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ADDITIONAL OBSERVATIONS ON THE BLOOD PARASITES OF UGANDAN BIRDS

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*Abstract*s One thousand and seventy-six birds of 26 families and 127 species were examined for hemoprotozoa; 404 birds (37%) of 41 species representing 17 families harbored one or more blood parasites. Most parasites were species of *Haemoproteus* which represented 95% of all parasitic infections detected. Prevalence of blood parasites in birds collected from four areas over a period of six years was relatively stable.

INTRODUCTION

Bennett *et al.*[1] reported on the blood parasites found in a sample of 922 birds collected in and around the Zika forest reserve in Uganda, Africa, during the years 1971-1972. This paper summarizes the results of a continuance of the study and compares the prevalence of parasitism in four major sampling areas, as well as the changes in hematozoan prevalence among the five years of the study. Uganda represents one of the few areas outside North America in which a long-term surveillance of the blood parasites of an avian population has been carried out.

MATERIALS

Blood films were obtained and handled during the period 1974-1976 as previously described. Most birds came from the same sampling sites used in the earlier survey. The four main areas of collection were Lunyo, Zika, and Bugabo, all located in lakeshore vegetation in the Zika Forest, (*loc. cit.* p. 458-459)[1] and the environs of Masaka, a town on the shores of Lake Victoria, some 100 km. southwest of Entebbe. Birds were sampled throughout the year.

RESULTS AND DISCUSSION

A total of 1076 birds of 26 families and 127 species were examined for blood parasites (Table 1); 404 birds (38%) of 41 species, representing 17 families harbored one or more blood parasites. By far the dominant parasites were members of the genus *Haemoproteus,* which occurred in 36% of the population and represented 95% of all parasitic infections detected. Microfilaria were the next most commonly encountered parasite, followed by species of *Leucocytozoon, Plasmodium* and *Trypanosoma.* The pattern of hematozoan prevalence was similar to that recorded previously for the same areas.

The extremely high prevalence of *Haemoproteus* recorded in birds in this and the previous paper highlights some of the problems in the interpretation of survey data, especially as it applies to the haemosporozoons. Greiner *et al.*[2] (p. 1780) discuss some of the factors influencing prevalence of parasitism. They concluded that the predominance of *Haemoproteus* in most surveys was probably attributable to (i) the ubiquity of the ceratopogonid vector breeding resulting in a high vector potential in most areas (although the species might

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TABLE 1. Prevalence of blood parasites in some Ugandan Birds. H. = **Haemoproteus;** L. = **Leucocytozoon;** Pl. = **Plasmodium;** T. = **Trypanosoma;** M. = **Microfilaria.**

	Number Examined		Blood Parasites				
	Total	Infected	H.	L.	Pl.	T.	M.
ALCEDINIDAE							
Alcedo cristata	8	1	1				
Halcyon senegalensis	6	2	2				
Ispidina picta	49	12	7		1	3	1
Negative birds*	11	0					
Total	74	15 (20%)	10		1	3	1
ARDEIDAE							
Butorides striatus	1	1		1			
CAMPEPHAGIDAE							
Negative birds*	3	0					
CAPITONIDAE							
Pogoniulus bilineatus	1	1	1				
Negative birds*	24	0					
CAPRIMULGIDAE							
Negative birds*	2	0					
COLIIDAE							
Negative birds*	1	0					
COLUMBIDAE							
Negative birds*	8	0					
CUCULIDAE							
Chrysococcyx caprius	2	1	1				
Negative birds*	2	0					
ESTRILDIDAE/ FRINGILLIDAE							
Lagonosticta rubricata	2	1	1				
Negative birds*	16	0					
Total	18	1 (6%)	1				
HIRUNDINIDAE							
Hirundo abyssinica	8	3	3				
Hirundo griseopyga	2	2	2				
Negative birds*	26	0					
Total	36	5 (14%)	5				

TABLE 1 — continued

	Number Examined		Blood Parasites				
	Total	Infected	H.	L.	Pl.	T.	M.
INDICATORIDAE							
Negative birds*	1	0					
LANIIDAE							
Telophorus sulfureopectus	3	1	1				
Negative birds*	3	0					
MEROPIDAE							
Aerops albicollis	31	8	8				1
Melittophagus variegatus	22	2	2				
Merops superciliosus	1	1			1		
Negative birds*	1	0					
Total	55	11 (20%)	10		1		1
MOTACILLIDAE							
Anthus leucophrys	3	2	1		1		1
Macronyx croceus	3	1	1				
Motacilla alba	2	1	1				
Motacilla flava	9	5	4		1		
Negative birds*	1	0					
Total	18	9 (50%)	7		2		1
MUSCICAPIDAE							
Dyaphorophyia castanea	5	1	1				
Parisoma plumbeum	4	2	1		1		
Tchitrea nigriceps	3	1	1				
Negative birds*	9	0					
Total	21	4 (19%)	3		1		
NECTARINIDAE							
Cinnyris chloropygius	1	1	1				
Nectarinia senegalensis	1	1	1				
Nectarinia verticalis	3	1	1				
Negative birds*	49	0					
Total	54	3 (5.6%)	3				

TABLE 1 — continued

	Number Examined		Blood Parasites				
	Total	Infected	H.	L.	Pl.	T.	M.
PICIDAE							
Negative birds*	2	0					
PLOCEIDAE							
Plocepasser mahali	3	1	1				
Ploceus aurantius	35	11	9	1			2
Ploceus bojeri	25	1					1
Ploceus cucullatus	31	23	23				1
Ploceus luteolus	5	1	1				
Ploceus nigerrimus	41	33	33	5		1	
Ploceus nigricollis	57	22	22	1			
Ploceus ocularis	2	1	1				
Ploceus weynsi	245	223	222	8	2		10
Quelea erythrops	7	3	3	1	2		
Negative birds*	10	0					
Total	461	319 (69%)	315	16	4	1	14
PSITTACIDAE							
Negative birds*	1	0					
PYCNONOTIDAE							
Chlorocichla flaviventris	3	1				1	
Pycnonotus curvirostris	10	1					1
Pycnonotus virens	97	10	6	3		1	2
Negative birds*	41	0					
Total	151	12 (8%)	6	3		2	3
SCOLOPACIDAE							
Negative birds*	10	0					
SYLVIIDAE							
Camaroptera brevicaudata	23	3	2			1	
Sylvia borin	24	4	4				
Negative birds*	33	0					
Total	80	8 (9%)	6			1	
TIMALIIDAE							
Trichastoma fulvescens	13	1	1				1

TABLE 1 — continued

	Number Examined		Blood Parasites				
	Total	Infected	H.	L.	Pl.	T.	M.
TURDIDAE							
Cossypha natalensis	4	1	1				
Negative birds*	12	0					
Total	16	1	1				
ZOSTEROPIDAE							
Zosterops senegalensis	15	12 (80%)	12				
Total	1076	404	384	20	9	7	21
% infected of total sample		38	36	2	1	1	2
% of infected birds			95	5	2	2	5
FROM BENNETT *et al.*[1]							
TOTAL BIRDS	922	217	179	14	11	16	12
% infected of total sample		24	20	2	1	2	1
% of infected birds			82	6	5	7	6

*NEGATIVE BIRDS. ALCEDINIDAE: *Alcedo semitorquata* (1); *Ceryle rudis* (5); *Halcyon malimbrica* (5). CAMPEPHAGIDAE: *Campephaga phoenicea* (3). CAPITONIDAE: *Pogoniulus leucolaima* (20); *P. scolopaceus* (1); *Tricholaema hirsutum* (3). CAPRIMULGIDAE: *Caprimulgus aegyptius* (1); *C. natalensis* (1). COLIIDAE: *Colius striatus* (1). COLUMBIDAE: *Turtur afer* (2); *Tympanistria tympanistria* (6). CUCULIDAE: *Ceuthmochares aereus* (1); *Chrysococcyx klaas* (1). ESTRILDIDAE: *Amauresthes fringilloides* (1); *Lagonosticta rara* (1); *Lonchura bicolor* (3); *L. cucullata* (3); *Mandingoa nitidula* (2); *Pyrenestes ostrinus* (2); *Nigrita canicapilla* (2); *Uraeginthus bengalus* (1). FRINGILLIDAE: *Serinus mozambicus* (1). HIRUNDINIDAE: *Hirundo angolensis* (1); *H. rustica* (21); *Psalidoprocne holomelaena* (1); *Riparia cincta* (3). INDICATORIDAE: *Indicator indicator* (1). LANIIDAE: *Tchagra australis* (2); *Telophorus bocagei* (1). MEROPIDAE: *Melittophagus gularis* (1). MOTACILLIDAE: *Motacilla aguimp* (1). MUSCICAPIDAE: *Alseonax cinereus* (1); *A. griseigularis* (1); *Bradornis pallidus* (1); *Stizorhina fraseri* (2); *Tchitrea plumbeiceps* (1); *T. viridis* (4). NECTARINIDAE: *Anthreptes collaris* (2); *A. rectirostris* (10); *Cyanomitra olivacea* (14); *Hylia prasina* (19); *Nectarinia cuprea* (3); *N. seimundi* (1). PICIDAE: *Dendropicos fuscescens* (1); *Campethera nivosa* (1). PLOCEIDAE: *Passer griseus* (1); *Ploceus baglafecht* (1); *P. jacksoni* (1); *P. nigriceps* (1); *P. pelzelni* (1); *P. superciliosus* (1); *Quelea quelea* (2); *Vidua macroura* (2). PSITTACIDAE: *Agapornis pullaria* (1). PYCNONOTIDAE: *Criniger calurus* (1); *Nicator gularis* (1); *Phyllastrephus albigularis* (16); *P. fischeri* (1); *Pyrrhurus flavicollis* (1); *Pycnonotus barbatus* (18); *P. latirostris* (1); *P. tricolor* (2). SCOLOPACIDAE: *Actitis hypoleucos* (6); *Burhinus capensis* (1); *Erolia minuta* (3). SYLVIIDAE: *Acrocephalus*

TABLE 1 — continued

scirpaceus (1); *Apalis moreaui* (3); *A. rufogularis* (1); *Calamocichla graciliorostris* (1); *Camaroptera chloronota* (1); *C. brachyura* (2); *Cisticola galactotes* (7); *C. natalensis* (2); *C. nigriloris* (1); *Hippolais pallida* (1); *Prinia leucopogon* (2); *P. subflava* (1); *Sylvietta brachyuras* (1); *S. virens* (8). TURDIDAE: *Cossypha niveicapilla* (4); *Erythropygia hartlaubi* (2); *Myrmecocichla nigra* (1); *Neocossyphus rufus* (1); *Turdus olivaceus* (4).

differ) and (ii) the prolonged duration and high intensity of haemoproteid infections leading to a ready diagnosis by blood film techniques.

The taxonomic chaos surrounding the avian hematozoa precludes specific identification of some parasites encountered at this time. However, certain species could be identified. Among the haemoproteids, *Haemoproteus halcyonis* was seen in all kingfishers except *Ispidina picta,* in which *H. enucleator* occurred. *Haemoproteus lanii* was seen in a single shrike while *H. fallisi* was noted in a thrush. *Haemoproteus fringillae/orizivorae* was seen in the Estrildidae, Ploceidae and Sylviidae, and was the commonest haemoproteid encountered. Other haemoproteids encountered require further taxonomic evaluation before specific identification can be made. Leucocytozoids were generally uncommon and included *Leucocytozoon ardea* in a *Butorides striatus, L. fringillinarum* in a number of ploceids and *L. brimonti* in *Pycnonotus virens.* Infections with *Plasmodium* were also rare and were all *P. vaughani.* Trypanosomes were rarely seen; *Trypanosoma avium* was the only species encountered. Microfilaria were not differentiated. Although representatives of 26 avian families were examined for blood parasites, only birds of 17 families were found to be parasitized, the families being essentially the same as those reported previously. As previously, birds of the Ploceidae (69%) and Zosteropidae (80%) were the most heavily parasitized.

There was little difference in prevalence in three areas (Table 2) but the prevalence of parasitism at Bugabo was higher than at the other three. Three of the four areas were sampled throughout both studies while Masaka was sampled only during the 1974-76 period. The species composition of the avian hosts in all four areas was similar.

Analysis of the prevalence of infection during the five years of sampling indicate that the overall prevalence (which is essentially the prevalence of haemoproteids) was similar in 1971, 1972 and 1975 (Table 3), but was almost doubled in 1974 and 1976. The 1976 results are based on a small

TABLE 2. Prevalence of blood parasites in birds sampled in 4 areas of Uganda—1971-1976.

Area	Total	Infected	L.	H.	Pl.	T.	M.
Lunyo	180	39	2	30	3	1	4
%		21	1	17	2	1	2
Zika	668	147	4	131	6	6	3
%		22	1	20	1	1	0.5
Bugabo	607	231	14	218	5	2	15
%		38	2	36	1	0.5	3
Masaka	278	82	1	70	5	5	6
%		29	0.5	25	2	2	2

TABLE 3. Prevalence of blood parasites in birds sampled during a five-year period in the Zika forest reserve.

Year	Total	Infected	L.	H.	Pl.	T.	M.
1971*	543	111	5	88	8	8	6
%		20	1	16	1	1	1
1972*	360	86	4	80	2	5	6
%		24	1	22	0.5	1	2
1974	610	265	14	253	0	6	14
%		43	2	41	0	1	2
1975	342	78	3	65	8	2	5
%		23	1	19	2	0.5	1
1976	111	71	3	68	1	1	2
%		64	3	61	1	1	2

* Figures from Bennett *et al.*[1]

sample and are probably less valid. The 1974 results, however, are predicated on a substantial sample with a bird species composition similar to that for all other years. During 1974, some factor(s) (possibly climatic) apparently enhanced the vector (*Culicoides*)-host relationships, resulting in greatly increased transmission of *Haemoproteus* spp. Whatever the factor(s), it had a relatively short-term effect on the population, as the prevalence in 1975 was again closely similar to that in 1971-72.

It appears that the distribution of avian blood parasite infection in the Zika area has not materially changed in the two periods 1971-72 and 1974-76, although the overall prevalence increased by nearly 50% in the 1974-76 period. These findings suggest a fairly stable environment and indicate the range of variability that might be anticipated from year to year within a similar population in the same area.

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