

2. On the Turbellarian Worm *Avagina incola*, with a Note on the Classification of the *Proporidæ*. By ROBERT T. LEIPER, Research Student, Glasgow University (Embryological Laboratory)\*.

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(Plate XXV.)†

The Turbellarian which forms the subject of the present paper was briefly described by me at the Meeting of the British Association for the Advancement of Science held at Belfast in 1902. The chief characters were pointed out and the name of *Avagina incola* gen. et sp. nov. given to it, in a report of that Meeting in 'Nature' (cf. vol. lxvi. p. 641, 1902).

It was observed by me to be present in the "accessory canal" of about five per cent. of the specimens of the common Heart-Urchin, *Echinocardium cordatum* Penn., collected from Kames Bay, Cumbræ, N.B., in the summer of 1902, and is of interest as being the only recorded example of distinct parasitism among the Acœlous Turbellaria (III.)‡.

*General Features* (Plate XXV. figs. 1, 2).

*A. incola* is whitish and moderately translucent in appearance, leaf-like in shape, obovate in outline when contracted, lanceolate when extended, the blunt end being anterior. It measures in length 2.5 mm., in breadth transversely .6 mm., dorsi-ventrally .2 mm., and progresses by a slow creeping spiral movement. Several examples are usually found in the same host.

*Integument* (Plate XXV. fig. 3).

The integument consists, as in other Acœla, of (1) a muscular network of single, circular, oblique, and longitudinal fibres abutting on the superficial parenchyma, and (2) a granular cuticle uniformly covered with cilia. Not unfrequently along the ventral surface, but seldom on the dorsum, the cuticle is swollen by vesicular structures which are sometimes surmounted by large granular projections (fig. 3, A, B). There are no rhabdites or sagittocysts.

*Mouth* (Plate XXV. fig. 4).

The mouth is merely an opening in the cuticle exposing the superficial parenchym. Its position on the under surface at about the junction of the anterior fourth with the rest of the body is recognisable in the living animal, even from the dorsal surface on careful focussing, by the converging action of the cilia. There is practically no pharynx.

\* Communicated by the SECRETARY.

† For explanation of the Plate, see p. 411.

‡ Roman numerals in brackets refer to the List of Literature given at the end of this paper.



*Parenchyma* (Plate XXV. figs. 4, 6).

The parenchyma may be divided into two portions :—(1) A cellular layer, much thicker on the ventral surface than on the dorsal, with oval nuclei lying for the most part at right angles to the cuticle and staining faintly. This is known as the “dermal layer” and gives support to the integument which is immediately superimposed. (2) Fine protoplasmic strands passing inwards from the dermal portion. These by their anastomosis form a meshwork enclosing vacuoles in which various free cells lie. On reaching the ovaries they unite to form a delicate capsule, whence still finer strands pass to enclose the individual ova in follicle-like spaces.

*Digestive Vacuole* (Plate XXV. figs. 1, 2, 4).

Immediately over the mouth the ovaries are separated by a large vacuole extending between the dorsal and ventral layers of the dermal parenchyma and traversed by protoplasmic strands only at the periphery. The ovaries soon reunite ventrally, but the space is continued a short distance further along the mid-dorsum and roughly occupies the anterior middle fourth of the body. In it are found particles of ingested material together with wandering cells. It represents the digestive tract, but has not an epithelial lining or any defined passage to the mouth. The food-particles are in all probability caught in the mobile protoplasm presenting at the mouth, and passed on into this digestive vacuole.

*Frontal Organ* (Plate XXV. fig. 5).

The frontal organ differs from that of all other Acœla save *Böhmigia maris-albi* (Sabussow), and is here represented by numerous large single-cell mucous glands lying in the parenchymatous strands and bulging into the vacuolar spaces above and around the brain. Those lying immediately under the dermal parenchyma dorsally are perhaps the largest, but their ducts all pass to open like those of the remainder, each by a separate aperture, on to the ventral surface only. As it perforates the cuticle each duct dilates to form a small ampulla. Both glands and ducts stain readily and deeply with hæmatoxylin owing to the presence of very fine granules. The secretion is adhesive and plays an important part in locomotion.

*Nervous System.*

The nervous system, which is not well differentiated, consists of two lateral masses situated at the anterior end of the body and communicating with one another by a commissure in which lies the otocyst. From each ganglionic mass a lateral and a posterior nerve are seen to be given off. The tissue generally is finely fibrillar, enclosing small clear cells with punctate nuclei. Eye-spots are absent.



*Reproductive System* (Plate XXV. figs. 6, 7).

*A. incola* is hermaphrodite and is found sexually mature at Millport, N.B., in June and July.

The penis is situated on the ventral surface at the junction of the posterior fourth with the rest of the body. It is conical and carries a knob-like armature at its distal end. At its proximal end its duct dilates to form a pyriform vesicula seminalis, the walls of which are formed by a thickening of the surrounding dermal parenchym and into which the testes open on either side by no distinct or epithelially lined channels. The testes consist of follicular masses extending forwards on either side in the parenchym of the lateral parts of the body, outside the ovaries, to beyond the mouth, and posteriorly also for a short distance into the tail. The sperm-follicles near the vesicula seminalis contain deeply staining chromatin figures.

The ovaries extend on either side of the middle line from beneath the brain to within a short distance of the male apparatus. They early unite, but are soon separated by the digestive vacuole, joining again in the posterior middle fourth of the body (figs. 1, 2). The ova increase in size as they pass backwards and are enclosed in delicate parenchyma, each occupying latterly a separate "follicle."

No accessory female organs are present. There is no vagina through which the ova can be extruded, and it would appear from a careful examination of ripe specimens that the cuticle simply gives way before the ripe ovum owing to an ever-increasing growth-pressure—this rupture taking place at a short distance in front of the penis (fig. 7). In several examples the ova lying most posteriorly had acquired a relatively dense capsule, stainable with osmic acid, and these not infrequently showed mitotic figures. These facts, taken in relation with the armature of the penis, seem to point to copulation being effected by simple perforation of the cuticle.

## SYSTEMATIC POSITION.

The turbellarian now described differs along with all the species of *Haplodiscus* from other Acœla in that it possesses no female accessoria. From *Haplodiscus* also it differs in the following respects:—

- (1) Shape.
- (2) Parasitic habitat.
- (3) Mouth in anterior fourth.
- (4) Paired lateral testes.
- (5) No defined vasa deferentia.
- (6) Penis with knob-like armature.
- (7) Frontal organ well developed and opening by many mouths.
- (8) Large digestive vacuole.

These differences seem to be of sufficient importance to warrant the erection of a new genus, which I have called *Avagina*. As an



indication of its habit—this being the first recorded parasitic Acœl (III.)—I suggested *incola* as the specific name.

#### NOTE ON THE PROPORIDÆ.

V. Graff in his recent monograph (I.) divided the Proporidæ—Acœla with one genital pore—into two genera: (a) *Proporus*, (b) *Monoporus*. In both these the male and female ducts open into a common atrium genitale which communicates with the exterior by a single aperture. They are distinguished from each other by the absence and presence respectively of a spermatheca.

Since then (1890) some further contributions have been made to our knowledge of this family. In 1892 v. Graff (II.) drew attention to the turbellarian characters of *Haplodiscus piger* (Weldon). In 1895 Böhmig (IV.) described six new species of this genus and corroborated Weldon's observation of the absence of female accessoria. The following year Sabussow (V.) recorded another species, on which also Monticelli wrote (VI.). In 1899 Sabussow (V.) obtained from the White Sea an Acœl to which he gave the name *Böhmigia maris-albi* (VII.).

Böhmig's classification of the family is as follows:—

- “Genera—(a) *Monoporus*—Proporidæ mit Bursa-seminalis, &c.  
 (b) *Proporus*—Proporidæ ohne Bursa-seminalis, &c.  
 (c) *Haplodiscus*—Proporidæ ohne Bursa-seminalis.  
 Die Mundöffnung findet sich in oder hinter der mitte der Bauchfläche. Der Pharynx ist, wenn vorhanden, kurz und wenig entwickelt. Der Korperform ist platt scheibenförmig.”

He thus distinguishes *Proporus* and *Haplodiscus* merely by the position of the mouth, the size of pharynx, and shape of body, while he ignores the absence in *Haplodiscus* of the “atrium genitale” in the other two genera.

Now it has been shown above (p. 409) that in *Avagina* the female apparatus is incomplete, the ova being extruded through a temporary opening which has no connection with that of the male organ. As in *Haplodiscus* there is a similar absence of vagina, it seems not improbable that a like method of ova-extrusion also obtains.

The union of the male and female systems to form a common genital atrium in the genera *Proporus*, *Monoporus* and *Böhmigia*, and their total separation in *Haplodiscus* and *Avagina*, seem to render desirable a subdivision of the family as under:—

Family PROPORIDÆ: Acœla with one genital aperture.

Subfamilies I. *Proporinæ*: to include those Proporidæ with a common genital atrium.

Genera: (a) *Proporus*, (b) *Monoporus*,  
 (c) *Böhmigia*.

II. *Avaginina*: to comprise those Proporidæ with male accessoria only.

Genera: (a) *Haplodiscus*, (b) *Avagina*.







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