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ENDOPARASITE FAUNA OF DOMESTIC WATERFOWL IN THE CENTRAL REGION OF THE REPUBLIC OF MOLDOVA

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Abstract

The research on the endoparasite fauna of domestic waterfowl (ducks and geese) from the Anatidae family in the Central Zone of the Republic of Moldova revealed the presence of several endoparasitic species. In ducks (Anas platyrhynchos domesticus), the following parasites were identified: Class Trematoda: 4 species (Echinostoma paraulum, Echinostoma revolutum, Echinostoma robustum, Prosthogonimus ovatus); Class Cestoda: 2 species (Drepanidotaenia lanceolata, Retinometra giranensis);Class Secernentea: 2 species (Amidostomum acutum, Ganguleterakis dispar);Class Conoidasida: 2 species (Eimeria anatis, E. danailovi). In geese (Anser anser domesticus), the following endoparasites were found: Class Trematoda: 1 species (Catatropis verrucosa);Class Cestoda: 1 species (Drepanidotaenia lanceolata); Class Secernentea: 4 species (Amidostomum anseris, Ascaridia galli, Heterakis gallinarum, Ganguleterakis dispar); Class Conoidasida: 4 species (Eimeria anseris, E. nocens, E. truncata, E. stigmosa). The study reveals a diverse range of endoparasites in both ducks and geese, with a greater variety found in geese. This highlights the need for effective parasite control in domestic waterfowl populations, given the potential impact of these parasites on the health and productivity of the birds.

Key words*: endoparasite fauna, habitat, mixtinvasions, monoinvasions, waterfowl.*

INTRODUCTION

There are approximately 200 zoonoses transmitted from animals to humans. Of these, half are parasitic zoonoses. Studying the infestation process in waterfowl constitutes an important fundamental and, especially, applied problem, as they serve as definitive hosts in the development cycle of various parasite species and as transmitters of these, which are dangerous for both humans and domestic animals (Rusu, 2021a; Erhan, 2020; Akbaev, 2000).

The evolution of zoonoses in humans and animals causes incalculable damage through loss of human lives or the incapacitation of a considerable number of people.

Therefore, monitoring the parasitofauna in animals, in various biotopes, depending on intrinsic and extrinsic factors, has bioecological, medical, and veterinary importance in preventing the transmission of parasitic agents to humans and animals involved in the biological cycles of zoonotic and epizootic parasites. In this context, it is necessary to study the epizootiology and biology of these helminth infections (Erhan, 2024; Rusu, 2021b; Șuteu et al., 2011; Dărăbuș et al., 2006; Olteanu, 2001).

Parasitic agents can significantly influence the dynamics of both domestic and wild animal populations. It has been proven under experimental conditions that both ecto- and endoparasites are vectors for various viral and bacterial agents that are dangerous to humans and domestic animals, causing considerable economic and social damage (Rusu, 2021a; Erhan et al., 2017; Anderson, 2000; Marquardt et al., 2000; Olteanu, 1991a; Șuteu, 2017).

Infestations with gastro-intestinal helminths in domestic waterfowl species from the Anatidae family (ducks, geese) constitute, first and foremost, a major health problem for birds, reflected in significant economic losses for poultry farmers.

Endoparasites are parasitic organisms that live inside the host's body, having a significant impact on its health. These parasites are a major concern in animal production, especially in the case of domestic waterfowl such as ducks, geese, and swans, which are often exposed to conditions favorable for their development and spread. Internal parasites can severely affect the health of the birds, causing a

decrease in productive performance, chronic infections, digestive system disorders, and, in extreme cases, even death. In this context, studying the endoparasitic fauna and understanding how these parasites influence the health of waterfowl represents an essential aspect of research in animal health and poultry management.

In regions where domestic waterfowl are an important resource for agricultural production, as well as in rural areas where these birds are traditionally raised, endoparasites represent a constant challenge. Especially in wetland regions, such as the central part of the Republic of Moldova, where waterfowl frequently have access to stagnant waters and are exposed to interactions with wild birds, the risk of parasitic infestation is increased. These environments promote the proliferation of various parasite species, which can be transmitted through direct contact with contaminated water, infected food, or through contact with the feces of other birds (Șuteu et al., 2003; Miron, 2002; Niculescu & Didă, 1998).

The endoparasitic fauna of domestic waterfowl includes a wide range of species, including helminths (parasitic worms), protozoa, and nematodes. Although these parasitic infections are often subclinical, their cumulative effects on the health of the birds are particularly significant. Parasites can cause a decrease in physiological performance, including inefficient digestion, reduced nutrient absorption, weight loss, and increased vulnerability to other diseases. Additionally, parasites can pose a threat to food safety, considering the risks of transmitting diseases from infected birds to humans or other animals (Șuteu & Cozma, 2007a; Dărăbuș et al., 2006; Olteanu, 1999; Didă, 1996; Olteanu, 1991b; Bejsovec, 1972).

Studying the endoparasitic fauna of domestic waterfowl in the central region of the Republic of Moldova is a relevant research topic, considering the ecological and agricultural complexity of this area. The central region of the Republic of Moldova, characterized by a temperate-continental climate and an extensive network of stagnant waters, constitutes a favorable habitat for waterfowl and, consequently, for the development of various parasite species. Furthermore, the constant interaction between domestic and wild birds can contribute to maintaining a continuous cycle of infestation, having a significant impact on the health of domestic waterfowl (Rusu, 2021a; Erhan, 2024).

This research aims to identify and analyze the diversity and prevalence of endoparasites in domestic waterfowl from the central region of the Republic of Moldova. The study highlights the ecological and zootechnical factors that favor their presence, as well as methods for controlling and preventing infestations. The results obtained will contribute to the development of more effective strategies for managing the health of waterfowl, with the aim of protecting them and improving poultry production. Additionally, this study will address the importance of educating and informing farmers about the impact of parasites on the health of birds and will provide recommendations for implementing prevention measures tailored to the specificities of the central region of the Republic of Moldova (Șuteu & Cozma, 2007b; Abuladze, 1990).

MATERIALS AND METHODS

Research on establishing the parasitic fauna in domestic waterfowl from various anthropogenic biotopes in the central region of the Republic of Moldova was carried out in the Parasitology and Helminthology Laboratory of the Institute of Zoology at the State University of Moldova (USM). Biological samples were collected from anthropogenic ecosystems in the central region of the Republic of Moldova. For this purpose, studies were conducted to determine the extent and intensity of endoparasite invasion in waterfowl from the private sector of the central region of the Republic of Moldova.

To achieve the proposed objectives, coproovoscopic methods (Fulleborn, Darling), coprolarvoscopic methods (Popov, Baermann), partial parasitological investigations, and successive washing techniques (Erhan et al., 2007) were used.

For achieving the research goal and objectives, the following equipment was used: automatic dispenser, laboratory centrifuge, "Letz Laborlux D" microscope, digital camera DCM 130,1,3 Mpix, trinocular microscope PWN 107,

thermostatic unit ТСв -80 Y x Л 4.2. The collected material was subsequently examined with the help of the МБС-9 magnifying glass (ob.14x2) and the Novex Holland B microscope (ob. 20-40 WF 10x Din/20mm) in the Parasitology and Helminthology Laboratory of the Institute of Zoology, USM. The obtained data were processed statistically, calculating the variation parameters of the arithmetic mean (M) and the standard error (m). The statistical significance (P) between the mean values of the studied parameters in different groups was calculated using the Student's t-test.

To study the parasitic fauna in the main species of hunting importance, coproovoscopic and coprolarvoscopic methods were employed. Among the coproovoscopic methods used, direct slide methods were applied, which are among the simplest and are recommended for detecting almost all helminths in the digestive tract, accessory glands, and respiratory apparatus of the main species of hunting importance.

With particular success, for parasitological diagnosis, enrichment ovoscopic methods were used. By using these methods, the fecal sample was concentrated on as small a surface or volume as possible to examine as many or even all parasitic elements contained in the sample.

Additionally, for the diagnosis of fascioliasis, dicrocoeliosis, and paramphistomiasis in animals, the repeated washing method was also used, which allows for accurate determination of the eggs of helminths of larger size and weight.

Furthermore, in the parasitological investigation of animals, flotation methods were successfully used, allowing for the diagnosis of ascariasis, neoascariasis, strongylatoses, strongyloidosis, parascaridosis, monieziosis, tizhaneziosis, avitellinosis, etc. The flotation technique is based on the density differences between the parasitic forms and the diluting liquids. Hyper-saturated solutions of various salts, which have a higher density than the eggs or larvae of parasites, were used as diluting liquids. For this, a fecal sample (3 g) was homogenized in a glass with a hyper-saturated solution of kitchen salt (400-420 g salt in 1000 ml of water, density 1.18-1.20). The volume of the solution should be approximately 20 times larger than the fecal mass. After that, the solution was filtered through a sieve into another glass and left to settle for 45-60 minutes. Using a metal loop, parasitic elements were collected from different points on the surface of the solution and then transferred to a slide and covered with a cover slip. The obtained preparations were examined under a microscope no later than 60 minutes. To concentrate the parasitic elements, 1-2 drops of aqueous soap solution (green soap) mixed with ethyl alcohol in a 1:1 ratio were added to the solution.

For the diagnosis of ascariasis, trichocephalosis, metastrongyloidosis in pigs, neoascariasis, gastrointestinal strongylatoses, monieziosis, tizhaneziosis, toxocariasis, and strongyloidosis, the flotation method with a hyper-saturated potassium nitrate (NH_4NO_3) solution was used, according to Kotelnicov (Erhan et al., 2007).

For parasitological diagnosis in the main species of hunting fauna, combined diagnostic methods were also used. These methods are based on sedimentation and flotation principles, hence they are called sedimentation methods. They are more effective, requiring less hyper-saturated solution. The method was proposed by the American parasitologist Darling (Erhan et al., 2007).

The modified Darling method, developed by Kotelnicov and Hrenov (Erhan et al., 2007), allowed for the diagnosis of metastrongyloidosis in wild boars, ascariasis, trichocephalosis, and other parasitoses. The method was implemented in two variants: using a hyper-saturated lead nitrate solution (density 1.5).

For this, the fecal sample was homogenized in a glass (50 ml volume) with tap water until it became fluid, then it was strained through a sieve into 50 ml centrifuge tubes and centrifuged for 1-2 minutes at 1000-1500 rpm. The supernatant was discarded, and the sediment was treated with 50 ml of freshly prepared hyper-saturated lead nitrate solution (650 g of substance per 1000 ml of water), which was agitated well and then centrifuged again under the same conditions. The test tubes were covered with degreased slides so that they would make contact with the solution. If the solution level was too low, more hyper-saturated solution was added carefully with a

pipette, so the liquid reached the top, forming a convex meniscus at the neck of the test tube, preventing spillage when placing the cover slip. After 5 minutes, the slide could be examined. When lifting the cover slip, care was taken not to move it across the neck of the test tube, but to lift it all at once.

For identifying parasitic larvae in fecal masses in the main species of hunting fauna, coprolarvoscopic diagnostic methods were also used, such as the Baermann method which allowed not only the detection of parasitic larvae in fecal masses but also those in parasitized organs. This method is based on the negative geotropism, thermotropism, and mobility of the larvae.

RESULTS AND DISCUSSIONS

As a result of the parasitological investigations carried out on ducks (*Anas platyrhynchos domesticus*) and geese (*Anser anser domesticus*) from various anthropized biotopes of the Republic of Moldova, it was found that they are infested with various dangerous parasitic agents, with the level of infestation varying depending on species, age, maintenance method, and biotope.

The parasitological examination of 60 samples collected from geese (*Anser anser domesticus*) in the private sector of the Central Zone of the Republic of Moldova revealed parasitic elements belonging to the following classes:

- **Class Trematoda** – one species: *Catatropis verrucosa* (Frohlinch, 1789)
- **Class Cestoda** – one species: *Drepanidotaenia lanceolata* (Bloch, 1782)
- **Class Secernentea** – four species: *Amidostomum anseris* (Zeder, 1800), *Ascaridia galli* (Schrank, 1788), *Heterakis gallinarum* (Schrank, 1788), *Ganguleterakis dispar* (Schrank, 1790)
- **Class Conoidasida** – four species: *E. anseris* (Kotlan, 1932), *E. nocens* (Kotlan, 1932), *E. truncata* (Railliet et Lucet, 1891), *E. stigmosa* (Klimes, 1963) (Table 1).

The parasitological examination of 70 samples collected from ducks (*Anas platyrhynchos domesticus*) in the private sector of the Central Zone of the Republic of Moldova revealed parasitic elements belonging to the following classes:

- **Class Trematoda** – four species: *Echinostoma paraulum* Dietz, 1909, *Echinostoma revolutum* (Frohlinch, 1802), *Echinostoma robustum* (Yamaguti, 1935), *Prosthogonimus ovatus* (Rud., 1803)
- **Class Cestoda** – two species: *Drepanidotaenia lanceolata* (Bloch, 1782), *Retinometra giranensis* (Sugimoto, 1943)
- **Class Secernentea** – two species: *Amidostomum acutum* (Diesing, 1851), *Ganguleterakis dispar* (Schrank, 1790)
- **Class Conoidasida** – two species: *E. anatis* (Scholtyscek, 1955), *E. danailovi* (Graubmann et Betke, 1965) (Table 1).

Table 1. Distribution of endoparasite species in domestic waterfowl from the Central Zone of the Republic of Moldova

Species of Parasites	Host	
	Geese	Ducks
TREMATODA		
Echinostoma paraulum (Dietz,1909)		+
Echinostoma revolutum (Frohlinch, 1802)		+
Echinostoma robustum Yamaguti, 1935		+
Catatropis verrucosa (Frohlinch, 1789)	+	
Prosthogonimus ovatus (Rud.,1803)		+
CESTODA		
Drepanidotaenia lanceolata (Bloch, 1782)	+++	++
Retinometra giranensis (Sugimoto, 1943)		+
SECERNENTEA		
Amidostomum acutum (Diesing, 1851)		+
Amidostomum anseris (Zeder,1800)	++++	
Ascaridia galli (Schrank, 1788)	+	
Heterakis gallinarum (Schrank, 1788)	+	
Ganguleterakis dispar (Schrank, 1790)	+++	+
CONOIDOSIDA		
E.anseris (Kotlan,1932)	+++	
E. nocens (Kotlan,1932)	++	
E. truncata (Railliet et Lucet, 1891)	++	
E. stigmosa (Klimes,1963)	+	
E. anatis (Scholtyscek,1955)		++
E. danailovi (Graubmann, et Betke, 1965)		++

Legend: (+++) – massive infestation; (++) – moderate; (+) – slight.

The parasitological examination results for 68 samples collected from geese (*Anser anser domesticus*) in the private sector of the Central-North Zone of the Republic of Moldova revealed parasitic elements belonging to the following classes:

- **Class Trematoda** – two species: *Echinostoma paraulum* (Dietz, 1909), *Prosthogonimus ovatus* (Rud., 1803)
- **Class Cestoda** – two species: *Drepanidotaenia lanceolata* (Bloch, 1782), *Retinometra giranensis* (Sugimoto, 1943)

- **Class Secernentea** – four species: *Amidostomum anseris* (Zeder, 1800), *Ascaridia galli* (Schrank, 1788), *Heterakis gallinarum* (Schrank, 1788), *Ganguleterakis dispar* (Schrank, 1790)
- **Class Conoidasida** – four species: *E. anseris* (Kotlan, 1932), *E. nocens* (Kotlan, 1932), *E. truncata* (Railliet et Lucet, 1891), *E. stigmosa* (Klimes, 1963) (Table 2).

The parasitological examination results for 46 samples collected from ducks (*Anas platyrhynchos domesticus*) in the private sector of the Central-North Zone of the Republic of Moldova revealed parasitic elements belonging to the following classes:

- **Class Trematoda** – three species: *Echinostoma revolutum* (Frohlinch, 1802), *Echinostoma robustum* (Yamaguti, 1935), *Prosthogonimus ovatus* (Rud., 1803)
- **Class Cestoda** – two species: *Drepanidotaenia lanceolata* (Bloch, 1782), *Retinometra giranensis* (Sugimoto, 1943)
- **Class Secernentea** – two species: *Amidostomum anseris* (Zeder, 1800), *Ganguleterakis dispar* (Schrank, 1790)
- **Class Conoidasida** – two species: *E. anatis* (Scholtyscek, 1955), *E. stigmosa* (Klimes, 1963) (Table 2).

Table 2. Spread of endoparasite species in domestic waterfowl in the Central-North Zone of the Republic of Moldova

Species of Parasites	Host	
	Geese	Ducks
TREMATODA		
Echinostoma paraulum (Dietz,1909)	+	
Echinostoma revolutum (Frohlinch, 1802)		++
Echinostoma robustum Yamaguti, 1935	++	+
Prosthogonimus ovatus (Rud.,1803)		+
CESTODA		
Drepanidotaenia lanceolata (Bloch, 1782)	++	++
Retinometra giranensis (Sugimoto, 1943)	++	+
SECERNENTEA		
Amidostomum acutum (Diesing, 1851)		
Amidostomum anseris (Zeder,1800)	+++	+
Ascaridia galli (Schrank, 1788)	+++	
Heterakis gallinarum (Schrank, 1788)	+	
Ganguleterakis dispar (Schrank, 1790)	+++	++
CONOIDOSIDA		
E.anseris (Kotlan,1932)	++	
E. nocens (Kotlan,1932)	+++	
E. truncata (Railliet et Lucet, 1891)	++	
E. stigmosa (Klimes,1963)	+++	++
E. anatis (Scholtyscek,1955)		++

Legend: (+++) – massive infestation; (++) – moderate; (+) – slight.

From the total samples collected from ducks, it was found that approximately 20.0% were infested with a single species of endoparasites, approximately 45.0% were infested with two species of endoparasites, approximately 25.0% were infested with three species of parasites, and approximately 10.0% with four species (Figure 1).

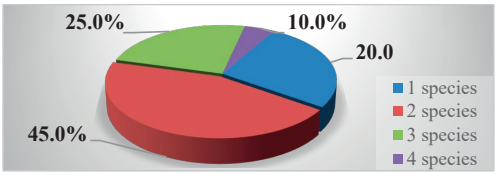

Figure 1. Endoparasitic associations in ducks (*Anas platyrhynchos* L.)

From the total number of infested samples collected from geese, it was found that approximately 35.0% were infested with a single species of endoparasite, approximately 55.0% were infested with two species of endoparasites, approximately 7.0% were infested with three species of parasites, and approximately 3.0% with four species (Figure 2).

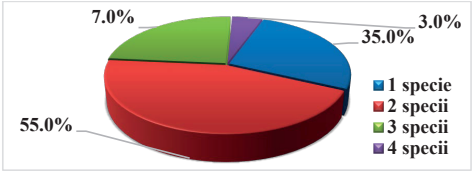

Figure 2. Endoparasitic associations in geese (*Anser anser domesticus*)

CONCLUSIONS

The conducted research highlighted that domestic waterfowl, specifically ducks (*Anas platyrhynchos domesticus*, Linnaeus, 1758) and geese (*Anser anser domesticus*, Linnaeus, 1758), are polyparasitized by various parasitic agents from the classes Trematoda, Cestoda, Secernentea, and Conoidosida, with their presence varying depending on species and habitat.

The highest infestation levels were identified in both ducks (*Anas platyrhynchos domesticus*, Linnaeus, 1758) and geese (*Anser anser domesticus*, Linnaeus, 1758) in the southern region of the Republic of Moldova.

It was found that irregular deworming or even its absence, the continuous contact of domestic

birds with wild ones, as well as the massive pollution of their habitats with parasitic elements in various forms of infestation, contribute to maintaining a high level of infestation in the investigated waterfowl.

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