Helminths of the digestive tract in Buteo buteo (Falconiformes: Falconidae) in Bursa Province of Northwest Turkey

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Abstract: Raptors can be parasitized by numerous helminth species due to their feeding behavior. When the parasite load is high, the bird's life can be affected. A total of 21 common buzzards, Buteo buteo, from different districts of Bursa, in Northwest Turkey, were examined for helminth infections. The results of the postmortem examination revealed that 15 of 21 buzzards (71.43%) harbored 1 or more helminth species. Seven species/genera of helminths were detected at the following prevalence rates: ascarid larvae (47.62%), Strigea falconis (38.09%), Neodiplostomum attenuatum (33.33%), Cladotaenia globifera (14.29%), Centrorhynchus amphibius (14.29%), Physaloptera alata (9.52%), and Synhimantus laticeps (4.76%). The most common helminth species was S. falconis, which was found in the small intestine of its hosts. This study is the first report to describe the presence of N. attenuatum, S. falconis, C. globifera, P. alata, and C. amphibius in the common buzzards of Turkey. This study is also the first to report the presence of S. laticeps in common buzzards, although this helminth had been previously reported in a sparrow hawk in Turkey.

Key words: Helminths, common buzzard, Buteo buteo, Turkey

1. Introduction
Turkey has 97 Important Bird Areas (IBAs), which cover a total of 29,978 km², or 4% of the total land area. The country is divided into 7 major geographical regions, each with different climates, habitats, flora, and fauna. The study area, Bursa, is located along the Marmara Sea. This province, which lies along migratory flyways, is an important transit area for migratory birds and contains 4 IBAs (Magnin et al., 2000).

Members of the genus Buteo are primarily residents or short-distance migrants. The common buzzard (Buteo buteo) is a medium-to-large bird of prey whose range covers most of Europe and extends into Asia. The subspecies Vulpinus (steppe buzzard) generally uses the south of Turkey as its wintering area, except the southeastern region (Heinzel et al., 1995).

Buzzards eat various small mammals and amphibians, including rabbits, snakes, and lizards, as well as worms and insects. As a result of these dietary habits, it is likely that they are frequently exposed to larval or adult parasites. Parasites can affect the health and productivity of wild birds to different degrees. While most helminths infect wild birds without causing much damage, heavy infections can result in reduced performance and increased mortality (Krone and Cooper, 2002; Tarello, 2006, 2007). However, most of these infections remain undetected. Helminth infections are generally detected during the necropsy of wild birds that die of other diseases, illegal hunting, or starvation under difficult climate conditions.

Because most raptors are protected species from which suitable samples are difficult to obtain, studies on the helminth fauna of raptors are rare. Although there have been a few studies performed in other countries (Kinsella et al., 1995; Sanmartin et al., 2004; Santoro et al., 2010), to date, there have been no systematic and detailed studies conducted on the buzzards of Turkey.

Due to the lack of information about the helminths of buzzards, the objectives of this study were the following: to determine the species of helminths that parasitize buzzards in Bursa Province, and to evaluate the parameters of prevalence, mean intensity, and mean abundance of the recorded helminth species.

2. Materials and methods
2.1. Study area
The study area is located in the southeast of the Marmara region (40°11’N, 29°04’E) and is characterized by hot and dry summers with some rainfall. The mean annual
temperature is between 14 °C and 16 °C, with minimum and maximum averages of 5 °C and 25 °C, respectively.

2.2. Buzzards
The examined birds were found injured or dead by the local population of the rural areas of Bursa Province during the period of January 2010 to April 2013. The injured raptors were taken to the researchers after they died despite medical treatment. Some of the birds were necropsied immediately after death, while others were kept frozen (–18 °C) for a few days before necropsy.

2.3. Necropsy
During the postmortem examination, the body cavity of each bird was opened by a longitudinal incision, and the gastrointestinal tract was removed by cutting across the esophagus and rectum. The esophagus, stomach, small intestine, and large intestine of each bird were examined separately for endoparasites. The contents of each organ were sieved through a 100-µm aperture sieve, and the residue was transferred to petri dishes and examined under a stereomicroscope. Additionally, the mucosa of the gastrointestinal organs was examined under a stereomicroscope to determine if any small helminths were adhering to the mucosal layer. All of the helminths obtained from each organ were counted. Nematodes were killed in hot saline solution, fixed in 70% ethanol solution, mounted in glycerol, allowed to clear, and then examined. Cestodes and digeneans were fixed in 70% ethanol, regessively stained with hematoxylin, and mounted in balsam for examination.

2.4. Identification
All helminths were identified under a light microscope according to the figures and descriptions given by Yorke and Mapleton (1926), Schad et al. (1960), Yamaguti (1961), Tolgay (1964, 1973), Schmidt (1986), Skryabin (1991), Labiola and Suriano (1998), Gibson et al. (2002), Kajerova et al. (2004), Bray et al. (2008), and Anderson et al. (2009).

Finally, representative helminth specimens were deposited in the helminth collection of the Uludağ University Museum of Zoology, Bursa, Turkey.

2.5. Data analysis
The terminology for describing infection parameters such as prevalence, mean intensity, and mean abundance (as shown in the Table) follows that of Bush et al. (1997). All of the calculations were performed using the Minitab (version 15) software package.

3. Results
Out of 21 birds examined, 15 (71.43%) were infected with 2 or more helminth species. Seven helminth species were identified, including 3 nematodes, 2 trematodes, 1 cestode, and 1 acanthocephalan. The mean intensity, mean abundance, range, and prevalence of each helminth species are presented in the Table. The most commonly detected helmints in necropsied birds were Strigea falconis (38.09%) and Neodiplostomum attenuatum (33.33%). In 3 birds (14.29%), the acanthocephalan Centrorhynchus amphibius was encountered. Helminths were free in the intestinal lumen when they were detected by necropsy. However, most of the acanthocephalans were attached to the mucosa, and mucosal inflammation associated with mechanical damage caused by their proboscises was observed in all 3 cases.

Of these species, this is the first record of Neodiplostomum attenuatum, Strigea falconis, Cladotaenia globifera, Physaloptera alata, and Centrorhynchus amphibius in Turkey’s common buzzard (Figures 1A–1F).

Table. Prevalence, mean intensity, mean abundance, and range of helminth species in 21 buzzards necropsied in the province of Bursa.

<table>
<thead>
<tr>
<th>Order</th>
<th>Species</th>
<th>No. of infected birds</th>
<th>Prevalence (%)</th>
<th>Total number</th>
<th>Range</th>
<th>Mean intensity (mean ± SEM)</th>
<th>Mean abundance (mean ± SEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trematoda</td>
<td>Neodiplostomum attenuatum</td>
<td>7</td>
<td>33.33</td>
<td>127</td>
<td>2–78</td>
<td>18.14 ± 27.03</td>
<td>6.04 ± 3.75</td>
</tr>
<tr>
<td></td>
<td>Strigea falconis</td>
<td>8</td>
<td>38.09</td>
<td>336</td>
<td>1–158</td>
<td>43.75 ± 18.85</td>
<td>16.66 ± 8.36</td>
</tr>
<tr>
<td>Cestoda</td>
<td>Cladotaenia globifera</td>
<td>3</td>
<td>14.29</td>
<td>7</td>
<td>1–4</td>
<td>2.33 ± 0.88</td>
<td>0.23 ± 0.21</td>
</tr>
<tr>
<td>Nematoda</td>
<td>Synhimantus laticeps</td>
<td>1</td>
<td>4.76</td>
<td>8</td>
<td>8</td>
<td>8.0 ± 0.00</td>
<td>0.38 ± 0.38</td>
</tr>
<tr>
<td></td>
<td>Physaloptera alata</td>
<td>2</td>
<td>9.52</td>
<td>10</td>
<td>4–6</td>
<td>5.0 ± 1.00</td>
<td>0.47 ± 0.33</td>
</tr>
<tr>
<td>Acanthocephala</td>
<td>Centrorhynchus amphibius</td>
<td>10</td>
<td>47.62</td>
<td>62</td>
<td>1–17</td>
<td>6.4 ± 1.80</td>
<td>3.04 ± 1.10</td>
</tr>
</tbody>
</table>

SEM: Standard error of the mean.
4. Discussion
Although there are nearly 465 species of birds in Turkey, including 3 buzzard species, very little is known about their parasite fauna. Because common buzzards, like other Falconiformes, are protected and therefore hunting them is prohibited, suitable samples are difficult to obtain. Thus, the helminth fauna of raptors has been poorly investigated (Umur et al., 2010) in Turkey. Furthermore, no specific study has been carried out on the helminths of *Buteo buteo* in Bursa Province, Turkey. Therefore, this study is the first systematic research into the subject and provides baseline information on the subject in this area.

In this study, 7 helminth species were recovered from common buzzards, which is a new record for helminth studies in Turkey. Of these species, this is the first record of *Neodiplostomum attenuatum, Strigea falconis, Cladotaenia globifera, Physaloptera alata,* ascarid larva, *F) Centrorhynchus amphibius.*
Buteo buteo. Additionally, the prevalence rate changed from 4.76% to 47.62% based on the species of helminths.

Few studies have been performed on the helminth parasites of this raptor specifically. Santoro et al. (2010, 2012) conducted 2 studies in southern Italy and reported that the species prevalence rates varied between 2.8% and 100%. In a Spanish study conducted by Sanmartin et al. (2004), prevalence rates were reported to be between 0.9% and 52.7%. Although the overall prevalence rate of helminths reported in our study was similar to those of these studies, the species prevalence rates were markedly lower than the prevalence rates reported by these authors. These differences can likely be linked to geographical variations and differences in the feeding habitat of the buzzards. Common buzzards use different habitats, feeding strategies, and diversity of prey. These raptors feed primarily on insects, amphibians, fish, reptiles, birds, and rodents. Therefore, it is generally agreed that buzzards ingest a wide range of prey taxa and feed in diverse habitats, thereby being exposed to a high number of potential intermediate host species, resulting in greater helminth richness. Our observation of the gastrointestinal contents during necropsies confirmed that they are parasitized by different hymenopterans and dipterans.

The number of animals examined in this study may have been too small to allow for the evaluation of different factors in this region. The small sample size was due to most of the raptors being protected species from which suitable samples are difficult to obtain. Many published studies are single-species reports and descriptions of parasite species. Very few studies have presented detailed epidemiological statistics on buzzard populations (Sanmartín et al., 2004; Santoro et al., 2010, 2012; Santos et al., 2011). Therefore, there is a clear need for parasitological studies of buzzards to provide that detailed epidemiological data.

In our study, ascarid larvae were highly prevalent (47.62%) helminths in common buzzards. Ascarids have a direct life cycle and are the most common parasites found in birds that are maintained in enclosures with access to the ground. In the study region, periods of heavy rainfall are observed in the autumn and winter months. High rainfall and mild winters create favorable conditions for helminth eggs and larval stages, especially ascarids. Thus, in the rainy season, it is possible that buzzards ingest a large number of infective worm eggs or larvae and shed a large number of eggs.

The digeneans Strigea falconis and Neodiplostomum attenuatum can cause diarrhea and severe duodenitis; the cestode Cladotaenia globifera can cause cachexia and partial luminal obstruction of the duodenum (Santoro et al., 2010).

In contrast to other species, N. attenuatum and S. falconis were the digenean species that were most prevalent in this study. These trematodes are transmitted by small vertebrates, which are frequent prey animals for these raptors.

Cestodes were rare in our samples, restricted to single infections of Cladotaenia globifera. This result is similar to results in Italy (Santoro et al., 2010, 2012). These parasites are transmitted by small mammals, so the low prevalence of cestodes in common buzzards, which only rarely feed on small mammals, can most likely be explained by diet.

Members of the genus Physaloptera use insects such as coleopterans, dermapterans, dictyopterans, and orthopterans (Anderson, 2000) as intermediate hosts. However, some species have reportedly used amphibians and reptiles as paratenic hosts, which might account for the low prevalence of P. alata (9.52%). Synhimantus laticeps was earlier reported in a sparrow hawk’s (Accipiter nisus) gizzard in Turkey (Umur et al., 2010). This nematode species was also detected in one animal in our study. Synhimantus laticeps and Physaloptera sp. in buzzards can be associated with erosions and ulcers of the gastric mucosa (Santoro et al., 2010), as was observed in our study.

The acanthocephalans detected in this study were attached to the mucosa by their proboscis or were free in the intestinal lumen. The prevalence of Centrorhynchus spp. was previously reported to be 1.1% in Germany (Krone, 2000) and 100.0% in Italy (Santoro et al., 2010).

Centrorhynchus amphibia was the only acanthocephalan species found in Buteo buteo. This species has an indirect life cycle, with arthropods as intermediate hosts, and reptiles (lizards and snakes) and small mammals (usually shrews) as paratenic hosts (Golvan, 1994). A possible explanation for the lower rate of infection in our study area compared to that of the Spanish report is that the first orthopteran intermediate hosts of this species are rarer in this area of Turkey than in Spain.

It is generally assumed that parasitic infections in raptors cannot cause serious health problems in healthy individuals, but helminths can lead to serious health problems when they are combined with other factors or stressors. Furthermore, helminth infections may affect flying performance and predatory effectiveness. However, the impact of helminth infections on the well-being of the studied raptors was not investigated, and further studies are needed to determine the effect of helminth infections on the mortality and performance of common buzzards.

Acknowledgments
The authors thank their colleagues for the notifications of wild birds brought to the animal hospital. This paper was edited by the American Journal Experts (AJE).
References


