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Morphological identifications of gastrointestinal nematodes and acanthocephalans of raptors and owls from Austria

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Abstract

Viscera of a total of 10 birds of prey (order Accipitriformes and Falconiformes) and 14 owls (order Strigiformes) were examined parasitologically to evaluate their endogenous helminth fauna. In total, the following five different nematode taxa were identified: *Cyrnea leptoptera* (Rudolphi, 1819), *C. spinosa* (Gendre, 1923), *Physaloptera alata* (Rudolphi, 1819), *Synhimantus laticeps* (Rudolphi, 1819) and Capillaridae gen. sp. Furthermore, one acantocephalan species, *Centrorhynchus aluconis* (Mueller, 1780), was recorded. The current study delivers further insights on gastrointestinal nematodes and acanthocephalans of birds of prey and owls in Austria and underlines the importance of museum collections in providing voucher specimens as reference and comparative material for morphological identifications of nematodes and acanthocephalans.

Key Words: Birds of prey, owls, nematodes, *Cyrnea*, *Synhimantus*, Capillaridae, Acanthocephala

Introduction

Austria exhibits a speciose fauna of birds of prey including 34 species, among which 18–20 breeding species have been documented (Dvorak et al. 1993, Gamauf 2012). Nine autochthonous owl species have been reported to breed in Austria. However, populations of four of these species, viz. *Asio flammeus* (Pontoppidan, 1763), *Athene noctua* (Scopoli, 1769), *Otus scops* (Linnaeus, 1758), *Tyto alba* (Scopoli, 1769) have suffered a distinct fall due to loss of breeding sites and hunting grounds (Berg 1992).

Only few studies have hitherto focused on helminth fauna of birds of prey and owls in Austria. Thereby, knowledge on endogenous metazoan parasite fauna is mainly based on large-scale examinations during pathological dissections (Frank 1977; Frank 1980; Kutzer et al. 1980, 1982), single species reports (Ebmer et al. 2017) or coproscopical analyses (Frey & Kutzer 1982; Zöchling 2010). High incidences of intestinal parasites can lead to weakness and emaciation and cause secondary infections (Loupal 1996). The present study aims to study the endoparasite fauna of birds of the order Accipitriformes, Falconiformes and Strigiformes in Austria, focusing on gastrointestinal nematode and acanthocephala infections.

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Material and Methods

Examined birds

Between 1995 and 2016, birds were found dead in Burgenland, Lower Austria and Upper Austria and were brought to the Natural History Museum Vienna (NHMW). The specimens were stored in a freezer at minus 18 °C. After unfreezing at room temperature, the inner organs were fixed in 75% ethanol for further procedures. A total of 10 raptors and 14 owls were included in this study as follows: the common kestrel *Falco tinnunculus* (Linnaeus, 1758), 6 specimens; the Eurasian sparrowhawk *Accipiter nisus* (Linnaeus, 1758), 4 specimens; the long-eared owl *Asio otus* (Linnaeus, 1758), 7 specimens; the barn owl *Tyto alba* (Scopoli, 1769), 7 specimens; the little owl *Athene noctua* (Scopoli, 1769), 2 specimens; the brown owl *Strix aluco* (Linnaeus, 1758), 1 specimen.

Dissection of viscera

Viscera of birds were mainly composed of gastrointestinal tract. However, in some cases cardiopulmonary system was also included. Dissection of organs was conducted using a stereo-microscope (Wild M7). Gastrointestinal tracts were opened longintudinally using surgical clippers and tweezers. Parasitic worms were searched and collected under varying magnifications. Finally, the gut was rinsed with ethanol and the sediment was studied under the microscope.

Morphological identifications of adult nematodes

Detected nematodes and acanthocephala were extracted using dissection needles and stored in Eppendorf tubes in 80% ethanol for further studies. For morphological identification, specimens were cleared using glycerol. Thus the nematodes were put in a 1:1 mixture of 80%-ethanol and concentrated glycerol overnight at room temperature and subsequently put in a drop of pure glycerol on microscope slides, covered with cover slips and examined under transmitted-light microscope (Leitz Diaplan). Morphological identifications were made using determination keys (Chabaud 1975) and based on literature (Furmaga 1957; Barus 1966; Krone 2000; Etchegoin et al. 2000).

Specimens from the collection Evertebrata Varia (NHMW) were used to cross-check our identifications. All studied specimens are inventoried and deposited in the collection Evertebrata Varia (NHMW) (Table 2).

Results

The pathological dissections of 23 different viscera samples of raptors and owls revealed the presence of five different nematode taxa, viz *Cyrnea leptoptera* (Rudolphi, 1819), *C. spinosa* (Gendre, 1923), *Physaloptera alata* (Rudolphi, 1819), *Synhimantus laticeps* (Rudolphi, 1819) and Capillaridae gen. sp. (Table 1). The species *S. laticeps* showed widest host range of nematodes within this study.

Regarding adult nematodes, *C. leptoptera* was found in stomach and small intestines, *C. spinosa* and *P. alata* were detected in stomach. *S. laticeps* individuals were found under lining of the gizzard, whereas Capillaridae gen. sp. were extracted from small intestine.

Table 1. Findings of gastrointestinal nematodes and acanthocephalans detected in five host species

Parasites	Host species					
	Falco tinnunculus	*Accipiter nisus*	*Asio otus*	*Tyto alba*	*Athene noctua*	*Strix aluco*
Cyrnea leptoptera	x	–	–	–	–	–
Cyrnea spinosa	x	x	–	–	–	–
Physaloptera alata	–	x	–	–	–	–
Synhimantus laticeps	x	x	–	x	–	–
Capillaridae gen. sp.	–	x	x	–	x	–
Centrorhynchus aluconis	–	–	–	–	–	x

During morphological identifications, *P. alata* specimens were compared with a voucher specimen of the Everebrata Varia (inventory number: 6590, NHMW) found in *Falco nisus* (synonym for *Accipiter nisus*). In the anterior parts of the body, a distinct cuticular expansion was noted, which was less marked in the museum specimens due to preservation. Two lateral lips expressing one terminal tooth each was noticed (Fig. 1). In *Strix aluco*, acanthocephalans of the species *Centrorhynchus aluconis* (MUELLER, 1780) were recorded in the small intestine.

Discussion

Morphological identifications of adult nematodes found in the current study were in accordance with existing determination keys (CHABAUD 1975), reports, descriptions and illustrations of parasitic nematodes of raptors and owls (BARUS 1966; KRONE, 2000; ETCHEGOIN et al. 2000). In total, four species-specific identifications were performed in nematodes (*C. leptoptera*, *C. spinosa*, *P. alata* and *S. laticeps*). Due to preservation of anterior ends of nematodes of the order Capillaridae, a species-specific determination was not possible. However, capillarid nematodes *Capillaria tenuissimia*, *Baruscapillaria falconis*, *Eucoleus dispar* were reported to parasitize gastrointestinal tract of owls and raptors in Austria (KUTZER et al. 1980, 1982; MORAVEC 1982; OKULEWICZ 1993). Additionally one acanthocephalan species could be identified (*C. aluconis*).

Nematodes of the genus *Cyrnea* (KUTZER et al. 1980, 1982) were synonymously named *Procyrnea* (BARUS 1966; SANTORO et al. 2012) or *Habronema* (ILLESCAS-GÓMEZ et al. 1993). *Cyrnea leptoptera* and *C. spinosa* constitute common spirurid nematodes of birds of prey and were already reported in the common kestrel in Austria before (KUTZER et al. 1980). To our best knowledge, our findings of *C. spinosa* constitute the first report of this parasite in the Eurasian sparrowhawk (*A. nisus*) in Austria.

Findings of *P. alata* were earlier reported for the Eurasian sparrowhawk (*A. nisus*) in Austria (KUTZER et al. 1980). The species was originally discovered by J.G. Bremser from a sparrowhawk and left to C.A. Rudolphi for the first description of the species. This first finding, which is likely to have occurred in Austria, as many of BREMSERS

Table 2. Identified gastrointestinal nematodes and their inventory numbers of the Evertebrata Varia collection of the Natural History Museum Vienna.

Inventory number	Gastrointestinal nematode	Host species	Localisation
5795	*Cyrnea leptoptera*	*Falco tinnunculus*	Eisenstadt, Burgenland
5796	*Cyrnea leptoptera*	*Falco tinnunculus*	Eisenstadt, Burgenland
5797	*Cyrnea leptoptera*	*Falco tinnunculus*	Eisenstadt, Burgenland
5798	*Cyrnea leptoptera*	*Falco tinnunculus*	Eisenstadt, Burgenland
5799	*Cyrnea leptoptera*	*Falco tinnunculus*	Eisenstadt, Burgenland
5791	*Cyrnea spinosa*	*Accipiter nisus*	Podersdorf, Burgenland
5792	*Cyrnea spinosa*	*Accipiter nisus*	Podersdorf, Burgenland
5793	*Cyrnea spinosa*	*Accipiter nisus*	Illmitz, Burgenland
5787	*Cyrnea spinosa*	*Falco tinnunculus*	Eisenstadt, Burgenland
5788	*Cyrnea spinosa*	*Falco tinnunculus*	Eisenstadt, Burgenland
5789	*Cyrnea spinosa*	*Falco tinnunculus*	Eisenstadt, Burgenland
5790	*Cyrnea spinosa*	*Falco tinnunculus*	Eisenstadt, Burgenland
5794	*Cyrnea spinosa*	*Falco tinnunculus*	Illmitz, Burgenland
5775	*Physaloptera alata*	*Accipiter nisus*	Podersdorf, Burgenland
5776	*Physaloptera alata*	*Accipiter nisus*	Illmitz, Burgenland
5773	*Synhimantus laticeps*	*Accipiter nisus*	Purkersdorf, Lower Austria
5784	*Synhimantus laticeps*	*Falco tinnunculus*	Podersdorf, Burgenland
5785	*Synhimantus laticeps*	*Falco tinnunculus*	Podersdorf, Burgenland
5786	*Synhimantus laticeps*	*Falco tinnunculus*	Eisenstadt, Burgenland
5770/1-8	*Synhimantus laticeps*	*Tyto alba*	Podersdorf, Burgenland
5778	*Synhimantus laticeps*	*Tyto alba*	Eisenstadt, Burgenland
5779	*Synhimantus laticeps*	*Tyto alba*	Eisenstadt, Burgenland
5780	*Synhimantus laticeps*	*Tyto alba*	Eisenstadt, Burgenland
5781	*Synhimantus laticeps*	*Tyto alba*	Eisenstadt, Burgenland
5782	*Synhimantus laticeps*	*Tyto alba*	Eisenstadt, Burgenland
5783	*Synhimantus laticeps*	*Tyto alba*	Eisenstadt, Burgenland
5801	*Synhimantus laticeps*	*Tyto alba*	Illmitz, Burgenland
5802	*Synhimantus laticeps*	*Tyto alba*	Illmitz, Burgenland
5803	*Synhimantus laticeps*	*Tyto alba*	Illmitz, Burgenland
5804	*Synhimantus laticeps*	*Tyto alba*	Illmitz, Burgenland

helminths, has been documented also by Westrumb (1821) and Diesing (1851). The example of a female *P. alata*, an old specimen from the collection of the Natural History Museum Vienna, demonstrates the importance of Museums collections in studying and identifying rare and poorly known helminths in general (Fig. 1).

In recent years, findings of *S. laticeps* were reported for a broad spectrum of raptor and owl hosts (Furmaga 1957, Etchegoin et al. 2000, Santoro et al. 2012, Borgsteede et al. 2003) including Austrian findings of the common kestrel (*F. tinnunculus*), the common buzzard (*Buteo buteo*), the Eurasian sparrowhawk (*A. nisus*) and the long-eared owl (*Asio otus*) (Kutzer et al. 1980, 1982). The first record of this species in the wbarn

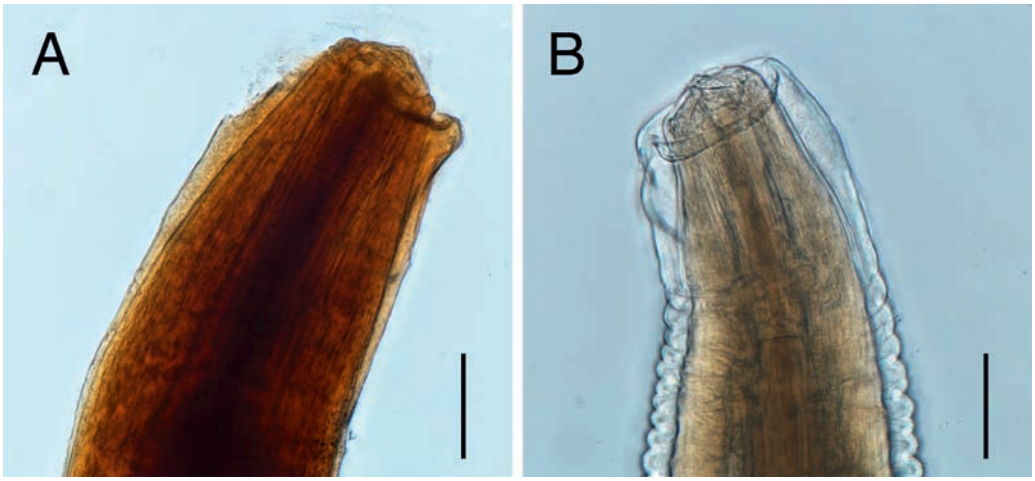

Fig. 1: Comparison of anterior ends of (A) female *P. alata* stored in Evertebrata Varia collection and (B) female *P. alata* obtained in this study. Scale bar: 0.1 mm.

owl in Austria was published by Ebmer et al. (2017) together with a molecular genetic identification via DNA-barcode.

The present study represents an overview of helminth parasites found during dissections of viscera and adds information on gastrointestinal nematode fauna of birds of prey and owls. The study also demonstrates the importance of museum collections for documentation and diagnostic support for morphological identifications of nematode species. The overall sparse data on helminths calls for more research in the field of parasitology of these birds to obtain current data on the endoparasite fauna of raptors and owls in Austria.

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