STUDIES ON HÆMOSPORIDIA FROM INDIAN BIRDS—SERIES II

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(With 1 Plate)

This paper is the continuation of the series in our studies on Hæmosporidia from Indian birds and embodies the result of our observations on some species of Hæmosporidia of the families, Hæmoproteidæ and Plasmodiidæ. The parasites described here are new to science except Hæmoproteus danilewskyi (Grassi and Feletti, 1890) which is being reported for the first time from this part of India.

The birds were purchased from the local dealers.* The blood of fourteen different species of birds were examined, but it happened that only four of them harboured the parasites. The table at the end of this paper shows the occurrence of the parasites in different species of birds and the number of birds infected out of the total number examined. The locality of the parasites is also noted in the table.

FAMILY Hæmoproteidæ Döflein (1916)

Of the two genera Leucocytozoon and Hæmoproteus of this family, only the latter is represented here.

GENUS Hæmoproteus Kruse (1890)

During the course of our investigation we found two birds, the Indian white-eye Zosterops p. palpebrosa (Temm. and Schlegel), and the Indian Magpie-Robin, Copsychus s. saularis (Linn.), infected with Hæmoproteus. The parasite of Copsychus s. saularis is synonymous with Hæmoproteus danilewskyi (Grassi and Feletti, 1890), while that of the white-eye is a new

* Some of the birds were kindly procured for us by Mr. B. Biswas, B.Sc., a post-graduate student of this department, for which we are indebted to him.

B3
one, as it does not resemble any known species of *Hamoproteus* so far described, we propose to call the parasite *Hamoproteus zosteropsi* n.sp.

**Observations on *Hamoproteus zosteropsi* n.sp.**

The early gametocytes are spherical in outline (Fig. 1) with a hyaline cytoplasm and a dot-like chromatin mass representing the nucleus. In these forms no pigment could be seen. As the parasites grow bigger in size, pigment granules appear in the cytoplasm and their sexual dimorphism becomes apparent.

Mature male and female gametocytes are found in abundance in the red blood corpuscles and majority of them are typically halter-shaped, while some are broadly oval in form.

A young female gametocyte (Fig. 2), measuring $2.2 \mu$ in diameter, is spherical in outline with a blue stained cytoplasm and circular nucleus. The cytoplasm contains scattered pigment granules. A mature female gametocyte, however, is a typical halteridium, completely filling the infected red blood corpuscle and displacing the nucleus of the latter to the periphery (Fig. 3). The cytoplasm takes up a deep blue stain and contains scattered pigment granules which are dark brown in colour. The nucleus is spherical in outline and sub-central in position. The female gametocytes measure $13.2 \mu \times 5.5 \mu$.

The early male gametocytes (Fig. 4), $6.6 \mu \times 2 \mu$, are elongated bodies with hyaline cytoplasm and a rod-like nucleus. The cytoplasm contains finely scattered pigment granules which are lighter in colour than that of the female. The mature male gametocytes are mostly halter-shaped (Fig. 5) while some are broadly oval in form (Fig. 6). The cytoplasm of the gametocytes appears almost unstained in Geimsa. The pigment has the same form as in the female, but they are aggregated at both poles of the parasites. The nucleus is more or less rectangular in shape, central in position, and contains chromatin granules. The male gametocytes measure $8.8-11 \mu \times 3.3 \mu$.

**Affinities**

The parasite under report resembles *Haemoproteus coraciae* de Mello and Afonso (1935) in general appearance, but differs in structural details. The female gametocytes of *H. zosteropsi* approach those of *H. coraciae* in shape and character of the nucleus, but differ in the homogeneous nature of the cytoplasm unlike that of *H. coraciae*. Further the pigments in *H. zosteropsi* are in the form of fine granules scattered irregularly throughout the cytoplasm and they never show any tendency to aggregate at the poles as in *H. coraciae*. The male gametocytes of *H. zosteropsi* on the other hand,
differ from those of *H. coraciae* in having a rectangular nucleus, the nucleoplasm of which is highly granular.

**Diagnosis**

*Systematic position.*—*Hæmoproteus zosteropsi* n.sp. (Hæmosporidia, Hæmoproteidæ).

*Description.*—Gametocytes halter-shaped, some broadly oval in form; the female gametocytes, measuring 13·2 µ × 5·5 µ, with a spherical nucleus and pigment scattered throughout the cytoplasm; the male gametocyte, measuring 8·8—11 µ × 3·3 µ, with a rectangular nucleus and pigment aggregated at both the poles.

*Location.*—Red blood cells.

*Host.*—*Zosterops palpebrosa palpebrosa* (Temm. and Schlegel)

*Locality.*—Calcutta, Bengal.

*Date.*—June, 1944.

**Observations on *H. danilewskyi* (Grassi and Feletti, 1890)**

Plimmer (1912) reported the occurrence of this parasite in a long list of Indian birds, including the present host, kept in the Zoological Gardens, London. Recently de Mello (1937) recorded this parasite in Scops owl, *Otus bakkamana* Pennant, from Ceylon. We have also encountered *H. danilewskyi* in the blood of the Indian Magpie-Robin *Copsychus s. saularis* (Linn.).

**Family Plasmodiidae Mesnil** (1903)

Of the three genera of the above family, *Proteosoma*, *Laverania* and *Plasmodium*, only the last genus is represented here.

**Genus Plasmodium Marchiafava and Celli** (1885)

During our routine blood examination of birds, we found, the weaver bird *Ploceus philippinus* (Linn.) and the small minivet *Pericrocotus cinnamomeus iredalei* Baker, infected with two distinct species of *Plasmodium* respectively. As these parasites do not resemble any known species of *Plasmodium*, we propose to call them *Plasmodium ploceii* n.sp. and *Plasmodium pericrocoti* n.sp. after the names of their hosts.

**Observations on Plasmodium ploceii** n.sp.

The trophozoites (Fig. 7) are irregular in outline, measuring about 2·2 µ in diameter and are devoid of pigment. The cytoplasm is clear and contains a centrally placed chromatin dot representing the nucleus.
The schizonts (Fig. 8) are also irregular in outline, contain blue stained cytoplasm and a distinct mass of pigment granules. In a mature form (Fig. 9) measuring 6.6 μ in diameter, eight nuclei can be seen.

An early gametocyte is spherical in outline (Fig. 10) and measures 4.4 μ in diameter. The cytoplasm stains blue and contains a spherical nucleus. A group of fine pigment granules can also be seen.

The female gametocytes are variable in form. They may be spherical (Fig. 11) or oval (Fig. 12) in outline. The former measures 5.5 μ in diameter, while the latter 4.4 μ x 3.3 μ. The cytoplasm takes up deep blue stain and contains irregularly scattered pigment granules which are dark brown in colour. The nucleus is more or less sub-centrally placed and may be spherical (Fig. 11) or bi-lobed (Fig. 12) in shape.

The male gametocytes (Fig. 13) are more or less oval in form with one end broader than the other and measure 6.6 μ x 3.3 μ. The cytoplasm is faintly stained and contains pigment granules aggregated at one pole of the parasite. The nucleus is spindle-shaped with the ends pointed and stains lighter than that of the female.

Affinities

The present parasite approaches *Plasmodium praecox* var. *munita* Dasgupta and Siddons (1941). The schizonts and female gametocytes of *P. ploceii* resemble those of *P. praecox* var. *munita* in the number of nuclei and shape respectively; but the two parasites differ from each other in the shape and in the detailed structure of the male gametocytes.

Diagnosis

**Systematic position.**—*Plasmodium ploceii* n.sp. (Hæmosporidia, Plasmodiidae).

**Description.**—Trophozoites irregular and non-pigmented; schizonts, measuring 6.6 μ in diameter, with eight nuclei; female gametocytes spherical (5.5 μ in diameter) or oval (4.4 μ x 3.3 μ), with scattered pigment granules and spherical or bi-lobed nucleus; male gametocytes, measuring 6.6 μ x 3.3 μ more or less oval with one end broader than the other, nucleus spindle-shaped and cytoplasm with the pigment aggregated at one pole; infected red blood cells hypertrophied with nucleus displaced to one end.

**Location.**—Red blood corpuscles.

**Host.**—*Ploceus philippinus* (Linn.)

**Locality.**—Calcutta, Bengal.

**Date.**—June, 1944.
OBSERVATIONS ON Plasmodium pericrocoti n.sp.

The trophozoites (Fig. 14), measuring $2.2\mu$ in diameter, are spherical in outline with hyaline cytoplasm and a chromatin dot representing the nucleus. In these forms no pigment could be seen. Multiple infection of the red blood cells by the early trophozoites are not uncommon. As many as five parasites have been found to infect a corpuscle (Fig. 15).

The early schizonts (Figs. 16 and 17) observed by us are spherical or crescent-shaped with faint blue stained cytoplasm and two nuclei. In these forms pigment granules could not be observed. In later stage, however, (Fig. 18) pigment granules appear for the first time in the cytoplasm. A mature schizont (Fig. 19) measuring $5.5\mu$ in diameter is spherical in outline, with blue stained cytoplasm and pigment granules concentrated at the centre in a small dense mass. In a mature schizont sixteen nuclei can be counted. The infected red cells become distorted with the nucleus displaced to one side.

A female gametocyte (Fig. 20) measuring $9.9\mu \times 4.4\mu$ is more or less oval in outline and completely fills the cytoplasm of the infected red blood cell. The cytoplasm stains deep blue and contains scattered pigment granules. The nucleus is spherical in outline and placed near one pole of the parasite.

The male gametocyte (Fig. 21) measuring $9.6\mu \times 4.4\mu$ is bean-shaped with faint blue stained cytoplasm and the pigment granules aggregated at one pole. The nucleus is spindle-shaped and situated at the convex border of the parasite; it stains lighter than that of the female and contains scattered chromatin granules.

Affinities

Of the known species of Plasmodium from birds, the parasite under report resembles P. praecox (Grassi and Feletti, 1890; vide Wenyon, 1926). The schizonts of P. pericrocoti approach those of P. praecox in shape, number of nuclei, and in the similar clumping of pigment into a single dark mass. But the two species differ from each other in the shape, size and structure of the gametocytes.

Diagnosis

Systematic position.—Plasmodium pericrocoti n.sp. (Hæmosporidia, Plasmodidae)

Description.—Trophozoites spherical and non-pigmented; schizonts measuring $5.5\mu$ in diameter with sixteen nuclei and the pigment collected
into single dense clump; female gametocytes, measuring $9.9 \mu \times 4.4 \mu$, more or less oval with scattered pigment granules and a spherical nucleus; male gametocytes, measuring $9.6 \mu \times 4.4 \mu$, bean-shaped with pigment aggregated at one pole and the nucleus situated at the convex border.

**Location.**—Red blood cells.

**Host.**—Pericrocotus cinnamomeus iredalei Baker.

**Locality.**—Calcutta, Bengal.

**Date.**—June, 1944.

### Table

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### References

Bhatia, B. L. . . . . Fauna of British India (Sporozoa), 1938.
Mukundamurari Chakravarty
& Amiya Bhusan Kar

Fig. 1
**EXPLANATION OF PLATE IV**

All figures are magnified 1,660 times

Figs. 1–6. *Haemoproteus zosteropsi* n.sp.

Fig. 1. An early gametocyte
Fig. 2. A young female gametocyte.
Fig. 3. A mature female gametocyte.
Fig. 4. A young male gametocyte.
Figs. 5 & 6. Mature male gametocytes.

Figs. 7–13. *Plasmodium ploceii* n.sp

Fig. 7. A trophozoite.
Fig. 8. An early schizont.
Fig. 9. A mature schizont showing 8 nuclei.
Fig. 10. An early gametocyte.
Figs. 11 & 12. Female gametocytes.
Fig. 13. A male gametocyte.

Figs. 14–21. *Plasmodium pericrocoti* n.sp.

Fig. 14. A trophozoite.
Fig. 15. A corpuscle showing multiple infection by the parasites.
Figs. 16 & 17. Early schizonts.
Fig. 18. A schizont showing pigment granules.
Fig. 19. A mature schizont showing 16 nuclei. Note the concentration of the pigment granules into a small dense mass.
Fig. 20. A female gametocyte.
Fig. 21. A male gametocyte.