Taxonomic Characterization of a New Circumoncobothrium Species (Cestoda) from Channa striata Collected at Koradi Dam, Buldhana District (MS) India

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Abstract
The present investigation describes a new species of cestode belonging to the genus Circumoncobothrium Shinde, 1968, recovered from the intestine of the freshwater fish Channa striata Bloch, 1793, collected from Koradi Dam, District Buldhana (M.S.), India, four mature specimens were collected, processed using standard parasitological techniques, stained with acetocarmine and Harris hematoxylin, and examined under a compound microscope. Detailed morphological and morphometric analyses were carried out for taxonomic identification. Comparative analysis with all previously described species of Circumoncobothrium reveals distinct differences in scolex morphology, number of rostellar hooks, number and arrangement of testes, structure of ovary, and configuration of vitellaria. On the basis of these consistent morphological differences, the present form is established as a new species, Circumoncobothrium gawaii sp. nov., named in honor of the author's surname.
This study contributes to the growing knowledge of cestode diversity in freshwater fishes of India and expands the taxonomic record of the genus Circumoncobothrium.

Keywords: Circumoncobothrium gawaii, Mastacembelus armatus, Cestode parasite, Taxonomy

1. Introduction

The genus Circumoncobothrium was established by Shinde G.B. (1968) from the intestine of the freshwater fish Ophiocephalus leucopunctatus, with C. ophiocephali designated as the type species. Subsequently, Jadhav and Shinde (1976) added three new species to the genus: C. aurangabadensis and C. raoii from Mastacembelus armatus, and C. gachuai from Ophiocephalus gachua. Chincholikar and Shinde (1976) described two additional species: C. shindei from M. armatus and
C. bagariusi from Bagarius species. Shinde (1977) reported C. khami from O. striatus, while Jadhav et al. (1990) described C. yamaguti from M. armatus. Further additions include C. alii from M. armatus (Shinde et al., 1994), C. vadgaonensis from M. armatus (Patil et al., 1998), and C. baimaii from M. armatus (Wongasawad and Jadhav, 1998). Kalse and Shinde (1999) added C. punctatusi from O. punctatus, followed by C. mastacembelusae from M. armatus (Shinde et al., 2002) and C. armatusae (minor) from M. armatus (Pawar et al., 2002). Tat and Jadhav (2004) reported C. manjari from O. gachua, and Supugade et al. (2005) described C. vitellariensis from M. armatus. Later contributions include C. cirrihinae from Cirrihina mrigala (Kharade et al., 2007), C. mehdii from M. armatus (Shelke et al., 2007), C. ambajogaiensis from M. armatus (Pardeshi et al., 2007), C. yogeshwari from M. armatus (Jawalikar et al., 2008), C. purnae from M. armatus (Borde and Jawale, 2008), C. naidui from M. armatus (Kalse et al., 2009), and C. paithenensis from M. armatus (Shah, 2010). Menkudale and Jawale (2010) added C. thapari from O. striatus, Pardeshi and Hiware (2011) described C. jadhavae from M. armatus, and Dhole and Kadam (2011) added C. clariase from Clarias batrachus. Most recently, Fartade A.M. et al. contributed four species from Channa marulius: C. maruliusae (2013), C. nathii (2015), C. godavarae (2016), and C. govindii (2017).

2. Material And Method

Koradi Dam, Maharashtra, and recognized by means of common ichthyological keys. Cestode parasites were extracted from the fishes' intestines after they were dissected, cleaned in regular saline, relaxed in lukewarm water, and preserved in 4% formalin.
Hematoxylin Harris staining, graded alcohol series dehydration, xylene clearing, and DPX mounting were performed on the specimens in order to prepare them for permanent slide preparation. using a camera lucida attachment, line drawings of diagnostic structures (scolex, proglottids, and reproductive organs) were created after thorough morphological observations were done under a compound microscope.
Taxonomical identification was carried out based on morphological characters following standard keys and descriptions given by Yamaguti and Wardle and McLeod

3. Description

Four mature cestode parasites were collected from the intestine of the freshwater fish Channa striata Bloch, 1793 from Koradi Dam, District Buldhana (M.S.), India, in 2023

The cestodes were flattened, preserved in 4% formalin, stained with acetocarmine and Haematoxylene, passed through a graded series of alcohol, cleared in xylene, and mounted in DPX. Whole-mount slides were prepared for detailed anatomical studies. Drawings were made with the aid of a camera lucida. All measurements are given in millimeters.

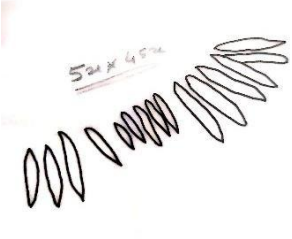
All cestodes were elongated, comprising a scolex, neck, and immature and mature proglottids. The scolex is circular in shape, measuring 1.930 (1.887 1.972) in length and 0.910 (0.510 1.309) in width.
The anterior end of the scolex is rounded and bears a prominent rostellum armed with 46 50 hooks, arranged in a single row, measuring 0.069 (0.066 0.072) in length and 0.011 (0.006 0.015) in width.
The scolex possesses two bothria situated laterally, occupying nearly the entire length of the scolex; they are narrow anteriorly, crossed at the anterior end, and widen posteriorly, measuring 1.420 (1.275 1.564) in length and 0.145 (0.102 0.187) in width.
The neck is reduced.

1. Mature proglottids are small, approximately 2 3 times broader than long, measuring (0.924 1.386) in length and 2.261 (2.211 2.310) in width.
2. The testes are oval to rounded, 165 170 in number, scattered throughout the segment, and measure 0.116 (0.099 0.132) in length and 0.050 (0.033 0.066) in width.
3. The small, oval cirrus pouch is situated in the center of the segment, prior to the ovary, and is 0.198 (0.165 0.231) in length and 0.083 (0.066 0.099) in width.
4. Within the cirrus pouch, the cirrus is a thin, tubular structure that is 0.149 (0.132 0.165) long and 0.025 (0.016 0.034) wide.
5. Located in the posterior half of the segment with a short isthmus, the ovary is tiny, bilobed, dumbbell-shaped, and has unequal lobes. Its dimensions are 0.314 (0.231 0.396) in length and 0.776 (0.495 1.056) in breadth.
6. The vagina is a narrow tube that is 0.083 (0.066 0.099) long and 0.033 wide, beginning at the genital hole and ending posterior to the cirrus pouch.
7. The tiny, spherical genital pore is situated behind the cirrus pouch and has a length of 0.083 (0.066 0.099) length and 0.025 (0.016 0.033) in width.
8. The uterus is saccular, filled with numerous eggs, and measures 0.380 (0.264 0.495) in length and 0.578 (0.363 0.792) in width
9. The vitellaria are follicular, arranged in two lateral rows along the margins of each segment

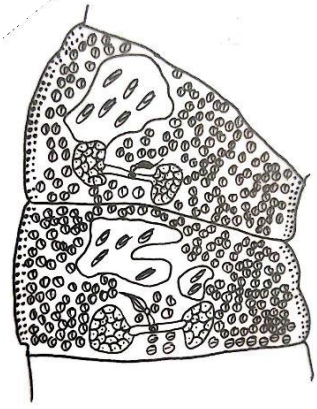
Scolex

Mature Segment

Scolex



Hooks



Mature Segment

4. Discussion:

The genus Circumoncobothrium was established by Shinde (1968) with C. ophiocephali as the type species, reported from Ophiocephalus punctatus. The cestode under study exhibits general morphological features consistent with the genus Circumoncobothrium, including the overall topography of its organs. However, it differs from previously

described species of this genus in several characters, as detailed below.

1. The present cestode differs from C. ophiocephali Shinde, 1968 in having a distinct scolex, 80 rostellar hooks, 70 80 oval testes, a compact single conical ovary, follicular vitellaria, and in its host, Ophiocephalus punctatus from India.
2. It is different from C. aurangabadensis Jadhav & Shinde, 1976 in that it has a neck, 135 145 testes, a bilobed ovary, granular vitellaria, a scolex that is broad in the middle and small at both ends, and 42 rostellar hooks. It has also been claimed to be from Mastacembelus armatus in India.
3. The current tapeworm is different from C. raoii Jadhav & Shinde, 1976 in that it has 210 215 testes, a neck, 46 hooks grouped in a single circle, and a scolex that is broad in the middle and small at both ends.
4. It differs from C. gachuai Jadhav & Shinde, 1976 in having a pear-shaped scolex, 46 hooks, neck present, squarish mature proglottids, 375 400 testes, and follicular vitellaria arranged in two rows, reported from Ophiocephalus gachua in India.
5. Its 260 275 testes, 49 hooks, and short anterior and large posterior scolex set it apart from C. shindei Chincholikar & Shinde, 1976, which was described from Mastacembelus armatus in India.
6. 275 285 testes arranged in two lateral fields, a scolex that is narrow anteriorly and broad posteriorly, 55 hooks, no neck, and follicular vitellaria all of which were reported from Bagarius sp., India are some of the characteristics that set it apart from C. bagariusi Chincholikar & Shinde, 1976.
7. It differs from C. khami Shinde, 1977 in having 48 hooks, no neck, 190 200 testes evenly distributed, follicular vitellaria, reported from Ophiocephalus sp., India.
8. It differs from C. yamaguti Jadhav et al., 1990 in having a distinct scolex narrow anteriorly and broad posteriorly, 56 hooks, 130 150 testes, absence of neck, reported from Mastacembelus armatus in India.
9. It differs from C. alii Shinde et al., 1994 in having a triangular scolex, 34 hooks, 230 240 testes, granular vitellaria, reported from Mastacembelus armatus in India.
10. It differs from C. vadgaonensis Patil et al., 1998 in having a triangular scolex, 56 hooks, 490 510 testes, reported from Mastacembelus armatus in India.
11. It differs from C. baimaii Wongsawad & Jadhav, 1998 in having a pear-shaped scolex, 48 hooks, 88 100 testes, compact ovary, granular vitellaria, reported from Mastacembelus armatus in Chiang Mai.
12. It differs from C. punctatusi Kalse & Shinde, 1999 in having a rectangular scolex, squarish mature proglottids, 140 150 testes, follicular vitellaria arranged in 3 6 rows, reported from Ophiocephalus punctatus, India.
13. It differs from C. armatusae Shinde et al., 1999 in having a triangular scolex, 23 hooks, neck present, 90 100 testes, compact ovary, reported from Mastacembelus armatus, India.
14. It differs from C. mastacembelusae Shinde et al., 2002 in having a pear-shaped scolex, 38 hooks, absence of neck, 130 140 testes, bilobed ovary, reported from Mastacembelus armatus, India.
15. It differs from C. armatusae Pawar et al., 2002 in having a triangular scolex, 58 hooks, absence of neck, 190 200 testes, follicular vitellaria, reported from Mastacembelus armatus, India.
16. It differs from C. manjari Tat & Jadhav, 2004 in having a triangular scolex, 48 hooks in a single circle, 128 145 testes, reported from Ophiocephalus gachua, India.
17. It differs from C. vitellariensis Supugade et al., 2005 in having a large triangular scolex, 48 hooks, 250 260 testes, bilobed ovary, reported from Mastacembelus armatus, India.
18. It differs from C. cirrhinae Kharade et al., 2007 in having a large cylindrical barrel-shaped scolex, 56 hooks, 300 305 medium oval testes, dumbbell- shaped ovary, granular vitellaria, reported from Cirrihina mrigala, India.
19. It differs from C. mehdii Shelke et al., 2007 in having a triangular scolex, medium squarish mature segments, 280 290 testes, large distinctly bilobed ovary, reported from Mastacembelus armatus, India.
20. It differs from C. ambajogaiensis Pardeshi et al., 2007 in having a triangular scolex, absence of neck, mature segments ten times broader than long, 250-300 testes, bilobed dumbbell-shaped ovary, reported from Mastacembelus armatus, India.
21. The present worm differs from C. yogeshwari Jawalikar et al., 2008 in having a triangular scolex, 53 hooks, 95 98 testes, reported from Mastacembelus armatus, India.
22. It differs from C. purnae Borde & Jawale, 2008 in having a triangular scolex, 52 hooks, absence of neck, squarish mature segments slightly broader than long, 230-235 testes, bilobed ovary, reported from M. armatus, India.
23. It differs from C. naidui Kalse et al., 2009 in having a cylindrical scolex, 40 hooks, absence of neck, 200-210 medium rounded testes, oval single compact ovary, transversely elongated with acini.
24. It differs from C. paithenensis Shah, 2010 in having a triangular scolex, 58 hooks, bilobed ovary, reported from Mastacembelus armatus, India.
25. It differs from C. thapari Menkudale & Jawale, 2010 in having 52 hooks, absence of neck, 95 medium oval testes, medium lobed ovary, follicular vitellaria arranged in 2 3 rows.
26. It differs from C. jadhavae Pardeshi & Hiware, 2011 in having a triangular dome-shaped scolex, 35-45 hooks, 95-105 oval to round testes, bilobed ovary, reported from Mastacembelus armatus, India.
27. It differs from C. clariasi Kadam & Dhole, 2011 in having a triangular scolex, 48 hooks, 249-259 oval testes, reported from Clarias batrachus, India.
28. It differs from C. heamlatae Reddy et al., 2011 in having a large triangular scolex, 54 hooks, 200-225 testes,

large bilobed ovary, small round genital pore, reported from Mastacembelus armatus, India.

29. It differs from C. maruliusae Fartade et al., 2013 in having a triangular scolex, 62- 65 hooks, 60- 65 testes, bilobed ovary, reported from Channa marulius, India.
30. It differs from C. nathii Fartade et al., 2015 in having a cylindrical scolex, 63 hooks, 70 testes, irregularly bilobed ovary, reported from Channa marulius, India It differs from C. godavarae Fartade et al., 2016 in having a scolex narrow anteriorly and broad posteriorly, 27 hooks, 10- 120 testes, bilobed ovary, follicular vitellaria arranged in 2 3 rows, reported from Channa marulius, India.
31. It differs from C. govindii Fartade et al., 2017 in having a conical scolex, 58-60 hooks, 80-89 testes, irregularly bilobed ovary, granular vitellaria, reported from Channa marulius, India.
32. It differs from C. khushalraoi Sp. Nov. in having a cylindrical scolex, 17-20 hooks, 125-130 testes, oval to rounded ovary, granular vitellaria, reported from Mastacembelus armatus, India.
33. The above-mentioned characters are sufficient to propose a new species, named Circumoncobothrium gawaii Sp. Nov., in honor of author's surname

Taxonomic Summary

Genus	-	Circumoncobothrium, Shinde, 1968.
Species	-	Circumoncobothrium Gawaii, Sp.Nov.
Type host	-	Channa straita, Bloch, 1793
Habitat (Site)	-	Intestine.
Type locality	-	Koradi Dam District Buldhana (M. S.) India
Holotype and	-	Deposited in the Research Lab., Department of Zoology
Paratype	-	Lal Bahadur Shastri College, Partur Dist -Jalna
Etymology	-	Name proposed in honor of surname of auther.

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Conflict- No conflict of interest

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