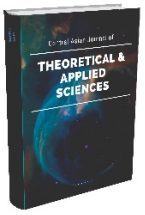

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Helminths of Galliformes in Uzbekistan: Fauna, Distribution and Ecology

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Abstract: *Some features of the helminth fauna in domestic and wild Galliformes and their distribution and ecology in a number of regions of Uzbekistan were studied. In total, 43 helminth species were identified in the studied birds; they were represented by the classes Cestoda, Trematoda and Nematoda. 13 of them were recorded for the first time in Uzbekistan. The article also provides original data on the qualitative and quantitative composition and the structure of helminth associations.*

KeyWords: *Ecology, Helminths.*

Introduction

The vertebrate fauna of Uzbekistan includes 8 species and subspecies of Galliformes (Himalayan snowcock, chukar, see-see, grey and Daurian partridges, common quail and pheasants – *Phasianuscolchicus*and *Phasianuscolchicuszerafschanicus*). They all are terrestrial herbivores [11]. *Phasianuscolchicuszerafschanicus* is listed in the Red Data Book of Uzbekistan (2019)[10]. Most Galliformes are resident, but can cover relatively large distances in search of food. The only truly migratory species is the common quail [8].

The helminth fauna of wild and domestic Galliformes has been poorly studied in Uzbekistan. Much of the information is outdated [13]. No comprehensive research has been made into the fauna of parasitic wormsparasitising this group of birds in Uzbekistan in the last 50 years.

Nevertheless, studying the structure of the fauna of parasitic worms in the birds of a specific region is highly important from both theoretical and practical scientific aspects. Wild Galliformes (chukar and see-see partridges, common quail and *Phasianuscolchicus*)are valuable game species [2, 14]. Various types of poultry farms in North-Western, North-Eastern and Central Uzbekistan breed chickens, turkeys and guineafowl for meat and eggs, which are essential food for humans. Feathers and down are used for various industrial purposes. Like all other birds, Galliformes are subject to infection with various parasites often causing serious economic damage to poultry farming.

The goal of this research was to specify the species composition of helminths in Galliformes inhabiting the terrestrial coenoses of the north-western, north-eastern and central portions of Uzbekistan.

Materials and methods

The material for the studies was collected in 2018-2021 in three regions of Uzbekistan – north-west (Republic of Karakalpakstan and Khoresm Province), north-east (Tashkent, Syrdarya and Jizzah Provinces) and centre (Bukhara, Navoi and Samarkand Provinces) (fig.). This work is based on parasites found by the authors in 1,674 individuals of domestic and wild Galliformes: Himalayan snowcock*Tetraogallushimalayensis* – 105 individuals, chukar partridge *Alectorischukar* – 150 individuals, grey partridge *Perdixperdix* – 295 individuals, common quail *Coturnixcoturnix* – 211 individuals, pheasants (*Phasianuscolchicus* – 152 individuals and *Phasianuscolchicuszerafschanicus* – 6 individuals), chicken *Gallus gallus* – 480 individuals, turkey *Meleagrisgallopavo* – 236 individuals, guineafowl*Numidameleagris* – 39 individuals. Standard methods were used to collect and treat helminths [6].

To identify helminth species we used various guidelines by Uzbek and foreign researchers [1, 3, 4, 5, 7, 12, 13]. Species were identified at the laboratory for general parasitology at the Institute of Zoology, Academy of Sciences of Uzbekistan, using modern instruments, including a CK2-TR inverted microscope (Olympus, Japan), a LOMO microscope and an ML-2200 binocular microscope (Olympus, Japan).

Figure. Map of Uzbekistan: material collecting location

1-North-West; 2-Central; 3-North-East regions.

The following parameters were used to measure the level of the infection of birds with helminths: prevalence and infection intensity.

Results and discussion

We established that the species diversity of helminths of domestic and wild Galliformes in Uzbekistan is represented by 43 species, 10 of which are from the class Cectoda, 12 Trematoda and 22 Nematoda.

The helminth faunas are very similar in both groups of Galliformes, which is caused by the commonality of food. Nematodes predominate in both groups (table 1).

Table 1 Helminth species composition in Galliformes of Uzbekistan

Species	Host groups	
	Domestic	Wild
Davaineaproglottina(Davaine, 1860)	+	+
Raillietinatetragona(Molin, 1858)	+	+
R. echinobothrida(Megnin, 1881)	+	+
R. penetrans(Baczynska, 1914)	+	+
Skrjabiniacestitillus(Molin, 1858)	+	+
Echinolepis carioca (Magalhaes, 1898)	+	+
Sobolevicanthusgracillis (Zeder, 1803)	+	+
Myxolepuscollaris (Batsch, 1786)	+	+
Fimbrariafasciolaris (Pallas, 1781)	+	–
Choanotaenia infundibulum (Bloch, 1779)	+	+
Brachylaemafuscatus (Rudolphi, 1819)	–	+
Corrigiacorrigia (Braun, 1901)	–	+
Collyriclumfaba (Bremser, 1831)	+	–
*E. miyagawai*Ichii, 1932	+	–
Echinostomarevolutum (Frohlich, 1802)	+	–
Echinoparyphiumrecurvatum(Linstow, 1873)	+	–
*Ech. syrdariense*Burdelev, 1937	+	–
Hypoderaeumconoideum(Block, 1872)	+	–
Plagiorchisarcuatus Strom, 1924	+	–
Prosthogonimusovatus(Rudolphi, 1803)	+	–
P. cuneatus (Rudolphi, 1803)	+	+
Notocotylusattenuatus(Rudolphi, 1809)	+	–
*Capillariaphasianina*Kotlan, 1940	+	+
Aonchothecabursata (Freitas et Almeida, 1934)	+	+
Aonchothecacaudinflata (Molin, 1858)	+	+
Baruscapillariaobsignata (Madsen, 1945)	+	+
Ascaridiacompar (Schrank, 1790)	+	+
Ascaridiagalli (Schrank, 1788)	+	+
*Ascaridiaskrjabini*Fedjuschin, 1952	–	+
Heterakisgallinarum (Schrank, 1788)	+	+
Heterakismacroura (Linstow, 1883)	–	+
Subulurabrumpti (Lopez-Neyra, 1922)	+	+
Subuluracurvata (Linstow, 1833)	+	+
Subuluraskrjabini (Semenov, 1926)	+	+
Acuariagruveli (Gendre, 1913)	–	+
Acuariahamulosa (Diesing, 1851)	+	+
Dispharynxnasuta (Rudolphi, 1819)	+	+
Streptocaracrassicauda (Creplin, 1829)	+	+
Tetrameresfissispina (Diesing, 1861)	+	+
Tetramereslhuillieri (Seurat, 1918)	–	+
*Oxyspiruraschulzi*Skrjabin, 1929	+	+
*Diplotriaenaperdicis*Sonin et Spassky, 1958	–	+

*Splendidofilariagvozdevi*Sonin et Barus, 1978	–	+
Splendidofilariapapillocerca (Lubimov, 1946)	–	+
Species total:	35	33

The diversity of the helminth fauna of Galliformes clearly indicates that the birds lead a terrestrial lifestyle. They are predominantly infected with parasites, whose development is associated with terrestrial environment.

The class Cestoda in our collection is represented by 10 common and abundant species.

The class Trematoda in the studied regions is composed of 11 species. 2 species were recorded for the first time in Himalayan snowcock – *Brachylaimafuscatus* (Rudolphi, 1819) and *Corrigiacorrigia* (Braun, 1901), in chukar partridge – *Echinostomamiyagawai*Ichii, 1932 (in the mountains in the north-east of Uzbekistan). Species from the genera *Brachylaema*and *Corrigia* we recorded in chukar partridge had earlier been found in Uzbekistan [13] and Kazakhstan [9]. Trematode*Collyriclumfaba* (Bremser, 1831) found in the turkeys of Karakalpakstan is the first record of this species in the territory of Uzbekistan.

The class Nematoda showed the highest species diversity in Galliformes of Uzbekistan – we recorded 22 species. Some of them, such as *Diplotriaenaperdicis*SoninetSpassky, 1958, *Splendidofilariagvozdevi*SoninetBarus, 1978 and *Splendidofilariapapillocerca* (Lubimov, 1946), had never been recorded in Galliformes before.

Earlier, in various regions of Uzbekistan 14 species were recorded in common quail, 7 species in various partridges and 30 species in chukar partridge and pheasants [13]. Our research helped to augment the old list of helminths of Galliformes in Uzbekistan. The new species include trematodes – *Brachylaimafuscatus* (Rudolphi, 1819), *Collyriclumfaba* (Bremser, 1831), *Echinostomamiyagawai*Ichii, 1932 and nematodes – *Capillariaphasianina*Kotlan, 1940, *Aonchothecacaudinflata* (Molin, 1858), *Aonchothecabursata* (Freitas et Almeida, 1934), *Ascaridiaskrjabini*Fediuchin, 1952, *Heterakismacroura*Linstow, 1883, *Dispharynxnasuta* (Rud., 1819) *Streptocaracrassicauda* (Creplin, 1829), *Diplotriaenaperdicis*Sonin et Spassky, 1958, *Splendidofilariapapillocerca* (Lubimov, 1946).

The data we have obtained indicate that the highest diversity of helminth species is demonstrated by Galliformes of North-Eastern Uzbekistan (32 species), which is followed by the north-western (25 species) and central (13 species) parts of the country (table 2).

The following conclusions can be made based on the results of the research into the helminth fauna of domestic and wild Galliformes of Uzbekistan.

The modern helminth fauna in Galliformes of Uzbekistan is represented by 44 species from 3 classes – Cestoda, Trematoda and Nematoda.

Table 2 Distribution of helminth fauna of Galliformes across the regions of Uzbekistan

Family	No. of species	Regions of Uzbekistan		
		North-West	North-East	Centre
Davaineidae	**5**	**4**	**5**	**3**
Hymenolepididae	**4**	**-**	**4**	**1**
Choanotaeniidae	**1**	**1**	**1**	**1**
Brachylaimidae	**2**	**-**	**2**	**–**
Collyriclidae	**1**	**1**	**-**	**–**
Echinostomidae	**4**	**4**	**3**	**2**
Plagiorchiidae	**1**	**1**	**-**	**–**

Prostogonimidae	**2**	**2**	**2**	**–**
Notocotylidae	**1**	**1**	**-**	**1**
Capillariidae	**4**	**2**	**2**	**2**
Ascarididae	**3**	**2**	**1**	**1**
Heteracidae	**2**	**1**	**1**	**1**
Subularidae	**3**	**1**	**2**	**–**
Acuaridae	**3**	**-**	**3**	**–**
Tetrameridae	**2**	**2**	**2**	**1**
Streptocaridae	**1**	**-**	**1**	**–**
Thelaziidae	**1**	**-**	**1**	**–**
Diplotriaenidae	**1**	**1**	**1**	**–**
Splendidofilariidae	**2**	**2**	**1**	**–**
Total	**43**	**25**	**32**	**13**

Characterizing the helminths of the Galliformes from the point of view of their localization, it is necessary first of all to note the variety of places of their localization in the bird's body. Members of the Cestoda class live in the digestive system, mainly in the small intestine. The trematodes we have noted are parasites of the digestive system, the reproductive system and subcutaneous fiber. Nematodes turned out to be parasites of many organs and systems of the Galliformes. They live in a sexually mature state in the digestive tract, air bags and under the skin.

Classifying by the nature of the localization of the species of helminth recorded by us, it is possible to distribute them into the following groups:

1. Parasites of the digestive system (species, genera of cestodes - *Davainea, Raillietina, Skrjabinia, Echinolepis, Sobolevicanthus, Myxolepus, Fimbraria, Choanotaenia*; species of trematode genera - *Brachylaema, Corrigia, Echinostoma, Echinoparyphium, Hypoderaeum, Plagiorchis, Notocotylus*; all nematode species, with the exception of representatives of the genera *Diplotriaena and Splendidofilaria*).
2. Air Sac parasites (*Diplotriaenaperdicis*).
3. Parasites of Oviduct and bursa of Fabricius (nematodes of the genus *Prosthogonimus*).
4. Parasites of subcutaneous fiber (trematodes*Collyriclumfaba*, nematode species of the genus *Splendidofilaria*).

By the nature of the biological cycle, the helminths of Galliformes recorded by us can live in two groups: homoxic species (development without the participation of an intermediate host) and heteroxic species (development with the participation of an intermediate host). The heteroxic forms in our material are - 80.0%, which are represented by Cestodes (10 species), Trematodes (12 species) and Nematodes (14 species).

An analysis of the extensive literature and our data shows that a variety of invertebrate groups, aquatic and terrestrial ecosystem inhabitants can participate in the life cycles of heteroxic groups of helminth of the studied Galliformes (table 3).

Table 3 Participation of certain groups of invertebrate animals in the life cycles of heteroxic forms of helminth of Galliformes of Uzbekistan.

Helminths	Numberofspecies	Intermediatehosts
Cestodes	10	Crustaceans, Insects, Molluscs (Terrestrial)
Trematodes	12	Molluscs (Freshwater), Molluscs (Terrestrial), Insects
Nematodes	14	Oligochaeta, Mollusca (Terrestrial) Insects, Crustaceans

Table 3 provides general information about intermediate hosts of helminth of the studied birds. As can be seen from the data of this table, invertebrates of many classes are involved in the transfer of invasive helminth larvae. They act as first or second intermediate hosts.

Infection of Galliformeshelminths occurs on land and in different ways, depending on the bioecological characteristics of the corresponding groups and species of parasitic worms. Thus, species of cestodes, trematodes and heteroxic groups of nematodes of birds can be infected when eating the corresponding invertebrates containing the larvae of the parasites in question. Infection with homoxic nematodes occurs when eating feed infected with eggs and helminth larvae.

Thus, helminths of each taxonomic group are used to infect the Galliformes with certain cenotic channels. The cenotic connections of partners of the parasitic system are a factor determining the possibility of invasion circulation in nature.

Conclusion

The total recorded prevalence of helminths in Galliformes was 50.5%. The infection intensity ranged from single to several dozen individuals.

Galliformes were infected with 10 Cestoda species, 12 Trematoda species and 22 Nematoda species. The following helminths were for the first time recorded in Galliformes of Uzbekistan: 3 Trematoda species – *Brachylaemafuscatus*, *Collyriclumfaba* and *Echinostomamiyagawai*, and 10 Nematoda species from the genera *Capillaria*, *Aonchotheca*, *Ascaridia*, *Heterakis*, *Dispharynx*, *Streptocara*, *Tetrameres*, *Diplotriaena* and *Ornithofilaria,* and *Splendofilaria*.

By the character of their life cycles, Galliformes of Uzbekistan 35 of the total of 43 species are heteroxenous and 9 homoxenous.

The data of the research may be used to develop antiepizootic measures for the poultry farming of Uzbekistan.

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