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Sex-dependent differences in the blood protozoa of the domestic birds - chickens (*Gallus domesticus*) and turkeys (*Meleagridis gallopavo*L.)

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Abstract

In this article, was studied the extent of infection of poultry – chickens and turkeys infected with haemoparasites depending on the sex of the birds and a difference in the extent of invasion in these birds was revealed. A total of 200 chickens (*Gallus gallus domesticus*) and 200 turkeys (*Meleagridis gallopavo*) have been were divided into two age groups as follows: males and females. Parasites of genus *Leucocytozoon*, *Haemoproteus* and *Plasmodium* were found in the blood from domestic birds in Republic of Azerbaijcan. It was found that in roosters, infection with blood parasites of the genus *Leucocytozoon* is 13%, parasites of the genus *Plasmodium* 16%, parasites of the genus *Haemoproteus* 14%, and in hens with parasites of the genus *Leucocytozoon* -10%, parasites of the genus *Plasmodium* - 11%, *Haemoproteus* - 8%. It was found that in the studied birds, the rate of infection with the parasites Leucocytozoon, *Haemoproteus*, and *Plasmodium* was comparatively higher than males compared to females.

Keywords: *Leucocytozoon; Haemoproteus;* Sex; chickens; blood parasites

1 Introduction

In recent years, the number of works, including studies on the study of blood parasites in domestic and wild birds has significantly increased in the world. Blood parasites of the order Haemosporidia are vector-borne parasites that infect amphibians, reptiles, birds, and mammals worldwide [1].

Parasite prevalence in birds is often different between males and females [2, 3]. Mounting evidence indicates that sex hormones influence the immune system [4, 5]. Some authors, comparing the infection with blood parasites of males and females of birds (yellow wagtails), found that the studied birds were infected almost identically. However, in the spring and early summer (April, May, June), during the period of sexual activity of birds, the difference in the infection of males and females is comparatively increased. Microscopy study on *H. nucleocondensus* in birds found that prevalence in adults declined with age, that males were more likely to be infected that females [6].

In birds, evidence suggests that an effective immune system is costly, and that there are trade-offs among investment in immune function during reproduction [7]. This may result in differences in parasite prevalence between the sexes [8]. There is, therefore, a need to assess what role, if any, sex-related trade-offs between investment in immunity and other aspects of reproduction play in mediating acquisition of parasites, and if costs of parasite infections are different for each sex.

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The aim of this study was to detect haemoparasites of birds (chickens and turkeys) and characterize degree of infection with blood parasites of males and females of birds.

2 Methods

Experiments were carried out in the of Protozoology laboratory of Institute Zoology of ANAS in September 2018 to December 2018. Birds were examined from private farms of Absheron region of Azerbaijan. Material on the fauna of blood parasites of chickens was taken fromvia bronchial venipuncture in birds. The birds were divided into two age groups as follows: males and females. Blood smear were made on site, and after air drying, fixing with 100% methanol, and stained using a modified Romanovsky staining technique [9]. Examination of blood smears were performed using the microscope with video camera (Carl Zeiss Axio Scope.A1) with oil immersion (400× and 1000×) for haemoparasites, which were identified to genus based on morphology. The number of parasites observed in 100 optic fields was recorded. Data from the study were entered in Ms-Excel, for statistical processing the results used the statistical program IBM SPSS Statistics 20.

3 Results

A comparative analysis of data on hematoparasite infection, depending on the gender of the bird, reveals a difference in the extent of invasion (table).

Parasites of genus *Leucocytozoon*, *Haemoproteus* and *Plasmodium* were found in the blood from domestic birds in Republic of Azerbaijcan (fig).

It was found that in roosters, infection with blood parasites of the genus *Leucocytozoon* is 13% (200/26), parasites of the genus *Plasmodium* 16% (200/32), parasites of the genus *Haemoproteus* 14% (200/28), and in hens with parasites of the genus *Leucocytozoon* -10% (200/20), parasites of the genus *Plasmodium* - 11% (200/22), *Haemoproteus* - 8% (200/16). As can be seen from the table, the infection of hens with hemosporidia is lower than that of roosters (tab.).

Table 1 Sex-dependent differences in the blood protozoa of the domestic birds

Birds	**Sex**	**Extent of invasion, %**		
		Leucocytozoon	***Plasmodium***	***Haemoproteus***
chickens	♀	10	11	8
	♂	13	16	14
turkeys	♀	11	3	6
	♂	18,1	8,9	9

In male turkeys, the infection with the parasite of the genus *Leucocytozoon* is 18.1% (270/49), with parasites of the genus *Plasmodium* is 8,9% (270/24), parasites of the genus *Haemoproteus* – 9% (270/24).

In female turkeys, the infection with the parasite of the genus *Leucocytozoon* is 11% (400/44), parasites of the genus *Plasmodium* 3% (400/12), parasites of the genus *Haemoproteus* – 6% (400/24). In female turkeys, the infection examined for parasites of the genus *Leucocytozoon, Haemoproteus*, and *Plasmodium*, blood infection was lower than male.

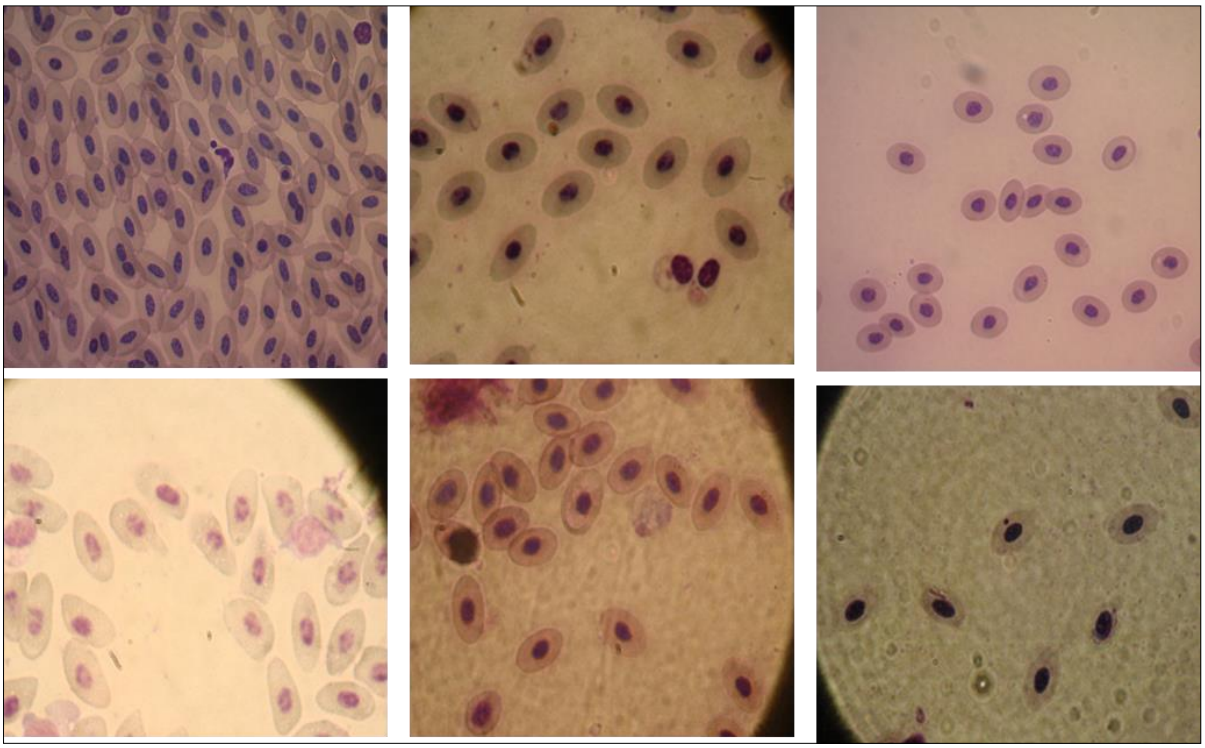

Figure 1 The blood protozoa of the domestic birds (chickens and turkeys) - *Leukocytozoons*p., *Plasmodium Haemoproteus* stained with Giemsa stain (100X)

4 Discussion

Differences between males and females in prevalence and intensity of infection, in particular male-biased parasitic infections, are often observed in nature. The some work represents that birds do not exhibit overall sexual diference in parasite prevalence, and parasite prevalence do not predict sex-specifc mortality [10].

In other studies, Allander and Bennett (1994) failed to detect any sex-related differences with respect to hemoparasite prevalence, while Norris et al. (1994) found that females were more frequently infected than males [11, 12]. Studies in other bird species have shown higher blood parasite prevalence either in females [13, 14] or in males [15] or have failed to reveal any sex differences [16]. Although anti-malarial treatment reduced Haemoproteus infection, intensity and ultimate fitness cost, i.e. survival only in females, whereas males did not benefit from such a manipulation [17].

5 Conclusion

In conclusion, our analyses showed that male hens examined for parasites of the genus *Leucocytozoon*, Haemoproteus, and Plasmodium, blood infection was higher than females.

Therefore, our results suggest that birds (domestic turkeys, domestic chickens) are infected with avian blood parasites, and that male birds have higher prevalence than females of these birds.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have no conflict of interests to declare regarding the publication of this paper.

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