

**NUCLEOCORBULA ADHEKENS GEN. & SP. NOV.
(CILIATA, THIGMOTRICHIDA) FROM
SHIPWORMS**

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**NUCLEOCORBULA ADHERENS GEN. & SP. NOV.
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SHIPWORMS**

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ABSTRACT

Nucleocorbula adherens gen. & sp. nov. representing a new family, Nucleocorbulidae, is described and figured. It lives inside the mantle cavity of the shipworms *Nausitora hedleyi* and *Teredo furcifera* which occur in large numbers in the estuarine localities of the south west coast of India. The species is carnivorous and its behaviour outside the body of the host is described.

INTRODUCTION

Apart from the record of the occurrence of *Boveria teredinidi* from the shipworms at Visakhapatnam (Ganapati & Nagabhushanam, 1955) very little is known about the taxonomy, biology and distribution of the commensalistic and parasitic ciliates of molluscs from Indian waters. The present paper deals with an interesting new genus and species belonging to the Thigmotrichida collected from the shipworms *Nausitora hedleyi* Schepman and *Teredo furcifera* von Martens infesting the underwater timber structures in the estuarine localities of the south west coast of India.

The authors are deeply indebted to Dr. Tom Fenchel, Marine Biological Laboratory, Helsingør, Denmark, for valuable discussions about the identification of the species. Funds were provided by the Council of Scientific and Industrial Research for the execution of the scheme "Studies on the biological aspects of marine borer problem in India".

MATERIAL AND METHODS

The host material *Nausitora* and *Teredo* were collected from the underwater timber structures at Cochin harbour, Ayiramthengu barmouth and Neendakara barmouth. The shipworms were removed from their burrows and their mantle fluid

pipetted into a petridish. The ctenidia were also dissected out for examination. Ciliates were separated with the aid of a pipette. Living individuals were studied under a compound microscope with ordinary light. For studies of the nuclei some specimens were stained with methyle green in acetic acid, and others were fixed in Zenker's solution and stained with Mallory's triple connective tissue stain. Some were fixed in Da Fano's solution and impregnated with silver using the method of Chatton and Lwoff as refined by Corliss (1953).

DESCRIPTION OF THE SPECIES

Thigmotrich ciliate of large size. Length of the body may vary from 90 to 500 μ and breadth from 120 to 360 μ . The form of the body is extremely variable depending upon the size and age of the ciliate. In general, the body is somewhat cylindrical.

A thin pellicule covers the highly flexible body of the animal and is greatly specialised at the aboral region where there is a circular disc-like skeletal area "Sucker". From the longitudinal section of the animal (Fig. 1 B) it is clear that the centre of this adhesive disc is much thicker than the peripheral region. In whole mounts, this skeletal area appears as a deeply staining circular structure. A contractile vacuole was only rarely observed.

The cytostome (mouth) is situated at the posterior end of the body. The mouth and the pharynx can be clearly made out when the animal is actively feeding. Then the cytopharynx seems very broad, deep and extending up to nearly three fourth the entire length of the body. It is slightly orientated to one side of the body. The peripheral region of the mouth is encircled by strong adoral cilia which assist in ingestion of food particles. After the food particles have been trapped by the mouth, food vacuoles are formed. This ciliate is a carnivore feeding indiscriminately on almost all other ciliates living within the mantle cavity of shipworms (Fig. 1 C).

There are three different types of cilia. 1) The cilia on the posterior region of the body: Surrounding the oral pole is a row of folds (about 24) which carry short dense rows of kinetosomes which carry long cilia forming some sort of membranelles (Fig. 1 D). These cilia help to capture other ciliates and direct the prey to the cytostome. The length of these cilia in certain individuals may reach up to 60 μ . 2) The body cilia which are small attaining 6-11 μ in length: The somatic ciliature is orientated nearly perpendicular to the body axis and meets in a line parallel to the body axis on one side (Fig. 1 E). 3) The cilia on the anterior, aboral region: These are about 7-15 μ in length. The ciliature is very closely arranged unlike the ciliary rows of the body region (Fig. 1 F). These cilia apparently assist the animal in forward movement especially when the animal is swiftly moving. The kineties are not connected with the remaining somatic kineties. This organelle resembles the corresponding organelles in such thigmotrichs as *Ptychostomum* or

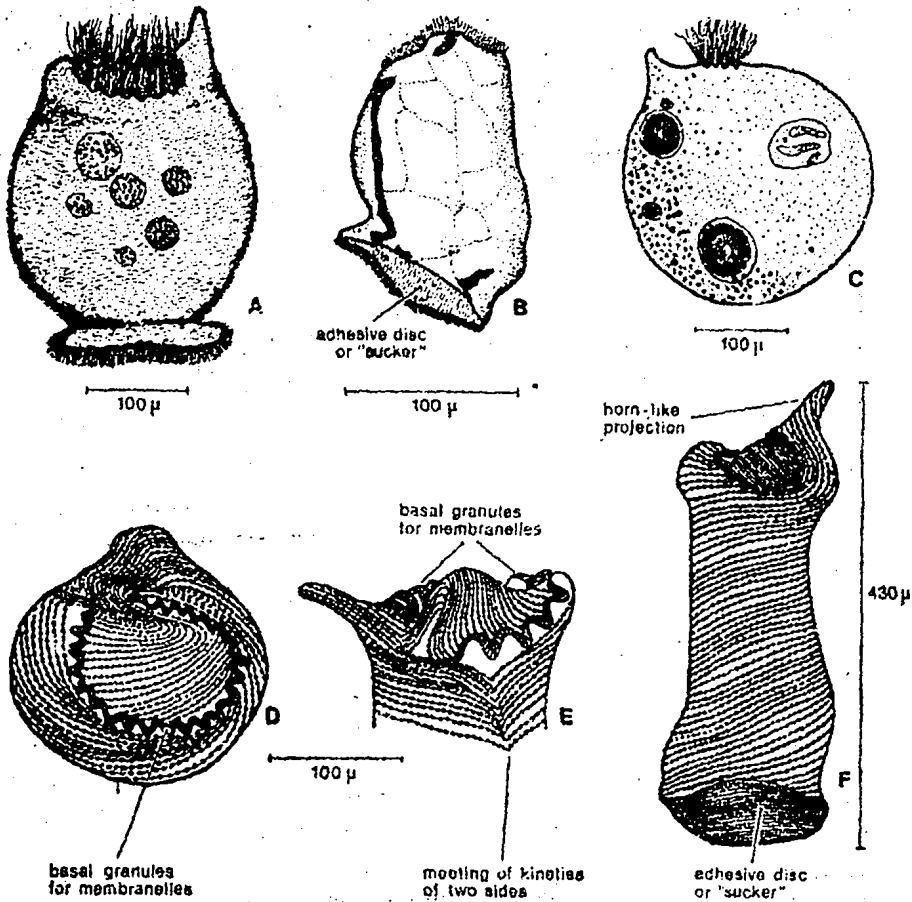


FIG. 1. *Nucleocorbula adherens*. A, sketch of a living specimen to show typical shape; B, longitudinal section to show the details of the adhesive disc; C, living specimen to show in particular the food vacuoles with ingested ciliates (especially trichodinids and *Boveria*); D, oral view to show the rows of folds which carry rows kinetosomes, silver impregnated specimen; E-F, silver impregnated specimen to show the details of the kinetosomes.

Hemispeira (Raabe, 1949; Kozloff, 1960; Chatton & Lwoff, 1949).

The aboral disc ("Sucker") is ciliated and the animal gets firmly attached to any object with its aid. In the oral region there is a horn-like projection (Fig. 1 F) which varies in size depending upon the age of the ciliate. A well defined layer of ectoplasm is not discernible. The cytoplasm in live specimens is pale, straw coloured and apparently structureless. The cytoplasm contains a varying number of glistening globules which are glycogenous in nature since they turn reddish-brown when the ciliates are treated with iodine.

Food vacuoles, fewer in number, are usually larger in size and appear as spherical vesicles. The size of the food vacuole may vary depending upon the size of the prey (usually other ciliates living in the mantle cavity of the shipworm) they ingest.

The macronucleus also varies in size and shape depending upon the age of the ciliate. In a full grown specimen, the macronucleus is greatly branched and appears like a basket. The longitudinal branches of the macronucleus may extend from the oral end to the aboral end of the animal. There are transverse connections too between the longitudinal branches and these arise from the aboral end of the body. In young (small) specimens the macronucleus is sausage shaped (Fig. 2A). As the animal grows the macronucleus changes its shape and branches arise that ramify and spread up to the oral end of the animal. Gradually the transverse connections are also formed to give the characteristic shape in adult specimens (Fig. 2B-F).

Stages of fission have been observed in this form. Transverse fission occurs as shown in Fig. 3.

BEHAVIOUR OF THE ANIMAL OUTSIDE THE BODY OF THE HOST

When the animals are separated from the host animal and placed in sea-water on a slide they swim vigorously in all directions. They move speedily with the anterior "sucker"-like portion directed forwards in a characteristic swerving motion. An animal can also rotate in clockwise spirals and move rapidly forwards. During this movement the bristle-like cilia on the oral end are normally retracted. Coming into contact with any object on its path it slows down, stops for a while, and then gently retracts and relaxes the oral cilia in a rhythmic manner. Very rarely it shows gliding movements also. Occasionally it comes up to the surface of the water and on reaching the surface film it assumes a position which is almost vertical, with the oral end downwards the whole body rotating in a clockwise direction. With the aid of this clockwise rotation it moves in a spiral fashion. Then it lies parallel to the surface of the water. A few minutes later it assumes a posture in which the oral end is directed upwards. Then it slowly rotates in an anticlockwise direction. This type of movement of the animal is constant, the pace is very slow and the animal gradually describes an irregular circle. But when the animal moves along a long path, it assumes the swerving clockwise motion.

The ciliate may attach to the substrate by its aboral end. In this pose it always keeps its highly flexible body at an angle of about 90° to the substrate. When the animal attaches to the substratum, waves of pulsations can be seen on the body. By the action of the oral cilia currents are apparently produced in the ambient water. At times, the animal makes very gently somersault movements. The adhesive power of the animal to the substratum is quite high so that much effort is

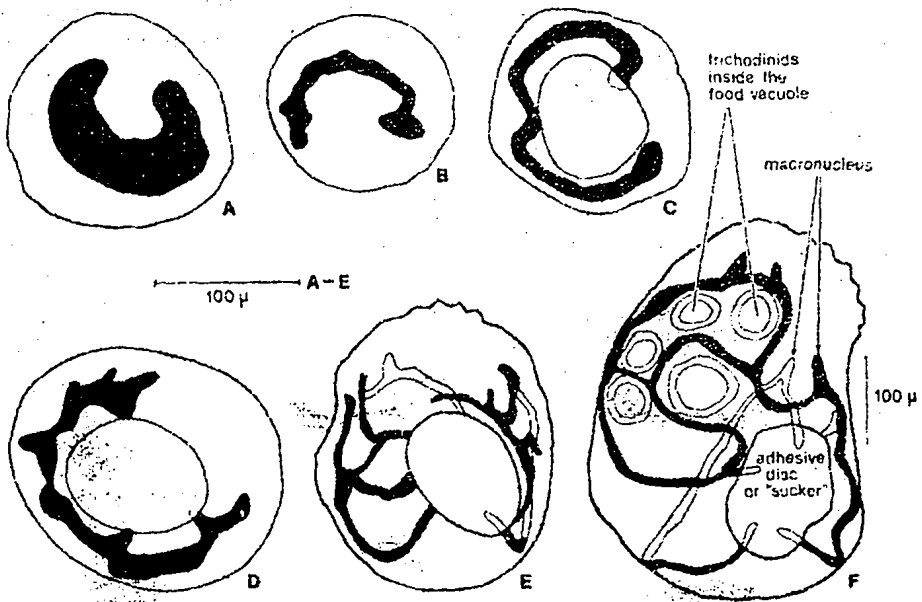


FIG. 2. *Nucleocorbula adherens*. A, specimen with sausage shaped nucleus; B-F, different shapes of the macronucleus in relation to the growth of the animal.

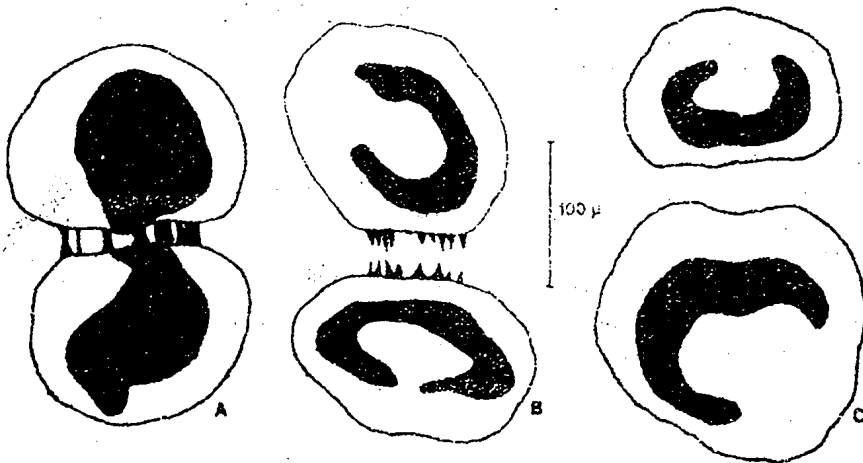


FIG. 3. *Nucleocorbula adherens*. Stages of transverse fission.

needed to dislodge it. As time passes, the activity of the organism outside the host decreases and finally the movement ceases. When the animal is taken out from the host, it has a light straw colour, but on death it becomes pale and colourless.

DISCUSSION

The family Nucleocorbulidae can be distinguished from the other families of the order Thigmotrichida by its unique basket-shaped macronucleus. It also possesses a ciliated, circular, aboral disc ("Sucker"), a horn like projection in the oral region surrounding the oral pole, a row of folds which carry the long cilia forming a sort of membranelles and somatic ciliature perpendicular to the body axis. The body of the ciliate is cylindrical in shape (Fig. 1A).

Genus *Nucleocorbula* gen. nov. has the diagnostic characters of the family Nucleocorbulidae enumerated above.

The aboral disc ("Sucker") is ciliated with a large number of dense kineties which are not connected with the remaining somatic kineties. As already mentioned this organelle resembles organelles within other thigmotrichs (*Phychostronum* or *Hemispeira*), but this may, of course, be due to convergent evolution. The somatic ciliature is orientated nearly perpendicular to the body axis on one side as in *Hemispeira* (Fig. 1F). Surrounding the oral pole is a row of folds which carry short dense rows of kinetosomes which carry cilia forming a sort of membranelles. The hornlike structure is seen in the oral region. The possession of the above described characters justify the erecting a new family, Nucleocorbulidae, for the species. The name *Nucleocorbula* refers to the basket-shaped macronucleus which is characteristic of the adult specimens and *adherens* refers to the adhesive nature of the animal.

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