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Source: Journal of Wildlife Diseases, 18(1) : 81-88

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-18.1.81

BLOOD PARASITES OF SOME BIRDS FROM THE LORRAINE REGION, FRANCE

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Abstract: A total of 1650 birds of 56 species representing 21 families (primarily Passeriformes), was examined for blood parasites in the Lorraine region of France. Only 120 (7.3%) birds were infected, with members of the Paridae, Sylviidae and Turdidae the most frequently parasitized. Haemoproteids were the most commonly encountered parasites followed by the leucocytozoids. Other avian hematozoon genera were uncommon. Prevalence of parasitism was closely similar each year over a three-year period. Immature birds were first noted to be infected with *Leucocytozoon* in mid-June, suggesting transmission in late May to early June. Haemoproteids were first noted in immature birds in early July, suggesting transmission in mid-June. A review of the literature indicates that the prevalence of parasitism by avian blood parasites has decreased in western Europe since the turn of the century and is currently much lower than the prevalence encountered in Scandinavia, central Russia and eastern North America.

INTRODUCTION

Most of the pioneering studies on avian blood parasites were carried out by European workers such as Franca,[16] Franchini,[17] Leger[19] and Woodcock[30] at the turn of the century in France, England and the Iberian peninsula. By the end of World War I, few studies on avian blood parasites were conducted in western Europe and the number of studies declined even further in the interval between the two world wars and has remained low until the present. Curiously, however, workers from western European countries were exceptionally active in pursuing such studies in the outposts of their respective empires. Paradoxically, therefore, the birth place of avian haemoparasitology has had the least amount of study in this field directed towards it.

The more recent studies on avian blood parasites in western Europe (over the past two decades) suggests that there has been a drop in the prevalence of parasites in the indigenous avifauna. Over the past 100 years, western Europe has experienced major environmental changes resulting from extensive industrialization, the upheaval from two major wars and intensive agricultural practices. It could be postulated that significant changes in blood parasite prevalence would occur through the interaction of lowered avian and vector populations, populations reduced through loss of suitable breeding habitat. However, no continuous sampling of the avian population for their blood parasite burden is available so such a postulate cannot be confirmed. In 1977, one of us (JB) initiated a long term study to examine the

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avian community for their hematozoan parasites in the Lorraine region about Nancy. This report summarizes this study and compares the results with those published previously in western Europe in an effort to determine the change in prevalences of these blood parasites over the past 80 years.

MATERIALS AND METHODS

Birds were captured, aged, sexed and ringed for future identification in various areas of the Lorraine region of France—specifically, in the Departments of Meurthe-et-Moselle and the Meuse, near the towns of Nancy, Metz, Commercy, Arraincourt and Broussey. The towns are about 50 km from each other and have similar topography, ecology and climates. Blood smears were taken at the time of capture and were air-dried, fixed in 100% methanol or ethanol, stained with Giemsa's stain and sent to the International Reference Centre for Avian Haematozoa for examination. Accession numbers for these slides are as follows: 64245-64593; 67642-67818; 68007-68664; 68976-69292; 77222-77436.

RESULTS AND DISCUSSION

A total of 1650 birds of 56 species (mainly Passeriformes), representing 21 families, was examined for blood parasites over the period 1977-1980. Only 120 birds (7.3%), representing 25 species of 10 families, were infected with hematozoa, with species of the Paridae (8.4%), Sylviidae (14.4%) and Turdidae (10.2%) the most frequently parasitized (Table 1). *Sylvia atricapilla* (41.7%), *Emberiza citrinella* (27.3%) and *Turdus merula* (21.6%) were the most frequently parasitized species. Species of *Haemoproteus* (3.9%) were the most commonly encountered parasites, followed by *Leucocytozoon* (1.8%), *Trypanosoma* (0.9%), *Plasmodium* (0.8%), *Atoxoplasma* (0.2%) and microfilaria (0.1%). Haemoproteids encountered were *Haemoproteus fringillae/orizivora* in the Fringillidae, Motacillidae, Muscicapidae, Ploceidae and Sylviidae; *Haemoproteus majoris* in the Paridae; *Haemoproteus lanii* in the Laniidae; *Haemoproteus prognei* in the Hirundinidae and *Haemoproteus fallisi* in the Turdidae. The leucocytozoids included *Leucocytozoon fringillinarum* in the fringillids, parids and sylviids; *Leucocytozoon hirundinis* in the Hirundinidae; *Leucocytozoon majoris* in the Paridae and *Leucocytozoon dubreuili* in the Turdidae. All trypanosomes seen were morphologically consistent with *Trypanosoma avium*. The species of *Plasmodium* encountered were *P. polare* in *Emberiza citrinella* and *Parus atricapillus; P. cathemerium* in *Phoenicurus phoenicurus* and *P. vaughani* in *Parus atricapillus, P. caeruleus, P. major, Acrocephalus scirpaceus, Phylloscopus collybita, Turdus merula* and *T. philomelos*. The *Atoxoplasma* and microfilaria were not further identified. Most infections were of a low intensity suggesting a chronic, rather than fulminating, phase of parasitism.

The overall prevalence of parasitism was remarkably stable over the period 1978-1980 (Table 2). The prevalence of the individual parasite genera was more variable but only once exceeded 4%. The highest prevalence of blood parasites was encountered in September (Table 3) when 10% of the birds were infected. This month also coincided with the period when the largest sample size was obtained. The first immature birds showing infections with *Leucocytozoon* were taken in mid-June, suggesting that they had acquired their infections in late May to early June — a timing consistent with observations in North America.[14,15] This timing allows for a week of prepatent infection together with a week of development in the vectors. Presumably this also means that the simuliid vectors in this region were active from mid-May to mid-June. The earliest records for immature birds infected with *Haemoproteus* was in

TABLE 1. Blood parasites of birds from the environs of Nancy, France. *H.* = *Haemoproteus; L.* = *Leucocytozoon; M.* = microfiliaria; *P.* = *Plasmodium; T.* = *Trypanosoma; A.* = *Atoxoplasma.*

Family & Species	Total birds examined	infected	*H.*	*L.*	*M.*	*P.*	*T.*	*A*
FRINGILLIDAE								
Carduelis carduelis	6	1	1					
Coccothraustes coccothraustes	15	2		2				
Emberiza citrinella	22	6	4	1		1		
Emberiza schoeniclus	98	2	1	1				
Uninfected birds	142	0						
Total:	283	11	6	4		1		
HIRUNDINIDAE								
Hirundo rustica	286	12	1	2			9	
Riparia riparia	161	5		1			4	
Uninfected birds	4	0						
Total:	451	17	1	3			13	
LANIIDAE								
Lanius collurio	3	1	1					
MOTACILLIDAE								
Anthus spinoletta	6	1					1	
Anthus trivialis	8	1	1					
Total:	14	2	1				1	
MUSCICAPIDAE								
Ficedula hypoleuca	4	1	1					
PARIDAE								
Parus atricapillus	33	2		1		2		
Parus caeruleus	71	8	2	4		1		1
Parus major	138	13	3	8		2	1	1
Uninfected birds	32	0						
Total:	274	23	5	13		5	1	2
PICIDAE								
Jynx torquilla	7	1		1				
Uninfected birds	2	0						
Total:	9	1		1				

TABLE 1. (continued)

Family & Species	Total birds examined	infected	*H.*	*L.*	*M.*	*P.*	*T.*	*A*
PLOCEIDAE								
Passer montanus	13	1	1					
Uninfected birds	18	0						
Total:	31	1	1					
SYLVIIDAE								
Acrocephalus schoenobaenus	12	1	1					
Acrocephalus scirpaceus	139	6	1	3	1	1		
Phylloscopus collybita	44	1			1			
Sylvia atricapilla	84	35	35					
Sylvia borin	21	3	3					
Sylvia curruca	16	2	2					
Uninfected birds	17	0						
Total:	333	48	42	3	2	1		
TURDIDAE								
Erithacus rubecula	90	3	3					
Phoenicurus phoenicurus	6	1				1		
Turdus merula	37	8	3	4		1		1
Turdus philomelos	11	3	1	1		1		
Uninfected birds	3	0						
Total:	147	15	7	5		3		1
Uninfected families (below)	101							
Grand Total:	1650	120	65	29	2	10	15	3
Percent infected		7.3	3.9	1.8	0.1	0.8	0.9	0.2

UNINFECTED BIRDS: ACCIPITRIDAE - *Buteo buteo* (7); ALCEDINIDAE - *Alcedo atthis* (5); CERTHIDAE - *Certhia brachydactyla* (1); CORVIDAE - *Garrulus glandarius* (2); FRINGILLIDAE - *Acanthis cannabina* (2), *Carduelis chloris* (87), *Fringilla coelebs* (1), *Fringilla montifringilla* (33), *Pyrrhula pyrrhula* (19); HIRUNDINIDAE - *Delichon urbica* (4); PARIDAE - *Aegithalos caudatus* (23), *Parus palustris* (9); PICIDAE - *Dendrocopos major* (1), *Dendrocopos minor* (1); PLOCEIDAE - *Passer domesticus* (18); PODICIPEDIDAE - *Podiceps ruficollis* (1); PRUNELLIDAE - *Prunella modularis* (28); RALLIDAE - *Rallus aquaticus* (1); SCOLOPACIDAE - *Actitis hypoleucos* (2), *Gallinago gallinago* (14); STRIGIDAE - *Asio otus* (1); STURNIDAE - *Sturnus vulgaris* (36); SYLVIIDAE - *Acrocephalus arundinaceus* (6), *Hippolais icterina* (1), *H. polyglotta* (2), *Phylloscopus trochilus* (6), *Sylvia communis* (2); TROGLODYTIDAE - *Troglodytes troglodytes* (3); TURDIDAE - *Erithacus megarhynchos* (1), *E. svecicus* (1), *Turdus pilaris* (1).

TABLE 2. Prevalence of avian haematozoa in birds near Nancy, France during the period 1977-80.

Year	Total birds examined	infected	*H.*	*L.*	*M.*	*P.*	*T.*	*A.*
1977	7	0						
1978	988	75	32	28	2	8	7	2
Percent infected		7.6	2.8	3.2	0.8	0.7	0.7	0.2
1979	454	29	18	1		1	8	1
Percent infected		6.4	4.0	0.2		0.2	1.8	0.2
1980	201	16	15			1		
Percent infected		8.0	7.5			0.5		

TABLE 3. Prevalence of species of *Haemoproteus* (H), *Leucocytozoon* (L) and *Plasmodium* (P) by month in some birds near Nancy, France. Percent infections in parentheses.

Month	Total birds examined	infected	H.	L.	P.
January	98	1 (1.0)		1 (1.0)	
February	27	0			
March	31	0			
April	20	1 (5.0)	1 (5.0)		
*May	9	1 (11.1)			
*June	163	8 (4.9)	2 (1.2)	4 (2.5)	
*July	283	18 (6.4)	8 (2.8)	4 (1.4)	1 (0.4)
*August	275	21 (7.6)	14 (5.1)	4 (1.5)	3 (1.1)
*September	598	61 (10.2)	36 (6.0)	12 (2.0)	6 (1.0)
*October	88	8 (9.1)	3 (3.4)	8 (9.1)	
November	20	0			
December	36	1 (2.8)		1 (2.8)	

*Total infections include infections of microfilaria, *Trypanosoma* and *Atoxoplasma* not listed in the table.

early July, suggesting transmission occurred some two to three weeks earlier in mid-June, again a time consistent with observations in North America in regions at approximately the same latitudes. Again, presumably the ceratopogonid vectors were active throughout June. *Plasmodium vaughani* was first recorded in an immature bird in late July, again a pattern remarkably similar to that observed in the Tintamirre marshes in North America.[28] Presumably a late-summer mosquito is the vector in this region.

The early records of prevalence of blood parasites in western Europe are fragmentary, based on small samples and usually directed towards a specific blood protozoan. Consequently, it is difficult to obtain a realistic overview of the situation. Additionally, it is difficult to compare in a statistical manner, prevalence of parasites in a broad range of bird species sampled in different ecological systems at different times of the year. This is particularly true when it appears that certain bird groups are more (or less) prone to parasitism (for

whatever reason) than others.[18,21] However, most avian blood parasite surveys in western Europe include the same species of passeriforms, and most are taken during the summer period, thus presenting a certain commonality in sampling which permits, in the broadest sense, a comparative analysis — an analysis which illustrates a trend.

In 1907 Bettencourt and Franca[7] recorded an 8% prevalence of trypanosomes in 551 birds in Portugal, and Franca[16] in 1912, recorded 61.4% of 44 birds as harboring an assortment of hematozoa in the same country. Leger[19] in 1917 reported *Leucocytozoon* in 21 of 27 corvids obtained from the vicinity of Reims, France, a region close to the present study sites. Coles,[10] Petrie[27] and Woodcock[30] together recorded trypanosomes in 29 of 114 birds examined in Britain. Franchini[17] noted a 52.7% prevalence of blood parasites in 186 Italian birds in 1924. These results, while far from being conclusive, indicate a fairly high prevalence of blood parasites, especially trypanosomes, in the wild bird fauna. Ten years later, Orbaneja Aguero[20] noted blood parasites in 25.2% of 272 birds in Spain. In 1946 and 1947, Covaleda Ortega and Gallego Berenguer[11,12] noted only 23 infected birds among the 295 examined in the same country. In the period 1954-1970, Baker[1,2,3] summarized examinations in England and noted that only 216 of 2490 birds (8.7%) were infected. Bennett *et al.*[5] found only 4 of 156 to harbor hematozoa in the Cambridge area of England and Peirce and Cooper[22] and Peirce and Mead[23,24,25,26] in the period 1976-1980, found only 283 infected birds of 2020 examined (14.0%). Garnham (in Baker[3]) did not find a single *Plasmodium* infection in 835 birds. These records clearly suggest that the prevalence of blood parasites in western European birds has decreased over the past 70-80 years. The results of the present study are well within the prevalence levels noted by recent European workers and confirm the opinion that blood parasites are now uncommon in the western European avifauna. This is in sharp contrast to the observations of Borg,[8,9] Wingstrand[29] and Eide *et al.*[13] in Sweden and Norway, where prevalence levels of 67%, 53% and 70%, respectively, were recorded. These Scandinavian figures are in agreement with those reported by Bennett *et al.*[4] for birds in Newfoundland and by Greiner *et al.*[18] for the prevalence of avian hematozoa in North America, especially eastern Canada, and are also similar to figures reported by Yakunin and Zhazyltaev[31] for birds from the central USSR. The reason for the much higher prevalence levels in Scandinavia, Russia and eastern North America are difficult to define and are undoubtedly influenced by a number of factors. However, it is true that most of the surveys in these countries are conducted in areas where there are considerable tracts of untrammelled wilderness and a natural host population-vector population interaction occurs. Possibly the decline in the prevalence of blood parasites in western European birds is associated with the loss of natural biotypes through the intensive agricultural practices and high degree of industrialization associated with Europe over the past century. Such loss of extensive areas of natural habitats could operate to lower populations of both hosts and vectors to a level where the required degree of host-vector-parasite interaction is no longer possible and the previously higher transmission rates are no longer operative.

Acknowledgements

Mlle. Marie-José Vautravers assisted in the preparation of the blood smears prior to their shipment to the International Reference Centre for Avian Haematozoa. Mr.

Norman Williams, Mrs. Ellen White and Miss Madonna Whiteway prepared the data for analysis. The financial assistance of the Natural Sciences and Engineering Research Council of Canada to the first author is gratefully acknowledged.

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Received for publication 16 June 1981