

Original Article


Ecological Peculiarities of Waterfowl Parasitocenosis Distribution

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ABSTRACT

Background: Invasive diseases cause severe illnesses in birds, which become extensive and threatening under conditions of general waterfowl breeding.

Objectives: The study aims to investigate the ecological peculiarities of the distribution of parasitocenoses of waterfowl.

Methods: Helminthoscopic method (Fülleborn method) was used in the research. Also, we used the incomplete helminthologic autopsy method according to K.I. Skryabin.

Results: It was found that the prevalence of parasitocenosis of waterfowl in the forest-steppe zone was 76.7%, in the steppe zone 54.5%, and in the mountain-forest zone 36.7%. At low infestation intensity, the reproductive capacity of *Echinostoma* increases.

Conclusion: Parasitocenoses in waterfowl are caused by several species, including *Echinostoma revolutum*, *Hypodereum conoideum*, and *Echinoparyphium recurvatum*. These parasites can cause various waterfowl diseases, including intestinal disorders, loss of appetite and weight, and decreased productivity. Mixed infestation is quite common in which waterfowl are simultaneously infected with two or more intestinal parasites. In our study, the intensity of mixed infestation in geese with a combination of *E. revolutum* and *H. conoideum* species amounted to 36%.

Keywords: Ecology, Infestation, Infestation extents, Infestation intensity, Parasitocenosis, Waterfowl

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Introduction

Waterfowl breeding is currently a developed area of poultry farming and an essential industry for the growth and development of specific countries and regions. The Republic of Bashkortostan is a region of the Russian Federation, part of the Volga Federal District and the Ural Economic Region. Bashkortostan has a long tradition of poultry farming. The Republic has many poultry farms, including small and large industrial complexes. Currently, the Republic of Bashkortostan is a leading region in the Russian Federation regarding the amount of waterfowl and meat produced. To further increase the production of poultry products, infectious and invasive diseases of poultry should be prevented (Abtin et al., 2022; Bashashati et al., 2023; Razmarai Iranagh et al., 2023; Rusli et al., 2023).

Echinostomatidoses are widespread among waterfowl and cause significant economic damage. The Echinostomatidae family causes severe bird infestations, which have become extensive and threatening in conditions of general breeding of geese and ducks. Echinostomatidoses of birds represent a group of poorly studied diseases affecting birds. The main manifestations of echinostomatidoses are an oppressed state, emaciation, diarrhea, and lesions of different parts of the intestine by trematodes from the family Echinostomatidae. The most common species of trematodes causing echinostomatidoses in birds are *Echinostoma revolutum*, *Hypodereum conoideum*, and *Echinoparyphium recurvatum* (Chai et al., 2020; Fried et al., 2004).

Echinostomatidae parasitizing in the intestine traumatizes the mucosa, causing hyperemia, focal hemorrhages, loosening, and desquamation of the villous epithelium. Mixed infestations caused by trematodes of the genera *Echinostoma*, *Echinoparyphium*, *Hypodereum*, *Echinostomus*, *Notocotylus*, and *Calotropis* are also recorded, significantly reducing slaughter quality, fatness, body weight gain, and productivity of geese (Mohanta et al., 2018). Sick geese and ducks are the source of echinostomatidoses pathogens. The transmission factors of pathogens are aquatic plants (cassava) and silt sediments from the bottom of water bodies containing Echinostomatidae adolesearicae. To date, researchers have not fully reflected seasonal changes and peculiarities of the formation of different intensities of trematodes of the genus Echinostomatidae in domestic waterfowl (Dietz, 1909). The genus *Echinoparyphium* was discovered by Dietz in 1909 and has following typical species: *Echinoparyphium elegans* (Looss, 1899) from flamingos, *E. recurvatum* (Von

Linstow, 1894) from chicken, pigeon and duck birds, *Echinoparyphium agnatum* (Dietz, 1909) from *Buteo buteo*, *E. aconiatum* (Dietz, 1909) from *Vanellus vanellus*, and *Echinoparyphium baculus* (Diesing, 1850) from the bird orders of Anseriformes and Columbiformes (Dietz, 1909). In 1911, Odhner added another species to this genus from his Nile collection called *Echinoparyphium volvulus* (Odhner, 1910) from *Ibis hagedash*.

In connection with the above, our research aimed to study the ecological peculiarities of echinostomatidoses distribution in waterfowl.

Materials and Methods

The prevalence of trematodes of *E. revolutum*, *H. conoideum*, and *E. recurvatum* species in waterfowl (geese) was studied in the Republic of Bashkortostan, Russian Federation, in many years (2016-2022). Five natural zones, forest, forest-steppe, steppe, mountain-forest, and mountain-forest-steppe, have been distinguished on the territory of the Republic of Bashkortostan. Forests occupy more than 40% of the territory of the Republic.

The degree of poultry infestation was determined by the results of helminthoscopic studies of goose droppings using the flotation method (Fulleborn's method). A saturated solution of table salt was prepared (400-420 g of salt per 1 liter of water). A sample of feces weighing 3-5 g was placed in a glass, poured a small amount of flotation liquid, stirred thoroughly, then added 50-100 mL of this solution and filtered through a metal sieve into a dry, clean glass. The suspension was allowed to stand for 40-60 minutes, then the surface film was removed by touching the loop and transferred to a slide for microscopy.

Intensity and extent of invasion were determined by collecting helminths from the intestines of birds during an incomplete helminthologic autopsy of the gastrointestinal tract, according to K.I. Skryabin. For this purpose, the intestines of birds were opened, and the co-substance was extracted and studied in small portions, first in black and then in white cuvettes. Large helminths were selected visually, and small ones with the help of a hand-held magnifying glass with 8-10x magnification. Intensity of infestation (II) is the number of helminths detected in the examined poultry, expressed in copies. The extent of infestation (EI) is the ratio of infected birds to the total number of examined birds, expressed as a percentage.

The obtained digital material was processed statistically, determining the average number of trematode eggs in 1 g of feces and the number of detected imaginal echinostoma from each bird individually.

Results

According to helminthoscopic studies of waterfowl feces, echinostomatidoses are widespread in the territory of the Republic of Bashkortostan. EI in adult waterfowl population fluctuates with a wide range from 24.0% to 88.0%, averaging 56.0%. Peak values of echinostomatidoses invasion extent in waterfowl were established in the forest-steppe zone (65.5%-88.0%). In the steppe zone, the EI of waterfowl echinostomatidoses decreases (46.5%-61.0%). In the mountainous forest zone, echinostomatidoses were observed much less frequently, and the EI amounted to 28.5% and 44.0% of infected birds.

According to helminthologic studies, the intensity of invasion varied in different species of trematodes. Thus, the II in *E. revolutum* was $74.2 \pm 11.3/206.3 \pm 38.1$ specimens/head, in *H. conoideum* was $75.4 \pm 13.2/221.4 \pm 41.2$ specimens/head, and in *E. recurvatum*, it was $52.1 \pm 7.2/124.5 \pm 12.3$ specimens/head.

The results of an incomplete helminthologic autopsy of geese intestines also confirmed the wide distribution of poultry echinostomatidoses. The EI ranged from 48.0% to 63.0%. The number of trematodes *E. revolutum* isolated from poultry raised in the steppe zone was lower and amounted to $52.1 \pm 10.2/177.3 \pm 26.1$ specimens/head, *H. conoideum* $63.2 \pm 12.3/182.5 \pm 38.1$ specimens/head and *E. recurvatum* $42.3 \pm 5.1/108.3 \pm 9.1$ specimens/head. In the Republic's mountain forest zone, the lowest percentage of echinostomatidoses infestation was observed at 34.0% to 65.0%.

The intensity of invasion according to the results of incomplete helminthological autopsy was maximum in *E. revolutum* ($43.2 \pm 6.3/132.1 \pm 11.2$ specimens/head). In *Hypoderaeum conoideum*, it was $33.3 \pm 8.5/141.0 \pm 26.1$ specimens/head, and in *E. recurvatum*, $28.3 \pm 6.7/96.1 \pm 1.21$ specimens/head.

With the onset of fall (October-November), most trematodes of *H. conoideum* and *E. revolutum* reached the sexually mature stage (73.0%). Microscopy revealed a highly developed sexual apparatus in the maritimes, and the eggs contained a formed miracidium.

Discussion

Waterfowl are a widespread, species-rich group of animals that play a massive role in human life and economic activity. One of the factors reducing the productivity of waterfowl is helminths, which, under certain conditions, cause mass death of young birds and reduce the fatness of adult birds. Proper organization and timely implementation of diagnostic and therapeutic measures to improve the health of waterfowl from helminthiasis are possible only based on knowledge of the basic biology of pathogens, epizootiology, and pathogenesis of helminths.

Echinostomatid infestation is known to be widespread among waterfowl. At intensive echinostomatidoses, lesions of the small intestine, the body weight gain of geese decreases by 30% to 40%, and egg production by 15% to 25%. Therefore, echinostomatidoses of waterfowl represent a serious ecological and economic problem.

As a result of researching and studying the ecological distribution of echinostomatidoses of waterfowl in the Republic of Bashkortostan, we have established significant differences in the invasiveness of birds. The high spread of echinostomatidoses in the forest-steppe zone of the Republic of Bashkortostan is attributable to the broad type of goose breeding and many artificially created small water bodies as a source of drinking water.

Our data are consistent with the results of many helminthologists. [Zhemukhova et al. \(2020\)](#) showed that in the Central Caucasus, trematodes of the genus *Echinoparyphium* ([Dietz, 1909](#)) of the family Echinostomatidae in domestic and zoned breeds of waterfowl are characterized by significant species diversity and wide distribution. In the territory of the Kabardino-Balkar Republic, [Kozhokov et al. \(2007\)](#) studied the etiological factors of waterfowl parasitocenoses. They found that the prevalence of echinostomatidoses of geese differed depending on the zones. *E. revolutum*, *Echinoparyphium aconiatum*, *H. conoideum*, and *Echinochasmus beleocephalus* were predominant in geese. [Ignatkin et al. \(2019\)](#) drew attention to the ecological role of aquatic and amphibians in the circulation of trematodes of domestic birds in the Ulyanovsk region. They established the circulation of the pathogen echinostomatidoses in mollusks to assess the danger of infection in waterfowl. A similar study was conducted by [Assis et al. \(2022\)](#) in an urban area of Brazil.

According to Labony et al. (2022), one of the key factors that affect the development of eggs and larvae of Echinostoma is the average water temperature, which in turn adversely affects the development of intermediate hosts, i.e. freshwater mollusks of the genera Radix, Lymnaea, Physa, Planorbis, and Anisus. As a consequence, their numbers decrease. Consequently, in the forest-steppe zone of the Republic of Bashkortostan, we observed a tendency to increase the intensity of invasion of the gram of litter with the maximum intensity of echinostomatidoses.

Thus, the possibility of the formation of echinostomatidoses parasite fauna in waterfowl in the form of mono-invasion and widespread helminthiasis is most favorably influenced by the close relationship of parasites between themselves and the environment, as well as the influence of environmental temperature, air humidity, terrain, a wind rose, etc. of the forest-steppe zone. These factors allow the trematode of the Echinostomatidae family to develop cyclically from the egg stage to sexual maturity.

It should be noted that the intensity of invasion of echinostomatidoses of all species in the mountain forest zone is 2-2.2 times less compared to the forest-steppe and steppe zones of the Republic. These data are in favor of the data obtained by helminthology, i.e. the biological activity of the parasitofauna and confinement to certain ecological zones of waterfowl echinostomatidosis directly depend on the ecological conditions of the Republic (Gu et al., 2020).

Conclusion

As a result of our research, we found that in the Republic of Bashkortostan, there is an active process of infection of waterfowl with echinostomatidosis due to the presence of favorable conditions for the biological cycle of development at the egg, larval, and adult stages of trematodes of *E. revolutum*, *H. conoideum*, and *E. recurvatum*. According to the results of intestinal autopsies and helminthoscopic studies of droppings, the II in waterfowl in the forest-steppe zone of the Republic amounted to 76.75%, in the steppe zone 54.5%, and the mountain-forest zone 36.7%. The EI in the form of mixed infestation in combination of *E. revolutum* and *H. conoideum* species in waterfowl amounted to 36.0%.

Ethical Considerations

Compliance with ethical guidelines

The study followed the ethical principles approved by the Ethics Committee for Animal Experiments of the Federal State Budgetary Educational Institution of Higher Professional Education, [Bashkir State Agrarian University](#), Ufa, Russia (Protocol No.: 8 of 28.03.2019).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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References

- Abtin, A., Shoushtari, A., Pourbakhsh, S. A., Fallah Mehrabadi, M. H., & Pourtaghi, H. (2022). Two novel avian influenza virus subtypes isolated from domestic ducks in North of Iran. *Archives of Razi Institute*, 77(2), 861-867. [PMID]
- Assis, J. C. A., Pulido-Murillo, E., Melo, A. L., Martins, N. R. D. S., & Pinto, H. A. (2022). *Philophthalmus gralli* in domestic waterfowl: An environmental study in an urban area from Brazil. *Veterinary Parasitology, Regional Studies and Reports*, 29, 100701. [DOI:10.1016/j.vprsr.2022.100701] [PMID]
- Bashashati, M., Banani, M., Haerian Ardakani, B., & Sabouri, F. (2023). Complete genome sequencing of an embryonated chicken egg-adapted duck adenovirus A. *Archives of Razi Institute*, 78(2), 757-765. [DOI:10.22092/ARI.2022.360121.2557] [PMID]
- Chai, J. Y., Cho, J., Chang, T., Jung, B. K., & Sohn, W. M. (2020). Taxonomy of echinostoma revolutum and 37-collar-spined echinostoma spp.: A historical review. *Korean Journal of Parasitology*, 58(4), 343-371. [DOI:10.3347/kjp.2020.58.4.343] [PMID]
- Dietz, E. (1909). Die Echinostomiden der Vogel. *Zoologischer Anzeiger*. 34: 180-192.
- Fried, B., & Graczyk, T. K. (2004). Recent advances in the biology of Echinostoma species in the «revolutum» group. *Advances in Parasitology*, 58, 139-95. [DOI:10.1016/S0065-308X(04)58003-X] [PMID]

- Gu, S. L., Luo, M. Y., Guo, W., Pan, Y., & Zhan, X. D. (2020). [Characterization of *Echinostoma miyagawai* in domestic ducks in Wuhu City (Chinese)]. *Chinese Journal of Schistosomiasis Control*, 32(2), 191-194. [PMID]
- Ignatkin, D. S., Romanova, E. M., Indiryakova T. A. (2019) Ecological role of hydro- and amphibions in the circulation of trematodosis of domestic birds in the Ulyanovsk region. *Bulletin of the Ulyanovsk State Agricultural Academy*, 2(26), 50-55. [Link]
- Kozhokov, M. K., Aramisov, A. M., & Afaunova, L. Kh. (2007). Formation of mixtinvasions of waterfowl. *Reports of the Russian Academy of Agricultural Sciences*, 33, 339-340. [DOI:10.3103/S1068367407050205]
- Kurniawan Rusli, R., Amizar, R., Zurmiati, Z., Reski, S., Darmawan, A., & Subekti, K., et al. (2023) Supplementation of Zinc on antioxidant activity, blood profile, mineral availability, abdominal fat, digestive and accessory organs of sikumbang janti duck. *Archives of Razi Institute*, 78(5), 1586-1593. [DOI:10.32592/ARI.2023.78.5.1586] [PMID]
- Labony, S. S., Paul, S., Alim, M. A., Hossain, M. S., Inoue, T., & Ritu, S. N., et al. (2022). Research Note: Genetic analysis, pathology, and vectors of echinostomiasis, a zoonotic helminth infection in chickens in Bangladesh. *Poultry Science*, 101(3), 101682. [DOI:10.1016/j.psj.2021.101682] [PMID]
- Mohanta, U. K., Watanabe, T., Anisuzzaman, Ohari, Y., & Itagaki, T. (2019). Characterization of *Echinostoma revolutum* and *Echinostoma robustum* from ducks in Bangladesh based on morphology, nuclear ribosomal ITS2 and mitochondrial nad1 sequences. *Parasitology International*, 69, 1-7. [DOI:10.1016/j.parint.2018.11.002] [PMID]
- Odhner, T. (1910). Nordostafrikanische Trematoden, grösstenteils vom weissen Nil. I; Fascioliden. *Results of the Swedish Zoological Expedition to Egypt and the White Nile. 1901 (Jägerskiöld)*, 23A, 1-170. [Link]
- Razmarai Iranagh, A. A., Razmaraii, N., Aghaei, R., Shayegh, J., Mousaviyan, M., & Ameghi Roudsary, A. (2023). Study on propagation and adaptation of EDS-76 Avian Adenovirus in Duck and SPF primary embryonic chicken cell culture comparison to duck and SPF Embryonated Chicken Eggs. *Archives of Razi Institute*, 78(3), 1095-1105. [PMID]
- Zhemukhova, O. A., Shakhmurzov, M. M., Kozhokov, M. K. (2020). Seasonal changes in the extensiveness and intensity of mixed invasion of trematodes of the genus *Echinoparaphium* Dietz, 1909 in domestic geese, zoned breeds in the Central Caucasus. s, *Izvestia Kabardino-Balkarian State Agrarian University named after V. Proceedings of the Kabardino-Balkarian State Agrarian University named after VM Kokov*, (3), 29. [Link]
- von Linstow, O. (1894). [Helminthological studies (German)]. *Jenaische Zeitschrift für Naturwissenschaft*, 28, 328-342. [Link]

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