

XXIV. ON *BOTHRIONEURUM IRIS*, BEDDARD.

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I recently received from Dr. Annandale for examination a tube of worms which had been taken at Kurseong in the Eastern Himalayas. These I believe to be the species first described by Beddard from the Malay Peninsula, in 1901, as *Bothrioneuron iris*; Michaelsen subsequently examined some specimens of the same form from Kurseong.

These appear to be the only occasions on which this species has been met with; the material at the disposal of the investigator does not seem in either case to have been large in amount, since Beddard speaks of finding spermatophores in three out of six mature examples, and Michaelsen had one mature and a number of immature specimens at his command.

The collection sent to me from the Indian Museum comprised a considerable number of individuals, of which perhaps a third were sexual. I have been able to note a certain number of variations from the original description; and it seems worth while therefore to add the following short account to the existing literature of this form

Bothrioneurum iris, Beddard.

1901 *Bothrioneuron iris*, Beddard, *Proc. Zool. Soc. Lond.*,
1901, vol. i, p. 81.

1909 *Bothrioneurum iris*, Michaelsen, *Mem. Ind. Mus.*,
vol. i, No. 3, p. 135.

The present specimens were whitish in colour in the preserved condition; after transference to oil of cedar preparatory to examination by transparency or imbedding, the posterior half of a number of specimens was darker than the anterior, in fact was blackish.

The longest specimens measured about one inch; the worms were moderately stout. Annulation distinct. A number of epizoic Ciliata, not unlike *Spirochona* in general form, were attached to a number of individuals, perhaps to most, near their posterior end.

Segments about 64. Prostomium semicircular. The surface of all the individuals shows a number of blisters, or raised patches of epithelium, probably due to the method of fixation (Perenyi's fluid).

Setæ. Both dorsal and ventral series are of the same type, double-pronged and doubly curved in the usual \int -shape: both

begin in segment ii. Their average length is about .087 mm.; the longest measured was .094 mm. The prongs of the fork are at a wide angle to each other, the distal being usually, not always, the longer, about $1\frac{1}{2}$ times as long as the proximal; the proximal however is the thicker, $1\frac{1}{2}$ times as thick as the distal prong at its base. There is a nodulus, which is situated distal to the middle of the shaft; its exact position varies only slightly, the proportions between the length of the shaft proximal and distal to the nodulus being about as 5:3. The number of setæ per bundle varies from three to six in the anterior part of the body, and in the posterior is regularly two per bundle. There are no ventral setæ on the segment which bears the male aperture (xi or xii). An examination in balsam of the specimen with five spermatophores, referred to below, seems to show that the dorsal setæ of segment xi (that of the male aperture) are small and singly pointed.

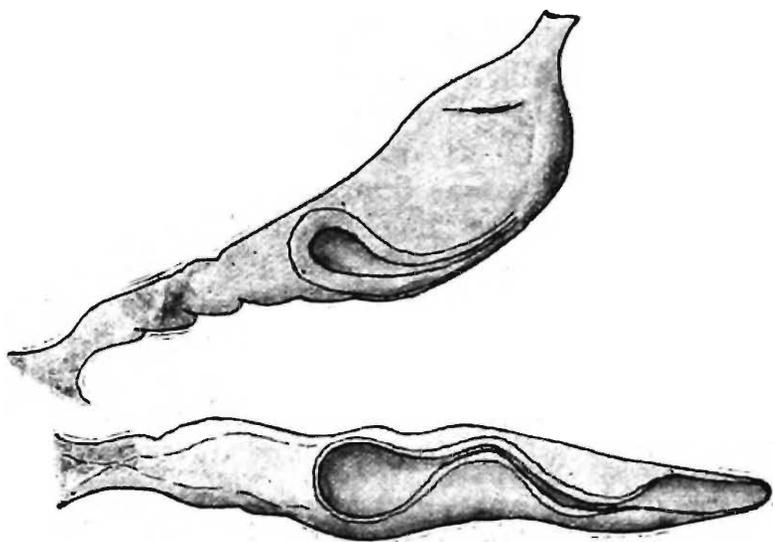


FIG. 1.—Two spermatophores from the same individual, showing their deformations when empty.

The *sensory depression* on the prostomium has the characters described by Beddard; it is variable in position, and may be nearly terminal.

The *clitellum* varies in position. It may be on segments xi and xii, or on xii and xiii.

The *male aperture*, single, median and ventral, varies in position with the clitellum; it is on xi or xii, accordingly as one or other of these is the first segment of the clitellum. In one case the clitellum extended over $\frac{1}{2}$ xi, xii, and xiii; ventral setæ were present on xi, and therefore the male pore was probably on xii, though owing to distortion at this place it could not be actually seen.

The setal distribution on these segments varies, as already said, according to the position of the male aperture, ventral setæ being always absent from the segment in which this occurs. They

appear to be sometimes absent in the following segment also ; thus in a specimen with no ventral setæ in xi, there was on one side in xii one seta only, and on the other side none ; while in another case none could be distinguished in either xi or xii.

The *spermatophores* characteristic of the genus are present on some, not all, sexual individuals. They have the general form described by Beddard ; when empty, many, indeed nearly all, exhibit a characteristic deformation (fig. 1). Such spermatophores appear at first sight to have a large pear-shaped opening on one side, the broad end of pear being towards the attached end of the spermatophore ; the margins of this apparent opening seem to be raised and rounded. The appearance is however probably due to shrinkage, since the margin of the apparent opening may not be complete at the narrow end of the pear ; moreover, one empty spermatophore had no such appearance of a lateral rent ; and in one case an open mouth was distinctly seen at the distal end of the spermatophore. The spermatozoa therefore probably escape from the free end of the spermatophore, and, as Beddard previously concluded, arguing from the solid nature of the stalk, hypodermic impregnation is improbable.

The spermatophores may occur singly, or may be present in larger numbers ; I counted as many as five in one specimen, and two on several occasions. They are found on the clitellar segments, often in or near the intersegmental groove behind the male aperture. I have never seen any on the ventral surface, *i.e.*, within the ventrolateral ridges which give this part of the body a triangular appearance in transverse section ; they are, for example, all dorsal or dorso-lateral in the specimen with five spermatophores already referred to. With one exception, all spermatophores seen were empty.

The female apertures are small openings in the intersegmental furrow behind the male aperture.

Reproductive organs. The testes spring from the junction of the septum and the ventral body-wall. The sperm funnels are small. The first part of the conducting apparatus is contained in a forward bulging of the septum on each side, so that this part of the tube is at the same actual level in the animal's body as the testis in the preceding segment, and the testis may appear wedged in between the winding vas deferens on the outer and the intestine on its inner side. The vas deferens is divisible into two regions, of which the characters and relations are as described by Beddard.

The atrium (spermiducal gland) differs a little from the previous description of *B. iris*. The typical condition, as illustrated by several series of sections, appears to be as follows :—the first part is a well defined tube, without the thick investment of peritoneal cells which clothes the vas deferens ; it is circular in transverse section and gradually widens, having on the whole a somewhat fusiform shape ; its epithelium consists of numerous layers of close-set cells, the inner ones being columnar ; the cells are very finely granular, and the cytoplasm stains equally. The next

part reaches to within a short distance of the aperture; the epithelium is columnar, the cells are in a single layer, and the lining has a ragged appearance, due to the fact that the inner portions of the cells are not in contact with each other; these cells are mucous cells, their bodies being for the most part clear

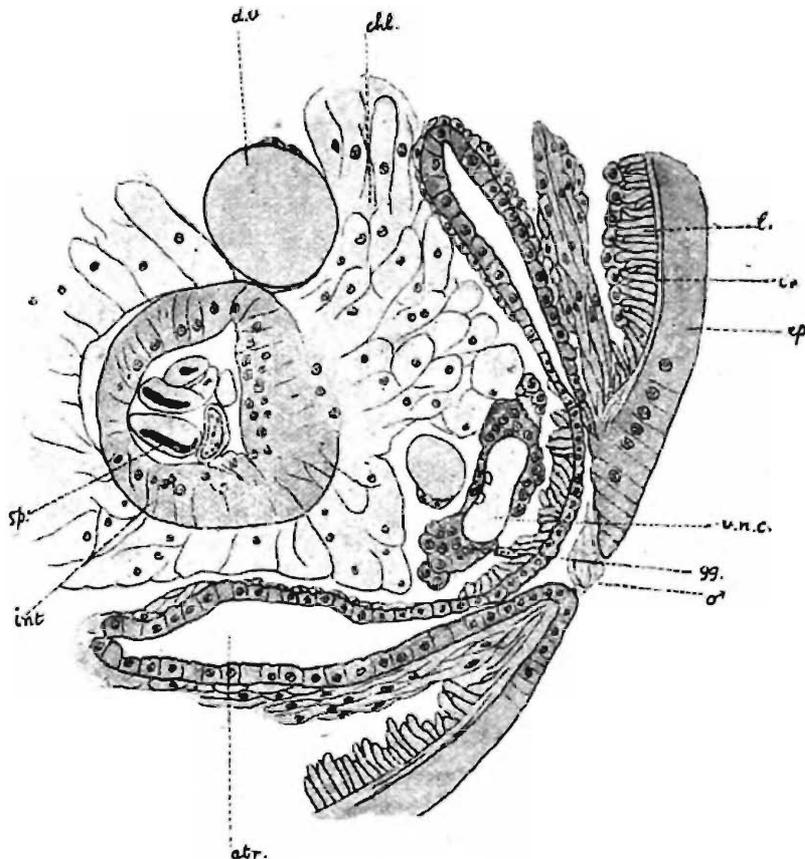


FIG. 2.—Part of a transverse section passing through the male aperture. The character of the epithelium lining the last part of the atrium, the flattening of the nerve cord in this region, its 'Neurochordröhrchen', the great bulk of the chloragogen cells, and the Sporozoa in the alimentary tract (the nucleus of one individual has broken up), are illustrated. The ventral vessel is the structure just dorsal to the nerve cord.

Zeiss's drawing apparatus, obj. DD, oc. 6.

Atr., atrium; *c.*, circular muscular layer; *chl.*, chloragogen cells; *d.v.*, dorsal vessel; *ep.*, surface epithelium; *gg.*, nerve ganglion cells; *int.*, intestine; *l.*, longitudinal muscular layer; *sp.*, sporozoa in intestine; *v.n.c.*, ventral nerve cord; *σ* male aperture.

and non-staining, and masses of a clear secretion are cast out into the lumen; the walls of the tube are thinner than those of the first part, and its outline is far less regular,—not only internally, owing to the ragged nature of the lining, but externally also, since a number of small diverticula are given off from it; these diverticula are lined by a similar epithelium to that of the tube

itself. The paratrium, which is small, egg-shaped, without a cap of peritoneal cells, and possesses a hardly distinguishable lumen, arises from this portion of the tube a little beyond the end of the first part; its mouth is invaginated into the atrium. The last part of the tube, comprising only a short extent near the male aperture, is lined by a cubical or even slightly flattened epithelium (fig. 2).

I am, however, doubtful if there is any such sharp division between the character of the cells of the first and second parts of the tube as is indicated above. In one of the series of sections, the cells of the first part of the tube, as well as the second, are mucous-looking cells, in appearance very similar to those of the clitellum in the same specimen; and the cells of the second part of the tube are close-set like those of the first part, and not ragged in appearance. The differences may, therefore, be due to differences in the functional activity of the cells.

The ovaries are in the segment succeeding the testes. The female apertures have already been mentioned. The egg funnels, in the only specimen in which they were identified, are small, and the oviducts short and narrow. There are no spermathecae.

With regard to the other systems, the following remarks may be made. The *alimentary canal* shows very little differentiation from mouth to anus; in segment i what may be called the buccal cavity is lined by a flattish epithelium; this is succeeded by columnar cells in segment ii; in segments ii and iii the cells are higher than elsewhere, and this portion may be called the pharynx; a few muscular fibres radiate backwards in these segments, attaching the pharynx to the bodywall, and reaching the parietes in segments iii and iv. Masses of gland cells are present in connection with the alimentary canal in segments iii, iv and v. Two of the most striking features in sections are the enormous parasitization of the anterior part of the alimentary canal by large sporozoa, and the great bulk of the chloragogen cells around the alimentary tube; these latter begin in segment iv (*cf.* fig. 2).

I have, in agreement with Beddard, failed to find any system of *cutaneous capillaries*. The atria unite in the middle line underneath the *nerve cord*, as described by that author; the nerve cord is here very considerably flattened in a horizontal direction; it contains, in the anterior part of the body, a tubular cavity (Neurochordröhrchen), which is double in the genital region, and may be so elsewhere (fig. 2).

The original diagnosis of *B. iris*, as given by Beddard, runs as follows:—Male pore single and median on xii. Clitellum xii, xiii. No integumental vascular system. No genital setae. Spermatophores present to the number of one.

It will be seen that the present specimens do not conform to this diagnosis, since (i) the male pore is not invariably on xii; (ii) nor is the clitellum invariably on xii—xiii; and (iii) the spermatophores may be as many as five. Further differences are found in (iv)

the number of setæ in a bundle,—not more than four in Beddard's specimens, sometimes as many as six in mine; (v) the position of the spermatophores,—not round the male generative pore, but on the dorsal and dorsolateral surfaces of the clitellar segments; (vi) some histological differences in the male efferent apparatus.

It may therefore seem hazardous to include these specimens in the same species with those formerly described. I do so however for the following reasons:—

(a) The species is already known to be a variable one. This is illustrated by the variations in the position of the sensory depression on the head. It is also illustrated by the fact that in the single specimen recently examined by Michaelsen, which he had no difficulty in assigning to this species, the male aperture was on the xi, and the clitellum on the xi and xii segments; and it is interesting to note that Michaelsen's words, "I think this dislocation (*i.e.*, the dislocation backwards of male organs and clitellum in Beddard's specimens) an abnormality without systematic importance," are supported by the finding of both modes of disposition in the one batch of specimens examined by me. And further, the variable nature of this form comes out in the difference in shape of the spermatophores as found by Beddard and Michaelsen respectively.

(b) As noted above, the number of specimens at the disposal of previous investigators appears to have been small. It is therefore not impossible that the examination of a larger number of individuals would have revealed variations similar to those recorded in the present paper, which would have necessitated a widening of the specific diagnosis.

(c) I have of course also been influenced by the fact that my specimens come from Kurseong,—the identical place from which those submitted to Prof. Michaelsen were taken.

I have in conclusion to offer my thanks to Dr. Annandale for affording me the opportunity of examining this interesting form.

