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Study of Ciliate Commensals from the Gills of Freshwater Bivalves (Molluscs: Bivalvia) of Jayakwadi Dam, Paithan, (M.S.), India

N. Z. Deshmukh*, B.V. More, E. L. Jaid and S. V. Nikam

Protozoology Laboratory, Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431001 (M.S.), India

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*Corresponding Author

Tel : +91-8055320437

Email: naazideshmukh@gmail.com

Abstract

Samples of bivalve species viz. *Lamillidens marginalis* L. *corrianus* and *Indonaia caeruleus* were collected from the Jayekwadi dam. Three species of obligate commensalistic ciliates, *Conchophthirus acuminatus*, *C. curtus* and *C. nikamentus* n.sp. belonging to genus *Conchophthirus* were observed on the gills and mantle cavity of bivalve. Prevalence of the ciliate infection were reported for all three species of bivalves and *Conchophthirus*. Correlation of infection intentisity with the length of shell in three species of bivalves were studied.

Key Words: *Lamillidens marginalis, L. corrianus , Indonaia caeruleus Conchophthirus acuminatus, C. curtus ,C. nikamentus n.sp.,* Jayekwadi dam

Introduction

A wide diversity of endosymbiotic organism can be found within the mantle cavity and gills of bivalve. Molloy et al.[6] discussed 34 species as parasites. The ciliate commensals of the various fresh water mussels exist in great abundance and after excellent material for cytological study. The greatest number of these organisms belongs to the genus *Conchophthirus*.

There are many species of symbionts associated with bivalve including ciliates trematode, nematode etc. In the present study three species of ciliate conchophthirus were observed. *Conchophthirus* found to be more abundant among all the species of bivalve. The ciliate *Conchophthirus acuminatus* (Scuticiliatida : Conchophthiridae) is the most common of these organism [6]. Although North American sampling has been conducted. This species *Conchophthirus acuminatus* found in European population of *Driessena polymorpha*, including Denmark [3], Poland [3], Hungary [8], Macedonia [10], Bulgaria [7] and Switzerland [2]. Lalpotu observe the two species; *Conchphthirus aurangabadensis n.*sp. and *Conchophthirus curtus* in 1976 from the gill and mantle cavity of and *Indonaia caeruleus* and *Pyrresia corrugatea*, from a new locality i.e. Maharashtra, India.

Chonchophthirus spp. has an obligate association with bivalves and likely can tolerate only brief periods in open waters, as during their transfer to the new host [4]. *C. acuminatus* in particular extremely host specific. It has been found exclusively in *D. polymorpha* [6]. But in present study *C. acuminatus* found to be associated with bivalve (*Lamillidens marginalis, L. corianus* and *Indonaia caeruleus*). Raabe [8] reported that he never observed *C. acuminatus* in Unionidae, even though their shells were sometimes completely covered by *C. acuminatus* infected *D. polymorpha*. Three species of *Chonchophthirus* (*Conchophthirus acuminatus*, *C. curtus* and *C. nikamentus n.*sp.) observed from the gills and mantle cavity of bivalve (*Lamillidense marginalis, L. corianus* and *Indonaia caeruleus*). The *Conchophthirus acuminatus* was most frequently observed on the surfaces of the visceral mass and gills of bivalve, where they creep about using their short and dense cilia [6].

Materials and Methods

The samples of bivalves viz; *L. marginalis, L. corrianus* and *Indonaia caeruleus* were collected during period from May to Dec, 2009 at Jayaskwadi Dam, Paithan, located at 59 km distance from Aurangabad. Collection method varied depending on substrates available but included scraping of uniform surfaces, or by hand picking from irregular surfaces. These mussels collected in bags and brought to laboratory and kept in aquarium. In laboratory each bivalve measured using vernier caliper. Then each bivalve dissected beginning carefully cutting the adductor mussels and mantle ligament. The mantle cavity thoroughly flushed with distilled water and gills were removed intact by cutting with stainless still scissors. These gills then kept in a cavity block and repeatedly flushed with distilled water from a pipette to remove ciliates from exposed epithelial surfaces of gills. Because the ciliates are also present within gills, water tubes and suprabranchial cavity [5], gills were lacerated with forceps and then flushed by pipette. 1 ml of these flushed water transferred to a Sedgwick Rafter counting chamber and examined under a compound light microscope. Instead of this we also used a drop count method in which the gills were repeatedly flushed with 2 drops of distilled water every time from which 1 drop had taken on the slide to examine the ciliates and counted the intensity per ml by calculating it as 10 drops is equal to 1 ml.

The number of *Conchopthirus acuminatus*, *C. curtus, C. nikamentus n.sp*. present in this 1 ml sample was counted and recorded as the intensity of infection ml^{-1}. The slides then after semidrying, fixed in Schauldin's fixative and stained with haematoxylene stain for the further study of morphology of ciliates. The kineties were also observed in *C. acuminatus* by silver impregnation method. Removed gills were observed for adhering and internal ciliates were observed under compound light microscope.

Results and Discussion

Prevalence

In present study bivalves found to be positive for *C. acuminatus* i.e. the 100% prevalence observed in all three species of bivalve. The percentage of prevalence of *C. curtus* and *C. nikamentus n.*sp. was higher in *L. corrianus* i.e. 27.9% and 55.81% respectively (Table 1) the moderate prevalence was observed in *L. marginalis* for *C. acuminatus* (25.8%) and *C. nikamentus n.sp.* (54.83%) the lowest percentage of prevalence of *C. curtus* (21 %) and *C. nikamentus* n.sp. had seen in *Indonaia caeruleus* (Table 1). There are several reports of prevalence of ciliate infection [3, 9 and 10].

Table 1. The prevalence of ciliates in bivalve.

Host	Total no of host examined	*C. acuminatus*		*C. curtus*		*C. nikamentus n.sp.*	
		No. of sample positive	Prevalence %	No. of sample positive	Prevalence %	No. of sample positive	Prevalence %
L. marginalis	62	62	100%	16	25.8%	34	54.83%
L. corrianus	43	43	100%	12	27.9%	26	55.81%
Indonaia caeruleus	19	19	100%	4	21.0%	6	31.57%

Intensity

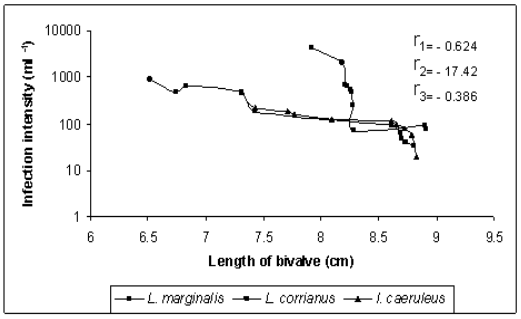
Infection intensity is directly correlated with mussel length [1]. This is the first study to quantify the intensity of *Conchopthirus* infection in *Lamellidens* and *Indonaia.* In our samples the intensity of *Conchopthirus acuminatus* observed higher than the rest ciliates in all three bivalves. The higher intensity (4340 ml^{-1}) of *C. acuminatus* observed in the *L. marginalis* measuring 7.918 cm in length. During the investigation negative significant coefficient were recorded for all speceis.

Conchophthirus acuminatus (Fig. 1 a, b, c):

C. acuminatus is most frequent observed on the surfaces of the visceral mass and gills of bivalve. The anterior portion of their left side possesses thrigmotactic cilia which can beat independently from other cilia and become stiff and motionless when touching to a substratum [3]. The body outline of this species is oval. The anterior end is being somewhat pointed and the posterior is rounded, wider than the anterior end.

The peristome is triangular or 'V' shape. When viewed from lateral aspects, the dorsal margin of the ciliate is seen to convex and it is concave from the ventral margin, there is constriction on the dorsal margin at the anterior one third. This ciliate measures 58µ to 95µ in body length and 38µ to 60µ in width.

The movement of ciliate was straight, sometimes moves in a wide circle or it was also observed that this ciliate swims by keeping its body horizontally on the lateral margin and swims in a zigzag motion. The anterior one third of the body filled with smaller granules and due to these the ciliates appear brownish in that part or the dark anterior zone can be seen. 1--3 contractile vacuoles are observed and all were similar in size and located in line from cytostome toward posterior end. The macronucleus is rounded and located in centre of the body. Measuring 33µ to 60µ in diameter. Embedded in the macronucleus one micronucleus is observed. This cannot be seen in the living state but can be demonstrate in the resting condition after a well differentiated haematoxylene stain.



Graph 1. Correlation of infection intensity of *C. acuminatus* with the length of shell in three bivalves viz; *L. marginalis, L. corrianus* and *I. caeruleus*

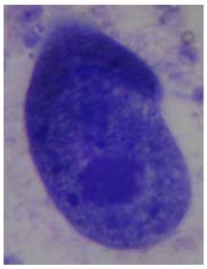


Fig 1 (a): *Conchophthirus acuminatus*, stained with haematoxylene stain

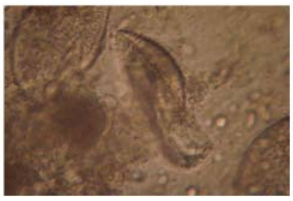


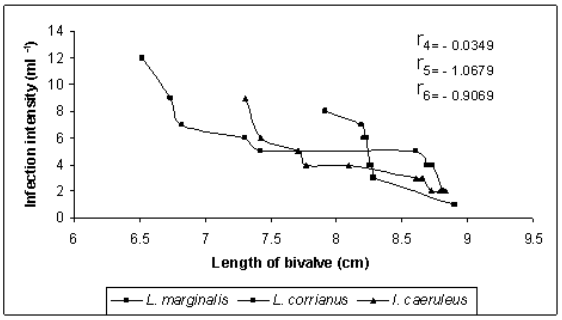
Fig 1 (b): *Conchophthirus acuminatus*, side view of living form

Fig 1 (c): *Conchophthirus acuminatus* showing kineties when stained with silver impregnation method

Conchophthirus curtus (Fig.2 a, b):

This species of ciliate found in two bivalves viz; *Lamellidens marginalis* and *L. corrianus.* The infection was rare in most cases. The body of ciliate is typically elongated and ovoid, the length being one and a half times the width of the body. The body length measured 74.91µ to 104.42µ and the width is 45.4µ to 68.1µ. Both the ends are rounded. The peristome is cup shaped or somewhat triangular and lies first above the middle of the body. The peristome is ovoid or round and lies in the centre.

Macronucleus is rounded located at centre of body and measure about 15.89µ to 18.16µ in diameter. There is single contractile vacuole lying close to the macronucleus on its postero-ventral side. The cytoplasm shows a finely granular area in the anterior one third and several large inclusions in middle and posterior thirds.



Graph 2. Correlation of infection intensity of *C. curtus* with the length of shell in three bivalves viz; *L. Marginalis* (r_4), *L. corrianus* (r_5), and *I. caeruleus* (r_6)

Fig 2 (a): *Conchopthirus curtus*, living form

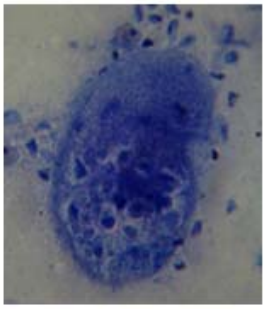


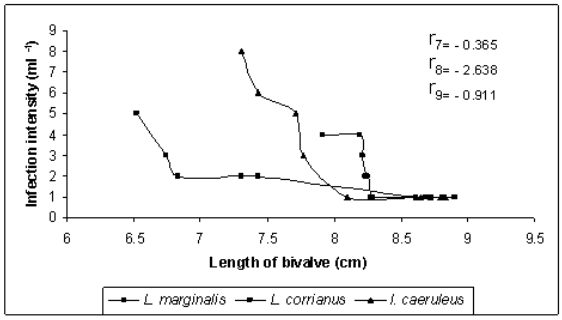
Fig 2 (b): *Conchopthirus curtus,* stained with haematoxylene stain

Conchophthirus nikamentus n.sp. (Fig. 3 a, b):

This ciliate was found on the gills and in the mantle cavity of all three species of bivalve. The ciliate was most common in *L. marginalis* and *L. corrianus* while it was rare in *Indonaia caeruleus*. In these hosts heavy infection of *Conchophthirus acuminatus* and light infection of *Conchophthirus curtus* were also found.

In the living condition the ciliates move about fast with the round end forwards, moving along almost in a straight line and periodically changing the direction and sometimes swim in wide circle. The body of ciliate is elongated with rounded, posterior and anterior end. The posterior end is broader than the anterior end. The ciliate is dorsoventrally flattened. Body measures 50 µ to 60 µ in length and 22 µ to 32 µ in width. The peristome is 'C' shaped area lying at anterior third of the body.

The macronucleus lies near the posterior end of the body but just above the body margin being either in the center or slightly nearer the dorsal margin. It is rounded in shape and measure about 6 µ to 9 µ. The micronucleus was not seen. One contractile vacuole was observed between macronucleus and peristome. The anterior one third of the body filled with smaller granules. The cytoplasm is filled with several food vacuoles. The kineties run from posterior end to anterior margin, longitudinally, parallel to one another.



Graph 3. Correlation of infection intensity of *C. nikamentus n.sp.* with the length of shell in three bivalves viz; *L. marginalis* (r_7), *L. corrianus* (r_8), and *I. caeruleus* (r_9).

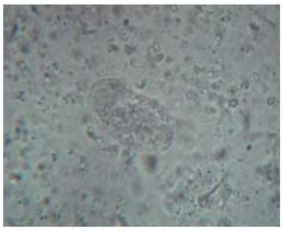


Fig 3 (a): *Conchopthirus nikamentus* n.sp. stained with haematoxylene stain

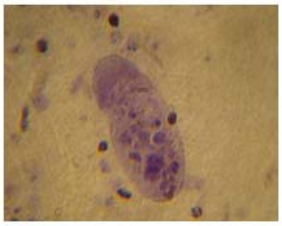


Fig 3 (b): *Conchopthirus nikamentus* n.sp. stained with haematoxylene stain.

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