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**A Monograph of the Genus *Macrostomum* O. Schmidt 1848.
Part V.**

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(With 26 Figures.)

Eingeg. 9. September 1939.

Macrostomum lewisi mihi.

Macrostomum lewisi mihi¹ is an inhabitant of "the land of the sky" living as it does in the waters of the high mountain country of the Skyline Drive, Greene County, Virginia. It was first collected from the rushing water of the White Oak Canyon Falls, where it may be taken in masses of algae and moss which cover the rocks of the cataract.

The animal is colorless and measures 1.3 mm. in length. The elongate slender body has a truncated anterior and a spatulate posterior end. The epidermal body surface is provided with cilia, sensory hairs, spines, and rhabdites. The entire body surface is ciliated and the sensory hairs located in tufts (34 μ long) are more prominent on the lateral body surfaces. Spines are present only at the extremities. Rhabdites in the adhesive disk of the tail measure 16 μ by 1.6 μ and project from the epidermis about two-thirds of their length in the act of adhering to the sub-strate. They are usually four or five to a group.

The reniform eyes (Fig. 1, *e*) are situated dorsoposterior to the commissures of the brain. There is a difference of about 4 μ between the width of the ganglia and that of the commissure which joins them in the mid-line of the body.

The development of the digestive system is normal.

The excretory system (Fig. 1, *pn*) did not present an observable external opening. The protonephridia, branches and terminal flame cells are usual in their morphology.

The smooth-walled sac-like testes (Fig. 1, *t*) occupy a position in the lateral mid-body region. The vasa deferentia (Fig. 2, *vd*) join just to the left of the mid-line posterior to the female genital atrium where they empty simultaneously into the lumen of the vesicula seminalis (Fig. 2, *vs*), which at times may possess a false anterior part. The enormous false vesicula seminalis which may be developed in the same size as the maturing egg in the female

¹ *Macrostomum lewisi* mihi is named in honor of Dr. IVEY F. LEWIS, Miller Professor of Biology, University of Virginia, who, in innumerable ways, has assisted in the completion of this work.

genital atrium. The vesicula granulorum (Fig. 2, *vg*) contains ciliated chambers and is located ventral to the seminalis.

The penis-stilette (Fig. 2, *p*) is a lengthy, tubular structure containing two right angle bends in its main axis, and measures 104μ in length. The basal proximal rim is dentate while the terminal part is provided with a unique knobbed process. Observations of this terminal knob at higher magnification show the stilette to

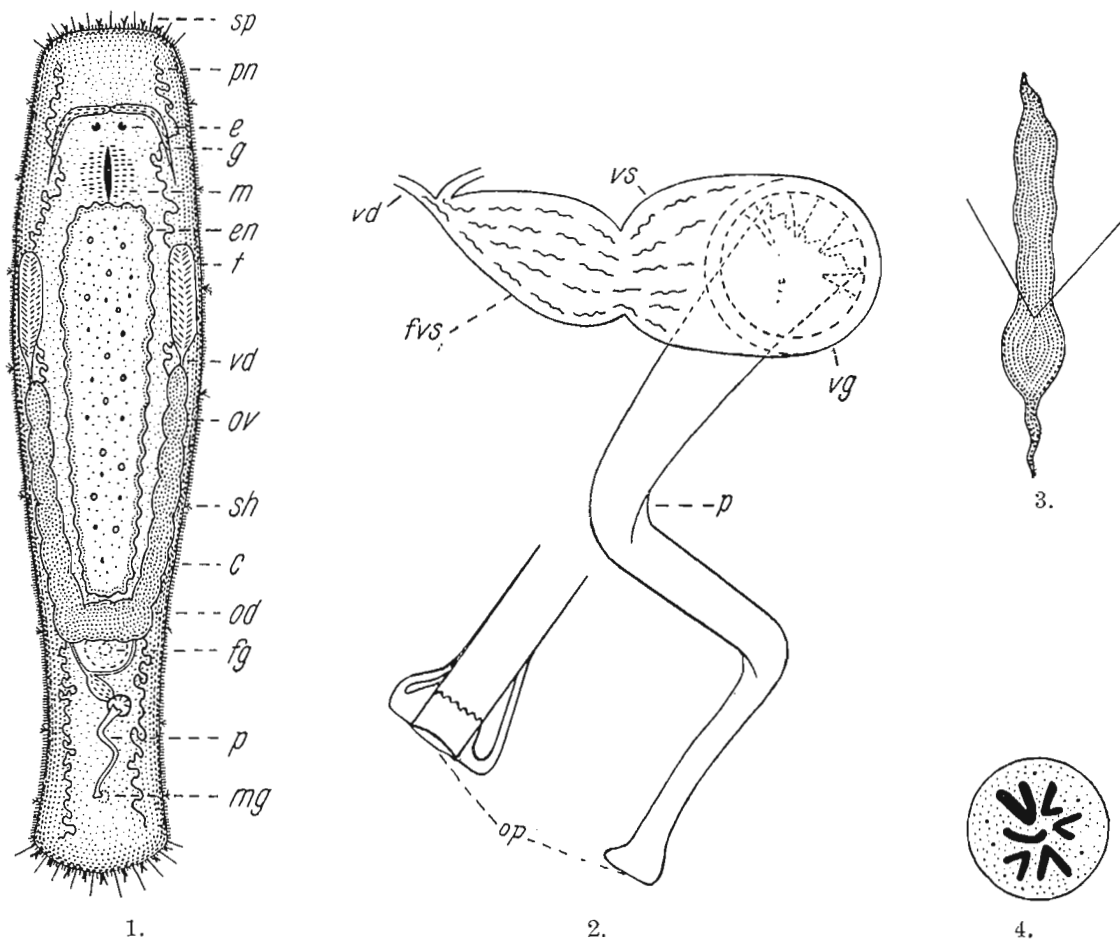


Fig. 1. *M. lewisi mihi*. Dorsal view of gross anatomy. 60 ×.
 Fig. 2. *M. lewisi mihi*. Male sex apparatus. 1000 ×. Detail of terminus of penis-stilette. 1200 ×.
 Fig. 3. *M. lewisi mihi*. Mature sperm-cell. 1200 ×.
 Fig. 4. *M. lewisi mihi*. Spermatogonial Chromosomes. 2000 ×.

be of the *M. bulbostylum mihi* type. This enlarged end, however, is quite asymmetrical in that one side wall is always longer and larger than the other one. The main sub-terminal genital canal is provided with a dentate circumferential ornamentation. The opening is terminal and circular in shape. The male gonopore has ciliated margins.

The sperm cell (Fig. 3) has a feeler, a conspicuous anterior swelling, lateral paired setae, but lacks a definite tail region. This cell, which lacks observable chromatin granules, measures 32μ by 5μ .

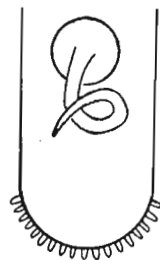
The female reproductive system does not present especial features.

The chromosome number is $n = 3$, $2n = 6$. A metaphase plate of spermatogonial tissue (Fig. 4) displays three pairs of chromosomes. There is a large V-shaped pair, a medium-sized V-shaped pair, and a smaller pair with unequal arms.

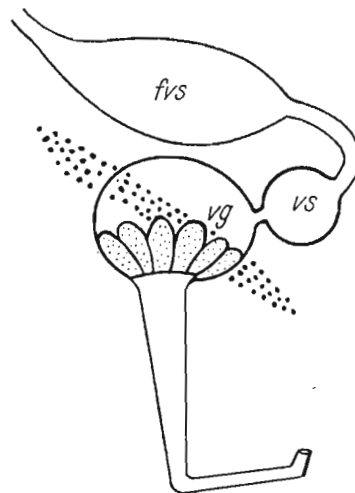
The literature upon this genus does not present a description comparable to that of *M. lewisi mihi*.

Species Diagnosis.

Macrostomum lewisi new species: Body anteriorly blunted, posterior small, rounded, body colorless, epidermal rhabdites, sensory hairs, spines, cilia present, unusually large false vesicula seminalis, ciliated chambers pres-



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Fig. 5. *M. lineare* Uljanin. Penis-stilette. (After Graff 1913, p. 54, Fig. 61.)
 Fig. 6. *M. nassonovi mihi*. Male sex apparatus. (After Nassonov 1926, Taf. I, Fig. 1.)

ent in vesicula granulorum, penis-stilette (104μ long) is elongate tube with two right angle bends in main axis, asymmetrical knobbed distal portion, opening circular and terminal, sperm cell has feeler, middle portion, lateral pair of setae, chromosome number $n = 3$, $2n = 6$, body length 1.3 m.

Paratype: U.S.N.M. No's. 20448 and 20480.

Macrostomum lineare ULJANIN.

1870. *Macrostoma lineare*, ULJANIN in: Syezda Russ. Est., Syezda 2, 2, 9, t. 2, f. 1.

1882. *Macrostoma lineare*, L. GRAFF in: Monogr. Turbell., 1, 244.

1908. GRAFF, L. V., in BRONN, H. G. p. 2590.

1913. GRAFF, L. V., p. 54, f. 61.

Macrostomum lineare ULJANIN was found living in the Black Sea at Panajatow by ULJANIN in 1870. It was collected in water plants at the mouth of the Sebastopol.

The body is described as being slender and of the same width for its entire length. The extremities are rounded. The tail is pro-

ded with "Haftpapillen". Ostensibly there are no sensory hairs
· rhabdites present. Two "Stäbchenstrassen" extend to the
terior tip of the body, apparently intertwinning at intervals.

The ventrally disposed mouth is located in the first body
urth. Eyes are lacking.

The female gonopore is found in the last body fourth and
usually contains a mature egg. The ovaries are laterally located.

The penis-stilette communicates with a rounded vesicula
minialis. This stilette (Fig. 5) is a completely bent spiralled and
sharply pointed tube which is of the same caliber for its entire
length. It is said to be of considerable (?) size. This poorly described
species hardly warrants giving it a position in the genus.

Species Diagnosis.

Macrostomum lineare ULJANIN: Body slender, cylindrical, rounded
extremities, "Haftpapillen" present in tail region, sensory hairs and rhabdites
lacking, eyes lacking, anterior "Stäbchenstrassen", penis-stilette is a completely
tight spiral with sharp termination.

M. nassonovi mihi (*M. obtusum korsakoffi* NASSONOV).

1926. *Macrostomum obtusum korsakoffi*, NASSONOV, N. in: Die Tur-
llarienfauna des Leningrader Gouvernements. C. R. Ac. Sci. U.R.S.S.,
821, t. 1, f. 1.

M. nassonovi mihi² is found in the waters of the Peterhofer Institut
community in Leningrad, Russia. It is stated by Dr. N. NASSONOV that this
species is easily found in this region.

In a description characterized by its paucity of information,
NASSONOV (1926, p. 821) gives the morphology of the male copu-
latory apparatus as the most distinguishing feature of this form.
In this system (Fig. 6) there is found an unusually large false vesi-
cula seminalis leading into a small spheroidal vesicula seminalis
which in turn communicates with the vesicula granulorum by
a very short ductus ejaculatorius. The vesicula granulorum is pro-
vided by a singular rosette of gland cells which spread fan-wise
from the distal part of the organ and whose occurrence has not
been noted before in the genus. Presumably, they are part of the
accessory gland system which sends lateral ducts into the vesi-
cula granulorum serving it with granular material.

The penis-stilette is of the most extraordinary structure, being
essentially a lengthened funnel which has suffered two abrupt terminal
bends, the second one only approximating the perfect right angle

² This new species is renamed in honor of Dr. N. NASSONOV of the
R. S. S. Academy of Science, who thought it to be a variety of *M. obtusum*.

of the first bend (Fig. 6). The base of the stilette is smooth in contour. The walls of the stilette are terminally thickened. An oval terminal external opening is provided.

Taxonomically, it is deserving that an animal possessing such a unique male copulatory system should be granted the position of species. A comparison of the penis-stilettes of *M. obtusum* VEJDOVSKÝ (Fig. 9) and of *M. nassonovi* mihi (*M. obtusum korsakovi* NASSONOV) will show that the varietal inference of NASSONOV (1926) for the latter species is insufficient for this species. The two species have practically nothing in common. The only other species so far described having two right angle bends in the main axis of the stilette is *M. lewisi* mihi, whose penis-stilette (Fig., part V) differs radically from that of *M. nassonovi* mihi. This description has been taken from NASSONOV (1926).

Species Diagnosis.

Macrostomum nassonovi mihi new species: Male copulatory system composed of large elongate false vesicula seminalis, small spheroidal vesicula seminalis, very short ductus ejaculatorius, large oval vesicula granulorum with rosette of glandular cells at distal region, penis-stilette is a lengthened funnel which extends from a smooth rimmed base to a stumped termination with oval external opening, main axis of stilette has two right angle bends in its course.

Macrostomum obtusum VEJDOVSKÝ.

1895. *Macrostoma obtusum*, VEJDOVSKÝ in: Z. wiss. Zool. **60**, 155, t. 7, f. 95—102.

1909. *Macrostomum obtusum*, L. GRAFF, in: BRAUER, Süsw., **19**, 77, f. 161.

1905. LUTHER, A., pp. 26, 28—37, 37—41.

1908. GRAFF, L., in: BRONN, H. G., pp. 2152, 2233, 2285; t. XXV, f. 54.

1913. GRAFF, L. v., p. 54, f. 62.

Macrostomum obtusum VEJDOVSKÝ was originally described from Chotěboř, Bohemia. This form measures up to 2 mm. in length and has a spatulate tail and a stumped anterior end.

Rhabdites are so numerous as to make observation of the internal anatomy difficult. The rhabdites, cilia and sensory hairs are comparable to those of *M. appendiculatum* (O. FABR.). It is inferred that epidermal "Haftpapillen" are present as shown in the original drawing of the posterior body by VEJDOVSKÝ (1895, T. VII, Fig. 98) or by the present author's copy of that drawing (Fig. 7).

The eyes are described as unusually small and are shown to lie in hyaline vesicles. The general anatomy of the brain compares to that of *M. appendiculatum* (O. FABR.).

The most unusual anatomical features of this species is the

ence of a pair of lateral ciliated pits. These discrete structures (Fig. 8) are located at the level of the mouth. There are no swellings at the ends of the ganglia which are found at the base of the ciliated pits. The cilia of these pits, which are discernable only in resting animals, are of the same length as those of the external body surface.

The mouth communicates with a highly contractile pharynx complex. The walls of the pharynx are so extrusible as to disclose contents of the enteron to the exterior. In this manner enteric wastes are expelled. The dilations of the pharynx in this species assume

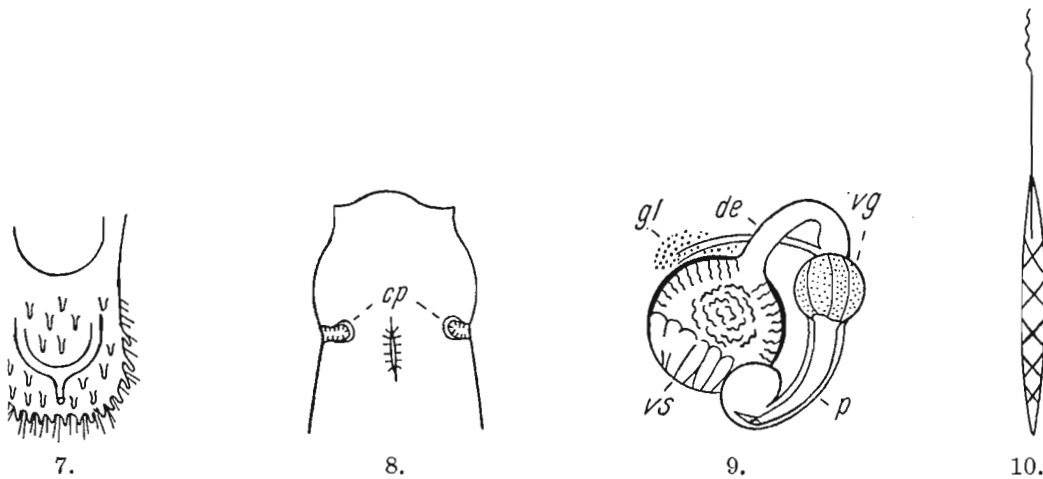


Fig. 7. *M. obtusum* Vejdovský. External opening to excretory system. (After Vejdovský 1895.)
 Fig. 8. *M. obtusum* Vejdovský. Ciliated pits. (After Vejdovský 1895.)
 Fig. 9. *M. obtusum* Vejdovský. Male sex apparatus. (After Vejdovský 1895.)
 Fig. 10. *M. obtusum* Vejdovský. Sperm-cell. (After Vejdovský 1895.)

form comparable to that of *M. riedeli* mihi (Fig., part VI). The entire pharyngeal region is glandose. Both enteron and pharynx are ciliated.

The excretory system consists of paired, coiled, lateral protothridia which join caudally and empty to the exterior from a collecting ampulla (Fig. 7).

Two small pyriform testes, located ventrally and posterior to the pharynx, supply sperm cells to the spheroidal vesicula seminalis via the vasa deferentia. The vesicula seminalis, which is composed of a ciliated epithelium, has an unusual arrangement of glands which assume the form of a rosette whose component parts are antero-posteriorly directed (Fig. 9). Gland cells generally do not attend the vesicula seminalis in *Macrostomum*. A curved and dilated ductus ejaculatorius (Fig. 9) connects this structure with a much smaller vesicula granulorum (Fig. 9) which is lined by spindle-shaped masses of granular material which emanate from accessory glands appended to its proximal region. The penis-

stilette (Fig. 9) which is securely sheathed in a muscular tunic, is a simple curved funnel which has its external opening at the point of bending of the terminus. It would appear that the bulbar end of the penis-stilette tunic might well be designated as a male genital atrium.

The singular sperm cells are particularly well described as lengthened fine threads which have an undulating feeler at one end. The major portion of the cell is spindle-shaped and contains a non-spherical nucleus enmeshed in an hyaline cytoplasm (Fig. 10). Axial and spirally arranged filaments are present in the cell.

Species Diagnosis.

Macrostomum obtusum VEJDOSKÝ: Body elongate, slender, has stumped anterior and a spatulate posterior end, epidermal structures include rhabdites, cilia, sensory hairs and "Haftpapillen", eyes encapsulated in hyaline vesicles, discrete paired antero-lateral ciliated pits present, protonephridia empty from posterior ampulla, peculiar arrangement of gland cells accessory to vesicula seminalis, ductus ejaculatorius elongate, vesicula granulorum small, spheroidal, penis-stilette is a simply curved funnel with sharp, bent termination and subterminal external opening, sperm cells are spindle-shaped cells with long feeler, non-spherical nucleus, axial and spiral filaments, body length up to 2 mm.

Macrostomum orthrostylum BRAUN.

1885. *Macrostoma orthrostylum*, M. BRAUN in: Arch. Dorpat. Naturk. Ges. Ser. 2, 10, 138, t. 2, f. 1.

1909. *Macrostomum orthrostylum*, L. GRAFF in: BBAUER, Süßw. 19, 77, f. 158.

1911. *Macrostomum orthrostylum*, HOFSTEN, N. v., in: Zool. Bidr. Uppsala 1, 18, f. 1.

1905. LUTHER, A., pp. 28—37.

1911. HOFSTEN, N. v., pp. 4, 18.

1912. HOFSTEN, N. v., pp. 563, 577, 606, 608.

1913. GRAFF, L. v., p. 52, f. 56.

1915. MEIXNER, J., pp. 463, 468—470, 471—478, t. 30, f. 5, 6, 7, 8.

1926. STEINBÖCK, O., pp. 210—212, 254, 255, 258.

1934. REISINGER, E., p. 241.

Macrostomum orthrostylum BRAUN lives in the waters of Peipus (Dorpat) Russia and in several lakes in the Swiss alpine country. The animal is described as being white in color and having the general shape of *M. appendiculatum* (O. FABR.). The anterior body is broadly rounded. The greatest length recorded for this species is 2.4 mm. as given by HOFSTEN (1911) who found it living in Lake Maggiore, Switzerland.

The cilia are slightly fewer in number on the ventral side. Anteriorly the cilia measure 4—5 μ in length. The rhabdite struc-

res are divided into: (1) adenal types which measure 6—9 μ in length, are thicker on the dorsal side and in the tail region and are almost absent ventro-anteriorly; (2) characteristic rhammiten which develop in numerous gland cells in the region of the cephalic region and extend in sausage-shaped rows anteriorly to empty at the extremity, they measure $11 \mu \times 1.3 \mu$; (3) small spindle-shaped rhabdites (14 μ long) which develop at the anterior end and are found associated with small spheroidal erythrophil granules in the same gland cell resembling those of *M. appendiculatum* (FABR.).

In this connection, there exists an interesting developmental series in the granulo-rhabditic structures with which *Macrostomum* is supplied (Fig., part III). This present author suggests that there is a gradual developmental series which starts with the simplest type of granule producing cell, the mucous gland cell, which is followed in sequence by characteristic "Körnerkolben" gland cells, the so-called "Stäbchendrösen" cells of the genital atrium, the large granular platelets of the vesicula granulorum, the pharyngeal gland cells containing both rhammiten and granules, and ultimately the adenal rhabdite cells.

MEIXNER (1915) mentions the very small spindle-shaped rhammiten which lie associated with granules in the gland cells rimming the mouth as the fourth type of rhabdoid. The "Stäbchen" of the genital atrium are presented as the last type. They greatly resemble the peripheral granules in the egg-shell, both in color and thickness. "Laftpapillen", located in the tail region, are not discernable in the mentioned material and are only apparent at the moment of adhesion. Mucous glands occur over the entire body surface.

The musculature, parenchyma and enteron do not present special features. The enteron is provided with the usual "Körnerkolben" and is supplied with a set of closely lying circular muscle fibers and a set of longitudinal fibers which are much fewer in number.

There has been no study on the excretory system of this form reported to date.

The observations of LUTHER (1905) upon the anatomy of the

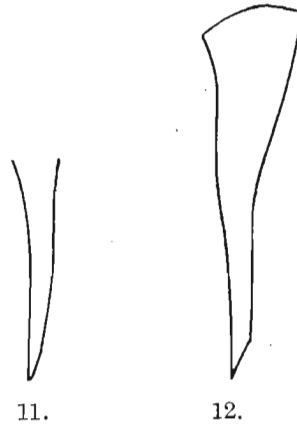


Fig. 11. *M. orthrostylum* Braun. Penis-stilette. (After Braun 1885, Taf. II, Fig. 1.)

Fig. 12. *M. orthrostylum* Braun. Penis-stilette. (After Hofsten 1911, p. 9, Fig. 1.)

nervous system is verified by those of MEIXNER (1915). The pigment-cup almost entirely encapsulates the retinula of the visual organ. The nucleus of the retinula is described as being close to the pigment cup (?). The pigment spherules measure 1—3 μ in diameter.

The testes are small and round and are located antero-laterally in the body. There is the usual complement of vasa deferentia, false vesicula seminalis, vesicula seminalis, vesicula granulorum and penis-stilette. The vesicula seminalis is supplied with both a basal membrane and an outer set of circular muscle-fibers in its wall. The false vesicula seminalis may often contain sperm cells while they are absent in the vesicula seminalis. The ductus ejaculatorius is very short, being about one-half as long as it is in *M. appendiculatum* (O. FABR.). The vesicula granulorum is a very plump structure composed of flattened epithelium. The walls of this organ are provided with muscle-fibers running obliquo-circular or in a spiralling manner. The gland-cells, accessory to the granulorum, enter at the ductus ejaculatorius. LUTHER (1905) first noted the presence of a crown-shaped region of the epithelium in the distal part of the granulorum which it is suggested may contribute to the formation of the penis-stilette. MEIXNER (1915) also believes that this tissue may be the "Anlage" of the stilette.

The penis-stilette of *M. orthrostylum* BRAUN has been figured both from the original drawing (Fig. 11) and from the later work of HOFSTEN (1911) in Fig. 12). This copulatory tube is essentially a funnel which is almost straight in its main axis and terminates in a reduced and greatly sharpened point (Fig. 12). The original stilette drawing of BRAUN (1894) shows this termination to be somewhat stumped (Fig. 11). The basal or proximal part of the stilette communicates with the crown-shaped epithelial region of the vesicula granulorum. The set of protractor muscle fibers which aid in the extrusion of the penis-stilette extend from the male ciliated gonopore to the distal part of the vesicula granulorum.

The ovaries are non-compacted, heavily indented structures. The "Sammelgang" is very short. The forewall of the female genital atrium has a mass of sperm cells buried partially within it. Ostensibly, according to MEIXNER (1915), they are being nourished there. This present author suggests that they are drawn to the anterior walls of this structure by a different force or stimulus. Sperm-cells of many species have been noticed massing at the sphincter muscles which mark the female genital atrium and the common oviduct

separate and distinct. However, in these various species, when an egg is present in the atrium, the anterior walls no longer hold an attraction but the mass of sperm-cells may be found dispersed over the surface of the maturing egg in a fairly proportionate manner, as indicated by the study of sectioned material. From the foregoing observations, this author has been led to believe that the stimulus to which the sperm-cells respond is a chemical one which is attendant upon ultimate fertilization of the egg. Thus it is inferred that the sperm-cells, while sejourning in the atrium, are making an effort to reach the developing eggs, being held in check by the sphincter and are apparently partially buried in the fore-wall tissues in a positive chemi-tropic reaction. It would appear that at any time after maturity, that is, after they have reached the vesicula seminalis, that sperm-cells would attempt to nourish themselves; yet they have never been seen in the mature condition to bury themselves in the epithelium of either the vesicula seminalis or vesicula granulorum, in which they lie for some time awaiting ejaculation. Thus it is reasoned that nourishment in the mature stages of the sperm-cells is obtained from the body fluids which bathe them, whether it be in the seminalis, granulorum, or as they are, seemingly partially buried, in the fore-wall of the female genital atrium.

MEIXNER (1915) concurs with LUTHER'S (1905) ideas as to the explanation of masses of sperm-cells which lie buried in the tissues surrounding the female genital atrium. They arrive at this unusual destination by use of the very sharp hypodermic stilette. The papillae of the female genital canal are longer and more sparsely arranged than over the external body surface.

The above description of the anatomy has been taken largely from the excellent work of MEIXNER (1915).

Species Diagnosis.

Macrostomum orthostylum BRAUN: Body shaped like that of *M. appendiculatum* (O. FABR.), color white to gold, various gradations in rhabdoids, "Haftpapillen" present in tail region, crown-shaped anlage of penis-stilette and distal vesicula granulorum, penis-stilette is elongate (length $142\ \mu$) funnel-shaped, almost straight with oval external opening at very sharp termination, ovaries heavily indented, "Sammelgang" short, body length up to 2.4 mm.

Macrostomum phillipsi FERGUSON and STIREWALT.

1938. *Macrostomum phillipsi* FERGUSON and STIREWALT. F. F. FERGUSON and M. A. STIREWALT in: Zool. Anz. **123** (1938) 3.

The figures to the text of the above reference and the species diagnosis are included here for purposes of comparative study.

Species Diagnosis.

Macrostomum phillipsi FERGUSON and STIREWALT: Body slender, lacking pronounced tail spatulation, colorless, epidermal ciliation includes long cilia

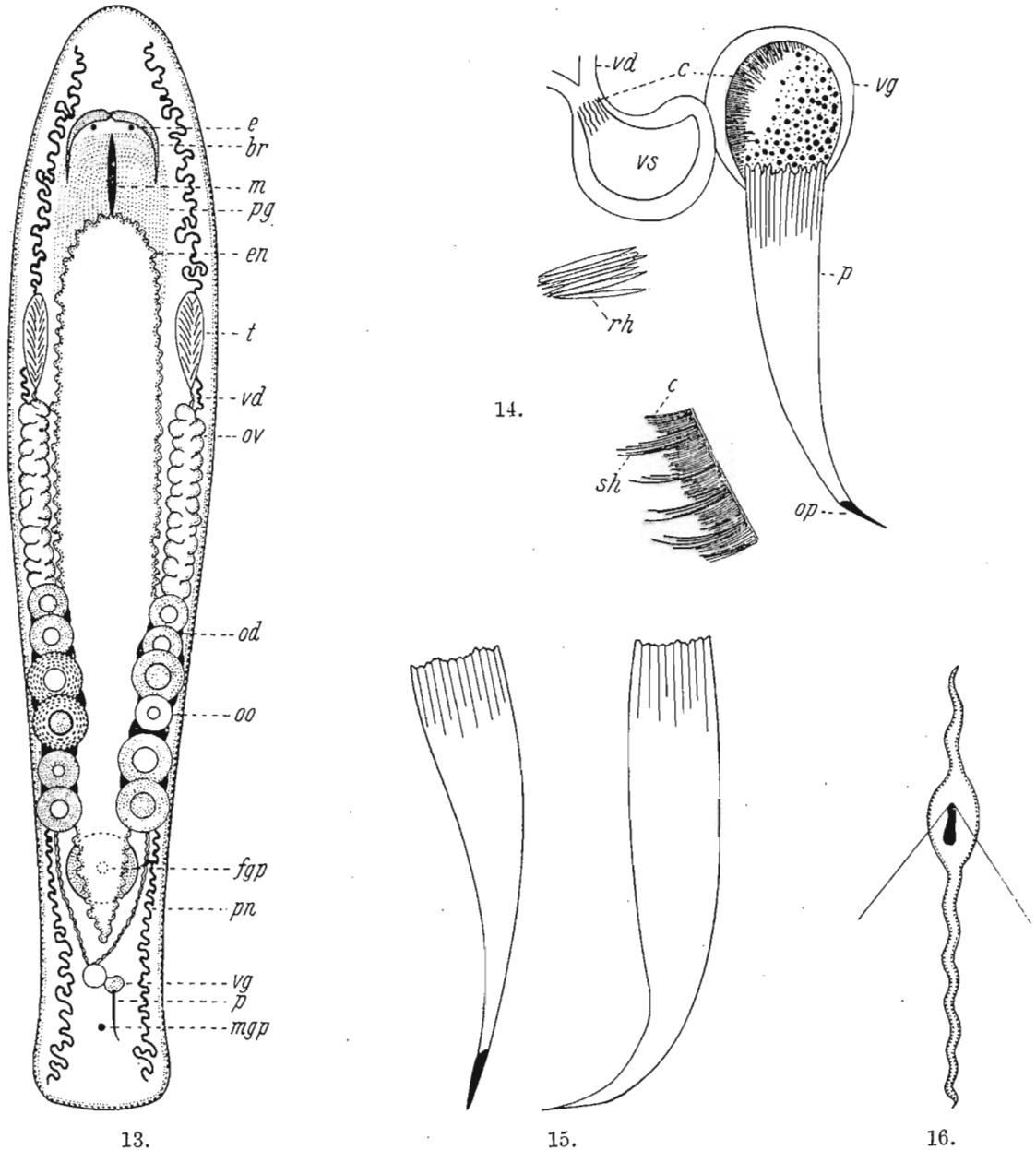


Fig. 13. *M. phillipsi* Ferguson and Stirewalt. Dorsal view of gross anatomy. 58 ×.
 Fig. 14. *M. phillipsi* Ferguson and Stirewalt. Male sex apparatus. 360 ×. Detail of ciliation. 500 ×. Detail of rhabdites, 250 ×.
 Fig. 15. *M. phillipsi* Ferguson and Stirewalt. Two views of penis-stilette. 408 ×.
 Fig. 16. *M. phillipsi* Ferguson and Stirewalt. Mature sperm-cell. 800 ×.

and numerous sensory hairtufts, pigment-spherules of eye very small, testes small and smooth walled, granulorum lacks distinct ciliated chambers, penis-stilette is slender funnel with crenated base and curved distal end, opening terminal (length 65 microns), body length up to 2 mm.

Macrostomum reynoldsi mihi.

Macrostomum reynoldsi mihi is found living in great numbers in the algae and mosses which cover the rocks of the Cascades, a waterfall in Little

ony Creek, Giles County, Virginia. This form³ has been collected and studied during the summers of 1936 and 1937, during which time a general taxonomic and ecological survey was made upon the Turbellaria of the mountain region near the Mountain Lake Biological Station at Mt. Lake, Virginia. This form responds well to artificial culturing in the refrigerator. Lowland species *Macrostomum* do not require this special treatment.

The acuminate pointed anterior end and the uniformly rounded posterior end are characteristic of the body form. This animal is fairly wide (Fig. 17). Except for the brownish enteron, the entire body of this animal is colorless and translucent. The average length is 1.5 mm.

The epidermis is studded with rhabdites which lie in groups of three or four in the posterior end while in the middle and anterior parts of the body they occur in groups of three, four, six, or eight. Those of the posterior and middle parts of the body measure $8 \mu \times 1.6 \mu$, while those of the anterior body measure $8 \mu \times 1.2 \mu$. A detailed study of the rhabdite action of the spatulate tail region is shown (Fig. 18). It would appear that the so-called adhesive function of the peripheral rim of the tail region is accomplished by a type of vacuum-cup operation of the pointed ends of the projecting rhabdites, rather than by the use of an adhesive secretion from the glands of the region. This present author suggests this explanation after having made numerous high magnification observations of the phenomenon.

Non-rigid sensory hairs (Fig. 17, *sh*) are developed in the anterior body in groups of two to five, in the posterior in groups of three and four and singly or in pairs on the sides of the body. In the anterior body they are 11μ long and in the posterior they measure 24μ in length. The highly active coat of cilia (Fig. 17, *c*) measures 3.2 to 4.8μ . All external openings in the body have ciliated margins. Rigid spines (Fig. 17, *sp*) are located sparsely over the body surface, being more numerous, however, in the anterior and posterior parts. They appear singly, ranging in length from 20μ to 27μ .

The "brain" (Fig. 17, *br*) is composed of two bilaterally opposed ganglia which join by an indented commissure in the mid-line of the anterior body. It is located about 72μ from the anterior tip of the body. The commissure has an approximate diameter of

³ This species has been named in honor of Dr. B. D. REYNOLDS of the Miller School of Biology, University of Virginia, who first collected and named it in 1933.

12.8 μ while the ganglia measure about 16 μ in diameter. Bilateral posterior extensions are appended to the ganglia.

The eyes (Fig. 19, *e*) of this species are oblong masses of pigmented spherules, blackish-brown in color. They lie embedded in the dorso-posterior tissues of the "brain", near the commissure.

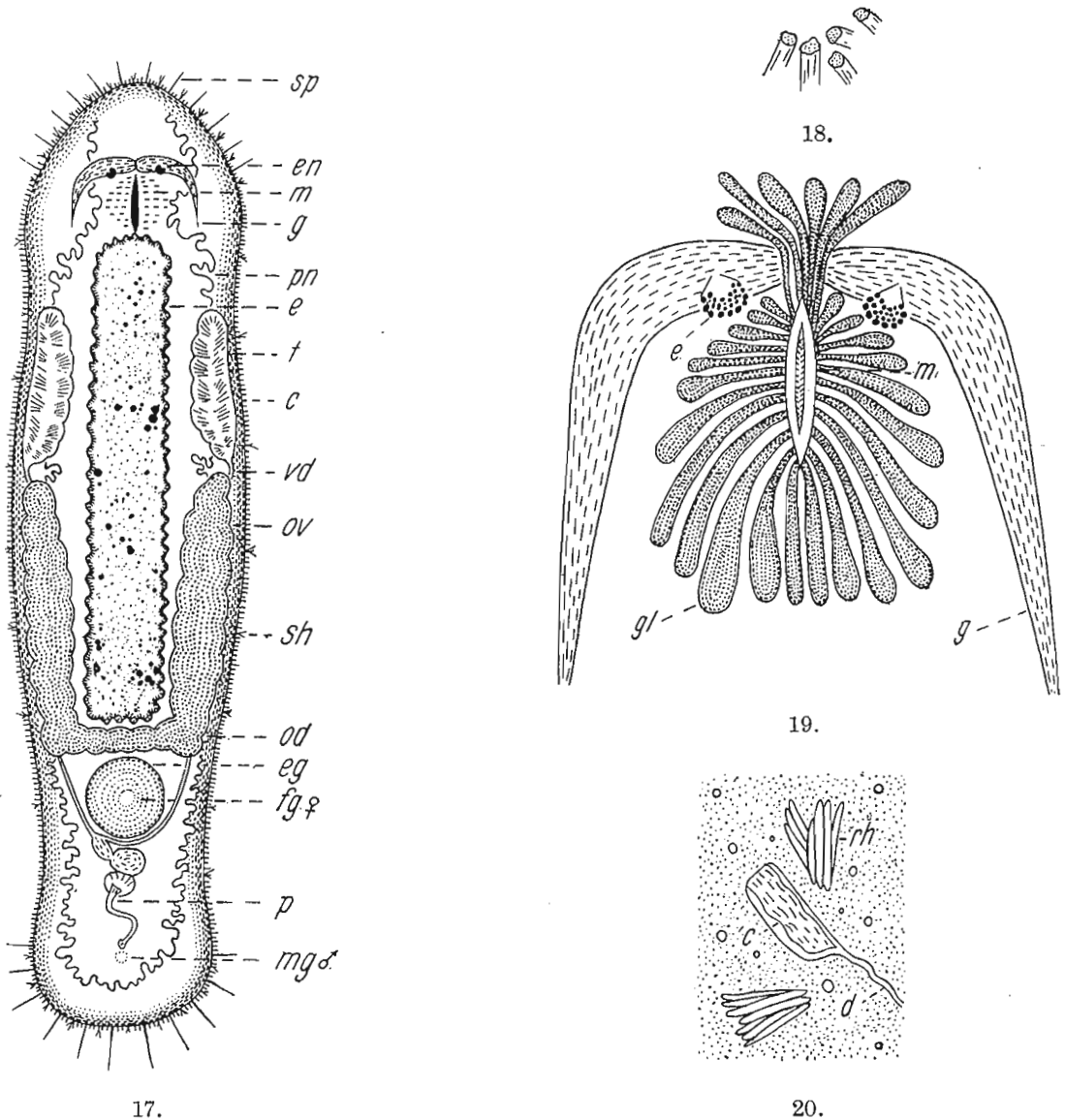


Fig. 17. *M. reynoldsi mihi*. Dorsal view of gross anatomy. 177 \times .
 Fig. 18. *M. reynoldsi mihi*. Diagram showing vacuum-cup action of rhabdites. 1200 \times .
 Fig. 19. *M. reynoldsi mihi*. Dorsal view of mouth and "brain". 510 \times .
 Fig. 20. *M. reynoldsi mihi*. Detail of flame-cell. 300 \times .

The mouth (Fig. 19, *m*) is guarded by two longitudinal ciliated lips which form a ventral split in the first anterior fifth of the body in the mid-line. When the animal is resting the two lips which limit the opening meet in the mid-line and together measure about 48 μ by 4.8 μ .

The mouth communicates directly with the pharyngeal cavity which may be triangular in shape in optical section. The base of

the triangle is connected with the anterior end of the enteron (as Fig. 2, part II). The muscular walls of the pharyngeal cavity

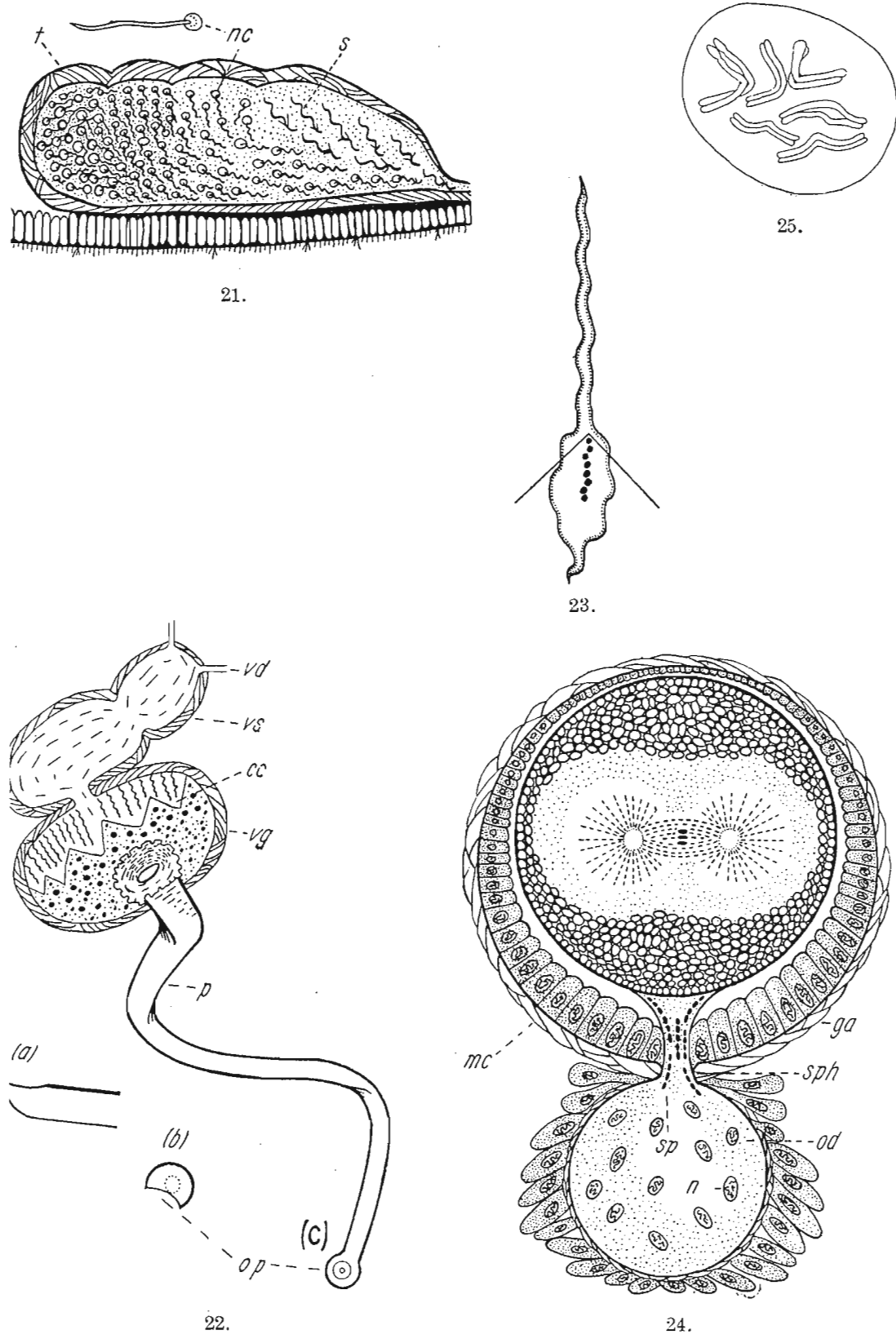


Fig. 21. *M. reynoldsi mihi*. Diagram showing division of labor in testis. 400 ×.
 Fig. 22. *M. reynoldsi mihi*. Dorsal view of male sex apparatus showing terminus of penis-stilette in (a) lateral view, (b) end view. 600 ×.
 Fig. 23. *M. reynoldsi mihi*. Nature sperm-cell. 1800 ×.
 Fig. 24. *M. reynoldsi mihi*. Section of oviduct and female genital atrium with egg. 375 ×.
 Fig. 25. *M. reynoldsi mihi*. Germinal chromosomes. 2400 ×.

form an almost equilateral triangle when viewed in optical section. An opening, which is normally about 12.8μ in diameter, leads from the base of the triangular cavity into the flagellated enteron. The enteron is the typical cylindrical structure found in the genus. The waving, undulating, non-synchronized flagella which line the walls of the enteron are about 8μ in length. The enteron is approximately 408μ long and has a diameter of about 85μ .

Glands are prevalent throughout the body, being more numerous, however, at the external openings where they usually appear as rosettes. At the mouth each gland which is filled with granular material connects with the opening by a small duct (Fig. 19). These radiating streamers of gland cells extend as far posteriorly as the mid-body. The glandular radiations ("Stäbchen-drüsen") at the female opening appear as small oblongs (Fig., part IV) measuring 5μ by 3.2μ . Mucous glands are developed over the entire body surface.

The protonephridial system consists of two lateral tubules which join posteriorly and which contact the glandular system of the pharyngeal cavity at near the level of the eyes. The external opening was not observed. Flame cells are prevalent throughout the body (Fig. 20). The fused cilia (*c*) beat continuously in the fundus of the lumen of the excretory duct (*d*).

The testes are not particularly compact and are finely divided, giving the appearance of many small extensions leading at an oblique angle into the lumen of the structure. From the muscular walls numerous sperm-cells may be seen hanging from the nurse cells (*nc*) which partially form the interior surface (Fig. 21). There is evidence of a division of labor in the mature testes, since only the anterior region concerns itself with the elaboration of sperm cells. The posterior part is used as a storeroom for mature and partially mature sperm cells.

A vas deferens extends from the ventro-posterior part of each testis and continues caudally under the ovary to a point just back of the enteron. Here the vasa deferentia unite to produce a false vesicula seminalis. The route of the vasa deferentia is fairly straight and is close to the lateral body wall. As many as ten sperm cells may lie compacted side by side in the distended lumen of a vas deferens.

The false vesicula seminalis leads into the true vesicula seminalis, which is ciliated. Here the sperm cells are stored as a bolus. The vesicula seminalis does not possess an easily observable mus-

ar structure as is generally found in *Macrostomum*. This simply constructed sack may become so distended by sperm cells that it covers one-half of the body width at that level.

Sperm cells may enter the vesicula granulorum by the release of a set of sphincter muscle fibers in the distal part of the vesicula terminalis. The vesicula granulorum is divided into two areas—one contains a proximal group of five ciliated chambers (Fig. 22, *cc*) whose cilia keep the sperm cells and granular material moving toward the base of the penis-stilette; the other area is granular and nearest the stilette. This granular material ranges in size from 4μ to very small diameters. Occasionally the granular material is arranged in two distinct masses, both being oriented toward the stilette base.

The penis-stilette (Fig. 22, *p*) is a slender, greatly curved tube which extends from a broadened roughly crenated base to a slightly knobbed end which contains the external opening. The termination is a very peculiar structure, three drawings of which are given to better describe it (Fig. 22). Lateral, end, and dorsal views (a), (b), and (c) are shown. The greatest length of the stilette is 72μ , this figure being an average one obtained from the study of 40 mature specimens of this form. The male gonopore (Fig. 17, *mg*) is located mid-ventrally, posterior to the female gonopore. The diameter of this opening is 12.8μ , while the cilia which guard the entrance are about 4.8μ long. Copulation has been observed in this species.

The sperm cell (Fig. 23) is a tapering filament which is possessed of several lateral setae in the posterior third of the cell. It is interesting to note that the greatest number of sperm cells in this species is produced in the latter part of June, the warmest part of the summer in the Mountain Lake region. Also of interest is the fact that sperm cells liberated in macerations of the animal will make attempts to penetrate the egg of the parent. The "feeler" is a slowly undulating tactile organ as long as the sperm cell remains in the body of the animal, but it becomes a highly vibratile structure when liberated in maceration. The rest of the sperm cell always maintains slow undulating movements in maceration.

The ovaries of this species are light brown in color and, with the oviduct, present a dumb-bell appearance in optical section. They occupy a position in the first part of the posterior third of the body (Fig. 17, *ov*). They are dorso-laterally disposed and are connected by broadened oviducts. These latter passageways fuse in the mid-line of the body to form the common oviduct which com-

municates directly with the anterior wall of the ventrally disposed female genital atrium (Fig. 24). This highly ^{modifiable} distensible organ (Fig. 24) is located in the mid-line and communicates with the exterior by the ventral female gonopore whose lips are heavily ciliated and glandulated. After copulation sperm cells cling in great numbers to the forewall of the female genital atrium awaiting the arrival of the egg. The maturing egg in the atrium has a diameter of $71\ \mu$ and is light brown in color.

The chromosome morphology in this form has been studied from both somatic and spermatogonial tissue in macerations using BELLING'S Iron Aceto-carminic technic. As with other American *Macrostomum*, $n = 3$, $2n = 6$ for the chromosome count. In somatic metaphase plates there are two small pairs of chromosomes and a larger pair, all with median attachment points (Fig. 25).

Taxonomically, this form occupies a distinct position, since the present literature upon the genus does not offer any description comparable to it.

Species Diagnosis.

Macrostomum reynoldsi new species: Body anteriorly pointed, posteriorly rounded, colorless, epidermal inclusions include cilia, sensory hairs, and spines, protonephridia join posteriorly, vesicula granulorum has proximal group of five ciliated chambers, penis-stilette is greatly curved tube with peculiar knobbed end, opening sub-terminal, length $72\ \mu$, sperm cells are tapering filaments with lateral pair of setae, ovaries brownish, dumb-bell-shaped, chromosome number $n = 3$, $2n = 6$, body length up to 1.50 mm.

Paratype: U.S.N.M. No's. 20438, 20439, 20440, 20441, 20442, 20443, and 20466.

Macrostomum rhabdophorum BEKLEMISCHEFF.

1927. *Macrostomum rhabdophorum*, BEKLEMISCHEFF, W., in: Bull. Inst. Biol. Perm. 5, 177—207, t. 1, f. 4.

Macrostomum rhabdophorum BEKLEMISCHEFF is found in the limestone waters of the area around Odessa.

The anterior body of this form is broadly rounded, when in contraction it is blunted. The posterior end is not broad but small and rounded. There are no adhesive cells present in this tail region. Posterior "Rhabditenstrassen" are provided, emptying terminally in two exterior ducts. The rhammiten contained in this system are long and pointed. The usual type of "Rhabditenstrassen" is found anteriorly supplied with smaller rhammiten. A complex of granular cephalic gland cells empty terminally just ventral to the "Rhabditenstrassen". The remainder of the body lacks rhabditic structures.

The "brain", pharynx and enteron are regular in their morphological features.

The eyes are very small, each being composed of only from ten to twenty pigment granules, however, entirely colorless individuals have been observed. In the only mature specimen studied by BEKLEWISCHEFF (1927) two red lateral ovaries, a median mature egg, and a penis-stilette were observed.

The penis-stilette (Fig. 26) is funnel-shaped with an obliquely truncated base and a bent distal part of the main axis of the genital canal. The terminal opening is oval in shape and terminally rounded.

This description was taken from BEKLEMISCHEFF (1927).



Fig. 26. *M. rhabdophorum* Beklemischeff. Penis-stilette. (After Beklemischeff, 1927, Taf. I, Fig. 4.)

Species Diagnosis.

Macrostromum rhabdophorum BEKLEMISCHEFF: Body anteriorly rounded, anterior small, rounded, adhesive cells lacking in posterior, "Rhabditen-sen" located both anteriorly and posteriorly, rhabditic structures lacking on most of body surface, penis-stilette is funnel with obliquely truncated base and distal bend, stilette opening oval and terminal.

Landasseln aus Balkanhöhlen, gesammelt von Prof. Dr. Karl Absolon.

9. Mitteilung.

(Zugleich 25. Beitrag zur Isopodenfauna des Balkans.)

Von Dr. HANS STROUHAL, Wien.

(Mit 22 Abbildungen.)

Eingeg. 25. Oktober 1939.

In dieser Mitteilung werden einige weitere Trichonisciden aus der Kollektion »Biospeologica balcanica« Prof. Dr. KARL ABSOLONS und seiner Mitarbeiter behandelt. Mit Ausnahme des *Trichoniscus bosniensis* VERH. sind die hier beschriebenen Arten neu. Ihre Feststellung ergänzt weitgehendst unser Kenntnis der Landasseln des NW.-Balkans. Herr Prof. Dr. ABSOLON hat sich durch seine langjährigen Arbeiten in den Balkanhöhlen und die in Verbindung damit erfolgte Aufsammlung eines umfangreichen Materials an Trichonisciden große Verdienste um die Erforschung der gerade in diesem Gebiet so artenreichen Höhlenfauna erworben. In Anerkennung dieser verdienstvollen Tätigkeit, die sich auch für die Landisopodenkunde so erfolgreich erwies, sei dem Forscher auch in diesem Aufsätze wieder eine neue Mitteilung gewidmet.