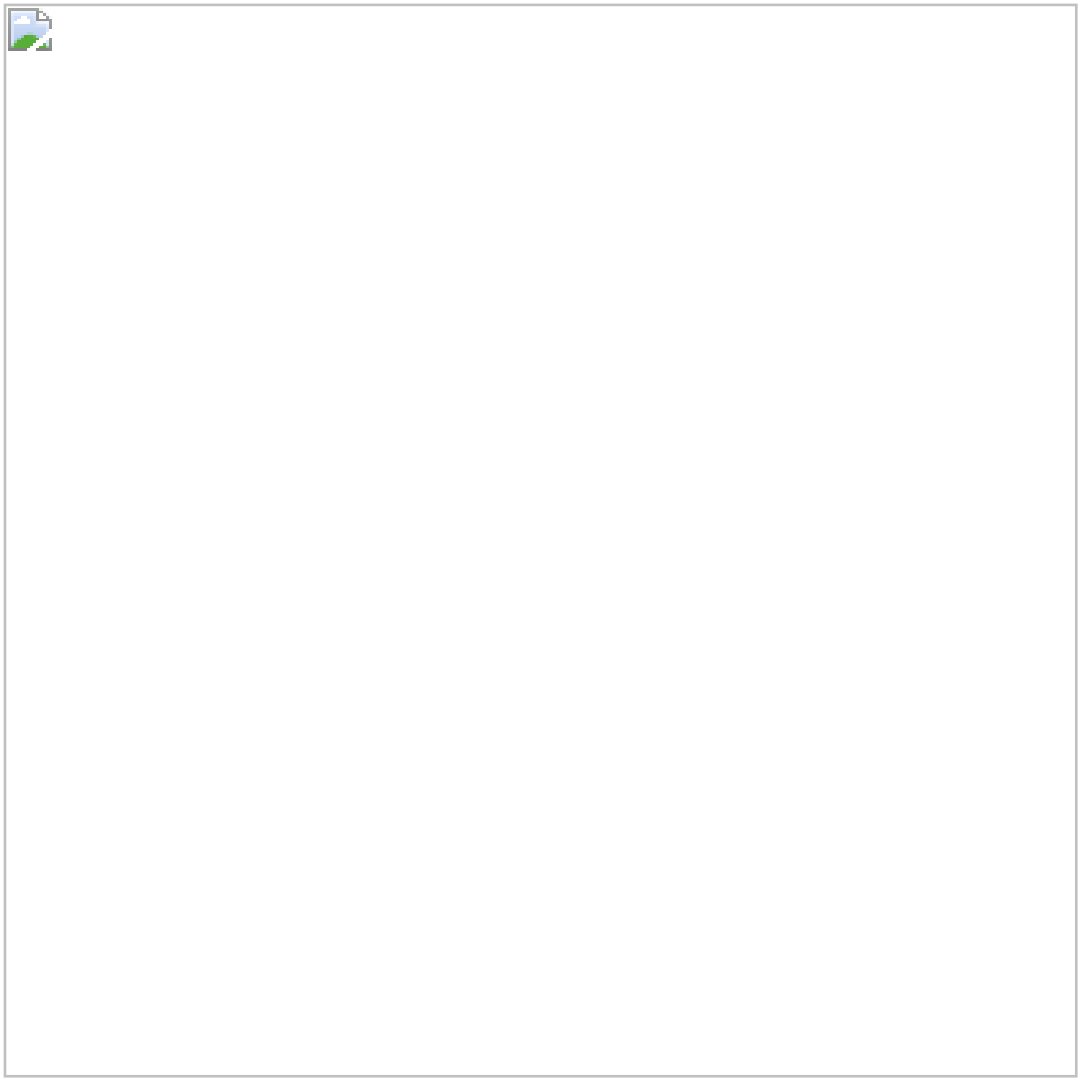

# AVIAN HEMATOZOA OF SOME UGANDAN BIRDS

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# AVIAN HEMATOZOA OF SOME UGANDAN BIRDS

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*Abstract:* The hematozoa occurring in 217 of 922 Ugandan birds of 107 species is reported. Species of Haemoproteus were the most prevalent blood parasite, occurring in 82% of the infected birds. The other groups of avian hematozoa encountered, namely *Leucocytozoon* (6%), *Plasmodium* (5%), Trypanosoma (7%) and microfilaria (6%), were virtually identical in their rate of occurrence in the bird population. Multiple infections (6.9%) were uncommon. The highest prevalence of blood parasites were recorded in the Zosteropidae (80%) and Ploceidae (56%). Birds showed blood parasitaemias throughout the year, but the peak prevalence was in October, suggesting that vectors were most active at this time.

## INTRODUCTION

Considerable attention was paid to the avian hematozoa of Africa during the early part of the 20th century by many researchers, including such prominent authorities as Neave[9] and Wenyon,[15] both in the Sudan, the Sergeants[12] in Algeria, Rodhain et al.[11] and Todd and Wolback[14] in the Congo; their studies were essentially taxonomic in nature. In recent times, however, relatively few studies on African birds have been reported: Tendeiro[13] discussed the results of a survey in Portuguese Africa; Markus and Oosthuizen[7] recently conducted surveys in South Africa; Bray,[4] Ashford[1] and Peirce and Backhurst[10] have carried out rather extensive studies on African birds. Fallis et al.[6] recently reported on some studies on the vectors of *Leucocytozoon* species in Tanzania, the first work of this nature in Africa. Little has been published on the avian hematozoa of Uganda with the exception of a description of *Haemoproteus enucleator* by Bennett et al.[3] from pygmy kingfishers in this and other regions of eastern Africa.

Recently, extensive studies by the East African Virus Research Institute at Entebbe, Uganda on arboviruses provided the opportunity to obtain blood films from a number of local Ugandan birds. This report summarizes the results of the examination of 922 birds of 107 species (representing 31 families) for blood parasites. In addition, the seasonal prevalence profile of the blood parasites during the course of a year are illustrated.

## DESCRIPTION OF THE AREA

The Entebbe peninsula is 0° 10'N and 32° E and, like the rest of the Ugandan plateau, is 1182 m above sea level. Temperatures show little change throughout the year, ranging from a minimum of 17 C in the cooler months of July and August to 27 C in the months of January to March. Rain falls throughout the year but two rainfall maxima are clearly discernible (Fig. 1). The highest rainfall occurs from March to May followed by a drier spell while the second less intense rainfall occurs between October and December, giving a mean annual rainfall of 1500 mm.

The vegetation is savannah, with strips of evergreen forest fringing the shores of Lake Victoria, surrounded by semideciduous woodland and bush giving way to

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open savannah. From these forests, as the land slopes towards the lake, the forest is replaced by swamp and a luxuriant growth of papyrus. An example of this type of habitat is Zika Forest, 10 km north of the Entebbe airport on the northern shores of Lake Victoria, where most of the bird-netting was done. The topography and vegetation of this forest have been detailed by Buxton;[5] the forest has not changed much since then. In the immediate area around the forest, cultivation is carried out and the forest is visited by both humans and cattle.

## MATERIALS AND METHODS

Birds were obtained by mist netting in and around three strips of lakeshore forest, namely Zika, Bugabo and Lunyo, during the periods April 1971 to June, 1972. The blood films were fixed in 100% methanol and stained with Giemsa's stain, buffered to pH 7.2.

## RESULTS AND DISCUSSION

A total of 922 birds of 107 species (representing 31 avian families) were examined for hematozoa; 217 (24%) harboured one or more genera or species of blood parasites (Table 1). However, only 42 of the 107 bird species were infected; the negative bird species, with the numbers examined in parentheses, are listed at the end of Table 1.

Haemoproteids were by far the most common parasite encountered, occurring in 179 (82%) of the infected birds. The current taxonomic chaos surrounding the Haemoproteidae precluded specific diagnosis of most infections, but the 13 pygmy kingfishers (*Ispidina picta*) all harboured *Haemoproteus enucleator* Bennett et al., and the single infected *Ceryle rudis* harbored *H. halcyonis* de Mello. The haemoproteids of the Estrillidae, Ploceidae and Sylviidae were considered to be either *H. fringillae* Labbé or *H. orizivora* Anschütz. These two species

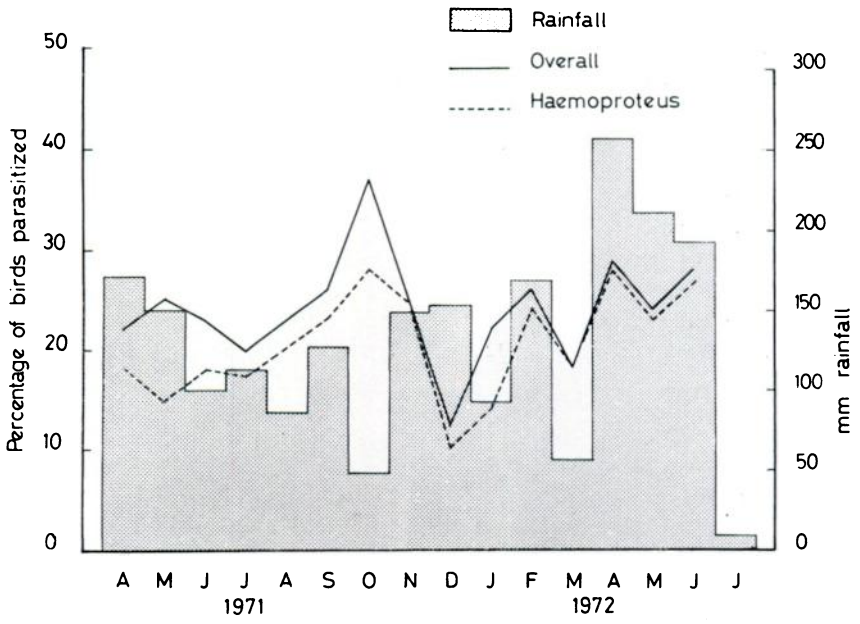


FIGURE 1. The seasonal prevalence of avian hematozoa and of **Haemoproteus** during the period April, 1791 through June, 1972, in the Entebbe Area, Uganda.

TABLE 1. Avian hematozoa of some Ugandan birds.

| Species | Number examined | | Blood parasites | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Infected | L. | H. | Pl. | T. | M. |
| ALCEDINIDAE | | | | | | | |
| *Ceryle rudis* | 23 | 2 | | 1 | | 1 | |
| *Ispidina picta* | 101 | 21 | 1 | 13 | 2 | 4 | |
| Negative birds (4 sp.) | 22 | | | | | | |
| Total birds: | 146 | 23 | 1 | 14 | 2 | 5 | |
| COLUMBIDAE | | | | | | | |
| *Tympanistria tympanistria* | 15 | 4 | 1 | 2 | | 1 | |
| Negative birds (2 sp.) | 2 | | | | | | |
| Total birds: | 17 | 4 | 1 | 2 | | 1 | |
| CUCULIDAE | | | | | | | |
| *Ceuthmochares aereus* | 4 | 3 | | | | | 3 |
| Negative birds (4 sp.) | 13 | | | | | | |
| Total birds: | 17 | 3 | | | | | 3 |
| ESTRILIDAE | | | | | | | |
| *Lonchura bicolor* | 2 | 1 | | 1 | | | |
| *Lonchura cucullata* | 2 | 2 | | 2 | | | |
| *Mandingoa nitidula* | 4 | 2 | | 2 | | | |
| Negative birds (4 sp.) | 16 | | | | | | |
| Total birds: | 24 | 5 | | 5 | | | |
| HIRUNDINIDAE | | | | | | | |
| *Cecropis abyssinica* | 11 | 2 | | 2 | | | |
| *Hirundo rustica* | 13 | 1 | | 1 | | | |
| *Riparia cincta* | 6 | 1 | | | 1 | | |
| Negative birds (2 sp.) | 2 | | | | | | |
| Total birds: | 32 | 4 | | 3 | 1 | | |
| INDICATORIDAE | | | | | | | |
| *Indicator indicator* | 3 | 1 | | 1 | | | |
| Negative birds (1 sp.) | 2 | | | | | | |
| Total birds: | 5 | 1 | | 1 | | | |
| LANIIDAE | | | | | | | |
| *Tchagra australis* | 4 | 2 | 1 | | 1 | 1 | |
| Negative birds (1 sp.) | 1 | | | | | | |
| Total birds: | 5 | 2 | 1 | | 1 | 1 | |

TABLE 1 (continued)

| Species | Number examined Total | Infected | Blood parasites L. | H. | Pl. | T. | M. |
|---|---|---|---|---|---|---|---|
| MEROPIDAE | | | | | | | |
| *Aerops albicollis* | 1 | 1 | | 1 | | | |
| *Melittophagus variegatus* | 17 | 1 | | 1 | | | |
| Total birds: | 18 | 2 | | 2 | | | |
| MOTACILLIDAE | | | | | | | |
| *Motacilla flava* | 10 | 5 | | 5 | | | |
| Negative birds (1 sp.) | 2 | | | | | | |
| Total birds: | 12 | 5 | | 5 | | | |
| MUSICAPIDAE | | | | | | | |
| *Alseonax griseigularis* | 2 | 1 | | 1 | | | |
| *Platysteira cyanea* | 3 | 2 | 1 | | 1 | | |
| Negative birds (2 sp.) | 3 | | | | | | |
| Total birds: | 8 | 3 | 1 | 1 | 1 | | |
| NECTARINIDAE | | | | | | | |
| *Cyanomitra olivacea* | 19 | 1 | | | 1 | | |
| *Hylia prasina* | 17 | 2 | | 2 | | | |
| *Nectarinia cuprea* | 4 | 1 | | 1 | | | |
| *Nectarinia senegalensis* | 3 | 2 | | 2 | | | |
| Negative birds (4 sp.) | 8 | | | | | | |
| Total birds: | 51 | 6 | | 5 | 1 | | |
| PLOCEIDAE | | | | | | | |
| *Melanopteryx* sp. | 14 | 8 | | 8 | | | |
| *Passer griseus* | 6 | 1 | | 1 | | | |
| *Ploceus aurantius* | 31 | 4 | 1 | 2 | | 1 | |
| *Ploceus cucullatus* | 27 | 23 | 1 | 20 | | 2 | |
| *Ploceus melanocephalus* | 1 | 1 | | 1 | | | |
| *Ploceus nigerrimus* | 46 | 32 | | 32 | | 1 | |
| *Ploceus nigricollis* | 36 | 18 | | 17 | 1 | | |
| *Ploceus ocularis* | 3 | 1 | | 1 | | | |
| *Ploceus pelzelni* | 4 | 1 | | 1 | | | |
| *Ploceus weynsi* | 29 | 26 | 3 | 25 | | | |
| *Quelea erythrops* | 4 | 1 | | 1 | | | |
| Negative birds (1 sp.) | 5 | | | | | | |
| Total birds: | 206 | 116 | 5 | 109 | 1 | 5 | |

TABLE 1 (continued)

| Species | Number examined Total | Infected | Blood parasites L. | H. | Pl. | T. | M. |
|---|---|---|---|---|---|---|---|
| PYCNONOTIDAE | | | | | | | |
| *Pycnonotus barbatus* | 56 | 13 | 1 | 10 | 1 | | 1 |
| *Pycnonotus virens* | 119 | 1 | | | | 1 | |
| Negative birds (7 sp.) | 49 | | | | | | |
| Total birds: | 224 | 14 | 1 | 10 | 1 | 1 | 1 |
| STRIGIDAE | | | | | | | |
| *Ciccaba woodfordii* | 2 | 2 | | 2 | 1 | | |
| Total birds: | 2 | 2 | | 2 | 1 | | |
| SYLVIIDAE | | | | | | | |
| *Acrocephalus* sp. | 1 | 1 | | 1 | | | |
| *Camaroptera brevicaudata* | 5 | 1 | | 1 | 1 | | |
| *Phylloscopus trochilus* | 1 | 1 | | 1 | | | |
| *Sylvia borin* | 9 | 2 | | 1 | 1 | | |
| Negative birds (7 sp.) | 8 | | | | | | |
| Total birds: | 24 | 5 | | 4 | 2 | | |
| TIMALIIDAE | | | | | | | |
| *Trichastoma fulvescens* | 9 | 1 | | | 1 | | |
| Total Birds: | 9 | 1 | | | 1 | | |
| TURDIDAE | | | | | | | |
| *Turdus olivaceus* | 4 | 1 | | | 1 | | |
| Negative birds (7 sp.) | 19 | | | | | | |
| Total Birds: | 23 | 1 | | | 1 | | |
| ZOSTEROPIDAE | | | | | | | |
| *Zosterops senegalensis* | 15 | 12 | 2 | 12 | | 5 | 1 |
| Total birds: | 15 | 12 | 2 | 12 | | 5 | 1 |
| Unknown species | 32 | 8 | 2 | 4 | | 2 | 1 |
| TOTAL BIRDS: | 922 | 217 | 14 | 179 | 11 | 16 | 12 |
| % infected of total | | 24 | | | | | |
| % infected of total infected | | | 6 | 82 | 5 | 7 | 6 |

L. = *Leucocytozoon;* H. = *Haemoproteus;* Pl. = *Plasmodium;* T. = *Trypanosoma;* M. = *microfiliaria.*

TABLE 1 (continued)

NEGATIVE BIRDS:

ALAUDIDAE—*Mirafra africana* (1); *Mirafra* sp. (1). ALCEDINIDAE—*Alcedo cristatus* (1); *Alcedo quadribrachys* (1); *Halcyon malimbica* (14);*Halcyon senegalensis* (6). ANATIDAE—*Anser anser* (5). CAMPEPHAGIDAE—*Campephaga phoenicia* (3). CAPITONIDAE—*Lybius bidentatus* (1); *Pogoniulus leucolaima* (12); *Pogoniulus scolopaceus* (1); *Tricholaema hirsutum* (1). CAPRIMULGIDAE—*Caprimulgus pectoralis* (2); *Caprimulgus* sp. (1). CHARADRIIDAE—*Hemiparra crassirostris* (1). COLIIDAE — *Colius striatus* (1). COLUMBIDAE — "Dove" (1); *Turtur afer* (1). CUCULIDAE — *Cercococcyx mechowi* (2); *Chrysococcyx caprius* (5); *Chrysococcyx cupreus* (3); *Chrysococcyx klaas* (3). ESTRILIDAE—*Lagonosticta rubricata* (3); *Nigritta canicapilla* (5); *Pyrenestes ostrinus* (7); *Spermophaga ruficapilla* (1). FRINGILLIDAE—*Serinus sulphuratus* (6). HIRUNDINIDAE—*Cecropis cucullata* (1); *Pseudhirundo griseopyga* (1). INDICATORIDAE—*Indicator variegatus* (2). LANIIDAE—*Laniarius barbarus* (1). MOTACILLIDAE—*Anthus leucophyrs* (2). MUSCICAPIDAE—*Stizorhina fraseri* (1); *Tchitrea nigriceps* (2). NECTARINIDAE—*Nectarinia chloropygia* (1); *Nectarinia cyanolaema* (1); *Nectarinia verticalis* (5); "Sunbird" (1). PHASIANIDAE—*Gallus gallus* (10). PICIDAE—*Campethera nivosa* (1). PLATALEIDAE—*Hagedashia hagedash* (1). PLOCEIDAE—*Euplectes axillaris* (5). PYCONONOTIDAE—*Andropadus* sp. (1); *Chlorocichla flavicollis* (4); *Nicator gularis* (2); *Phyllastrephus albigularis* (22); *Pycnonotus curvirostris* (9); *Pycnonotus latirostris* (10); unknown bulbul (1). RALLIDAE—*Sarothrura pudchra* (1). SCOLOPACIDAE—*Actitis hypoleucos* (2); *Tringa* sp. (1). SYLVIIDAE—*Acrocephalus arundinaceus* (1); *Cisticola erythrops* (1); *Cisticola robusta* (1); *Cisticola* sp. (1); *Eminia lepida* (2); *Prinia leucopogon* (1); *Sylvietta virens* (1). TURDIDAE—*Alethe diademata* (2); *Cossypha heuglini* (3); *Cossypha niveicapilla* (5); *Erythropygia leucophrys* (3); *Myrmecocichla nigra* (3); *Saxicola rubetra* (2).

frequently occur as mixed infections in the same individual[2] and may prove to be the same species. The single infected thrush harboured *H. fallisi* Bennett & Campbell. The remaining haemoproteids were not identified, pending extensive review of the taxonomy of the family.

The remaining blood parasite groups occurred with virtually the same frequency but in considerably smaller numbers than the haemoproteids (Table 1). Leucocytozoids occurred in 14 birds (6% of the infected birds), the commonest (and only specifically identified) species being *L. fringillinarum* Woodcock, which occurred in the Ploceidae. Trypanosomes, most of which were referable to *Trypanosoma avium*, occurred in 7% of the infected birds, particularly the kingfishers and ploceids. Microfilaria occurred in 12 birds. Double infections of hematozoa were uncommon; among the 217 infected birds, there were only 232 infections (Table 1), indicating only 15 (6.9%) double infections.

Species of *Plasmodium* occurred in 5% of the infected birds but were not concentrated in any specific family, the 11 infections recorded in birds of 10 families. *Plasmodium circumflexum* occurred in both the dark-capped bulbul and the grey-backed camaroptera. *Plasmodium nucleophilum* was identified in the black-necked weaver and a banded martin; the latter host also harboured *P. relictum*. *Plasmodium rouxi* was found in the brown illadopsis. A species of *Plasmodium*, consistent in every respect with *P. vaughani*, was found in a garden warbler, the African thrush and the brown-headed bush shrike. *Plasmodium vaughani* is reputedly restricted to Turdidae in North America although Bennett et al.[2] have reported it in fringillids, parulids and parids in Newfoundland. If *P. vaughani* is indeed in Africa, then the distribution of this species is considerably enlarged and a revision of the *Plasmodium* (*Novyella*) group might well be in order. *Plasmodium* infections of young parasites, not identifiable beyond the generic level, were recorded in two pygmy kingfishers and an African wood owl.

Although representatives of 31 avian families were examined, only birds in 17 families were infected (Table 1). Members of the Zosteropidae (12 of 15, 80%) and the Ploceidae (116 of 206, 56%)

were the most heavily infected of the bird families, the majority of the birds harboring haemoproteids. The members of these two families usually occur in non-forested areas. This level of infection is in marked contrast to that observed in the Pycnonotidae, where only 14 of 224 birds (6%) were infected; 13 of these 14 were from 1 species, *Pycnonotus barbatus,* a non-forest species, while the forest bulbuls were mostly free of infection. It is presumed that some behavioural characteristic of the Zosteropidae, Ploceidae and other typically non-forest species involved, bring them into considerably more frequent contact with the vectors of *Haemoproteus* (possibly Ceratopogonidae) than other birds. In general, it would seem that the non-forest species harbour more infections than the forest species or those species that mostly forage in the forest undergrowth. Conversely, it is possible that the vectors of these haemoproteids in this area are specific for, or prefer the members of these two families. The clear preponderance of haemoproteids in the overall infection indicates that the vectors of the other hematozoan parasites are limited in this region.

A large portion of the sample of birds surveyed was collected at monthly intervals from April, 1971 through June, 1972. This data (Fig. 1) has been illustrated both as the total seasonal prevalence of hematozoa and seasonal prevalence of *Haemoproteus.*

Haemoproteids (Fig. 1) appear to be most prevalent at two periods—October and April, corresponding to the beginning and middle of the two rainfall seasons. Presumably then, this is the time that vectors are most active, but of the possible vectors little is yet known in this area. Bird-biting *Aedes africanus* has been observed to reach peaks of human-biting activity in April and November (McCrae et al.[8]), while Fallis et al.,[6] studying *Leucocytozoon* and its vectors in Tanzania, reported finding an abundance of simuliids between September and October.

The overall prevalence, which is primarily composed of haemoproteids, reflects the same pattern, although the accentuated October peak is also the result of the increased prevalence of the other genera of hematozoa.

Apart from correlating with increased rainfall and possible vector activity, the peak also correlates with increased number of ploceids caught. For example, during the catching period, the highest percentage of ploceids caught in any one month (32%) was obtained in October, 1971. This marked increase in the ploceids could be a result of recruitment of the young birds into the flying population, a recruitment that would also be susceptible to new infection.

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