STUDIES ON THE TREMATODE PARASITES OF BIRDS.


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The discovery of the first genus of this family was originally made by Bilharz in 1851 when he recovered some worms from the mesenteric veins of a native of Cairo. This was reported by Bilharz in 1852 who named it Distomum hæmatobium. Later this genus was reported by other workers under different names, viz., Gynæcophorus Diesing, 1858; Bilharzia Cobbold, 1859; Thecosome Moquin-Tandon, 1860. The name “Distomum” for this blood-fluke was a misnomer and was replaced by Schistosoma by Weinland in 1858; and although later workers tried to immortalize the name of Bilharz, the discoverer of this blood-fluke, by naming it after him, the name had to be given up in view of priority of Schistosoma.

Looss (1899) created the family Schistosomidae for the genus Schistosoma Weinland (1858) and added the second genus Bilharziella to the family which was described earlier by Kowalewski (1895) under the name of Bilharzia polonica. Odhner (1910) described Gigantobilharzia and later (1912) added another genus Ornithobilharzia. Johnston (1917) reported the genus Austrobilharzia from Australia. Three years later Skrjabin and Zakharow (1920) removed an earlier form Bilharziella pulverulenta Braun, 1901, to their new genus Dendritobilharzia. In the same year they recorded another new genus Trichobilharzia. Tanabe (1923) created the genus Schistosomatium for his experimentally obtained forms in white rats and mice. Travassos (1923) added the genus Macrobilharzia to the family. The latest work on the family is that of Price (1929) where he recognizes all these forms, except Macrobilharzia of Travassos which he regards as a synonym of Ornithobilharzia, and creates three new genera Microbilharzia, Heterobilharzia and Paraschistosomatium. He also divides the family Schistosomidae into two sub-families, Schistosominæ and Bilharziellinæ. Subsequently (1931) the
same author in a brief note revives the genus *Macrobilharzia* and sup-
presses one of his newly created genera, viz., *Paraschistosomatium* as a
synonym of *Macrobilharzia*. The family Schistosomidae is of recent
occurrence in India. Montgomery (1906) described *Schistosoma indica*,
from mammals. Christophers and Stephens (1905) discovered an egg of
*Schistosoma spindalis* in the urine of a Madrasi. The larval stages have
been recorded by Soparkar (1921) and Sewell (1922). Leiper (1923)
mentions that several cases of infection occurred in the neighbourhood
of Hyderabad after the return of infected troops from Egypt.

From birds, however, the family has been very recently reported in
India. The earliest case, so far as the writer is aware, is from Rangoon
when Gogate (1914) obtained two immature male specimens of blood-flukes
from wild ducks. Although he has neither given diagrams nor adequate
description of his forms, he tentatively refers them as *Ornithobilharzia* sp.
under the subfamily Schistosominae. The writer, in the course of his
investigations, has also come across two cases of blood-fluke infection in
birds. These forms, which are being described in the present communi-
cation, come under the subfamily Bilharziellinae Price, 1929, but owing
to certain peculiar characters presented by them necessitate the emendment
of the subfamily diagnosis.

Subfamily Bilharziellinae Price, 1929, emended.

Schistosomidae: Suckers present or absent. Gynaecophoric canal
absent or imperfectly formed or sometimes well developed. Paired intes-
tinal caeca short, uniting cephalad of the middle of the body; common
cæcum long, with or without lateral dendritic branches. Testes numerous
and situated behind the cæcal union along the course of the common
cæcum. Uterus short, containing a single egg.

Type genus—*Bilharziella* Looss, 1899.

*Bilharziella indica* N. G. N. Sp.

A very large number, exceeding 200, of specimens of this species were
obtained from the main blood vessels and internal organs of the common
teal, *Nettion crecca*. The bird which was captured at the Chinhut Lake,
about 8 miles from Lucknow, was kept under observation but died next
morning. The post-mortem examination revealed a very heavy infection with
*Bilharziella*. There were signs of lesion formation in liver, kidney and even lungs.

The animals were inactive showing little movement when liberat-
ed in salt solution. They appeared white in colour and were sticking
fast to the tissues by their powerful ventral sucker which is a cup-shaped
structure with slightly pedunculated base.
Male.—It is a long, thin animal with blunt anterior end and tapering posterior end. The length of the specimen is 2.95 mm. and the maximum breadth which is a little behind the caecal union is .375 mm. The lateral edges of the body are rolled inwards to form a deep gynæcophoric groove which extends right from the hinder end of the oral sucker up to the posterior end.

![Text Fig. 1. Chinhuta indica male—Lateral view showing the Gynæcophoric groove.](image)

The circular oral sucker lies ventrally and is rather weakly developed. It measures .1 mm. in diameter. The ventral sucker, which is muscular and very powerful, is larger than the oral sucker and measures .15 mm. in diameter and lies at a distance of .5 mm. from the anterior end.

The mouth leads into a long thin oesophagus which measures .375 mm. There is no pharynx in these forms. There are a large number of unicellular glands surrounding the base of the oesophagus and they appear to be arranged in a grape-bunch manner. It is rather difficult to surmise the exact nature of these glands but probably they may be producing some secretions which prevent the clotting of blood on which these parasites feed.

The oesophagus divides into two intestinal cæca at its posterior end just in front of the ventral sucker. There is a small cæcal projection directed forwards just at the intestinal bifurcation which probably is a representative of the H-shaped cæcal bifurcation seen in some other blood-flukes. The two intestinal cæca run dorsal to the ventral sucker and after a brief course
join together in the pre-equatorial region to form a common cæcum at a distance of 0.625 mm. behind the ventral sucker and 1.275 mm. from the anterior end. The common cæcum which is longer than the separate intestinal cæca runs behind in a zigzag manner ending blindly at a distance of about 0.1 mm. from the posterior end. The common cæcum shows thickenings of its walls at various places which also become sharply pointed.

Text Fig. 2. *Chinhula indica* male—Ventral view showing general anatomy.

Text Fig. 3. Cirrus sac showing bilobed vesicula seminalis, prostate cells and pars prostatica—ventral view.

The testes, which vary between 70-80 in number, lie on the two sides of the common cæcum, beginning just behind the cæcal union and ending
a little in front of the cæcal end. They are oval bodies of variable size, the largest measuring \(1.25 \text{ mm.} \times 0.04 \text{ mm.}\) and the smallest measuring \(0.05 \text{ mm.} \times 0.025 \text{ mm.}\). The vesicula seminalis is a lobed structure, situated behind the ventral sucker. It consists of a large oval lobe measuring \(1.17 \text{ mm.} \times 0.0875 \text{ mm.}\) and a small lobe, irregular in shape measuring \(0.087 \text{ mm.} \times 0.07 \text{ mm.}\) and joined by a very narrow constriction in the middle. The smaller lobe of the vesicula seminalis is enclosed within the cirrus sac which is a long cylindrical body containing the ejaculatory duct, pars prostatica and a large number of prostate gland-cells. The terminal end of the cirrus sac is bent and opens at the genital pore on the left side of the median line just in front of the level of the cæcal union. A small S-shaped duct leads from the vesicula seminalis to open into an elliptical pars prostatica measuring \(1 \text{ mm.}\) in length. A small duct terminating in the cirrus arises from the pars prostatica, takes a bent course and opens out at the genital pore.

**Female.**—The female is much smaller in size than the male. It measures \(1.8 \text{ mm.}\) in length and has a maximum breadth of about \(1.19 \text{ mm.}\) behind the ovary in the level of the vitellaria. The body is flat and narrower towards the two ends. It does not show any inrolling of its lateral edges. The oral sucker is ventral and measures \(0.04 \text{ mm.}\) in diameter. The ventral sucker is strongly developed as in the case of the male and measures \(0.075 \text{ mm.}\) in diameter.

The mouth leads into a long oesophagus which measures \(2.25 \text{ mm.}\) and is surrounded at its base by the unicellular oesophageal glands. It bifurcates into the two intestinal cæca at its posterior end, about \(0.075 \text{ mm.}\) in front of the ventral sucker. The two intestinal cæca run for a short distance and unite to form a common cæcum at the level of the anterior end of the ovary at a distance of \(0.25 \text{ mm.}\) from the ventral sucker and about \(0.675 \text{ mm.}\) from the anterior end. The common cæcum follows a zigzag
course behind, shows peculiar thickenings of its wall and ends at a distance
of \( \cdot 05 \text{ mm.} \) from the posterior end.

The ovary is an elongated sinuous body, broader anteriorly and
tapering posteriorly. It lies at a distance of \( \cdot 27 \text{ mm.} \) behind the ventral
sucker and measures \( \cdot 155 \text{ mm.} \) in length and \( \cdot 05 \text{ mm.} \) in maximum breadth.
The oviduct arises from the right side of the broad anterior end of the ovary
and after a sharp curve enters the \( \ddot{\text{o}} \)otype. The \( \ddot{\text{o}} \)otype is surrounded by small
unicellular shell-glands. The short straight uterus arises as a broad tube
in front of the \( \ddot{\text{o}} \)otype and ends at the genital pore, \( \cdot 04 \text{ mm.} \) behind the
ventral sucker. No eggs were found in the uterus.

The vitellaria consist of distinct and large follicles which extend right
behind the ovary to the posterior end. They lie on the two sides of the
common \( \text{cæcum} \) and pour their yolk by narrow ducts into a large \( \text{U} \)-shaped
vitelline reservoir which lies at the level of the ovary and leads by a thin
duct to open into the \( \ddot{\text{o}} \)otype.

To sum up, the genus \textit{Chinhuta} is characterised thus:—

Male with a well-developed gynæcophoric canal, extending from a
little behind the oral sucker up to the posterior end; female with flattened
body and smaller than the male. Suckers present. Oesophagus provided
with unicellular \( \text{œsophageal} \) glands. The two intestinal \( \text{cæca} \) unite a little
in front of the middle of body; common \( \text{cæcum} \) long, without lateral
branches but provided with angular thickenings of its wall. Testes vary
between 70–80 in number and extend from the \( \text{cæcal} \) union to the posterior
end of the animal. Cirrus pouch well developed, enclosing a part of vesicu-
ula seminalis, prostate gland-cells, pars prostatica and the cirrus. The
terminal end of the cirrus sac is slighlty bent to the left side. The male
genital pore lies slightly to the left of the median line near the middle of
the body. The ovary is elongated and sinuous, situated at the level of the
\( \text{cæcal} \) union. Uterus short and straight. The female genital opening is a little
behind the acetabulum. Vitellaria situated on the sides of the common
\( \text{cæcum} \), in distinct follicles. A vitelline reservoir is present.

Type species—\textit{Chinhuta indica}.

\textit{Remarks}.—The new genus differs from the members of the subfamily
Bilharziellinae in having an extremely well-developed gynæcophoric canal
in which feature it stands near the subfamily Schistosominae. But it
differs from the subfamily Schistosominae in having cephalad union of the
intestinal \( \text{cæca} \) and testes behind the \( \text{cæcal} \) union, features in which it closely
resembles the subfamily Bilharziellinae. The genus, in fact, forms a con-
nnecting link between the two subfamilies. The nearest ally of the new
genus is the genus *Bilharziella* with which it shows several features of resemblance. It differs, however, from the genus *Bilharziella* in having an extremely well-developed gynaecophoric canal, in the possession of the oesophageal glands, bent terminal end of the cirrus sac and in the position of the female genital opening. It is, therefore, considered necessary to create a new genus which is designated *Chinhuta* owing to its recovery from a bird caught at the lake, Chinhut.

*Gigantobilharzia egreta* N. Sp.

Only one male specimen of this parasite was obtained from the renal vein of the cattle egret, *Bulbulcus ibis coromandus*. The worm was quite inactive and white in colour when liberated in normal salt solution. It is a long thread-like, thin worm and is somewhat fragile. The length

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**Text Fig. 5.** *Gigantobilharzia egreta* male—Ventral view of (a) Anterior end showing intestine and cirrus sac and (b) Posterior end showing the termination of intestinal cæcum.

**Text Fig. 6.** *C. egreta*, middle of the body showing the relation of testes with intestine.
of the specimen, obtained by the writer, is 38.85 mm. of which about 35.6 mm. is occupied by the testes. It is broadest in the middle where it measures 2.275 mm. The body tapers gradually towards the anterior end; posteriorly also it tapers but widens again to end in a dilated and blunt posterior end. There is no trace of an oral or a ventral sucker. The gynaecophoric canal is also absent. The mouth begins in a shallow depression and is continued behind into a long oesophagus 1.2 mm. in size. The intestinal cæca arise from the posterior end of the oesophagus and run for a very short distance to meet to form the common intestinal cæcum. The cæcal union takes place at a distance of about .4 mm. behind the cæcal bifurcation. The common cæcum extends in a zigzag manner to almost up to the dilated posterior end of the animal.

The exceedingly large number of testes, more than 600, are round or oval bodies and lie on the two sides of the common cæcum. They vary in size, the largest measures .15 mm. x .1 mm. and the smallest .075 mm. x .05 mm. The vesicula seminalis lies in the space enclosed by the bifurcation and re-union of intestinal cæca. It is a sinuous structure, about .2 mm. in size and ends in a small papilla on which is situated the genital aperture which lies at a distance of .175 mm. from the cæcal union and .225 mm. from the cæcal bifurcation. The writer has not been able to observe clearly a cirrus sac in this species which probably is present.

Remarks.—So far only two species of the genus have been described, G. acotylea by Odhner (1910) from Sweden and G. monacotylea by Szidat (1930) from East Prussia. The present form, of which the writer has obtained a male specimen, differs from both the existing species in several important characters. It differs from G. acotylea in the absence of a gynaecophoric canal, in having its genital opening slightly dextral and in possessing a comparatively much longer oesophagus. From G. monacotylea, it differs in the absence of an oral sucker, in the position of the genital pore, in much smaller vesicula seminalis and in having a much longer oesophagus. It is therefore, designated as a new species for which the name Gigantobilharzia egreta is proposed.

Remarks on the Family Schistosomidae.

The family Schistosomidae contains 11 genera and these have been grouped into two subfamilies by Price (1929). The subfamily Schistosominae is distinguished from the other subfamily Bilharziellinae on the basis of a well-developed gynaecophoric canal and re-union of the intestinal cæca behind the middle of the body. The discovery of the new genus Chinhula, with an extremely well-developed gynaecophoric canal and
cephalad union of the intestinal cæca, is very interesting as it appears to form a connecting link between the two existing subfamilies. The difference between these subfamilies, therefore, narrows down to only one character, viz., the level of the re-union of the intestinal cæca. This naturally creates a doubt as to the validity of the subfamily division under the family.

Another interesting feature of systematic value is the occurrence of the cirrus sac which has been described in some species of the family. Unfortunately, the writer could not have an access to all the literature on the subject but feels that a re-study of some of the forms is needed. Species have been described under the same genus in which a cirrus sac is either present or absent. It is rather strange to find this discount on the value of the cirrus sac, which has been regarded as a subfamily character in various cases. The writer, therefore, urges for a revision of the genera and species of the family Schistosomide in order to remove the prevailing confusion and thereby to place the group on a sound basis.

The writer wishes to record here his sincere thanks to Dr. G. S. Thapar for his valuable criticism and suggestions during the course of this work.

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Fig. A.—Section of Liver of *Nettion crecca* showing lesion formation due to the presence of *Chinkuta indica*.

Fig. B.—Section of Kidney of *Nettion crecca* showing *Chinkuta indica* in the cavity of the kidney.

Fig. C.—Section of Kidney of *Nettion crecca* showing *Chinkuta indica* in the renal vein, obliterating the cavity.


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