

**ON HERDMANIA (RHABDOCYNTHIA)
ENNURENSIS N.SP.
(A NEW MONASCIDIAN FROM MADRAS)**

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I. Introduction

THE present contribution is the second of a series¹ (1938) in which the author desires to add to the existing knowledge of the ascidian fauna of the Indian coasts. Except for Herdman's work⁵ (1906) very little systematic work on ascidians has been done in India. Oka⁸ (1915) published a report on the ascidians in the collection of the Indian Museum, Calcutta; but the marjoity of the species reported were those already described by Herdman⁵ (1906) or by other workers in the West. The only other publications on Indian Tunicata are by myself,^{2, 3} (1936) on the morphology of *Herdmania*

pallida; by Lall⁷ (1938) on some Tunicates from Karachi; and by Sebastian⁹ (1939) on the development of *Herdmania pallida*.

The external form, shape and coloration of preserved ascidians are often misleading on account of contraction and post-preservation changes. I propose, therefore, to lay more stress on internal characters as criteria for specific distinction.

The material was received in a preserved condition from the Marine Biological Supply Station at Ennur (Madras). There is no label or report showing the place and time of collection. Presumably the specimens were collected either from the Madras coastal region or from the coast at Tuticorin (S. India), where animal supplies for the Biological Station at Ennur are collected. Only three specimens of the present species were received, but they were in a well preserved state for necessary examination.

My acknowledgements are due to the management of the Ennur Station for supplying me the material. To Prof. K. N. Bahl of Lucknow I am deeply indebted for obtaining the material and for finally revising the manuscript. Thanks are due to Prof. Huus of Oslo and Dr. Van Name of the American Museum of Natural History for personally communicating to me their views on the validity of the genus *Herdmania*.

II. Historical

The genus *Rhabdocynthia* was first instituted by Herdman⁶ (1891) to include those species of *Cynthia* (now *Pyura*) that possess calcareous echinated spicules in the body-tissues. In 1906⁵ while advocating the desirability of retaining the genus *Rhabdocynthia*, originally established by him, Herdman wrote "Notwithstanding Michaelsen's remark (1905) and the fact that several recent writers have seen fit to relinquish the genus *Rhabdocynthia*, I believe it is both natural and useful to group together those species of *Cynthia* that show echinated unbranched calcareous rods or spicules in the connective tissue of the body. The grouping of species into genera is largely a matter of convenience, and if a set of closely related species can be defined and recognized by the possession of a common character, the application of a generic name seems justifiable and is certainly an aid in classification. On these grounds I make use of *Rhabdocynthia* as the generic designation of the set of species which may be grouped around Heller's '*Cynthia pallida*'."

In the same paper, however, Herdman makes a note that if this is exactly the genus for which Lahille (1888) proposed the name *Herdmania*, then *Rhabdocynthia* must give way to that prior designation. Later

Hartmeyer⁴ (1910) established the identity of *Rhabdocynthia* Herdman and *Herdmania* Lahille, and pointed out that on anatomical characters these two genera should be merged in the common genus *Pyura* (*Cynthia*), and that the presence of spicules was not a very distinguishing character. In spite of Hartmeyer's statement and Michaelsen's agreeing with his view, I accepted the genus *Herdmania*² (1936) as I found no record of an ascidian other than a Pyurid (and that also in closely related species) which showed echinated, unbranched calcareous spicules (knob-shaped, spindle-shaped or pipette-shaped) in the test and connective tissue of the body. And if certain Pyurids had this character (*i.e.*, the presence of echinated calcareous spicules in the test as well as in the connective tissue) in common, I thought it useful to retain the genus *Herdmania* for them.

Johan Huus, author of 'Tunicata' in Kukenthal Series, wrote to me in 1937: "As to the genus *Rhabdocynthia* or *Herdmania*, I do not find the presence of rod-like spicules in the tissues being reason enough for maintaining it as a valid genus. I quite agree with Hartmeyer³ (1910) and Michaelsen that it should be treated as a synonym of *Pyura*. It should be remembered that not rod-like spicules (stellate, dumb-bell, etc.) are also found in several Pyurid species, *e.g.*, *P. pachydermata*, *P. gibbosa*, *P. australis*. Moreover in *P. bradleyi* Van Name, stellate spicules occur along with rod-like forms (Van Name,¹⁰ 1931). These facts are obvious against the maintenance of the genus *Herdmania* as defined by Herdman and now by you." Despite this note by Huus I do not think the case strong enough to relinquish the genus *Herdmania* for the broader genus of monascidians, *Pyura*, which comprises a vast number of species. The fact that Van Name¹⁰ (1931) has discovered the widely found stellate spicules along with rod-like ones in *Pyura bradleyi* does not depreciate my argument. If the rod-like spicules are found in the test and connective tissue and if they are echinated, *Pyura bradleyi* should be renamed *Herdmania bradleyi*. But then the spicules found in *P. bradleyi* by Van Name, though rod-shaped, are not echinated like those of *Herdmania*; and this discovery, therefore, does not stand against my maintenance of the genus *Herdmania*. *The facts that (i) echinated calcareous spicules are not found in all Pyurids, (ii) that they are found only in closely allied species, and (iii) that wherever they are present they are abundant and conspicuous, induces me to maintain that their presence should constitute a character of generic importance.* Van Name (April 1939) also comes to the same conclusion when he writes "*Pyura bradleyi* from the west coast of South America has some needle-like spicules in the walls of the blood vessels but they bear little resemblance to those found in *Herdmania* which I regard as a good genus,".

III. External Characters

The animal (photograph) is pyriform in shape and small in size, the largest individual measuring 22 mm. in length (the length being the distance from the attached end to the base of the siphons) and 20 mm. broad. The attached end consists of a narrow base while the body is broadest at its middle. The coloration in the preserved specimens is dull white, although this is no clue to the actual colour of the living forms. The siphons are the most prominent structures visible externally, both the siphons being elongated and much longer than in the three species of *Herdmania* already described from the Indian coasts. The atrial siphon in the present species is longer than the branchial being almost half the length of the body. The maximum measurement for the atrial siphon was 12 mm. and that for the branchial 7 mm. The siphons are about 5 mm. apart at their bases, while the siphonal apertures are approximately 16 mm. apart. This is due to the fact that the siphons diverge from each other as they arise from their bases and extend more or less upwards and outwards. The atrial aperture is directed sideways while the branchial remains nearly upright. Each siphon is about 7 mm. broad at the base, and tapers towards the distal extremity. The siphonal apertures are bounded by four lips of the test, while the extension of the test, lining the interior of each siphon, has four longitudinal double rows of white-spotted streaks clearly seen in the photograph.

All the three specimens had, what appeared at first sight, stellate hair, forming a fine down all over the surface of the test. Even under a binocular microscope they appeared very much like the hair (projections of the test) described and figured by Herdman⁵ (1906) for *Cynthia* (*Pyura*) *crinitistellata* from the Gulf of Manaar. But a close examination revealed them to be extensive hydroid colonies of *Bougainvillia* sp. This is significant as it shows how mere external characters might be entirely deceptive at times; for not only were the hair reminiscent of *Cynthia crinitistellata*, but one of the siphons was also much elongated, though in the present species it came out to be the atrial and not the branchial siphon.

IV. The Test

The test is thin, and soft and cartilaginous in section, its average thickness being only 1 mm. It is almost smooth and transparent allowing the internal organs to be seen through. At the place of attachment, however, the test is thrown into folds and appears to be corrugated. There are a large number of branching vascular vessels in the test, while its matrix is interspersed with a number of minute, knob-headed, echinated spicules (Fig. 3, microscleres) as described in *Herdmania pallida* by the author²

(1936). The test is traversed by the vessels which branch, anastomose, and send pear-shaped vascular ampullæ towards the surface. Each ampulla is lined by a single layer of cells which are largest at its distal and smallest at its proximal end. No bladder cells could be discerned in the test. The inpushing of the test into each siphon is extremely thin and flecked with four white longitudinal streaks.

V. The Internal Organs

1. *The Mantle*.—The mantle or body wall is thick and muscular in the antero-dorsal half of the body, where it forms an opaque covering over the internal structures, but is very thin and transparent in the postero-ventral half, allowing the pericardium, the gonads, and part of the gut to be seen through it. At the antero-dorsal end the mantle is prolonged to

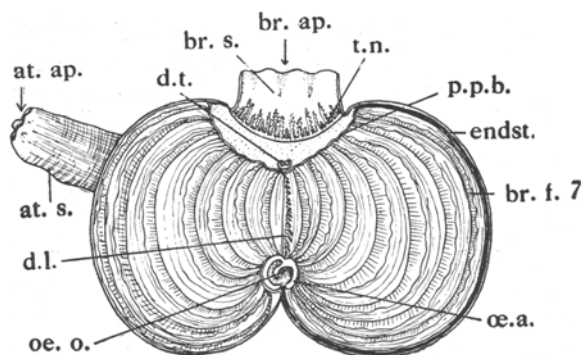


FIG. 1

The animal cut open longitudinally from the ventral side to show the internal view of the branchial sac ($\times 2$). *at.ap.*, atrial aperture; *at.s.*, atrial siphon; *br.ap.*, branchial aperture; *br.f.*, branchial fold; *br.s.*, branchial siphon; *d.l.*, dorsal lamina; *d.t.*, dorsal tubercle; *endst.*, eoadostyle; *œ.a.*, oesophageal area; *œ.o.*, oesophageal opening; *p.p.b.*, peripharyngeal band; *t.n.*, tentacle.

form two elongated siphons—the atrial much longer than the branchial—and the distal ends are produced into four lips which fit into four similar lips of the test. The muscles of the mantle, as in *Herdmania pallida*, consist of (i) the branchial group, (ii) the atrial group, and (iii) the branchio-atrial group. At the place of their insertion the muscle bands of the longitudinal set in the branchial group number about 46, while in the atrial group they number roughly 34, the branchio-atrial group consisting of five muscle bands only, when compared to *H. pallida*, the numbers of which approximately are 60, 40 and 5 respectively.

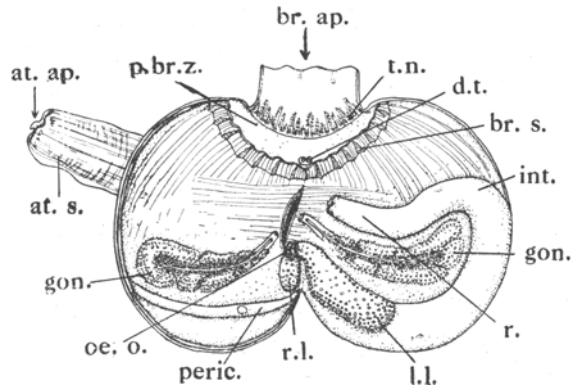


FIG. 2

A ventral view of the internal anatomy after removal of the branchial sac ($\times 2$). *at.ap.*, atrial aperture; *at.s.*, atrial siphon; *br.ap.*, branchial aperture; *br.s.*, branchial sac; *d.t.*, dorsal tubercle; *gon.*, gonad; *int.*, intestine; *l.l.*, left digestive gland; *oe.o.*, oesophageal opening; *peric.*, pericardium; *p.br.z.*, pre-branchial zone; *r.*, rectum; *r.l.*, right digestive gland; *t.n.*, tentacle.

A large number of spindle-shaped echinated calcareous spicules are present throughout the mantle, some of which even extend into the connective tissue of the internal organs. As in *H. pallida*, they are enclosed in tubular sheaths which run in long strings in the substance of the mantle (Fig. 3). The pipette-shaped spicules found in *H. pallida* are absent in the present species.

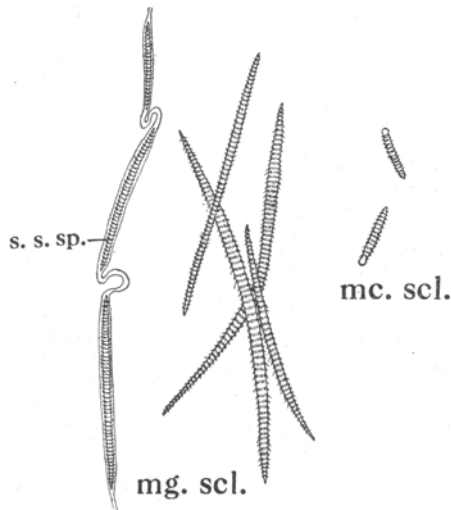


FIG. 3

The spicules of *Herdmania ennurensis* n. sp. ($\times 55$). *mc.scl.*, microscleres; *mg.scl.*, megascleres; *s.s.sp.*, spindle-shaped spicules.

2. *The Branchial Sac.*—The branchial sac has 7 folds on each side, the ventral-most fold near the endostyle being the thinnest (Fig. 1). There are 6 internal longitudinal bars (vessels) on a fold and 3 in the interspace between two adjacent folds, the bars being flattened inwards into thin flaps. The stigmatic areas in the interspaces are larger than those in the branchial folds and contain 8 to 10 stigmata each (Fig. 5). Intra-stigmatic vessels are present. There are three orders of transverse vessels in the wall of the branchial sac instead of four as in *Herdmania pallida*.

3. *The Tentacles.*—There are 22 to 24 tentacles, in three sizes (Fig. 4), about 8 being large, 8 medium, and 8 small-sized, those of various sizes

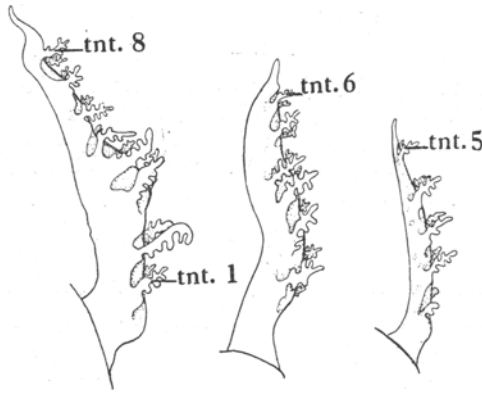


FIG. 4

The three orders of tentacles viewed from the side ($\times 12$). *tnt.*, 1–8, first to eighth tentaculet.

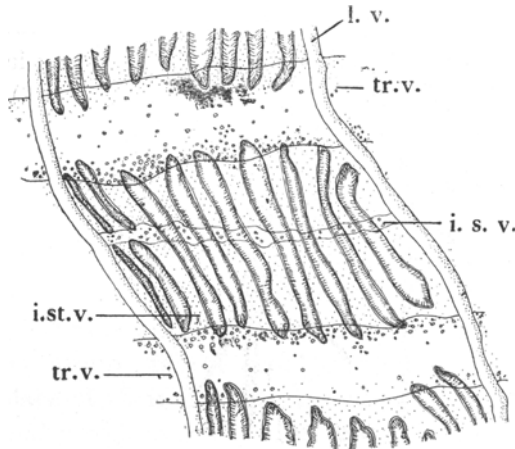


FIG. 5

A part of the branchial sac to show the branchial vessels and the stigmata ($\times 56$). *i.s.v.*, intra-stigmatic vessel; *i.st.v.*, inter-stigmatic vessel; *l.v.*, longitudinal vessel; *tr.v.*, transverse vessel.

alternating with one another. The tentacles are much branched and of the type called 'compound' by Herdman. Each tentacle is a flat curved structure attached by a broad base to the inner wall of the branchial siphon in the region of the branchial sphincter. The anterior border of the tentacle carries two rows of lateral branches, while the posterior portion forms a thin membranous flap (Fig. 4). The branches or tentaculets carry two rows of secondary branches, but the tertiary branches of *H. pallida* are absent here.

4. *The Dorsal Tubercle*.—The dorsal tubercle is comparatively large for a small ascidian of the present genus. It consists of a broad base from which arise two conical projections, each of which is formed by a spirally coiled conical lobe (Fig. 6). Each spirally coiled lobe consists of two loops or coils (3 in *H. pallida*) the proximal one being larger.



FIG. 6

Vertical view of the dorsal tubercle ($\times 26$). *hyp.d.*, opening of the duct, of the Hypophysial (neural) gland.

5. *The Peripharyngeal Bands*.—The peripharyngeal bands have a characteristic undulating course, being convex at the places where the branchial folds arise, and pushed inwards at the intervening spaces (Fig. 1).

6. *The Dorsal Lamina*.—The dorsal lamina is about 5 mm. in length and consists of 18 to 20 dorsal languets borne on a narrow flap attached to the mid-dorsal wall of the branchial sac (Fig. 1). Each languet is broadest at its base and tapers to a point at its distal end (Fig. 7). The languets are longest in the posterior third of the dorsal lamina.

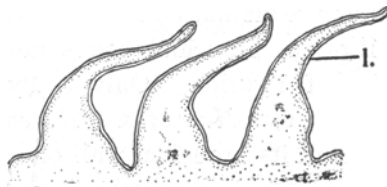


FIG. 7

Side view of a part of the dorsal lamina with languets ($\times 55$). *l.*, languet.

7. *The Alimentary Canal*.—The œsophageal aperture (Fig. 1), surrounded by the œsophageal area, leads through a short œsophagus into a wide tubular stomach. There are two digestive glands (Fig. 2), the larger situated on

the left and the smaller on the right side of the stomach, into which they open. The left gland measures 8 mm. \times 3 mm. and the right 3 mm. \times 3 mm. approximately. The intestine forms a long wide loop on the left side of the body, and the rectal orifice has four lips.

8. *The Gonads*.—There are two lobed gonads (Fig. 2), one on each side of the body. Each gonad along with its duct, measures roughly 12 mm. by 4 mm., the width representing the broadest posterior region of the gonad. The right gonad is usually more or less smaller than the left one. The testicular cæca are arranged in 9–14 clumps all around the outer side of each gonad; while the ovarian follicles lie along the central axis.

VI. *Specific Characters*

The size of the present species is smaller than that of other species of *Herdmania*. The test is thin, almost transparent, and devoid of sand, shell-fragments or spines and hair. The atrial siphon is very long, almost equal to half the length of the body, and the siphonal apertures are situated wide apart. The compound tentacles are of three alternating sizes and are usually 24 in number. The dorsal tubercle is large, consisting of two spiral coils. The stigmatic areas contain 8 to 10 stigmata each; intra-stigmatic vessels are present.

VII. *Remarks*

Herdman⁶ (1891) described 10 species of *Herdmania* (*Rhabdocynthia*), viz., *H. mollis*, *H. sacciformis*, *H. mauritiana*, *H. subfusca*, *H. tenuis*, *H. papientensis*, *H. complanata*, *H. rosea*, *H. pyriformis* and *H. pallida*; of which only two (*H. mauritiana* and *H. pallida*) were reported from the Indian Ocean. Later⁵ (1906) he added one more species (*H. ceylonica*) to this list. The species described in this paper brings the number of species of *Herdmania*; found in Indian waters, to four.

According to the detailed examination made by the author² (1936), the number of folds in the wall of the branchial sac is more or less a constant character in all the species of Pyuridæ. Only 3 Pyurids have yet been described with 7 branchial folds, viz., *H. subfusca*, *H. tenuis* and *H. ceylonica*. *H. ennurensis* also has 7 folds in its branchial wall on each side of the body. It differs, however, from *H. subfusca* in its pear-shaped body, in its smaller size, in the number of tentacles, and in the number of stigmata in each stigmatic area. The present species differs from *H. tenuis* in the size and shape of its body, in the number of tentacles, and in the arrangement of stigmata. It also differs from *H. ceylonica* in the absence of sand or shell fragments from the test (though much importance should not be attached

to this character, as the presence or absence of sand or shell-fragments depends mostly upon the nature of the substratum), in the great length of the atrial siphon, and in the large size of the dorsal tubercle with 2 spiral coils.

Herdmania is a cosmopolitan Pyurid found in all the seas of the world, except the Arctic of which the ascidian fauna has not been properly investigated. The Indian species *H. pallida* has been reported from the Pacific and Atlantic Oceans, as also from Malaya and West Indies. The other two Indian species *H. mauritiana* and *H. ceylonica* have been reported only from the Indian Ocean; while the present species *H. ennurensis* should be common on the East Coast of India.

VIII. Summary

The author describes a new species of *Herdmania* (fam. Pyuridæ) from Ennur (Madras). The present species can be distinguished from other existing species of *Herdmania* by the co-existence of the following characters:

Body small and pear-shaped; atrial siphon enormously elongated, being almost equal to the length of the body; dorsal tubercle large, consisting of a double spiral; tentacles compound, in 3 alternating sizes and 24 in number; branchial sac with 7 folds on each side; 8-10 stigmata in each stigmatic area.

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KEY TO THE INDIAN SPECIES OF *HERDMANIA*

Branchial sac with 7 folds on each side—1.

Branchial sac with more than 7 folds on each side—2.

1. Dorsal tubercle simple horse-shoe shaped—*H. ceylonica*.

Dorsal tubercle consisting of a double spiral—*H. ennurensis*.

2. Branchial sac with 8 folds on each side—*H. mauritiana*.

Branchial sac with 9 or 10 folds on each side—*H. pallida*.

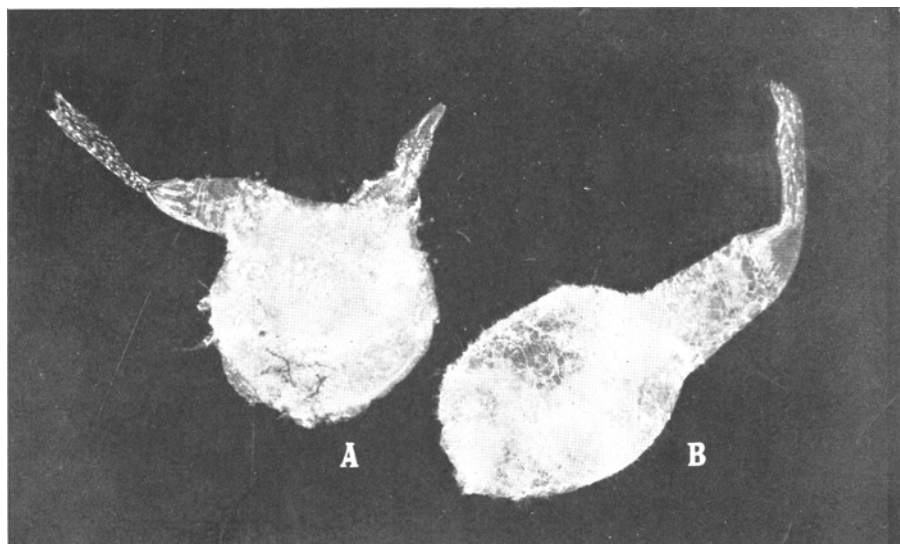


FIG. 8

Photograph of two entire specimens of *Herdmania ennurensis* n. sp.
A., side view; B., dorsal view; ($\times 1\frac{1}{2}$ nat. size).