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Research Article

Two new records of parasitic trematodes (Plagiorchiida: Opecoelidae and Bucephalidae) in fishes from India

A Ghosh*, S Das & U Bhattacharya

Zoological Survey of India, M Block, New Alipore, Kolkata, West Bengal – 700 053, India
*[E-mail: aninditaghosh2009@rediffmail.com]

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The study reports two species of parasitic trematodes in fishes, namely, *Coitocaecum plagiorchis* Ozaki, 1926 (Opecoelidae) and *Prosorhynchus squamatus* Odhner, 1905 (Bucephalidae). These parasites were collected from the fishes *Glossogobius giuris* (Hamilton, 1822) and *Synaptura commersonnii* (Lacepède, 1802), respectively, from the riverside of Lothian Island in the Sundarban Biosphere Reserve, West Bengal (India). Both reported species constitute new records for the Indian fauna, while both fish species constitute new host records for the respective parasites. The description and distribution of these parasites are discussed in the present study.

[**Keywords**: *Coitocaecum plagiorchis*, *Glossogobius giuris*, Lothian Island, *Prosorhynchus squamatus*, Sundarban Biosphere Reserve, *Synaptura commersonnii*]

Introduction

Trematodes usually infect the intestines of fish hosts, but in severe cases, they may infect the lungs, bile duct, and other tissues. Genus *Coitocaecum* under Family Opecoelidae was coined by Nicoll (1915)[1] with the type species *C. gymnophallum* Nicoll, 1915. Globally, 48 valid species of *Coitocaecum* have been reported[2], with only 11 species from India. While, genus *Prosorhynchus* was coined by Odhner (1905)[3] and 78 valid species of *Prosorhynchus* have been reported so far[2], of which 11 species have been recorded from India. During the present study, *Coitocaecum plagiorchis* Ozaki, 1926 and *Prosorhynchus squamatus* Odhner, 1905 were collected from the intestines of *Glossogobius giuris* (Hamilton, 1822) and *Synaptura commersonnii* (Lacepède, 1802), respectively, from Lothian Island (SBR), West Bengal (India). Very few studies have been carried out on the parasitic trematodes in fishes from Sundarbans[4,5], and no known report exists on fish trematodes from the Lothian Island of Sundarbans.

Morphological characters of the reported species in the present study have been compared with their original descriptions[3,6] (Tables 1 & 2). For both the genus *Coitocaecum* Nicoll, 1915 and *Prosorhynchus* Odhner, 1905, list of species earlier reported from India (Tables 3 & 4) and also comparison of morphological characters of both the species with earlier reported species in India[7-22] (Tables 5 & 6) have been incorporated in this document. List of host species (Tables 7 & 8) reported earlier and in this study for both the species has also been included in this document.

Material and Methods

Study area

Sundarban is the largest delta with a mangrove forest in the world. UNESCO declared it as a Sundarban Biosphere Reserve (SBR) in 1989. The Sundarban Biosphere Reserve comprises one National Park and three Wildlife Sanctuaries: Sajnekhali, Lothian Island, and Haliday Island. Lothian Island was notified as a Wildlife Sanctuary in June 1976. It is located between 21°36′49.0″ N to 21°42′31.97″ N latitude and 88°18′40.0″ E to 88°20′21.98″ E longitude, covering an area of 38 sq. km. It is situated at the confluence of the river Saptamukhi and the Bay of Bengal.

Collection of host species and parasites

Host fish species were collected from the riverside of Lothian Island through fishes caught by local fishermen during the survey. Six specimens of *Glossogobius giuris* (Hamilton, 1822) and two specimens of *Synaptura commersoni* (Lacepede,

Table 1 — Comparative chart of morphological characters of the species *Coitocaecum plagiorchis* Ozaki, 1926 with original description

Morphological characters	Original description	Present description
Body shape	Ovate, fairly broad	Oval, small, broad at posterior end
Sucker ratio	1 : 1.6–2.0	1:1.66
Prepharynx	Very short	Rudimentary
Pharynx	Barrel shaped	Barrel shaped
Intestinal caeca	Bifurcates halfway between two suckers	Bifurcates midway between two suckers
Testes	Usually diagonal but nearly tandem, contiguous	Entire, diagonal, contiguous
Genital pore	Sinistrally submedian, at about level of pharynx	Submedian, at the level of posterior part of pharynx
Vitellaria	Follicular; follicles distributed between pharynx or sometimes oral sucker and posterior extremity of body	Follicular, extend from posterior portion of oral sucker to the posterior end of the body
Ovary	Globular, submedian, anterodextral to anterior testis	Pyriform, anterolateral to the anterior testis
Excretory vesicle	'I' shaped	'I' shaped

Table 2 — Comparative chart of morphological characters of the species *Prosorhynchus squamatus* Odhner, 1905 with original description

Morphological characters	Original description	Present description
Body shape	Oval	Ovoid
Cuticle	Covered with closely set spines	covered with very minute closely set spines
Oral sucker	Rostellum like	Rostellum like
Intestine	Saccular, blindly ended	Saclike, blindly ended
Testes	Slightly broader than long, situated in the third quarter of the body	Slightly broader than long, closed together, situated at posterior quarter of the body
Ovary	Situated just above the anterior testis and partially overlapping it	Ovary partially overlapping right testis
Vitellaria	Forming an arc midway between the rostellum and the mouth opening	Forming an arc in between oral sucker and mouth opening.
Cirrus sac	Very large, lies on the left side of the body	Large, 546.23 long; extends from genital atrium to the level of posterior end of left testis

Table 3 — List of species of the genus *Coitocaecum* Nicoll, 1910 earlier reported from India

Sl. No.	Species	Host	Distribution in India	Global distribution
1	*Coitocaecum orientalis* Dwivedi, 1978	*Nandus nandus* (Hamilton, 1822)	Uttar Pradesh, Madhya Pradesh	_
2	*Coitocaecum bengalense* (Madhavi, Narasimhulu & Shameem, 1986) Bray, 1987	*Thryssa mystax* (Bloch & Schneider, 1801)	Andhra Pradesh (Bay of Bengal)	South Africa
3	*Coitocaecum bombayense* (Ahmad, 1984) Bray, 1987	*Gymnothorax undulatus* (Lacepède, 1903)	Maharashtra (Arabian sea)	South Africa
4	*Coitocaecum indicum* Ahmad, 1980	*Thryssa mystax* (Bloch & Schneider, 1801)	Bay of Bengal	-
5	*Coitocaecum purius* Madhavi & Bray, 2018 (= *C. manteri* Ahmad, 1980)	*Glyphisodon bengalensis* Cuvier & Valenciennes, 1830	Odisha, Bay of Bengal	-
6	*Coitocaecum scombri* Ahmad, 1980	*Rastrelliger kanagurta* (Cuvier, 1860)	Andhra Pradesh, Odisha, West Bengal, Bay of Bengal	-
7	*Coitocaecum thapari* Ahmad, 1980	*Trachinocephalus myops* (Forster, 1801)	Andhra Pradesh, Odisha, West Bengal, Bay of Bengal	-
8	*Coitocaecum longivesiculum* Madhavi & Bray, 2018	*Parupeneus macronemus* (Lacepede,1801)	Andhra Pradesh, Odisha, West Bengal, Bay of Bengal	-
9	*Coitocaecum thrissoclesis* (Bilqees, 1972) Bray, 1987	*Setipinna phasa* (Hamilton, 1822) *Thryssa purava* (Hamilton, 1822)	Andhra Pradesh, Bay of Bengal	Pakistan, South Africa
10	*Coitocaecum tropicum* Manter, 1940	*Bathygobius soporator* (Valenciennes, 1837), *Halichoeres dispilus* (Günther, 1864), *Malacoctenus zonifer* (Jordan & Gilbert, 1882), *Opistognathus scops* (Jenkins & Evermann, 1889)	Andaman & Nicobar Islands	Galapagos Island and its neighbouring Pacific, South America
11	*Coitocaecum chaetodoni* Ahmad, 1984	*Chaetodon pictus* Forsskal, 1775	Maharashtra (Arabian Sea)	South Africa

Table 4 — List of species of the genus *Prosorhynchus* Odhner, 1905 earlier reported from India

SL. No.	Species	Host	Distribution in India	Global Distribution
1	*Prosorhynchus atlanticus* Manter, 1940	*Epinephelus malabaricus* (Bloch & Schneider, 1801)	Karnataka	Florida, Carribean Sea, Gulf of Mexico
2	*Prosorhynchus bengalensis* Gupta & Gupta, 1987	*Sphyraena obtusata* Cuvier, 1829	Eastern India	-
3	*Prosorhynchus tewariae* Gupta & Gupta, 1987	*Scomberoides tala* (Cuvier, 1832), *S. lysan* (Forsskål, 1775)	Eastern India	Celebes
4	*Prosorhynchus epinepheli* Yamaguti, 1939	*Mycteroperca acutirostris* (Valenciennes, 1828), *Epinephelus chlorostigma* (Valenciennes, 1828), *E. diacanthus* (Valenciennes, 1828), *E. areolatus* (Forsskål, 1775)	Tamil Nadu, Karnataka, Gujarat	Japan, Indian Ocean, Persian Gulf, Red Sea, South China Sea
5	*Prosorhynchus indicus* Madhavi, 1974 (= *P. caballeroi* Gupta & Ahmad, 1976)	*Scomberoides tala* (Cuvier, 1832)	Eastern India	-
6	*Prosorhynchus madhaviae* Gupta & Gupta, 1990	*Parastromateus niger* (Bloch, 1795)	Eastern India	-
7	*Prosorhynchus manteri* Srivastava, 1938	*Takifugu oblongus* (Bloch, 1786), *Trichiurus lepturus* Linnaeus, 1758, *Eupleurogrammus muticus* (Gray, 1831)	Eastern India	Mozambique, Persian Gulf
8	*Prosorhynchus orientalis* Gupta & Ahmad, 1976	*Rastrelliger kanagurta* (Cuvier, 1816)	Indian part of Bay of Bengal	-
9	*Prosorhynchus pacificus* Manter, 1940	*Epinephelus tauvina* (Forsskål, 1775)	Karnataka, Andhra Pradesh, Bay of Bengal	Galapagos, Brazil, Caribbean Sea, Colombia, Cuba, Gulf of Mexico, Malacca Strait, Malaysia, North Atlantic Ocean, North Pacific Ocean, Persian Gulf, South China Sea, South Pacific Ocean, Thailand
10	*Prosorhynchus platycephali* (Yamaguti, 1934) Srivastava, 1938	*Grammoplites scaber* (Linnaeus, 1758)	Cochin	Toyama Bay, Arabian Sea, Coral Sea
11	*Prosorhynchus truncatus* Verma, 1936	*Cephalocassis jatia* (Hamilton, 1822)	Eastern India	-

1802) were collected during the survey. Host fish species were dissected in the field itself, and parasites were collected. Normal saline was used in this stage so that trematodes would relax and come out of the dissected organs of the host species. Live trematodes were gently pressed between a slide and a coverslip so that their morphological characters could be well studied under a microscope. Later, the trematodes were fixed in FAA solution and preserved in 70 % alcohol for further processing. In the laboratory, trematodes were stained with the Borax-Carmine stain, and acidified ethyl alcohol was used for differential staining. For dehydration of the specimens, they were subjected to a gradation of ethyl alcohol, cleaned in Clove oil, and mounted with Canada Balsam. The permanent slides were examined under a microscope (LEICA DM 1000) to study morphological characters. Species identification was done following available taxonomic keys[23,24]. Measurements were taken in µm. Identified species are deposited in the National Zoological Collections of the Zoological Survey of India.

Results

Two species, *Coitocaecum plagiorchis* Ozaki, 1926 and *Prosorhynchus squamatus* Odhner, 1905, collected from Lothian Island (SBR), are found to be new records for India.

Table 5 — Comparative chart of morphological characters of the species of the genus *Coitocaecum* Nicoll, 1915 with reported Indian species of the genus

Sl. No.	Species	Body shape	Body length × width	Oral sucker	Ventral sucker	Sucker ratio	Testes	Ovary	Cirrus sac	Seminal vesicle	Egg size	Vitelline follicles
1	*C. orientalis* Dwivedi, 1978	-	-	-	-	-	-	-	-	-	-	
2	*C. bengalense* (Madhavi, Narasimhulu & Shameem, 1986) Bray, 1987	Body spatulate	1376–1920 × 256–400	46–76 × 78–104	117–136 in diameter	1:1.2–1.5	Tandem, deeply lobed, situated at posterior third of body	Lobed, Submedian, post-equatorial	Saccular, very small and thin walled, encloses ejaculatory duct	Long coiled, extends posterior to ventral sucker	55–58 × 27–30	Large, shape irregular, extend from the level of intestinal bifurcation to hind end of body, mostly extracaecal
3	*C. bombayense* (Ahmad, 1984) Bray, 1987	Elongate	1320–1690 × 320–430	77–93 × 106–119	135–145 in diameter	1:1.2–1.27	Tandem, contiguous, smooth, transversely elongated, situated at posterior third of body	Contiguous to anterior testis Entire, submedian	Fusiform, thin-walled, encloses a small pars prostatica, few prostate gland cells and cirrus	slender club shaped, extends extends posterior to ventral sucker	-	Follicles round shaped, circumcaecal, extend between from middle of oesophagus to hind end of body
4	*C. indicum* Ahmad, 1980	Elongate	1280–1636 × 395–425	113–129 × 127–143	227–243 × 210–225	1:1.57–1.65	Tandem, contiguous, smooth, transversely elongate, situated at posterior half of body	Transversely elongated, slightly submedian	Fusiform, thin-walled, encloses a small pars prostatica, few prostate gland cells and cirrus	Saclike, extends posteriorly upto the margin of ventral sucker slightly overlapping it.	75–86 × 44–52	Follicles large, extend from mid-level of oesophagus to hind end of body
5	*C. purius* Madhavi & Bray, 2018	Short, both the ends rounded	1022–1300 × 431–460	100–131 × 130–180	165–195 × 200–220	1:1.22–1.53	Tandem, entire, transversely elongate, situated at posterior half of body	Transversely elongated	Thin-walled, enclosing indistinct pars prostatica and cirrus	Saclike, extends upto posterior margin of ventral sucker	87–96 × 50–73	Extend from middle of oesophagus to hind end of body
6	*C. scombri* Ahmad, 1980	Elongate, both the ends rounded	-	-	262–276 × 245–251	-	Tandem, Entire, transversely elongated, post equatorial	Bilobed,	Thin-walled, encloses indistinct pars prostatica and cirrus	Saclike, extends upto anterior margin of ventral sucker	60–80 × 30–46	Extend from middle of oesophagus to hind end of body, circumcaecal
7	*C. thapari* Ahmad, 1980	Elongate	3360–3471 × 865–877	210–223 in diameter	270–293 × 320–342	1:1.5	Tandem, smooth, transversely elongate, situated at middle third of body	Triangular in shape	Thin-walled, encloses indistinct pars prostatica and cirrus	Short, coilrd, extends upto one-third of ventral sucker	62–67 × 38–50	Extend from level of posterior margin of ventral sucker to posterior end of body, circumcaecal
8	*C. longivesiculum* Madhavi & Bray, 2018	Elongate	1250–1915 × 390–455	72–94 × 90–115	130–170	1:1.44–1.47	Tandem, smooth, oval, contiguous, situated at posterior third of body	Multi-lobed, submedian	Thin-walled, encloses indistinct pars prostatica and cirrus	Elongatea tubular, extends upto anterior margin of ovary	50–64 × 30–40	Extend upto posterior end of body, circumcaecal
9	*C. thrissoclesis* (Bilqees, 1972) Bray, 1987	Short	1960–2130 × 441–478	182–196 in diameter	240–290 × 228–241	1:1.2	Tandem, bilobed, closely situated at posterior third of body	Trilobed, contiguous to anterior testis, post-equatorial	Thin-walled, enclosing indistinct pars prostatica and cirrus	Saclike, extends slightly below posterior margin of ventral sucker	60–82 × 40–51	Circumcaecal, Extend from the level of posterior margin of pharynx to posterior extremity
10	*C. tropicum* Manter, 1940	Smooth, elongate	780– 1140 × 277 – 465	88-135 in diameter	165–277 in diameter	1:1.9–2	Tandem, or slightly oblique, close together, smooth, transversely elongate, situated at posterior half of body	Small, ovoid, transversely elongate,	Thin walled, situated between genital pore and left caecum enclosing a sinuous ductus ejaculatorius and cirrus	Tubular, coiled situated between intestinal bifurcation and ventral sucker slightly overlapping it	48–851 × 26–832	Extend from intestinal bifurcation to hind end of body
11	*C. chaetodoni* Ahmad, 1984	Elongated with rounded posterior end	1150–1360 × 382–431	110–122 x 130–135	190–236 × 165–188	1:1.2–1.4	Tandem, Transversely elongate, anterior testis kidney-shaped, posterior testis bi-lobed in, situated at posterior third of body;	Kidney-shaped, contiguous to anterior testis	Fusiform, thin walled, enclosing small pars prostatica, few prostate gland cells and small cirrus	Slender club-shaped, extends up to mid-level of ventral sucker slightly overlapping it	76–91 × 47–69	Follicles large, extend from the level of posterior margin of pharynx to hind end of body
12	*C. plagiorchis* Ozaki, 1926	Oval, small, broad at posterior end	788.14 × 376.66	84.41 × 94.36	145.61 × 156.56	1:1.7	Entire, diagonal, contiguous, posterior testis situated in front of the cyclocoel	Entire, pyriform, anterolateral to the anterior testis	Small, muscular	Extends upto ventral sucker	32.26 × 63.01	Extend from posterior portion of oral sucker to the posterior end of the body

Systematics

Phylum PLATYHELMINTHES Minot, 1876
Class TREMATODA Rudolphi, 1808
Order PLAGIORCHIIDA La Rue, 1957
Suborder XIPHIDIATA Olson *et al*., 2003
Family OPECOELIDAE Ozaki, 1925
Subfamily OPECOELINAE Ozaki, 1925
Genus *Coitocaecum* Nicoll, 1915

***Coitocaecum plagiorchis* Ozaki, 1926**

Material examined: 4 specimens; size: 827.30 – 749.66 × 395.28 – 357.05; host: *Glossogobius giuris* (Hamilton, 1822); Number of hosts examined: 6, out of which two host specimens were found infected. Locality: Lothian Island (SBR), West Bengal, India; 21°42′26.93″ N, 88°20′8.63″ E.

Specimen details: ZSI/HQ/Platyhelminthes/W10789/1 (Zoological Survey of India, Kolkata).

Table 6 — Comparative chart of morphological characters of the species of the genus *Prosorhynchus* Odhner, 1905 with reported Indian species of the genus

Sl. No.	Species	Body Shape	Body length × width	Rhynchus	Mouth	Intestine	Testes	Ovary	Cirrus Sac	Eggs	Vitelline follicles
1	*P. atlanticus* Manter, 1940	Elongated with truncated anterior end and tapering posterior end	705–1677 × 200–300	Cone shaped, Large, muscular	Slightly anterior to midbody	Saccular, short	Tandem or slightly diagonal, situated near pharynx	Pretesticular, rounded, situated at right of pharynx	Well developed, not extending beyond posterior testis	27–34 × 14–22	Large, arranged laterally, extend from the level of midpharynx to anterior end of body with 11- 16 follicles at each side
2	*P. bengalensis* Gupta & Gupta, 1987	-	-	-	-	-	-	-	-	-	-
3	*P. tewariae* Gupta & Gupta, 1987	Elongate	-	-	-	-	-	-	-		Follicles four in numbers, two at each side
4	*P. epinepheli* Yamaguti, 1939	-	875–1400 × 325–800	Rostellum inverted cone-shaped,muscular 125–350 × 190–200	-	Saccular, 260–550 x 180–300	Slightly diagonal	At level of anterior testis, occasionally intertesticular	Extends upto posterior testis	25–33 × 13–18	Follicles arranged in laterally in two groups, extend from the level of junction of testes forming an arch in between caecum and rhynchus
5	*P. indicus* Madhavi, 1974	Slender	3360–4480 × 400–500	Triangular, small, with disclike anterior part and conical posterior part. Laterally papillae present	Slightly post-equatorial	-	Tandem, separated situated at posterior quarter of body	Pretesticular	Extends upto the level of posterior testis	17–19 × 8–11	Confined to posterior half of body
6	*P. madhaviae* Gupta & Gupta, 1990	Slender with long neck	1550–1810 × 410–490	Oval	Median, just post-equatorial		Tandem, overlapping each other, situated at middle third of body	Almost rounded, overlapsanterior testis	Extends upto mid-level of testes	14–16 × 12–14	Extend from the level of ovary to midway between ovary and anterior end
7	*P. manteri* Srivastava, 1938	Elongate	1460–1600 × 330–450	Plug-shaped, small	Pre-equatorial, at anterior fifth of body	-	Tandem, oval, tandem, situated at middle third of body	Oval, pretesticular, well seperated from anterior testis	Extends upto posterior level of posterior testis	18–24 × 12–15	Laterally arranged, extend from the level of anterior margin of ovary to mid pre-mouth region
8	*P. orientalis* Gupta & Ahmad, 1976	-	-	-	-	-	-	-	-	-	-
9	*P. pacificus* Manter, 1940	Elongate, blunt at anterior end, tapering at posterior end	1206–1444 × 300–397	Large, conical	Between 1/3 and 1/2 body length from anterior end	Saclike	Diagonal, almost rounded, large	Round, situated at the level of pharynx overlapping anterior testis	Large overlapping posterior testis	24–27 × 12–17	Extend from the level of ovary to the level of anterior margin of caecum
10	*P. platycephali* (Yamaguti, 1934) Srivastava, 1938	-	2430 × 380	Funnel-shaped	-	Directed antero-dorsally	Tanem, subspherical, tandem, situated at the level of pharynx	Contiguous with the anterior testis	_	26–30 × 17–19	Follicles 13 on each side
11	*P. truncatus* Verma, 1936	Elongated cylindrical body	1760 × 420	Triangular, truncated with a broader margin in front	-	-	Obliquely tandem, oval	Contiguous with anterior testis	Short, extends upto the level of posterior margin of posterior testis	35–40 × 18–20	Forms an arc around anterior edge of caecum
12	*P. squamatus* Odhner, 1905	Ovoid, covered with very minute closely set spines	1740.01 × 775.24	Conical, anterior part flattened, muscles in rhynchus are arranged bilaterally	At middle of the body	Sac shaped	Slightly broader than long, close together, situated at posterior quarter of the body	Partially overlapping right testis	Large, extends from genital atrium to the level of posterior end of the left testis	24.03 × 43.15	Forms an arc in between oral sucker and mouth opening

Description: Body oval, small, broad at posterior end, 788.14 × 376.66, cuticle smooth; oral sucker almost globular, ventroterminal, smaller than ventral sucker, 84.41 × 94.36; prepharynx rudimentary; pharynx barrel-shaped, 58.62 × 50.13; oesophagus short, bifurcates midway between the two suckers; caeca united posteriorly; ventral sucker 145.61 × 156.56; sucker length ratio 1:1.7; sucker width ratio 1:1.66; testes entire, diagonal, contiguous; posterior testis situated in front of the cyclocoel; anterior testis 162.61 × 154.24; posterior testis 155.93 × 198.81; cirrus pouch small, muscular, external seminal vesicle reaches upto ventral sucker; genital pore submedian, situated at the left side of the posterior part of pharynx; ovary entire, pyriform, 109.14 × 83.22, anterolateral to the anterior testis; eggs numerous, operculate, 32.26 × 63.01; extension of uterus in between ovary and genital pore; vitelline follicles extend from posterior portion of the oral sucker to the posterior end of the body; excretory vesicle 'I' shaped (Figs. 1 & 2).

Remarks: The distribution of *Coitocaecum plagiorchis* Ozaki, 1926 was confined to Japan and China. The present species was first reported by

Table 7 — Fish host records of *Coitocaecum plagiorchis* Ozaki, 1926

Locality	Host	Reference
Type Locality: Japan	Type Host: *Odontobutis obscurus* (Temminck & Schlegel, 1845)	Ozaki, 1926[ref. 6]; Shimazu *et al*., 2011[ref. 25]
Japan	*Anguilla japonica* Temminck & Schlegel, 1845	Shimazu *et al*., 2011[ref. 25]
Japan	*Tachysurus nudiceps* (Cauvage, 1883)	Shimazu *et al*., 2011[ref. 25]; Yamaguti, 1939[ref. 16]
Japan	*Cottus reinii* Hilgendorf, 1879	Shimazu *et al*., 2011[ref. 25]; Shimazu, 2000[ref. 44]
Japan	*Gymnogobius isaza* (Tanaka, 1916)	Shimazu *et al*., 2011[ref. 25]; Shimazu, 2000[ref. 44]
Japan	*Gobius similis* (Gill, 1959)	Shimazu *et al*., 2011[ref. 25]; Shimazu, 2000[ref. 44]
Japan	*Gymnogobius urotaenia* (Hilgendorf, 1879)	Shimazu *et al*., 2011[ref. 25]; Yamaguti, 1939[ref. 16]; Shimazu, 2000[ref. 44]
Japan	*Tridentiger brevispinis Katsuyama,* Arai & Nakamura, 1972	Shimazu *et al*., 2011[ref. 25]; Shimazu, 2016[ref. 45]; Shimazu, 2008[ref. 47]
Japan	*Coreoperca kawamebari* (Temminck & Schlegel, 1843)	Yamaguti, 1934[ref. 21]
Japan	*Chaenogobius annularis* Gill, 1859	Yamaguti, 1939[ref. 16]
China	*Siniperca chuatsi* (Basilewsky, 1855)	Gibson *et al*., 2005[ref. 26]
Japan	*Tachysurus aurantiacus* (Temminck and Schelegel, 1846)	Shimazu, 2016[ref. 45]
Japan	*Rhinogobius flumineus* (Mizuno, 1960)	Yoshida & Urabe, 2005[ref. 46]
Japan	*Misgurnus anguillicaudatus* (Cantor, 1842)	Yamaguti, 1942[ref. 48]

Table 8 — Fish host records of *Prosorhynchus squamatus* Odhner, 1905

Locality	Host	Reference
Sweedish exclusive economic zone	*Myoxocephalus scorpius* (Linnaeus, 1758)	Odhner, 1905[Ref. 4]
North and East Iceland	*Myoxocephalus scorpius* (Linnaeus, 1758)	Brinkmann, 1956[Ref. 27]
Polish part of the Baltic Sea	*Liparis liparis* (Linnaeus, 1766)	Markowski, 1933[Ref. 28]
Barents Sea	*Myoxocephalus scorpius*, *M. quadricornis* (Linnaeus, 1758), *Liparis liparis* (Linnaeus, 1766), *Anarhichass lupus* Linnaeus, 1758, *Gymnocanthus tricuspis* (Reinhardt, 1830), *Brosme brosme* (Ascanius, 1772), *Hemitripterus villosus* (Pallas, 1814), *Gadus macrocephalus* Tilesius, 1810, *Eleginus nawaga* (Walbaum, 1792), *Zoarces viviparous* (Linnaeus, 1758), *Salvelinus alpines* (Linnaeus, 1758), *Mytilus edulis* Linnaeus, 1758	Skrjabin & Guschanskaja, 1962[Ref. 29]; Chubrik, 1952[Ref. 30]; Issaitschikov, 1928[Ref. 32]; Polyansky, 1995[Ref. 33]
Northumberland Coast	*Myoxocephalus scorpius* (Linnaeus, 1758)	Lebour, 1908[Ref. 31]
North and East Iceland	*Mytilus edulis* Linnaeus, 1758	Sannia & James, 1977[Ref. 34]
North West Atlantic	--	Brunel *et al.*, 1998[Ref. 35]
Faraoes	*Myoxocephalus scorpius* (Linnaeus, 1758), *Lophius piscatorius*, *Gadus morhua*, *Liparis montagui*, *Hippoglossus hippoglossus*	Køie, 2000[Ref. 36]
European waters	--	Gibson, 2001[Ref. 37]
White Sea	*Zoarces viviparous* (Linnaeus, 1758), *Gadus macrocephalus* Tilesius, 1810, *Eleginus nawaga* (Walbaum, 1792), *Myoxocephalus quadricornis* (Linnaeus, 1758), *M. scorpius* (Linnaeus, 1758)	Shulman-Albova, 1952[Ref. 38], Shulman & Shulman-Albova, 1953[Ref. 39]; Smirnov & Dobrovolskij, 2019[Ref. 40]
Gulf of St. Lawrence	*Hippoglossus hippoglossus* (Linnaeus, 1758)	Ronald, 1960[Ref. 41]
Canadian Atlantic coast	*Myoxocephalus scorpius* (Linnaeus, 1758)	Bray, 1979[Ref. 42]
Okhotsk Sea	*Myoxocephalus polyacanthocephalus* (Pallas, 1814), *M. ochotensis* Schmidt, 1929, *M. tuberculatus* Soldatov & Pavlenko, 1922	Atopkin *et al.*, 2022[Ref. 43]
Russia	*Myoxocephalus polyacanthocephalus* (Pallas, 1814)	Atopkin *et al.*, 2022[Ref. 43]
Canadian Atlantic Coast	*Brosme brosme* (Ascanius, 1772)	Miller, 1941[Ref. 49]

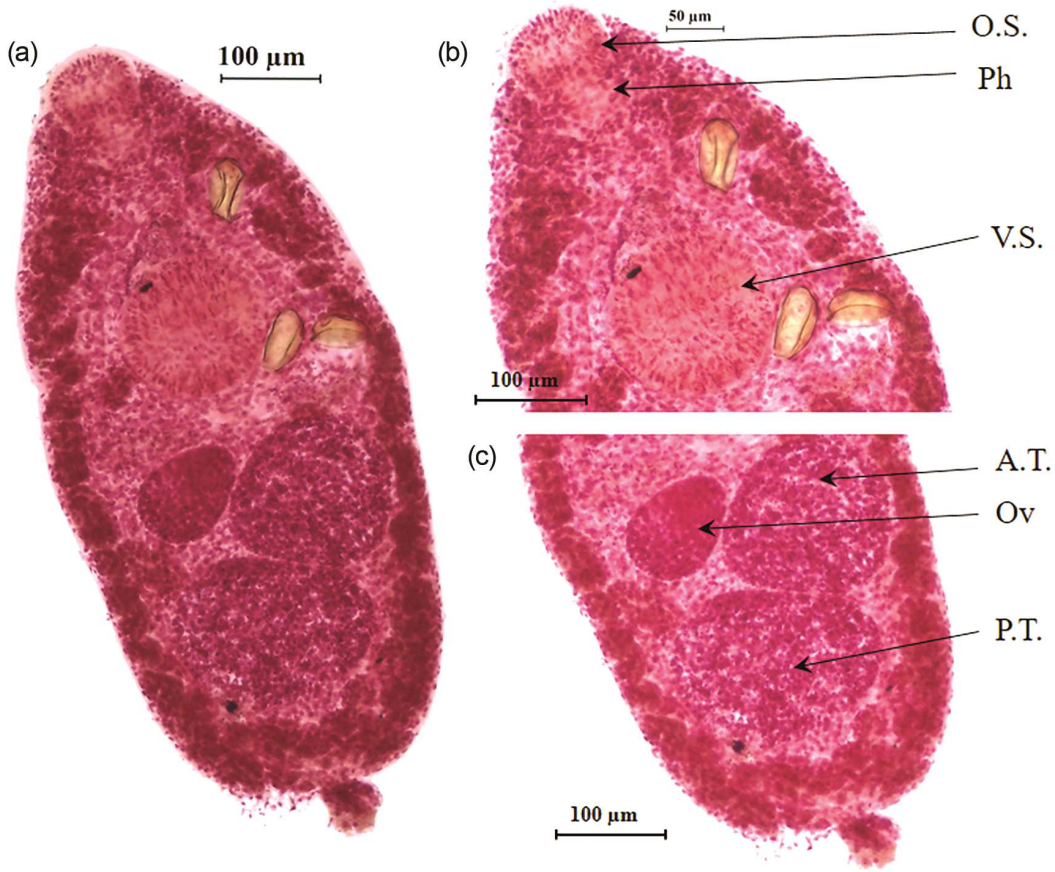

Fig. 1 — *Coitocaecum plagiorchis* Ozaki, 1926: (a) Entire worm, (b) Anterior part, and (c) Posterior part of the body. Oral Sucker: O.S.; Pharynx: Ph; Ventral Sucker: V.S.; Anterior Testis: A.T.; Posterior Testis: P.T.; and Ovary: O

Ozaki[6] from Japan from the fish host, *Odontobutis obscurus* (Temminck & Schlegel, 1845). Japan has a few more records from different fish hosts[16,21,25] (Table 3), and China has one record[26]. Earlier, 11 species of the genus *Coitocaecum* Nicoll, 1910 had been reported from India (Table 2). Thus, the present document reports the first record of *Coitocaecum plagiorchis* Ozaki, 1926 from India, making it the 12th species record of the genus *Coitocaecum* from India.

Phylum PLATYHELMINTHES Minot, 1876
Class TREMATODA Rudolphi, 1808
Order PLAGIORCHIIDA La Rue, 1957
Suborder BUCEPHALATA La Rue, 1926
Family BUCEPHALIDAE Poche, 1907
Subfamily PROSORHYNCHINAE Nicoll, 1914
Genus *Prosorhynchus* Odhner, 1905

***Prosorhynchus squamatus* Odhner, 1905**

Material examined: 3 specimens; size: 1827.4 – 1653.3 × 813.0 – 737.8; host: *Synaptura commersoni* (Lacepede, 1802); number of hosts examined: 2, out of which only one host specimen was found infected. Locality: Lothian Island (SBR), West Bengal, India; 21°42′26.93″ N, 88°20′8.63″ E.

Specimen details: ZSI/HQ/Platyhelminthes/W10778/1 (Zoological Survey of India, Kolkata).

Description: Body ovoid, 1740.01 × 775.24, covered with very minute closely set spines; oral sucker rostellum-like, 129.61 × 306.43; rhynchus well developed, conical, anterior part flattened, muscles in rhynchus are arranged bilaterally; pharynx situated almost at centre; mouth opening is at middle of the body, intestine sac shaped; testes slightly broader than long, close together, situated at posterior quarter of the body; anterior testis 158.32 × 161.64; posterior testis 151.15 × 161.36; ovary partially overlapping right testis; eggs small, 24.03 × 43.15, numerous; cirrus sac large, 546.23 long; extends from genital atrium to the level of posterior end of the left testis; vitellaria forming an arc in between oral sucker and mouth opening (Figs. 3 & 4).

Remarks: *Prosorhynchus squamatus* Odhner, 1905 was first reported from Sweden from the fish

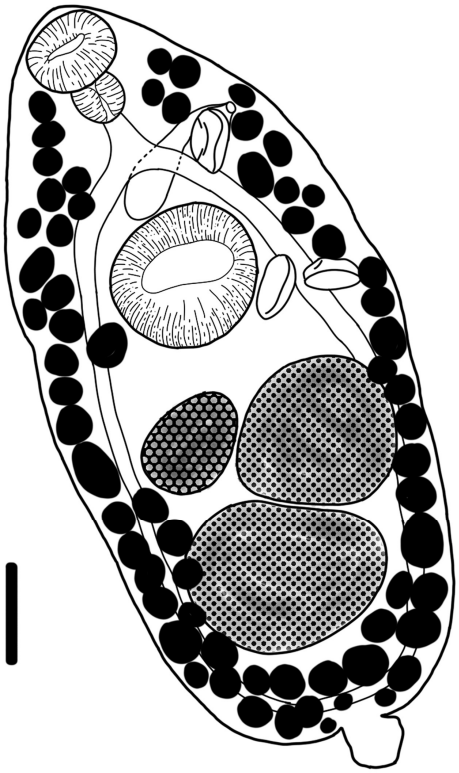

Fig. 2 — Line drawing of *Coitocaecum plagiorchis* Ozaki, 1926

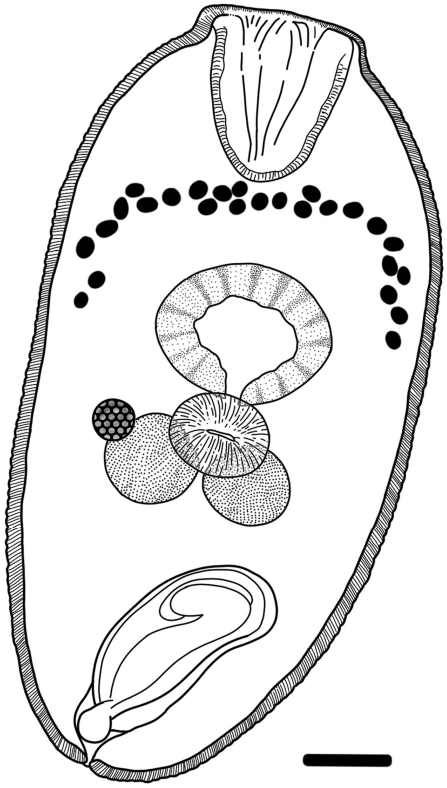

Fig. 4 — Line drawing of *Prosorhynchus squamatus* Odhner, 1905

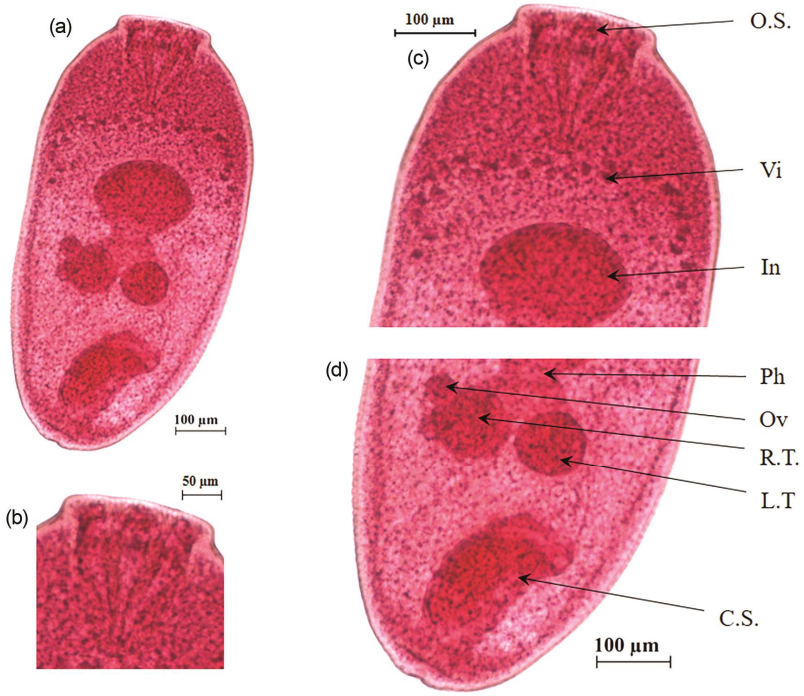

Fig. 3 — *Prosorhynchus squamatus* Odhner, 1905: (a) Entire worm, (b) Oral sucker with rhynchus, (c) Anterior part, and (d) Posterior part of body. Oral Sucker: O.S.; Vitellatia: Vi; Intestine: In; Pharynx: Ph; Ventral Sucker: V.S.; Anterior Testis: A.T.; Posterior Testis: P.T.; Ovary: Ov; and Cirrus Sac: C.S.

Myoxocephalus scorpius (Linnaeus, 1758). Studies show that the distribution of this species was mainly confined to countries in Europe[3,27-37] . Three reports exist from Russia[38-40], two reports from North America[41-42], and one from Japan[43]. Eleven species of the genus *Prosorhynchus* Odhner, 1905 have been reported from India (Table 5). The present species, *P. squamatus* Odhner, 1905, represents the first record and the 12th species of the genus *Prosorhynchus* from India.

Conclusion

The present study is based on two trematode species, namely *Coitocaecum plagiorchis* Ozaki, 1926, and *Prosorhynchus squamatus* Odhner, 1905, which were collected from fish hosts from the riverside of Lothian Island in Sundarban Biosphere Reserve, West Bengal (India). Six specimens of *Glossogobius giuris* (Hamilton, 1822) were collected, out of which 2 fishes were infected with 4 specimens of parasite *Coitocaecum plagiorchis* Ozaki, 1926. Two specimens of *Synaptura commersoni* (Lacepède, 1802) were collected, of which one fish was infected with 3 specimens of parasite *Prosorhynchus squamatus* Odhner, 1905. The reported trematode species are compared with their original descriptions and with other species of the genus reported from India. Both the species are found to be new records from India, and both fish hosts are new host records for these two trematode species.

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Conflict of interest

The authors have no conflict of interest.

Ethical Statement

No separate ethical clearance was required, as specimens were obtained post-capture from commercial sources.

Author Contributions

AG: Participated in surveys, collection and identification of parasites, and manuscript writing. SD & UB: Manuscript writing, review and editing.

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