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MALARIA IN *CHORDEILES MINOR* (AVES: *CAPRIMULGIDAE*), AN INTERCONTINENTAL MIGRANT

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SUMMARY

Plasmodium polare was found in Colombia in a juvenile nighthawk on its first migration to South America. This parasite is known from both migrant and non-migrant Neartic birds, but has not previously been reported from South America. Avian malaria may be carried between continents within a few weeks by migrating birds.

INTRODUCTION

On September 24, 1973, a few boys caught an immature male nighthawk, *Chordeiles minor* (Fig. 1) in a field near the Universidad del Valle Medical School in Cali. The bird was wounded during capture and lived for less than half an hour. Before it died, blood was obtained by heart puncture to make a single thin smear. The body was frozen soon after death, and the blood smear proved positive for malaria.

The nighthawk is one of a group of migrant bird species (Fig. 2). It is well known throughout most of the United States and southern Canada where it breeds from April to August. In September, it migrates to South America, residing for the next 5 — 6 months throughout most of the continent south of Colombia. It passes through Colombia twice each year: on its flight south between September and November, and again in March and April as it migrates north [1, 2].

The malaria parasite seems to be *Plasmodium polare*. Parasites of similar structure have been reported from cliff swallows in New York, shore birds in Nebraska and grouse in North Dakota [4]. GALINDO & SOUSA [3] found it in cliff swallows in Panama. Our observation is one more case of a *Plasmodium* species in migrating birds, and illustrates the potential of avian malaria species to achieve intercontinental distribution.

MATERIALS AND METHODS

Our description of the parasite is based on a single blood smear covering about 8 cm^2 obtained from the moribund nighthawk. The slide was fixed in absolute methanol and stained 40 minutes with Giemsa's blood stain, diluted 1:20 with buffered distilled water at pH 7.2. Drawings were made with a camera lucida. Impression smears of brain tissue were prepared later in a search for exoerythrocytic forms. The blood slide is now deposited at the W. H. O. International Reference Center for Avian Malaria Parasites, Memorial University, St. John's, Newfoundland, Canada (No. WHO-IRC-38496). Dr. Eugene Eisenmann of the American Museum of Natural History in New York identified the nighthawk to subspecies, and the skin is in the AMNH collection.

RESULTS

Although subspecies identification of juvenile nighthawks is difficult, the captured

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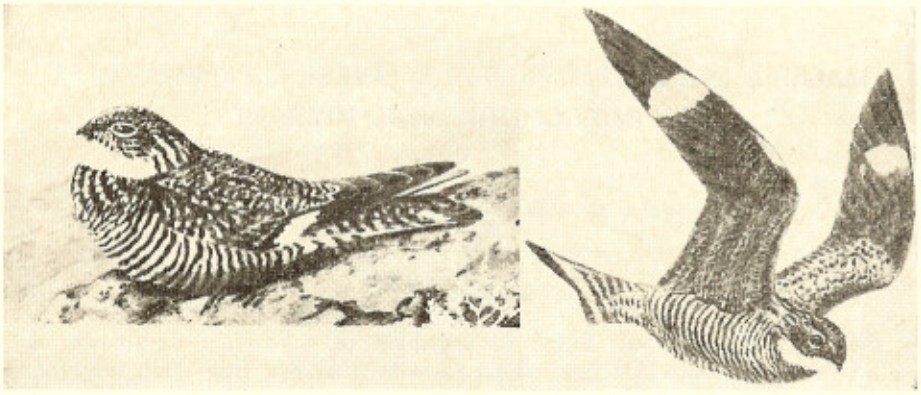

Fig. 1 — *Chordeiles minor*, from A. Wetmore, The Book of Birds, National Geographic Society Publ., 1911, 1915.

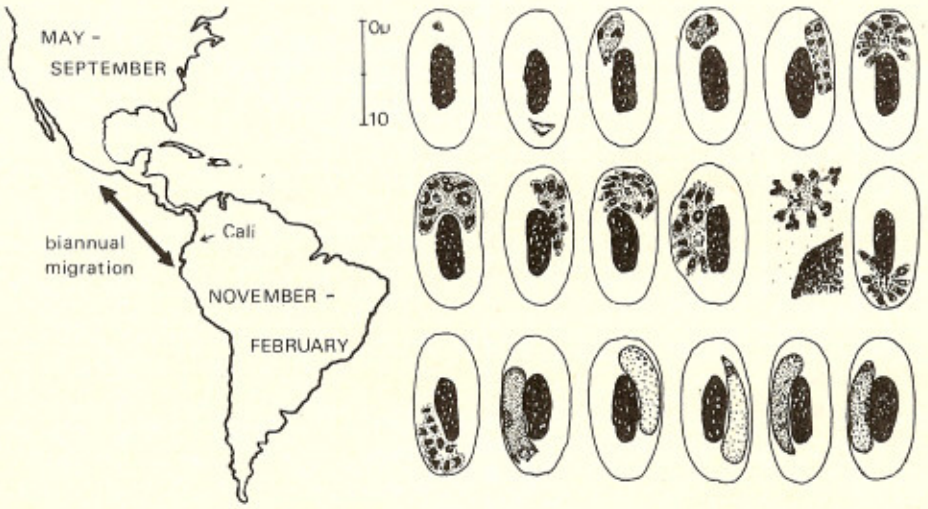

Fig. 2 — Migration pattern of *Chordeiles minor* from North to South America, and drawings of *Plasmodium polare* found in a juvenile nighthawk on its first trip south; Cali, Colombia, September 1973.

bird was most probably *C. m. hesperis*. If so, it would have been hatched during the preceeding May or June in the Great Basin or western Rocky Mountains (British Colombia and Montana south to California, Nevada or Utah). The only other possible identification, considering its large size, is *C. m. sennetti* of the northern Great Plains and eastern Rockies (Eisenmann, pers. comm). The nighthawk was making its first migration to South America, and must have acquired its infection during the preceeding months in western North America.

The malaria infection was active, with a moderately low parasitemia: one parasite in every 10 to 15 (820 X) microscope fields, or 1/2,000 erythrocytes. All characteristic forms were present, with segmenters comprising 30 to 40% of the total. About half of the gametocytes appeared ragged and senile. The blood picture was essentially normal, with 5% basophilic immature erythrocytes. The parasite is illustrated in Fig. 2.

DESCRIPTION OF THE PARASITE

Trophozoites — Infrequent in blood smear, usually polar in host cell, smaller forms 1.6 μ in diameter, assuming triangular shape with growth, some ameboid with one or two prominent pseudopods; pigment granules in more advanced forms.

Schizonts — Nearly always polar or lateral-polar in host cell; 2 to 7 chromatin masses, cytoplasm prominent, 4 to 8 yellow-brown pigment granules almost always in a compact mass at one side or end, 3.5 to 5.5 μ.

Segmenters — Usually polar or lateral-polar, generally 8 to 12 merozoites (6 to 12, average 10.2, N = 20), polar forms fan-shaped (diameter 5 to 6 μ), lateral-polar forms elongate (5 to 7 by 2 to 3 μ). Pigment in a single compact, centrally located mass.

Gametocytes — Elongate, 6 to 8.5 by 2 to 3 μ, lateral to host cell nucleus or lateral-polar, occupying 1/4 to 1/3 available space in cell and curving slightly around host cell nuclues; most sausage-shaped but others distinctly tapered at one end. Microgametocytes stained less intensely blue than microgametocytes, but sex not clear of several gametocytes whose cytoplasm contained reddish, chromatin-like masses; one or more vacuoles in some of the more ragged gametocytes.

Exoerythrocytic schizonts — Not seen in either leucocytes or in capillary endothelial cells of brain.

Host Cell — Mature erythrocytes, normal staining and undistorted; nucleus also undistorted, but sometimes slightly displaced by segmenters.

DISCUSSION

GARNHAM [4] described four groups or subgenera of avian malarial parasites: *Plasmodium (Haemamoebia):* eight described species with round gametocytes and large, round segmenters; *P. (Giovannolaia):* ten species with elongate gametocytes and large schizonts with abundant cytoplasm; *P. (Novyella):* five species with elongate gametocytes and small schizonts containing up to 8 merozoites; and *P. (Huffia):* two species with elongate gametocytes, small schizonts containing a maximum of 10 merozoites, showing continuous exoerythrocytic schizogony in circulating leucocytes.

The nighthawk's parasite would belong in the second subgenus, *P. (Giovannolaia)*, whose species include *P. circumflexum* and *P. polare*, and the lesser known *P. fallax*, *P. gundersi*, *P. durae* and *P. garnhami* of Africa, *P. lophurae* of Borneo, *P. formosanum* and *P. anasum* of Formosa, and *P. pinottii* of a Brazilian toucan.

We identified the nighthawk's parasite as *P. polare*, since its structure coincides closely with that species as described by MANWELL [6, 7] from cliff swallows in New York. Dr. E. C. Greiner of the W. H. O. Reference Center for Avian Malaria agreed that it appeared to be *P. polare*. The only difference is that the gametocytes in the nighthawk appear slightly smaller than those shown by Manwell. Parasites found in a grouse in North Dakota [10] were similar except for a lower merozoite number (4 to 12, average 7 in the grouse). Grouse are ground-dwelling birds that live in the same habitats as the nighthawk, and the two might be expected to share common parasites. Structural characters such as gametocyte size or merozoite number would likely vary somewhat in different host species.

Extremely little is known about the distribution of *Plasmodium* species in Neotropical wildlife. The only published information for birds of the Colombian area is the llanos survey of Renjifo, SANMARTIN & ZULETA [8], and three surveys of birds of Panama [3, 5, 9].

In Panama, GALINDO & SOUSA [3] found several malarial parasites infecting migrant birds from North America. Their list includes *P. polare* in cliff swallows, *P. circumflexum* in the Swainson's thrush, Baltimore orioles and summer tanagers, *P. vaughani* in yellow warblers and bobolinks, *P. heximerium* in a northern waterthrush, and *P. nucleophilium* in an orchard oriole.

It has been previously recognized that migrating birds carry avian plasmodia from one continent to another in a short time, and that the place where a parasite is discovered may be far from the place it was acquired (for example, see GARNHAM [4]). An infected nighthawk might pass its infection to resident birds anywhere along the migration route. Once found in resident birds, the parasite might erroneously be classified as new, rather than identified as a species described on another continent thousands of kilometers away.

Reptile malaria provides a useful model for tracing the regional evolution of *Plasmodium* populations and the historical zoogeography of their hosts. Avian malaria models, on the other hand, are helpful for analyzing the dispersal of *Plasmodium* among host species of different regions. However, investigation of the historical zoogeography of bird malaria populations based on their current distribution patterns is hampered by the mobility of their hosts.

RESUMO

Malária numa ave migrante intercontinental, Chordeiles minor *(Aves:* Caprimulgidae)

O *Plasmodium polare* foi achado na Colômbia, num jovem bacurau, em sua primeira migração do oeste dos Estados Unidos para a América do Sul.

Este parasito é encontrado tanto nas aves de arribação como nas não-migratórias da Região Neártica, mas sua presença não tinha sido ainda assinalada na América do Sul. A malária aviária pode ser transportada de um continente a outro, dentro de algumas semanas, por aves migratórias.

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POSTSCRIPT: STABLER, R.; KITZMILLER, N. & BRAUN, C. (*J. Parasit.*, **60**:536-537, 1974) believe they have found the same malaria parasite reported by Wetmore [10] in six Galliform species from Colorado: two blue grouse, four sharp-tailed grouse, 15 bobwhite quail, one Gambel's quail, one mountain quail, and 21 gray partridge. They refer to it as *Plasmodium pedioecetii,* citing Stabler et al., *J. Parasit.*, **59**:395, 1973 and Shillinger, *Yearb. Agric.*, 1217-1225, 1942.