Rev. Inst. Med. trop. São Paulo
19(6):411-416, *novembro-dezembro,* 1977

UDC 616.936

HAEMOPROTEUS, PLASMODIUM, AND HIPPOBOSCID ECTOPARASITES OF COLOMBIAN WILD DOVES

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SUMMARY

465 **Zenaida auriculata** from western Colombia were examined over 8 months during 1973-1974 to correlate blood parasite infection patterns and dove population dynamics. The birds are reproductively active year-around, with decreased activity during September-October and March-April. **Haemoproteus maccallumi** was found in 446 (96%) and monthly prevalence varied from 92 to 100%. Immature doves had heavier infections $\bar{x}$ = 78/10,000 erythrocytes than adults $\bar{x}$ = 13/10,000. Overall infection intensity in the population varied little, depending upon the proportion of immature birds in the monthly sample. Two Hippoboscid species were collected: **Stilbometopa podostyla** (44 flies on 34 birds) and **Microlynchia pusilla** (462 flies on 219 doves). **M. pusilla** probably accounts for the high transmission rate of **Haemoproteus. Plasmodium hexamerium** was identified in three doves.

INTRODUCTION

The eared dove, **Zenaida** (=**Zenaidura**) **auriculata** of South America and the Caribbean, and the mourning dove **Zenaida macroura** of North America comprise a superspecies. There are several reports on the presence and seasonal dynamics of hemosporidian parasites in mourning doves [7,8,9,10], but almost none on its southern congener.

As part of a study on the biology of **Z. auriculata caucae** in western Colombia, we attempted to correlate hemosporidian infection patterns with population dynamics of the doves. We also examined blood films from other local Columbid species, including domestic pigeons and ruddy ground doves, **Columbina talpacoti.**

MATERIALS AND METHODS

Our study site in the Cauca River valley is located 3.° north of the Equator, with a mean elevation of 1,000 m; temperature averages 23-25°C with little monthly variation. Rainfall is typically 20-50 mm/month during the two dry seasons: June-September and December-February, and 80 — 150 mm/month during March-May and October-November.

Eared doves were shot in roosting areas or grain fields and ruddy ground doves netted at granaries near Cali. The doves were classified into age groups as indicated by feather condition and bursal development, weighed, examined for ectoparasites, and autopsied to determine the reproductive state, milk gland development, crop contents, and intestinal pa-

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Note: The **Plasmodium** reported here corresponds closely to **P. columbae** Carini, 1912, as redescribed from **Columba livia domestica** from Venezuela by Gabaldon and Ulloa (Bol. Dir. Malariol. y Saneam. Amb. Venezuela **16** (2): 93-106, 1976).

rasites. Thin blood smears were fixed in absolute methanol and stained with Giemsa blood stain. Parasitemia was estimated by counting the number of parasites in 10,000 erythrocytes (62 oil immersion fields containing approximately 163 erythrocytes each). The blood films are deposited at the International Reference Centre for Avian Haematozoa, Memorial University of Newfoundland, St. John's, Newfoundland, Canada. Hippoboscid flies were preserved in 10% formalin or 70% alcohol.

RESULTS

EARED DOVES

Hippoboscid flies

Ectoparasites were sought on 401 eared doves, including 24 juveniles, 70 subadults and 307 adults. Two hippoboscid species were found on 244 (61%) of the doves: a large species **Stilbometopa podostyla** and a smaller one **Microlyncha pusilla** (Fig. 1). Thirty-four doves (8%) harbored a total of 44 **S. podostyla,** most birds harboring a single fly; 219 doves (55%) carried a total of 362 **M. pusilla,** most birds harboring 1 to 3 flies but occasionally 8 to 10 were found and one dove had 20.

Younger doves had more frequent and heavier infestations: juveniles 71% infested with an average of 4.2 flies per infested bird, subadults 71% ($\bar{x}$ = 2.2 flies) and adults 58% ($\bar{x}$ = 1.2 flies). Roughly equal numbers of hippoboscids were captured in each month of the year. Unfortunately, the storage in preservative made them brittle and unsuitable for dissection.

Haemoproteus

Blood films were obtained from 465 eared doves (26 juveniles, 79 subadults and 360 adults), between September 1973 and May 1974. Films from 446 (96%) showed **Haemoproteus** gametocytes (Figs. 2 — 13), with no evident differences between male and female doves.

We identified all the haemoproteids as **H. maccallumi,** following other recent workers. Many of the gametocytes showed the morphological changes known to occur soon after death of the host (WENYON 1926, p. 888).

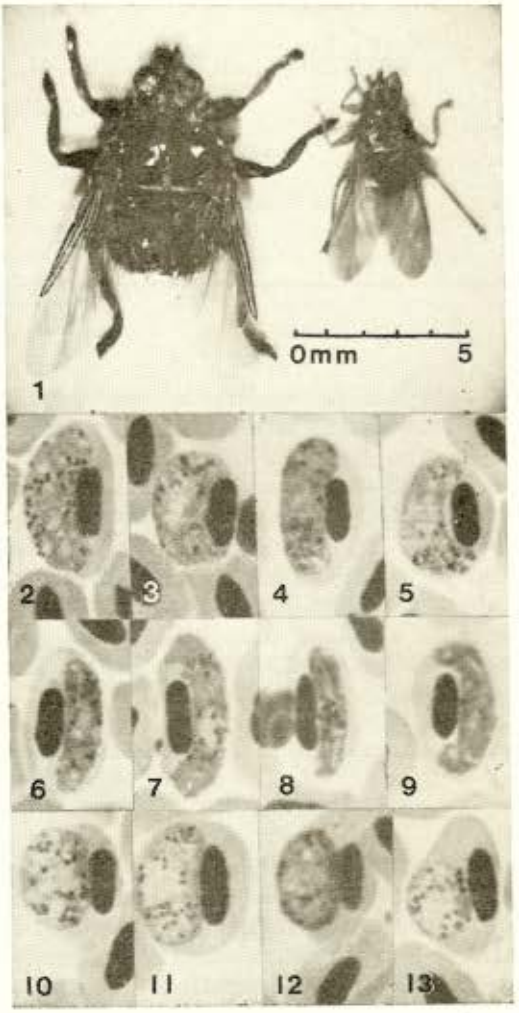


Fig. 1 — Hippoboscids from Colombian eared doves: **Stilbometopa podostyla** (large species) and **Microlyncha pusilla** (small species).

Figs. 2 — 13 — Divers forms of **Haemoproteus maccallumi** gametocytes found in 96% of the eared doves examined.

There were no **H. sacharovi**-like gametocytes in any of the doves that completely filled the host cell, surrounding, displacing or distorting the host cell nucleus while producing little or no pigment.

Parasitemia was closely related to the bird's age: Juveniles < 1 to 530, $\bar{x}$ = 78/10,000; subadults < 1 to 550, $\bar{x}$ = 44/10,000; adults < 1 to 210, $\bar{x}$ = 13/10,000 (Fig. 14). The heaviest infections seen were usually around 260 to 270 per 10,000 erythrocytes, the heaviest being 550/10,000.

Patent infections were found in 92 to 100% of each monthly sample (Fig. 15). The two "negative" immature and subadult doves may not yet have been infected, but most of the 17 "negative" adults probably had latent infections. The true prevalence probably approached 100%.

The annual reproductive cycle of the eared dove population in the Cauca River valley, as judged by gonad size, is superimposed over Fig. 15. Reproduction occurs year-around, but it is concentrated in two annual peaks. Neither prevalence nor parasitemia varied within the age groups during the biannual decreases in reproductive activity. However, the overall parasitemia level was higher in months such as October when immature and subadult doves comprise a larger proportion of the population.

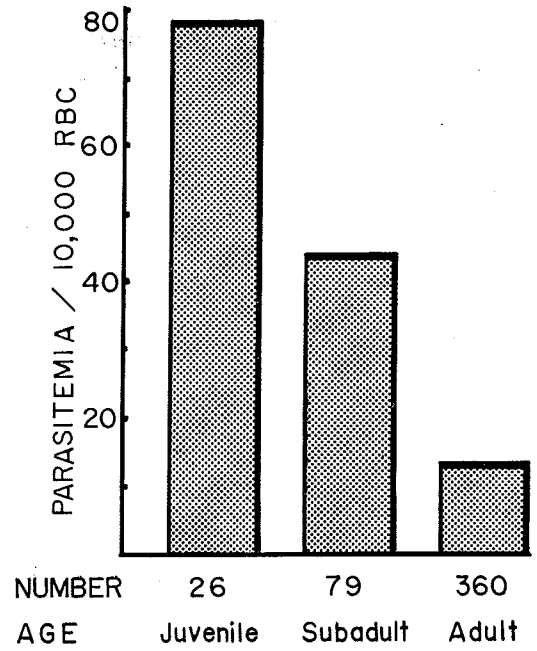


Fig. 14 — **Haemoproteus maccallumi:** average parasitemia in eared doves of different age groups.

Plasmodium

Plasmodium sp. schizonts were found in three of the 465 eared doves (Figs. 16-31): each bird carrying concurrent **Haemoproteus** infections. The birds were collected in January (two subadults) and February (one adult). Two of the infections were of moderate level. Host cells were all normocytes and doubly-infected cells were not uncommon. Mature segmenters (Figs. 16 — 31) measured about 5 μm across, were spherical, fan or rosette shaped, occupied 1/5 to 1/6 of the available space in the mostly undistorted host cell and had an average of 6 (3 to 10) merozoites (Fig. 32). Schizonts in one dove showed distinctive 'punched-out' circular vacuoles (Figs. 28-31).

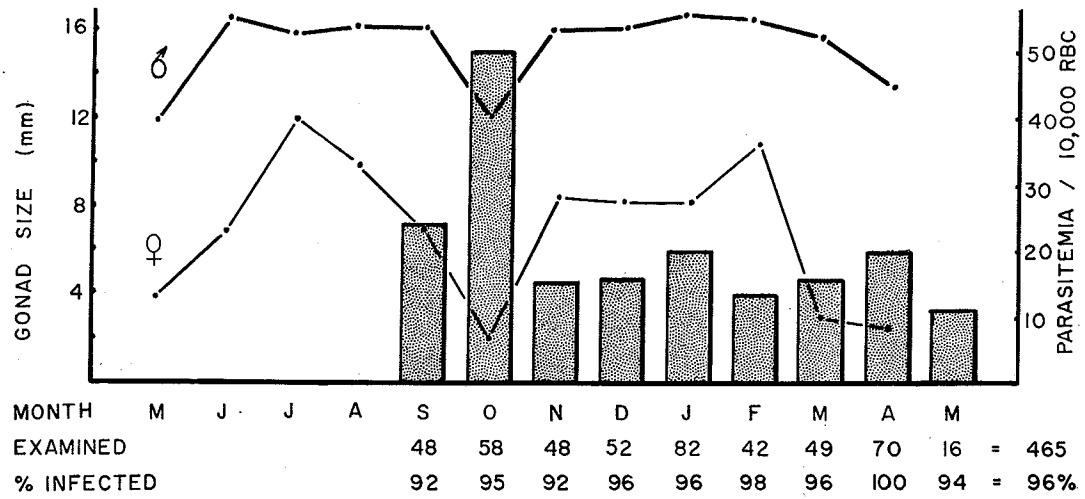
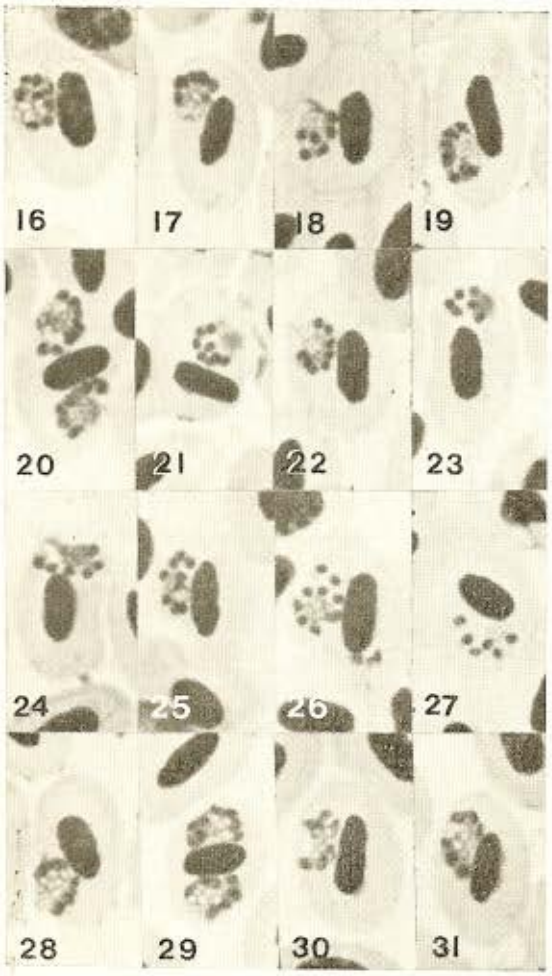


Fig. 15 — **Haemoproteus maccallumi** prevalence and average monthly parasitemia in 465 eared doves from Valle, Colombia, 1973-1974. Gonad size = length of the longest tests; diameter of largest ovarian follicle. High average parasitemia in October reflects the larger proportion of immature doves in that month's sample (see Fig. 14).

The presence of **Haemoproteus** gametocytes in various stages of development prevented us from distinguishing the **Plasmodium** gametocytes.



Figs. 16 — 31 — Typical **Plasmodium** segmenters from two eared doves.

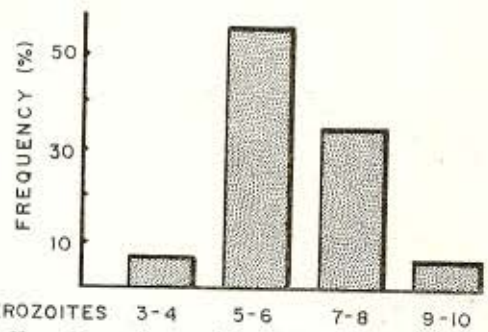


Fig. 32 — Merozoite numbers (%) of 52 mature schizonts in two eared doves carrying **Plasmodium** infections, January 1974.

Small, rounded schizonts and compact merozoites with little cytoplasm quickly suggest one of the **Novyella** group species; probably **P. vaughani** or **P. hexamerium.** According to MANWELL [11], **P. vaughani** is distinguished by having segmenters with usually four (although often as many as eight) merozoites and a noticable refractile granule in the larger trophozoites and segmenters. **P. hexamerium** is characterized by having segmenters usually containing six merozoites (range four to eight) and an oblique polar position frequently taken by larger trophozoites in the host cell. The absence of refractile granules and the average of 6 (3 — 10) merozoites in the segmenters inclines us to lable our parasites as **P. hexamerium** until these species are more thoroughly described.

Other parasites

No other blood parasites were seen in any of the eared doves. Occasional doves showed symptoms of disease, but they could usually be attributed to other agents: trichomoniasis in 8 of 690 birds examined, fowl and lymphoid leucocosis in one bird each. Other infectious agents included **Sarcocystis** in 6 of 6 doves, intestinal cestodes in 32 of 436, and subcutaneous nematodes in 1 of 690 doves examined.

RUDDY GROUND DOVES AND PIGEONS

Haemoproteus gametocytes, morphologically indistinguishable from those of the eared doves, were found in 106 (55%) of the 191 **C. talpacoti** and 2 of 10 domestic pigeons examined. Prevalence varied markedly in the different ground dove populations. Both large and small hippoboscid flies were seen on the ground doves; they looked identical to **S. podostyla** and **M. pusilla** but none was captured or identified.

DISCUSSION

The near 100% **Haemoproteus** prevalence we saw in every month and in each age group is higher than that found in doves from temperate areas [9]. Average parasitemia in each age group remained stable throughout the year. There is no synchronized seasonal variation in the infection state except for the

increased percentage of active infections during periods when immature doves form a larger proportion of the population sample.

The **Haemoproteus** transmission rate in Colombian eared doves is clearly high. Infections are acquired early, reach highest levels in young birds and soon become chronic, despite probable frequent reinfections.

The apparent absence of **H. sacharovi** is significant, since this species occurs together with and is often even more frequent than **H. maccallumi** in mourning doves throughout much of North America. GABALDON et al. [5] may have found it in five domestic pigeons in Venezuela.

Both **Microlyncha pusilla** and **Stilbometopa podostyla** occur on mourning doves in North America and both species have been incriminated as transmitting **Haemoproteus** of pigeons and doves. BEQUAERT [2] felt that **M. pusilla** was probably the primary vector of both **H. maccallumi** and **H. sacharovi.** Low frequency of hippoboscids on mourning doves in some Nearctic region surveys has cast doubt on their role as vectors. This is not a problem in Colombian eared dove populations. In western Colombia, **M. pusilla** maintains a high population density on eared doves throughout the year, and is apparently responsable for their extremely high incidence of **Haemoproteus** infection. BEQUAERT [3] mentions that Santiago Renjifo Salcedo found both hippoboscid species on domestic pigeons in the Cauca River valley near our own study sites.

The low frequency of **Plasmodium** infections in doves suggests that these may be predominantly infections of other bird populations, secondarily acquired by the doves, and in the enzootic cycles of which the doves play no significant role. Similar parasites of the subgenus **Novyella** were found in birds of 12 different families in Venezuela [4,5]. It could even be more than coincidence that the infected eared doves were collected during months when Nearctic migrants are overwintering in South America [1]. The **Novyella**-group plasmodia found in Columbids from Colombia [12], Panama [6], and Venezuela [4,5] could be the same species. MANWELL [11] reported a similar parasite from Colombian silver beaked tanagers.

RESUMEN

Haemoproteus, Plasmodium, y Hippoboscidos ectoparasíticos en Palomas silvestres de Colombia

Fueron examinados 465 **Zenaida auriculata** de la región occidental de Colombia durante los años 1973-1974, con el fin de correlacionar los patrones de infección por hemoparásitos y la dinámica de población de las palomas. Las aves se reproducen durante todo el año, con descenso en los meses de Septiembre-Octubre y Marzo-Abril. Se encontró **Haemoproteus maccallumi** en 446 (96%), y la prevalencia mensual de infección varió desde el 92 hasta el 100%. Las infecciones más intensas occurieron en aves inmaduras: promedio 78/10.000 eritrocitos infectados versus 13/10.000 en los adultos. La intensidad de infección en la población durante el año varió poco, con relación a la proporción de aves inmaduras presentes. Se encontró dos especies de Hippoboscidae: **Stilbometopa podostyla** (44 moscas en 34 aves) y **Microlynchia pusilla** (462 moscas en 219 aves). La elevada taza de transmisión de **Haemoproteus** en la población de palomas probablemente se deba a **M. pusilla.** También se identificó **Plasmodium hexamerium** en tres palomas.

ACKNOWLEDGEMENTS

Danilo Valencia, Gustavo Morales, Paul Woronecki, Maurice Thomas, T. C. Maa, Barry Tashis, Carmen Elena de Sánchez, Ernesto Gómez and Olga Quintero provided essential help at different stages of the program. Additional support came from the Instituto Colombiano Agropecuário — U.S./A.I.D. vertebrate damage control program (Denver Wildlife Research Center), the Tulane University International Center for Medical Research (ICMR) grant AI-10050, NIH; and a U. S. Public Health grant AI 12511-01 NIH to Dr. Ayala.

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Recebido para publicação em 10/9/1976.