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## Comparative Analysis of the Distribution of Domestic Water Birds Helminths in Different Economic Regions in Azerbaijan

### Abstract

In poultry farms established in our country, along with the breeding of productive domestic water birds, it is observed that helminthiasis affecting the quality of meat of the hosts is also spreading. There is a need to study the fauna of these pathogens and a number of ecological problems. In the present research work, the helminth fauna of domestic geese and ducks in various economic regions of Azerbaijan was determined and a comparative analysis was conducted. For this purpose, a total of 928 domestic water birds from 12 economic regions were examined by the method of complete helminthological dissection and identified using key books. As a result, it was found that a total of 27 species of helminths are currently parasitic in birds. Among the helminths belonging to four systematic groups, nematodes (13 species) predominate. Five species of them (*A. anseris*, *T. tenuis*, *H. dispar*, *C. anatis* and *B. obsignata*) are found in most economic regions (at least 9 economic regions). The *A. anseris* nematode is recorded throughout the study area. The highest number of helminth species is observed in the Lankaran-Astara (17), and the lowest number is observed in the Mil-Mughan (3) economic regions.

**Keywords:** *Anser anser dom.*, *Anas platyrhynchos dom.*, *helminth fauna*, *distribution*, *economic regions*, *nematodes*

### Introduction

Poultry products have their own place in satisfying people's needs for food, including meat. Helminths that cause serious harm to the host organism and reduce their productivity are still encountered in domestic water birds raised on local farms (Seyidbeyli, 2021). Therefore, one of the urgent issues is the determination of the helminth fauna of domestic waterfowl in the current period and the comparative analysis of their occurrence in different ecologically different areas. Studies on the helminth fauna of domestic geese and ducks in Azerbaijan began at the beginning of the 20th century and were later continued by other researchers (Shults, 1931; Shahtahtinskaya, 1952, 1959; Shirinov, 1961; Vahidova, 1978; Vahidova et al., 1982). As a result of the analysis of the literature data obtained, it became clear that the studies do not cover all economic regions of the country. In recent years, we have investigated the helminth fauna of domestic waterfowl in various regions of the country, the ultrastructural features of their practically important species, and a number of ecological problems (Rzayev, 2021a, 2021b, 2023a, 2023b, 2024; Rzayev et al., 2020, 2021a, 2021b, 2023; Seyidbeyli & Maharramov, 2018; Seyidbeyli & Rzayev, 2018; Seyidbeyli et al., 2020). The aim of the current research work was to conduct a comparative characterization of the distribution of domestic geese and ducks helminths in different economic regions of Azerbaijan.

### Material and methods

The research work was carried out in the Institute of Zoology of Ministry of Science and Education, Parasitology Laboratory in 2012-2024. 928 domestic water birds (*Anser anser* dom. and *Anas platyrhynchos* dom.) from 12 economic regions, were studied using the full helminthological dissection method (Dubinina, 1971). The processing of samples by economic regions is as follows: Baku and Absheron-Khizi (n=65), Daghlig Shirvan (n=32), Ganja-Dashkasan (n=154), Karabakh (n=33), Gazakh-Tovuz (n=59), Guba-Khachmaz (n=294), Lankaran-Astara (n=82), Central Aran (n=88), Mil-Mughan (n=27), Shaki-Zagatala (n=52), Shirvan-Salyan (n=42). Helminths collected from various organs of birds were fixed in 70% alcohol or 4% formaldehyde, and permanent preparations were prepared from a part of them. Helminths were examined under MBS-9 (Russia) magnifier, Amplival (Germany) and DM1000 (Leica, Germany) light microscopes, and pictures of worms were taken with a DFC425 (Leica, Germany) digital camera. Helminths were identified based on the Key book (Ryzhikov, 1967).

### Results and discussion

As a result of the helminthological studies conducted by us to determine the helminth fauna of domestic birds, materials from 12 of the existing 14 economic regions were processed and the results are presented in table 1. It should be noted that since the areas of Baku and Absheron-Khizi economic regions are small, these areas were combined. Therefore, 11 divisions were made in Table 1. Material was not taken from the Eastern Zangazur economic region. In the Nakhchivan economic region, such studies have already been conducted by another researcher (Seyidbeyli, 2021). The distribution of helminth species detected was found to vary across the study regions. It was found that among the helminths included in systematic groups, the smallest distribution area was found in the acanthocephala - only 1 (Guba-Khachmaz economic region), while the trematodes were found in 4 (Guba-Khachmaz economic region; Lankaran-Astara economic region; Central Aran economic region; Shirvan-Salyan economic region), cestodes were found in 7 (Baku and Absheron-Khizi economic regions; Karabakh economic region; Guba-Khachmaz economic region; Lankaran-Astara economic region; Central Aran economic region; Mil-Mughan economic region; Shirvan-Salyan economic region), and nematodes were found in all the studied economic regions. Therefore, nematodes are the most widespread group among helminths in domestic waterfowl in the territory of country. In addition, out of the 13 nematode species recorded by us in domestic waterfowl, 5 species (*A. anseris*, *T. tenuis*, *H. dispar*, *C. anatis* and *B. obsignata*) are found in most economic regions (at least 9 economic regions) of Azerbaijan.

**Table 1**

Distribution of domestic water birds helminths by economic regions

№	Helminth species	1	2	3	4	5	6	7	8	9	10	11
	Cestodes											
1	<i>Cloacotaenia megalops</i>	-	-	-	-	-	+	-	-	-	-	-
2	<i>Diorchisinflata</i>	-	-	-	-	-	+	-	-	-	-	+
3	<i>Drepanidotaenia lanceolata</i>	-	-	-	-	-	+	+	+	+	-	-
4	<i>Drepanidotaenia przewalskii</i>	-	-	-	+	-	-	-	-	-	-	-
5	<i>Fimbriariafasciolaris</i>	-	-	-	-	-	+	+	+	-	-	+
6	<i>Microsomacanthus paramicrosoma</i>	-	-	-	-	-	+	-	-	-	-	-
7	<i>Tschertkovilepi ssetigera</i>	+	-	-	-	-	-	+	-	-	-	+

8	<i>Ligula intestinalis</i>	-	-	-	-	-	-	+	-	-	-	-
	Trematodes											
9	<i>Echinoparyphium recurvatum</i>	-	-	-	-	-	-	-	+	-	-	-
10	<i>Echinostoma revolutum</i>	-	-	-	-	-	-	+	+	-	-	-
11	<i>Hypoderaeum conoideum</i>	-	-	-	-	-	+	+	+	-	-	-
12	<i>Paryphostomum novum</i>	-	-	-	-	-	-	+	-	-	-	-
13	<i>Notocotylus attenuatus</i>	-	-	-	-	-	+	+	-	-	-	+
	Nematodes											
14	<i>Amidostomum acutum</i>	-	-	-	-	-	-	+	+	-	-	-
15	<i>Amidostomum anseris</i>	+	+	+	+	+	+	+	+	+	+	+
16	<i>Trichostrongylus tenuis</i>	-	+	+	+	+	+	+	+	+	+	+
17	<i>Heterakis altaica</i>	-	+	-	-	-	-	-	-	-	-	-
18	<i>Heterakis dispar</i>	+	+	+	+	+	+	+	+	-	+	+
19	<i>Heterakis gallinarum</i>	-	-	+	-	-	+	-	+	-	-	-
20	<i>Ascaridiagalli</i>	-	-	+	-	-	-	-	-	-	-	-
21	<i>Porrocaecum crassum</i>	-	-	-	-	-	-	+	-	-	-	-
22	<i>Tetrameres fissispina</i>	+	-	-	-	-	+	+	+	-	+	+
23	<i>Hystrichis tricolor</i>	-	-	-	-	+	-	-	-	-	-	-
24	<i>Capillaria anatis</i>	+	+	+	+	+	+	+	+	-	+	+
25	<i>Eucoelus contortus</i>	-	+	-	-	-	-	+	+	-	-	-
26	<i>Baruscapillaria obsignata</i>	+	+	+	+	+	+	+	+	-	+	-
	Acanthocephala											
27	<i>Polymorphus magnus</i>	-	-	-	-	-	+	-	-	-	-	-

**Note:** 1. Baku and Absheron-Khizi; 2. Daghlig Shirvan; 3. Ganja-Dashkasan; 4. Karabakh; 5. Gazakh-Tovuz; 6. Guba-Khachmaz; 7. Lankaran-Astara; 8. Central Aran; 9. Mil-Mughan; 10. Shaki-Zagatala; 11. Shirvan-Salyan economic regions

One species of nematod (*A. anseris*) is found in all economic regions. This worm is considered a geohelminth and a specific parasite of waterfowl. It has been determined that the species diversity of helminths found in domestic water birds varies across economic regions. The

fewest helminth species in birds were recorded in the Mil-Mughan economic region (3 species), 6 species in each of the Baku and Absheron-Khizi, Karabakh, Gazakh-Tovuz, and Shaki-Zagatala economic regions, 7 species in the Daghlig Shirvan and Ganja-Dashkasan economic regions, 9 species in the Shirvan-Salyan economic region, 14 species in the Central Aran economic region, 15 species in the Guba-Khachmaz economic region, and the most in the Lankaran-Astara economic region (17 species).

Helminths belonging to all systematic groups in domestic waterfowl were recorded only in the Guba-Khachmaz region. Cestodes, trematodes and nematodes were found in domestic waterfowl in the Shirvan-Salyan, Lankaran-Astara and Central Aran economic regions. Cestodes and nematodes were found in Baku and Absheron-Khizi, Karabakh, Mil-Mughan economic regions, and only nematodes were found in the Daghlig Shirvan, Ganja-Dashkasan, Gazakh-Tovuz, Shaki-Zagatala economic regions.

The largest number of cestodes species (5 species) is found in the Guba-Khachmaz economic region. Four species are found in Lankaran-Astara, 3 species in Shirvan-Salyan, 2 species in Central Aran, and 1 species of cestode was found in birds in Baku and Absheron-Khizi, Karabakh and Mil-Mughan economic regions. Two species of cestodes (*D. lanceolata* and *F. fasciolaris*) that parasitize domestic water birds, unlike other tapeworms, were found in a total of 5 different areas (Guba-Khachmaz, Lankaran-Astara, Central Aran, Mil-Mughan, Shirvan-Salyan economic regions). *T. setigera* helminth 3 (Shirvan-Salyan, Lankaran-Astara, Baku and Absheron-Khizi economic regions), *D. inflata* parasite 2 (Guba-Khachmaz and Shirvan-Salyan economic regions), *C. megalops*, *D. przewalskii*, *M. paramicrosoma*, *L. intestinalis* cestodes were recorded in 1 economic region each. In terms of number (4 species) of digenetic sucking worms, they prevailed in the Lankaran-Astara economic region. 3 species are found in Central Aran, 2 species in Guba-Khachmaz, and 1 species in the Shirvan-Salyan economic region. Of the trematodes recorded in domestic waterfowl, the helminths *H. conoideum* and *N. attenuatus* are more often distributed in the study areas than others and are encountered in the Guba-Khachmaz, Lankaran-Astara, Shirvan-Salyan and Central Aran economic regions. The trematode *E. revolutum* is distributed in 2 (Lankaran-Astara and Central Aran economic regions), while the helminth *P. novum* and *E. recurvatum* are distributed in one economic region each (Lankaran-Astara and Central Aran economic regions, respectively). Nematodes, unlike helminths belonging to other systematic groups, dominate both in terms of species and in terms of distribution in economic regions. Nine species of nematodes are found in each of the Lankaran-Astara and Central Aran economic regions, 7 species in each of the Daghlig Shirvan, Ganja-Dashkasan, Guba-Khachmaz economic regions, 6 species in each of the Gazakh-Tovuz and Shaki-Zagatala economic regions, 5 species in each of the Shirvan-Salyan, Karabakh, Baku and Absheron-Khizi economic regions, and 2 species in the Mil-Mughan economic region. Five species of nematodes are observed in almost all economic regions. The least common species of nematodes in the study areas are the helminths *A. acutum*, *H. altaica*, *A. galli*, *P. crassum*, *H. tricolor*.

The prevalence of helminths in both domestic geese and domestic ducks was studied separately in economic regions of Azerbaijan. Table 2 shows the prevalence of domestic geese in 12 economic regions of the country. In total, 21 species of helminths belonging to 4 systematic groups (cestodes, trematodes, nematodes and acanthocephala) were detected in domestic geese during the study years (Table 2). Among these species, nematodes predominated (11 species). On the other hand, 4 species of the mentioned helminths (all nematodes - *A. anseris*, *T. tenuis*, *H. dispar*, *B. obsignata*) were found in most economic regions. Of these, 1 species of nematode - *A. anseris* was recorded in all economic regions where the study was conducted (Table 2). In most areas, all nematodes recorded in domestic geese do not have intermediate hosts in their development cycle, that is, they are geohelminths. The highest number of helminth species infection of the named hosts was identified in the economic regions of Lankaran-Astara (12 species), Guba-Khachmaz (10 species), and Central Aran (10 species).

**Table 2**

Distribution of domestic geese helminths by economic regions												
№	Helminth species	1	2	3	4	5	6	7	8	9	10	11
	Cestodes											
1	<i>Diorchisinflata</i>	-	-	-	-	-	+	-	-	-	-	-
2	<i>Drepanidotaenia lanceolata</i>	-	-	-	-	-	+	+	+	+	-	-
3	<i>Drepanidotaeniaprzewalskii</i>	-	-	-	+	-	-	-	-	-	-	-
4	<i>Fimbriaria fasciolaris</i>	-	-	-	-	-	+	+	+	-	-	+
5	<i>Tschertkovilepis setigera</i>	+	-	-	-	-	-	-	-	-	-	+
6	<i>Ligula intestinalis</i>	-	-	-	-	-	-	+	-	-	-	-
	Trematodes											
7	<i>Echinostoma revolutum</i>	-	-	-	-	-	-	+	-	-	-	-
8	<i>Paryphostomum novum</i>	-	-	-	-	-	-	+	-	-	-	-
9	<i>Notocotylus attenuatus</i>	-	-	-	-	-	+	-	-	-	-	-
	Nematodes											
10	<i>Amidostomum acutum</i>	-	-	-	-	-	-	+	-	-	-	-
11	<i>Amidostomum anseris</i>	+	+	+	+	+	+	+	+	+	+	+
12	<i>Trichostrongylus tenuis</i>	-	+	+	+	+	+	+	+	+	+	-
13	<i>Heterakis altaica</i>	-	+	-	-	-	-	-	-	-	-	-
14	<i>Heterakis dispar</i>	+	+	+	+	+	+	+	+		+	+
15	<i>Heterakis gallinarum</i>	-	-	+	-	-	+	-	-	-	-	-
16	<i>Ascaridia galli</i>	-	-	+	-	-	-	-	-	-	-	-
17	<i>Tetrameres fissispina</i>	-	-	-	-	-	-	-	+	-	-	-
18	<i>Capillaria anatis</i>	+	+	+	+	+	-	-	-	-	-	+
19	<i>Eucoleus contortus</i>	-	-	-	-	-	-	+	+	-	-	-
20	<i>Baruscapillaria obsignata</i>	+	+	+	+	+	+	+	+	-	+	-
	Acanthocephala											
21	<i>Polymorphus magnus</i>	-	-	-	-	-	+	-	-	-	-	-

**Note:** 1. Baku and Absheron-Khizi; 2. Daghlig Shirvan; 3. Ganja-Dashkasan; 4. Karabakh; 5. Gazakh-Tovuz; 6. Guba-Khachmaz; 7. Lankaran-Astara; 8. Central Aran; 9. Mil-Mughan; 10. Shaki-Zagatala; 11. Shirvan-Salyan economic regions

Helminths belonging to all systematic groups (cestodes, trematodes, nematodes and acanthocephala) were found in domestic geese only in the Guba-Khachmaz economic region. Cestodes, trematodes and nematodes were found in geese only in the Lankaran-Astara economic region. Cestodes and nematodes were found in Baku and Absheron-Khizi, Karabakh, Central Aran, Mil-Mughan, Shirvan-Salyan economic regions, and only nematodes were found in Shaki-Zagatala, Gazakh-Tovuz, Daghlig Shirvan, Ganja-Dashkasan economic regions.

In terms of the number of species, it was determined that cestodes were found most often in the Guba-Khachmaz and Lankaran-Astara economic regions (3 species in each), and least often in the Mil-Mughan, Karabakh, Baku and Absheron-Khizi economic regions (1 species in each). Of the 6 species of cestodes mentioned in domestic geese, 2 are more widespread than the others. The cestode *D. lanceolata* was found in the Guba-Khachmaz, Lankaran-Astara, Central Aran, Mil-Mughan economic regions, and the tapeworm *F. fasciolaris* was found in the Shirvan-Salyan, Guba-Khachmaz, Lankaran-Astara, Central Aran economic regions. Digenetic worms in domestic geese are found only in the Guba-Khachmaz and Lankaran-Astara economic regions and consist of 3 species (*E. revolutum*, *P. novum* and *N. attenuatus*). In terms of the number of species of nematodes, they were identified in the Ganja-Dashkasan economic region (7 species), the Daghlig Shirvan, Lankaran-Astara, Central Aran economic regions (6 species in each), and the Karabakh, Gazakh-Tovuz, Guba-Khachmaz economic regions (5 species in each). The nematodes that are least often found in domestic geese include the species *A. acutum*, *H. altaica*, *A. galli*, *T. fissispina*.

In the 12 economic regions studied, helminths of domestic ducks were also identified, the number of which, as in geese, is 21 (cestodes 5, trematodes 4, nematodes 11, and acanthocephala 1) (Table 3). Nematodes (11 species) predominate among the listed species. Among the 12 areas studied, the most parasites were recorded in the Guba-Khachmaz (11 species) and Lankaran-Astara (10 species) economic regions. No parasites were detected in domestic ducks in the Daghlig Shirvan and Mil-Mughan economic regions. One species of nematode (*C. anatis*) was observed in ducks in the Karabakh economic region. Helminths belonging to all systematic groups (cestodes, trematodes, nematodes, and acanthocephala) are found only in the Guba-Khachmaz economic region. Cestodes in domestic ducks are recorded in only 3 economic regions (Shirvan-Salyan, Guba-Khachmaz, Lankaran-Astara). More cestodes (4 species) were found in the Guba-Khachmaz economic region than in other areas. Digenetic worms in domestic ducks are recorded only in the Guba-Khachmaz, Lankaran-Astara, Central Aran, and Shirvan-Salyan economic regions.

Table3

Distribution of domestic ducks helminths by economic regions

№	Helminth species	1	2	3	4	5	6	7	8	9	10	11
	Cestodes											
1	<i>Cloacotaenia megalops</i>	-	-	-	-	-	+	-	-	-	-	-
2	<i>Diorchisinflata</i>	-	-	-	-	-	+	-	-	-	-	+
3	<i>Fimbriariafasciolaris</i>	-	-	-	-	-	+	+	-	-	-	-
4	<i>Microsomacanthus paramicrosoma</i>	-	-	-	-	-	+	-	-	-	-	-
5	<i>Tschertkovilepis setigera</i>	-	-	-	-	-	-	+	-	-	-	-
	Trematodes											
6	<i>Echinoparyphium recurvatum</i>	-	-	-	-	-	-	-	+	-	-	-

7	<i>Echinostoma revolutum</i>	-	-	-	-	-	-	-	+	-	-	-
8	<i>Hypoderaeum conoideum</i>	-	-	-	-	-	+	+	+	-	-	-
9	<i>Notocotylus attenuatus</i>	-	-	-	-	-	-	+	-	-	-	+
	Nematodes											
10	<i>Amidostomum acutum</i>	-	-	-	-	-	-	-	+	-	-	-
11	<i>Amidostomum anseris</i>	-	-	+	-	-	+	+	-	-	-	+
12	<i>Trichostrongylus tenuis</i>	-	-	+	-	-	+	+	+	-	+	+
13	<i>Heterakis dispar</i>	-	-	+	-	-	+	+	-	-	+	-
14	<i>Heterakis gallinarum</i>	-	-	+	-	-	-	-	-	-	-	-
15	<i>Porrocaecum crassum</i>	-	-	-	-	-	-	+	-	-	-	-
16	<i>Tetrameres fissispina</i>	+	-	-	-	-	+	+	-	-	+	+
17	<i>Hystrichis tricolor</i>	-	-	-	-	+	-	-	-	-	-	-
18	<i>Capillaria anatis</i>	+	-	+	+	+	+	+	+	-	+	-
19	<i>Eucoleus contortus</i>	-	-	-	-	-	-	-	+	-	-	-
20	<i>Baruscapillaria obsignata</i>	-	-	+	-	-	-	-	-	-	-	-
	Acanthocephala											
21	<i>Polymorphus magnus</i>	-	-	-	-	-	+	-	-	-	-	-

**Note:** 1. Baku and Absheron-Khizi; 2. Daghlig Shirvan; 3. Ganja-Dashkasan; 4. Karabakh; 5. Gazakh-Tovuz; 6. Guba-Khachmaz; 7. Lankaran-Astara; 8. Central Aran; 9. Mil-Mughan; 10. Shaki-Zagatala; 11. Shirvan-Salyan economic regions

The most common species of digenetic worms (3 species) were found in the Central Aran economic region. The most widespread species among trematodes in domestic ducks in the study regions is the helminth *H. conoideum*. This parasite is recorded in domestic ducks in the Guba-Khachmaz, Lankaran-Astara and Central Aran economic regions. The trematode *N. attenuatus* is also found in 2 economic regions (Lankaran-Astara, Shirvan-Salyan). In domestic ducks, as in domestic geese, nematodes predominate in terms of species. Their distribution by region is as follows: 6 species in each of the Ganja-Dashkasan and Lankaran-Astara economic regions, 5 species in the Guba-Khachmaz economic region, 4 species in each of the Central Aran and Shaki-Zagatala economic regions, 3 species in the Shirvan-Salyan economic region, 2 species in each of the Baku and Absheron-Khizi, Gazakh-Tovuz economic regions, and 1 species of nematode in the Karabakh economic region. The nematode *C. anatis* is the most common species recorded in domestic ducks. The nematodes *B. obsignata*, *E. contortus*, *H. tricolor*, *P. crassum*, and *A. acutum* are each recorded in only one of the economic regions surveyed.

### Conclusion

A total of 27 species of helminths were detected in domestic water birds in various economic regions of Azerbaijan. Of the helminths, acanthocephala is recorded in only 1 region, trematoda in 4 regions, cestodes in 7 regions, and nematodes in all economic regions. Out of 13 species of nematodes recorded in domestic waterfowl, 5 species (*A. anseris*, *T. tenuis*, *H. dispar*, *C. anatis*

and *B. obsignata*) were found in most economic regions (at least 9 economic regions). The nematode *A. anseris*, being a specific parasite of domestic waterfowl, was found in all study areas. The least number of helminth species in domestic geese and ducks was recorded in the Mil-Mughan economic region (3 species), and the most in Lankaran-Astara economic region (17 species).

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