *Synhimantus* (*Dispharynx*) Railliet, Henry Andsisoff, 1912 (Nematoda, Acuarioidea, Acuariidae) from birds of prey in Beijing, China, with description of a new species. Acta Zootax Sin 30:520–523