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XX.—NOTES ON PHOSPHORESCENCE IN
MARINE ANIMALS.

By R. E. LLOYD, M.B., B.Sc., Captain, I.M.S., Surgeon Naturalist,
Marine Survey of India,

WITH

A DESCRIPTION OF A NEW POLYCHÆTE WORM.

By A. WILLEY, D.Sc., F.R.S., Director, Colombo Museum.

Towards the end of 1905, the R.I.M. Survey Ship "Investigator" trawled five times in the shallow waters of the northern part of the Persian Gulf. On one of these occasions the trawl was lowered late in the afternoon, so that the process of preserving the specimens had to be carried out in the dusk of the evening. While depositing some of them in formalin, my attention was arrested by a fine display of illumination by one of them,—a certain active Polychæte.

Before dropping this worm into the solution, no phosphorescence was noticed, but under the stimulus of the irritant, two rows of brilliant points of light, one on either side of the animal's back, became visible, and remained so for several seconds before gradually fading away.

These points of light were circular in outline, and about the size of a small pin's head. It was noticed that they were separated by equal intervals, that they appeared less in number than the segments, that they were situated about the bases of the parapodia, and that they were very prominent.

The worm was soon identified as probably belonging to the genus *Lepidasthenia*, and was sent to Dr. Willey, of Colombo, who confirmed it in this genus, pronounced it without hesitation as a new and well-marked species, and kindly gave the description quoted verbatim at the end of this paper as the definition of the species.

In sending this definition Dr. Willey asked me to add my own observations and figures, and further remarked that the first pair of elytra required a special description. The first pair of elytra are about three times the size of the others, they are carried on peduncles which curve forwards and then inwards, so that the elytra of either side overlap, mid-dorsally, hiding the prostomium and the bases of the palps and antennæ. It will be noticed in fig. 1,

that the second elytron of the right side and the second cirrus of the left side and their peduncles are missing.

This Polychæte was obtained in 25 fathoms of water about 30 miles west of Bushire.

In regard to the source of the phosphorescent lights observed, there can be no doubt that they emanated from the small elytra, but to say that the elytra were actually seen to be luminous would not be quite a true statement. The observation of the exact source of a phosphorescent light in such a case is a matter of great difficulty: to see the elytra it is necessary to examine the animal in a light so strong that the phosphorescence is inappreciable. The nature and distribution of the points of light described above agree exactly with the nature and distribution of the elytra, which were examined after the death of the animal. For this reason it is safe to assume that the light actually emanated from the elytra, and it is possible that all species of the genus exhibit this interesting phenomenon which was observed in this case merely owing to the happy chance of the animal being consigned to formalin late in the evening.

In order to make further observations on the phosphorescence of marine animals, the trawl was used twice this year at night in deep water, once off North Andaman Island in 235 fathoms, and once off Dondra Head, Ceylon, in 605 fathoms. The results of these stations may be enumerated as follows:—

STATION 374, OFF NORTH ANDAMAN ISLE, 235 FATHOMS.

Fish.

Macrurus investigatoris	..	..	..	I
Coloconger raniceps	..	..	..	2
Ateleopus indicus	..	..	..	I

Crustacea.

Nephrops andamanica	..	..	..	I
Aristeus semidentatus	..	..	..	{ I male. I female.
Homola megalops	..	..	..	I
Pandalus alcocki	..	..	..	{ 3 females. 2 males.
Pandalus martius	..	..	..	3
Munidopsis regia.				
Heterocarpus lævigatus.				
Squilla <i>sp.</i>				

Mollusca.

Xenophora pallidula.
Verticordea eburnea.
Two others unidentified.
A Decapod Cephalopod.

Hexactinellidæ.

Aphrocallistes beatrix.

Alcyonaria.

Pennatula pendula.

STATION 375, OFF DONDRA HEAD, CEYLON, 605 FATHOMS.

Fish.

Lamprogrammus niger.

Crustacea.

Heterocarpus alphonsi.

Polycheles phosphorus.

Nematocarcinus gracilis.

Mollusca.

Pleurotoma symbiotes with its symbiotic Epizoanthus
 A small species of Dentalium.

Asterids.

A species of Hymenaster.

Among these twenty-four species only three showed phosphorescence. These were the prawns *Heterocarpus alphonsi* and *Pandalus alcocki*, and the Alcyonarian *Pennatula pendula*. Of these the *Heterocarpus* gave the most striking display of its illuminating powers, which have been already noted by a former "Investigator" naturalist (Alcock, *Ann. Mag. Nat. Hist.*, vol. viii, 1891, page 16). We, too, were able to observe all that this author described. While the prawn was in water the light floated away from its oral region in two streams which became extinguished about two inches from their source.

The property which the secretion has of retaining its illuminating power after leaving the body was well illustrated by the following occurrence: When the prawn was taken out of the bucket, the water, dripping from the animal, was so highly luminous that a bright phosphorescent stream flowed down the antennæ (which were five inches long) and dripped from their ends in globules of light that did not become extinguished until they intermingled with the water in the bucket.

The other prawn which showed the same powers, but to a rather less marked extent, was one of the five specimens of *Pandalus alcocki*. The other four, whose tissues must have been quite dead, showed no light. This proves that negative evidence is of no value in such observations.

The third species which showed light was the Alcyonarian *Pennatula pendula* (common in deep waters about the Andamans, but only recently described by Thompson and Henderson, *Investigator Alcyonarians*, part i).

This specimen merely showed faint evanescent light when disturbed, but when placed in formalin solution rows of brilliant light points at once appeared on its pinnules and remained in evidence for at least a minute before dying out. This brilliant display suggested the possibility of recording such phenomena by photography; and the idea of photography, involving as it does the use of a dark room, helped me to see that our dredging in the dark, a most inconvenient procedure, was also unnecessary. The same results could obviously be obtained by removing the specimens to a dark room, where any well-marked phosphorescence could be recorded by placing them in a bottle of formalin solution on which a camera with very sensitive plates had previously been focussed.

It is hoped that such experiments will be carried out in future. Nevertheless my thanks are due to Commander W. G. Beauchamp, R.I.M., for allowing trawling at night and for the skilful way in which it was carried out under his personal supervision.

DESCRIPTION OF A NEW POLYCHÆTE WORM.

Family APHRODITIDÆ.

Lepidasthenia stylolepis, Willey, sp. nov.

"All appendages glabrous except the palps, which bear rows of small blunt papillæ. Antennæ sub-equal, the median slightly longer than the lateral and less than one-third the length of the palps. Elytra very small, borne upon long peduncles, which are somewhat shorter than the parapodia. Notopodia obsolete, with acicula but without setæ. Neuropodial setæ (fig. 4) of the anterior segments (and perhaps of all when unworn) with filiform tips below which there is a deep bidentation, as well as subterminal serrulations. There are thirty-seven segments present in the specimen, which is incomplete behind. Segments with brownish transverse bands along the posterior border. Dorsum quite exposed, the elytra directed away from it, on their stalks. The first ventral cirrus as long as the parapodium, the rest very short. Dorsal cirri pigmented, some pale, some fallen off, borne upon long peduncles which are as long as the parapodia, the cirri being shorter than their peduncles.

Elytra on segments II, IV, V, VII, IX, XXI, XXIII, XXVI, XXIX, XXXII, XXXV.

Both cirriophores and elytriphores penetrated by a cæcal diverticulum of the gut arising from the latter by a very narrow pedicel, then widening out."

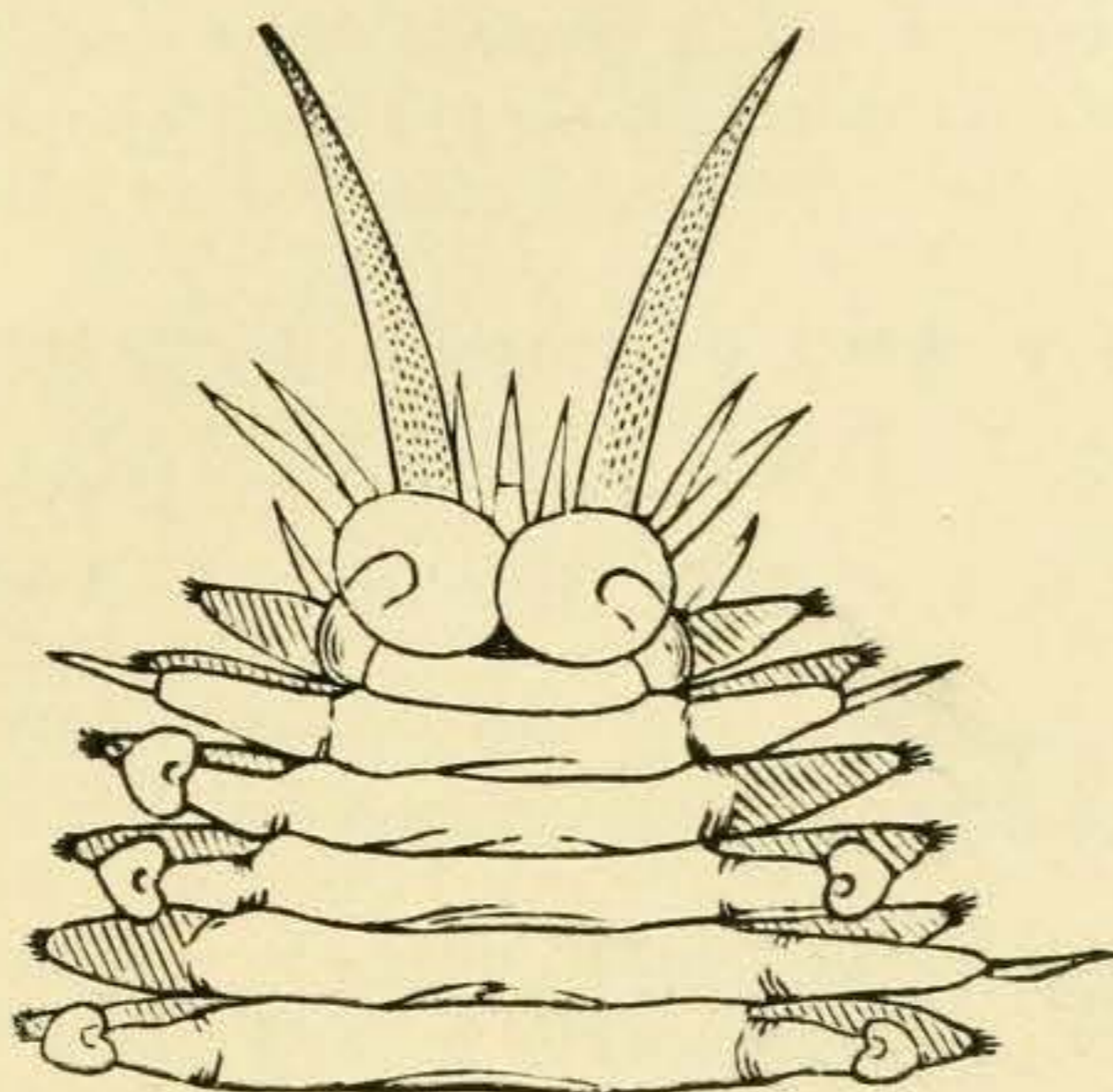


FIG. 1.—Anterior end of dorsal view of head and anterior segments. The left lateral antenna is shown too long.

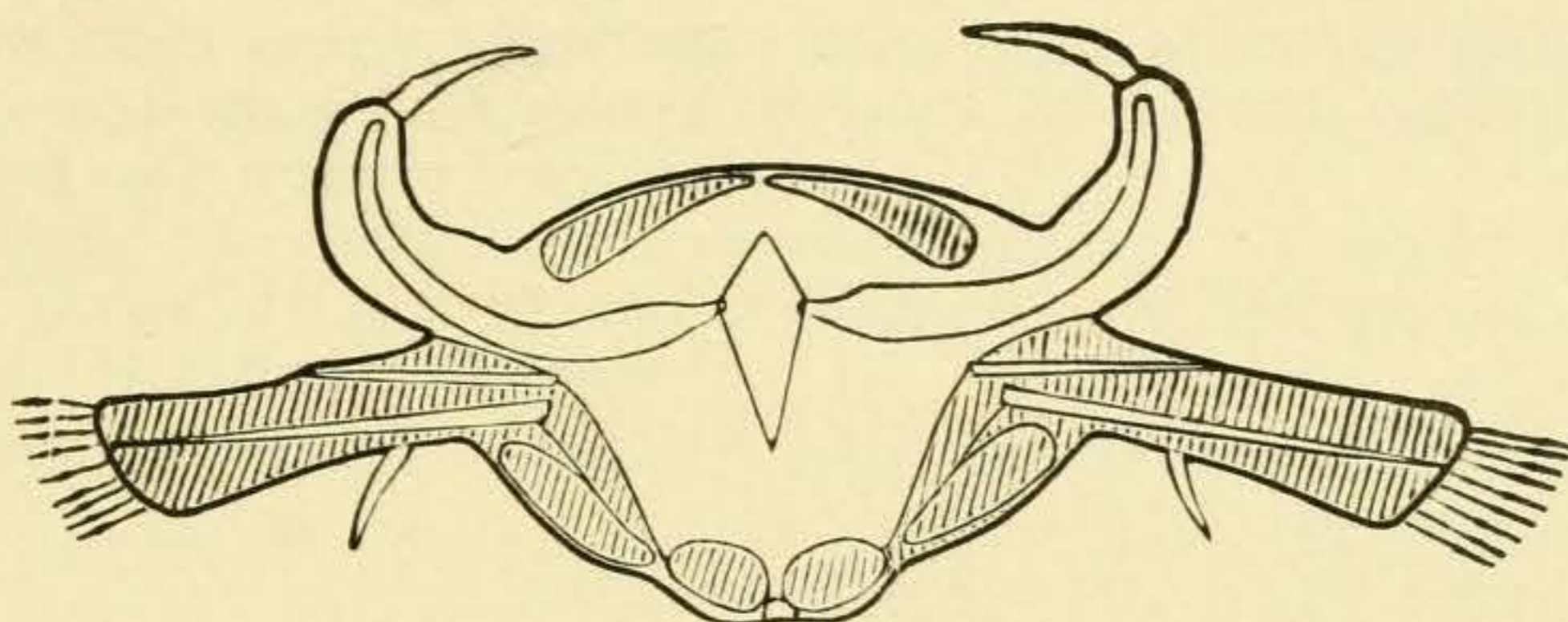


FIG. 2. — Segment bearing dorsal cirri.

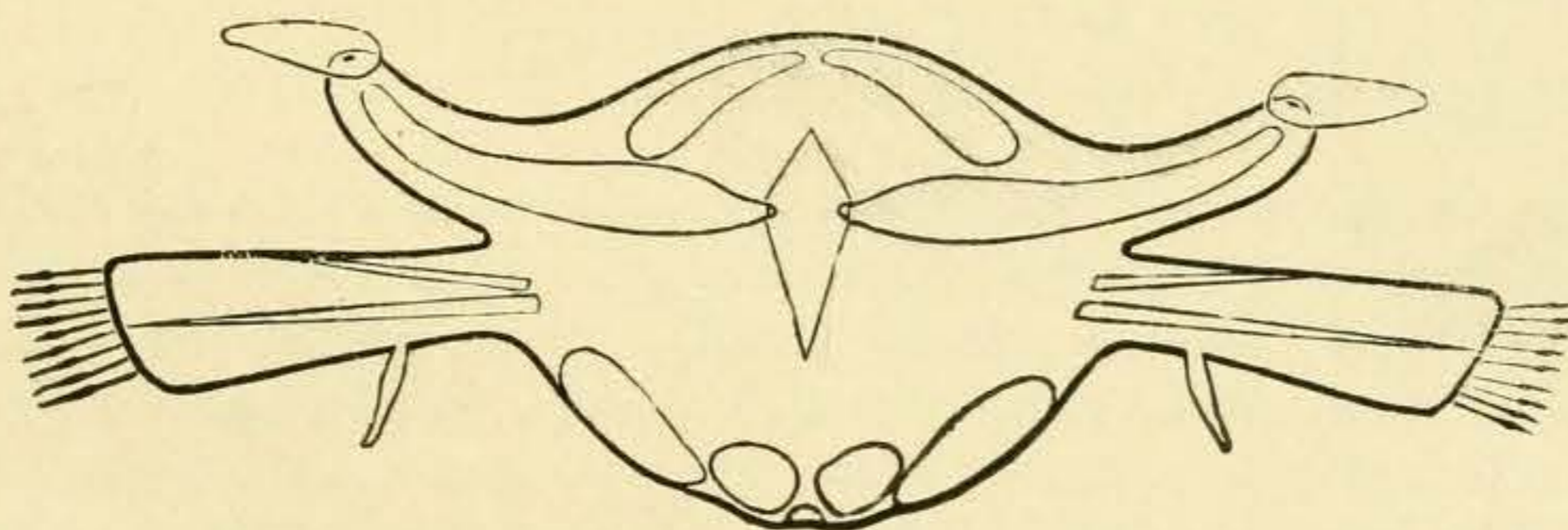


FIG. 3.—Segment bearing elytra.



FIG. 4. — Neuropodial seta.