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BLOOD PARASITES OF BIRDS COLLECTED IN FOUR SUCCESSIVE YEARS IN PANAMA¹

Although knowledge of the blood parasites of nondomesticated birds is being advanced along special lines, the geographic and systematic frequency and distribution of these parasites are still not well known. This is particularly true of the parasites of birds in tropical regions. There is a great need for field studies, in both temperate and tropical regions, which would contribute to our knowledge about such parasites as *Plasmodium* and *Leucocytozoon* (which are transmitted by biting, flying insects) in reference to (1) the seasonal acquisition of parasites by the birds and (2) the interrelations between the parasite populations in the migratory and nonmigratory hosts.

This report is based on the study of blood smears made in Panama by one of us (AW) during the months of February and March of 1952, 1954, and 1955 and during May and June of 1953. The birds were collected for the Smithsonian Institution. Blood smears were made in the field at the time the birds were collected and were numbered to correspond to the specimens from which they were taken. Later in the laboratory the dried smears were fixed in methyl alcohol and stained with Giemsa's stain. Examination was made first by a high dry objective to detect the presence of the larger parasites such as microfilaria and then by an oil immersion objective to detect the smaller parasites.

Table 1 summarizes the distribution of the birds in which no blood parasites were found, according to their geograph-

ic distribution and their systematic classification. Table 2 lists the parasites found and their hosts. The provinces of Panama from which specimens were taken were Chiriqui, Veraguas, Cocolé, Colon, and Panama; also Taboga and Taboguilla islands and the Canal Zone. Smears were examined from 183 individual birds. Twenty-eight of these contained one species of parasite (in 3 cases there were double infections). *Plasmodium* was found in 5 birds belonging to 5 families; *Haemoproteus* occurred in 11 birds belonging to 6 families; only one bird was found to be infected with *Leucocytozoon*; *Trypanosoma* occurred in 4 birds belonging to 3 families; and microfilaria were found in 11 birds belonging to 8 families.

No attempt is made here to determine the species of any of these parasites with the exception of some of those belonging to the genus *Plasmodium*. The stages of the latter found in *Eucocetis penicillata* would appear to place it close to, or in the *hexamerium vaughani* group of *Plasmodium*, and the stages found in *Tangavius aeneus* probably are *P. cathemerium* or *P. relictum*. Precise determination of species of *Plasmodium* usually can be made only by isolation of the parasites in susceptible laboratory animals and a careful study of the biological as well as the morphological characteristics of the resulting infections. Specific determinations of the parasites belonging to *Haemoproteus*, *Leucocytozoon*, *Trypanosoma* and of microfilaria cannot be made, except in rare cases, upon the study of the very few parasites found in a blood smear.

One is inclined to expect that birds living in tropical areas might exhibit a higher incidence of infection of those parasites such as *Plasmodium* and *Leucocytozoon* which, in more temperate climates, have their transmission restricted to the warmer months of the year. The results from this small group of smears from Panama do not meet

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TABLE 1. *Distribution of Birds Examined and Found Not To Have Blood Parasites*

Order and Family	Number of Specimens from							Totals	Number species	Number genera
	Cocle'	Chiriqui'	Veraguas	Panama'	Colon'	Canal Zone	Taboga Is.			
Tinamiformes										
Tinamidae	1							1	1	1
Podicipediformes										
Podicipedidae				2				2	2	2
Ciconiiformes										
Ardeidae	1							1	1	1
Falconiformes										
Cathartidae			1					1	1	1
Buteonidae	1		2					3	2	2
Falconidae	1							1	1	1
Galliformes										
Phasianidae			1					1	1	1
Columbiformes										
Columbidae	1	5	1					7	5	4
Psittaciformes										
Psittacidae		3						3	1	1
Cuculiformes										
Cuculidae		1						1	1	1
Apodiformes										
Trochilidae	3	9	3	1			1	17	14	11
Trogoniformes										
Trogonidae		1						1	1	1
Coraciiformes										
Alcedinidae			1					1	1	1
Piciformes										
Capitonidae	1	1						2	2	2
Ramphastidae		1						1	1	1
Picidae	1	6		1				8	6	5
Passeriformes										
Dendrocolaptidae	2	1	1					4	3	3
Furnariidae		1	1					2	2	2
Formicariidae	2	3	3					8	7	5
Cotingidae		4						4	3	3
Pipridae		2	2					4	3	3
Tyrannidae	5	13	7	2	1		2	31	23	19
Hirundinidae	3	1	3			1		8	4	4
Troglodytidae	1	1	2	4		1		9	5	3
Turdidae	1							1	1	1
Vireonidae		1						1	1	1
Coerebidae			2			1		3	2	2
Parulidae	1	1		1		1		4	4	3
Icteridae		2	1				1	4	4	4
Thraupidae	3	5	2					10	8	5
Fringillidae	5	3	2	1				11	8	8
TOTALS	33	65	35	12	1	4	3	2155	119	102

TABLE 2. Blood Parasites of Birds of Panama

<i>Plasmodium</i>		
<i>Thryothorus modestus</i> , TROGLODYTIDAE (wrens) ♀ Sona', Veraguas	(449,100)	23 Jun '53
<i>Tyrannus melancholicus</i> , TYRANNIDAE (tyrant flycatcher) ♀ El Uracillo, Coclé	(445,237)	27 Feb '52 III
<i>Eucometis penicillata</i> , THRAUPIDAE (tanagers) ♂ Chilar, Colo'n	(445,528)	18 Mar '52 III
<i>Tengarrus aeneus</i> , ICTERIDAE (blackbirds) ♂ Sona', Veraguas	(449,234)	27 May '53 III
<i>Myioborus torquatus</i> , PARULIDAE (wood warblers) ♂ Cerro Punta, Chiriquí	(455,959)	23 Mar '54
<i>Haemoproteus</i>		
<i>Nyctalus radiatus</i> , BUCCONIDAE (puffbirds) ♀ El Uracillo, Coclé	(445,701)	25 Feb '52
<i>Gymnostinops montezuma</i> , ICTERIDAE (blackbirds) ♂ Taboga Is.	(445,479)	17 Mar '52 III
<i>Muscivora tyrannus</i> , TYRANNIDAE (tyrant flycatcher) ♂ Sona', Veraguas	(448,979)	27 May '53
<i>Vireo flavoviridis</i> , VIREONIDAE (vireos) ♀ Sona', Veraguas	(449,152)	1 Jun '53
<i>Vireo flavoviridis</i> , VIREONIDAE (vireos) ♀ Sona', Veraguas	(449,155)	5 Jun '53 III
<i>Vireo flavoviridis</i> , VIREONIDAE (vireos) ♂ Taboga Is.	(445,438)	17 III '52
<i>Vireo leucophrys chiriquirensis</i> , VIREONIDAE (vireos) ♂ El Volca'n, Chiriquí	(455,877)	22 III '54
<i>Dendroica petechia aequatorialis</i> , PARULIDAE (woodwarblers) ♂ Puerto Vidal, Veraguas	(449,215)	8 VI '53
<i>Dendroica petechia aequatorialis</i> , PARULIDAE (woodwarblers) ♂ Puerto Muris, Veraguas	(449,210)	11 VI '53
<i>Myioborus miniatus acceptus</i> , PARULIDAE (woodwarblers) ♂ El Volca'n, Chiriquí	(455,955)	3 III '54
<i>Falco s. sparverius</i> , FALCONIDAE (falcons) ♀ El Volca'n, Chiriquí	(455,527)	5 III '54
<i>Leucocytozoon</i>		
<i>Pharomchrous mocino costaticensis</i> , TROGONIDAE (trogons) ♀ El Volca'n, Chiriquí	(455,626)	5 III '54
<i>Trypanosoma</i>		
<i>Tyrannus melancholicus</i> , TYRANNIDAE (tyrant flycatcher) ♀ El Uracillo, Coclé	(455,237)	27 II '52
<i>Cyclarhis guianensis subflavescens</i> , CYCLARHIDAE (pepper shrikes) ♀ El Volca'n, Chiriquí	(455,866)	29 III '54
<i>Phloeocoestes g. guatemalensis</i> , PICIDAE (woodpecker) ♀ El Volca'n, Chiriquí	(458,607)	12 II '55
<i>Microfilaria</i>		
<i>Tanager inornata</i> , THRAUPIDAE (tanagers) ♀ El Uracillo, Coclé	(445,547)	25 II '52
<i>Chlorophanes spiza</i> , COEREBIDAE (honeycreepers) ♀ El Uracillo, Coclé	(445,221)	II '52
<i>Cyanocorax affinis zeledoni</i> , CORVIDAE (crows, jays) ♂ Sona, Veraguas	(449,135)	21 V '53
<i>Eubuteo boucardii salrini</i> , CAPITONIDAE (barns) ♂ El Volca'n, Chiriquí	(455,612)	11 III '54
<i>Turdus grayi calius</i> , TURDIDAE (thrushes) ♂ El Volca'n, Chiriquí	(455,858)	3 III '54
<i>Thryothorus rufifluis castanonotus</i> , TROGLODYTIDAE (wrens) ♂ Cerro Chame, Panama	(458,963)	27 Mar '55
<i>Gymnostinops montezuma</i> , ICTERIDAE (blackbirds) ♂ El Uracillo, Coclé	(445,479)	2 III '52
<i>Eucometis penicillata</i> , THRAUPIDAE (tanagers) ♂ Chilar, Colo'a	(445,528)	18 III '52

T also *Trypanosoma*T probably in *Hexamerium-raughani* group

T also microfilaria

T probably *eathemerium* or *relictum*

The numbers in parentheses are the U.S. National Museum catalog numbers.

that expectation. When compared with the smears made over a 10-year period from birds caught in the United States for banding purposes (Huff, 1939, J. Amer. Vet. Med. Assoc. 94: 615-620), the percentage of birds with blood infections is 15.2 for the smears from the birds of Panama, whereas it was 44.4 for the birds in the United States. It must, however, be noted that there are major differences between the two studies. First, collections were confined to the late winter and summer months in the Panamanian group while those in the United States were taken over a larger portion of the year. Second, the distributions among taxonomic groups were very different in the two studies. Although there were nearly seven times as many smears in the group from the birds in the United States as in those from Panama, the latter were taken from about four times as many species as the former. Likewise, in the higher taxonomic groups, there were 31 families and 13 orders of birds represented in the group from Panama as compared with 13 families and 6 orders represented in those from the United States.

Among the birds which were infected the percentages in the different genera of parasites were as follows:

	Panama birds	U.S. birds
<i>Haemoproteus</i>	39	80
<i>Plasmodium</i>	17	15
<i>Leucocytozoon</i>	3.5	2.7
<i>Trypanosoma</i>	10.7	2.7
Microfilaria	28.5	(not recorded)

In the present report all birds with infections of *Plasmodium* and microfilaria belonged to the order Passeriformes; the only *Leucocytozoon* was found in the order Trogoniformes; those with *Haemoproteus* were distributed in the orders Passeriformes (7 families), and Piciformes (1 family); and *Trypanosoma* were found in two families of the order Passeriformes and one family in the order Piciformes.

SUMMARY

During February and March of 1952, 1954, and 1955 and May and June, 1953, a total of 183 blood smears were made from birds collected for the Smithsonian Institution. Blood parasites were found in 28 of these; *Plasmodium* (5), *Haemoproteus* (11), *Leucocytozoon* (1), *Trypanosoma* (4), and microfilaria (11). The frequency for all blood parasites was 15.2 per cent as contrasted with 44.4 per cent in a previous survey of birds collected in the United States. *Haemoproteus* was less frequent and *Trypanosoma* more frequent in the birds from Panama than those in an earlier study from the United States.

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OBITUARY

Dr. Gordon M. Clark died June 20, 1967 from electrocution. He was working alone late at night in his new laboratory which was nearing completion. He was a research entomologist at the Rocky Mountain Laboratory of the U.S. Public Health Service in Hamilton, Montana.

Dr. Clark was a member of the Wildlife Disease Association since receiving his Ph.D. from the University of Maryland in 1936. Following graduation he was a member of the staff of the disease section of the Patuxent Wildlife Research Center until 1962 when he transferred to Montana. His main research interest was on arthropod vectors of disease and, at the untimely catastrophe of his death when only 37 years old, was a recognized authority on nasal mites of birds.

The Wildlife Disease Association mourns his loss and extends sympathy to his wife and