STUDIES ON THE COCCIDIA OF INDIAN BIRDS

II. Observations on Several Species of Coccidia of the Sub-Families Cyclosporinæ and Eimeriinæ.

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CONTENTS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>102</td>
</tr>
<tr>
<td>SUB-FAMILY CYCLOSPORINÆ</td>
<td>103</td>
</tr>
<tr>
<td>Genus Isospora</td>
<td>103</td>
</tr>
<tr>
<td>Observations on Isospora munia n.sp.</td>
<td>103</td>
</tr>
<tr>
<td>Observations on Isospora gymiriana n.sp.</td>
<td>106</td>
</tr>
<tr>
<td>Observations on Isospora temenuchii n.sp.</td>
<td>107</td>
</tr>
<tr>
<td>Genus Dorisiella</td>
<td>109</td>
</tr>
<tr>
<td>Observations on Dorisiella hareni n.sp.</td>
<td>109</td>
</tr>
<tr>
<td>SUB-FAMILY EIMERINÆ</td>
<td>111</td>
</tr>
<tr>
<td>Genus Eimeria</td>
<td>112</td>
</tr>
<tr>
<td>Observations on Eimeria malacce n.sp.</td>
<td>112</td>
</tr>
<tr>
<td>Observations on Eimeria pfeifferi (Labbé)</td>
<td>113</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>114</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>114</td>
</tr>
</tbody>
</table>

INTRODUCTION

This paper is the continuation of the series in our studies on the coccidia from Indian birds and embodies the results of our observations on several species of coccidia of the sub-families Cyclosporinæ and Eimeriinæ. The parasitic species described here are new to science, except Eimeria pfeifferi (Labbé, 1896) which is reported here for the first time from this country.
The birds were either collected from the suburbs of Calcutta or purchased from local dealers. Ten different species of birds were examined for their protozoan parasites and it happened that most 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 found infected out of the total number examined. The seat of infection and the locality of the parasites and the hosts are also noted in the table.

For the maturation of the oocysts 1 per cent. chromic acid solution or 2-5 per cent. potassium bichromate solution was used. For the study of the endogenous stages, the intestine of the infected birds was fixed in Bouin-Duboscq and Brasil's fluid for 24 hours. 6-12 μ thick sections were cut; they were stained with Delafields or iron-alum haematoxylin.

We have great pleasure in recording here our thanks to Dr. S. C. Law, the eminent ornithologist of Calcutta, for his identification of the birds used here.

**Sub-Family Cyclosporinae. Wenyon (1926)**

This sub-family* includes three genera, viz., *Cyclospora*, *Isospora* and *Dorisiella*. The species recorded here belong to the last two genera.

*Genus Isospora Schneider (1875)*

The only species of *Isospora* so far known from Indian birds is *I. lacazei* (Labbé) reported by the writers (1944). During the course of our investigation, we found the following birds namely the black-headed munia *Munia malacca malacca* Linn., the bank myna *Acridotheres ginginianus* (Lath.), and the black-headed myna *Temenuchus pagodarum* (Gmel.) infected with three distinct species of *Isospora*; as these parasites do not resemble any known species of *Isospora* we propose to call them *Isospora munia* n.sp. *Isospora ginginiana* n.sp. and *Isospora temenuchii* n.sp. respectively after the names of their hosts. The black-headed munia was found to be infected with a species of *Dorisiella* and *Eimeria* also.

*Observations on Isospora munia* n.sp.

*Schizogony.*—The youngest trophozoites (Fig. 1) encountered in the sections of intestine of the host are spherical in outline and measure 4-4 μ in diameter. They have nucleus which is placed centrally and consists of a deeply stained chromatic granule with a clear space around it.

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* The classification of the suborder Eimeriidea as given by Hoare (1933) is followed in this work.

B3
The schizonts (Fig. 2) are elongated, oval in shape; the full grown forms measure $10.0-13.2\mu \times 6.6-8.8\mu$. In a mature form sixteen nuclei can be seen. The nuclei have the same characteristic feature as in the previous stage.

The merozoites (Fig. 3) are crescentic in appearance and measure $8.8\mu \times 1.5\mu$. They have a uniformly granular cytoplasm. The nucleus

Figs. 1–9. *Isospora muniae* n.sp.—Fig. 1. An uninucleate trophozoite and a binucleate schizont. Fig. 2. A schizont showing nuclei. Fig. 3. A group of merozoites. Fig. 4. A macrogametocyte. Fig. 5. A microgametocyte showing fully developed microgametes. Fig. 6. An unsegmented oöcyst. Fig. 7. An oöcyst showing spherical sporoblasts. Figs. 8 and 9. Mature oöcysts. Figs. 10–14. *Isospora ginginiana* n.sp.—Fig. 10. An early trophozoite. Fig. 11. A microgametocyte. Fig. 12. A macrogamete. Fig. 13. An unsegmented oöcyst. Fig. 14. A mature oöcyst. (All figures are magnified 1066 times.)
is placed at the centre of the body and is provided with a small deeply stained chromatin mass which is contained within the nuclear membrane.

The endogenous cycle of development of the parasite takes place in the small intestine. Stages representing schizogony are found in the gland cells of the sub-mucous membrane while those of sporogony occur in the mucous membrane.

Sporogony.—The young macrogametocytes are spherical in shape and measure 8·8 μ in diameter. The cytoplasm is highly granular and contains a circular nucleus. The latter has a large karyosome and a nuclear membrane. As the macrogametocytes increase in size, they become oval in shape (Fig. 4) and their cytoplasm becomes vacuolated. The mature forms measure 13·2 μ × 18·8 μ. The macrogametes have the same form and size as the mature macrogametocytes, but the cytoplasm of the former presents deep staining inclusions which are regarded by many as reserve food-material. These inclusions usually occupy the peripheral region of the macrogametes. The nucleus of the macrogamete measures about 4·5 μ in diameter.

The microgametocytes are also oval in shape and contains several small vesicular nuclei arranged along the periphery. The fully grown microgametocytes measure 11·0 μ × 15·4 μ. The microgametes are small comma-shaped bodies (Fig. 5) with both the extremities pointed. Each microgamete measures 4·4 μ in length and is provided with a long flagellum at one end.

Both the mature and the immature oocysts are broadly or elongately oval. They are provided with a micropyle. The unsegmented zygote contained within the immature oocyst is spherical in shape measuring about 14·5 μ in diameter. Its cytoplasm is highly granular and contains several refringent globules (Fig. 6). The oocysts possess a double-layered envelope of about 1·0-2·0 μ thick and they measure 24·7-30·9 μ × 14·4-18·5 μ. Sporulation takes place after 48 hours when two circular sporoblasts appear without leaving any oocystal residuum (Fig. 7).

The sporocysts when fully formed are pyriform in shape with the anterior end pointed and the posterior rounded (Figs. 8 and 9). The sporocysts are also double-layered and each of them is provided with a refractile knob at the pointed anterior end. After the development of the sporozoites, the sporocystic residue is seen scattered irregularly within the sporocyst. The sporocysts measure 14·4-16·5 μ × 10·3 μ.

The sporozoites measuring 6·6 μ × 2·2 μ are sickle-shaped bodies arranged irregularly within the sporocyst (Fig. 9). Their anterior end is pointed and the posterior end rounded where the nucleus is situated.
Affinities.—Of the known species of Isospora from birds the parasite under report has some resemblances with *I. volki* Baughton (1937). The oocysts of *I. muniae* approach those of *I. volki* in shape but differ in size. Absence of micropyle, shape of the sporocysts and the structure of the sporozoites in *I. volki* at once distinguish it from this new coccidian.

Diagnosis—

Systematic position.—Isospora muniae n.sp. (Coccidiida, Eimeriidae).

Description.—Oocysts broadly oval or elongately oval, $24.7-30.9 \mu \times 14.4-18.5 \mu$, with a micropyle, no oocystic residuum; sporocysts pyriform, with a knob at the pointed end, $14.4-16.5 \mu \times 10.3 \mu$, sporocystic residual mass present; sporozoites sickle-shaped, irregularly arranged, $6.6 \mu \times 2.2 \mu$.

Seat of Infection.—Small intestine.

Host.—*Munia malacca malacca*. Linn.

Locality.—Calcutta.

Observations on Isospora ginginiana n.sp.

Schizogony.—Only a few stages representing schizogony were found in our preparations. The stages that we could observe are the earliest trophozoites and the schizonts; the former are circular in outline, possess a chromatin granule which represents the nucleus (Fig. 10) and they measure $2.2 \mu$ in diameter. The schizonts measuring $8.8 \mu$ in diameter are also circular in outline and have 8–16 nuclei scattered irregularly in the cytoplasm.

Sporogony.—The microgametocytes (Fig. 11) measuring $11.0-13.2 \mu$ in diameter, are perfectly spherical in shape and they have an uniformly granular cytoplasm. The nuclei consisting of minute chromatin dots are arranged along the periphery. The mature microgametes are comma-shaped in structure and each of them is provided with a short flagellum at one end.

The macrogametocytes are also spherical in shape and have highly granular cytoplasm containing a nucleus. The nucleus has a membrane around it and an excentrically placed karyosome. The mature macrogametes (Fig. 12), $11.0 \mu$ in diameter, have the same structure as the macrogametocytes, but the cytoplasm of the former is provided with food-material which occurs in isolated heaps and takes up deep stain.

The unsegmented oocysts (Fig. 13) were seen to pass out with fæces of the host. The oocysts, both mature and immature, are perfectly rounded in shape measuring $22.0-24.2 \mu$ in diameter. The unsegmented zygote within the immature oocyst is always spherical in shape and measures $12.0-15.4 \mu$ in diameter. Neither micropyle nor oocystic residuum is present.
The sporocysts, when fully grown, are typically pyriform in shape and have pointed anterior and rounded posterior extremities (Fig. 14). The pointed end is provided with a refractile knob. The sporocysts measure $15.4-17.6\,\mu\times11.0\,\mu$.

The sporozoites are elongated in shape, with their anterior end pointed and the posterior round. They measure $11\,\mu\times4\,\mu$. The cytoplasm is clear and a spherical nucleus is situated at the centre.

Affinities.—Isospora lacazei (Labbé, 1893) and Isospora lyruri Galli-Valerio (1931) resemble the coccidium under report in the shape of oöcyst, all of them being spherical in shape. In size the oöcysts of I. lyruri are much smaller than those of I. ginginiana. The latter species differs from I. lacazei in the structure of the sporocysts and the sporozoites.

Diagnosis—

Systematic position.—Isospora ginginiana n.sp. (Coccidiida, Eimeriidae).

Description.—Oöcysts rounded, $22.0-24.2\,\mu$ in diameter, no micropyle and oöcystic residuum; sporocysts pyriform, with a knob at the pointed end, $15.4-17.6\,\mu\times11.0\,\mu$, sporocystic residuum present, sporozoites elongated and irregularly arranged.

Seat of infection.—Intestine.

Host.—Acridotheres ginginianus (Lath.).

Locality.—Calcutta.

Observations on Isospora temenuchii n.sp.

The endogenous stages of this coccidian could not be found by us; probably the host bird was examined by us at the late stage of infection. Only immature oöcysts were found to come out in large numbers with the faecal matter of the bird.

The majority of the oöcysts are subspherical in shape while a few are slightly ovoid and they measure $22.0-24.2\,\mu\times19.8-22.0\,\mu$. A micropyle could be detected in a few of the oöcysts. The oöcystic wall is about $2\,\mu$ thick and double layered. The unsegmented zygote (Fig. 15) is highly granular and contains several refringent globules. It measures about $15.5\,\mu$ in diameter. The zygote divides equally to give rise to the two sporoblasts leaving no oöcystal residue.

The sporoblasts first appear as spherical bodies but soon they become elongated. The fully developed sporocysts are elongately oval in shape (Fig. 16), with the anterior end somewhat bluntly pointed. At this narrow
end there is a well-developed knob. The sporocysts measure $15.4 - 17.6 \mu \times 11.0 \mu$, the maximum width being at the middle region of the sporocyst. The sporocystal residual body is well marked after the differentiation of the sporozoites and accumulates in the form of a bunch which is about $5.0 \mu$ in diameter.
The sporozoites are elongated in shape with the anterior end narrowing down to a blunt point while the posterior end remains round. The nucleus which is spherical or slightly oval, is placed near the centre of the body or slightly towards the rounded end of the sporozoite. The sporozoites measure $8.8 \mu \times 3.3 \mu$.

Affinities.—This parasite resembles *Isospora nucifragae* Galli-Valerio (1933) and *Isospora strigos* Yakimoff and Matschaulsky (1936) but differs from both of them in many respects. *I. temenuchii* differs from *I. strigos* in having a micropyle, a well-marked sporocystic residuum and in the structure of the sporozoites.

**Diagnosis**—

Systematic position.—*Isospora temenuchii* n.sp. (Coccidiida, Eimeriidae).

Description.—Oocysts sub-spherical or slightly oval, $22.0-24.2 \mu \times 19.8-22.0 \mu$, micropyle present, no oocystic residuum; sporocysts elongately oval, with a knob at the pointed end, $15.4-17.6 \mu \times 11.0 \mu$, sporocystic residuum well marked; sporozoites elongated.

Seat of infection.—Intestine.

Host.—*Temenuchus pagodorum* (Gmel.).

Locality.—Calcutta.

**Genus** Dorisiella Ray (1930)

The genus *Dorisiella* was established in 1930, by Ray to accommodate the species *scolelepidis* found in the alimentary canal of the polychaete worm *Scolelepis fuliginosa* Claparede, occurring at Plymouth. Since then another species *D. hoarei* has been described by Yakimoff et Gousseff (1935) from the serpent *Elaps quatuor-lineata sauromates* Pallas. The species found by us in the alimentary canal of the bird *Munia malacca malacca* Linn. is new to science and is the third representative of the genus. For the first time it is recorded from an avian host, and is the only member of the genus so far reported from India. We propose to call it *Dorisiella hareni* n.sp. after the founder of the genus.

Observations on *Dorisiella hareni* n.sp.

Schizogony.—The stages representing schizogony occur in the gland cells of the submucosa and they are restricted in the small intestine of the host.

The youngest trophozoite, about $4 \mu$ in diameter is circular in outline. The cytoplasm is very clear and it contains a nucleus which consists of a
chromatin mass of very small size. The binucleate schizonts have the same characteristic features as shown by the uninucleate trophozoites.

The full grown schizonts (Fig. 17), measuring 13·2 μ × 6·6 μ are oval in shape and possess sixteen chromatin granules which are regarded as the precursors of the nuclei of the merozoites. The cytoplasm of these stages are uniformly granular.

The merozoites (Fig. 18) are elongated in form having one of the ends pointed and the other rounded. The cytoplasm of the merozoites is uniformly granular. The nucleus, at the centre, is circular in outline and consists of a small chromatin granule surrounded by a delicate membrane. They measure 8·8 μ × 2·2 μ.

Sporogony.—Both the macro and the microgametocytes were found in large numbers in the mucous-membrane of the small intestine.

An early macrogametocyte is spherical in shape and its nucleus contains a karyosome which is comparatively larger than the chromatin mass of the early trophozoite; the nucleus possesses a well-defined nuclear membrane. The cytoplasm of these forms is uniformly granular. As the microgametocytes grow in size the cytoplasm becomes vacuolar and in a still later stage heaps of food material are seen to accumulate within the vacuoles. These latter stages represent the mature macrogametes (Fig. 19) which retain the shape of the early macrogametocytes and measure 13·2 μ in diameter.

The fully grown microgametocytes (Fig. 20), measuring 9·8 μ in diameter, are also spherical in outline and contain a large number of dot-like chromatin granules arranged along the periphery. The chromatin granules become vesicular and give rise to the microgametes (Fig. 21). The latter are curved bodies having both the extremities pointed. From one of the ends of a microgamete a short flagellum is developed.

The fertilized macrogametes can be distinguished from other stages by the nature of the cytoplasm, which on surface view looks like a powdery mass and also by the structure of the nucleus. The nuclear membrane is ill-defined and the karyosome stains faintly.

The unsegmented oocysts (Fig. 22) were discharged in large numbers with the faeces of the host. Both the immature and mature oocysts are spherical in contour and possess a double envelope which is about 2·0 μ thick. No micropyile could be seen at any stage of development of the oocysts. The oocysts measure 18·5 μ–22·6 μ in diameter with an average of 20·6 μ. The unsegmented zygote, which is circular in outline, is highly granular and contains several refringent globules. The zygote divides into
Studies on the Coccidia of Indian Birds—II

111
two sporoblasts leaving no residuum in the oöcyst and the approximate time required for its division in 2·5 per cent. potassium bichromate solution, is about 24 hours.

The sporoblasts when they first appear, are ovoidal but soon they assume typical pyriform shape (Figs. 23–25). At the anterior pointed end of the sporocyst there is a knob which is not well developed.

The sporocysts measure 14·4–18·5 μ × 9·3–10·3 μ. They reach full maturity in two days when sporozoites begin to differentiate out in the form of spherical bodies (Fig. 23). The sporozoites (Figs. 24–25) are fully-formed after 3 or 4 days leaving a diffuse sporocystic residual mass.

The sporozoites are club-shaped and have bluntly pointed anterior end. The nucleus is situated near the posterior rounded end of the sporozoite which measures 8·2 μ × 2·2 μ.

Affinities.—The parasite under report differs from the type species D. scolelepidis in the shape of the oöcyst* and in the structure of the sporocysts which are oval in shape in the latter. Moreover, there is a considerable difference between the endogenous stages of D. hareni and D. scolelepidis.

Dorisiella hoarei Yakimoff et Gousseff (1935) resembles the present coccidium both in the shape and size of the oöcysts. In spite of this resemblance, they differ in the structure of the sporocysts and the sporozoites, which are of diagnostic value.

Diagnosis—

Systematic position.—Dorisiella hareni n.sp. (Coccidiida, Eimeriidae).

Description.—Oöcysts spherical, range 18·5–22·6 μ with an average 20·6 μ, micropyle and oöcystic residuum not present; sporocysts pyriform with a knob at the pointed end, range 14·2–18·5 μ × 9·3–10·3 μ, sporocystic residuum diffuse; sporozoites club-shaped measuring 8·2 μ × 2·2 μ.

Seat of infection.—Intestine.

Host.—Munia malacca malacca Linn.

Locality.—Calcutta.

Sub-Family Eimeriinae Wenyon (1926)

Of the three genera of this sub-family only one genus namely Eimeria is represented here.

* Hoare (1933) has pointed out that Ray (1930) in fig. 17, pl. XLI in his paper has shown a line connecting the two sporoblasts, though Ray stated that there is no common envelope or oöcyst i n D. scolelepidis. The line connecting the sporoblasts is regarded by Hoare as the oöcyst membrane.
Genus Eimeria Schneider (1875)

The only species of this genus described from the avian fauna of this country is Eimeria columbae Das-Gupta (1938) and we add here two more species to the list. The first is a new coccidian which we propose to call Eimeria malaccae n.sp., found in the alimentary canal of the bird Munia malacca malacca Linn. and the second is the well-known species Eimeria pfeifferi (Labbé) obtained from the Indian pigeon Columba livia intermedia, Strickl.

Observations on Eimeria malaccae n.sp.

Only a few oocysts of this coccidium were found by us, the endogenous stages could not be found in our preparations.

The oocysts both mature and immature, are either broadly oval or elongately oval in structure and measure 26·8–30·9 μ × 16·4–18·5 μ. A micropyle is present in the oocyst but no oocystic residuum is found after the formation of the sporoblasts (Fig. 26).

The sporocysts (Fig. 27) could be seen to develop in only one oocyst and the shape of the former is more or less oval with the anterior end pointed. A small knob can be seen at the anterior pointed end of the sporocyst which measures 12·4 μ × 10·3 μ. A diffuse sporocystic residuum is present. The sporozoites, measuring 8·3 μ × 2·1 μ, are elongated in shape with the anterior end tapering. The nucleus is placed near the posterior end of the sporozoite.

Affinities.—The oocysts of the parasite under report approach those of Eimeria caucasia Yakimoff and Buewitsch (1932), E. dispersa Tyzzer (1929), and E. johnsoni Yakimoff and Rastegaieff (1931), E. melangridis Tyzzer (1929), and E. tyzzeri Yakimoff and Rastegaieff (1931) in size, but differ from them in other characters.

Diagnosis—

Systematic position.—Eimeria malaccae n.sp. (Coccidiida, Eimeriidae).

Description.—Oocysts broadly oval or elongately oval, range 26·8–30·9 μ × 16·5–18·5 μ, micropyle present but no oocystic residuum; sporocysts oval with anterior end pointed bearing a small knob, 12·4 μ × 10·3 μ, diffuse sporocystic residuum present; sporozoites elongated with anterior end tapering and measure 8·3 μ × 2·1 μ.

Seat of infection.—Intestine.

Host.—Munia malacca malacca Linn.

Locality.—Calcutta.
Studies on the Coccidia of Indian Birds—I

Observations on Eimeria pfeifferi (Labbe)

This coccidian has been studied by various workers from different parts of the world. It is reported for the first time from this country.

The oöcysts (Fig. 28) were obtained by us from the faecal matter of a number of pigeons. They are either oval or spherical in shape, the oval form measures 19·8–20·9 μ x 16·5–17·6 μ while the spherical one is 17·6–18·7 μ in diameter. The range in size of the oöcysts as given by Wenyōn (1926) varies 15·0–26·0 μ x 14·0–24·0 μ. Wenyōn states “There is no evident micropyle in the oöcyst, and no residual body is formed within it, but a large one appears in each of the sporocyst.” The latter part of his statement needs no comment, but it should be noted here that a small micropyle occurs in the majority of the oöcysts examined by us. Nieschulz (1925) has delineated a micropyle-like structure in Figs. 11 and 14 of his Pl. 17. but no mention of it has been made in the text.

The sporocysts have the same characteristic features as described by previous workers and they measure 11·0–13·2 μ x 6·6 μ. The sporocystic residuum is accumulated into a mass and appears light green in colour under reflected light.

The sporozoites which are elongated bodies, also appear light green in colour and measure 6·6 μ x 2·2 μ.

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* All the birds were infected with Dorisiella harenii, four with Isospora muniae and one with Eimeria malacca.
Summary

1. Three new species of *Isospora* have been described.
2. A new species of the genus *Dorisiella* is recorded and described for the first time from an avian host and also from India.
3. A new species of *Eimeria* is described.
4. *Eimeria pfeifferi* (Labbé) is reported for the first time from this country.

REFERENCES


Wenyon, C. M. .. *Protozoology*, II, 1926, Bailliere Tindall and Cox.


*Not available to the authors.