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Occurrence of avian haematozoa in Ekaterinburg and Irkutsk districts of Russia

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One hundred and sixty-nine individual passeriform birds belonging to 12 families and 34 species were caught and investigated by microscopic examination of stained blood films in eastern Russia for the first time. The material was collected at two sites in Ekaterinburg district on the European slip of the Ural mountains and at one site in Irkutsk district near Lake Baikal during the breeding period of birds between 18 May and 7 June in 2004. The overall prevalence of infection was 63.9%. Prevalences of *Haemoproteus* spp. (31.4%), *Leucocytozoon* spp. (33.1%), *Plasmodium* spp. (12.4%), *Trypanosoma* spp. (17.2%), *Hepatozoon* spp. (0.6%), and microfilariae (8.9%) were recorded. No differences were discernible in the prevalence of infection between males and females or between young and adult birds. The prevalence of infection varied markedly in different species of avian hosts. The majority of infections (55% of all positive birds) were mixed, with parasites from two to five different genera present in each blood smear. Five new host–parasite associations were identified. The present communication indicates that an active transmission of avian blood parasites takes place in eastern Russia. Due to the high prevalence of avian haematozoa in eastern Russia, this territory can be a convenient study site for future investigations of these parasites and their relationships with birds.

Key words: bird blood parasites, *Haemoproteus*, *Hepatozoon*, *Leucocytozoon*, microfilariae, *Plasmodium*, *Trypanosoma*, Russia

INTRODUCTION

Birds are the only group of vertebrates that are almost world-wide inhabited by blood parasites (Atkinson, van Riper, 1991; Valkiûnas, 2005). The wide geographical distribution, high prevalence of infection, possibility for the analysis of many parasitological indices in living hosts differentiate all avian haematozoa into a group of promising subjects to study such fundamental biological problems as sexual selection, evolution of emerging diseases, virulence, and immunocompetence (Hamilton and Zuk, 1982; Sehgal et al., 2001; Perkins and Schall, 2002; Bensch and Åkesson, 2003; Ricklefs et al., 2004). Although numerous surveys have been conducted on haematozoa of the Palearctic birds (see reviews by Peirce, 1981; Valkiûnas, 1987, 2005), some regions of Europe and Asia remain insufficiently investigated. There is no information about the distribution of these parasites in vast territories of eastern Russia, including Ural Mountains, Siberia, and the Far East. These regions of the Palearctic are of particular interest due to huge densities of birds breeding there and migrating to the tropics. Because surveys of avian blood parasites in eastern Russia are uncommon, our objective was to obtain primary information on the occurrence of blood parasites in Ekaterinburg and Irkutsk districts of that country.

MATERIALS AND METHODS

The material was collected at two sites in Ekaterinburg district on the European slip of Ural Mountains (57° 20' N, 59° 49' E, and 56° 50' N, 58° 36' E) and at one site of Irkutsk district near Lake Baikal (51° 34 N, 103° 54' E) during the breeding period of birds between 18 May and 7 June in 2004. Birds were caught with mist nets, collected from nest boxes, and some of them were gun-shot. In all, 169 individual passeriform birds (79 subadults, 53 adults, and 37 of unknown age, 94 males, 61 females, and 14 of unknown sex) of 34 species belonging to 12 families were investigated (Table 1). The age and sex of birds were determined according to Ivanov and Stegmann (1978) and Svensson (1992). Subadult birds were <1 year and adult birds >1 year old.

Table 1. **Occurrence of haematozoa in passeriform birds from Ekaterinburg and Irkutsk districts of Russia, May–June 2004**

Bird family and species	Number examined	Number infected	Number infected with[1]					
			H	P	L	T	M	Hp
Aegithalidae								
Aegithalos caudatus	3	1			1			
Certhiidae								
Certhia familiaris	1							
Cinclidae								
Cinclus cinclus	2							
Emberizidae								
Emberiza rustica	2							
Fringillidae								
Carpodacus erythrinus	12	8	5	1	4	2	1	
Fringilla coelebs	7	5	4	1	2		1	
F. montifringilla	3	3		2	1	1		
Loxia curvirostra	2	2	2		2			
Spinus spinus	5	3	2		1			
Pyrrhula pyrrhula	4	3	2		3	1		
Motacillidae								
Anthus hadgson	1							
Motacilla alba	2	2		1	1			
Muscicapidae								
Ficedula hypoleuca	28	18	10	2	1	12	1	
Muscicapa latirostris	3	2	1	1				
Paridae								
Parus ater	12	7		3	4	1		
P. major	1	1	1					
P. montanus	17	11	1	5	6	1	1	1
Pruneliidae								
Prunella modularis	3	2		1	1			
Sittidae								
Sitta europaea	1	1		1				
Sylviidae								
Acrocephalus dumetorum	1	1	1					
Hippolais caligata	1	1	1					
Phylloscopus collybita	12	5	2		2	1		
P. fuscatus	1							
P. schwarzi	2							
P. trochilus	2							
Sylvia curruca	4	3	2		2			
Turdidae								
Erithacus rubecula	4	2			2			
Phoenicurus phoenicurus	2	2	1		1	1		
Luscinia cyane	4	1		1				
L. sibilatrix	1							
Tarsiger cyanurus	3	1			1	1		
Turdus iliacus	4	4	4	1	3	2	3	
T. philomelos	6	6	5	1	6	1	2	
T. pilaris	13	13	9		12	5	6	
Total:	169	108	53	21	56	29	15	1
Prevalence, %		63.9	31.4	12.4	33.1	17.2	8.9	0.6

[1] H = *Haemoproteus* sp.; P = *Plasmodium* sp.; L = *Leucocytozoon* sp.; T = *Trypanosoma* sp.; M = microfilaria; Hp = *Hepatozoon* sp.

Table 2. **Species of haematozoa recorded in passeriform birds from Ekaterinburg and Irkutsk districts of Russia, May–June 2004**

Parasite family, species and representative blood smears	Bird species
Adeleidae	
Hepatozoon parus (12663 NS) [1]	*Parus montanus* (1) [2]
Haemoproteidae	
Haemoproteus attenuatus (12862 NS) *H. balmorali* (12874 NS) *H. belopolskyi* (12735 NS) *H. fringillae* (12687 NS, 12696 NS) *H. majoris* (12871 NS) *H. minutus* (12779 NS, 12830 NS, 12836 NS) *H. pallidus* (12886 NS, 13826 NS)	*Phoenicurus phoenicurus* (1) *Ficedula hypoleuca* (1) *Hippolais caligata* (1) *Spinus spinus* (2) *Ficedula hypoleuca* (4) *Turdus iliacus* (2), *T. philomelos* (2), *T. pilaris* (3) *Ficedula hypoleuca* (3), *Muscicapa latirostris* (1)
Leucocytozoidae	
Leucocytozoon dubreuili (12767 NS, 12925 NS, 12940 NS, 13021 NS) *L. fringillinarum* (12928 NS, 12944 NS, 13725 NS) *L. majoris* (12782 NS, 12789 NS, 12818 NS, 12849 NS, 12922 NS, 12937 NS, 12982 NS, 13036 NS)	*Carpodacus erythrinus* (1), *Loxia curvirostra* (1), *Pyrrhula pyrrhula* (1), *Turdus iliacus* (1), *T. pilaris* (6) *Aegithalos caudatus* (1), *Parus ater* (1), *Prunella modularis* (1), *Pyrrhula pyrrhula* (1) *Carpodacus erythrinus* (2), *Fringilla coelebs* (2), *F. montifringilla* (1), *Loxia curvirostra* (1), *Motacilla alba* (1), *Parus montanus* (2), *Pyrrhula pyrrhula* (1), *Spinus spinus* (1), *Sylvia curruca* (1), *Tarsiger cyanurus* (1), *Turdus iliacus* (2), *T. philomelos* (5), *T. pilaris* (7)
Plasmodiidae	
Plasmodium (Haemamoeba) sp. (13062 NS, 13870 NS)	*Ficedula hypoleuca* (1), *Luscinia cyane* (1)
Trypanosomatidae	
Trypanosoma avium (12830 NS, 12871 NS, 12874 NS, 12910 NS, 12934 NS) *T. everetti* (12879 NS, 13013 NS)	*Carpodacus erythrinus* (2), *Ficedula hypoleuca* (10), *Fringilla montifringilla* (1), *Parus ater* (1), *P. montanus* (1), *Phoenicurus phoenicurus* (1), *Pyrrhula pyrrhula* (1), *Tarsiger cyanurus* (1), *Turdus iliacus* (2), *T. philomelos* (1), *T. pilaris* (5) *Ficedula hypoleuca* (2)

[1] Accession number of the representative blood slide.
[2] The number of infected birds is given in parentheses.

The blood was taken mainly by puncturing the brachial vein. In gunshot birds, the blood was taken from the heart immediately after collection of the birds. The blood smears were air-dried, fixed in absolute methanol in the field and stained with Giemsa in the laboratory. Approximately 100–150 fields were examined at low magnification (×400) and then at least 100 fields were studied at high magnification (×1000). Haematozoa were identified according to Baker (1976) and Valkiûnas (2005). Prevalences of infection were compared by Yates corrected χ^2 test. A *P* value of 0.05 or less was considered significant. Representative blood slides (Table 2) were deposited at the Institute of Ecology of Vilnius University, Vilnius, Lithuania.

RESULTS

Blood parasites were common at each study site. The overall prevalence of infection was 63.9% (Table 1). The majority (55% of all positive birds) were mixed infections with parasites from two to five different genera present in each blood smear. The *Haemoproteus*, *Leucocytozoon*, *Plasmodium*, *Trypanosoma*, *Hepatozoon* species and microfilariae were recorded. Representatives of all genera were found in resident

bird species belonging to the Aegithalidae, Paridae, and Sittidae, indicating transmission at the study sites.

There was no significant difference in the prevalence of haematozoa between males and females (χ^2 = 2.12; P = 0.15) or between young and adult birds (χ^2 = 0.31; P = 0.68).

Species identification of blood parasites was possible when the intensity of parasitemia was >0.01% and when fully-grown parasites were present on the slides. Thirteen haematozoa species were identified to the species level (Table 2). All recorded malaria parasites were *Plasmodium* (*Haemamoeba*) spp. They were not identified to the species level because of absence of mature erythrocytic meronts in the blood films. The great majority of recorded infections were light (<1%) and thus classified as chronic.

DISCUSSION

Blood parasites are prevalent in birds in eastern Russia. The overall prevalence of infection in this study was two times greater than that reported from Western Europe (Peirce, 1981). Using PCR-based methods, Scheuerleon and Ricklefs (2004) recorded the overall prevalence of infection of birds with blood parasites to be 26% in European passeriform birds. Venskute et al. (2005) found blood parasites in 36.3% of birds examined by microscopic examination of blood films in the environs of Vilnius, Lithuania. According to this study, blood parasites are more prevalent at our study sites in the eastern Palearctic.

Because representatives of all genera of the haematozoa were found in some resident birds such as the species of the Paridae, an active transmission of blood parasites certainly takes place at our study sites. The high densities of blood-sucking dipteran insects (Diptera: Culicidae, Ceratopogonidae, and Simuliidae), which are vectors of the great majority of recorded haematozoa (Baker, 1976; Valkiûnas, 2005), perhaps contribute to the wide distribution of the parasites in birds.

The overall prevalence of infection varied between 46.1% and 100% in different species of avian hosts (Table 1) and was especially high in birds belonging to the Turdidae (78.4%), Fringillidae (72.7%), Muscicapidae (64.5%), Paridae (63.3%), and Sylviidae (43.5%). It worth noting that all investigated *Turdus iliacus, T. philomelos and T. pilaris* were infected. The prevalences of *Haemoproteus, Plasmodium, Leucocytozoon, Trypanosoma* spp. and microfilarial infections in birds belonging to the genus *Turdus* were 78.3%, 8.7%, 91.3%, 34.8%, and 47.8%, respectively. It seems probable that the thrushes are attractive hosts for vectors of blood parasites due to their relatively large size (Valkiûnas, 2005).

The species of blood parasites found in this work are common in the Old World (Baker, 1976; Valkiûnas, 2005). All parasites recorded in this study were found for the first time in eastern Russia. This finding contributes to specifying the ranges of haematozoa distribution. *Haemoproteus minutus* was recorded for the first time in Redwing *Turdus iliacus*, Song Thrush *T. philomelos*, and Fieldfare *T. pilaris*. Brown Flycatcher *Muscicapa latirostris* and Common Redstart *Phoenicurus phoenicurus* are new host records for *H. pallidus* and *H. attenuatus*, respectively.

Further population field studies supplemented by experimental work on vectors, epidemiology, virulence, parasites' DNA investigation are needed to explain the high prevalence of blood parasites and their significance in wildlife. Due to the high prevalence of avian haematozoa in eastern Russia, this territory can be a convenient study site for future investigations of these parasites and their relationships with birds.

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PAUKÐÈIØ KRAUJO PARAZITØ PAPLITIMAS RUSIJOS FEDERACIJOS JEKATERINBURGO IR IRKUTSKO SRITYSE

S a n t r a u k a

Pirmà kartà iðtirti kraujo parazitø atþvilgiu 169 þvirbliniai paukðèiai priklausantys 12 ðeimø ir 34 rûðims, Rusijos Federacijos Jekaterinburgo ir Irkutsko apylinkëse. Medþiaga surinkta paukðèiø perëjimo laikotarpiu 2004 m. geguþæ–birþelá. Kraujo tepinëliai buvo fiksuojami, daþomi ir mikroskopuojami. Bendrasis uþsikrëtimo paukðèiø kraujo parazitais ekstensyvumas – 63,9%. Iðaiðkintas ekstensyvumas uþsikrëtimo kraujo parazitais ið ðiø genèiø: *Haemoproteus* spp. (31,4%), *Leucocytozoon* spp. (33,1%), *Plasmodium* spp. (12,4%), *Trypanosoma* spp. (17,2%), *Hepatozoon* spp. (0,6%) ir mikrofiliarijomis (8,9%). Uþsikrëtimo ekstensyvumo skirtumai tarp vieneriø metø ir vyresniø nei metø paukðèiø buvo statistiðkai nepatikimi. Skirtingø lyèiø paukðèiø uþsikrëtimo ekstensyvumas taip pat statistiðkai nesiskyrë. Dauguma infekcijø (55% visø teigiamø paukðèiø) buvo miðrios: nuo vienos iki penkiø skirtingø parazitø genèiø kiekviename kraujo tepinëlyje. Buvo nustatyti penki atvejai, kai gerai þinomos hemosporidijø rûðys parazituoja naujuose ðeimininkuose. Ðie tyrimai parodë, jog mûsø tirtose vietovëse yra aktyvi kraujo parazitø transmisija. Dël didelio paukðèiø uþsikrëtimo kraujo parazitais ekstensyvumo tirtos teritorijos yra tinkamos tolimesniems tyrimams.

Raktaþodþiai: paukðèiø kraujo parazitai, *Haemoproteus*, *Hepatozoon*, *Leucocytozoon*, mikrofiliarija, *Plasmodium*, *Trypanosoma*, Rusija