

### Short Communication

## Record of bi-operculate fouling serpulid polychaete, *Hydroides operculatus* (Treadwell, 1929) from Diu, west coast of India

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Present study consists the documentation of the bi-operculate form of fouling serpulid polychaete, *Hydroides operculatus* Treadwell, 1929 for the first time from India. It is provided for the first time from India. This variant was found in samples collected from Diu, North West coast of India. A perusal of literature indicates that the bi-operculate form is an advanced ontogenic stage of the polychaete rather than a different taxon. Such stages are transient and therefore rarely seen in natural populations. Polychaete species identification is intrinsic to many ecological and environmental studies. Therefore the present documentation will help prevent possible taxonomic confusion due to the presence of dual functional opercula.

**[Keywords:** *Hydroides operculatus*, polychaete, bi-operculate, Serpulidae, verticil, Diu].

In the present study, the bi-operculate form of the fouling serpulid polychaete, *Hydroides operculatus* Treadwell, 1929 is described for the first time from India. This organism with two distinct opercula was found in samples collected from Diu, north west coast of India. The family Serpulidae is a discrete group of sedentary polychaetes with calcareous tubes common on hard substrates, which shares a presence of coloured branchial radiolar crown<sup>1</sup> and separation of the body into thoracic and abdominal regions, contrary to the usually rather uniformly segmented motile polychaete form<sup>2</sup>. Serpulids are important wood fouling fauna as well as notorious biofoulers that are easily transported and introduced to allochthonous habitats<sup>3</sup>. With a mainly tropical to subtropical distribution, *Hydroides* is the largest genus with more than 89 known species in family

Serpulidae<sup>2</sup>. Species can be distinguished by characteristic chaetae and well differentiated two-tier operculum which serves for protection.

Samples were collected from the Diu coast (20°43'21.98"N, 70°58'56.65"E) (Figure 1) during January 2010 using a van Veen grab (0.04 m<sup>2</sup> area). The area was mostly comprised of rocks and compact sand. The serpulid tubes were mainly found on *Cerithidea* sp. (gastropod) shells inhabited by anomurans. Worms were carefully removed from the tubes with the help of a fine forceps and preserved in 5% buffered formalin. The species identification was carried out based on available literature<sup>4,5</sup>. Each specimen was measured with a millimeter scale. Characteristics of the operculum like the number and type of radii, verticil spines with its internal spinules were studied in the lateral and apical views, as well as counted. To study the characteristics of chaetae and uncini, the fourth thoracic chaetiger and two abdominal parapodia were extracted and mounted in semi-permanent preparations for detailed observations. Photo-micrographs of the entire worm and its dissected parts mounted in glycerin were

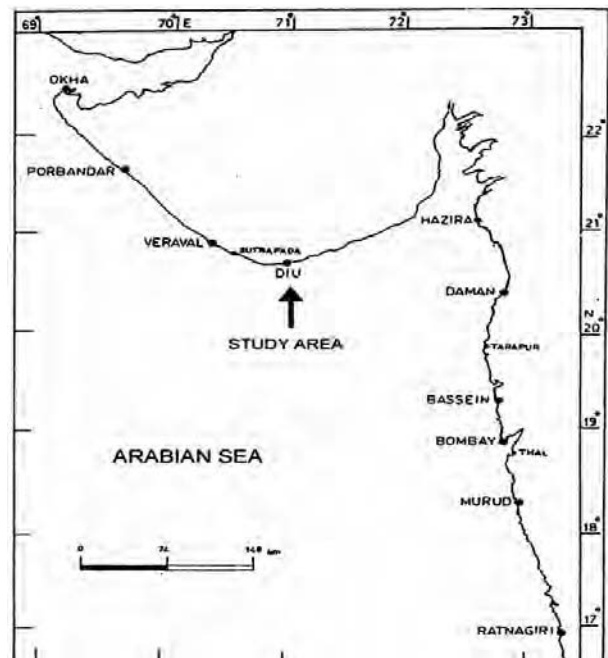


Fig. 1—Area of Samplin

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obtained with a Canon Power Shot digital camera under a Wild M3B stereo microscope and a Motic compound microscope respectively.

From the collected samples, six specimens of *Hydroides operculatus* (Figure 2C) were obtained. The description of the species is as follows. Length of specimens measured from 6-24 mm. Thorax (Figure 2Ac) was 0.8-1.5 mm long, 0.5-11 mm wide, with 7 chaetigers. Thoracic membrane was present and not connected dorsally. Abdomen (Figure 2Ad) had 35-76 chaetigers. Branchial crown was 0.6-1.8 mm long with 10-20 radioles (Figure 2Dc) with pinnule free tips arranged in 2 semicircles. Operculum

(Figure 2D) was two-tiered funnel shaped with smooth stalk. It had 29-36 radii with pointed tips (Figure 2Ea); verticil had 8 spines, strongly curved inwards with pointed tips; dorsal spine bigger than others (Figure 2Da); other spines similar in shape and size with one short basal internal spinule (Figure 2Ja) and without external and lateral spinules. Peduncle with operculum was 11-2.7 mm long with shallowly defined constriction. Hooded capillary chaetae (Fig. 2Ib) were embedded within the thoracic membrane (Figure 2Ia). Bayonet chaetae (Figure 2G) were smooth, with two blunt-elongate teeth (Figure 2Gb) and 116  $\mu\text{m}$  long distal blade (Figure 2Ga).

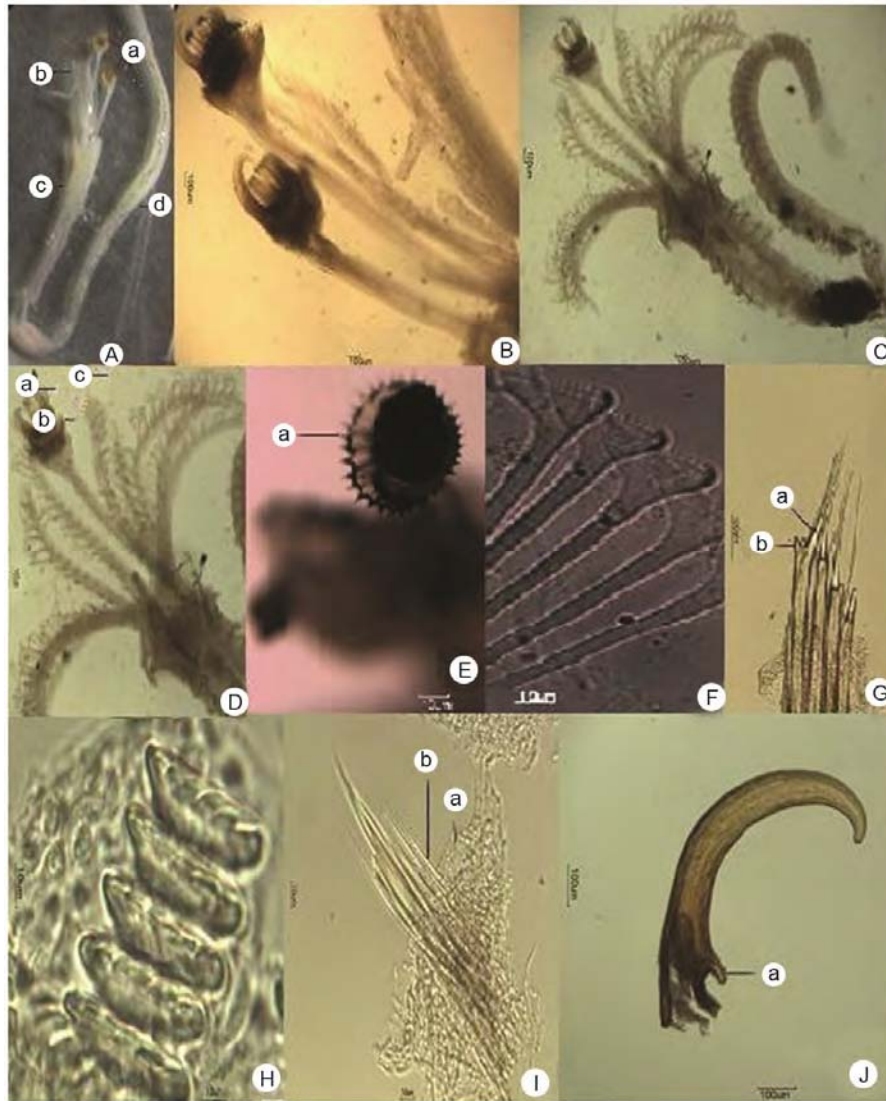


Figure 2. A)]—Bi-operculate *Hydroides operculatus*, entire worm (a) Two opercula (b) radioles (c) thorax (d) abdomen. B)] Two different 2-tier opercula. C)] *Hydroides operculatus* with single operculum. D)] Single 2-tier operculum (a) dorsal spine (b) radii (c) pinnule free tips. E)] Dorsal view of operculum (a) radii. F)] Abdominal trumpet shaped chaetae G)] Bayonet chaetae (a) distal blade (b) teeth. H)] Abdominal uncini. I)] Thoracic chaetae (a) thoracic membrane (b) hooded capillary chaeta. J)] Dorsal spine of verticil (a) internal spinule.

Abdominal chaetae trumpet-shaped (Figure 2F) with flat or only slightly rounded distal margin. Thoracic and anterior abdominal uncini (Figure 2H) with 5-7 teeth, arranged in a single vertical row. The preserved specimens had a pale yellow body with dark brown operculum.

Interestingly, one specimen among the six *H. operculatus* polychaetes had two separate two-tier opercula (Figure 2A), which was a novel observation. This polychaete was the largest among the collected *H. operculatus* specimens with a length of 24 mm. The two opercula (Figure 2B) were of variable length. The length of the longer operculum was 2.9 mm and the smaller operculum 2.0 mm. Treadwell<sup>4</sup> had observed a bi-operculate *H. operculatus* as having a very long opercular peduncle along with a second one having a much shorter peduncle. However, in our specimen both opercula had long peduncles though of variable lengths (Figure 2B). The smaller operculum was fully developed and chitinized, whereas the larger one was in the developing stage and unchitinized. Both the opercula had clear verticil with 8 spines.

Though *Hydroides* is the largest genus of the family Serpulidae, only few species belonging to this genus have been reported from India. *Hydroides diramphus* (under its synonymic name *H. lunulifera*) was recorded from the east coast of India<sup>6</sup>, whereas *H. elegans* and *H. operculatus*, were reported from Mumbai Harbour<sup>7,8</sup>. Though no bi-operculate form of *Hydroides* have been reported in India, they have been observed elsewhere<sup>9-11</sup>.

Studies have shown that when two opercula are present, the presence of the larger operculum directly or indirectly inhibits the power of development of the shorter one leading to a state of equilibrium<sup>12,13</sup>. Molecular studies have attributed this inhibition to the presence of a high concentration of the nucleotide 5' adenosine monophosphate in the functional operculum<sup>14-16</sup>. The inhibitory effect only takes place when the concentration of the nucleotide rises above a certain level, while regeneration occurs when this level is reduced. Schochet<sup>9</sup> explained that the paired functional opercula occur by some means during ontogeny, when the rudimentary operculum overcomes the "inhibition" of the functional operculum and becomes fully developed. This bi-operculate stage is ephemeral and generally the older operculum is autotomized to be replaced by a rudimentary operculum. Ten Hove and Ben-Eliahu<sup>11</sup> reported that an existing pseudoperculum will

differentiate into a new 2-tier functional operculum to replace the functional operculum when the latter is damaged, worn or overgrown with epibionts and that the bi-operculate stage is very brief and therefore a rare phenomenon. The ecological benefit of having a duplicate functional operculum is ensuring the existence of an effectual functional operculum to block the tube after the worm retracts for protection from predators and unfavourable conditions<sup>9-17</sup>.

In conclusion, this is the first record of the bi-operculate form of the fouling polychaete, *H. operculatus* from India. A perusal of literature indicates that the bi-operculate form is an advanced ontogenic stage of the polychaete rather than a different taxon. Such stages are transient and therefore, rarely seen in natural populations. Polychaete species identification is intrinsic to many ecological and environmental studies. Therefore the present documentation will help prevent possible taxonomic confusion due to unawareness of this variability.

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