

Helminth Parasites of the Whiskered Brown Bat, *Myotis aurescens* (Kuzyakin, 1935) (Chiroptera: Vespertilionidae) from Turkey

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Abstract: Fifteen individuals of *Myotis aurescens* (six females, nine males) from Bursa Province, Turkey, were examined for helminths and found to harbour six species of Digenea (*Prosthodendrium ascidia*, *Pr. longiforme*, *Lecithodendrium linstowi*, *Plagiorchis muelleri*, *P. vespertilionis* and *P. koreanus*) and one species of Nematoda (*Rictularia lucifugus*). *Prosthodendrium ascidia* was found in all host specimens and had the highest mean intensity per bat as well as abundance. This is the first helminth record of *Myotis aurescens* from Turkey. *Myotis aurescens* represents a new host record for all the parasite species. *Prosthodendrium ascidia*, *L. linstowi*, *P. muelleri*, *P. koreanus*, *R. lucifugus* are reported from Turkey for the first time.

Key words: Bat, *Myotis aurescens*, Digenea, Nematoda.

Introduction

Myotis aurescens (Kuzyakin, 1935) occurs in south-eastern Europe from northern Italy, Dalmatia and the Balkans through the steppes of southern Ukraine and Ciscaucasia to Transcaucasia, the steppes of western Kazakhstan, perhaps Asia Minor as well (BENDA & TSYTSULINA 2000). In Turkey, there is only one study on helminth parasites of bats (SCHAD et al. 1960). In the latter article, the studied bat species *Plecotus auritus* (L., 1758), *Miniopterus schreibersii* (Kuhl, 1819), *Myotis myotis* (Borkhausen, 1797) and *Rhinolophus ferrumequinum* (Schreber, 1774) hosted only Nematode parasites. In the world, there are some studies about helminth parasites of bats (MATSKASI 1967, 1973, 1980, SHIMALOV et al. 2002, TKACH et al. 2000, HORVAT et al. 2017). To the best of our knowledge, there are no reports of helminths from *Myotis aurescens* but it is important to note that this species before 2000 was often considered a synonym of *Myotis mystacinus* (Kuhl, 1819).

The purpose of this study is to present the first records of helminths from *M. aurescens* and to expand our knowledge on helminth species distribution from Turkey.

Materials and Methods

Fifteen bats were collected by mist net from four localities in a forested area in Bursa Province, Turkey (two samples from Uludag 40°7' N, 29°7' E, six samples from Keles 39°55' N, 29°4' E, two samples from Misi 40°10' N, 28°58' E and five samples from Dogancı Dam 40°6' N, 28°57' E). The bats were taken to the parasitology laboratory for necropsy and were identified as *Myotis aurescens* following DIETZ & HELVERSON (2004). Bats were euthanised with an overdose of ether, sexed and their body length was measured. The body cavity was opened and the digestive tract removed. The esophagus, stomach, small and large intestines and lungs were dissected, placed in distilled water in separate petri dishes and examined for helminths under a stereomicroscope. Digeneans were fixed in 70% ethanol, stained with iron-carmin as described by GEORGIEV et al. (1986), cleared in clove oil and mounted in entellan. Nematodes were killed in hot saline solution, fixed in 70% ethanol and mounted in glycerol. Helminths were identified with a light microscope and identification was based on the morphological and anatomical descriptions given by

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MATSKASI (1973), TKACH et al. (2000) and YAMAGUTI (1961, 1963). Helminth voucher specimens and bat specimens were deposited in the collection of the Uludag University Museum of Zoology, Bursa, Turkey. Collection and animal use permits used are as follow: HADYEK (Uludag University, Animal Experiments Local Ethics Committee) number: B.30.2.ULU.0.8Z.00.00/53, decision number: 2011-05/06 and Forest and Water Affairs Ministry number: B.23.0.DMP.0.15.01.-510-29610 from Turkey.

Results

A total of 979 helminths individuals were collected. They represented six species of Digenea: *Prosthodendrium ascidia* (Beneden, 1873), *Pr. longiforme* (Bhalerao, 1926), *Lecithodendrium linstowi* Dollfus, 1931, *Plagiorchis muelleri* Tkach & Sharpilo, 1990, *P. vespertilionis* (Muller, 1784) and *P. koreanus* Ogata, 1938. In addition, one Nematode species was collected, *Rictularia lucifugus* Douvres, 1956. These worms were found in fifteen individuals of *M. aurescens* (416 from male and 563 from female hosts). Although female hosts (six samples) were fewer than males (nine samples), they had more helminth individuals (563) and greater diversity. While female hosts had all of the recorded parasites *M. aurescens*, male hosts had *Pr. ascidia*, *Pr. longiforme*, *L. linstowi*, *P. koreanus*, *P. vespertilionis* and *R. lucifugus*.

All fifteen *Myotis aurescens* (100%) were infected with one or more helminth species. Two hosts were infected by one helminth species: a male host with six specimens of *Pr. ascidia* and another male host with 16 specimens of *Pr. ascidia*. Two hosts harboured two helminth species: a female host with eight specimens of *Pr. ascidia* and seven specimens of *L. linstowi* and another male host with 16 specimens of *Pr. ascidia* and two specimens of *L. linstowi*. Seven bats were infected by three helminth species: a male host with three specimens of *Pr. ascidia*, 13 specimens of *L. linstowi* and three specimens of *Pr. longiforme*; a female host with five specimens of *Pr. ascidia*, seven of *L. linstowi* and five of *R. lucifugus*; a male host with six specimens of *Pr. ascidia*, two of *L. linstowi* and one of *P. koreanus*; a female host with 53 specimens of *Pr. ascidia*, four of *L. linstowi* and two of *R. lucifugus*; a female host with 121 specimens of *Pr. ascidia*, 70 of *L. linstowi* and one of *P. koreanus*; a male host with four individuals of *Pr. ascidia*, five of *L. linstowi* and five of *R. lucifugus*; a male host with 13 parasites of *Pr. ascidia*, four of *Pr. longiforme* and six of *R. lucifugus*. Two host individuals were infected by four helminth species: a female with 32 specimens of *Pr. ascidia*, three of *L.*

linstowi, one of *P. muelleri* and two of *P. koreanus*; another male with 52 of *Pr. ascidia*, ten of *L. linstowi*, one of *P. koreanus* and two of *R. lucifugus*. Two hosts were infected by five helminth species: a female host with 229 specimens of *Pr. ascidia*, one parasite of *L. linstowi*, six individuals of *P. muelleri*, three of *P. vespertilionis* and three of *Pr. longiforme*; another male host with 234 parasites of *Pr. ascidia*, five of *L. linstowi*, one *P. vespertilionis*, five samples of *P. koreanus* and one sample of *R. lucifugus*.

None of the helminth species found in this study is specific to *M. aurescens* only. Helminth species, site of infection, prevalence (% of infected bats), mean intensity (average number of parasites per bat), abundance (total helminth number of total bats individual), number of infected host, total helminth number and range are given in Table 1.

Discussion

Thirty-seven species of bats have been reported from Turkey (KARATAŞ et al. 2006). The family Vespertilionidae is represented by 29 species; 13 of these assigned to the genus *Myotis*, i.e. namely *M. aurescens*, *M. bechsteini* Kuhl, 1817, *M. brandtii* (Eversmann, 1845), *M. capaccinii* (Bonaparte, 1837), *M. daubentonii* (Kuhl, 1819), *M. emarginatus* (Geoffroy, 1806), *M. blythii* (Tomes, 1857), *M. myotis* Borkhausen, 1797, *M. mystacinus* (Kuhl, 1819), *M. nattereri* (Kuhl, 1817), *M. nipalensis* (Dobson, 1871), *M. schaubi* Kormos, 1934 and *M. alcaethoe* Helversen & Heller, 2001. Of these, in Turkey, only *M. myotis* has been reported to harbour helminth parasites, i.e. the Nematode *Molinostrongylus alatus* (Ortlepp, 1932) see SCHAD et al. (1960). Data on helminth fauna of bats species are lacking in Turkey and this is the first study in terms of all kind of helminth groups. A summary of the helminth fauna of bats of the family Vespertilionidae from Turkey is given in Table 2.

In Turkey, the *M. mystacinus* morpho-group consists of three morphologically similar species: *M. mystacinus*, *M. aurescens* and *M. brandtii*. Prior to 2000, *M. aurescens* was often considered a synonym of *M. mystacinus*. We list the helminths found during the present study with their distributions and occurrence in *Myotis aurescens*.

Lecithodendrium linstowi is distributed in Europe, Asia and North Africa and has been recorded from *M. capaccinii*, *M. daubentoni*, *M. emarginatus*, *M. mystacinus* and *M. myotis* (DEMİDOVA & VEKHNİK 2004, MATSKASI 1967, 1980, SHIMALOV et al. 2002). It was second, based on prevalence, with a total of 129 specimens from twelve out of fifteen (80%) hosts. Measurements of the Bursa speci-

Table 1. Helminth species, site of infection, % prevalence, mean intensity, abundance, number of infected host, total helminth number and minimum – maximum helminth intensity found in *Myotis aurescens*.

Helminth species	Site of infection	Prevalence (%)	Mean intensity	Abundance	Number of infected hosts	Total helminths number	Min.– max. helminth number
<i>Prosthodendrium ascidia</i>	Small intestine	100	52.53	52.53	15	788	3-234
<i>Prosthodendrium longiforme</i>	Small intestine	20	3.33	0.66	3	10	0-4
<i>Lecithodendrium linstowi</i>	Small intestine	80	10.75	8.6	12	129	0-70
<i>Plagiorchis muelleri</i>	Intestine	13.33	3.5	0.46	2	7	0-6
<i>Plagiorchis vespertilionis</i>	Intestine	13.33	2	0.26	2	4	0-3
<i>Plagiorchis koreanus</i>	Intestine	33.33	2	0.66	5	10	0-5
<i>Rictularia lucifugus</i>	Intestine	40	3.5	1.4	6	21	0-6

Table 2. Helminth fauna of the bats of the family Vespertilionidae from Turkey.

Bat Species	<i>Myotis myotis</i>	<i>Myotis aurescens</i>	<i>Plecotus auritus</i>	<i>Miniopterus schreibersii</i>
Helminth Species				
Digenea				
<i>Lecithodendrium linstowi</i>		This study		
<i>Prosthodendrium longiformae</i>		This study		
<i>Prosthodendrium ascidia</i>		This study		
<i>Plagiorchis vespertilionis</i>		This study		
<i>Plagiorchis muelleri</i>		This study		
<i>Plagiorchis koreanus</i>		This study		
Nematoda				
<i>Litomosa chiropteroorum</i>			SCHAD et al. (1960)	SCHAD et al. (1960)
<i>Rictularia lucifugus</i>		This study		
<i>Molinostrongylus alatus</i>	SCHAD et al. (1960)			
<i>Molinostrongylus ornatus</i>				SCHAD et al. (1960)

mens were compatible with Hungarian specimens (MATSKASI 1967). *Myotis aurescens* represents a new host record and Turkey is a new geographical record for *L. linstowi*.

Prosthodendrium longiforme occurs in Europe (Poland, Czech Republic), India and the Philippine Islands; it has been recorded from *M. brandtii*, *M. daubentoni* and *M. mystacinus* (DEMIDOVA & VEKHNİK 2004, MATSKASI 1967, SHIMALOV et al. 2002). *Myotis aurescens* represents a new host record and Turkey is a new geographical record for *Prosthodendrium longiforme*.

Prosthodendrium ascidia was found in all host specimens and had the highest mean intensity of parasites as well as the highest mean abundance. It occurs in Europe and South-East Asia and has been reported in *M. brandtii*, *M. daubentoni*, *M. emarginatus* and *M. mystacinus* (DEMIDOVA & VEKHNİK 2004, MATSKASI 1967). *Myotis aurescens* represents a new host record and Turkey is a new geographical record for *Pr. ascidia*.

Plagiorchis vespertilionis is distributed in Europe, Asia, North America, Brazil and North

Africa. It has been recorded from *M. brandtii*, *M. daubentoni*, *M. emarginatus*, *M. mystacinus* and *M. myotis* (DEMIDOVA & VEKHNİK 2004, MATSKASI 1967, SHIMALOV et al. 2002). *Myotis aurescens* represents a new host record and Turkey is a new geographical record for *P. vespertilionis*.

Plagiorchis muelleri occurs in Europe and, to the best of our knowledge, this is the first occurrence in a species of *Myotis*. *Myotis aurescens* represents a new host record and Turkey is a new geographical record for *P. muelleri*.

Plagiorchis koreanus is a Palaearctic species and has been previously reported in *Myotis mystacinus* (DEMIDOVA & VEKHNİK 2004). *Myotis aurescens* represents a new host record and Turkey is a new locality record for *P. koreanus*.

Rictularia lucifugus has been reported from India, Nigeria, Japan and America; it has been found in *Myotis lucifugus* (LeConte, 1831), *M. keenii* (Merriam, 1895) and *M. sodalis* Miller & Allen, 1928. *Myotis aurescens* represents a new host record and Turkey is a new geographical record for *R. lucifugus*.

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