

Studies on the Turbellarian Fauna of the Norfolk Area, I

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Macrostomum ruebushi var. *kepneri** is a flat-worm of the Family Macrostromidae, of the sub-order Opisthandropora and of the order Rhabdoceola.¹

This actively swimming form may be collected at high tide in the reeds and muddy waters of Tanner's Creek at the Colley Avenue Bridge, Norfolk, Virginia, at a depth of from two to four feet. Many mature specimens were studied alive with the vaseline cover glass technique. Material fixed in Beauchamp's and Zenker's fixatives which was sectioned at 8 micra and stained in Delafield's and Heidenhain's, gave good histological results. Both sectioned and total-mount material has been deposited in the United States National Museum at Washington, D. C.

The animal (Fig. 1) is shaped like a typical *Macrostomum*, dorso-ventrally compressed with a rounded anterior end. There is a singular absence of a spatulate tail, this region being somewhat pointed in a freely-swimming specimen. The animal is approximately the same width throughout its length. Average measurements show the length to be 1.12 mm. and the width about .16 mm. This flat-worm is colorless except for the brownish enteric contents. Many unusually large, granular amoebocytes (10.5 micra) may be noted in the lateral parenchyma.

The epidermal epithelium is composed of a flattened layer of cells, pentagonal when viewed in dorsal optical section, tall and columnar (6 micra by 1.5 micra) when viewed laterally in sectioned material. The dorso-anterior epithelium is thicker, the cells measuring 7 micra by 1.5 micra. The epidermis is well supplied with oval glands (3 micra by 6 micra) which open externally and are presumably mucus-producers. The external body surface is entirely clothed by a fine coat of cilia approximately 6 micra in length. The anterior region is provided with short tufts of sensory hairs about one-third longer than the cilia. A sparse adornment of spines which measure up to 22 micra in length may be seen posteriorly. The rod-shaped adenal rhabdites occur in groups of 7 to 9 and are about 7.5 micra long. They are few in number and are located laterally upon both the ventrum and the dorsum, there being none down the mid-line of the body. Well defined "Rhabditen-strassen" may be discerned anteriorly originating above and below the "brain" commissure and

* *Macrostomum ruebushi* var. *kepneri* is named for Dr. W. A. Kepner of the University of Virginia.

¹ Meixner (1938) in his recent revision of the system of classification in the Turbellaria included the Family Macrostromidae in the Order Macrostromida.

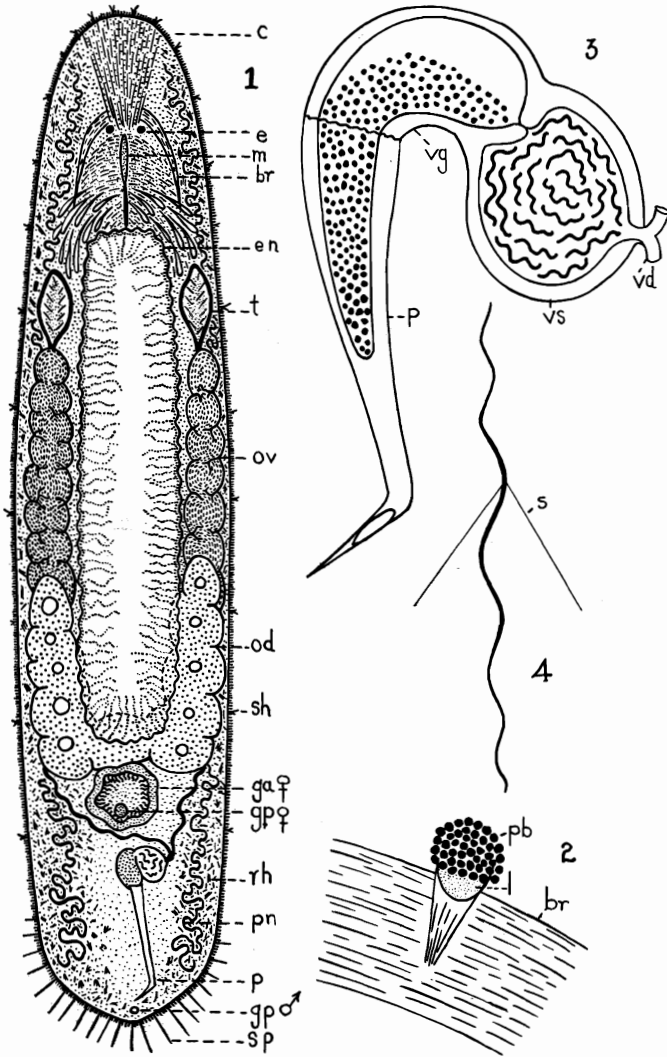


Fig. 1. Dorsal view showing gross anatomy $\times 80$. br, "brain"; c, cilia; e, "eye"; en, enteron; ga , female genital atrium; gp , female gonopore; gp , male gonopore; m, mouth; od, oviduct; ov, ovary; p, penis; pn, protonephridium; rh, rhabdites; sh, sensory hairs; sp, spines; t, testis.

Fig. 2. Detail of "eye" $\times 290$. br, "brain"; l, "lens"; pb, pigment beaker.

Fig. 3. Male Sex Apparatus $\times 623$. p, penis; vd, vas deferens; vg, vesicula granulorum; vs, vesicula seminalis.

Fig. 4. Mature sperm-cell: $\times 623$. s, seta "Nebengeisseln."

ending at the anterior terminus of the body. The pharyngeal walls are well supplied with streamers of rhabdoidal glands whose products are tiny "Rhammiten," very thin, long, and spindle shaped. Numerous large (3 micra) ovoidal "Stabchen" rim the walls of the female genital atrium and may be noted as a rosette over the atrium in a dorsal perspective.

The "brain" is not of the usual smooth semi-lunar contour so common to the genus but is semi-lobate. It is located equidistant from the dorsal and ventral sides of the body near the anterior end. There are noticeable dorsal projections of nerves, and in a frontal longitudinal section two prominent anterior ones may be noticed between the "eyes." The lateral longitudinal nerves are large and are appended to either ganglionic half of the brain. The commissure between the ganglia is not a prominent feature. The paired "eyes" (Fig. 2) lie immediately behind and dorsal to the "brain" being partially embedded in it. The pigment-cup and "lens" compose an organ of ovoidal shape which retains a tenuous connection with the "brain." The pigment-cup composed of very small dark brown globules (2 micra) measures 8 micra in length while the "lens" is 6 micra long.

The mouth is a slit-like opening guarded by two ciliated lips located in the ventral surface slightly posterior to the "eye"-level. It communicates directly with a pharynx simplex which is about twice as long as the mouth opening. In optical section the pharynx appears almost rectangular in shape and it opens directly into the enteron by means of a ventral trough. Two types of glands attend the pharyngeal cavity; the "Rhammiten" mentioned above, and a system of radiating streamers which extend as far posterior as the testes and which supply a product of granular nature to the pharynx. These gland-cells are slender and pyriform in shape. The pharyngeal walls are supplied with a dense coat of cilia which resembles that on the external body surface. The unusually strong epithelium of this organ is made up of closely packed columnar cells which are about 6 micra tall.

The rod-shaped, slightly diverticulated enteron (about 630 micra long) extends posteriorly to the common oviduct. The epithelium is ciliated and is provided with a multitude of very small enteric gland cells. Strong longitudinal muscle fibers course upon either side of the enteron. They are about 2 micra to 4 micra in thickness and are most prominent in the tail region.

The excretory system, composed of lateral protonephridial tubules, extends the length of the body, becoming quite prominent at the level of the "eyes" where the tubules measure about 2 micra in diameter. Very large (10 micra long) flame-cells are appended to the terminal branches of this system. The external opening was not observed.

The male reproductive system in this hermaphroditic form is made up of testes, vasa deferentia, vesicula seminalis, vesicula granulorum, prominent penis-stilette and male gonopore. The ovoidal, smooth-walled testes are

located latero-ventrally in the last of the first body third. Nurse-cells in these organs measure from 3 micra to 4.5 micra in diameter. From the posterior tip of each testis, a vas deferens extends caudally until it reaches the posterior margin of the enteron where it bends mesially to unite with its counterpart of the opposite side at a point slightly to the right of the mid-line of the body. There is no "false vesicula seminalis" developed at the juncture of the two tubes. The ductus seminalis empties directly into a small (30 micra diameter) vesicula seminalis (Fig. 3) of strongly developed muscular walls and a simple ciliated epithelium. There are no ciliated chambers such as are present in most other American Macrostromums. The sperm-cells lie rolled into a bolus awaiting passage through the short ductus ejaculatorius into a comparatively thin-walled vesicula granulorum packed with hyaline granules. These granules, arranged in small platelets, extend far into the male genital canal of the penis-stilette. The stilette (Fig. 3) is of the *M. ruebushi* Ferguson type, being a simple extended funnel with a terminal bend. The opening (15 micra long) lies adjacent to the very sharp point and may be seen as a lateral aperture. The stilettes have an average length of 67.5 micra with a basal dimension of 15 micra. The penis-stilette communicates directly with the male gonopore which has a singular position at the very posterior tip of the body. This does not occur in any other Macrostromum.

The mature sperm-cell (Fig. 4) as observed in material taken from the vesicula seminalis is a thin filament (up to 75 micra in length) of undulant movement and possessing no cellular differentiation except for a pair of "Nebengeisseln" or setae (3 micra long) which are directed latero-posteriorly from the mid-cell. The usual chromatin granules are not visible in living cells.

The female reproductive system consists of ovaries and oviducts; a genital atrium, a female gonopore and accessory glands. The paired, heavily indented ovaries are embedded in the latero-dorsal portion of the parenchyma and lie entirely within the posterior two-thirds of the body. The oöcytes are quite small measuring only 3 micra in diameter on the average. The oviducts course mesio-dorsally from the mesial margin of the posterior region of each ovary to unite in the common oviduct under the posterior end of the enteron. This common oviduct extends postero-ventrally to communicate with the female genital atrium. The atrium may be distended with a spherical egg of reddish-brown color measuring about 130 micra in diameter. The walls are so developed as to prevent collapse, however, so that the atrium may always be observed as a discrete structure even though it may not contain an egg. The ciliated epithelium of the atrium is quite tall (15 micra) and glandular. The female gonopore is a mid-ventral opening limited by ciliated lips and is located slightly postero-ventral to the atrium.

The chromosomes in this form are so small (2 micra long) as to prevent proper study of them.

The taxonomic placement of this form involves a consideration of, and a comparison with, the difficult *M. ruebushi* Ferguson group as outlined in the

monograph upon the genus now in press. If the morphology of the penis-stilette is taken as the chief diagnostic character then a comparison between this form and *M. ruebushi* var. *frigorophilum* Ferguson would be pertinent since the stilettes of the two compare favorably. The morphological features of *M. ruebushi* var. *frigorophilum* Ferguson which differ from the presently described form are herein listed.

(1) *M. ruebushi* var. *frigorophilum* Ferguson has a body shape resembling a large barge with a slightly pointed anterior end and an abruptly truncated posterior end.

(2) It measures 1.6 mm. by .4 mm.

(3) Rhabdites are unusually numerous throughout the epidermis.

(4) There are no spines and the sensory-hairs are located mostly at the extremities of the body.

(5) The "brain" is bi-ganglionic and has a clearly defined median commissure.

(6) The "eye" is a cone shaped structure with a rim of pigment globules.

(7) The mouth is an unusually long slender opening.

(8) The testes are located in the caudal region of the anterior half of the body.

(9) The vesicula granulorum is provided with ciliated chambers.

(10) The penis-stilette measures 88 micra in length and has almost a right angle bend terminally. The opening extends up to the sharpened tip.

(11) The male gonopore is located about 32 micra from the posterior body end.

(12) The sperm-cell is a thick spindle shaped structure differentiated into tail, body, feeler and lateral setae and measures about 52 micra in length.

Macrostomum ruebushi var. *kepneri* offers clear distinction from the features noted above in *M. ruebushi* var. *frigorophilum* and from all other previously described *Macrostomums*.

***Macrostomum ruebushi* var. *kepneri* var. nov.**

Body anteriorly rounded, posteriorly semi-pointed, colorless, ciliation consists of spines, sensory hairs and cilia, rhabdites lacking in mid-line of body, testes smooth-walled, ciliated chambers lacking in vesicula granulorum, penis-stilette (up to 67.5 micra long) a simple funnel with sharpener bent terminus, sperm-cell a thin filament, female genital atrium strongly developed, body length up to 1.12 mm. (Paratype; U. S. N. M. No. 20526).

SUMMARY

This paper describes the anatomy of a new flat-worm of the genus *Macrostomum* which attains an intense morphological variation in America. While it presents the general plan of a *Macrostomum* it has many unique features, the most singular being the absence of rhabdites in part of the epidermis and the presence of a male gonopore which is almost terminal in position.

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