

1975

## Blood Parasites from Birds of the Lake Okoboji Region, Iowa

John N. Farmer  
*University of Missouri*

David H. Vesole  
*University of Arizona*

*Let us know how access to this document benefits you*

Copyright ©1975 Iowa Academy of Science, Inc.

Follow this and additional works at: <https://scholarworks.uni.edu/pias>

---

### Recommended Citation

Farmer, John N. and Vesole, David H. (1975) "Blood Parasites from Birds of the Lake Okoboji Region, Iowa," *Proceedings of the Iowa Academy of Science*, 82(2), 106-108.

Available at: <https://scholarworks.uni.edu/pias/vol82/iss2/7>

This Research is brought to you for free and open access by the IAS Journals & Newsletters at UNI ScholarWorks. It has been accepted for inclusion in Proceedings of the Iowa Academy of Science by an authorized editor of UNI ScholarWorks. For more information, please contact [scholarworks@uni.edu](mailto:scholarworks@uni.edu).

**Offensive Materials Statement:** Materials located in UNI ScholarWorks come from a broad range of sources and time periods. Some of these materials may contain offensive stereotypes, ideas, visuals, or language.

Blood Parasites from Birds of the Lake Okoboji Region, Iowa<sup>1</sup>JOHN N. FARMER<sup>2</sup> and DAVID H. VESOLE<sup>3</sup>

FARMER, JOHN N., and DAVID H. VESOLE (Division of Biological Sciences, University of Missouri, Columbia, Missouri 65201). Blood Parasites from Birds of the Lake Okoboji Region, Iowa. *Proc. Iowa Acad. Sci.* 82(2): 102-105, 1975.

Hematozoa are reported from 171 birds, representing 7 orders of 20 families and 33 species, all collected in Dickinson County, northwest Iowa, with the majority of animals being collected at the Iowa Lakeside Laboratory, Milford, Iowa. Blood parasites were observed in 67 birds (39.2%), with an incidence as follows: *Haemoproteus* sp., 45 (26.3%); *Leucocytozoon* sp., 19 (11.1%); *Plasmodium* sp., 4 (2.3%); *Trypanosoma* 3 (1.7%); and microfilariae, 29 (16.9%).

An evaluation of these results indicates a dramatic decrease in the incidence of blood parasites later in the summer. The presence

Surveys of blood parasites of resident and migratory birds in Iowa have been few in number. Moreover, these studies, for the most part, have been restricted to a single avian species. Coatney (1938) examined the blood of 63 birds representing 15 families and 23 species captured or shot during 1935-1936 in the vicinity of the Iowa Lakeside Laboratory on Lake Okoboji. He reported finding only seven birds (1.1%) harboring blood parasites. During the period 1957-1959, Farmer (1960) surveyed the blood of birds, principally of the order Columbiformes, in central Iowa (Ames and Gilbert), and of the 568 examined, 99 (17.3%) were found to be infected with hematozoa. Roslein and Haugen (1962, 1964, 1970) have conducted several surveys in Iowa in order to assess the incidence of blood parasite infections in game bird populations. In 1962, they reported the absence of blood parasites in 364 pheasants and 673 bobwhite quail examined during the period 1957-1961. They indicated (1964) that while examining blood of 168 wood ducks (*Aix sponsa* L.) at the Upper Mississippi River Wildlife and Fish Refuge during 1963, 77 (46%) were found to be infected with *Haemoproteus*. Finally, while studying the blood of wild Rio Grande turkeys stocked in Iowa, they reported (1970) finding 31 of 39 (79%) harboring *Haemoproteus* infections.

The senior author has been a resident at the Iowa Lakeside Laboratory for several summers, and because the examination of birds for the presence of metazoan parasites has been an ongoing project of other investigators at the Laboratory, it has been a simple matter to obtain blood smears from a variety of avian hosts.

The following information represents the results of this study, conducted during the summers of 1967-1974. Because the common grackle (*Quiscalus quiscula*) was being trapped

of parasites early in the spring is considered to be a function of relapse in birds returning to the area to build nests and to reproduce. The subsequent decrease in incidence of parasitized birds occurs as the infections run their course and become latent.

A species of *Plasmodium* isolated from a blue jay (*Cyanocitta cristata*) was found to be highly pathogenic, since the natural host as well as two other blue jays with induced blood infections died, with over 60% of their erythrocytes being parasitized. Using gametocyte morphology, the number of merozoites in mature schizonts and the punctiform appearance of pigment, the parasite was considered to be *P. relictum*. The blue jay appears to be a new host record for this parasite, at least in Iowa.

INDEX DESCRIPTORS: Avian Blood Parasites, Hematozoa, *Plasmodium relictum*

as a part of a recent project, this group represents a major portion (42.1%) of the birds examined. No attempt was made to distinguish between the bronzed, purple and hybrid grackles. The results of the survey were also evaluated in relation to the time of summer that parasites were observed, because initial studies in 1967 indicated a dramatic decrease in the incidence of hematozoa in birds examined later in the summer.

## MATERIALS AND METHODS

All birds were captured or shot in Dickinson County, with the majority being collected in the vicinity of the Iowa Lakeside Laboratory during the spring and summer months of 1967-1974. Blood from birds was obtained by nicking a toe or the alar vein of live birds or by using a heparinized capillary tube to collect blood from the heart of killed birds. Blood smears so obtained were air dried, fixed in absolute methanol and stained in Giemsa. Stained slides were examined by low power and oil immersion microscopy. A slide was determined negative if after a 20-minute examination period (under oil immersion) no sign of blood parasites was detected. In only a few cases were attempts made to determine the species of the various blood parasites observed during this study. In one *Plasmodium* infection, observed in the blue jay (*Cyanocitta cristata*), blood from the host animal was transferred to two other blue jays that had been captured and held in the animal building. These had been examined a week earlier and had been found to be negative for blood protozoa. Each bird was inoculated with .25 ml of heparinized blood from the host animal with a patent *Plasmodium* infection. Two blood smears were made from each animal twice a day, once in the morning and again in the afternoon. One of each pair of slides was dipped in ether prior to fixation and staining in order to disrupt the erythrocytes to facilitate the counting of merozoites in mature schizonts.

## RESULTS AND DISCUSSION

Results of the blood survey are summarized in Table 1. Of

<sup>1</sup> This study was conducted at the Iowa Lakeside Laboratory, Milford, Iowa 51351, and supported in part by a Summer Research Fellowship (Biomed) awarded to John N. Farmer by the Research Council of the University of Missouri-Columbia.

<sup>2</sup> Division of Biological Sciences, University of Missouri, Columbia, Missouri 65201.

<sup>3</sup> Department of Microbiology and Medical Technology, University of Arizona, Tucson, Arizona 85721.

BLOOD PARASITES FROM BIRDS

TABLE 1. INCIDENCE OF BLOOD PARASITES FROM BIRDS OF THE LAKE OKOBOJI REGION

Family and Specific Name	Common Name	No. Examined	No. Positive	Parasite				Mf.
				H	L	T	P	
<i>Passeriformes</i>								
<i>Corvidae</i>								
<i>Cyanocitta cristata</i>	Blue Jay	9	3	1		1	1	
<i>Mimidae</i>								
<i>Dumetella carolinensis</i>	Catbird	5	1					1
<i>Toxostoma rufum</i>	Brown Thrasher	11	8	8	1			
<i>Tyrannidae</i>								
<i>Tyrannus tyrannus</i>	Eastern Kingbird	2	0					
<i>Contopus virens</i>	Eastern Wood Peewee	1	0					
<i>Paridae</i>								
<i>Parus atricapillus</i>	Black-Capped Chickadee	3	0					
<i>Turdidae</i>								
<i>Turdus migratorius</i>	Robin	8	0					
<i>Vireonidae</i>								
<i>Vireo gilvus</i>	Warbling Vireo	1	0					
<i>Icteridae</i>								
<i>Agelaius phoeniceus</i>	Red-Winged Blackbird	15	2	1	1			2
<i>Sturnella magna</i>	Meadowlark	1	1	1			1	
<i>Xanthocephalus xanthocephalus</i>	Yellowheaded Blackbird	1	0					
<i>Euphagus cyanocephalus</i>	Brewer's Blackbird	1	1				1	1
<i>Quiscalus quiscula</i>	Common Grackle	72	47	31	17	1	1	24
<i>Hirundinidae</i>								
<i>Hirundo rustica</i>	Barn Swallow	1	0					
<i>Progne subis</i>	Purple Martin	4	0					
<i>Ploecidae</i>								
<i>Passer domesticus</i>	House Sparrow	1	0					
<i>Troglodytidae</i>								
<i>Troglodytes aedon</i>	House Wren	5	0					
<i>Telmatorhynchus palustris</i>	Longbilled Marsh Wren	2	0					
<i>Parulidae</i>								
<i>Dendroica dominica</i>	Yellow-Throated Warbler	1	0					
<i>Picidae</i>								
<i>Colaptes auratus</i>	Yellowshafted Flicker	1	0					
<i>Dendrocopos pubescens</i>	Downy Woodpecker	1	0					
<i>Fringillidae</i>								
<i>Spinus tristis</i>	American Goldfinch	3	1	1				
<i>Melospiza melodia</i>	Song Sparrow	4	0					
<i>Melospiza georgiana</i>	Swamp Sparrow	2	0					
<i>Passerherbulus henslowii</i>	Henslow's Sparrow	1	0					
<i>Pheucticus ludovicianus</i>	Rose-Breasted Grosbeak	2	1			1		1
<i>Columbiformes</i>								
<i>Columbidae</i>								
<i>Zenaidura macroura</i>	Mourning Dove	3	2	2				
<i>Gruiformes</i>								
<i>Rallidae</i>								
<i>Fulica americana</i>	Coot	2	0					
<i>Falconiformes</i>								
<i>Accipitridae</i>								
<i>Buteo jamaicensis</i>	Red-Tailed Hawk	1	0					
<i>Ciconiformes</i>								
<i>Ardeidae</i>								
<i>Ardea herodias</i>	Great Blue Heron	1	0					
<i>Charadriiformes</i>								
<i>Laridae</i>								
<i>Chlidonias nigra</i>	Black Tern	3	0					
<i>Scolopacidae</i>								
<i>Erolia minutilla</i>	Least Sandpiper	2	0					
<i>Strigiformes</i>								
<i>Strigidae</i>								
<i>Bubo virginianus</i>	Great Horned Owl	1	0					
Totals		171	67	45	19	3	4	29

171 birds examined, 67 (39.1%) were positive for some form of blood parasite. The parasites and their incidence were: *Haemoproteus* sp., 45 (26.3%); *Leucocytozoon* sp., 19 (11.1%); *Plasmodium* sp., 4 (2.3%); *Trypanosoma*, 3 (1.7%); and microfilariae, 29 (16.9%). Of the microfilariae, two distinct forms were recognized, a blunted unsheathed form and an unsheathed form blunted anteriorly and tapered posteriorly.

Multiple infections involving two or more blood parasites were common. Of the total of 67 infected birds observed, 41 (60%) carried single infections, 17 (25%) carried two parasite species, seven (14%) carried three and two (3%) carried four species of parasite. These results suggest that the same vector may be responsible for the transmission of two or more blood parasites, a possibility suggested by Bennett and Fallis (1960).

Grackles represented 42.1% of the total number of birds examined (72 of 171), with 70.1% (47 of 72) being found infected with some type of blood parasite. Incidences of the infections in the grackles were: *Haemoproteus quisqualis*, 31 (68.8%); *Leucocytozoon* sp., 17 (89.4%); *Plasmodium*, one (25%); *Trypanosoma avium*, one (33.3%); and microfilariae, 24 (82.7%).

Contrary to previous studies (Stabler and Kitzmiller, 1970; Wetmore, 1941; Bennett and Fallis, 1960), not one of the eight robins we examined appeared to carry patent infections. On the other hand, eight of 11 (72.7%) brown thrashers were infected with *Haemoproteus beckeri*, with one possessing a *Leucocytozoon* infection as well. This contrast between incidence of infection in grackles and thrashers is puzzling and suggests that either the vectors for transmitting robin-specific parasites are not present in the Okoboji region or that relapses in these animals occur at other times of the year.

#### *Haemoproteus*

According to Levine and Campbell (1971), the genus *Haemoproteus* should only include those parasites transmitted by hippoboscid vectors. *Parahaemoproteus*, on the other hand, should be reserved for those haemoproteid forms that are transmitted by *Culicoides*. Since the vectors responsible for carrying blood parasites were not determined during our survey, no distinction was made between these two genera. We retained the genus *Haemoproteus* for all halteridium-type parasites seen in erythrocytes, although future studies might warrant their inclusion in the genus *Parahaemoproteus*, because no hippoboscids were observed on any of the birds we examined.

*Haemoproteus sakharoffi* was seen in one of nine (11.1%) blue jays; eight of 11 (72.7%) brown thrashers were infected with *H. beckeri*; 31 of 72 (41.8%) common grackles were hosts to *H. quisqualis*; and two of three (66.6%) mourning doves were infected with *H. macallumi*. One of these mourning doves also was host to the characteristic hypertrophied gametocytes of *H. sacharovi*. In addition, *Haemoproteus* was diagnosed from one of three goldfinches, from the only meadowlark examined, and one of 15 red-winged blackbirds.

#### *Leucocytozoon*

*Leucocytozoon* was observed in 19 of 171 (11.1%) birds examined; however, these infections were distributed among only three avian species, the grackle having by far the greatest incidence—17 of 19 (89.4%) infections being recorded from these animals. The two other species carrying *Leucocytozoon* were the brown thrasher and the red-winged blackbird, with one bird of each being infected.

The incidence of *Leucocytozoon* infections in grackles was

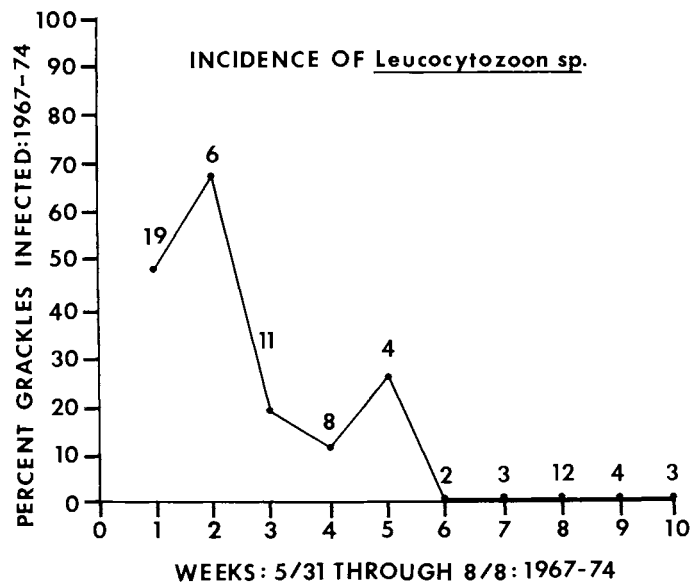


Figure 1. The incidence of *Leucocytozoon* sp. in the common grackle (*Quiscalus quiscula*) relative to the time of year. The birds were grouped according to their date of capture regardless of the year.

far greater in the spring (May) and early summer (June) than later in the summer (mid-July to August). Examination of Figure 1 indicates a dramatic decrease in the incidence of *Leucocytozoon*, with no birds being found with patent infections past mid-July. Bennett and Fallis (1960) attribute monthly variations in the incidence of *Leucocytozoon* infections in ducks to the abundance and prevalence of the appropriate vectors. In their study, the numbers of these intermediate hosts reached their highest level late in May and through the month of June. Furthermore, this period coincides with the breeding phase of the avian hosts. Khan and Fallis (1970) and Rogge (1968) consider that relapse of *Leucocytozoon* infections in previously infected birds is a function of the host's reproductive cycle rather than a function of stress due to migration. The results of our survey appear to corroborate these reports. *Leucocytozoon* infections in grackles are more common during the spring, coinciding with the active breeding phase of these animals. It is assumed that birds returning to this area to breed undergo relapse, causing *Leucocytozoon* to be available for the appropriate intermediate host. The relapse may be initiated by an increase in gonadal hormones in breeding birds (Haber-korn, 1968) or the release of steroids due to the stress of competition for mates and nest-building sites.

#### *Plasmodium*

The identification of *Plasmodium* in single blood smears is, at best, a speculative venture. One must be sure that the parasite is *Plasmodium*, because small, uninucleate stages of the various genera of hematozoa are so similar in appearance (i.e., *Haemoproteus* sp.). Only by the observance of segmenting stages can one be sure that the organism is *Plasmodium*.

Accordingly, *Plasmodium* was only clearly identified in four birds, namely blue jay, Brewer's blackbird, grackle and meadowlark. In the *Plasmodium* observed in the blue jay, the smear was obtained from a live bird, enabling a blood transfer to be made to two other jays that had been trapped four

days earlier, whose blood had been found free of blood parasites. Fulminating *Plasmodium* infections developed in these animals and the experimental animals died eight days after being infected, each with over 60% of their erythrocytes being infected. The host animals also died with parasitemias almost as high, indicating this species of *Plasmodium* to be highly pathogenic.

Identification of *Plasmodium* usually involves hourly blood examination of infected hosts to determine the timing of sporulation, and the periodicity and synchronicity of the parasite. This was not done; however, the morphology of gametocytes was examined and merozoite numbers in mature schizonts were determined. The parasites displaced host cell nuclei and the rounded gametocytes often caused the extrusion of the host cell nucleus completely. The morphology of pigment granules formed by the parasites was variable although tending to be small and punctiform. The mean number of merozoites per mature schizont was determined to be 16.5 with a range of 13-23. Although these data are scant, they do suggest that the parasite was *P. relictum*. A search of the literature indicates that *Plasmodium* infections in blue jays are rarely reported, if at all. This report appears to be a new host record for *Plasmodium relictum* in blue jays, at least in Iowa. *Trypanosoma*

Avian trypanosomes are rarely seen in the peripheral blood smears, so that their incidence has long been considered to be quite low. However, their occurrence is greater than previously suspected, as shown by the study of Stabler (1961), who used bone marrow smears and culture techniques in his study of 79 Colorado birds, with 81% of the birds surveyed by these methods being found to harbor *Trypanosomes*, while only 6% of these same animals yielded positive peripheral blood smears.

Only three *Trypanosoma* infections were observed during our survey, one each from a blue jay, a grackle and a grosbeak. All have previously been reported in the midwest as hosts for trypanosomes (Stabler, 1961). However, their incidence may be much greater, a speculation that can only be verified by utilizing bone marrow smears and culture methods during additional surveys.

One point that was apparent was that in all three hosts, the trypanosomes were found in association with at least one other haemoprotozoan, suggesting that a common vector may be responsible for transmission.

#### *Microfilaria*

These blood inhabiting stages of nematodes were observed in approximately 17% of the birds surveyed, with 29 infections being distributed among five avian species. Two morphological types of microfilariae were recognized, namely an unsheathed form blunted at both ends and an unsheathed form blunted anteriorly and tapered posteriorly. The former microfilariae are associated with a *Splendidofilaria* sp. nematode, the adults of which occur in the brain of grackles. Concurrent infections of the two microfilarial types were observed in five grackles. The pointed microfilariae, alone, were re-

ported from three birds: two grackles and a red-winged blackbird. The blunted forms were observed in 26 birds including 22 grackles, one catbird, one red-winged blackbird, one Brewer's blackbird and a grosbeak. The vector for *Splendidofilaria* sp. is considered to be a *Culicoides* (Robinson, 1961), but the transmission of these nematode parasites has never been studied in the Okoboji region.

#### ACKNOWLEDGMENTS

We wish to thank Edward K. Dykstra, Mary J. Barnett, David W. Frederickson and Robert R. Rankin for their help in collecting these data.

#### LITERATURE CITED

- BENNETT, C. F., and A. M. FALLIS. 1960. Blood parasites of birds in Algonquin Park, Canada, and a discussion of their transmission. *Can. J. Zool.*, 38:261-273.
- COATNEY, G. R. 1938. Some blood parasites from birds of the Lake Okoboji region. *Amer. Midl. Nat.*, 20:336-340.
- FARMER, J. N. 1960. Some blood parasites from birds in Central Iowa. *Proc. Iowa Acad. Sci.*, 67:591-597.
- HABERKORN, A. 1968. Zur hormonellen Beeinflussung von *Haemoproteus*-Infektionen. *Z. Parasitenk.*, 31:108-112.
- HSU, CHAO-KUANG, G. R. CAMPBELL, and N. D. LEVINE. 1973. A checklist of the species of the genus *Leucocytozoon* (Apicomplexa, Plasmodiidae). *J. Protozool.*, 20:195-203.
- KHAN, R. A., and A. M. FALLIS. 1970. Relapses in birds infected with species of *Leucocytozoon*. *Can. J. Zool.*, 48:451-455.
- LEVINE, N. D., and G. R. CAMPBELL. 1971. A checklist of the species of the genus *Haemoproteus* (Apicomplexa, Plasmodiidae). *J. Protozool.*, 18:475-484.
- ROBINSON, E. J., JR. 1961. Incidence of microfilariae in some Ohio birds and data on the habits of a possible vector. *J. Parasitol.*, 47:441-444.
- ROGGE, D. 1968. Experimentelle Beeinflussung der *Haemoproteus*-parasitemie beim Grünfink (*Carduelis chloris*) durch künstlichen Langtag. *Acta Parasitol. Pol.*, 15(40/50):397-407.
- ROSLEIN, D. J., P. L. FORE, and A. O. HAUGEN. 1962. Blood parasites in relation to pheasants and quail in Iowa. *Proc. Iowa Acad. Sci.*, 69:239-244.
- and A. O. HAUGEN. 1964. Occurrence of *Haemoproteus nettionis* in wood ducks (*Aix sponsa* L.). *Proc. Iowa Acad. Sci.*, 71:235-240.
- and ———. 1970. Some blood parasites and disease antibody findings in wild Rio Grande turkeys stocked in Iowa. *Proc. Iowa Acad. Sci.*, 77:93-96.
- STABLER, R. M. 1961. Comparison of *Trypanosoma* incidence in blood and bone marrow from 79 Colorado birds. *J. Protozool.*, 8:122-123.
- and N. J. KITZMILLER. 1970. Hematozoa from Colorado birds. III. Passeriformes. *J. Parasitol.*, 56:12-16.
- WETMORE, P. W. 1941. Blood parasites of birds of the District of Columbia and Patuxent Research Refuge vicinity. *J. Parasitol.*, 27:379-393.